Conservation and Management of Vernal Pools Through Analysis of Community Interactions of Grazing and Fire Impacts on Five Rare Plants and Two Rare Macro-Invertebrates in Tehama County

Final Report

Results and Discussion

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INTRODUCTION

This project began in late 1997 with initial funding from the U.S. Fish and Wildlife Service to monitor vernal pools in Tehama County using an ecosystem approach. Two reports were prepared and submitted. Lis and Eggeman (1999) presented the study design and methodology, while Lis and Eggeman (2000) presented the preliminary results and discussion from 1999. These two are included as appendices: Lis and Eggeman (1999) in Appendix 1, Lis and Eggeman (2000) in Appendix 2.

Vernal pool landscapes are frequently grazed and there has been an accelerated invasion by non-native plant species into this landscape upon the cessation of grazing. The study sites selected for this project had been grazed in the recent past (Dales Lake Ecological Reserve and the Hog Lake Plateau), or had been continuously grazed (Spring Branch Plains). All three areas had one or two pools that had been fenced to protect the pool from grazing effects (Figure 1, Figure 2, Figure 3).

The goal of this project was to select components of the vernal pool ecosystem and monitor water quality variables, density of branchiopods, and selected plant species using permanent plots, while assessing whether or not grazing was having positive, negative, or undetermined effects on the ecosystem components. To assess the effects of grazing, we used control pools that had been excluded from grazing, and nearby pools that would be (a) returned to grazing, (b) would have experimental grazing applied to them, or (c) had been maintained in a grazing regime. Further elaboration on the goals and objectives can be found in the introduction of Appendix 1.

Water quality was monitored throughout the season from inundation to dry-down to determine: (1) the ranges and cycles of water quality variables, in a pool, during a season, and (2) to ascertain whether cattle can perturb these variables in a manner that exceeds their natural variation in ungrazed pools (see Appendix 1, Water Quality Monitoring.)

Branchiopods (*Branchinecta lynchi, Linderiella occidentalis,* and *Lepidurus packardi*) were sampled for distribution and abundance estimates every two weeks throughout the season (see Appendix 1, Branchiopod Monitoring). Vegetation was monitored using a system of permanent plots. Monitoring was conducted for both native and non-native species compositional changes in an effort to determine whether species compositional shifts can be observed and if a combination of grazing or burning will promote native species over non-native species. Investigations into whether competition

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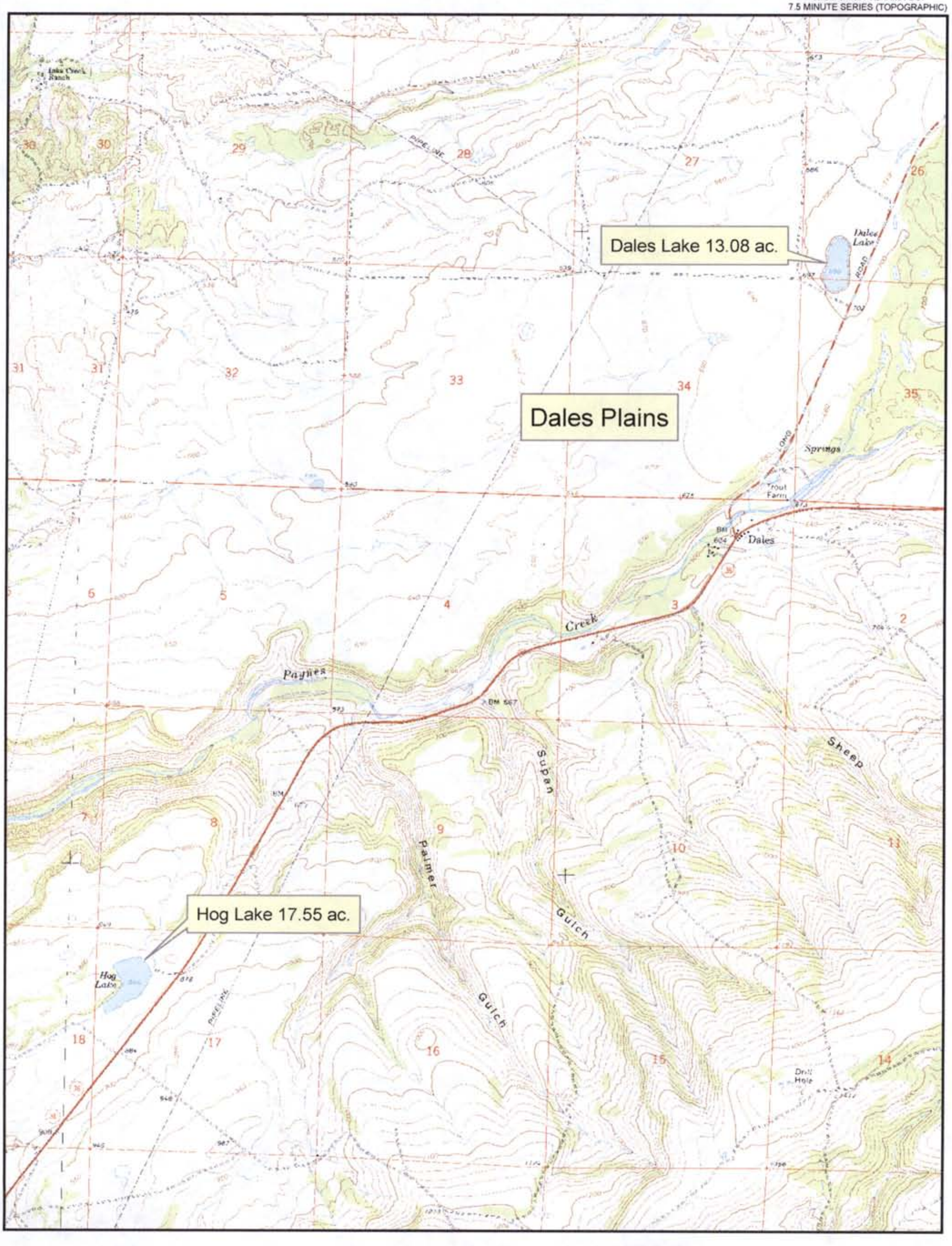

Figure 1. Location of Dales Lake in relation to Hog Lake.

CDFG Vernal Pool Grazing Study

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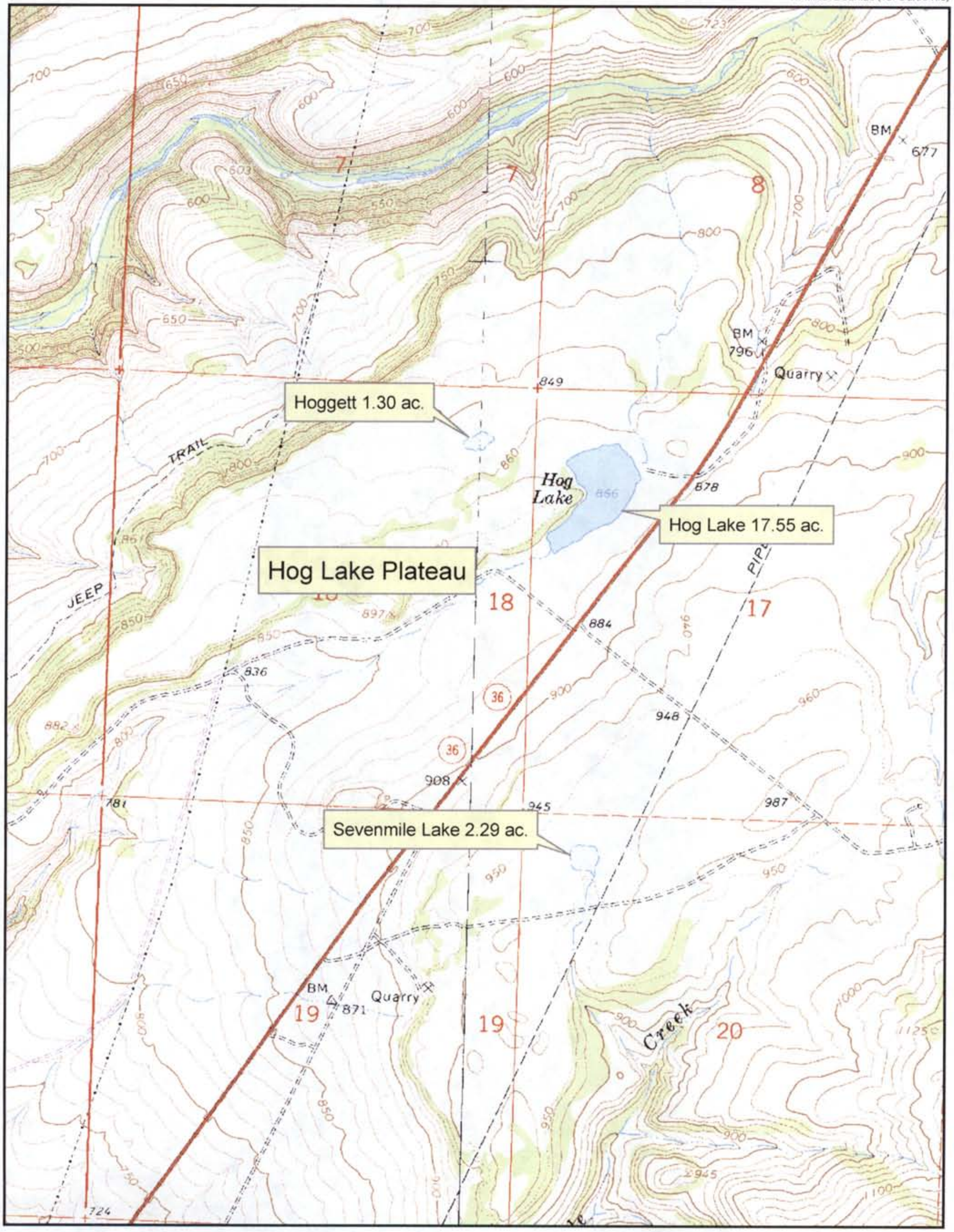

Figure 2. Locations of vernal pools Hog Lake, Hoggett, and Sevenmile Lake.

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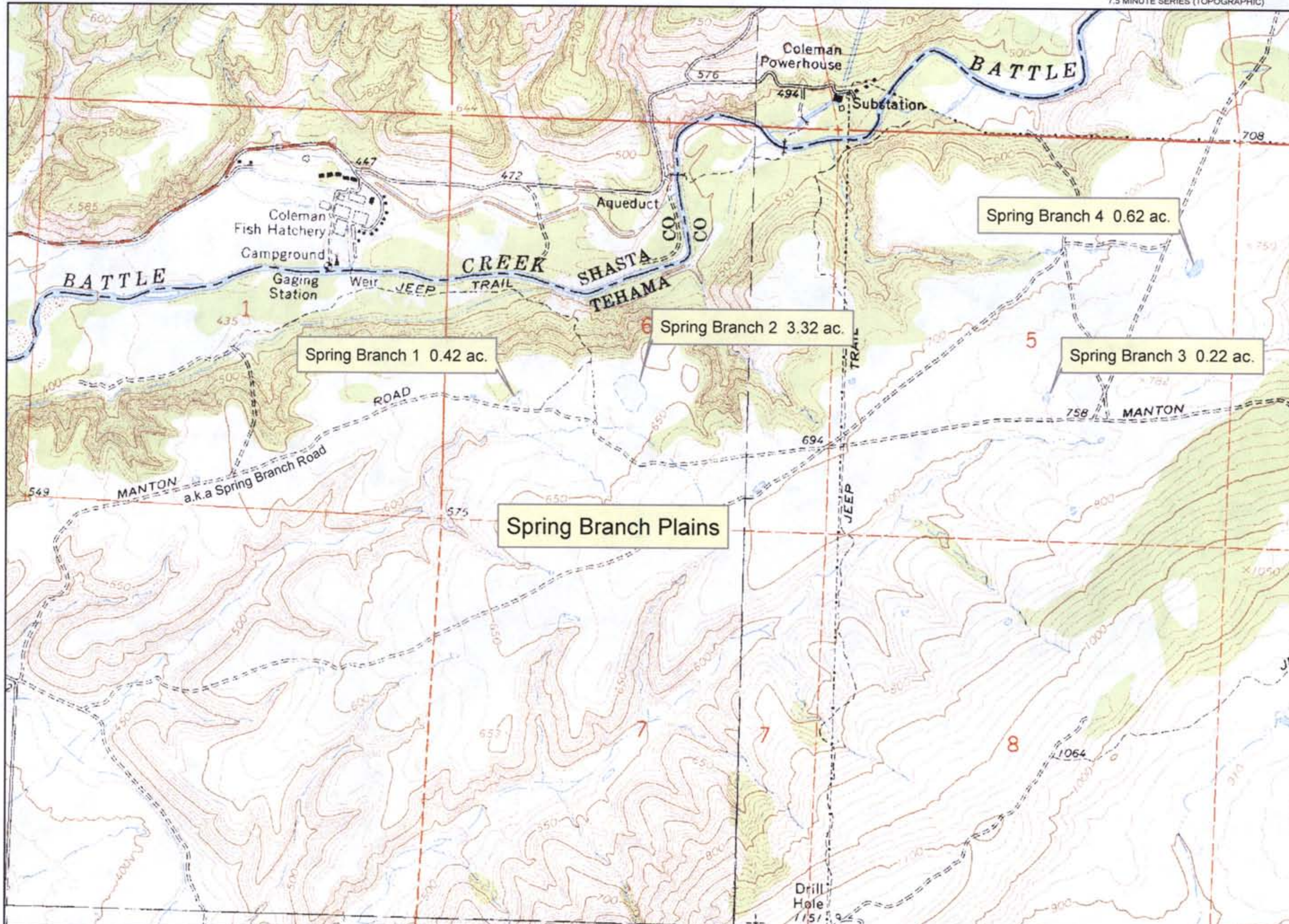

Figure 3. Locations of vernal pools 1, 2, 3 and 4 on Spring Branch Road.

between *Orcuttia tenuis* (State-listed, Endangered; Federally-listed, Threatened) and *Eleocharis macrostachya* occurs, and if such competition may be a threat to *O. tenuis*.

Appendices 1 and 2 provide extensive background of the study design, methodology and preliminary results of this project. Therefore, this report proceeds with the presentation of the results.

RESULTS

WATER QUALITY AND BRANCHIOPODS

Hog Lake

Introduction

Hog Lake is a very large (17.6 acres) vernal pool located northeast of Red Bluff and to the west of Highway 36 in Tehama County. It contains species typical of a vernal pool in this area. Its size was augmented substantially in the past when a large berm was placed along a section of the northeast shoreline. It is unknown what the original size of the pool was prior to the berm emplacement.

Hog Lake was grazed routinely as part of the general fall, winter, and early spring grazing typical of this area. For many years a corral existed approximately 200 yards northeast of the high water mark of the pool. This corral was deteriorating and rarely used by 1992. In 1993/1994 the Bureau of Land Management began negotiations to trade for the property and they acquired it in 1996. After acquisition, grazing was withdrawn for approximately four years while an Environmental Assessment was prepared for resource management of the newly acquired lands. Grazing resumed in fall 2000 and returned to the typical fall, winter, early spring grazing pattern.

Water Quality

Collection of water quality measurements began in water year (WY) 1997. The pH of the pool in the first quarter of the WY (Nov, Dec, Jan) was slightly alkaline (7.4 – 8.7) and then reached equilibrium at around pH 7.5. *Linderiella occidentalis* (California fairy shrimp) hatch and reach their highest numbers during this period. In the next quarter (Feb, Mar, Apr), the pH would either shift toward neutral (7.0) or continue in the slightly alkaline range. In the third quarter (May, June, July), pH would shift toward more alkaline conditions with pH typically ranging from 7.5 – 9.0, If the pool continued to hold water due to late rains, there may be a return to neutral or slightly acidic conditions (pH 6.8) as vegetation began to decay in the warm water temperatures.

Dissolved Oxygen (DO) typically ranges from 6-10 mg/l with rare declines to less than 6 mg/l. Specific Conductance (standardized at 25°C) tended to show higher values (45-60 uS/cm) in the first two quarters of the water year and then decline to values of 30-50 uS/cm, possibly as a result of the stabilizing of the sediment due to increasing growth of the vegetation. Salinity maintained a steady value of 0.0 ppt and never exceeded this until the final sampling of the pool in late summer.

Branchiopods

The fairy shrimp of Hog Lake are *Linderiella occidentalis*, *Lepidurus packardi* (tadpole shrimp), and two species of *Cyzicus* (clam shrimp). Quantitative monitoring was conducted only on *Linderiella occidentalis*. The complete sampling design and monitoring protocol for the branchiopods can be found in Appendix 1.

In WY 1998, initial mean density of *Linderiella* was 96 shrimp/ 0.5 m^3 (Figure 4). Mean density declined to a mean of between 13/0.5m^3 and 17/0.5m^3 during the next six weeks. In WY 1999, the first collections were on Dec 29, 1999, and the initial mean density was 38 /0.5m^3 followed by declines in the mean to 18/0.5m^3 and 3/0.5m^3 during the next four weeks. In WY 2000, the first collections, on Nov 30, 2000, had a mean density of 43/0.5m^3; the mean density steadily declined over the next eight weeks (Figure 4).

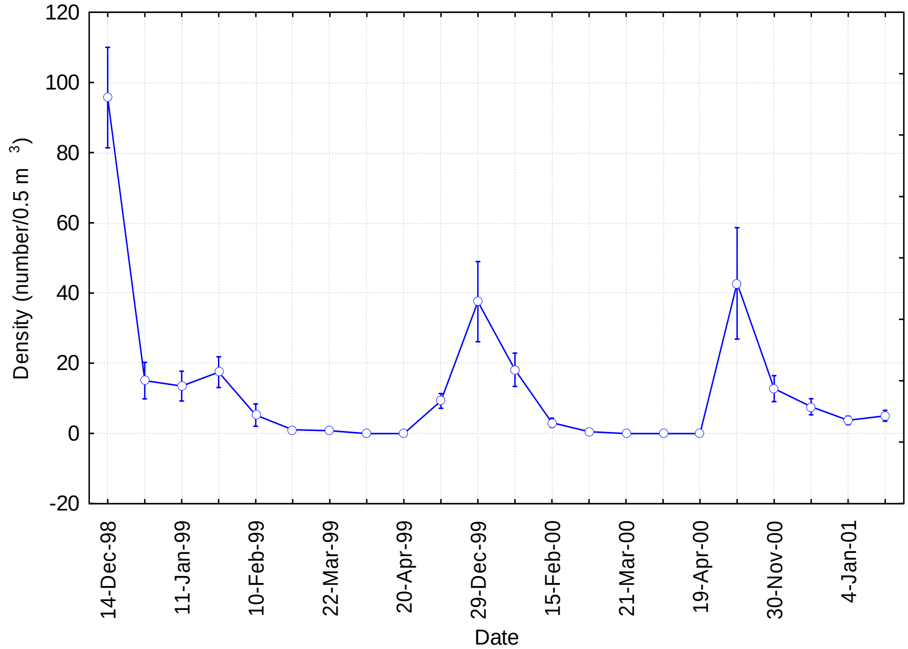

Figure 4. Hog Lake. Sampled density of *Linderiella occidentalis.*

<u>Dales Lake</u>

Introduction

Dales Lake is a large vernal pool (13.1 acres) located northeast of Red Bluff, in Tehama County; it is approximately one mile northwest of the town of Dales Station to the west of Manton Road. Dales Lake is most comparable to Hog Lake in size, plant species, and fairy shrimp species that inhabit it. One difference between the two vernal lakes is that Dales Lake has had virtually no augmentation in surface area or volume via the construction of berms. The only effect from water control structures has come from the slight road bed rise of Inks Creek Road, a gravel road at the southern boundary of Dales Lake, which only affects the lake at maximal pool levels.

Prior to 1994, Dales Lake was owned by the Denny Land and Cattle Company. In 1994, it was purchased by Pacific Gas and Electric Company (PG&E) as a component of their mitigation for vernal pool impacts due to construction of the natural gas pipeline one mile to the west of Dales Lake. Ownership was then transferred to the California Dept. of Fish and Game (CDFG) in 1995. Dales Lake had always been grazed as part of the Denny Land and Cattle Co operations; in 1995, after acquisition by CDFG, fences were repaired and new fence-lines installed around the property to control grazing effects. Two sets of created vernal pools were built by PG&E as another component of vernal pool mitigation which hastened the construction of fence-lines. The constructed pools were isolated by fences to protect them from trampling effects on their berms. These constructed pools were not monitored as a part of this project, due to potential legal disputes with PG&E during their monitoring period. The CDFG eliminated grazing on the Dales Lake property beginning in the summer of 1995.

Water Quality

Water quality measurements began in WY 1997 and continued through summer 2005. In the first quarter of the WY, pH was near neutral to slightly alkaline (7.1 – 8.3) . *Linderiella occidentalis* hatches and immediately reach its highest densities during this period. In the next quarter of a WY, the pH either shifts toward neutral (7.0) or continues in the slightly alkaline range (7.1 – 8.5), with occasional spikes to higher values (~ 9). In the third quarter pH, shifts toward more neutral conditions with the pH typically ranging from 7.1 – 8.1 although it may irregularly drop to slightly acidic (6.8). The pool tended to continue in this range of neutral to slightly acidic conditions as the pool dried down.

Dissolved oxygen was consistently in the range of 6-10 mg/l. Specific conductance (standardized at 25 °C) tended to show higher values (24 – 40 uS/cm) in the first two quarters of the WY and then decline to values of 20 – 40 uS/cm, possibly as a result of the stabilizing of the sediment due to increasing growth of the vegetation. Salinity maintained a steady value of 0.0 ppt and never exceeded this until the final sampling of the pool in late summer when it would reach 0.1 ppt.

Branchiopods

The branchiopods of Dales Lake are *Linderiella occidentalis* and *Lepidurus packardi*. Quantitative monitoring was conducted only on *Linderiella occidentalis*.

In WY 1998, initial mean density of *Linderiella* was $135/0.5m^3$ (Figure 5) that declined over the next 10 weeks to means ranging between $91/0.5m^3$ and $2/0.5m^3$. In WY 1999, the first collections were on Dec 29, 1999, and the initial mean density was very low at $1.6/\ 0.5m^3$ followed by still smaller means around $0.3/\ 0.5m^3$ over the next six weeks (Figure 5). In WY 2000, the first collections occurred on Nov 30, 2000, and had a mean density of $16/0.5m^3$ *Linderiella.* Declines in mean density values, ranging from $1.4/0.5m^3$ to $10/0.5m^3$, ensued over the next eight weeks.

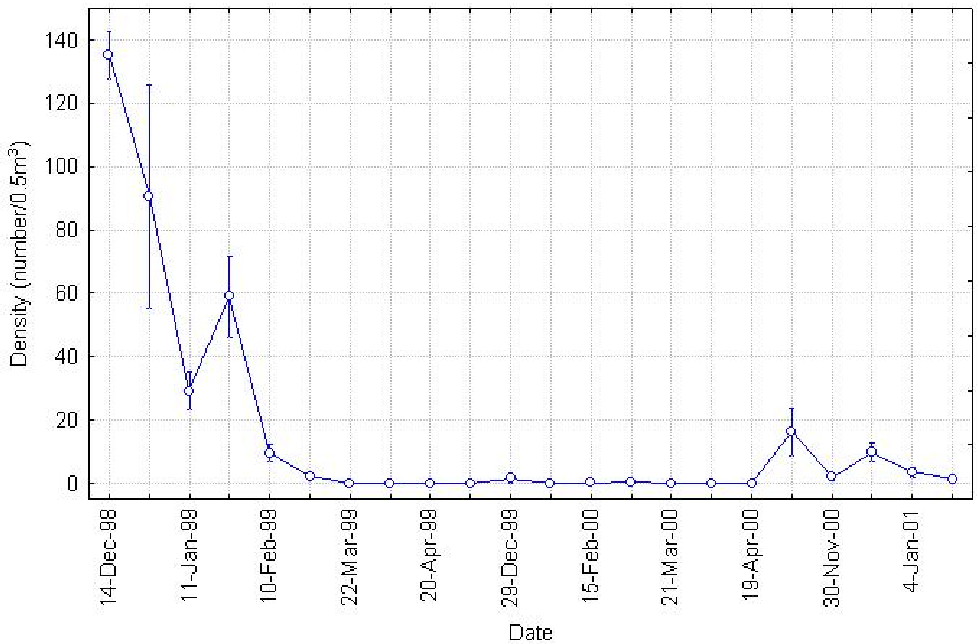

Figure 5. Dales Lake. Sampled density of *Linderiella occidentalis.*

Hoggett

Introduction

Hoggett is a pool located northwest of Hog Lake and much smaller in size (1.3 acres). It has a reduced plant species diversity and it supports *Linderiella occidentalis*. The pool is also in its natural state with no apparent augmentation by berms. Hoggett was acquired by the Bureau of Land Management (BLM) when they acquired the Hog Lake Plateau property in 1996. Grazing had been occurring on the property by the private land-owner or through cooperative leases with the Denny Land and Cattle Company. Once acquired by the BLM, grazing was stopped while an Environmental Assessment was prepared, resources inventoried, and new grazing leases developed. Hoggett is grazed in the same allotment as Hog Lake.

Water Quality

Water quality measures began in WY 1997 and continued through the summer of 2005. In the first quarter of the WY, pH was almost neutral to slightly alkaline (7.1 – 8.7).

Linderiella occidentalis hatches and reaches its highest densities during this period. In the second quarter of the WY, the pH shifts toward neutral (7.0) or continues in the slightly alkaline range (7.1 – 8.5); there tends to be no consistent pattern and this is likely due to the generally shallow conditions in this pool. In the third quarter, pH remains in more neutral conditions with the pH typically ranging from 7.1 – 8.1, with occasional drops to slightly acidic (6.8). The pool tended to continue in this range of neutral to slightly acidic, or slightly alkaline conditions as the pool dried down.

Dissolved oxygen frequently ranges between of 6-10 mg/l. There were rare occasions when it declined to as low as 4.4 mg/l; however, these are rare occurrences and are likely to be short in duration, occurring in mid-spring when plant respiration may be very high. Specific conductance (standardized at 25 °C) tended to show values of 30 – 50 uS/cm in the first two quarters of the WY and then increase slightly as the season progressed. At the end of the WY values would approach 60 uS/cm. Salinity maintained a steady value of 0.0 ppt and never exceeded this value.

Branchiopods

Linderiella occidentalis is the resident fairy shrimp and to date no other species have been found. Quantitative monitoring was conducted on *Linderiella occidentalis*.

In WY 1998, initial mean density of *Linderiella* was 0.5/ 0.5m^3 (Figure 6). The mean density then ranged between 0.06/0.5m^3 and 1.1/0.5m^3 over the next 10 weeks. In WY 1999, the first collections were on Dec 29, 1999, and the mean density was low at 3/0.5m^3, which then declined to 0.6/0.5m^3 two weeks later; no *Linderiella* were collected the remainder of the season. In WY 2000, the first collection, on Nov 30, 2000, found a mean density of 11.6/0.5m^3 *Linderiella*, which increased to 33/0.5m^3 and 43/0.5m^3 (Figure 6) in two and four weeks respectively following the initial collection. In the following six weeks, the mean density slowly declined. This was the best year for *Linderiella* in the three years of sampling.

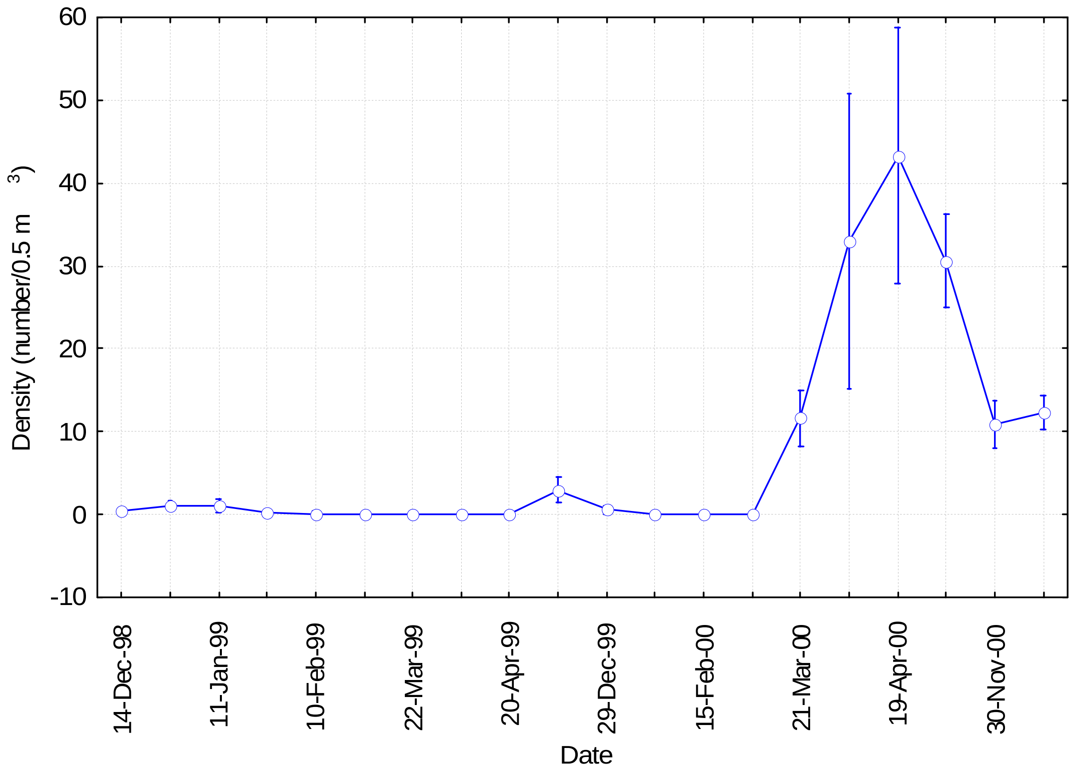

Figure 6. Hoggett. Sampled density of *Linderiella occidentalis*

<u>Sevenmile Lake</u>

Introduction

Sevenmile Lake is of moderate size (2.3 acres) and owned and managed by the Bureau of Land Management. It is located approximately one mile southeast of Hog Lake. A comprehensive discussion of the pool morphology, basin topography, soil depth and rock exposure frequency is available in Appendix 5. The pool itself appears to have incurred no direct augmentation work in the form of berms; however it appears that the surrounding uplands sustained some sort of garden rock quarrying, removal, or other form of rock moving, as there are irregular swathes remaining from bulldozer activity. Sevenmile Lake appears to be virtually unaltered, so is similar to Dales Lake and Hoggett.

The pool was unfenced and had been routinely grazed, but in 1993, it was fenced by PG&E as part of their vernal pool mitigation work for their natural gas pipeline expansion project. It has remained fenced with no applied grazing on the fenced property, except for the occasional steer or cow that slips through a fence opening.

Water Quality

Water quality sampling began in WY 1997 and continued through summer 2005. In the first quarter of a WY, pH begins near neutral to slightly alkaline (7.2 – 9.3). The branchiopods hatch and reach their highest densities during this period. The pH remained in the alkaline range (7.3 – 9.8) during the second quarter of the WY although there tends to be no consistent pattern to pH rising and falling that can initially be interpreted from this data set. More careful study of the pattern and climatic conditions may reveal why these fluctuations are occurring. In the third quarter, water is often absent by early June, or declining rapidly, and the pH begins shifting toward more neutral conditions in the range of 7.1 – 8.1with an occasional drop to slightly acidic (6.8). The pool tended to continue in this range of neutral to slightly acidic, or slightly alkaline conditions as the pool dried down.

Dissolved oxygen frequently ranged between of 8-10 mg/l with occasional dips to 7 mg/l or spikes to 12 mg/l. Specific conductance (standardized at 25 °C) tended to show values of 20 – 50 uS/cm in the first two quarters of the WY and then stabilized or increased slightly as the season progressed. These fluctuations were likely due to wind-induced sediment disturbance. Salinity maintained a steady value of 0.0 ppt and was never recorded as exceeding this value.

Branchiopods

The branchiopods of Sevenmile Lake are *Linderiella occidentalis* and *Lepidurus packardi*. Quantitative monitoring was conducted only on *Linderiella occidentalis*. *Lepidurus packardi* has been irregularly encountered and seems to in low numbers in this pool; the cause of this low occurrence is unknown.

In WY 1998, mean density of *Linderiella* was 97.2/0.5m^3 . Mean density declined rapidly to 16/0.5m^3 in two weeks, and two weeks later declined to 7.8/ 0.5m^3. The mean density then remained in the range of 2.1/ 0.5m^3 to 2.4/ 0.5m^3 for the next six weeks. In WY 1999, the first collections were on Dec 29, 1999, and the mean density was initially at 10.1/0.5m^3. It then decreased to 9.4/0.5m^3 two weeks later, and then ranged between 1.5/ 0.5m^3 and 1.8/ 0.5m^3 over the next six weeks. In WY 2000, the first collection, on Nov 30, 2000, found a mean density of 11.8/0.5m^3 *Linderiella*; mean density over the next eight weeks ranged from 4 to 8.1/0.5m^3 (Figure 7).

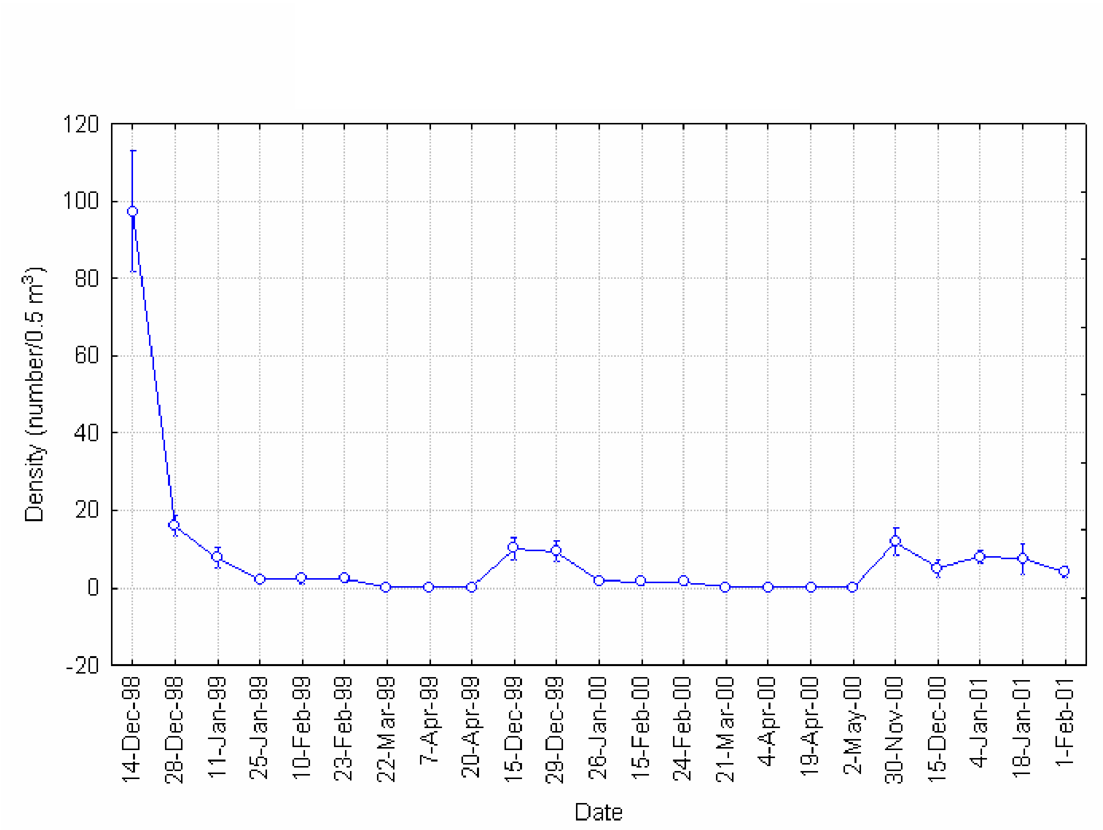

Figure 7. Sevenmile Lake. Sampled Density of *Linderiella occidentalis*

<u>Spring Branch One</u>

Introduction

The Spring Branch pools are at the northern edge of Tehama County on the plateau south of Battle Creek. The pools occur on BLM land that has been continuously grazed for many years. Spring Branch One is small (0.4 acres) compared to the Hog Lake pool along Highway 36; it was fenced to exclude grazing on approximately 80% of its perimeter. The fence-line was cut into the pool to allow cattle access to the other 20%. The lands surrounding the Spring Branch pools are typically grazed from late fall until early to mid spring when the plateau dries. The pool was substantially enlarged with the construction of a berm at an unknown date in the past. Given the composition of branchiopods and vegetation, it is likely that the pool had an original core area.

Water Quality

Water quality measures began in WY 1997 and continued through summer 2005. In the first quarter of a typical WY, pH is initially slightly acidic or neutral to alkaline (6.7 – 10.0). The branchiopods hatch and reach their highest densities during this period. In the second quarter of the WY, the pH is neutral (7.0) but shifts from slightly acidic to slightly alkaline, in the range of pH 6.4 – 8.7. In the third quarter, pH tends to range quite widely from acidic to alkaline (5.8 – 9.3). The pool tended to continue in the range of neutral to slightly alkaline conditions as the pool dried down.

Dissolved oxygen normally ranged from 6-9 mg/l, except very late in the WY when values dropped below 4 mg/l. Specific conductance (standardized at 25 °C) tended to show values of 20 – 60 uS/cm in the first two quarters of the WY and then increase slightly as the season progressed and stabilize in the range of 30-40 uS/cm. At the end of the WY, values would reach 70 – 140 uS/cm. Since this pool can hold water until late in the season and is accessible to cattle, the high conductivity reflects the turbidity from the unconsolidated and unvegetated sediment in this region of the pool. Salinity maintained a steady value of 0.0 ppt until late in the season when it would reach 0.1 ppt.

Branchiopods

The branchiopods of Spring Branch One are *Linderiella occidentalis*, *Lepidurus packardi*, and *Cyzicus* sp. Quantitative monitoring was conducted only for *Linderiella occidentalis*.

In WY 1998, mean densities of *Linderiella* were initially 183 /0.5 m^3. The mean density declined over the next 14 weeks to mean densities between 162.5/0.5 m^3 and 0.6/0.5 m^3 (Figure 8). In WY 1999, the first collections were on Dec 29, 1999, and the initial mean density was significantly lower than that measured in WY 1998, 37.4/0.5 m^3. The mean density declined over the next 10 weeks to mean densities ranging from 23.5/0.5 m^3 to 1.2/0.5 m^3. In WY 2000, the first collection, on Nov 30, 2000, showed a very high mean density of 256/0.5 m^3 (Figure 8). During the next eight weeks the mean density dropped dramatically to range between 4.6/0.5 m^3 and 14.1/0.5 m^3.

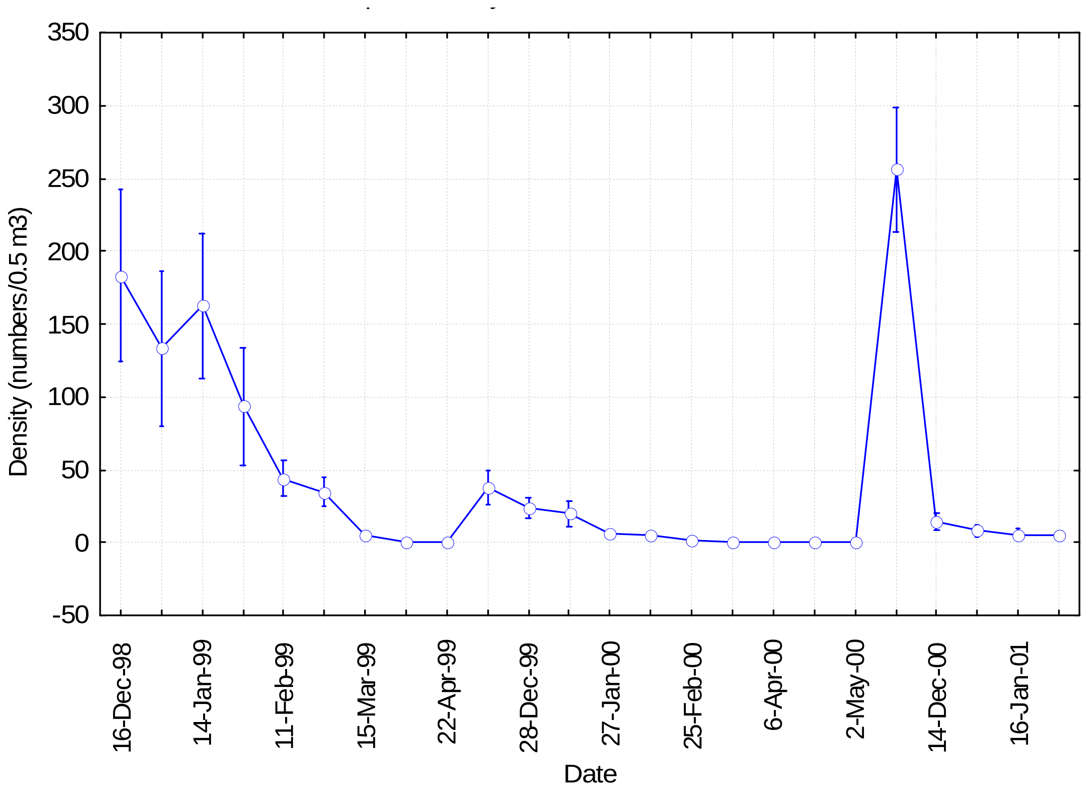

Figure 8. Spring Branch One. Sampled density of *Linderiella occidentalis.*

<u>Spring Branch Two</u>

Introduction

Spring Branch Two lies to the east of Spring Branch One. See Appendix 5 for a comprehensive discussion of the pool morphology, basin topography, soil depth and rock exposure frequency. This pool was fenced to exclude cattle grazing circa 1993. The pool was augmented with a long berm on the western margin of the pool at an unknown date in the past. This pool is unique in supporting a population of *Branchinecta lynchi* as opposed to *Linderiella occidentalis*, which is more common in the Tehama County pools.

Water Quality

Water quality measures began in WY 1997 and continued until summer 2005. In the first quarter of the WY, initial pH was slightly acidic or neutral to alkaline (6.1 – 8.1). The fairy shrimp hatch and reach their highest densities during this period. In the second quarter, the pH is neutral (7.0) but shifts from slightly acidic to alkaline, in the range of 6.5

– 8.6. In the third quarter, pH continued to range, quite widely, from acidic to neutral (5.7 – 9.4). The pool tended to vary fairly widely in pH toward the latter part of the season as the pool dried down.

Dissolved oxygen ranged fairly consistently between 6 mg/l and 10 mg/l, with frequent higher spikes to 12 mg/l; there was no late season decline in DO typical of the other pools, likely because of the lack of a deep depression where the water would collect at the last of the season. Specific conductance (standardized at 25 °C) tended to show values of 10 – 25 uS/cm as its typical range. Occasionally, high values (60 – 70 uS/cm) in the early part of the WY (Nov) and at the end of the WY (June to August) would be recorded. Salinity maintained a steady value of 0.0 ppt until late in the season when it would reach 0.1 ppt.

Branchiopods

The fairy shrimp of Spring Branch Two are *Branchinecta lynchi*, and *Lepidurus packardi*. In WY 1998, initial mean density of *Branchinecta* was 14.6/0.5 m^3 which declined in two weeks to 11.5/0.5 m^3, and then to 0.3/0.5 m^3 (Figure 9). In WY 1999, the first collections were on Dec 29, 1999, and the mean density was significantly higher than that recorded in WY 1998, 64.8/0.5 m^3. The mean density declined in two weeks to 31.6/0.5 m^3, followed in two weeks to 7.5/0.5 m^3 and then 0.5/0.5 m^3 at the final collection. In WY 2000, the first collection, on Nov 30, 2000, showed a mean of 39.6/0.5m^3. During the next four weeks, the mean declined dramatically to 6.1/0.5 m^3, and then to 0.06/0.5m^3.

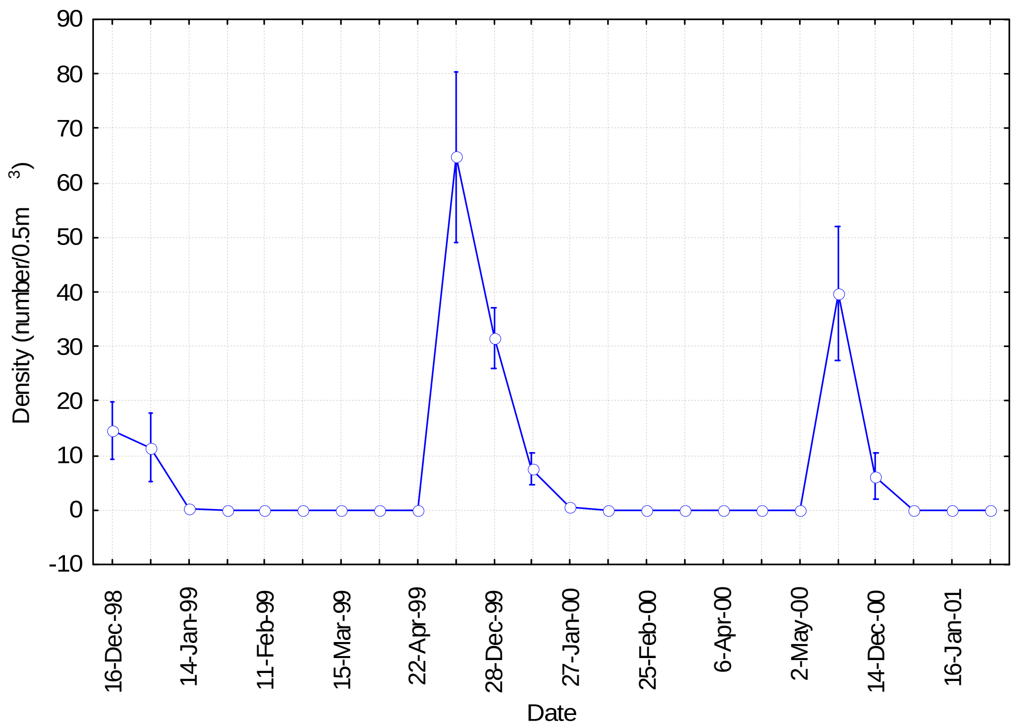

Figure 9. Spring Branch Two. Sampled density of *Branchinecta lynchi.*

Spring Branch Three

Introduction

Spring Branch Three is a pool that appeared to be similar to Spring Branch One and Spring Branch Four in that it has an extensive berm with a very deep margin along the berm that slopes up away from the berm to the soil surface. However, this pool is very depauperate in vernal pool vegetation and no branchiopods have been collected at any time during this study. The pool is fully open to grazing. Because it has such a depauperate flora and fauna, it is possible that there was no original vernal pool at this location in the past and the pool was wholly constructed as a stock pond. Topographically, this pool is higher in elevation than the other Spring Branch pools (Spring Branch One, Two, and Four); although it has a large catchment area, there is apparently no source of vernal pool propagules upslope of this pool.

Water Quality

Water quality measures began in WY 1997 and have continued through summer 2005. In the first quarter of the WY, pH is slightly acidic or neutral to alkaline (6.7 – 8.4). In the second quarter, the pH shifts from slightly acidic to alkaline, in the range 6.4 – 9.2. In the third quarter, pH would continue to range, quite widely, from acidic to neutral to alkaline (6.0 – 9.6). The pool tended to vary fairly widely toward the latter part of the season as the pool dried down. In pH, this pool is not particularly different from the other pools in this study.

Dissolved oxygen ranges in the Zone of 8-11 mg/l; there were some periodic low values (< 4 mg/l) that occurred in the early or late phases of the WY. Its higher oxygen range may be attributed to low vegetation cover in the pool. Specific conductance (standardized at 25 °C) tended to show values of 30 – 40 uS/cm although there were high values ranging from 70 – 242 uS/cm in the very late season due to the presence of cattle. Salinity maintained a steady value of 0.0 ppt throughout the season.

Branchiopods

To date we have never collected any species of *Linderiella*, *Branchinecta*, *Lepidurus*, or *Cyzicus* in this pool, although it was sampled repeatedly on the same schedule as the other Spring Branch pools.

Spring Branch Four

Introduction

As discussed in the introduction to Spring Branch Three, Spring Branch Four has a similar morphology similar to that of Spring Branch One and Spring Branch Three. Spring Branch Four is similar to Spring Branch Three in that it has a very depauperate vernal pool flora. Spring Branch Four is unique in that three species of branchiopods have been found in this pool. The dominant species is *Linderiella occidentalis*; less common and erratically occurring is *Branchinecta lynchi*; and occurring quite commonly is *Cyzicus* sp. The co-occurrence of a species of *Branchinecta* and *Linderiella* appears to be rare.

Spring Branch Four is fully open to grazing. From the presence of the branchiopods, it would appear that there was a natural vernal pool at this site prior to the construction of the very large berm. The depauperate flora could suggest, however, that this pool was constructed as a stock pond and the fairy shrimp have immigrated into this pool and found suitable habitat, whereas vernal plant species have not yet arrived to inhabit the pool.

Water Quality

Water Quality measures began in WY 1997 and continued until summer 2005. In the first quarter of the WY, pH is slightly acidic or neutral to alkaline (7.4 – 8.2). The branchiopods hatch and reach their highest densities during this period. In the second quarter, the pH is neutral (7.0), but shifts from acidic to alkaline, in the range 6.0 – 9.0. In the third quarter, pH continued to range, quite widely, from neutral to alkaline (7.0 – 9.8). The pool tended remain in the alkaline range toward the latter part of the season as the pool dried down.

Dissolved oxygen was frequently in the range of 8-10 mg/l. There was no general late season decline in DO, but sporadic declines which possibly depended upon surface area to volume ratios of the pool, water and air temperatures, and wind conditions. Specific conductance (standardized at 25 °C) tended to show values of 30 – 40 uS/cm with increasing values at the end of the WY when the pool was at the end of the dry-down phase. Salinity maintained a steady value of 0.0 ppt the entire season.

Branchiopods

The fairy shrimp of Spring Branch Four are *Linderiella occidentalis*, *Branchinecta lynchi*, and *Cyzicus* sp. Quantitative monitoring was conducted on *L. occidentalis* and *B. lynchi* when encountered; however data for *B. lynchi* is not presented here as it is too irregular.

In WY 1998, the initial mean density of *Linderiella* was 2.6/0.5 m^3. It declined, to 2.4/0.5 m^3, then to 0.9/0.5 m^3, and 0.06/0.5 m^3 during the succeeding two, four, and six weeks, respectively (Figure 10). In WY 1999, the first collections were on Dec 29, 1999, and the mean density was significantly higher than that recorded in WY 1998, 14.5/0.5 m^3. The mean density increased dramatically in two weeks to 105.9/0.5 m^3, then declined to 53.8/0.5 m^3 in the next two weeks. Over the next six weeks, the mean dropped to 8.5/0.5 m^3, 0.6/0.5 m^3, and finally ended at 0.1/0.5 m^3. In WY 2000, the first collection, on Nov 30, 2000, showed a very high mean density of 342.3/0.5 m^3; the mean density declined steadily over the eight weeks.

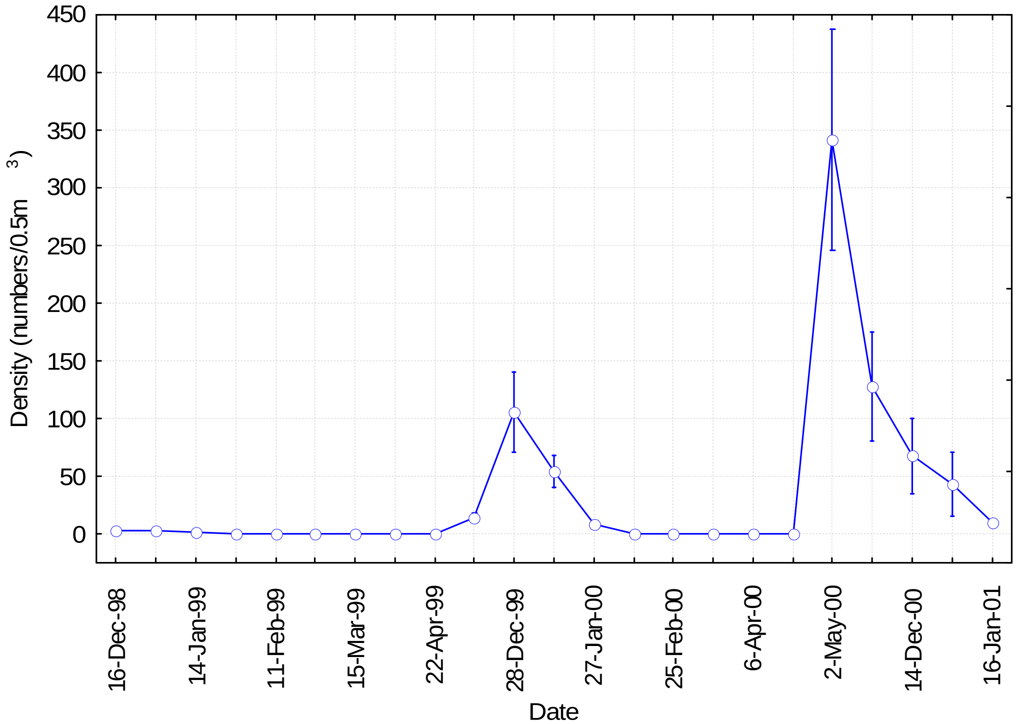

Figure 10. Spring Branch Four. Sampled density of *Linderiella occidentalis.*

VEGETATION ZONES

Permanent transects were used to monitor plant species vegetation changes and the methodology is fully described in the report provided as Appendix 1. Transects and plots were established such that upland mounds, wetland flats, and the pools would be monitored as completely as possible given limitations of personnel and time. Data was recorded on data sheets in the field and entered into Microsoft Access then converted to Microsoft Excel spreadsheets. Complete data was collected in 1999, 2000, 2001, and 2003.

<u>Dales Lake</u>

Introduction

Dales Lake has the long axis oriented north to south. The pool was divided with a fence to establish a control and grazed portion of the lake. This fence resulted in a north side and south side to the lake. Because the pool has a distinct basin topography in each half of the lake, two sets of transects were established in the deep central region of the pool. These transects radiated out from the center to the pool margins (see Appendix 1, Figure 4c). There was a pattern of zonation within the pool and sampled quadrats were stratified within the Zones of the pool. Complete details of the installation of these transects and Zones can be found in Appendix 1.

The northern transects are Dales Lake North (DLN) while the southern transects are Dales Lake South (DLS). Six plant Zones were identified within Dales Lake along the transects. Relative species composition and soil and rock cover indicated that plant species were changing in response to substrate conditions, period of inundation, light availability, and competitive abilities of the species given the microhabitat conditions of the site.

Dales Lake North (DLN) Vegetation Zones

Stratification of vegetation into Zones allowed the variation of the Zones to be examined over time. The indicator species that occurred in sufficient quantities and frequency within the transects to be monitored were *Orcuttia tenuis*, *Eleocharis macrostachya*, *Marsilea vestita*, *Sagittaria sanfordii*, *Eryngium castrense*, and a "catch all" category "Other". "Other" was composed predominantly of taxa such as *Isoetes* spp. and *Pilularia* which could not be identified without disturbing the quadrat itself, and sporadic occurrences of *Plagiobothrys* and other species typically found in areas of shorter inundation. Two other variables recorded were bare ground and rock cover.

Examination of Figures 11-16 reveals some interesting patterns and characteristics of the six Zones in Dales Lake North. The Zones move from deep regions of the pool (Zones 1-2; Figures 11 & 12), to intermediate depths (Zones 3-4; Figures 13 & 14), to shallow regions (Zones 5-6; Figures 15 & 16). In Zones 1-2 (Figures 11 & 12), rock is nearly absent and the mean of bare ground is around 20%, mean *Orcuttia tenuis* cover is 20% and *Eleocharis macrostachya* cover is <20%. A unique feature is the presence of *Sagittaria sanfordii* with a mean cover of 1-5%. The transition to intermediate Zones, finds a decrease in mean bare ground to <20%, and the increase of rock cover. *Orcuttia tenuis* increases to a mean of nearly 40% cover. While *E. macrostachya* variance increases, the mean cover decreases to <5% in the transition from Zone 3 to Zone 4 (Figures 13 & 14). *Sagittaria sanfordii* shows a decline from presence in Zone 3 to absence in Zone 4 with the decrease in pool depth. The shallower Zones (5 & 6; Figures 15 & 16), which still maintain inundation sufficient to support *O. tenuis*, show a large increase in mean rock cover to > 40%; mean cover of *O. tenuis* decreases to 15-20%; and *E. macrostachya* is absent.

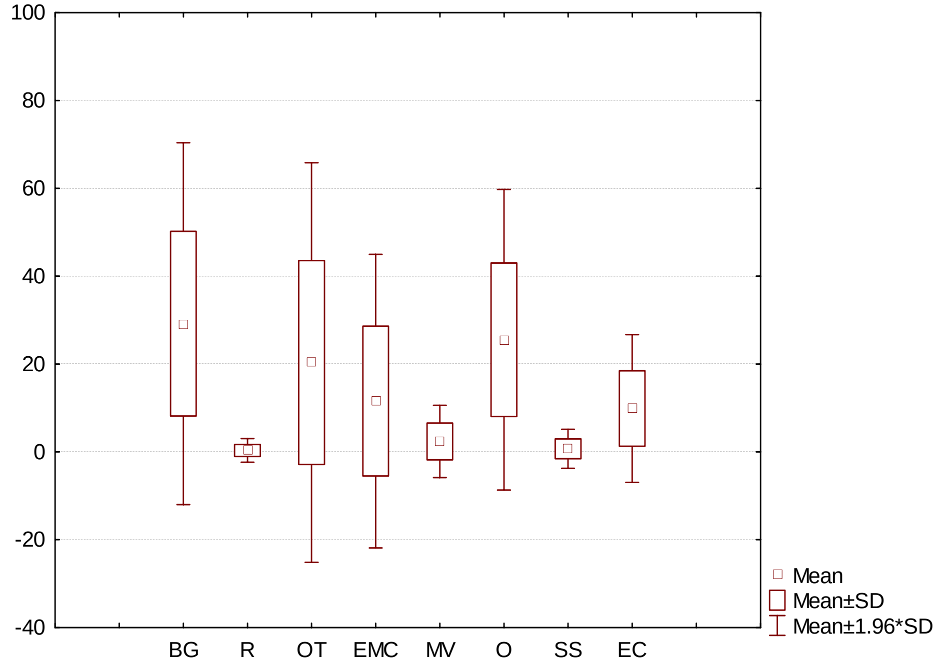

Figure 11. Dales Lake North transects. Zone 1.

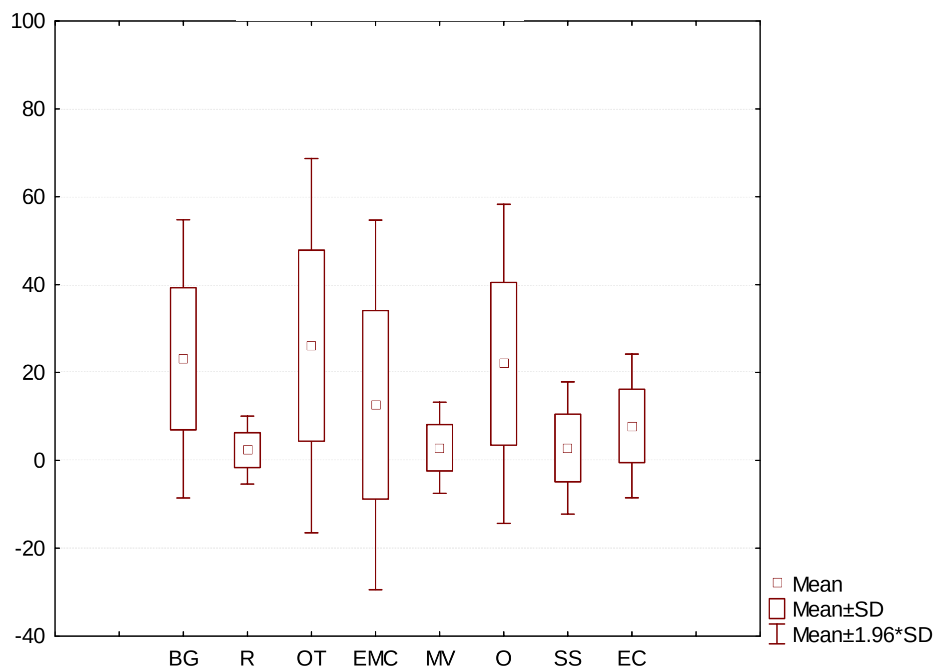

Figure 12. Dales Lake North transects. Zone 2.

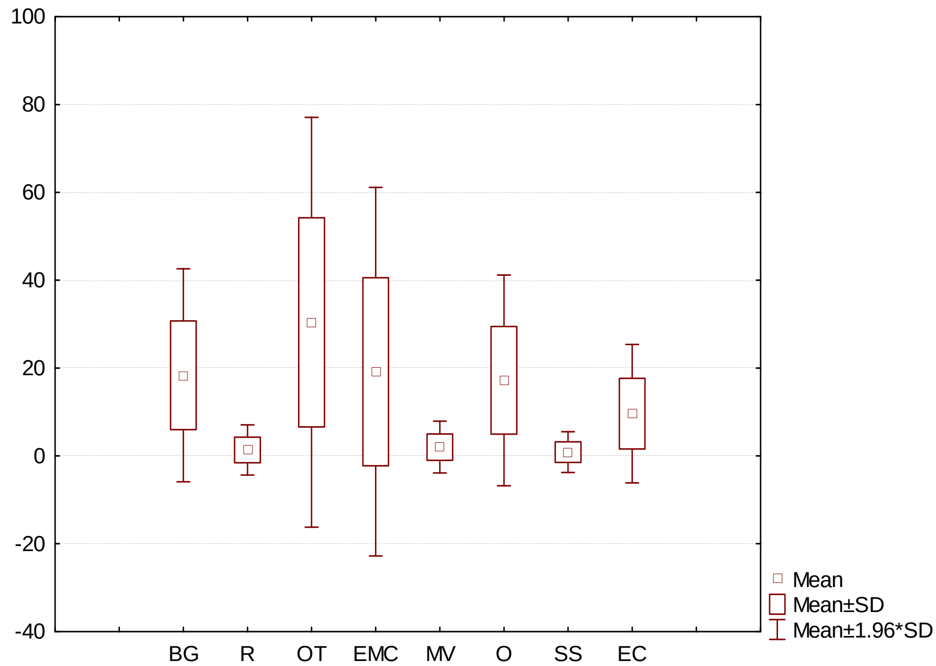

Figure 13. Dales Lake North transects. Zone 3.

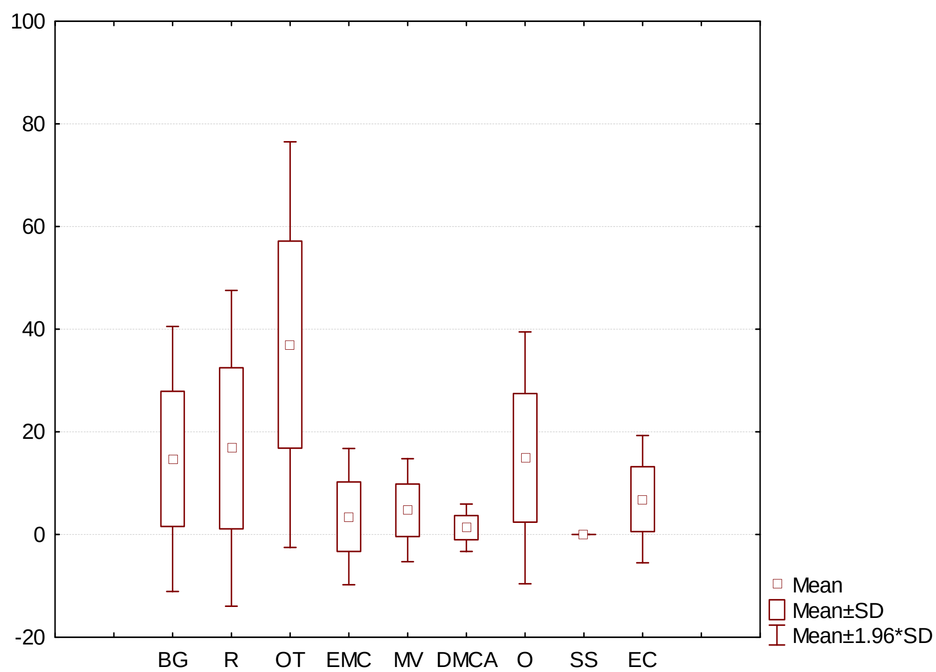

Figure 14. Dales Lake North transects. Zone 4.

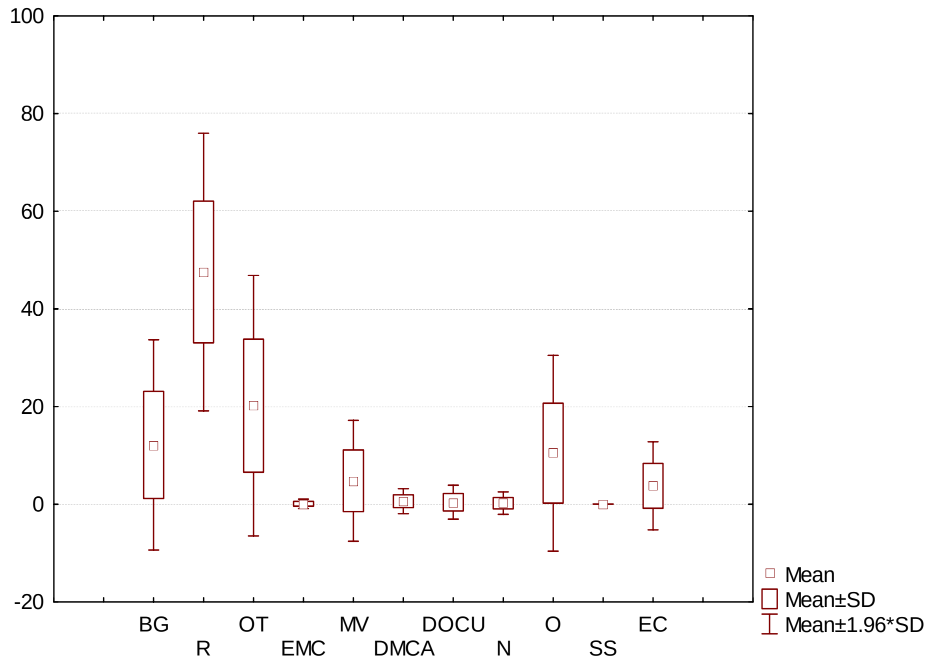

Figure 15. Dales Lake North transects. Zone 5.

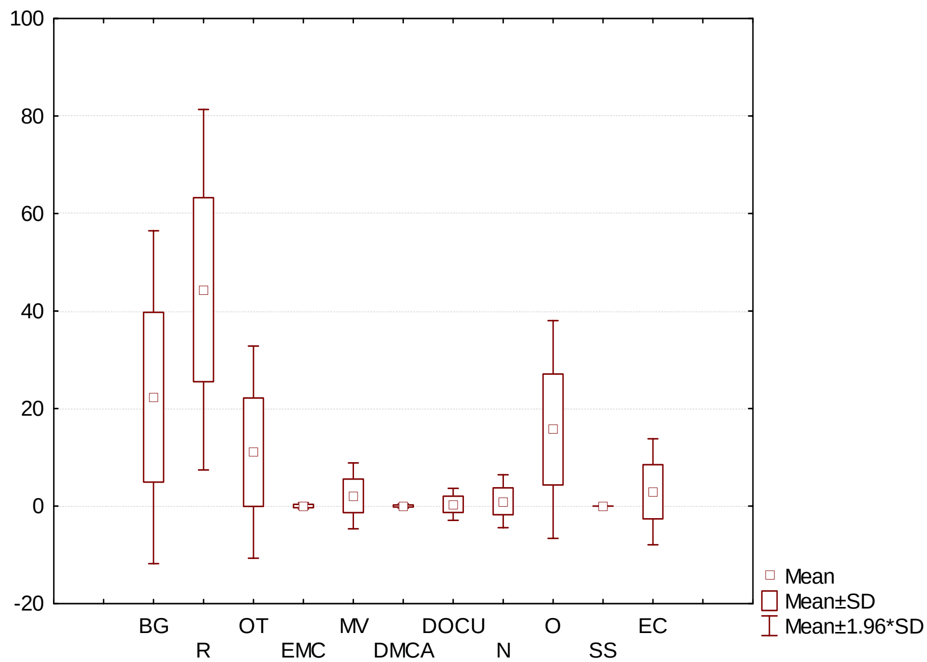

Figure 16. Dales Lake North transects. Zone 6.

Dales Lake South (DLS) Vegetation Zones

Dales Lake South has a different compositional signature as indicated by the plant species and rock cover in the southern region of the lake. As with DLN, the deep regions of DLS are Zones 1 and 2 (Figures 17 & 18), the intermediate depth Zones are 3 and 4 (Figures 19 & 20), and shallow Zones 5 and 6 (Figures 21 & 22). In the deep Zones (Figures 17 & 18), rock cover is low (mean < 5%) in similarity to the deep Zones of DLN. Mean *O. tenuis* cover ranges between 20 – 40%; *E. macrostachya* has mean cover of <5%; and *S. sanfordii* is absent from these quadrats. *Sagittaria sanfordii* does occur in this side of the pool although it was missed by the sampling procedure. The intermediate Zones (3 and 4; Figures 16 & 17) show mean rock cover <5%; *O. tenuis* with mean ranging from 15-20%; *E. macrostachya* increasing substantially with means ranging from 15-20%; and means for bare ground remain consistently around 20% in the deep and intermediate Zones. Moving into the shallow Zone (5 and 6; Figures 21 & 22), mean rock cover is still very low (<5%), while mean *O. tenuis* cover is still in the range of 15-20% and nearly paralleling *E. macrostachya* in range of means and overall variance. In these shallower Zones *Deschampsia danthonioides* has a strong presence although means are 10-15% and the variance is high.

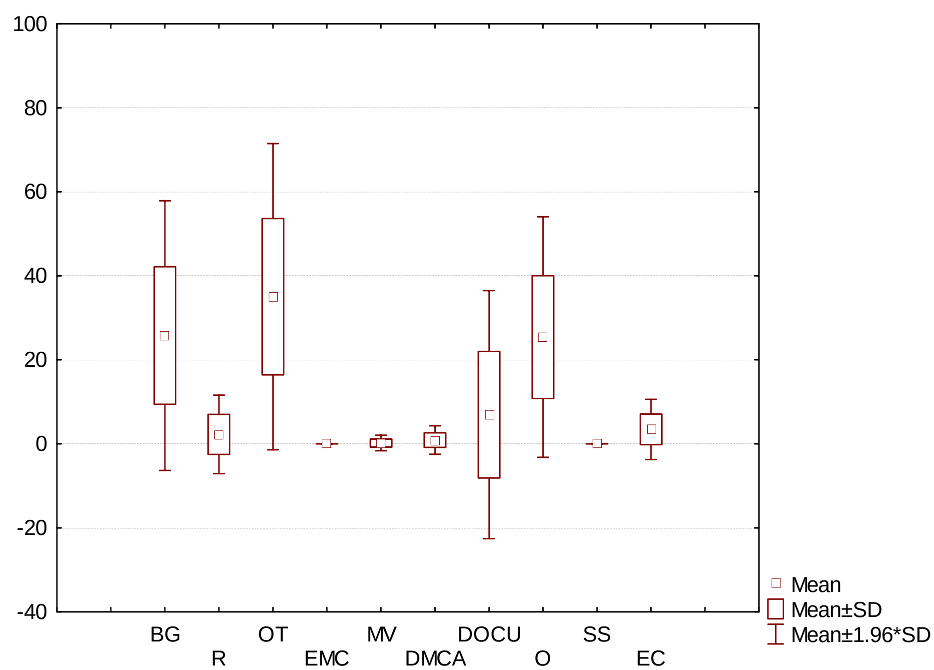

Figure 17. Dales Lake South transects. Zone 1.

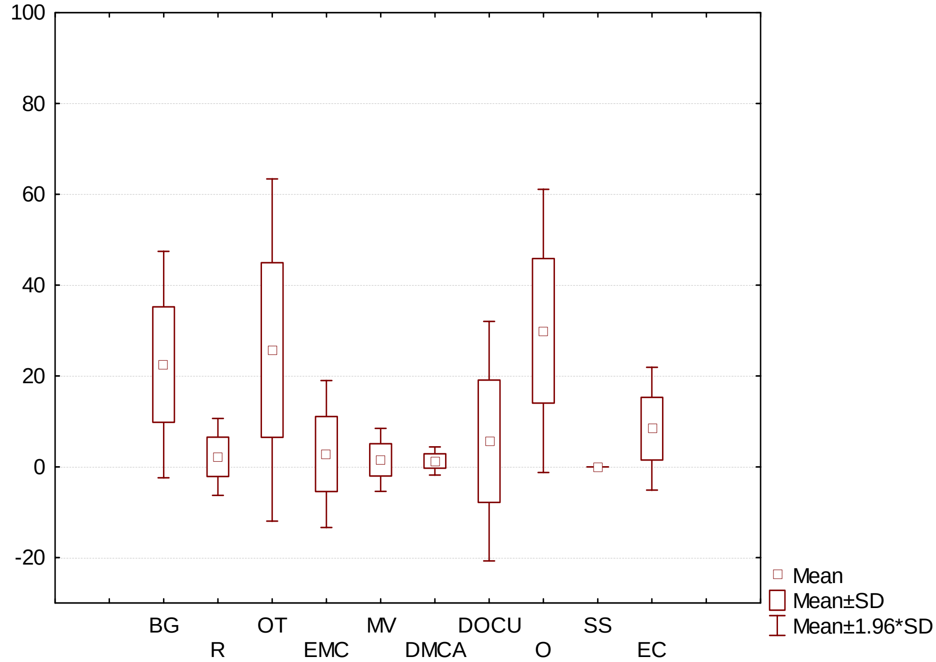

Figure 18. Dales Lake South transects. Zone 2.

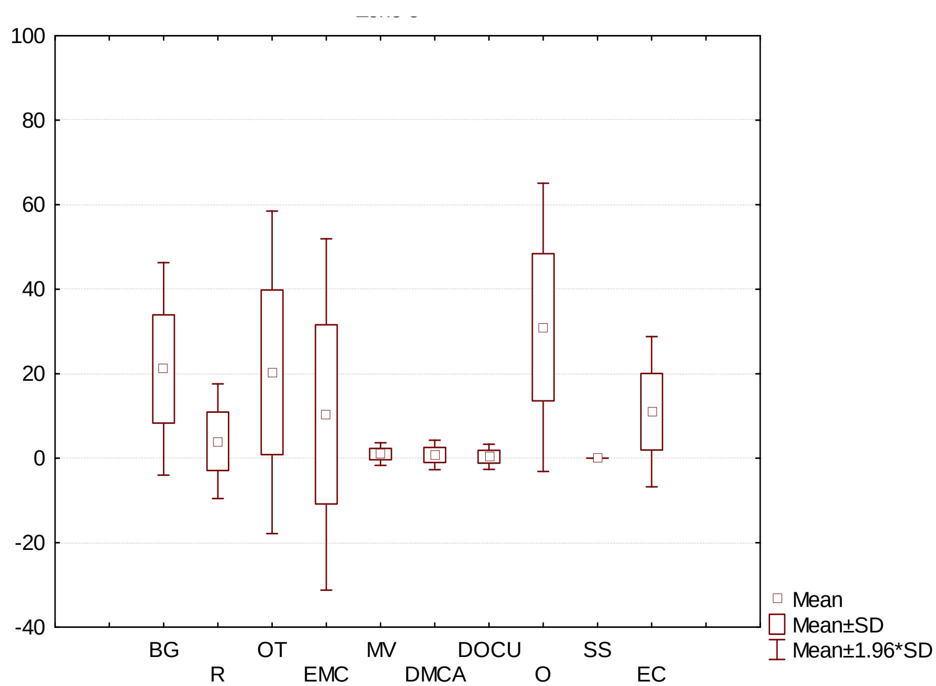

Figure 19. Dales Lake South transects. Zone 3.

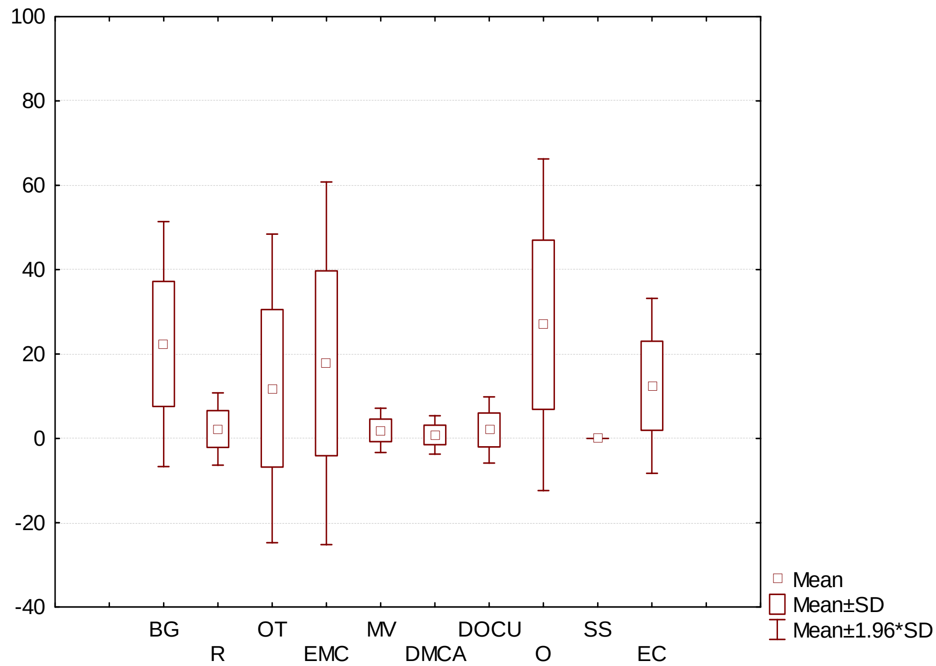

Figure 20. Dales Lake South transects. Zone 4.

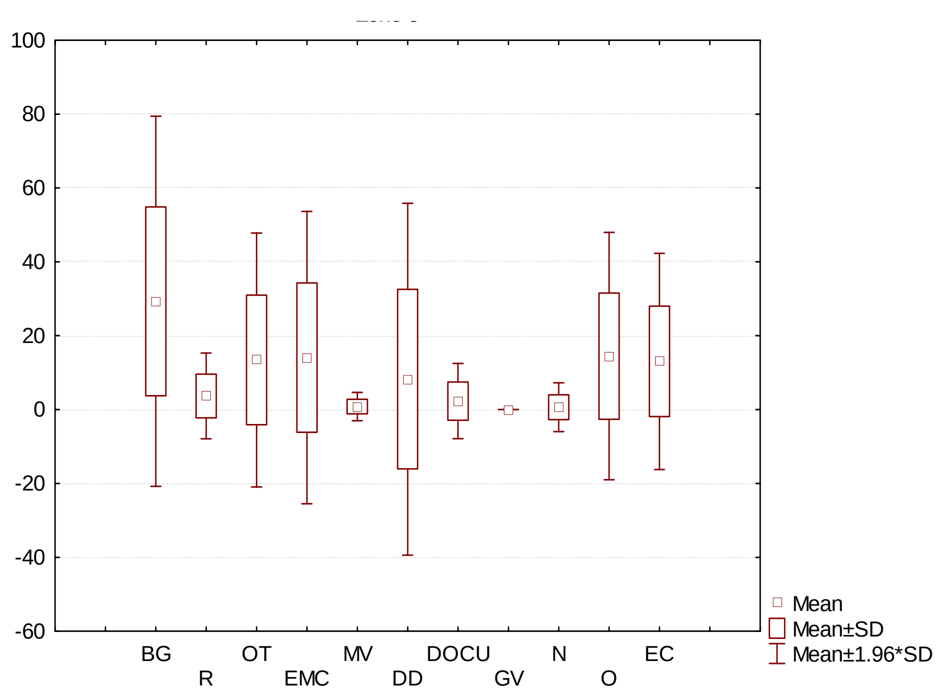

Figure 21. Dales Lake South transects. Zone 5.

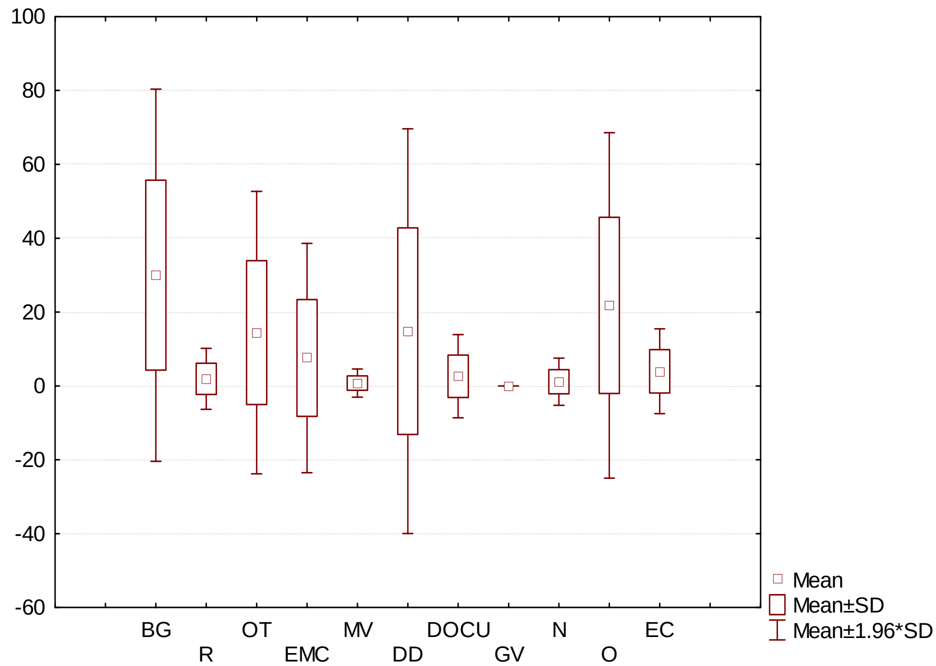

Figure 22. Dales Lake South transects. Zone 6.

<u>Hog Lake Vegetation Zones</u>

Due to the size of Hog Lake and it strong asymmetry with pool basin morphology, three parallel transects were laid out from the uplands and descending into the pool (see Appendix 1, Figure 4d for diagram). The depth of the pool and slow recession of water, with progression of the season, necessitated that the transects be visited at three separate times to collect data. The Zones are therefore numbered in reverse to those of Dales Lake, i.e. outside the pool, the Zone locations begin with 1 and increase towards the pool. The first Zone to occur in the pool boundary is Zone 4 and the deepest Zone established was 9. Discussion of the results will be from the deepest Zones (9 and 8), to intermediate (7 and 6), and shallow (5 and 4). Although this numbering scheme is awkward, it maintains consistency with the original data, and maintains the discussion pattern starting at the region of the pool with the longest period of inundation.

The deep Zones (Figures 23 & 24) show means of rock cover ranging from 5-10% and cover of *O. tenuis* around 15%. *Eleocharis macrostachya* has a mean cover of 40% in Zone 9 (Figure 23) with a wide range in standard deviation, but drops substantially in Zone 8

(Figure 24) with a mean near 5% and a much reduced range in standard deviation. In the intermediate Zones (7 and 6; Figures 25 & 26), rock cover and bare ground have means in the range of 10-20%, while means of both *O. tenuis* and *E. macrostachya* decline sharply; the "other" species rise substantially between the deep Zones and intermediate Zones. The shallow Zones (5 and 4; Figures 27 & 28) do not show a significant increase in rock or bare ground cover; however, *O. tenuis* and *E. macrostachya* are nearly absent. *Eryngium castrense* interestingly has a relatively stable mean from the deep Zones to shallow of 20-25%.

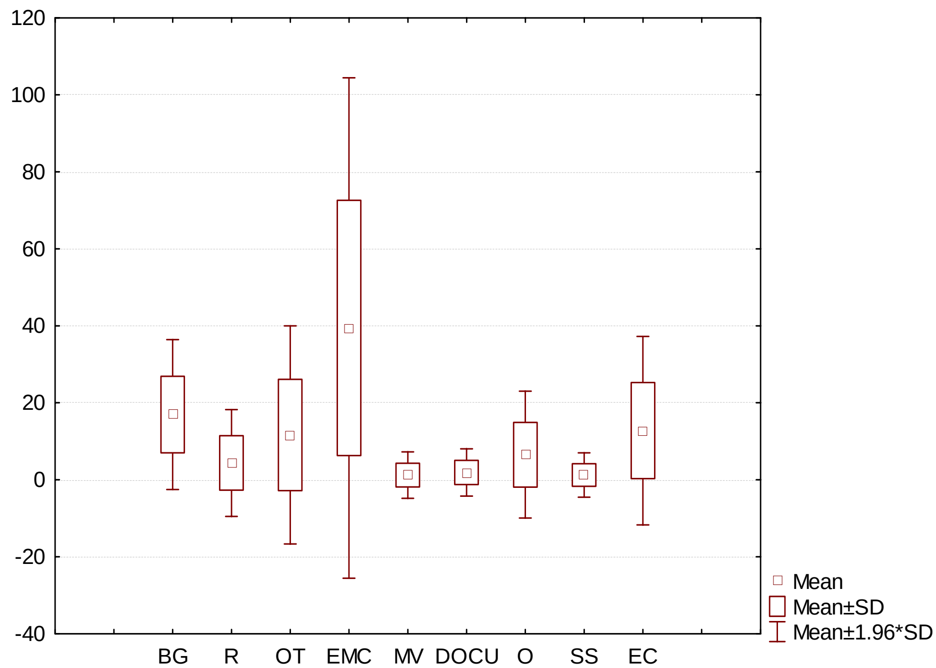

Figure 23. Hog Lake transects. Zone 9.

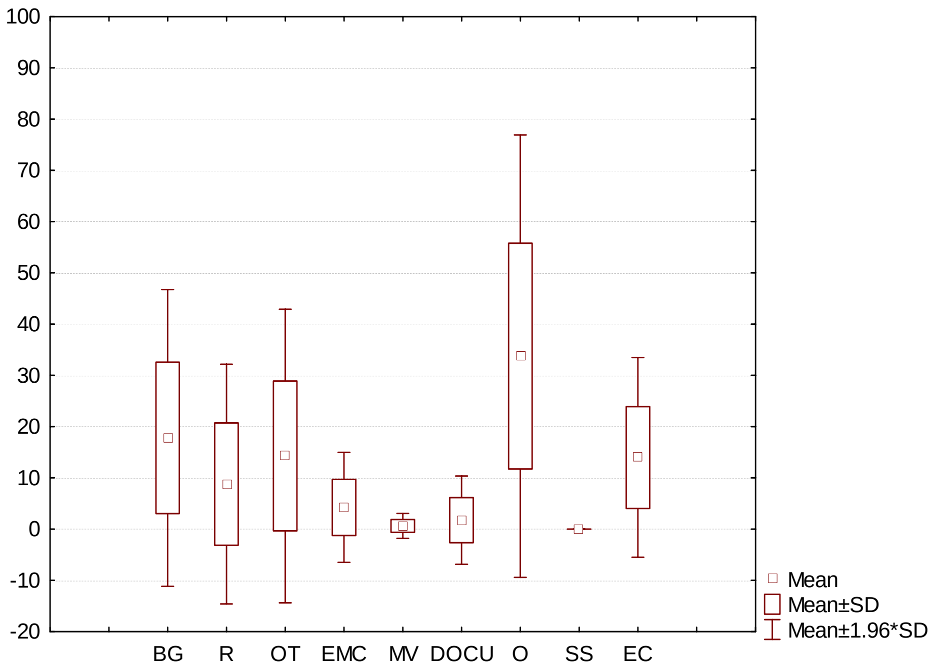

Figure 24. Hog Lake transects. Zone 8.

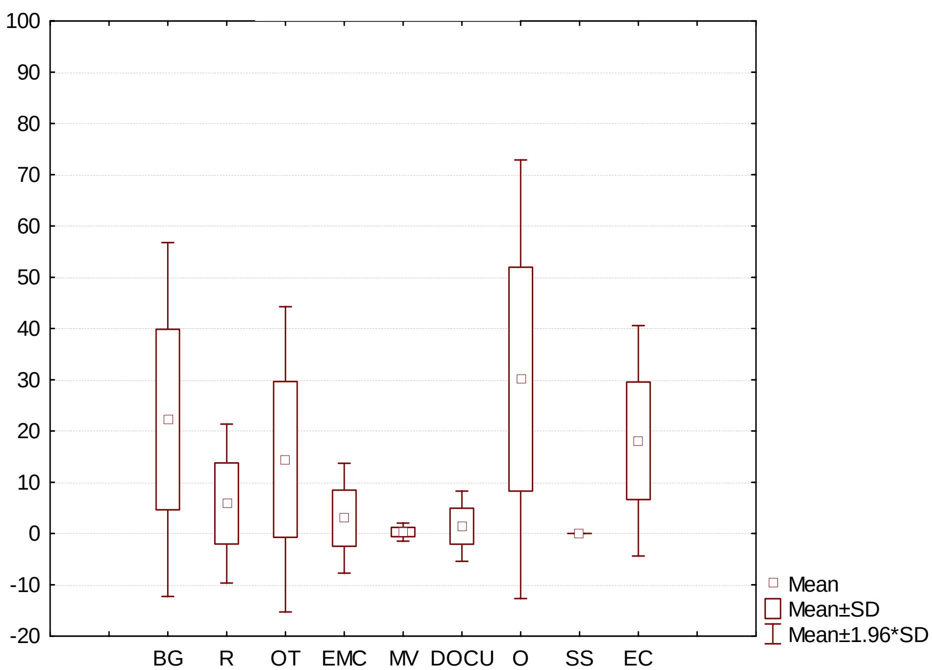

Figure 25. Hog Lake transects. Zone 7.

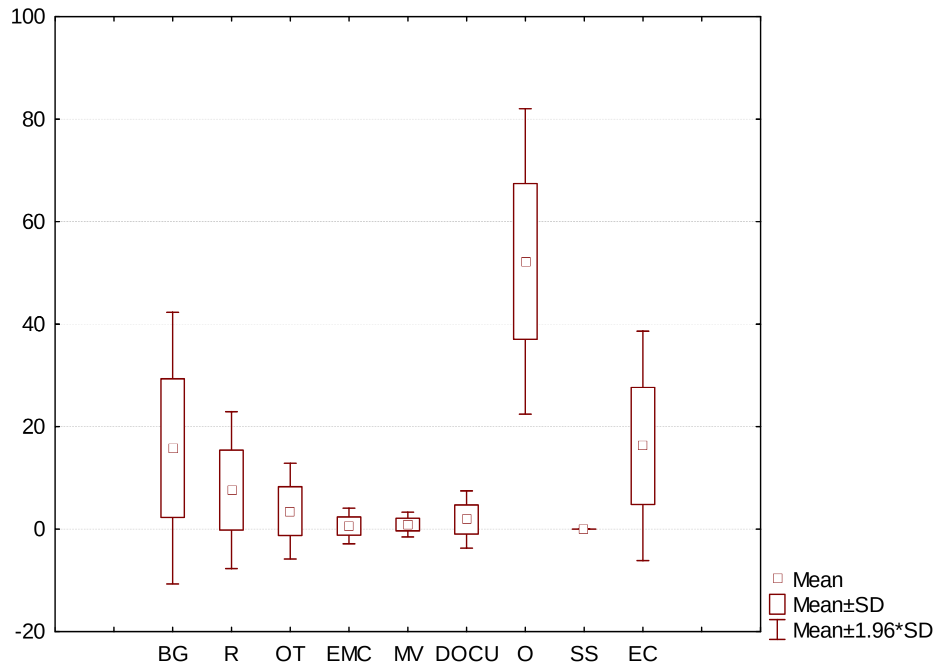

Figure 26. Hog Lake transects. Zone 6.

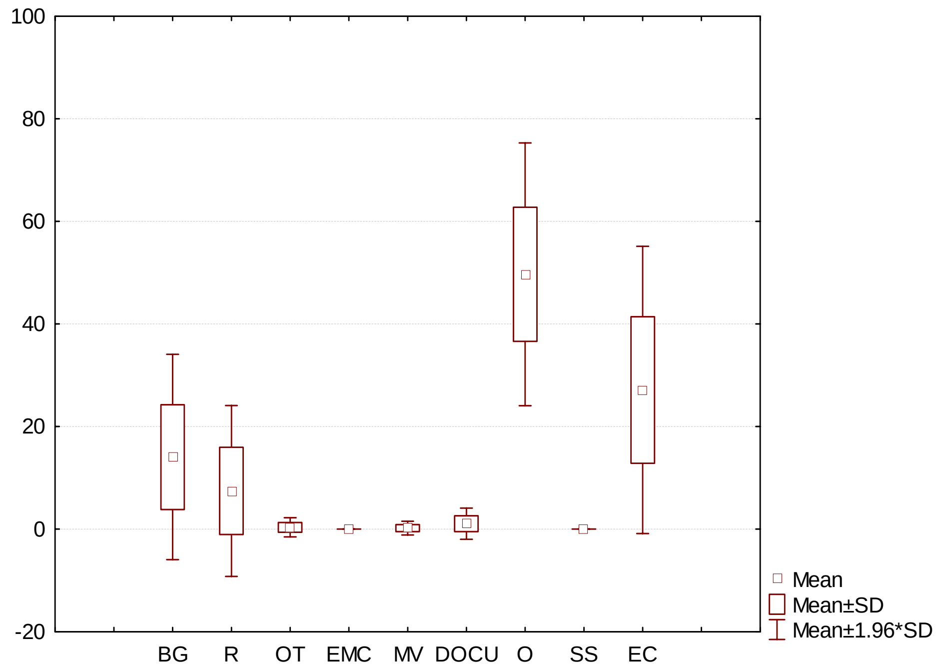

Figure 27. Hog Lake transects. Zone 5.

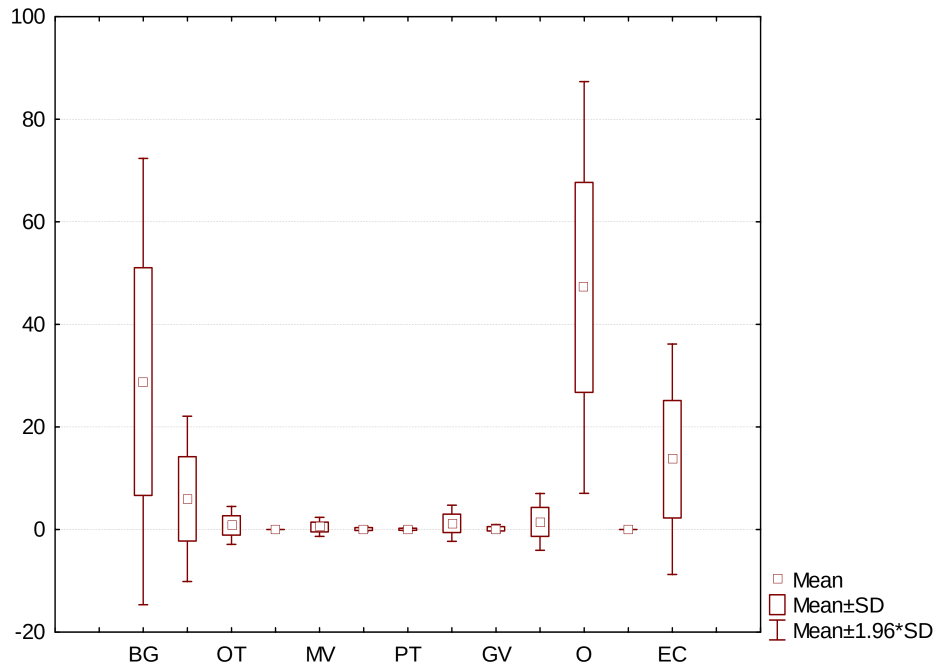

Figure 28. Hog Lake transects. Zone 4.

<u>Hoggett Vegetation Zones</u>

Hoggett is a shallow pool compared to Dales Lake or Hog Lake although it has a similar overall basin morphology to both Dales and Hog Lakes. Only three positions for Zones were identified in Hoggett. As with Hog Lake, the Zone numbering system begins outside the pool with Zone 1 and descends down into the pool (see Appendix 1, Figure 4d for diagram of transect layout). The first Zone number to encounter the pool was number 4; hence three pool Zones, 4, 5, and 6 were delineated (Figures 29-31). Zone 6 (Figure 29) has a small occurrence of *Lolium multiflorum* indicating that even at this position inundation is inconsistent in the pool. *Eleocharis macrostachya* occurs with a mean <20%, and *Deschampsia danthonioides* occurs. In Zone 5 (Figure 30), *L. multiflorum* has a mean near 10%, while the mean of *E. macrostachya* has declined slightly, *D. danthonioides* has increased, and even a small occurrence of *Taeniatherum caput-medusae* is found. This Zone is drier as some non-wetland plants occur here. In Zone 4 (Figure 31), mean cover of *E. macrostachya* decreases to <5%, while *L. multiflorum* and *D. danthonioides* each have a mean cover approaching 20%, while *T. caput-medusae* has a mean cover of nearly 25%.

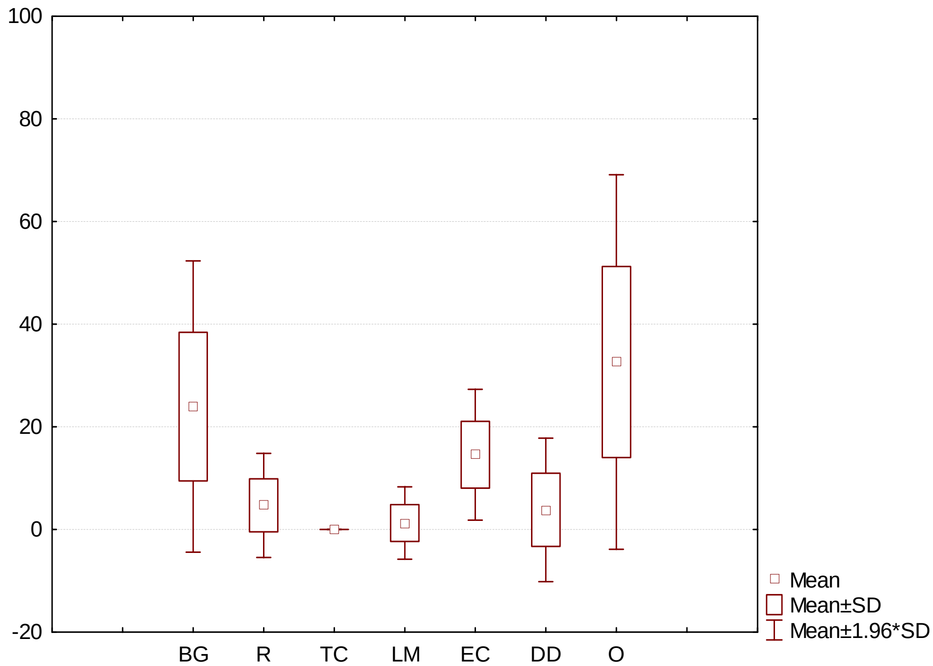

Figure 29. Hoggett transects. Zone 6.

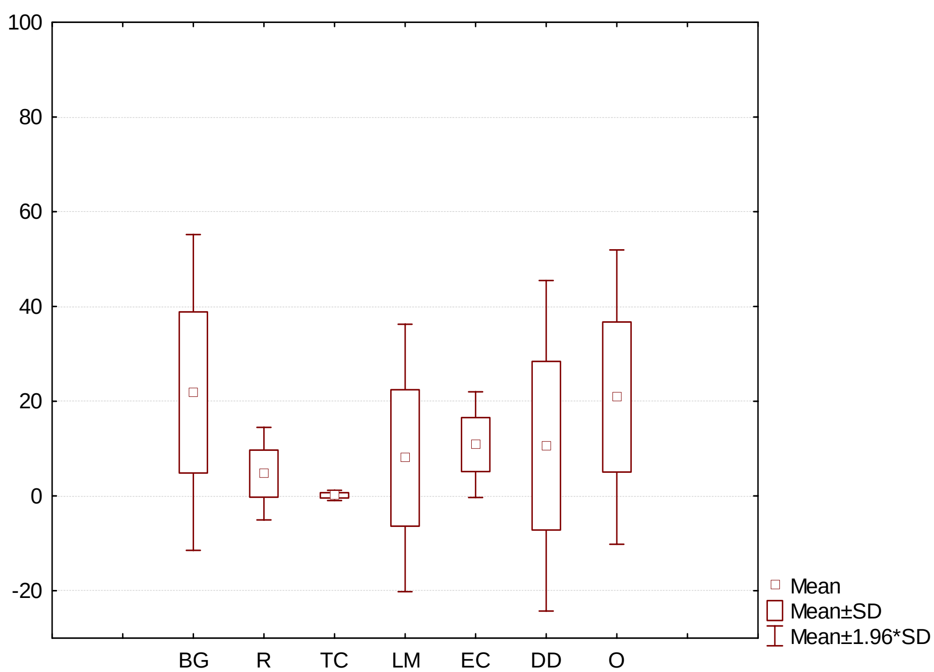

Figure 30. Hoggett transects. Zone 5.

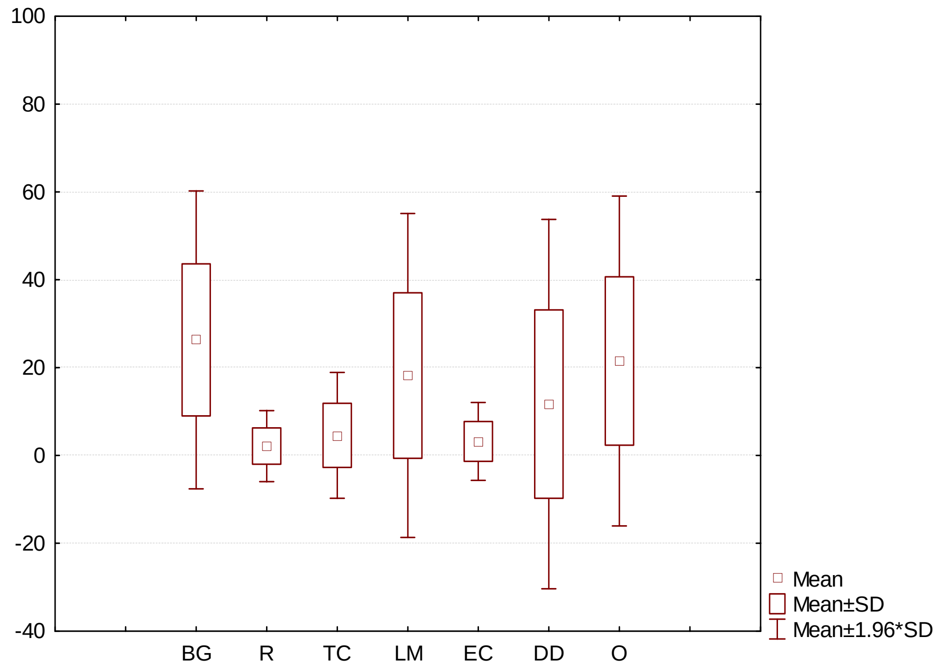

Figure 31. Hoggett transects. Zone 4.

Sevenmile Lake Vegetation Zones

Sevenmile Lake is comprehensively discussed in the draft paper Clark *et al.*. attached to this report as Appendix 5, and was initiated from the work started as part of this project and expanded in great detail in several areas.

The transects in Sevenmile Lake were established with four Zones (Figures 32-35). The topography and dry-down characteristics of this pool resulted in the Zones being established from the center out, hence the low Zone numbers correspond to deeper regions of the pool (see Appendix 1, Figure 4d for diagram). The topography of the pool was mapped in detail by Clark *et al.* (Appendix 5) and a map of the topography along with variation in *E. macrostachya, O. tenuis,* rock cover, bare ground, and soil depth is presented in this detailed study and comparison with Spring Branch Two.

With four Zones in the pool, Zone 1 is deep, Zone 2 intermediate, and Zones 3 and 4 shallow. Zone 1 (Figure 32) has low mean rock cover < 10%; *O. tenuis* has a mean of nearly 40%; *E. macrostachya* has a mean of <10%; and the large cover of "other" is predominantly *Isoetes* spp. and *Pilularia* spp. Zone 2 (Figure 33), shows an increase in mean rock cover to

> 20%, and high cover by *O. tenuis*, mean >35% while mean cover of *E. macrostachya* remains low, <10%. In Zone 3 (Figure 34), rock cover declines slightly, while mean cover of *O. tenuis* decreases to nearly 20% and *E. macrostachya* increases slightly. In Zone 4 (Figure 35), means of rock cover, *O. tenuis*, and *E. macrostachya* remain steady.

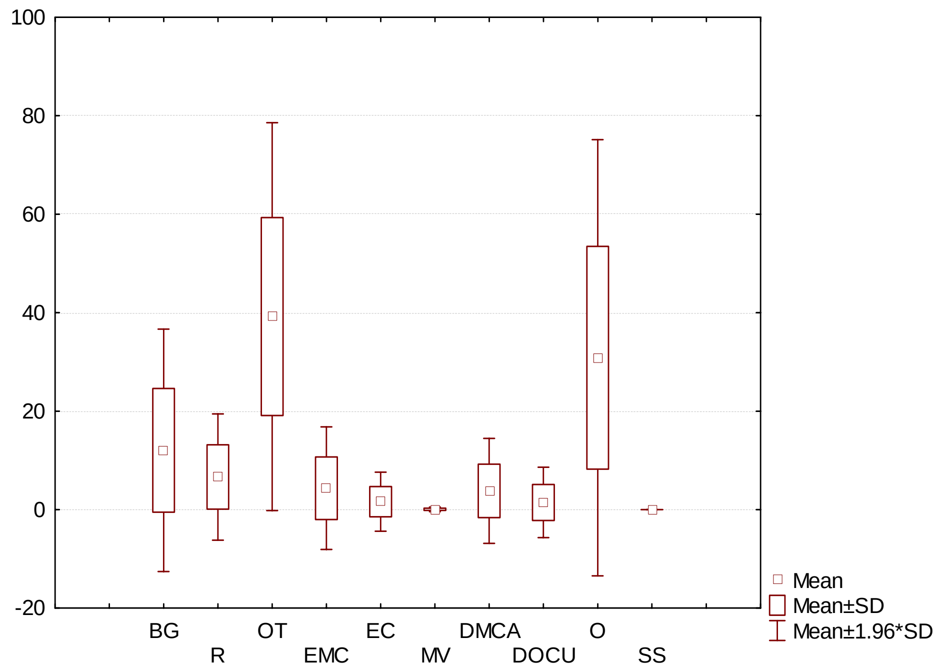

Figure 32. Sevenmile Lake transects. Zone 1.

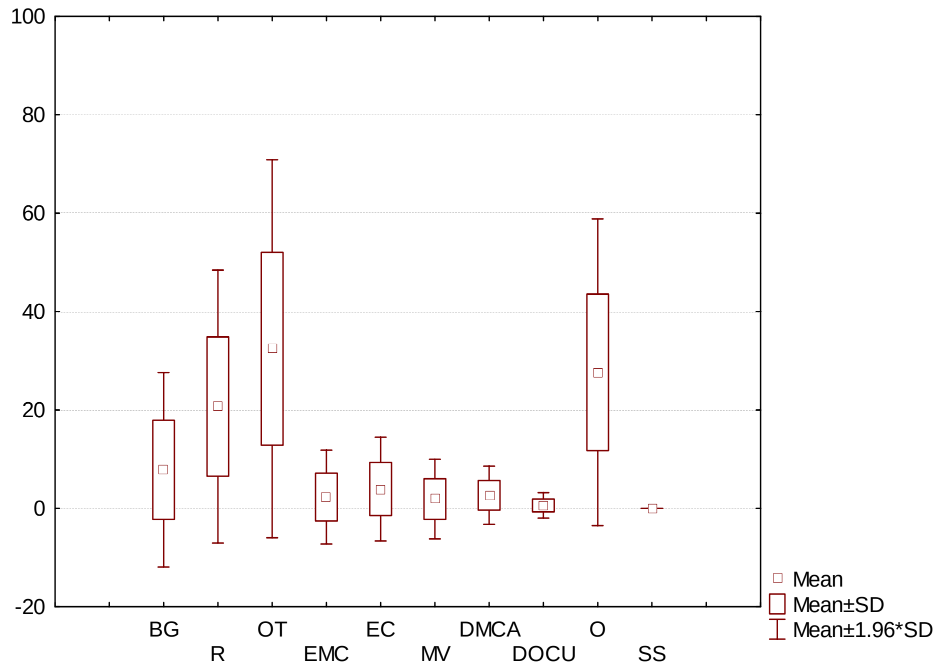

Figure 33. Sevenmile Lake transects. Zone 2.

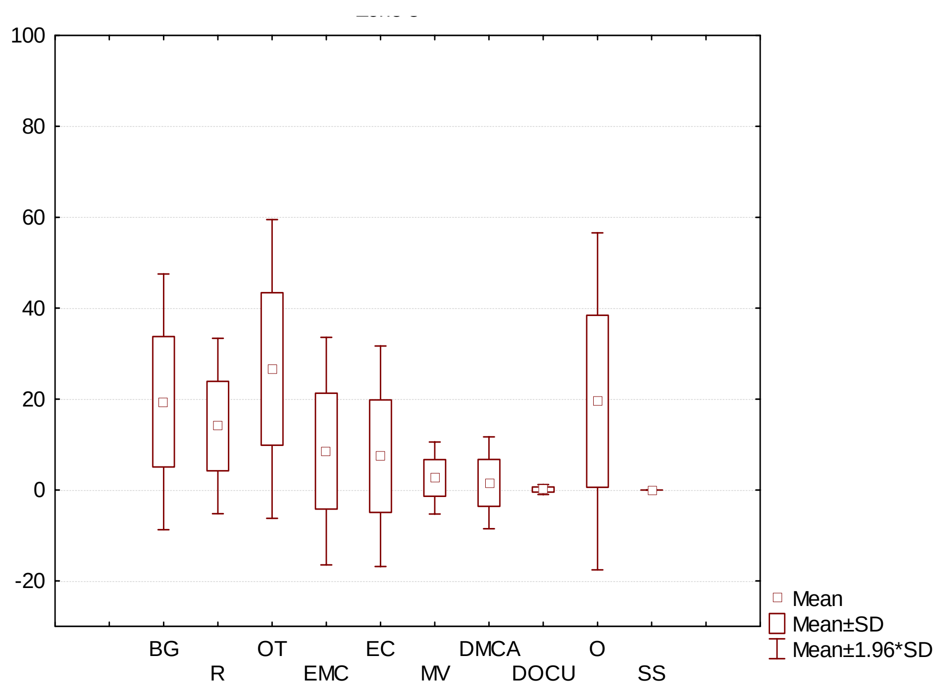

Figure 34. Sevenmile Lake transects. Zone 3.

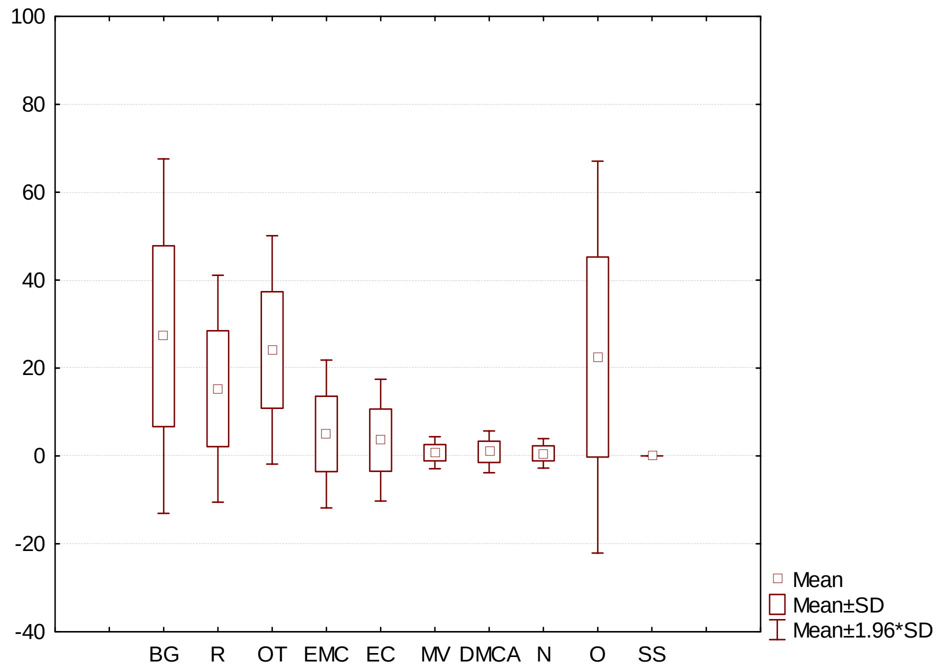

Figure 35. Sevenmile Lake transects. Zone 4.

Spring Branch One Vegetation Zones

The Zones in Spring Branch One were not combined from the two transects, but are shown separately. This is due to the highly variable pool basin topography. Ideally more transects would have been established and a map of pool basin topography would be made to more accurately analyze and characterize this vernal pool, but this could not be done due to constraints of time and personnel availability.

There are three Zones and they will be discussed as pairs from the two transects, thus the deep Zone 3 (Figures 36 & 37) will be discussed and compared to the intermediate depth pair, Zone 4 (Figures 38 & 39) , and finally the shallow water Zone 5 will be discussed (Figures 40 & 41).

In Zone 3 the mean cover of bare ground is > 40% and rock cover is near 0%; mean *O. tenuis* is dramatically different between the two transects, at near 10% in transect 1 (Figure 36) and 30% in transect 2 (Figure 37), while *E. macrostachya* is exactly opposite, nearly 40% in transect 1, and near 5% in transect 2. In both transects, *Eryngium castrense* is barely above 0%. In Zone 4 (Figures 38 & 39), bare ground cover means are 40-50%, with near 0% rock, mean *O. tenuis* is 10%, and *E. macrostachya* is <10%. In Zone 5 (Figures 40 & 41), bare ground cover means are near 55% in transect 1 and 30% in transect 2 and mean rock cover is near zero, while *O. tenuis* is < 10% in both transects, but much more variable in transect 1. *Eleocharis macrostachya* is nearly absent in transect 1, where *O. tenuis* is greater, while *E. macrostachya* has a mean of nearly 10% in transect 2 where *O. tenuis* is just slightly above 0% in cover.

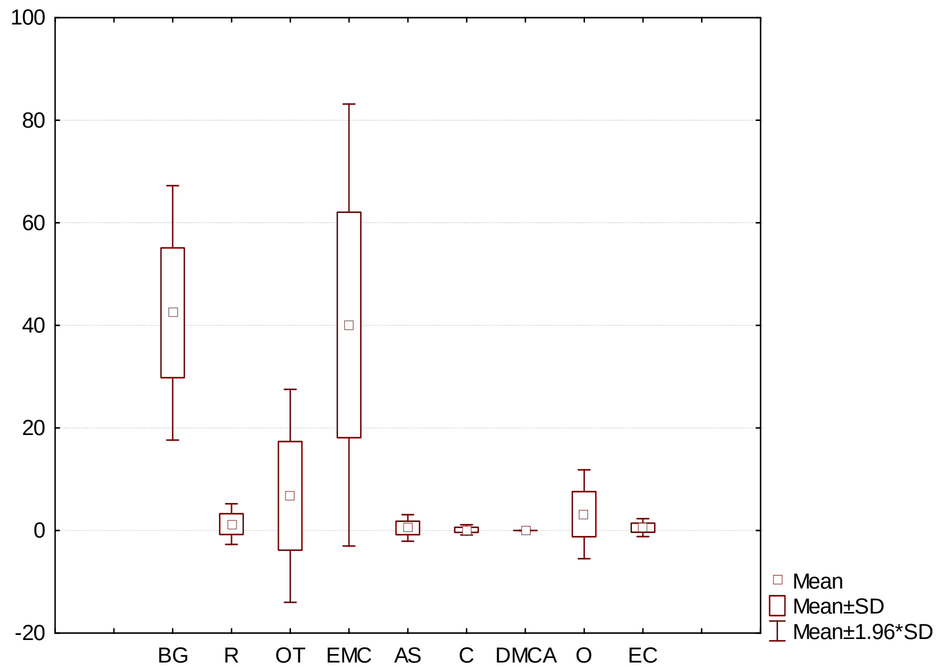

Figure 36. Spring Branch One, Transect 1. Zone 3.

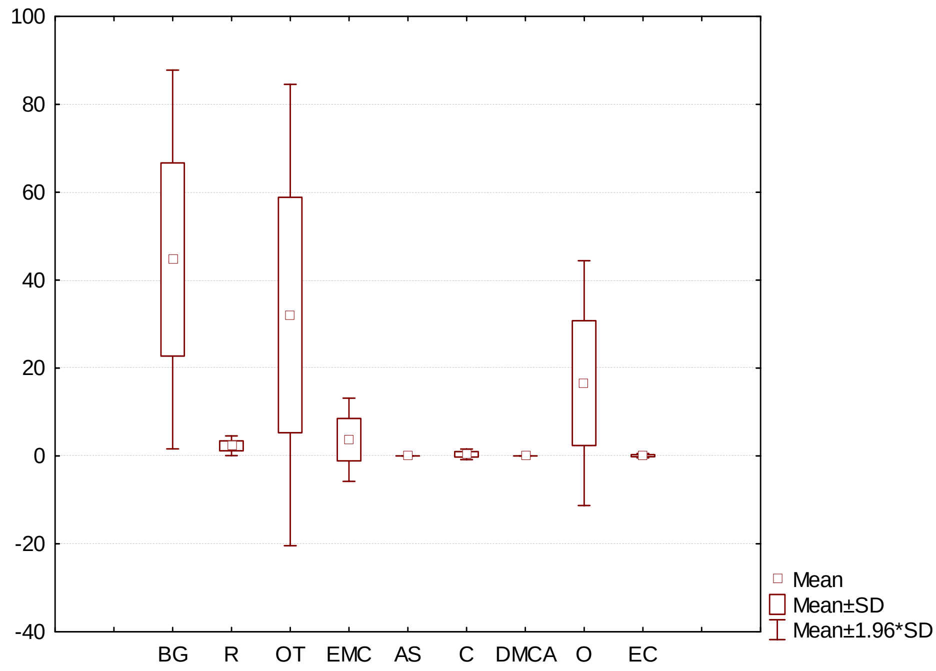

Figure 37. Spring Branch One, Transect 2. Zone 3.

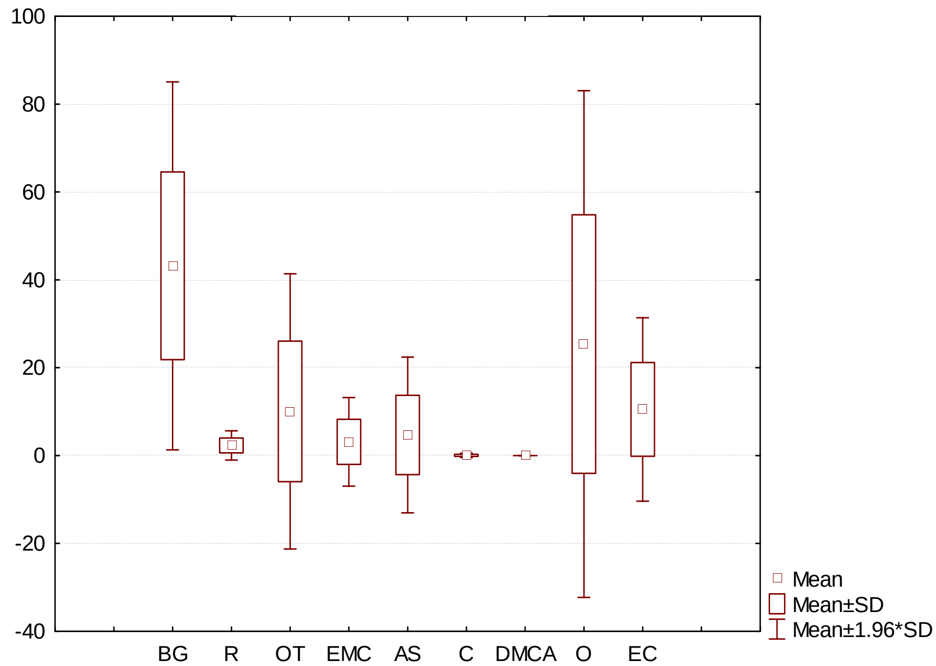

Figure 38. Spring Branch One, Transect 1. Zone 4.

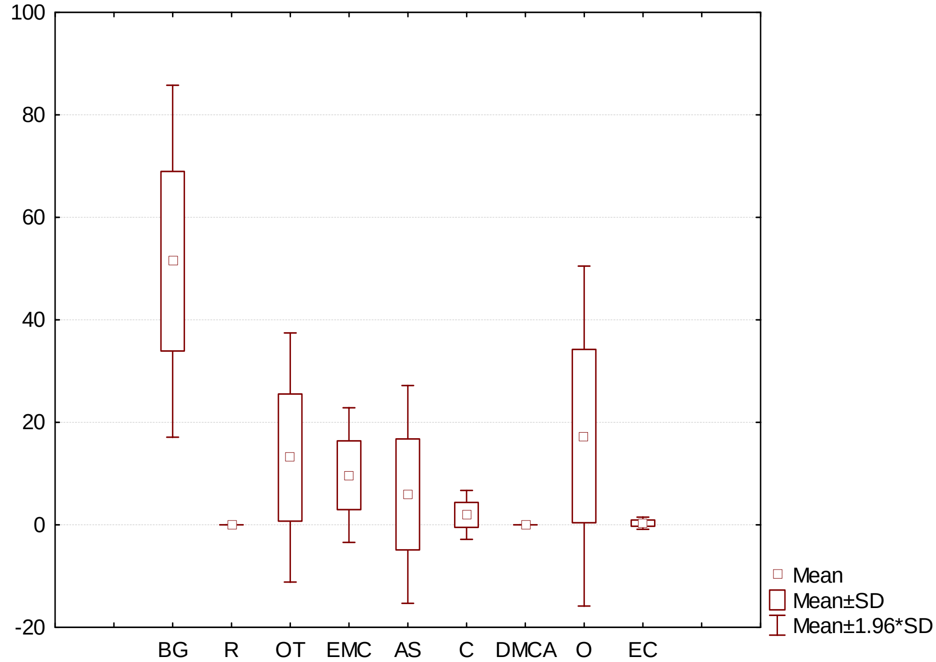

Figure 39. Spring Branch One, Transect 2. Zone 4.

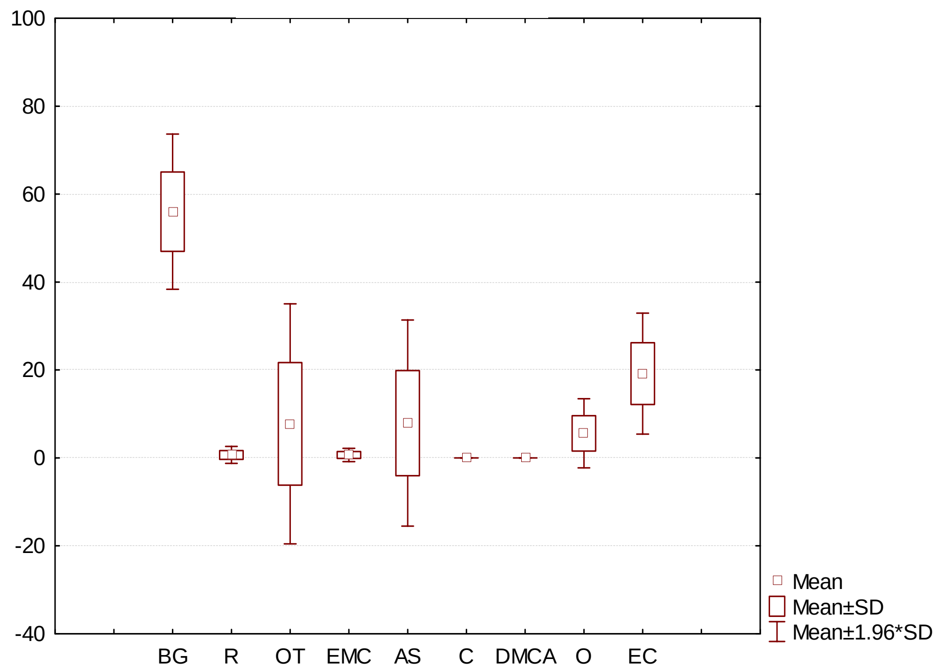

Figure 40. Spring Branch One, Transect 1. Zone 5.

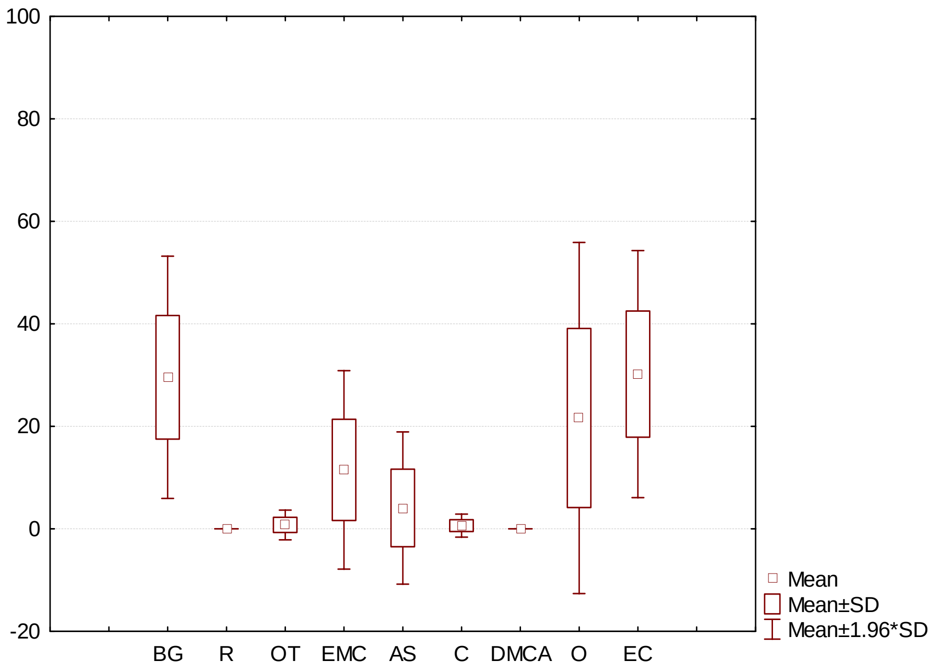

Figure 41. Spring Branch One, Transect 2. Zone 5.

<u>Spring Branch Two Vegetation Transects</u>

The two transects of Spring Branch Two are presented as they were for Spring Branch One; however, they will not be discussed as pairs as the Zones do not correspond as pairs. They will thus be discussed in sequence along the transect.

Appendix 5, the draft paper by Clark *et al.*., has a complete discussion of the basin morphology, soil depth, rock cover, and how these variables may interact to result in the observed distribution of *E. macrostachya* and *O. tenuis* in the pool.

Along transect 1, Zone 4 (Figure 42) is from the deepest part of the pool. Here the mean cover for bare ground is near 40% and mean cover of all other species have declined to 0, except that mean cover of *O. tenuis* is near 5% and mean cover of Other is nearly 50%. In Zone 3 (Figure 43), mean cover for bare ground has increased to nearly 50%, and the mean cover for *O. tenuis* has increased above 20%, with *E. macrostachya* present but with low cover percentage. Zone 2 (Figure 44) shows declines in mean cover to near 30% for bare ground and Other, while the mean cover values for *O. tenuis* and *E. macrostachya* have increased to nearly 20%. The Zone 2 region is not as deep as Zone 3 or 4. Although Zone 1 is deep again and similar to Zone 4 in overall vegetation (Figure 45), two features stand out:

the high mean cover for bare ground and Other (both near 40%), and all other species have mean cover of less than 10%.

Along transect 2, Zone 1 (Figure 46) has a very high percentage of bare ground with a mean cover of approximately 70%, mean cover of *O. tenuis* is <5%, that of Other is nearly 10%, and that of *E. macrostachya* is <5%. Zone 1 on this transect is also in the region of the pool that remains inundated the longest time. Zone 2 (Figure 47) has a steep decline in bare ground with the mean cover dropping to approximately 30%, while mean cover values for *O. tenuis*, *E. macrostachya*, Other, and *Eryngium castrense* are in the range of 10 to 20%. Zone 3 (Figure 48) is completely different with a mean cover of nearly 60% for *E. macrostachya* and *E. castrense* showing a mean of nearly 20%. Finally, Zone 4 (Figure 49) displays the most diversity on the transect with nearly equal mean cover values of *O. tenuis* and *E. macrostachya* approximately 15%, mean cover of bare ground near 40%, and mean cover of Other at near 30%.

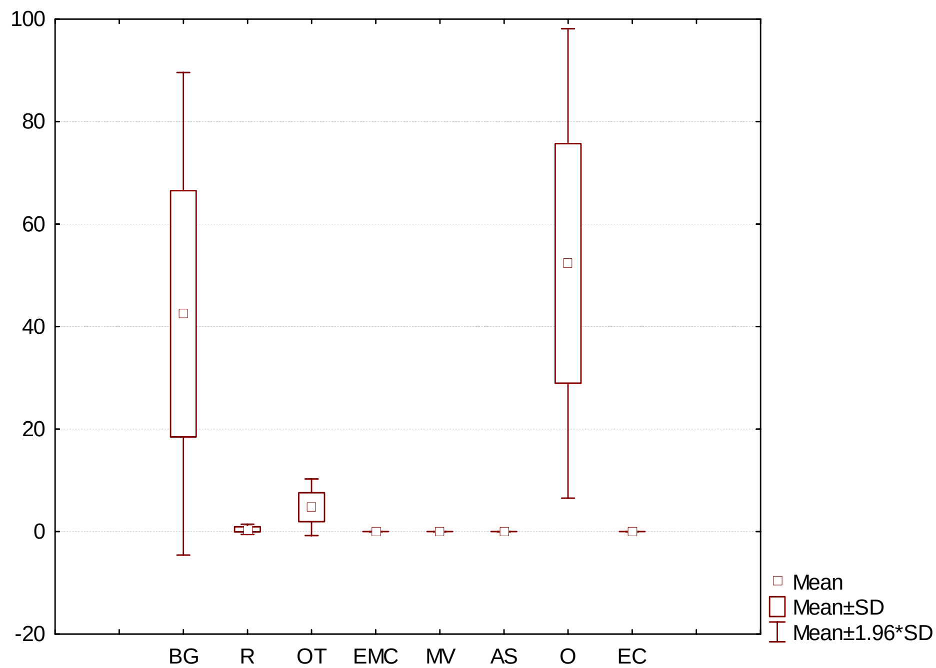

Figure 42. Spring Branch Two, Transect 1. Zone 4.

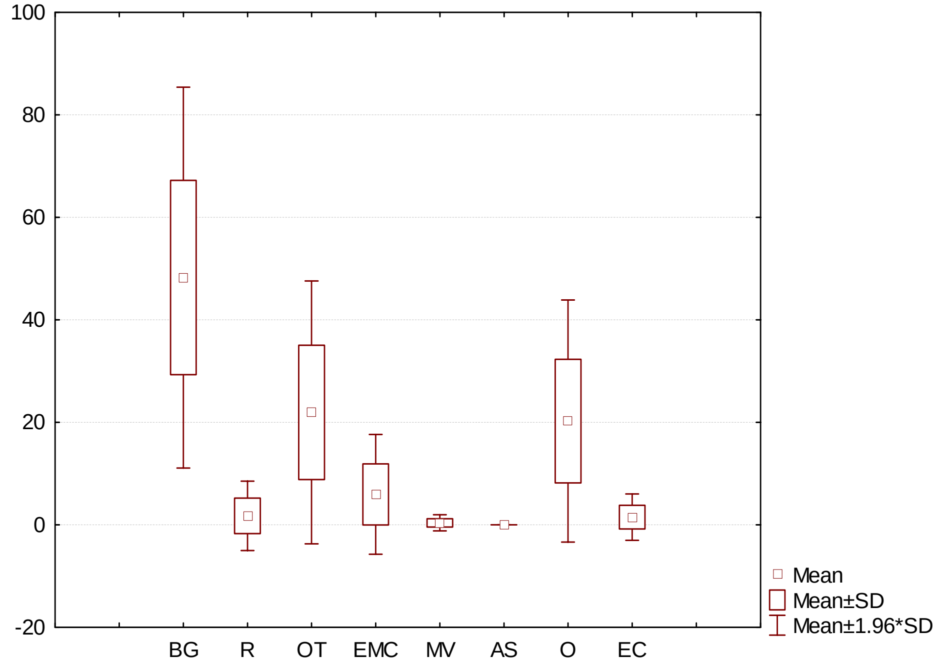

Figure 43. Spring Branch Two, Transect 1. Zone 3.

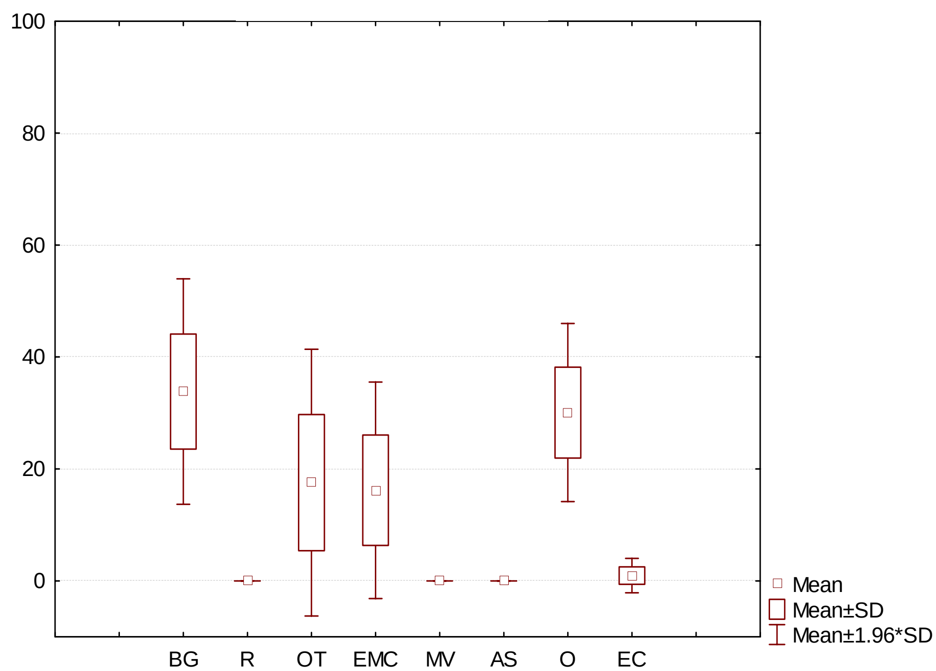

Figure 44. Spring Branch Two, Transect 1. Zone 2.

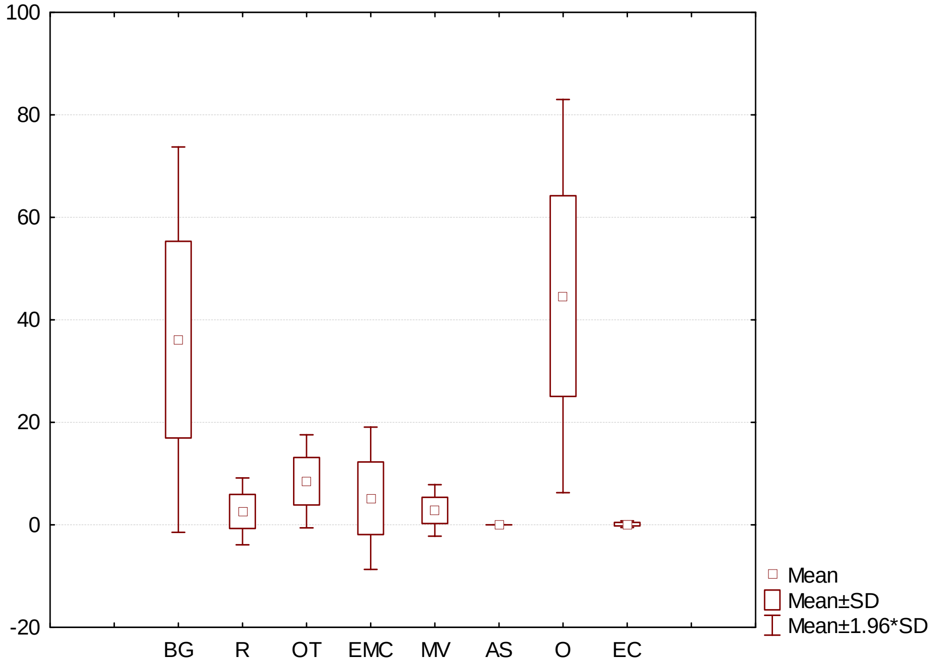

Figure 45. Spring Branch Two, Transect 1. Zone 1.

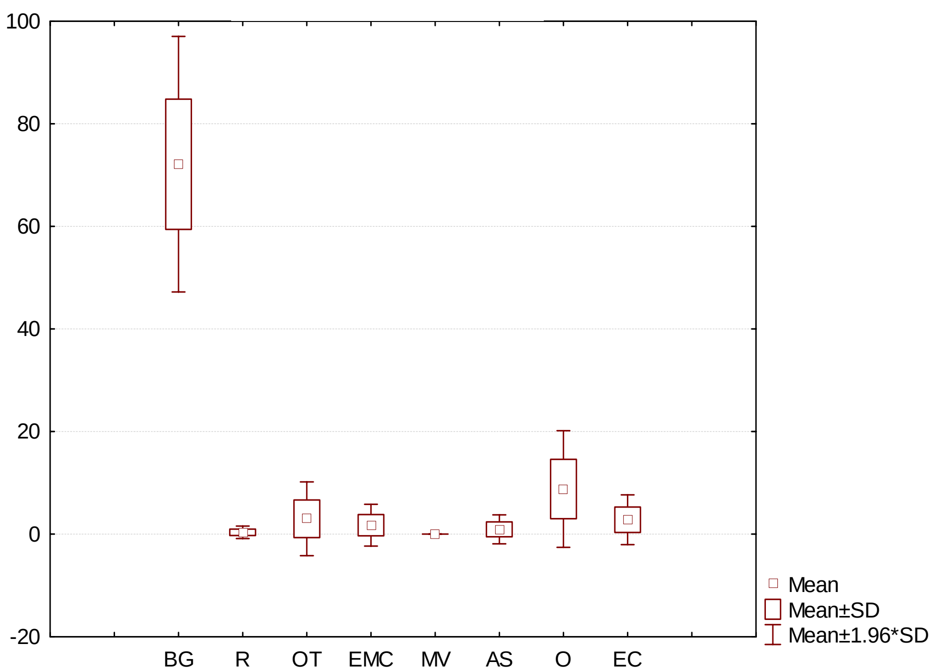

Figure 46. Spring Branch Two, Transect 2. Zone 1.

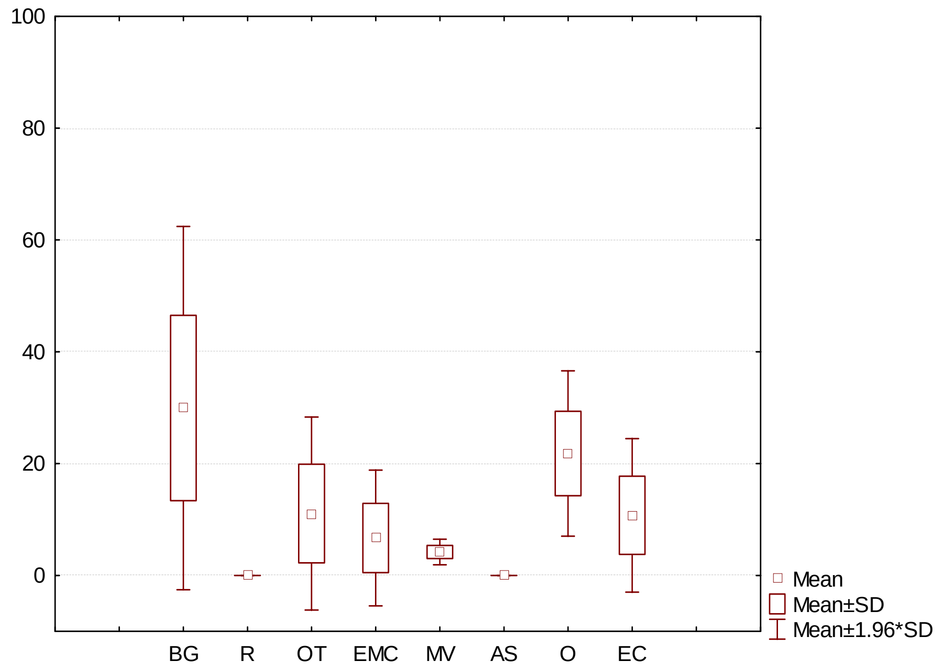

Figure 47. Spring Branch Two, Transect 2. Zone 2.

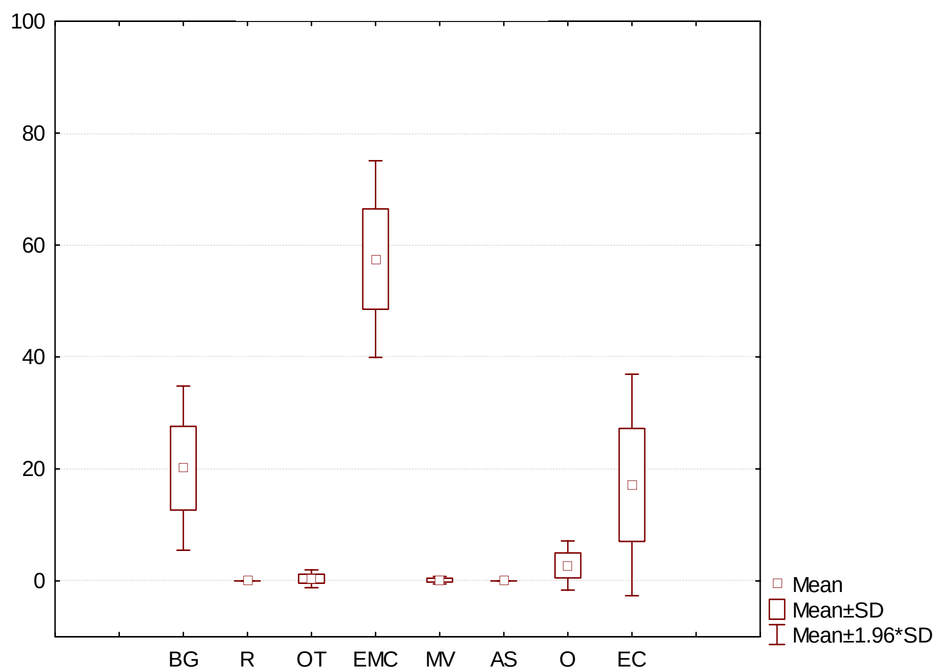

Figure 48 Spring Branch Two, Transect 1. Zone 3.

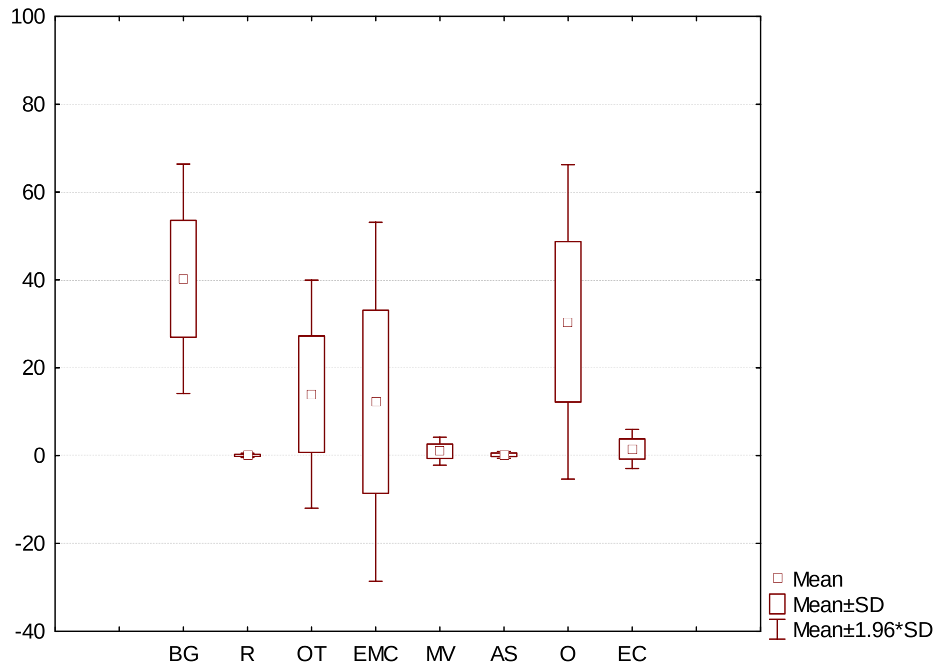

Figure 49 Spring Branch Two, Transect 2. Zone 4.

<u>Spring Branch Three Vegetation Zones</u>

Spring Branch Three, from both lack of vernal pool vegetation and the lack of branchiopod presence, is best classed as a stock pond. Although not displaying vernal pool organisms it does not stand out from Spring Branch One or Spring Branch Four in general morphology or water quality parameters that were monitored as being highly different.

Only one transect was established in this pond with Zone 1 being the shallow zone with progression to the deepest, Zone 4. Zone 1 is characterized by >60% bare ground and 10% or less of all other species (Figure 50). Zone 2 is similar to Zone 1 except cover by *E. macrostachya* has increased with the increase in water depth. All other species are <10% in absolute cover (Figure 51). In Zone 3, the percentage of bare ground has declined as *E. macrostachya* has increased relative to Zone 2 (Figure 52). Zone 4 (Figure 53) is the deepest region of the pool and is nearly entirely bare ground with the exception of a small percentage of Other made up of *Isoetes* spp.

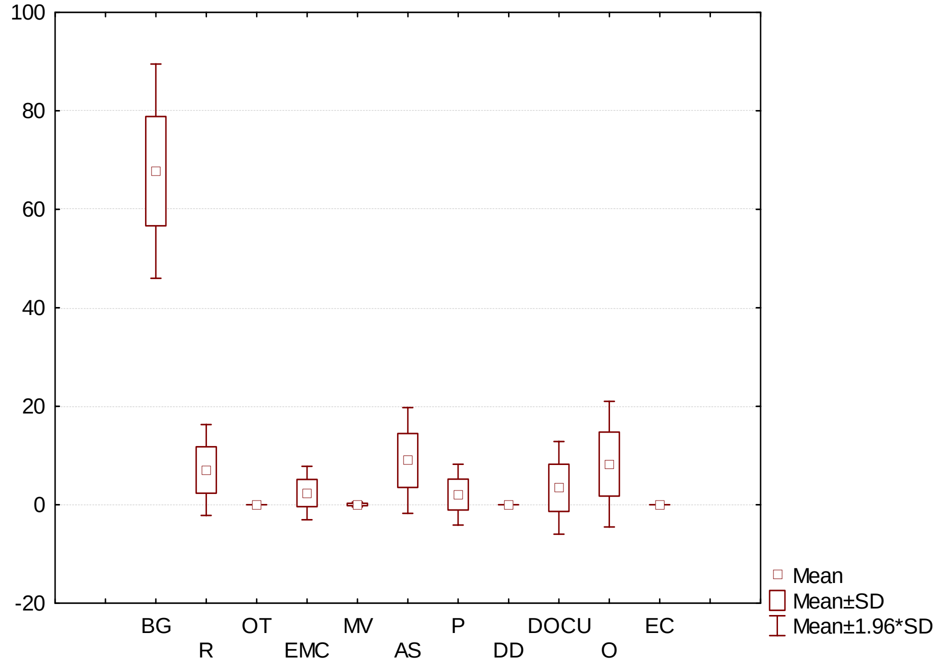

Figure 50. Spring Branch Three, Transect 1. Zone 1.

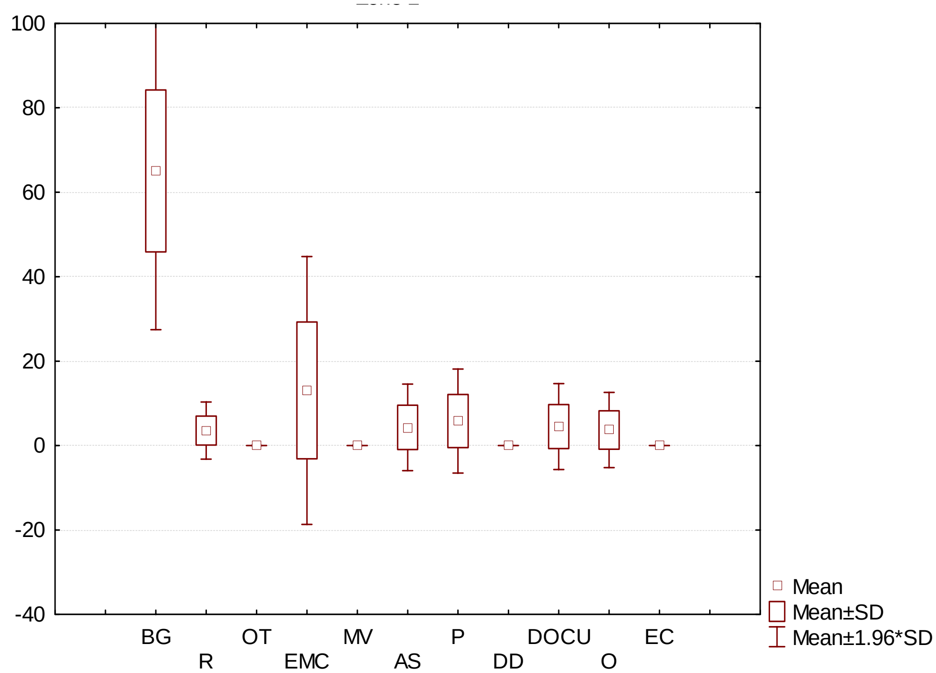

Figure 51 Spring Branch Three, Transect 1. Zone 2.

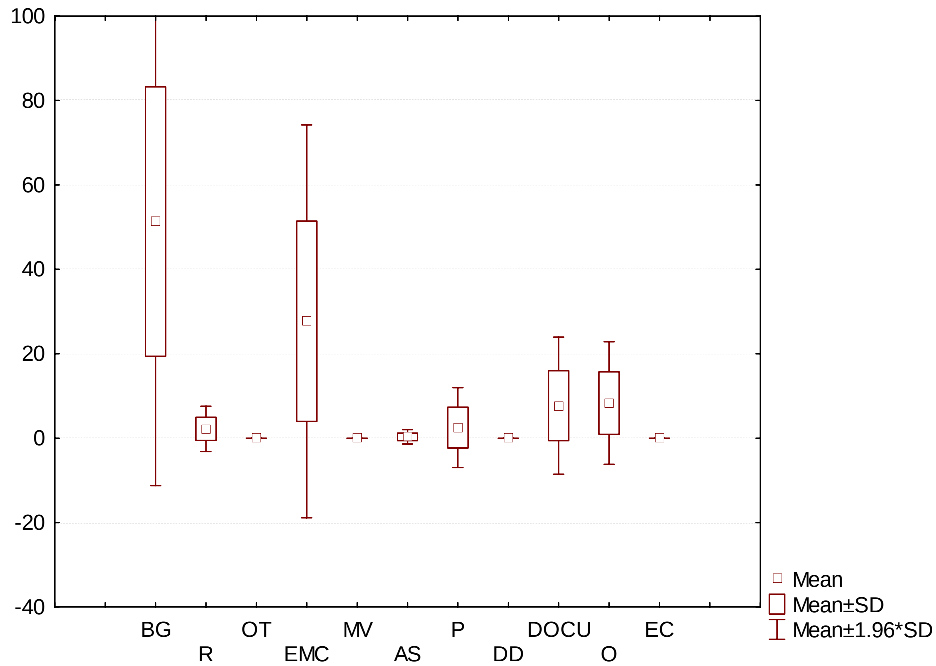

Figure 52. Spring Branch Three, Transect 1. Zone 3.

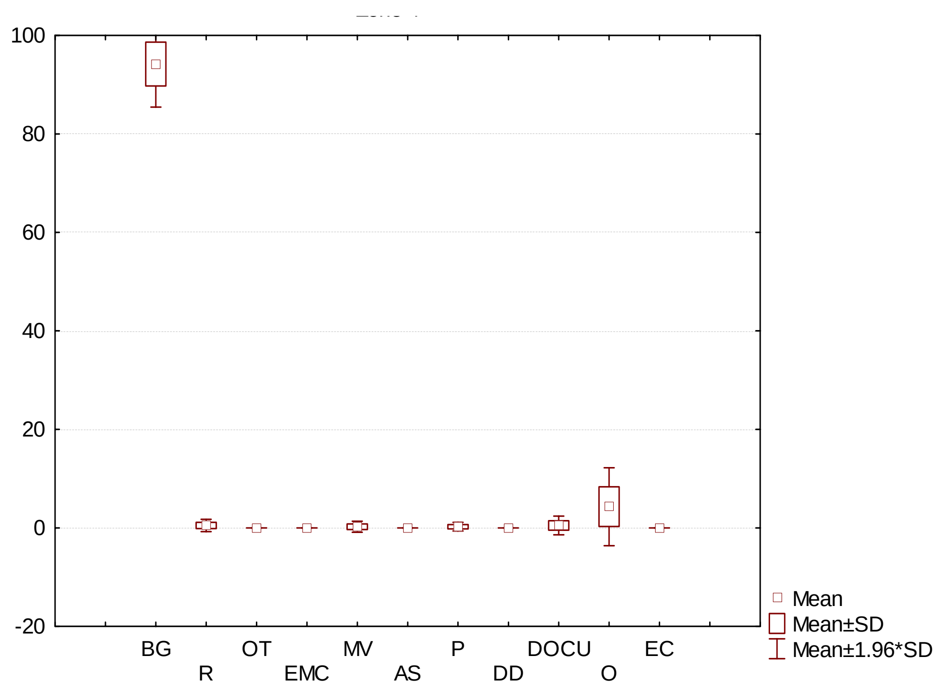

Figure 53. Spring Branch Three, Transect 1. Zone 4.

Spring Branch Four Vegetation Zones

Spring Branch Four had one transect placed in it and the transects follow the pattern of Spring Branch Three with the shallow water transect being Zone 1 and increasing in depth to Zone 4. In Zone 1 (Figure 54), bare ground is the outstanding feature with a mean cover of slightly over 80%. Other species contributing cover are primarily *Alopecurus saccatus*, *Downingia cuspidata*, *Poa* sp. and Other. In Zone 2 (Figure 55), mean cover by bare ground remains nearly the same as in Zone 1 with *Alopecurus saccatus* dropping out relative to Zone 1. In Zone 3 (Figure 56), the deeper water has *E. macrostachya* being able to maintain itself in this location. Finally, in Zone 4 (Figure 57), mean cover of bare ground drops below 60% and mean *E. macrostachya* cover exceeds 20% with Other comprised of *Isoetes* spp. approaching a mean of 20%.

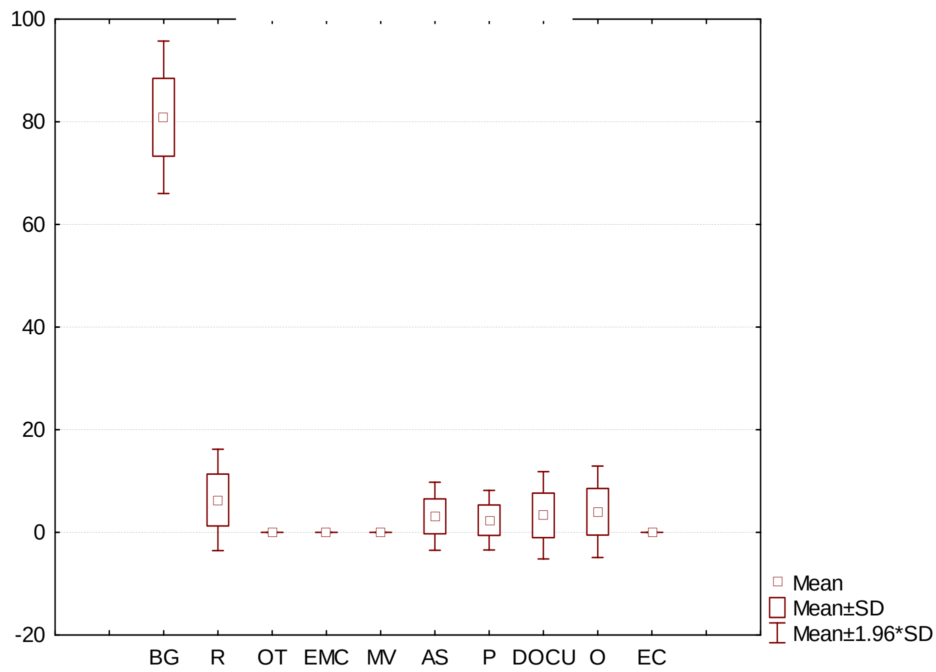

Figure 54. Spring Branch Four, Transect 1. Zone 1.

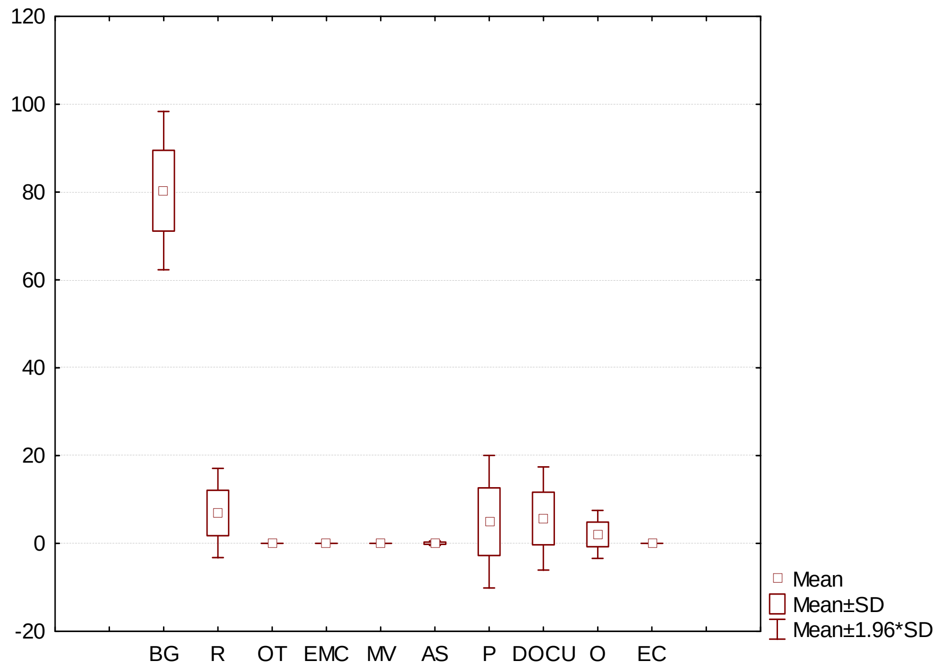

Figure 55. Spring Branch Four, Transect 1. Zone 2.

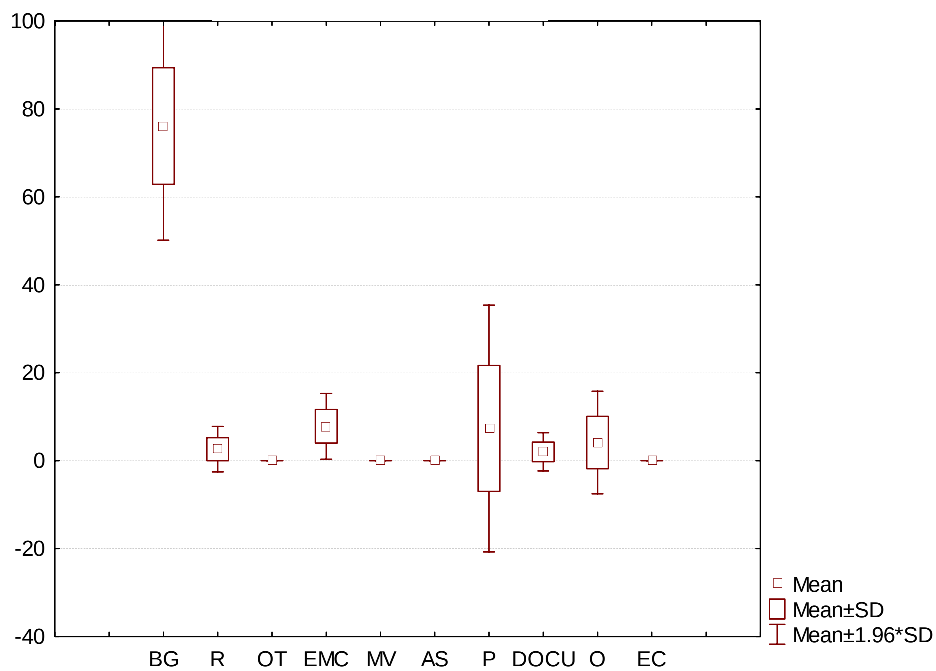

Figure 56. Spring Branch Four, Transect 1. Zone 3.

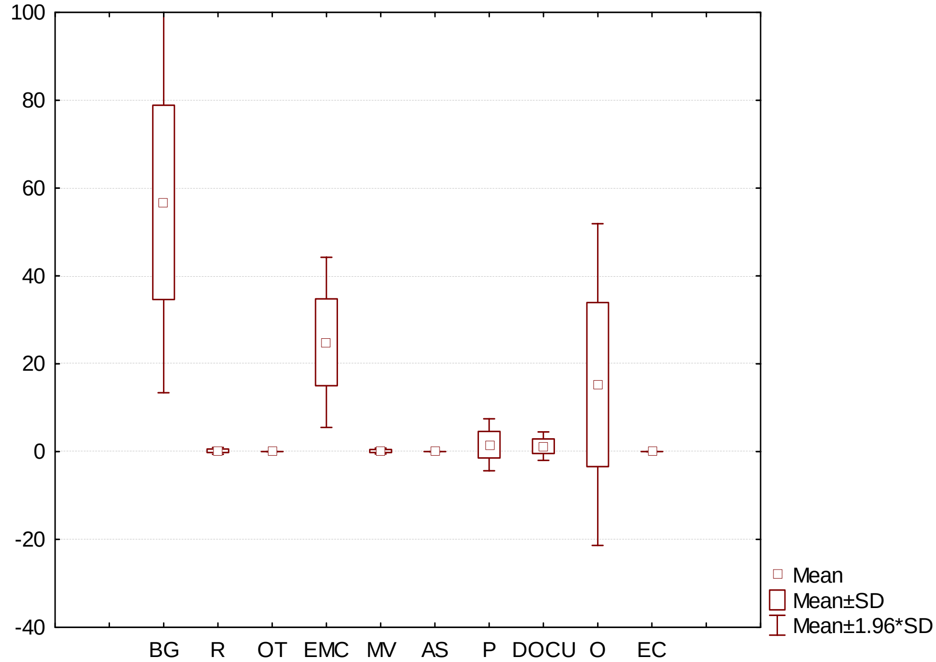

Figure 57. Spring Branch Four, Transect 1. Zone 4.

WATER QUALITY HYPOTHESES

We defined three water quality hypotheses that our project would attempt to test (Appendix 1). Because we had not previously undertaken a project of this type, some of our hypotheses reflect the notions we had at the outset of our study and most of them have turned out to be insufficiently specific, in retrospect, given the unexpected diversity of these pools.

Abbreviations in the hypotheses identifiers are: WQ = Water Quality, H = hypothesis being tested, N = null hypothesis, followed by the number of the hypothesis.

<u>Water Quality Hypotheses 1</u>.

WQH1 Grazing will not alter water quality variables beyond the range of natural variation in control pools.

WQN1 Grazing will alter water quality variables beyond the range of natural variation found in control pools.

This hypothesis and its null were poorly constructed because the control pools do not form a simple group that can be compared against the other grazed pools. There is too much inter-pool variation to compare the pools as grazed versus un-grazed.

Water Quality Hypotheses 2

WQH2 Branchiopod densities will be affected by changes in water quality variables that are outside the range of variation for a particular variable.

WQN2 Branchiopod densities will be not be affected by changes in water quality variables that are outside the range of variation for a particular variable.

The range and variation in water quality variables (being measured in this study) could not be tied to affecting changes in calculated branchiopod densities. As pools progress through the season there are shifts in water quality variables; however, the shifts during the period occupied by branchiopods appeared to be in the range of tolerance by the branchiopods. If there were water quality variables affecting branchiopods they may be ones that we were not recording in this study. At this time the null can not be rejected.

Water Quality Hypotheses 3

WQH3 Fires that occur in the surrounding uplands of a vernal pool or burn through the pool during the summer will produce changes in water quality that are outside the range of variation for the variable and this in turn will have effects on branchiopod densities.

WQN3 Fires that occur in the surrounding uplands of a vernal pool or burn through the pool during the summer will not produce changes in water quality that are outside the range of variation for the variable and this in turn will not have effects on branchiopod densities.

This hypothesis pair in retrospect had three levels within it: (1) fire in upland only, or pool and uplands; (2) fire will induce changes in water quality variables being monitored;

and (3) changes in water quality variables will have effects on branchiopod densities.

This hypothesis pair was written in too many levels to be tested with the data we have collected at the time. The effects of fire in surrounding uplands versus burning in the uplands and pool should have been separated. At the start of this project it was anticipated that we might have had more success in conducting prescribed fires on the Dales Lake Ecological Reserve; however, in the past few years it has become increasingly difficult to get permission from the air quality agencies to conduct vegetation management burns. As it turned out, we were able to conduct one prescribed burn at Dales Lake and then had one burn on the adjacent property escape into one pasture and burn two control transects. These burns were insufficient to test this hypothesis pair.

BRANCHIOPOD HYPOTHESES

We defined three branchiopod one-sided hypotheses that our project would attempt to test (Appendix 1). Because we had not previously undertaken a project of this type, some of our hypotheses reflect the notions we had at the outset of our study and most of them have turned out to be insufficiently specific, in retrospect, given the unexpected diversity of these pools.

Branchiopod Hypothesis 1

Hypothesis 1: Population density per pool of *Branchinecta lynchi* is lower in grazed pool-plots than ungrazed. This hypothesis will be tested at the pool called Spring Branch Two.

This hypothesis was not testable. Because *B. lynchi* occurred in Spring Branch 2, it was anticipated that they would also be found in at least one other pool, either Spring Branch 1, Spring Branch 3, or Spring Branch 4. They were found in Spring Branch 4 but in such low numbers and in sporadic occurrences that it is wholly incomparable with Spring Branch 2. Although Spring Branch 4 is grazed, the fact that these pools are so different, makes any comparison of *B. lynchi* density impossible, particularly because no density numbers could be estimated for *B. lynchi* in Spring Branch 4.

Branchiopod Hypothesis 2:

Hypothesis 2: Population density per pool of *Lepidurus packardi* is lower in grazed pool-plots than ungrazed. This hypothesis will be tested at Dales Lake, Hog Lake, Sevenmile Lake, Spring Branch One and Spring Branch Two.

Lepidurus packardi was found at the pools identified; however, the sampling protocol was not appropriate to estimate population density of this species. Insufficient knowledge about the behavior of this species led to the development of this hypothesis at the outset of the study. Therefore this hypothesis was not testable in this study.

Branchiopod Hypothesis 3:

Hypothesis 3: Population density per pool of *Linderiella occidentalis* is lower in grazed pool plots than ungrazed. This hypothesis will be tested at Dales Lake, Hog Lake, Hoggett, Sevenmile Lake, Spring Branch One, Spring Branch Two, and Spring Branch Four.

This hypothesis has turned out to be more complicated and heavily dependent upon the specific characteristics of each pool rather than comparable or testable at the broad level of grazed versus ungrazed pools. Grouping pools by grazed and ungrazed is too coarse a classification without knowing more about the grazing period being applied in the area of the pool. The pools and surrounding lands can be grouped by coarsely grouped by grazing treatment as: Ungrazed—Sevenmile, Spring Branch 2; Completely Ungrazed then completely grazed—Hog, Hoggett; Completely Grazed Spring Branch 3, Spring Branch 4; Partially Grazed Spring Branch 1 (long duration, low density) and Dales (short duration, high density).

Ungrazed Pools

The two ungrazed pools have different branchiopod faunas: Sevenmile (*L. occidentalis* and *L. packardi,* rare), Spring Branch 2 (*B. lynchi*, and *L. packardi*, common). Fluctuations in the populations in these pools appear to be environmentally controlled in some unknown manner.

Completely Ungrazed then Grazed Pools

The property was ungrazed from 1996 until fall 2000 at which time, both Hog and Hoggett were grazed. Although spatially close, and similar in some features, they have many differences. In branchiopod inhabitants, Hog Lake has *L. occidentalis* and *L. packardi*, probably two species of *Cyzicus*, while Hoggett only has *L. occidentalis*. In 1998,there was a large number of specimens sampled and this sampling occurred in most pools on the Hog Lake Plateau and Dales Plains.

Completely Grazed Pools

Spring Branch Three has never had any branchiopods detected during our period of sampling 1998-2005. Spring Branch 4 has a population of *L. occidentalis*, and rare occurrences of *B. lynchi*. None of these pools are comparable to each other and they all occur within 0.5 mile of each other. *Linderiella occidentalis* may be incurring effects from the grazing in this pool, but it cannot be tested by comparison to the other pools as they are too different. The best way to test this hypothesis on this pool would be to fence part of the pool to provide ungrazed and grazed elements of the pool.

Partially Grazed Pools

Spring Branch One was fenced to exclude grazing except for a small region that was left accessible to cattle. Because the grazed region is small compared to the protected area of the pool, this pool incurs partial grazing effects and fluctuations in the populations of *L. occidentalis* appear to be responsive to environmental parameters.

Dales Lake was the only pool in which experimentally controlled grazing was applied. The DLN pasture was grazed, but the population of *L. occidentalis* was gone for the season when the cattle were placed into the pasture. Cattle did go to the edge of the pool for water, but did not venture into the water much beyond the immediate shoreline as forage was fresh and available in the surrounding pasture. Their effects on *L. packardi* were likely also insignificant as the cattle did wade into deeper water where this species is most prevalent.

VEGETATION HYPOTHESES

In Appendix 1, we defined six vegetation hypotheses pertaining to the uplands, not the vernal pools (VH1 to VH6) that our project would attempt to test. Although data was collected, it is not being presented or discussed in this report since the hypotheses do not relate specifically to vernal pool vegetation.

SPECIAL STATUS PLANT SPECIES HYPOTHESES

We defined eight special status plant species hypotheses that our project would attempt to test (Appendix 1). Because we had not previously undertaken a project of this type, some of our hypotheses reflect the notions we had at the outset of our study. In retrospect, we found most of them to be insufficiently specific given the unexpected diversity of these pools.

Abbreviations in the hypotheses identifiers are: SSP = Special Status Plant, H = hypothesis being tested, N = null hypothesis, followed by the number of the hypothesis.

Special Status Plant Hypothesis 1

SSPH1 Grazing increases or decreases the distribution and abundance of *Paronychia ahartii*.

SSPN1 Grazing results in no change in the distribution and abundance of *Paronychia ahartii*.

Paronychia ahartii was monitored separately, but as it is an inhabitant of the uplands the data will not be discussed here.

Special Status Plant Hypothesis 2

SSPH2 Grazing increases or decreases the distribution and abundance of *Sagittaria sanfordii*.

SSPN2 Grazing results in no change in the distribution and abundance of *Sagittaria sanfordii*.

Sagittaria sanfordii occurs in Hog Lake, Dales Lake, and Sevenmile Lake. Sevenmile Lake was never grazed and so changes in *Sagittaria* were only changes in cover due to factors other than cattle effects. Dales Lake had experimental grazing applied to the DLN pasture which in the lake contains the primary occurrence of *Sagittaria sanfordii.* Cattle were only present in the pasture for 2-3 weeks per year, however, and during that time, the pool was full and *Sagittaria* plants were in water 0.5 – 1.0 m deep below the surface of the water. The cattle never waded into water much deeper than 0.3 meters. In Hog Lake, *Sagittaria* was only in the deepest Zones on our transects, and these deep water Zones were avoided by cattle, thus no effects from cattle either by hoof prints or grazing were found. Since the cattle did not reach the plants and had no direct effect on them the null hypothesis is accepted.

Special Status Plant Hypothesis 3

SSPH3 Grazing increases or decreases the absolute cover of *Legenere limosa*.

SSPN3 Grazing results in no change in the absolute cover of *Legenere limosa*.

This projects' primary monitoring emphasis has been on using permanent transects and quadrats to measure changes in vegetation when the pool receded from the site of the quadrat. *Legenere limosa* can only be identified when the pool is substantially full of water and in mid to late spring. It was not possible to establish a system to monitor for this plant among all the other monitoring protocols that were established. This hypothesis was not testable given the experimental design as originally anticipated.

Special Status Plant Hypothesis 4

SSPH4 Grazing increases or decreases the absolute cover of *Gratiola heterosepala*.

SSPN4 Grazing results in no change in the absolute cover of *Gratiola heterosepala*.

As transects were established, it became apparent that *Gratiola heterosepala* was not going to be found with sufficient regularity within the randomly established quadrats and transects for annual monitoring to be possible. One location was found and smaller quadrats were tested for monitoring. The site of these test plots was not a typical vernal pool site, but a mid-depth shelf in an old borrow pit that has been supporting a variety of vernal pool plant for possibly 50 years or more. Although accessible to cattle for grazing, the borrow pit would not sustain grazing effects that are typical of a vernal pool found in the area. This hypothesis was not testable given the experimental design as originally anticipated.

Special Status Plant Hypothesis 5

SSPH5 Grazing increases or decreases the absolute cover of *Orcuttia tenuis*.

SSPN5 Grazing results in no change in the absolute cover of *Orcuttia tenuis.*

This hypothesis and its null originally appeared straight-forward in the potential to test it in these pools; however as discussed under Branchiopod Hypothesis 3 above, the differences between pools, and the timing of grazing relative to the timing of *Orcuttia* presence in pool, and pool morphology, have rendered this hypothesis too simplistic to apply to all pools. Therefore, it will be discussed in the context of each pool and the sub-groups of grazing treatments.

Ungrazed Pools

The two completely ungrazed pools (Sevenmile Lake and Spring Branch Two) have fairly similar distributions of *Orcuttia* and the distribution of this species in these pools is comprehensively discussed in Clark (2006) and in Appendix 5.

Completely Ungrazed then Grazed

Hoggett, much smaller in area, has had *Orcuttia* collected in the pool; however, it was in a very small area of the pool and has not yet been identified by the authors. Despite qualitative surveys off the transects no *Orcuttia* has yet been found.

Hog Lake is very large and has a very large population of *Orcuttia*. As discussed above, in the vegetation section under Hog Lake, *Orcuttia* occupied an intermediate depth Zone where *Eleocharis* was less common and may be less competitive due to the recession of water. In deeper Zones, where the inundation period is longer, *Eleocharis* has much greater cover (see discussion below).

Completely Grazed Pools

Orcuttia has yet to be found in Spring Branch Three or Spring Branch Four during the period of sampling (1998 – 2004).

Partially Grazed Pools

Spring Branch One was fenced to exclude grazing except for a small region that was left accessible to cattle. As mentioned above in the vegetation section, there is an insufficient number of transects in this pool to characterize the habitat Zones. *Orcuttia* is doing well in the protected Zone of the pool.

The population of *Orcuttia* in Dales Lake never sustained any effects from grazing as the cattle were in the associated pasture in April and very early May, about one to two months prior to the first *Orcuttia* plants to be exposed in the pool. Thus the hypothesis could not be tested in this pool in the grazing that has been employed to date.

Special Status Plant Hypothesis 6

SSPH6 Grazing reduces or increases the absolute cover of *Eleocharis macrostachya.*

SSPH6 Grazing results in no change in the absolute cover of *Eleocharis macrostachya.*

This hypothesis and its null were originally proposed with little understanding of the effects that cattle grazing may have on *Eleocharis* other than the fact that it was a highly palatable plant. It was unclear whether some level of light grazing may stimulate *Eleocharis* to produce more stems as grazing can do for grass species, and as grazing pressure increased then there could be a reduction in *Eleocharis* cover. Thus the two-tailed nature of this hypothesis.

It was expected that the experimental grazing at Dales Lake would result in more grazing effects on *Eleocharis*; however, the initial goals for use of grazing to reduce and control *Taeniatherum caput-medusae* occurred when the pool was nearly at maximum water capacity. At this time *Eleocharis* was barely protruding above the water surface and the cattle would only wade into the water (about 0.3 m deep) and nibble the tops of the *Eleocharis*; this small amount of grazing early in the season had no effect on the *Eleocharis* population or cover as it affected much less than 1% of the population at a time when the maximum growth of *Eleocharis* had not yet begun. In this sense then, the null was not refuted and grazing had no effects to change the absolute cover of *Eleocharis*.

Hoggett is the pool that best displays the impact of grazing upon *Eleocharis macrostachya*. Figure 58 shows the two transects and the three Zones on those transects in which *Eleocharis* is found (Zones 4, 5, 6). The monitoring in July 1999 shows the percentage cover attained by *Eleocharis* after three years without grazing. In late summer (August) 1999 a wildfire burned Hoggett, Hog Lake, and the surrounding uplands. The effects of this wildfire can be seen in the decline in *Eleocharis* cover in the following monitoring period, May 2000. In the fall of 2000, grazing was reintroduced to Hoggett and Hog Lake and the effects of this grazing were to keep the cover of *Eleocharis* at or below the levels brought about by the fire. By June 2003, the cover of *Eleocharis* was reduced to < 10% in all Zones of Hoggett.

The Spring Branch Road pools, Spring Branch Three and Spring Branch Four, are completely open to grazing and the pool bottoms are heavily churned by hoof prints. Spring Branch One has one section open to grazing, and during the years of our monitoring period, this section saw a decline in both *Eleocharis* and *Orcuttia* coverage until that region was nearly completely open mud.

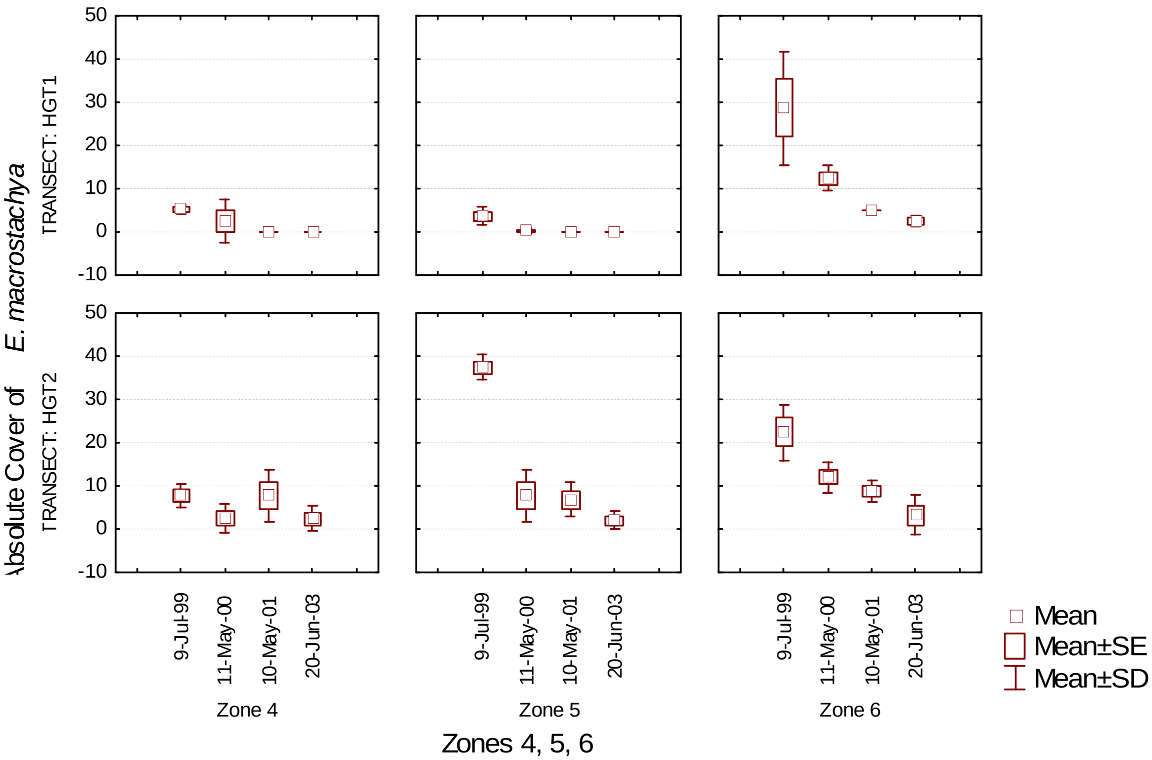

Figure 58. Change in absolute cover of ***Eleocharis macrostachya*** at Zones 4, 5, and 6 through time along the two transects in Hoggett. Fire burned the pool in late summer 1999. Grazing began in the fall 2000. Zone 4 is in shallow water (shorter period of inundations) while Zone 6 is in deeper water with a longer period of inundation.

Special Status Plant Hypothesis 7

SSPH7 Wildfire reduces or increases the absolute cover of *Eleocharis macrostachya*.

SSPN7 Wildfire results in no change in the absolute cover of *Eleocharis macrostachya*.

This hypothesis and its null were tested at Hoggett (Figure 58) and Hog Lake. As noted in the results above for Special Status Plant Hypothesis 6, there was a decrease in cover of *Eleocharis* following the fire of late summer 1999. Hog Lake burned at the same time as Hoggett; however the change in cover by *E. macrostachya* as recorded in the late spring 2000 is inconsistent (Figure 59). On transect HL2, Zone 8, the cover of *E.*

macrostachya declined, but increased slightly in Zone 9. On transect HL3, the cover of *E. macrostachya* increased in all three Zones (7-9). It is possible that the fire did not burn hot enough into the root Zone of *Eleocharis* in Hog Lake to affect the plant, but merely burned the dry stems, whereas Hoggett would have been drier longer and the fire may have burned hotter and destroyed the below ground stems and roots.

This hypothesis as phrased is too general in wording and based on our results the null is true for Hog Lake, while the alternate appears to be true for Hoggett.

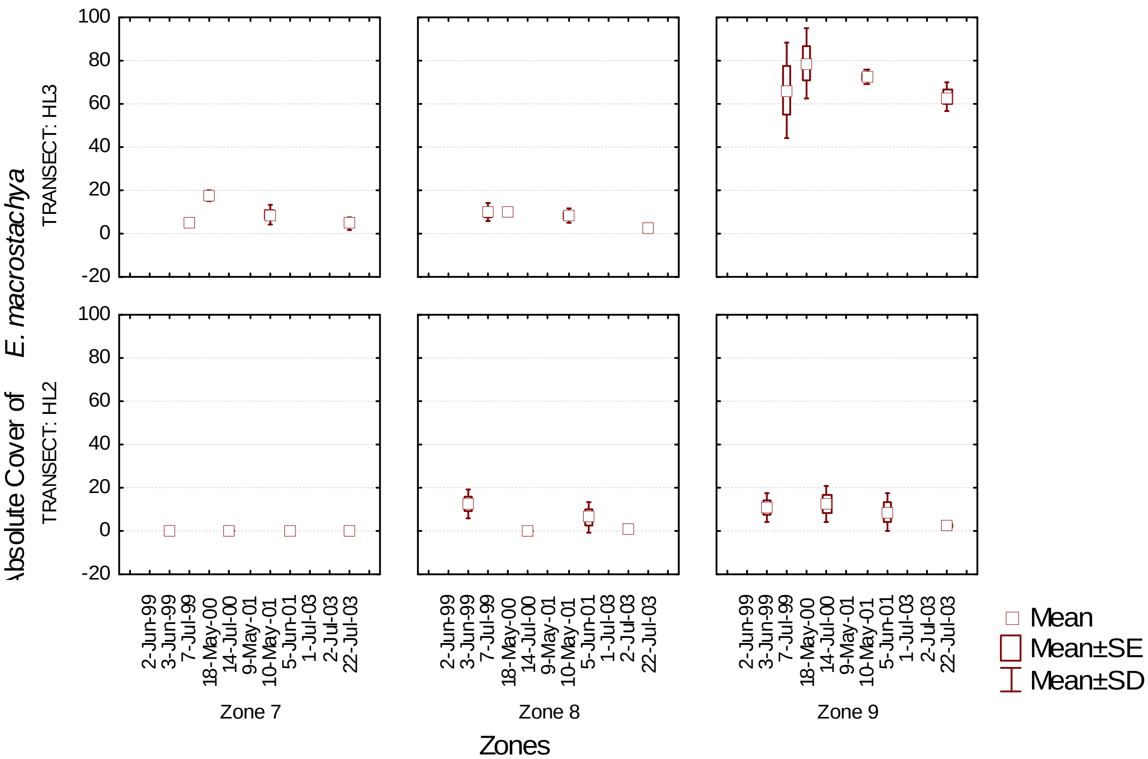

Figure 59. Change in absolute cover of ***Eleocharis macrostachya*** at Zones 7, 8, and 9 through time along the two of three transects in Hog Lake. Fire burned the pool in late summer 1999. Grazing began in the fall 2000. Zone 7 is closer to shore (shorter period of inundation) while Zone 69 is deepest water with a longer period of inundation.

Special Status Plant Hypothesis 8

SSPH8 A reduction in the absolute cover of *Eleocharis macrostachya* will result in an increase in the absolute cover of *Orcuttia tenuis*.

SSPN8 A reduction in the absolute cover of *Eleocharis macrostachya* will result in no change or decrease in the absolute cover of *Orcuttia tenuis*.

This hypothesis and null were intended to be tested at all pools; however, the only pool with sufficient cover of both *Orcuttia* and *Eleocharis* along with substantial effects from grazing occurred at Hog Lake, where cattle were grazed from late fall (Nov.) into mid-late Spring (April – May) depending upon the rainfall in each season. Figure 60 shows the changes in *Orcuttia* cover along transects HL2 and HL3 for Zones 7, 8, and 9 which were the Zones with sufficient inundation to support both *Orcuttia* and *Eleocharis* (see Figure 56). As can be see from a comparison of Figures 59 and 60, in places where *Orcuttia* has substantial cover (HL2 Zone 7, 8, & 9; Figure 60), then *Eleocharis* has very low cover (HL2 Zones 7, 8, & 9; Figure 59). While in transect HL3 Zones 7 and 8, there is relatively low cover (mean rarely exceeding 20%) of both *Eleocharis* and *Orcuttia* and in HL3 Zone 9 *Orcuttia* cover was near zero (Figure 60), while mean *Eleocharis* cover consistently exceeds 60% (Figure 59). The first values recorded in 1999 occurred prior to the resumption of grazing and prior to fire in late summer 1999. Although grazing resumed in fall of 2000, only Zone 7 on HL2 received any impacts from cattle as recorded by accumulation of hoof-prints or dung within a $2m^2$ area centered on the quadrats of each Zone. Hoof-prints were recorded only on Zone 7 of HL2. Zone 7 of HL3 never received hoof-printing and Zones 8 and 9 on both HL2 and HL3 never received cattle effects as recorded by hoof-prints or dung. Thus, the variation in both *Eleocharis* and *Orcuttia* as displayed in Figures 59 and 60, has occurred without the physical effects of cattle on these plots either through hooves, grazing, or dung deposition. The quadrats most occupied by *Orcuttia* are not receiving deleterious physical effects from cattle despite the entire area being grazed for nearly six months.

It would appear from the Hog Lake data of Zones 7, 8, and 9 on HL2 and HL3 that where the mean cover of *Eleocharis* is low (<20%), then mean cover of *Orcuttia* can range from 10-50% absolute cover.

Cover changes between *Eleocharis* and *Orcuttia* were studied at Sevenmile Lake and Spring Branch Two and comprehensively evaluated by Clark (2006) and Clark *et al*.. (Appendix 5).

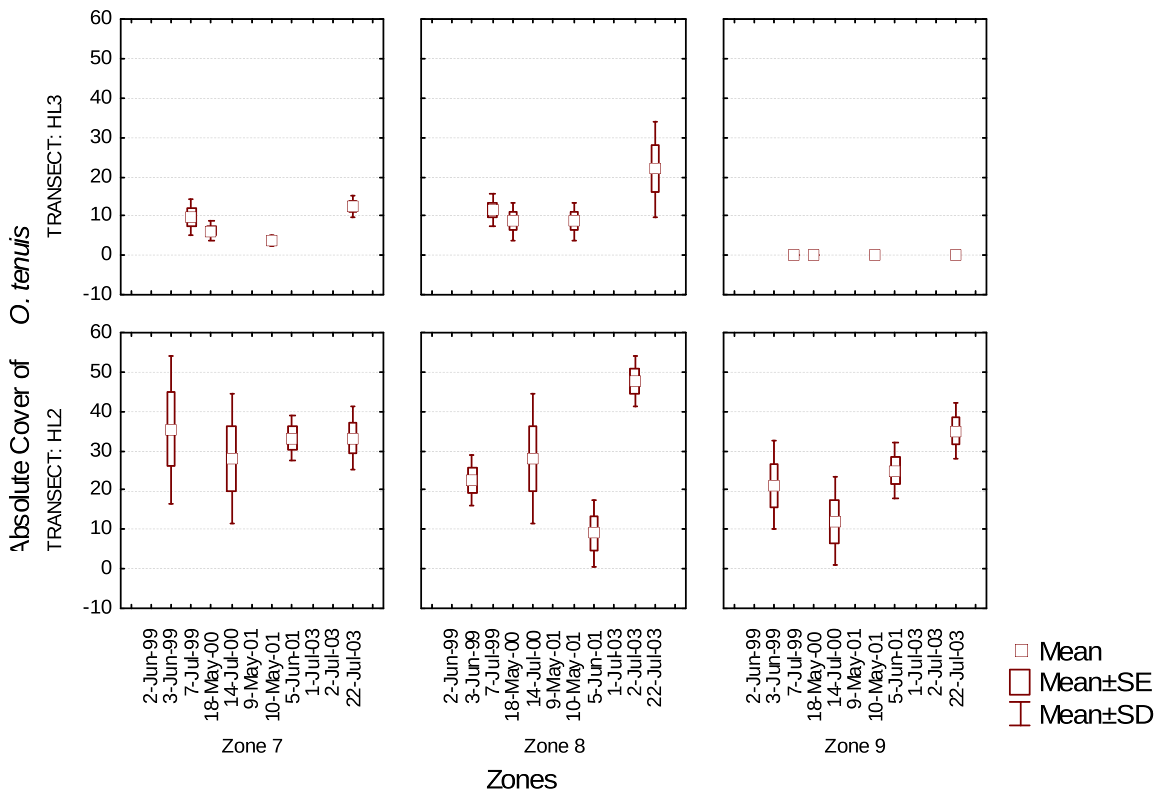

Figure 60. Change in absolute cover of ***Orcuttia tenuis*** in Hog Lake (Transects HL2 & HL3) in Zones 7, 8, and 9. Fire burned the pool in late summer 1999. Grazing began in fall 2000. Depth of water and period of inundation increases from Zone 7 to Zone 9.

DISCUSSION

WATER QUALITY

Water quality parameters selected for study (temperature, pH, dissolved oxygen, conductivity, salinity) were chosen because they would be relatively simple to measure in the field and they are commonly used indicators of water quality. The two objectives of monitoring these water quality parameters was to determine: (1) what the typical range of variation of these factors in a pool would be within a season and; (2) to determine if the presence of cattle brought about changes in these variables that were outside the range of variation observed in pools protected from cattle grazing. A great deal of data was collected which could be presented as a report unto itself; however, space does not permit such an analysis here.

The pH of the pools was monitored from WY 1997 through WY 2004. During that time pH rarely dropped below 6.5 in all pools and rarely exceeded 9 until very late in the season around June when the pools were very warm and drying rapidly. Bronmark and Hansson (1998, p. 27) state that the pH of the majority of lakes on earth is between 6 and 9, thus these pools are showing no unusual patterns of pH variation. The direct and indirect effects of pH are often difficult to distinguish, because of the many influences on water chemistry and on ion solubility, particularly metallic ions, which become increasingly mobile as pH declines (Lampert and Sommer 1997, p. 57). Scheffer (2004, p. 56) discusses the important equilibrium between iron as Fe(III) and Fe(II); in the presence of oxygen, soluble Fe(II) becomes insoluble Fe(III) and precipitates with phosphorus at the sediment water interface, forming a boundary to the diffusion of phosphorus out of the sediment which can lead to a shortage of available P in shallow lakes. Fluctuations in pH will affect the solubility of the Fe(III)-P precipitate, whereby increases in pH can reduce the capacity of iron to bind to phosphorus.

These vernal pools have formed on soils with a high iron content and the shallow nature of the pools means that the sediment-water interface will be aerobic, which raises the possibility that phosphorous may be a limiting resource for organisms in these pools. Phosphorous was not monitored as part of this study but would be worth considering for future water quality monitoring. In addition, measurement of the pH at repeated places within the pool, over time at constant intervals, would provide much better information on the changes occurring in the pool and how they correspond to the seasonal progression of the aquatic organisms.

Dissolved oxygen is a one of the most frequently used variables and an important chemical assay of the aquatic environment (Wetzel and Likens 2000, p. 73). In contrast to pH, dissolved oxygen (DO) was measured at the in the deeper regions of the pool at the sediment-water interface. It is likely then, that the measures of dissolved oxygen collected are low, relative to the surface water. The measures were done repeatedly at the same location, thus the values are consistent measures at the site, at the benthic boundary layer. The values do allow the range of DO to be observed in the pool over time and were intended to be a monitor for aberrant shifts that could be attributed to a major disturbance factor such as cattle and their possible disturbance effects in the pool. However, no effects of this type occurred into very late in the WY when the pool was declining in area and depth, such that volume was likely to less than one-quarter of the maximum capacity. At this time DO could be seen to decline with increasing water temperatures due to the onset of summer.

Conductivity (EC) measures the electrical current that a solution will conduct and this current is proportional to the concentration of ions in solution. Although eight years of data were collected in these pools, the primary intention was to use EC to determine what the specific conductance ranges were for the individual pools and then to note whether there were substantial deviations from the typical range observed. The very large pools (Dales Lake, Hog Lake) did not show any changes in specific conductance that were outside the typical range observed when cattle were grazing around these pools. Only Hoggett showed any deviation from this range while cattle were grazing the surrounding land and the deviation may be as attributable to the very shallow water conditions in this pool in late May. In general, specific conductance ranges appear to have characteristics for certain pools that will need more in depth analysis. However, no excessive electrolyte changes occurred in the pools until well after cattle were gone and the electrolyte concentration increases were due to shallow water and warm temperatures.

The water quality parameters monitored were useful for establishing a profile of the pool and may be useful in characterizing the pools themselves when additional data on the pool morphology, catchment area, and other features are acquired for each pool. The primary purpose of these parameters in this study was to assess baseline conditions and ranges and determine whether cattle grazing in and around the pools had any effects upon The nature of the cattle grazing, short duration (7-19 days) and high intensity (stocking density ranging from 9.8 to 19.8 animal days per acre) for Taeniatherum caput-medusae control, had no detectable effect on the water quality measures at Dales Lake.

The opposite grazing style of long duration/low density of cattle, as carried out on the Hog Lake Plateau on BLM property, did not have any effects on these water quality parameters that were outside their ranges observed prior to the establishment of grazing.

Water quality parameters measured in the pools along Spring Branch Road did not indicate major negative effects on water quality. Spring Branch Three would not qualify as a vernal pool lacking both typical vernal pool plants and branchiopods; however it certainly has the volume and inundation period to support either. Late in the season Spring Branch Three tended to have a slightly offensive odor that could not be associated with the measured parameters whereas the other pools did not have the odor. What this is from and whether it had something to do with the absence of vernal pool branchiopods is unknown. But clearly there are other chemical or biological processes occurring in this pool that led to the odor, which happens each year, and appears unrelated to these monitoring parameters.

BRANCHIOPODS

The branchiopod occupation of the various pools cannot be easily summarized by any general statements other than each pool has unique populations and their study is also pool specific. In review of the data collected, it was particularly interesting that the large spike of high density of branchiopods in WY 1998 occurred in Hog Lake, Dales Lake, and Sevenmile Lake. Then in WY 1999, the density was low in comparison to the 1998 high. Although the decline varied, it still occurred in all three pools. In WY 2000, an increase in branchiopod density occurred in all three pools that was greater than WY 1999, but still less than WY 1998. Also of note is that Hoggett, which had no spike in WY 1998, had a small density increase in WY 1999, but also had the increase in WY 2000.

The Spring Branch Plains pools, Spring Branch One and Spring Branch Four, with populations of *Linderiella occidentalis* at the Hog Lake Plateau and Dales Plains pools, showed the same pattern in Spring Branch One (a density spike in WY 1998, a much smaller density in WY 1999, and a density spike in WY 2000) while Spring Branch Four showed a pattern similar to that of Hoggett (WY 1998 was very low, but an increase in 1999, followed by a large density increase in WY 2000). Also of interest is the fact that Spring Branch Two, the only pool with a strong population of *B. lynchi*, had its greatest density in WY 1999, the year that pools with *L. occidentalis* were low in density. It would appear that these populations of branchiopods in separate pools are responding in similar ways to the environmental conditions.

This is the first study the authors are aware of where branchiopods populations have been sampled to determine density and occurrence in the pools. The attempts to sample for density have proven interesting as they have led to the determination that the branchiopods have preferred habitats within the pools. Thus, the assumption that the entire volume of water is potential habitat is likely in error and branchiopod habitat within the pool is actually much less. Quantification and determination of the microhabitat preferences of the branchiopods will be important in determining why or why not certain species occupy one pool or another. In addition, sampling for density can lead to an understanding of population dynamics of the branchiopods in the pools. When the preferred habitat can be ascertained, then absolute numbers of the species in a pool can be calculated. These are the first steps in gaining a greater understanding of branchiopod and vernal pool ecology.

VEGETATION

This report has focused on the vegetation in the vernal pools as sampled by permanent transects and quadrats. The system has worked well and transects and quadrats were easily relocated each year for sampling. The system could not completely monitor the predominant vegetation and all the special status plant species in each pool. Monitoring of *Orcuttia* worked particularly well and the system was designed to assess this species as of particular interest. For *Sagittaria sanfordii*, the system would only identify major shifts in population changes. Being perennial in deep water, there were fewer quadrats in this Zone and the density of the plants is not high. Likely additional species-specific modifications should be made to better monitor this species.

With *Sagittaria* being a large long-lived perennial of the deep water of the pools, the other special status plants, *Legenere limosa* and *Gratiola heterosepala* fall at the other extreme of being short lived annuals which have a very short period in which to identify and quantify the plants. The monitoring system did not work well to include these two species and efforts to set up additional plots for *Gratiola* were difficult to implement due to limitations of time to reach all plots at the appropriate times for monitoring. A completely separate monitoring protocol would be needed for *Legenere limosa* and it is not known what would be the best protocol for this plant.

A particularly difficult task in monitoring the number of transects and plots in this project was attempting to reach and monitor the plot at the best time, given the uncertainty of climate and maturation of the plants each year. At any given time only two persons were available to conduct the vegetation monitoring and one of these was not solely dedicated to this project, thus confounding the best of intentions as other unexpected job tasks often arose. Monitoring these large pools often required two to three separate visits to the transects to capture the Zones at the optimal vegetative state.

Monitoring of *Orcuttia* and *Eleocharis* appeared to be effective and more refined intensive analysis of the data may reveal other patterns not brought forth here. The work of Clark (2006) and Clark *et al.* (Appendix 5) was a more focused study of the interaction of *Orcuttia* and *Eleocharis* and was a derivative of this primary project. These two works suggest that the two species are in relative balance based upon soil depth and inundation rather than direct competition. The hypothesis in Clark *et al.* (Appendix 5) that sediment deposition over time would favor *Eleocharis* over *Orcuttia* has interesting ramifications for Hog Lake and Hoggett. Both of these pools sit low in their catchment basin and probably receive more sediment through erosive processes than a pool such as Dales Lake. In time, Hog Lake and Hoggett may become better habitat for *Eleocharis* than *Orcuttia*. In fact, the authors have not yet been able to find *Orcuttia* in Hoggett although it had occurred in the pool. It would take far longer for Hog Lake to become unsuitable habitat for *Orcuttia*, but much of the deep water area is dominated by *Eleocharis* and completely absent of *Orcuttia*. The sediment budgets of these pools would make interesting computations to assess sediment flux over time. It might be possible that Hoggett may be improved as habitat for *Orcuttia*, if this population has been extirpated due to sediment accumulation. Experimental plots may prove particularly useful here.

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APPENDIX 1

Community Interactions and Grazing Effects on Seven Rare Vernal Pool Plants and Macroinvertebrates in Tehama County

1998 Annual Report
Study Design and Methodology

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Abstract

A study to monitor the effects of grazing on vernal pools and their associated habitat was initiated in Tehama County, California in 1998. The study sites are: Dales Lake Ecological Reserve (California Department of Fish and Game), Hog Lake Plateau (Bureau of Land Management) and Spring Branch Plains (Bureau of Land Management). Monitoring is ongoing at these sites within grazed and ungrazed pastures. Prescribed fire effects are being studied at Dales Lake Ecological Reserve. Wildfire effects are being monitored at Hog Lake Plateau. Water quality data has been collected every two weeks (except for water temperature which is recorded hourly) throughout the season from inundation to dry-down to determine: (1) what are the ranges and cycles of these variables, in a pool, during a season, and (2) to ascertain whether cattle can perturb these variables in a manner that exceeds their natural variation in ungrazed pools. Fairy shrimps (*Branchinecta lynchi and Linderiella occidentalis*) and tadpole shrimps (*Lepidurus packardi*) are being sampled for distribution and abundance estimates every two weeks throughout the season. Permanent plots are being used to monitor changes in the vegetation component of the vernal pool ecosystem. Monitoring is being conducted for both native and non-native species compositional changes in an effort to determine whether and what combination of grazing and/or burning will promote native species over non-native species. Investigations into whether interspecific native species competition may be a problem for the special status species in our study area are also underway. Monitoring is also in place to determine whether grazing has beneficial effects for special status plant species (*Gratiola heterosepala*, *Legenere limosa*, *Orcuttia tenuis, Paronychia ahartii,* and *Sagittaria sanfordii)*. Grazing is being monitored to avoid any negative impacts to special status plant species. Grazing may serve to maintain a diversity of microhabitats that benefits native species and can be used as a method to reduce and control non-native plant species.

Introduction

This is the first of two reports that in combination describe the work conducted under two United States Fish and Wildlife Service (USFWS) Section 6 Program grants, EP96-5 and EP97-7, awarded to the California Department of Fish and Game (CDFG). The project, whose purpose is to study the effects of grazing on vernal pools in Tehama County, was conducted under two contracts with California State University, Chico, FG7502R1 and FG7512R1, respectively. Since the project is ongoing, these first two papers may be viewed as progress reports.

Work under these two contracts spans two years—from January 1998 to December 1999. In this region of California the vernal pool season spans approximately November 1st through July 1st. At the suggestion of contract manager Mr. Craig Martz, this first report contains the introduction, monitoring plans, proposed hypotheses, sampling protocol, and field methods. The second report builds upon the first, and presents data analysis methods, results, and discussion of the project to date. For concise summaries of first and second year activities, see Eggeman (1999) and Lis and Eggeman (2000).

The format and content of these two reports has been driven by several delaying and unpredictable events. This project began in the middle of a high rainfall water season (1997-98). Then, due to delays in the approval of contract FG7502R1 (submitted July 1, 1997 and approved January 13, 1998) several components could not be implemented on schedule. The delayed contract approval caused further delays including: (1) not obtaining the USFWS survey permit in time to sample fairy shrimps the first season, (2) waiting to purchase supplies and field equipment that delayed water quality data collection until mid-season and (3) postponing fence-line installation. This last item subsequently delayed the first season of grazing trials and the installation of botanical transects and data collection. Compounding the delays caused by the contract process, was the high rainfall water season which lasted until early summer. Consequently the largest pools, Dales Lake and Hog Lake, did not dry until early September–an extremely rare occurrence for pools that normally dry by early July. This late drying impeded the construction of fence-lines for the experimental grazing treatment; construction did not occur until mid-October 1998. Then the fall rains began again in early November and further fence-line installation was prohibited until late summer and fall of 1999.

Once the infrastructure was in place, this project began monitoring the effects of grazing and burning on native, non-native and special status plant species, vernal pool branchiopods and water quality variables for the purpose of controlling exotic pest plants and encouraging native species to reoccupy sites now dominated by non-natives. Three vernal pool complexes, Dales Lake Ecological Reserve, Hog Lake Plateau and Spring Branch Plains, are being studied (see Figures 1-3). The following seven special status species inhabit this area: two branchiopods, *Lepidurus packardi* (vernal pool tadpole shrimp) Federally Endangered, and *Branchinecta lynchi* (vernal pool branchinecta) Federally Threatened; and five plant species, *Orcuttia tenuis* (slender Orcutt grass) Federally Threatened and State Endangered, *Sagittaria sanfordii* (valley sagittaria), *Legenere limosa* (Legenere), *Gratiola heterosepala* (Boggs Lake hedge hyssop), State Endangered, and *Paronychia ahartii* (Ahart's witlow-wort). All of these plant species are included on list 1B (plants rare, threatened or endangered in California and elsewhere) by the California Native Plant Society (Skinner and Pavlik 1994).

Management Goals and Objectives

Vernal pool ecosystems evolved under grazing pressure from wild herbivores and with periodic fire. As these ecosystems were invaded by non-native annual plants, fenced, subjected to varying grazing regimes and protected from burning, the diversity and abundance of native plant species has declined. The removal of grazing has not resulted in a return to dominance of native plant species, but rather a rapid shift toward more aggressive non-native species (Barry 1998). The non-native species are new members of the ecosystem and have transformed it. The objectives of this study are to determine whether grazing or burning

CDFG Vernal Pool Grazing Study

BEND AND DALES QUADRANGLE
CALIFORNIA-TEHAMA CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)

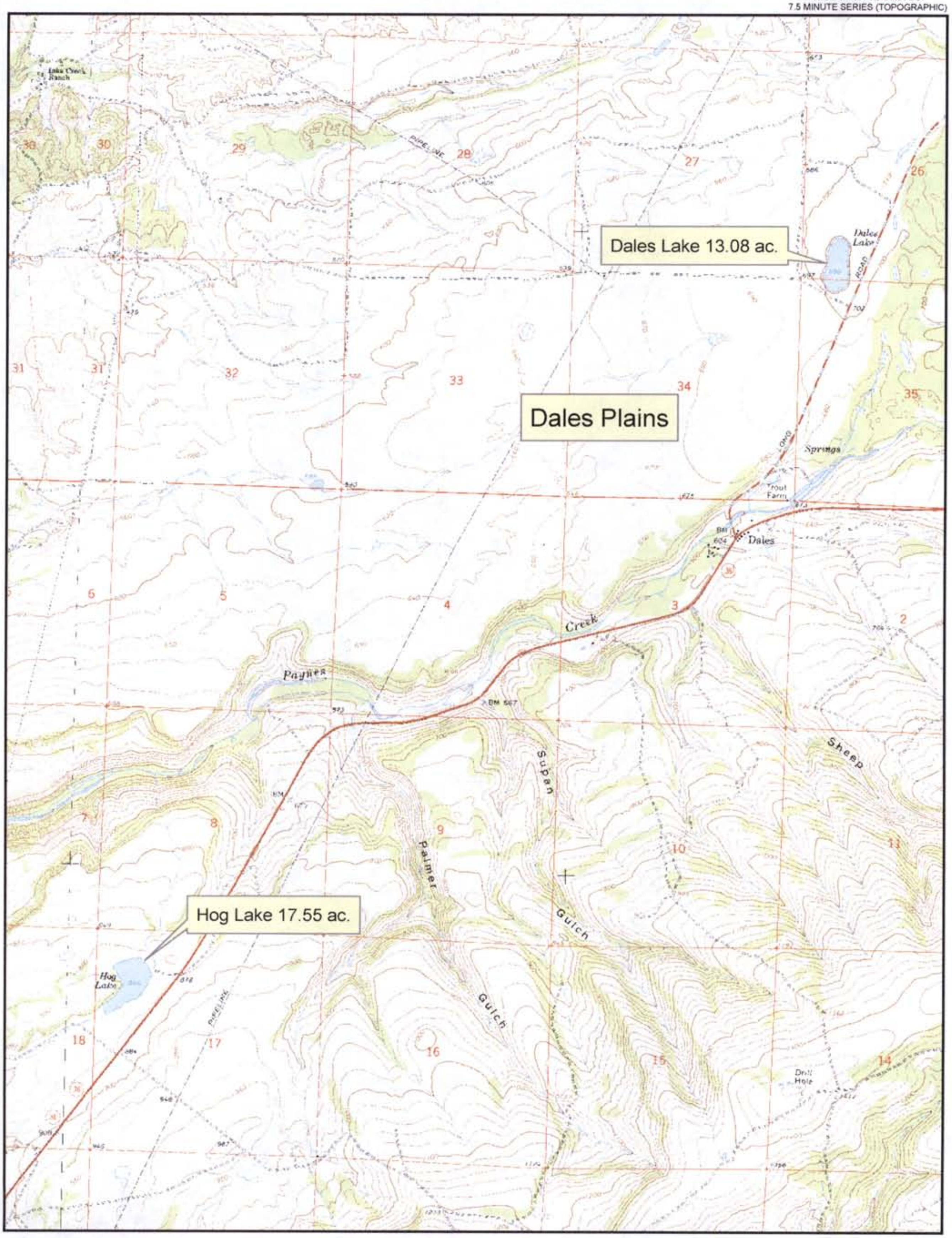

Figure 1. Location of Dales Lake in relation to Hog Lake.

CDFG Vernal Pool Grazing Study

BEND AND DALES QUADRANGLE
CALIFORNIA-TEHAMA CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)

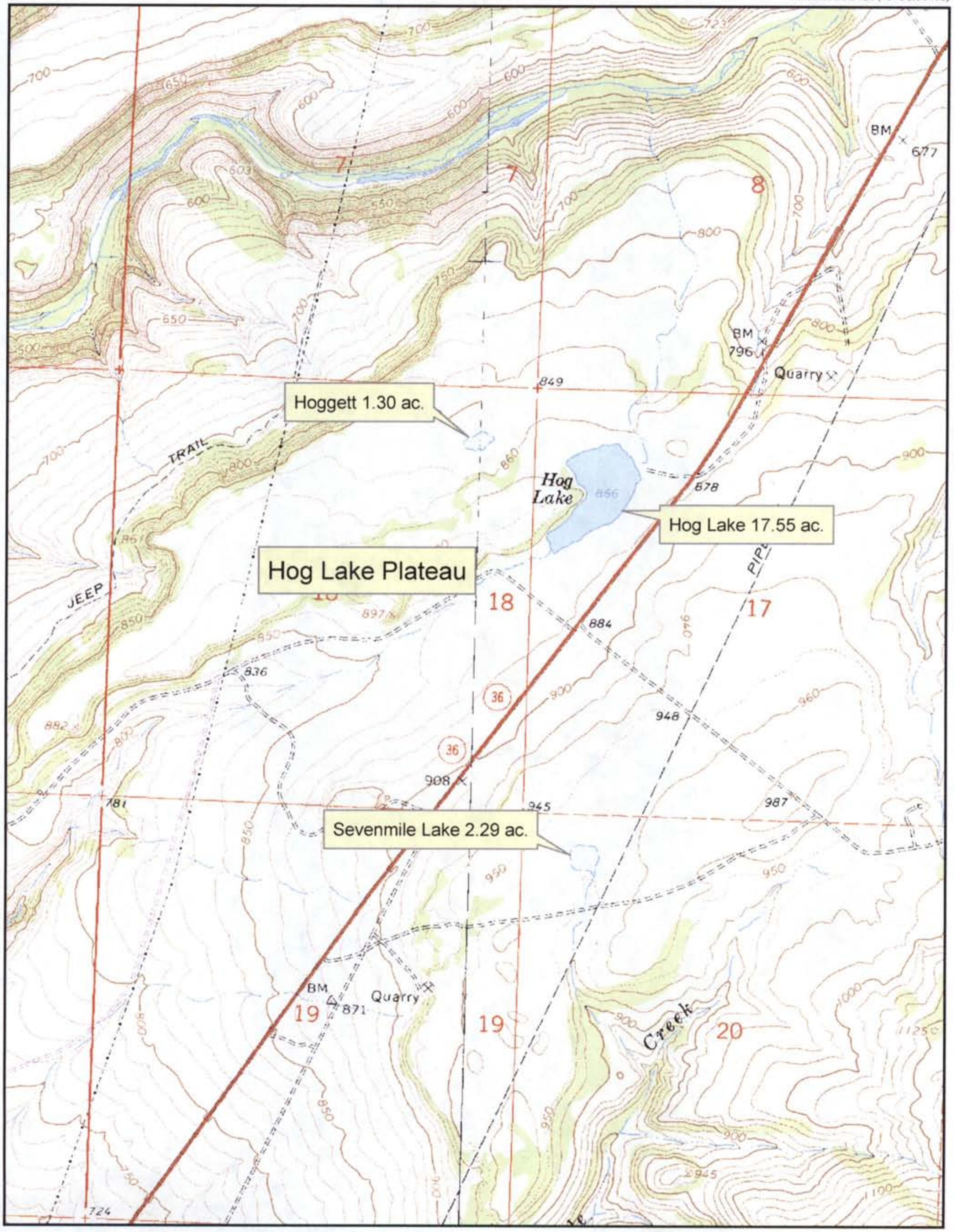

Figure 2. Locations of vernal pools Hog Lake, Hoggett, and Sevenmile Lake.

CDFG Vernal Pool Grazing Study

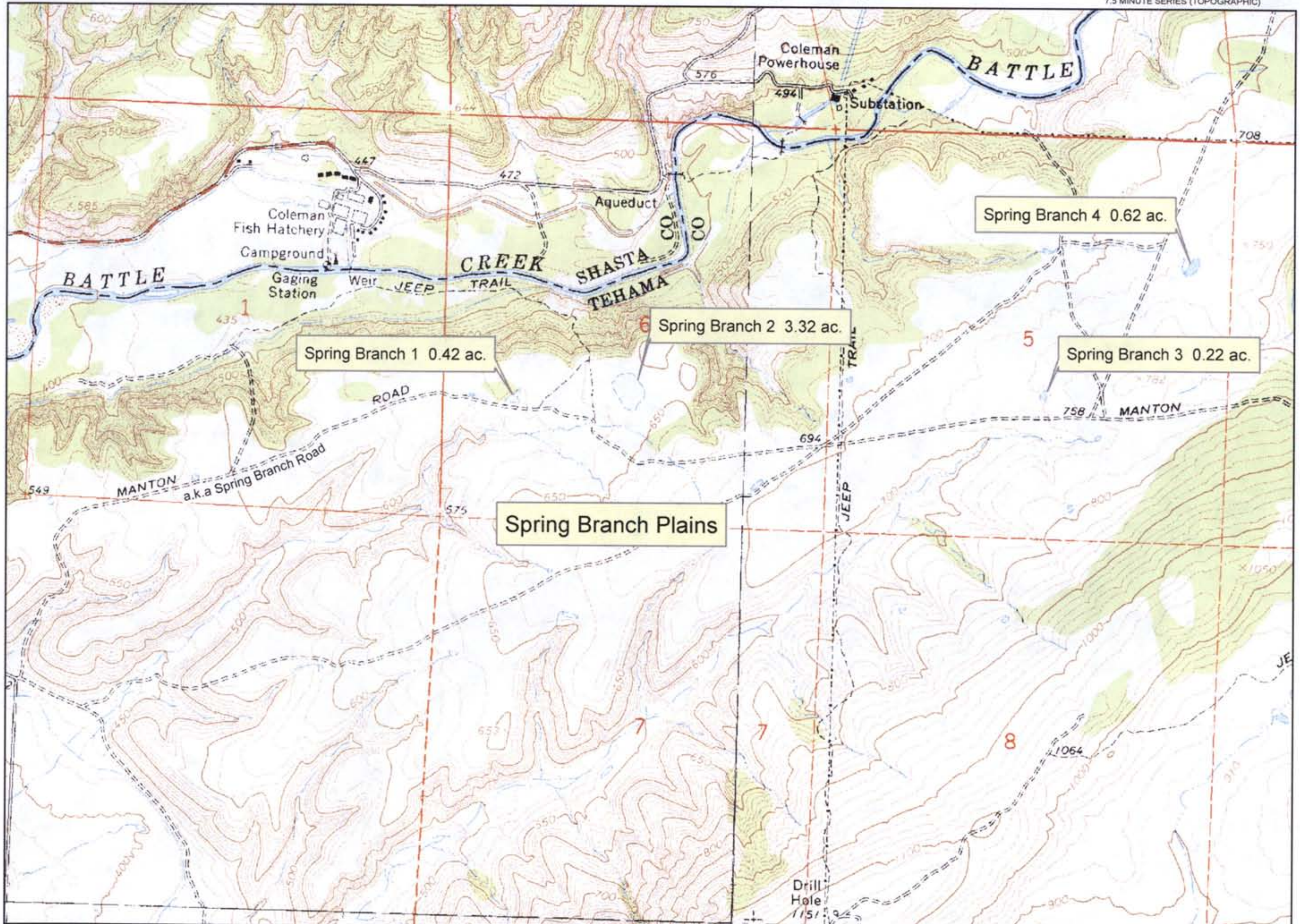

Figure 3. Locations of vernal pools 1, 2, 3 and 4 on Spring Branch Road.

regimes can be used to: (1) reduce and control non-native plant species, (2) increase native plant species diversity and density, (3) maintain or increase rare plant species, (4) maintain or improve branchiopod habitat, (5) monitor competition among vernal pool plants and (6) maintain suitable water quality for vernal pool organisms.

These objectives are best achieved through systematic data acquisition. Acquisition of periodic information in the pursuit of these objectives results in the collection of two forms of data: (1) the initial and final conditions and (2) the intermediate conditions that reveal the route through which the final conditions are achieved. The initial and final conditions indicate how far away from the goal the task began and how close it came in the end. The route taken in between indicates whether there was consistent progress toward the goal, widely varying fluctuation, progress followed by setbacks, or any number of varying changes toward the goal. Knowledge of the route requires that data be collected frequently. Changes in biological variables within an ecosystem that appear in any given year owe some of their observed values to conditions of the previous years. Depending upon the biological variable in question the degree of dependence upon previous years' values will vary significantly.

This monitoring information is needed to make informed management decisions for many reasons. Results of this study will have direct applicability to the management of the land among the participants of this study. For CDFG, improved management at DLER will occur because the status of the resources and threats to these are more fully understood and a formulary will be developed to guide the continued management for the site. Resource knowledge and the formulary will also be of value to the Bureau of Land Management (BLM) and Denny Land and Cattle Company, both participants in this study who are interested in using this information to modify their grazing management.

As the monitoring information is acquired it can be used to assess the status of other vernal pool lands and their potential for modification. Once status is assessed then estimates can be made as to the time and effort required to shift the vegetation toward a greater percentage of native species. Not all lands can be the subject of intense focused studies; these studies thus serve as examples and points of reference for other management projects to begin and also inform others of what methods failed to be useful. The formulary developed from this study can be applied to other lands or be modified. Detailed monitoring data can more accurately determine which variables have the most utility in their monitoring application, and can save time on other projects. The acquisition of monitoring information can also improve cooperation and interaction among involved parties and surrounding landowners.

Why Monitoring Program Has Value

The monitoring program has value because it will provide a great deal of information on these vernal pools that has never been collected throughout a vernal pool season. This information will allow a more accurate assessment of the ranges and cycles of the abiotic variables being monitored in the pools. Other information that will be gained includes estimates of the distribution and abundance of native, non-native, and special status plant species and branchiopods. The collection of this data on several key parts of the vernal pool ecosystem will bring increased understanding to the ecosystem as a whole. This study is using permanent quadrats which have traditionally been rejected in vernal pool habitat as being too difficult to maintain and relocate; however, permanent quadrats are the most sensitive to detecting spatial and temporal changes in vegetation dynamics (Austin 1981). The use of the permanent quadrats allows identification of the grazing and/or burning regime that will: (1) promote native species and reduce and control non-natives, and (2) maintain a higher level of native species diversity by controlling aggressive natives.

The interpretation of this information will lead to more responsible management because this monitoring project will answer many questions that were blocking the initiation of management action. Interest exists from many agencies, groups, and land-owners both public and private to promote native vegetation and maintain biodiversity. However, there was very little experience or data available to determine what would be the best grazing strategy to initiate. Without a monitoring program to coincide with grazing there would be no way to know whether the grazing was improving the habitat, having no detectable effect, or doing harm. This uncertainty and fear of damage could only result in no action. The availability of the monitoring program opened the way for the grazing program to begin. With the comprehensive monitoring program there was no fear or uncertainty that significant harm would inadvertently be done. The data being collected will be used by other agencies in the northern Sacramento Valley and by private ranchers interested in promoting native vegetation and controlling non-native species.

Study Area

Dales Lake Ecological Reserve (owned and managed by CDFG)

Dales Lake (Figure 1) -- The primary experimental grazing activities are being conducted at this site. To date over 12,000 feet of fencing have been installed to divide the site into seven pastures. Grazing trials have begun in uplands, flats, swales, and pools. Water quality, fairy shrimp, and botanical data have been collected on site during the past two years. A controlled burn on the site was conducted in late spring 1999; not all pastures were burned. High intensity short duration grazing experiments were conducted in Spring 1999 and 2000.

Hog Lake Plateau (owned and managed by BLM)

Hog Lake and Hoggett (Figure 2) -- Grazing was not initiated by the BLM in 1998, 1999, or 2000 because the Environmental Assessment was not finalized. Water quality, fairy shrimp, and botanical data have been collected at this site for the past two years. Wildfire burned the dry pool bottom in August 1999. Results from the impact of the wildfire at the site in 1999 will appear in the 2000 and 2001 data sets.

Sevenmile Lake (Figure 2) -- This pool is protected from grazing activities by fence. Water quality, fairy shrimp, and botanical data have been collected on site during the past two years. Botanical data is being collected both in ungrazed and grazed areas. The surrounding pasture is grazed on a long-term fall and spring rotation serving as a direct contrast to the grazing trials being implemented at DLER.

Spring Branch Plains (owned and managed by BLM)

Spring Branch Pools 1, 2, 3 and 4 (Figure 3) -- Two pools are excluded from grazing by fencing. Two pools are subject to grazing impacts. Water quality, fairy shrimp, and botanical data have been collected on site during the past two years. Botanical data is being collected both in ungrazed and grazed areas. The two grazed pools are undergoing the grazing regime prescribed by the BLM for the allottee. These pools cover a range from very natural and augmented slightly by berming to highly modified by berming.

Ecosystem

The vernal pool landscape we see today is completely changed from its appearance prior to invasion and settlement by Europeans (Rundel 1998; Walter 1998; Lis and Eggeman 2000). Habitat conversion and destruction have severely reduced the total acreage and diversity of vernal pools (King 1998), and what remains are not isolated pockets of pristine habitat (Pollack and Kan 1998). For the remaining vernal pool landscape, the primary changes have been in the composition of plant species and in the large herbivores that used to inhabit the region. Today, as one looks at the area, the dominant plant communities are annual grassland and blue oak woodland. Upon closer inspection, the annual grassland is now dominated by non-native plant species that have established themselves and in so doing have completely changed the plant community and dynamics of the ecosystem (Pollack and Kan 1998).

This ecosystem is maintained through several factors including: water cycle, soil type, seasonal patterns, nutrient cycles, and animal impacts. Animal impacts from deer, pigs, ground squirrels, birds, insects, earthworms, nematodes, and many others through their interactions with the environment play a role influencing the plant community.

In the Rancholabrean, which is a late Pleistocene, Mammalian provincial age approximately 300,000–10,000 years before present (y.b.p.), there was a wide variety of grazing and browsing animals that shaped the plant community (Edwards 1996). These animals include *Mammuthus* (mastodons), *Glossotherium* (ground sloths), *Camelops* (camels), *Cervus* (elk), *Bison antiquus* (bison), *Euceratherium* (shrub ox), and *Symbos* (woodland musk ox) [Edwards 1996]. Even the predators that are now absent, wolves and predatory cats, played an important role in the development of the plant community by keeping the grazing and browsing animals moving. If three complete lists of all animals present in the area could have been developed--one list for 12,000 y.b.p., one for 500 y.b.p. , and one for today--the most significant differences between them would be the reduction in the numbers of large herbivores and their predators. These declines in large grazers and browsers are phenomena that occurred on a continental scale affecting all of North America (Van Devender 1995).

The reasons for the declines are speculative, particularly the Pleistocene extinctions which have been variously attributed to dramatic climatic changes and to hunting pressure from early Native American peoples. The changes brought about with the arrival of Europeans are more clearly documented, and include, increased hunting pressures, importation of livestock and establishment of ranches, clearing and draining land, and controlling natural hydrologic cycles. These activities resulted in enormous disruptions to the landscape which disturbed migration patterns, summer and winter feeding grounds and breeding territories. With the invasion of Europeans came the seeds of plants as stowaways on livestock, in bags of grain or attached to various other items. These non-native plants found the new lands to be such suitable habitat that they have spread rampantly, particularly during the past 50 years.

Three significant impacts have now been identified as impacting the plant communities: 1) loss of large herbivores and their predators, 2) invasion and establishment of non-native plants, and 3) invasion and settlement of Europeans. The loss of large herbivores and their predators changed the dynamics which maintained the native plant communities. The settlement of Europeans was in direct competition with the large herbivores and predators and resulted in their decline through direct removal and habitat loss. In addition, Europeans replaced the native herbivores with domestic livestock which were managed in ways that were not conducive to the native plants and the grazing patterns with which they had evolved. The result was overgrazing and land degradation.

Overgrazed, disturbed lands were perfect sites for the non-native species to colonize and as they invaded and displaced the native species the entire community structure changed. The change in plant species composition changed the community type. A new community type has new properties which will affect the animals that can inhabit the site, the water cycle of the site, and the fire regime of the site. The large influx of non-native annual grasses has meant that these sites might burn more easily and frequently than they probably have in the past. The fire return interval can be dramatically increased by the presence of dense stands of both cheatgrass (*Bromus tectorum*) and medusa-head (*Taeniatherum caput-medusae*). In areas of dense cheatgrass, the fire return interval has declined to five years or less because the continuity of fine textured fuels promotes larger, frequent fires (Moseley et al.1999). Similarly, medusa-head forms dense continuous masses of litter that burn frequently destroying the native plants without destroying significant amounts of medusa-head seed (Miller et al. 1999; Young 1992).

This project is operating from the viewpoint that vernal pool ecosystems evolved under grazing pressure from a variety of large and small herbivores. In addition, fire had a periodicity in the evolution of the vernal pool ecosystem. With the invasion of many non-native plant species, the loss of the herbivore grazing patterns, and changes in fire cycles, the communities of the vernal pool ecosystem have undergone varying degrees of compositional changes. The uplands have gone through such extensive species compositional changes that the original composition is unknown and will never be known. Flats and swales have a greater percentage of native species, but some non-natives are quite dominant and may be increasing.

The vernal pools themselves have maintained the greatest diversity of native plant species with minimal impacts from non-natives; however certain native species may be increasing at the expense of diversity within the pool. The vernal pool ecosystem appears to not be one of equilibrium that will be self sustaining over time. Rather it appears to be one where <u>non-equilibrium</u> determines the biological community structure, whereby disturbance and heterogeneity, generate and maintain biodiversity of the communities within the ecosystem (Reice 1994; Tainton *et al.* 1996).

In this project we are attempting to apply and monitor grazing and burning (whether prescribed or wildfire) to determine what application of disturbance will increase heterogeneity and shift the compositional balance to increase native plant species. Water quality variables and fairy shrimps are being monitored to determine their patterns of variation in time and space. And, hopefully, these measures will allow determination of any adverse effects grazing and burning may have on water quality or fairy shrimp populations.

Management Problems and Needs

Many land management agencies (USFWS, BLM, CDFG, and Parks and Recreation, to name a few) are interested in using grazing as a management tool to promote the growth and diversity of native plants while controlling weeds and annual grasses. The lack of basic information about the effects of grazing on special status plants, vernal pool branchiopods, and the vernal pool ecosystem in general presents a serious impediment to sound management of vernal pool resources.

The rising number of species listings for vernal pool taxa prompts the need for increased information on the habitat requirements for these populations. Vernal pool habitat has been grazed for over a century yet no studies exist on the impacts of varying grazing regimes on vernal pool species or the habitat. Vernal pools in California are threatened by urbanization, agricultural conversion, over-grazing, hydrologic disruptions, and invasion by exotic plants (Eggeman 1999). The continual loss of vernal pool habitat results in the loss of many species of invertebrates and plants that may require future listing.

The continued loss of California vernal pools ensures that opportunities for these types of studies will diminish. Grazing is one of the few economic practices that should be compatible with the preservation and management of vernal pool habitat. Grazing has long been viewed as detrimental to vernal pools so some thought that total withdrawal from grazing was the only protection option. More recently, however, evidence suggests that without grazing many native species are declining due to competition from exotic plant species. Anecdotal evidence has been used both to denigrate and promote grazing in vernal pools; however very little data actually exists. It is imperative that grazing studies be supported so that real data is available, rather than competing sets of anecdotal information. Management techniques that will permit economic use of vernal pool habitats, while promoting recovery of the listed species they contain, are needed.

Water Quality Monitoring Plan

Introduction

Fairy shrimps (Anostraca) inhabit ephemeral wetlands world-wide that range from small vernal pools to desert playa lakes. Various studies have found different species occupying pools of differing water chemistry (Belk 1977, Eng et al. 1990, Gonzalez et al. 1996). These water chemistry differences have focused primarily on variations in cation and anion concentrations and the differing ionoregulatory capabilities of the Anostraca. It is clear there are variations between species in their tolerances to water chemistry differences, but these are rarely the sole factors in controlling species occurrence in ephemeral wetland habitats (Gonzalez et al. 1996).

Concerns over grazing around vernal pools often conjure images of many cattle around a pool with a wide ring of mud surrounding a pool of muddy water. Physical and chemical factors of the aquatic habitat that are important in the health and survival of branchiopods and plants are grouped within water quality. Resultant water quality conditions are the result of the interactions of biological activities and the physical and chemical processes and conditions, both inside and outside of the pools. Pools that become waste sites of urine and feces will not support a healthy vernal pool flora and fauna. Herbivores, whether domesticated (cattle, sheep, goats, horses) or wild (antelope, wild horses) do not preferentially produce toxic sites of excrement (Savory 1988). Domestic or wild herbivores will continually seek new forage and prefer not to graze on previously grazed sites (Savory 1988), occupy muddy areas for extended periods of time, and turn ponds into mud holes. Unsanitary and unhealthy conditions, such as these, are imposed on the animals through poor management, excessive confinement to pastures, and limited watering facilities. Vernal pools have very high water quality and with proper livestock management should maintain it. Healthy livestock should have water that meets water quality standards set for human consumption (Steyn and Reinach 1939, cited in McKee and Wolf 1963). Maintenance of high water quality is good for the pool flora and fauna and livestock.

Water quality was deemed important for this study for two reasons: (1) to determine the values of the water quality parameters, their variation between pools and through time within a pool; (2) Two, to monitor grazing activities on the pool and to keep any effects of grazing on water quality to within the normal variation observed in the pool that occurs without grazing.

Because respiration is through gills or directly through the body surface, Crustacea are important indicators of polluted conditions in water bodies. Much like the miner's canary, the Crustacea, including fairy shrimp, have been used in a variety of toxicity studies including tests for radioactivity, presence of ammonia, and insecticides (Centeno et al. 1993, cited in Eriksen and Belk 1999; McKee and Wolf 1963). The Anostraca are sensitive to varying water chemistry. Gonzalez et al. (1996) found that the distribution of four species of fairy shrimps was strongly influenced by the ionoregulatory physiology of the fairy shrimp and the water chemistry of the pools they inhabited.

Although water quality data have been sporadically reported by other observers, one objective of this project is to record consecutive years of data collected at biweekly intervals throughout the period of inundation for each pool. King, *et al.* (1996), in their vernal pool survey along the Pacific Gas & Electric pipeline corridor, measured alkalinity, conductivity, dissolved oxygen, pH, salinity, temperature and total dissolved solids. Eng, *et al.* (1990) reported alkalinity, chloride, pH, total dissolved solids and turbidity data derived from many sources. Water quality variables measured for this study include dissolved oxygen (milligrams per liter), pH, salinity (parts per thousand), specific conductance (micromhos per centimeter) and temperature (degrees Celsius).

<u>Sampling Variables and Methods</u>

Measurement of pH is one of the most important and frequently used tests in water chemistry. A waters' pH indicates the hydrogen ion activity or, at a given temperature, the intensity of the acidic or basic character of a solution. On this project, pH is measured with a hand held pH meter, the *pHastchek* pH pen, purchased from VWR Scientific Products. Since these meters are not fully immersible, pH readings are taken at the top of the water column. Measurements are taken at least two meters from the shore to avoid any margin effects.

Pool temperatures are collected in two ways. A submersible *Optic StowAway* data logger is placed in each pool once the pools are inundated (usually by November 1st) and is removed when the remaining water no longer covers the logger (usually by the following June). These data loggers, made by Onset Computer Corporation in Pocasset, Massachusetts, use infrared technology for communication and are easily offloaded in the field with the *Optic Shuttle*. The *Optic Shuttle* is then downloaded by a computer equipped with an *Optic Base Station* and *BoxCar Pro* software.

Finding the optimal location for logger placement is relatively tricky. The logger must be quickly and safely accessible for offloading by the data collector, yet not visible to curious members of the public. During a period of three years, only two loggers have been stolen. The data loggers are attached to approximately 1 – 3 meters of 3 mm steel cable which is anchored to the edge of the pool by a 15 – 30 cm piece of rebar (concrete reinforcing steel) driven halfway into the ground and concealed under a pile of rocks. The tethered logger is then activated to start recording temperatures and submerged in deep water. Every two weeks the data collector wades out to the logger and offloads the temperature readings onto the *Optic Shuttle.*

The first year, data loggers recorded the temperature every fifteen minutes. Plotting a two week period with this many points produced a complicated and congested graph. Since our purpose is to document temperature *trends* in the vernal pools, we decided one point every hour would adequately illustrate these trends. So, the second year, the loggers were reprogrammed to record the temperature once every hour. In addition to automatic logging devices, the pool temperature is read from the conductivity meter and the dissolved oxygen meter, at the time measures of these variables are collected.

The YSI Model 30, a hand-held meter made by YSI Incorporated in Yellow Springs, Ohio, measures conductivity, temperature compensated conductivity, salinity and temperature. Measuring conductivity yields the total concentration of ionized substances in a water body.

The conductivity of ionic solutions is highly dependent on temperature, and, because the exact composition of a natural medium is usually not known, it is best to report conductivity at a particular temperature. Thus, specific conductance, or temperature compensated conductivity, is the adjusted conductivity if the sample were read at 25 degrees Celsius. In addition to conductivity, the YSI 30 calculates salinity by using the conductivity and temperature readings. Eng *et. al.* (1990) found that salinity, conductivity and TDS (Total Dissolved Solids) are often used interchangeably, even though they represent different measures. To minimize confusion they used only TDS in their review of the California Anostraca. The availability of the YSI 30, a hand-held meter that measures three variables, thereby reducing the amount of equipment carried to the field (somewhat), was a key factor in our choice to measure conductivity.

Dissolved oxygen, the final water quality variable being measured, is read with a YSI Model 51B Dissolved Oxygen meter. This model requires calibration before each use but the recommended air calibration method is simple and reliable and is generally performed in the lab before leaving for the day's field work. The YSI 5739 field probe is attached to the meter by a ten foot cable which allows the meter to stay on shore while the probe is tossed out in undisturbed water. To maintain consistency, all the water quality readings are taken near the location of the temperature logger.

Data Analysis and Hypotheses

Because the natural range of variation in water quality variables is not known prior to the start of this project, data will be collected, plotted through time and correlated with each other and to grazing activities. Data analysis will initially consist of standard statistical measures of dispersion and variability. Vernal pools being small isolated water bodies will have a rhythm in the response of some water quality variables to diurnal and seasonal cycles. Temperature and pH have rhythmical diurnal fluctuations that are often inhospitable to plants (Keeley 1990) and animals. Once the data are collected they will analyzed using time series analysis. If the variables have a symmetrical functional relationship then a least squares regression will be used; otherwise, for non-symmetrical relationships a Fourier analysis will be employed (Zar 1996).

Water quality variables will be collected simultaneously with branchiopods. The changes through time of the branchiopod densities will be simultaneously analyzed with the water quality variables to determine whether there are correlations between changes in these two data sets within pools. Multiple linear regression and principal components analysis will be used to search for covariance patterns among the variables. Petersen et al. (2002) found that principal components analysis was useful in identifying the particular subset of variables that was stable and reliable in assessing the rivers' actual trophic state. The use of multivariate exploratory data analysis is relatively new in the realm of water quality data assessment, but in the analysis of large data sets these methods can provide new insight into ecosystem processes.

In this multi-year study we have the opportunity to determine whether fires (prescribed or wild) have any effects on water quality during the ensuing fall and winter. Whether fires occur in the surrounding uplands or in the pools, there may be measurable changes in water quality variables that may have effects in the pools.

The hypotheses that have been initially generated to test at the outset of this project are listed below (WQ = Water Quality, H = hypothesis being tested, N = null hypothesis, followed by the number of the hypothesis).

WQH1 Grazing will not alter water quality variables beyond the range of natural variation in control pools.

WQN1 Grazing will alter water quality variables beyond the range of natural variation found in control pools.

WQH2 Branchiopod densities will be affected by changes in water quality variables that are outside the range of variation for a particular variable.

WQN2 Branchiopod densities will be not be affected by changes in water quality variables that are outside the range of variation for a particular variable.

WQH3 Fires that occur in the surrounding uplands of a vernal pool or burn through the pool during the summer will produce changes in water quality that are outside the range of variation for the variable and this in turn will have effects on branchiopod densities.

WQN3 Fires that occur in the surrounding uplands of a vernal pool or burn through the pool during the summer will not produce changes in water quality that are outside the range of variation for the variable and this in turn will not have effects on branchiopod densities.

Branchiopod Monitoring Plan

Introduction

The invertebrate fauna of the vernal pools at Dales Lake Ecological Reserve (DLER), Hog Lake Plateau and Spring Branch Plains consists of a large assemblage of species which has not been documented. A complete invertebrate inventory for any of these vernal pools would be quite extensive. Simovich (1998) and King et al. (1996) summarized the crustacean diversity in northern California ephemeral wetlands. When all other groups of invertebrates are added to the crustaceans, the diversity in these wetlands consists of hundreds of species.

The Branchiopoda are absent from the marine environment and found exclusively in freshwater, except for *Artemia salina* which is restricted to highly saline lakes (Pennak 1989). In the past, pools were typically sampled once or twice during the vernal pool season. Branchiopods became more extensively surveyed once it was determined that these organisms are restricted to vernal pools and this habitat is steadily declining. It is neither possible nor practical to document the entire invertebrate fauna of the vernal pools under this study, nor is it feasible to document the effects of grazing upon a large suite of the invertebrate fauna. Rather, the vernal pool branchiopods that are currently listed or considered to be at risk will be targeted for monitoring in this study.

The Branchiopoda which inhabit the pools in this study are: Order Anostraca -- *Branchinecta lynchi* (vernal pool fairy shrimp), *Linderiella occidentalis* (California linderiella); Order Notostraca -- *Lepidurus packardi* (vernal pool tadpole shrimp); Order Conchostraca -- *Cyzicus californicus* (California clam shrimp). *Lepidurus packardi* is listed as Federally Endangered and *Branchinecta lynchi* as Federally Threatened. The term 'fairy shrimp' has been loosely used to refer to these three orders, however, it really only applies to the Anostraca. Pennak (1989) uses the term 'phyllopod' (leaf foot) to collectively refer to the Anostraca, Notostraca, and Conchostraca (see Appendix 1 for classification).

In adapting to the vernal pool habitat, phyllopods have developed a life history which is characterized by multiple overlapping egg and adult generations. Two types of eggs are produced in a season: (1) thin-shelled 'summer' eggs, which hatch soon after release, and (2) thick-shelled brown 'resting' eggs (Pennak 1989). Pennak's egg types were developed for application to all phyllopods and thus need slight modification for application to vernal pools. The 'summer' eggs are released and hatch during the fall, winter, or spring, and are more properly referred to as seasonal eggs since they hatch during the season of production. The 'resting' eggs are usually referred to as cysts. When the pools dry for the summer the cysts remain in the soil awaiting the next fall inundation. Defining and estimating population sizes can be exceedingly complex as overlapping generations hatch and mature from both seasonal eggs and cysts throughout the vernal pool season (Belk 1998).

The cyst bank functions much as a seed bank for annual plants and may store many years of accumulated genetic diversity. Genetic recombination can be maximized through the reproductive activities of individuals which have hatched from both seasonal eggs and cysts. As the numbers of individuals fluctuates in a season, the cyst bank would also fluctuate through time. Cyst bank fluctuation would likely not follow the same fluctuation pattern of individuals as the two are responding to different environmental stimuli.

Sampling Goal

The goal of sampling is to monitor the distribution, abundance, and period of pool occupancy, of adult phyllopods, mainly fairy shrimps and tadpole shrimps, through the vernal pool season; and further, to determine if there are any negative effects which can be discerned through the monitoring protocol. Questions regarding the biology and ecology of phyllopods that may be determined are: (1) Are the phyllopods in the pools during the period of grazing? (2) With the sampling strategy can changes in population density be detected from season to season that may be attributable to grazing? (3) Can the distribution and abundance of phyllopods within the pool be known with more certainty to avoid any potential negative effects from grazing? (4) Following a fire are phyllopods densities changed in numbers that are detectable? (5) Does the species composition of phyllopods vary from season to season within a pool? (6) Are there any correlations between the previous season's grazing or burning occurrences and the observed species composition? Continuous sampling will generate a baseline of information within and between seasons of the variation in species present, density fluctuations of species, and occurrence of a species.

Sampling Considerations

There are a number of considerations associated with sampling phyllopods. First, all species do not inhabit all vernal pools. Generally, our pools contain either *Branchinecta lynchi* or *Linderiella occidentalis.* Often the tadpole shrimp, *Lepidurus packardi,* will co-occur later in the season with either of these two. The factors that result in one species inhabiting a pool rather than another are unknown (Fugate 1998; Eriksen and Belk 1999). Historical accidents, ecological variables, physiological tolerances or combinations of all these may be involved (Fugate 1998). The fact that the same shrimps are not in all the pools complicates grazing and burning trials because all the tests cannot be carried out on a single pool.

Thus, there are two ways to conduct experimental treatments on vernal pools. One way is to split a pool with a fence line and graze or burn one side while maintaining the other side as a control. In a split pool the impact on plants is clear. The impact on fairy shrimps is less obvious as they can swim back and forth from the grazed to ungrazed side. However, the pool conditions are different between the grazed and ungrazed side and the fairy shrimps will respond to these and occupy the side with the more favorable environment for them. Another way is to pick a pair of pools and assign one to be grazed or burned and assign the other to be a control. In this study we have both treatment types—split pools and pairs of grazed/control pools. These treatment types were not ideally assigned by the study team, but rather had to be taken as found in the field, except at DLER where fence lines were installed for this project. We are thus confronted with specific hypotheses to be tested at specific sites. It is anticipated that the results can be extrapolated to other pools of this type or to other vernal pools in general.

One-sided Hypotheses

H1: Population density per pool of *Branchinecta lynchi* is lower in grazed pool-plots than ungrazed. This hypothesis will be tested at the pool called Spring Branch 2.

H2: Population density per pool of *Lepidurus packardi* is lower in grazed pool-plots than ungrazed. This hypothesis will be tested at Dales Lake, Hog Lake, Sevenmile Lake, Spring Branch 1 and Spring Branch 2.

H3: Population density per pool of *Linderiella occidentalis* is lower in grazed pool-plots than ungrazed. This hypothesis will be tested at Dales Lake, Hog Lake, Hoggett, Sevenmile Lake, Spring Branch 1, Spring Branch 2, and Spring Branch 4.

Sampling and Experimental Design

Sampling will consist of wet season sampling only. Although dry season sampling for cysts is a method approved by the USFWS, the cyst bank will be treated as a constant in this study. The numerous variables which affect the total observed cyst bank would be extremely difficult to isolate and measure in a natural system.

Sampling will be conducted in control and experimental pools. In some pools control and experimental regions are separated by a fence line through the pool. There is no previously documented information on the distribution, abundance, timing, or any other aspect of the ecology of the phyllopods in these pools. Certain aspects of the sampling protocol are being established to determine if the phyllopods are distributed randomly within a pool. A nonrandom distribution may be influenced by factors such as pool depth, substrate type, vegetation density, vegetation type, and weather conditions on the day of sampling.

Among the pools in this study, there is considerable variation in pool shape, gradient, depth, period of inundation, and time required to reach capacity. This study is working with some very large vernal pools. Three of these pools are called lakes, but apart from their large size they exhibit all of the ecological and biological characteristics of a vernal pool. The large areal expanse of these pools necessitates a sampling protocol that will allow the data collector to readily sample a randomly selected subsection of the pool with minimal walking and disturbance to the pool. Previous sampling work in vernal pools suggests that permanent invertebrate sampling transects repeatedly sampled throughout the vernal pool season impact the substrate to such a degree that changes in the vegetation can be observed during the spring as the pools dry down (Alexander and Schlising 1997). Therefore, semi-randomized transects deliberately chosen by the data collector to sample different areas of the pool will minimize any impacts to the substrate or vegetation.

At the sampling position a standardized non-overlapping sweep is conducted that samples a one-half cubic meter of pool water. The net's contents are emptied into a white enamel pan filled with pool water. The fairy shrimps and tadpole shrimps are identified and counted and any other types of invertebrates present are also noted. The pan's contents are then returned to the pool. Occasionally, a sample of approximately five fairy shrimps will be taken back to the office to confirm identification.

Approximately every 2.5 meters, along the transect, another sweep is made for a total of sixteen sweeps per pool. Wet season sampling occurs at two week intervals throughout the period of inundation. In all pools, less than 1% of the total pool volume will be sampled in any month and thus sampling is very unlikely to have any deleterious impacts on the phyllopod populations. Other physical variables including water temperature, pH, dissolved oxygen, salinity, and conductivity are being routinely collected in all the pools. The protocol for the collection of these abiotic variables is discussed in the water quality section.

Samples are collected by a trained and permitted biologist using a 15.3 X 12.8 cm brine shrimp net (0.5 mm fine mesh). The net is held vertically at a depth that just skims the pool bottom. The net is then drawn through the water in an s-shape, sampling approximately 0.5 cubic meter of water. In order to obtain this standard volume, the minimum pool depth that can be sampled is 160 mm. The volume of water sampled equals the net aperture area multiplied by the length of the net sweep.

In the first season of fairy shrimp sampling (1998-1999), total counts were made unless the number of fairy shrimps exceeded approximately 80 individuals. Fairy shrimp densities too numerous to count were then estimated by a method which employed a grid drawn on the bottom of the counting pan. The number of shrimps in five different squares were counted, averaged, and multiplied by the total number of squares in the pan. When compared with numbers obtained by counting all the individuals, this method overestimated fairy shrimp densities. In subsequent seasons, direct counts of all the fairy shrimps in each netted sample were made. Tadpole shrimps were much easier to count because fewer individuals were netted.

Data Analysis

The data are to be analyzed using univariate methods to demonstrate the accumulating baseline of data. Regression analysis of shrimp numbers with maximal depth at collection site. The data will be analyzed using time series analysis. If the variables have a symmetrical functional relationship then a least squares regression will be used, otherwise for non-symmetrical relationships, then a Fourier analysis will be employed (Zar 1996).

Changes through time of the branchiopod densities will be simultaneously analyzed with the water quality variables to determine whether there are correlations between changes in these two data sets within pools. Multiple linear regression and principal components analysis (PCA) will be used to search for covariance patterns among the variables (Legendre and Legendre 1983). Petersen et al. (2002) found that PCA was useful in identifying the particular subset of variables that was stable and reliable in assessing the rivers' actual trophic state, the addition of branchiopod data may present groupings that indicate similarity between pools that are not apparent. In addition to the analysis of the quantitative data (standardized and raw) the data will be converted to qualitative form and analyzed using Principal Coordinates Analysis (Gower 1966) and non-metric Multidimensional Scaling (Kruskal 1964a, b). Given the large data set to be collected the use of multivariate exploratory data analysis may provide new insight into the ecosystem processes affecting branchiopod distribution.

Vegetation Monitoring

Introduction

Many plant communities, particularly rangelands in a Mediterranean climate, have coevolved with grazing and fire. Each plant community's tolerance for grazing and fire varies with the amount and periodicity of rainfall, soil type, growing season, and plant functional types. Most cattle management methods were developed in mesic environments and were subsequently and inappropriately applied to arid environments (Savory 1988; Stafford Smith, 1996). Often, the focus of grazing trials and studies has been to increase production of meat through an application of the optimum stocking rate determined for a given landscape (Stafford Smith 1996). The optimum stocking rate was derived from the concept of carrying capacity (Caughley 1979) and the 'optimum' became synonymous with economic optimum (Stafford Smith 1996) for cattle production. In a comprehensive review of grazing studies from 1950 to 1999, Holechek et al. (1999) found that nearly all stocking rate studies characterized grazing intensity treatments as "heavy, moderate, or light," with no consistent definition used for these terms. Despite the large number of studies, most are not useful unless the goal is maximizing economic production of meat. In rangelands understanding the processes of plant establishment, persistence, and competition (given varying functional types and life histories) in the context of grazing and fire are critical to maintaining healthy native plant communities.

Vernal pools are often found in landscapes that would be described as rangelands. Rangelands are those landscapes and habitats that are too dry, too unreliable, too infertile, or too remote to warrant intensive management or agriculture (Stafford Smith 1996). Grazing has been the primary economic activity on rangelands and vernal pools were found to be good water sources for grazing animals. As rare and unique species and habitats were identified on rangelands, the potential threats and probable negative effects of grazing became a source of concern. Over-grazing was a known threat with devastating effects.

Dales Lake was acquired by the California Department of Fish and Game in 1993 as partial mitigation for damage to vernal pool resources by the Pacific Gas and Electric Company's pipeline expansion project. The pool and surrounding lands had been grazed for at least the past century. To fully protect the resources of the new 366 acre reserve, Dales Lake Ecological Reserve (DLER), the grazing rights were acquired with the property. All grazing was stopped on DLER and Department staff expectantly watched to see the dramatic improvements that would occur with the termination of grazing. Qualitative observations indicated some improvements the first two years, but less dramatic than expected. The dramatic changes began in the third year (1996) when non-native annual grasses particularly *Taeniatherum caput-medusae* (medusa-head) began to completely dominate all non-wetland habitats. By 1997 it was clear that, without management and some type of control, DLER would become a reserve for a few vernal pools and an ocean of medusa-head. The adjoining grazed land had less medusa-head and a good component of native species. At this time, some land managers were finding that control of medusa-head was possible with certain well timed applications of fire or grazing. Many decades of over-grazing had led to the belief that cattle or other domesticated herbivores were the enemy of natural landscape; however, reviews and work by Collins et al. (1998), Menke (1992), Savory (1988), and Williams (1997) were pointing out that the herbivores were not the problem, it was *management* of the herbivores that led to the problem. In fact, herbivores became one of the primary tools in the control of non-native species in the work of restoration and maintenance of native plant communities Collins et al. (1998) and Williams (1997).

The goals at DLER were to protect and promote native species and habitats. Of the available options (grazing, herbicides, hand-pulling, mowing, or burning) grazing and fire offered the best combination to reduce and control medusa-head and other non-native species. During the past century, these rangelands had become so infiltrated by non-native species (often with an absolute cover of 50-100%) that it was impossible to know what species composition of natives would comprise the management goal at DLER. There are no records of this areas' species composition 150 to 200 years ago. Therefore, the management of grazing and fire would be in a direction to reduce non-natives to the lowest possible level while monitoring the re-invading native species. A grazing and burning plan would be implemented and adjusted to promote the suite of native plant species that emerged.

The management method of fence and protect to allow the natives to flourish clearly had not worked. This management approach is rooted in the concept of a climax community, which was resulting in a monotypic stand of medusa-head. A possible ecosystem concept that appears to have application here is that of the non-equilibrium disturbance hypothesis. Reice (1994) suggests that the normal state of communities and ecosystems is to be recovering from the last disturbance. Stafford Smith (1996) questions whether the non-equilibrium disturbance hypothesis can be applied to rangelands and notes two limitations on its global application. Whether or not it can be completely applied to rangelands it does change the focus on the landscape from one of stasis to maintenance of equilibrium through disturbance. Grazing and fire are forms of disturbance capable of maintaining an equilibrium of plant species composition. The goal at Dales Lake is to reduce non-native species and promote natives. Grazing and burning are the means to the end but to determine the starting point and movement towards the goal requires a thorough monitoring plan.

Sampling Design

Permanent transects have been established in random locations in each treatment pasture to be monitored. A transect ranges from 60-100 meters in length. The mima-mound topography results in upland mounds and inter-mound flats or swales; henceforth, inter-mound flats or swales will be referred to as flats. Relief between mound tops and flats tends to range from 1 to 5 dm. In this habitat, swales channeling water are uncommon while sheet flow and standing water are predominant. The mounds support upland plants and the flats generally support species that range from less than facultative (fac-) to facultative wet (facw) wetland species, depending upon local microsite conditions.

Permanent transects were selected as the best available means to identify changes in plant composition over time. The communities are dominated by annual plant species which are notorious for annual quantitative fluctuations. A system of quadrats located on permanent transects should significantly dampen the data noise that might result if transects and quadrats were randomized each year.

The starting point for each transect was selected by locating a random point in each pasture. From the starting point a steel tape was pulled out in a direction that would intersect with the most mounds over a distance of 60-100 m. Eight points along the tape were selected, four on mounds and four in the flats (Fig. 4a). An 8, 10, or 12 inch steel spike was driven into the ground to mark these eight points, and each start and end point. The approximate mound and flat locations were subjectively chosen to yield a reasonable distribution along the transect given the particular mound and flat topography that was intersected by the transect. The exact location the spike was driven into the ground became a quasi-random selection as it was in a place that the spike could be driven into the ground without hitting rocks. These points were recorded and are easily found each year by locating the start point and then stretching out the tape to identify the other points. In many cases the direction and distance from the starting point to a key landmark such as a t-post or corner point along a fence line helps relocate the starting point. Transect locations were also mapped using a GPS unit.

In large pools transects have been established from a stake, or pivot point, driven into a central area of the pool. Transects all begin from this point and traverse to the pool margin. These transects were located by selecting random degree values either between 0° and 360° (Fig. 4b), or 0° and 180° (Fig. 4c), depending upon the placement of the pivot point.

A third method of transect layout was to start in the upland area and run the transect down into the pool (Fig. 4d). Hog Lake, Hoggett, and the land immediately surrounding them have a topography that is different from the pools in the mima-mound sites. Approximately 1/2 to 2/3 of the perimeter has a very steep, often vertical, shoreline and very few vernal pool plants grow on these banks. The remaining perimeter has a very gradual slope with a large variety of vernal pool species that form the typical centrifugal circles (may also be described as vertical zonation) as the water recedes. The consistent gradient continues out beyond the high

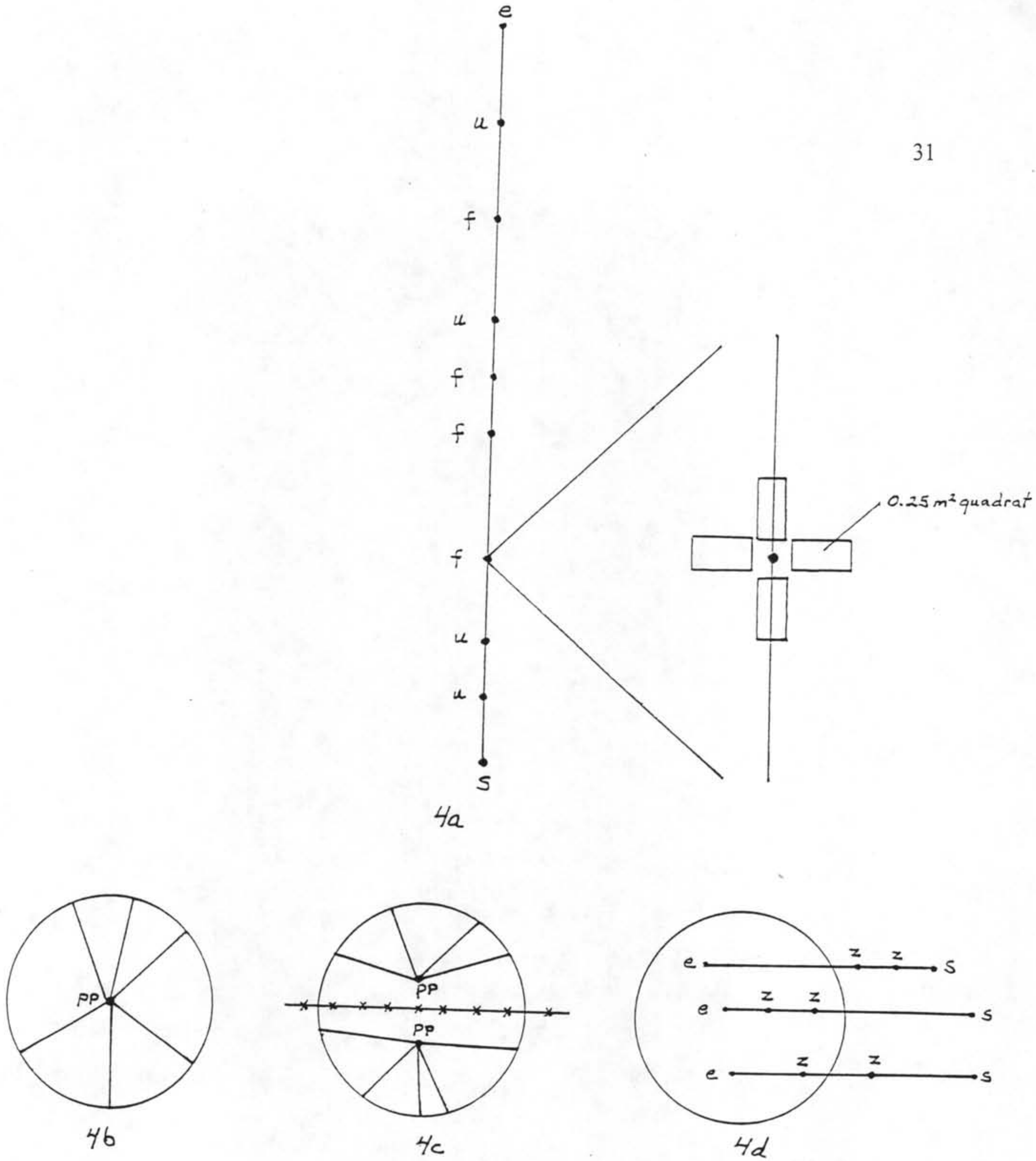

Figure 4. Vegetation transect layout configurations. 4a. The stardard transect with intersection points marked along it. The enlarged region shows the layout of the four permanent quadrats which occurs at each intersection point. The start and end points do not have quadrats associated with them. 4b. Layout of transects in a pool when the pivot point (pp) is placed at the center of the pool. 4c. Layout of transects in a pool when two pivot points occur in a pool, due to the pool being intersected by a fence. 4d. Layout of transects that move through a gradient from upland to bottom of pool. Here mounds and flats or swales are not delineated and the intersection points are recorded as zones in the field. Abbreviations: e = end point, f = flat, pp = pivot point, s = start point, u = upland, z = zone.

water mark of the pool such that a continuous compositional change from wetland to upland plant species occurs.

The permanent quadrats along the transect were located as shown in Figure 4a. At each intersection point four quadrats (0.25 m^2) were laid out, each quadrat 10 cm. from the intersection point, two quadrats oriented along the tape and two perpendicular to the tape. Each quadrat was identified by the compass direction that it fell nearest to, along the alignment of the tape, e.g. north, south, east, or west. This is a slight variation of replicated systematic sampling as recommended by Hayek and Buzas (1997), the only difference being that the sampling sites (quadrats in this case) are placed at a fixed location relative to the transect. Within each 0.25 m^2 quadrat, absolute cover of rocks, bare ground, and indicator plant species was recorded.

Photographs are being taken at one upland quadrat and one flat quadrat on all transects, each year. The particular two quadrats were randomly chosen at the start of the season. The same quadrats are being photographed each subsequent year. On sloping transects without mounds and flats, one quadrat is being photographed at each intersection point in every zone. Thus photographic plots are being maintained on all transects in all pastures.

Plant Species

In this project it was decided that indicator species would be used rather than attempt to record all species in each quadrat which would greatly slow data collection. Indicator species were selected which are: 1) common during the period of monitoring; 2) represent both native and non-native species; and 3) have the potential to show responses to the management regime. The indicator species selected vary between the uplands, flats, and pools. Indicator species are listed in Appendix 2. The indicator species may be slightly modified over time if, as is anticipated, there is a shift in the species composition of the vegetation.

Absolute cover was chosen as the value to estimate as it is rapid to assess and has been used in previous studies of vernal pool habitats. Cover changes over time will provide the trend information to evaluate whether the shift toward native species is occurring or not. Consistency of data collection has been maintained because the same two personnel have been assigned to data collection in the same habitat types from year to year.

Hypotheses

In the hypotheses listed below the coding systems is as follows. The first letters prior to the 'H' are the abbreviations for the section, e.g. 'SSP' = Special Status Plant, 'H' is the hypothesis being tested, 'N' is the null hypothesis, followed by the number of the hypothesis.

VH1 Grazing will reduce the absolute cover of non-native target annuals.
VN1 Grazing will not change or increase the absolute cover of non-native target annuals.

VH2 Grazing will increase the absolute cover of target native species.
VN2 Grazing will not change or may decrease the absolute cover of target native species.

VH3 Prescribed fire increases the absolute cover of native species in ungrazed pastures.
VN3 Prescribed fire will not change or may decrease the cover of native species in ungrazed pastures.

VH4 Prescribed fire decreases the absolute cover of non-native species in ungrazed pastures.
VN4 Prescribed fire will not change or may increase the cover of non-native species in ungrazed pastures.

VH5 Wildfire increases the absolute cover of native species in ungrazed pastures.
VN5 Wildfire will not change or may decrease the cover of native species in ungrazed pastures.

VH6 Wildfire decreases the absolute cover of non-native species in ungrazed pastures.
VN6 Wildfire will not change or may increase the cover of non-native species in ungrazed pastures.

Data Analysis

Standard descriptive statistics (mean, variance, standard deviation, standard error, and confidence intervals) will be computed at each intersection point, then summarized and compared within and between pastures using analysis of variance. Significance and power analysis will be applied to this data set (Elzinga et al. 1998; Fairweather 1991; Peterman 1990). Significance and power analysis is being questioned as to its true utility in biological field studies (Johnson 1999) and, if feasible, alternative views of the data will be compared to the standard methodology. Multivariate approaches will also be used to search for trends and structure within the data set: principal components analysis (Legendre and Legendre 1983) principal coordinates analysis (Gower 1966), and correspondence analysis (LeBart et al. 1984). Cluster analysis (Legendre and Legendre 1983) will be used for lower level structure analysis as applied to the ordination techniques.

Special Status Plant Monitoring

The special status plants found consist of four vernal pool plants, *Sagittaria sanfordii*, *Orcuttia tenuis*, *Legenere limosa*, *Gratiola heterosepala*, and one upland species, *Paronychia ahartii.* Each of these species occupies a different niche in the vernal pool landscape and therefore requires a slightly different monitoring plan.

Sagittaria sanfordii

Sagittaria sanfordii occupies the deepest parts of Dales Lake and Hog Lake. In these lakes *S. sanfordii* co-occurs with *Eleocharis macrostachya*. The *S. sanfordii* plants are interspersed among *E. macrostachya* in 0.3-1 m of water. The best time to monitor *S. sanfordii* is in the late spring or early summer when the pool depth is 0.3-0.6 m and the plants are at anthesis with leaves protruding from the water.

Monitoring protocol: Two belt-transects 23 meters long were established to monitor *S. sanfordii*. The tape served to divide the *S. sanfordii* region into two halves. The quadrats to be read, could be placed on either side of the tape; the western side was randomly selected. The quadrats were then laid out sequentially and the cover of *S. sanfordii* and *E.*

macrostachya was recorded for each transect. In this case the transect is permanent, but the quadrats are not. It would be difficult to install permanent quadrats in this area of the pool because they could not be relocated when the pool was holding water.

Orcuttia tenuis

Orcuttia tenuis occurs in six pools (Dales, Hog, Hoggett, Sevenmile, Spring Branch 1, and Spring Branch 2). It is being monitored as part of the vernal pool vegetation using the transects and permanent quadrats.

Eleocharis macrostachya competes with *Orcuttia tenuis* and has actually become a monotypic stand in many areas of Dales Lake and Hog Lake. *E. macrostachya* occurs most densely in the same regions of a pool that are preferred by *O. tenuis*. Therefore, monitoring *O. tenuis* consists of detecting possible competition from *E. macrostachya* and determining any beneficial or deleterious effects from grazing.

Grazing experiments on the north sides of Dales Lake will help determine whether cattle grazing can control the spread or density increase of *E. macrostachya*. Cattle will graze upon *E. macrostachya* and find it quite palatable; however they cannot graze on it below the water surface. One question will be whether the water will be low enough for the cattle to remove enough aerial biomass from the plant to weaken the plant and root system such that further spread of the plants will not occur.

Monitoring Protocol: This species is being monitored as part of the vernal pool plant monitoring using permanent quadrats. As the pools dry down *O. tenuis* is monitored as it develops during the summer, depending upon the rate of pool dry down. The change in cover over time for *O. tenuis* and *E. macrostachya* in permanent plots will be measured. Statistical variation in *E. macrostachya* cover will be quantified through measurements in control quadrats. Since the growth rate of *E. macrostachya* is unknown, the rate of above ground and underground spread and density increase rates are also unknown. Threshhold cover values will be determined from the data to determine whether *O. tenuis* and other species are excluded from co-occurring with *E. macrostachya*.

Gratiola heterosepala and *Legenere limosa*

Gratiola and *Legenere* both show highly variable distributions from year to year within the pools. *Legenere* in particular is difficult to census because it occurs in tangled mats at irregular places near the margins of the pool that have been inundated for a relatively long period of time. *Legenere* will be identified when it occurs within the permanent pool quadrats. Efforts will be made to locate this species and determine if it has any regular areas or zones of occurrence where specific monitoring sites may be established.

Gratiola occurs in regions of the pool that have a very low density of vernal pool plant species growing in them. These sites tend to be exposed clay areas with very thin soils underlain by a hardpan or bedrock substrate. These sites are not common and the transects cross only a few sites at Dales Lake and Hog Lake. These quadrat areas are being monitored for the occurrence of *G. heterosepala*. Most locations of *G. heterosepala* are not sufficiently large for the establishment of transects. Individual permanent quadrat sites will be established if the site will be useful for assessing grazing impacts or in attempt to determine population trends within the quadrat.

Paronychia ahartii

Paronychia ahartii is a very diminutive annual that lives in the upland areas. Its life history is unclear and there are conflicting observations regarding whether grazing is beneficial or detrimental to it. If the absence of grazing is detrimental, it appears that the reason may be the buildup of thatch that results in a decline of *P. ahartii*. Thus, the benefits of grazing may be removal of light intercepting thatch and thinning of grasses. Negative grazing impacts may occur in heavily overgrazed sites, sites that are grazed when too wet, or in sites that are grazed very late in the summer.

Monitoring Protocol: Six plots have been established that are each ten by thirty meters in size. There are three pairs of plots. One plot of each pair was protected from the prescribed fire of 1999. In 2000 no burns occurred on these plots. There is some uncertainty regarding future burning at DLER and this is being discussed with the land manager.

Hypotheses

In the hypotheses listed below the coding systems is as follows. The first letters prior to the 'H' are the abbreviations for the section, e.g. 'SSP' = Special Status Plant, 'H' is the hypothesis being tested, 'N' is the null hypothesis, followed by the number of the hypothesis.

SSPH1 Grazing increases or decreases the distribution and abundance of *Paronychia ahartii*.

SSPN1 Grazing results in no change in the distribution and abundance of *Paronychia ahartii*.

SSPH2 Grazing increases or decreases the distribution and abundance of *Sagittaria sanfordii*.

SSPN2 Grazing results in no change in the distribution and abundance of *Sagittaria sanfordii*.

SSPH3 Grazing increases or decreases the absolute cover of *Legenere limosa*.

SSPN3 Grazing results in no change in the absolute cover of *Legenere limosa*.

SSPH4 Grazing increases or decreases the absolute cover of *Gratiola heterosepala*.

SSPN4 Grazing results in no change in the absolute cover of *Gratiola heterosepala*.

SSPH5 Grazing increases or decreases the absolute cover of *Orcuttia tenuis*.

SSPN5 Grazing results in no change in the absolute cover of *Orcuttia tenuis*.

SSPH6 Grazing reduces or increases the absolute cover of *Eleocharis macrostachya*.

SSPH6 Grazing results in no change in the absolute cover of *Eleocharis macrostachya*.

SSPH7 Wildfire reduces or increases the absolute cover of *Eleocharis macrostachya*.

SSPH7 Wildfire results in no change in the absolute cover of *Eleocharis macrostachya*.

SSPH8 A reduction in the absolute cover of *Eleocharis macrostachya* will result in an increase in the absolute cover of *Orcuttia tenuis*.

SSPN8 A reduction in the absolute cover of *Eleocharis macrostachya* will result in no change or decrease in the absolute cover of *Orcuttia tenuis*.

Grazing and Fire Plan

Overview and Goals

Monitoring the effects of grazing requires a two-part plan. The first component takes place at Dales Lake Ecological Reserve (DLER) where all aspects of the grazing treatments can be controlled. The overall strategy at DLER is to apply short duration, high intensity grazing regimes for the control of non-native plant species, particularly invasive noxious weeds. The second component involves monitoring the current grazing regimes implemented by the Bureau of Land Management (BLM). The BLM grazing regimes are generally long duration, low intensity. These two plan components will broaden the array of grazing strategies that can be monitored and assessed.

The goal of the grazing implementation at DLER is to use large herbivores to reduce the area occupied by non-native species, particularly invasive noxious weeds. Field observations and incoming quantitative data support the conclusion that in the complete absence of grazing, non-natives thrive and continue to displace native species. Continually grazed areas have non-native species, but to a lesser degree than ungrazed areas. Surrounding sites have been grazed with varying goals, but none have been systematically grazed and monitored to elucidate what grazing regimes will promote native species and reduce non-natives.

Competition also occurs between native species. The literature shows that properly managed grazing maintains higher levels of biodiversity (Archer and Smeins 1991; Bakker 1998; Van Wieren 1998). Grazing will thus serve two purposes–maximization and maintenance of native species cover and diversity, and reduction of non-native species cover. A primary concern in implementing grazing is to avoid negative impacts to special status species, both plants and invertebrates. Monitoring will allow determination of whether the grazing strategy is working to reduce the targeted non-native species while allowing native species to increase or remain constant. Alternatively, monitoring may indicate that grazing is failing and non-natives are remaining stable or increasing while natives remain stable or decline.

Theory and Development

In terms of original community composition, the three primary hypotheses for this study are: (1) the community was dominated by perennial bunch grasses with an accessory annual herb and forb component, (2) annual herbs and forbs were dominants with annual grasses and perennial bunch grasses an accessory, or (3) an unknown community composition that cannot be speculated upon due to the extinction of important component species. Analysis of the site and surrounding area does not favor one hypothesis over another and components of both hypotheses one and two are found on site, while hypothesis three can never be proven or falsified. Using the Great Basin and Great Plains as an example, hypothesis one would be favored. In these areas perennial bunch grasses, were and are, one of the dominant life-forms of the rangeland. Historically and ecologically, it appears that many arid plant communities in North and South America were dominated by perennials with annuals comprising a reduced component. Hypothesis two is favored by analysis of the current native species composition, which displays a majority of annual herbs, grasses, and forbs. In addition, considerations of the summer drought and shallow nutrient poor clay soils, suggest a habitat that could favor winter annuals. However, similar conditions exist in the Great Basin where perennials were the dominant life form, and now, in disturbed areas are being overrun by non-native annuals. Summer aridity is a severe problem for plant performance in these western foothills; however, while drilling post holes at DLER, soil moisture was found within 18 inches of the soil surface in late September and October. Perennial grasses can easily tap this soil moisture. The presence of deeper rooted perennials may also have increased the biological activity of the soil profile. The demise of perennials over the past two hundred years may have led to a steady decline in soil nutrient levels which annual species may tolerate more readily. Thus, low soil moisture and low nutrient status may have declined to these levels during the past 200 years.

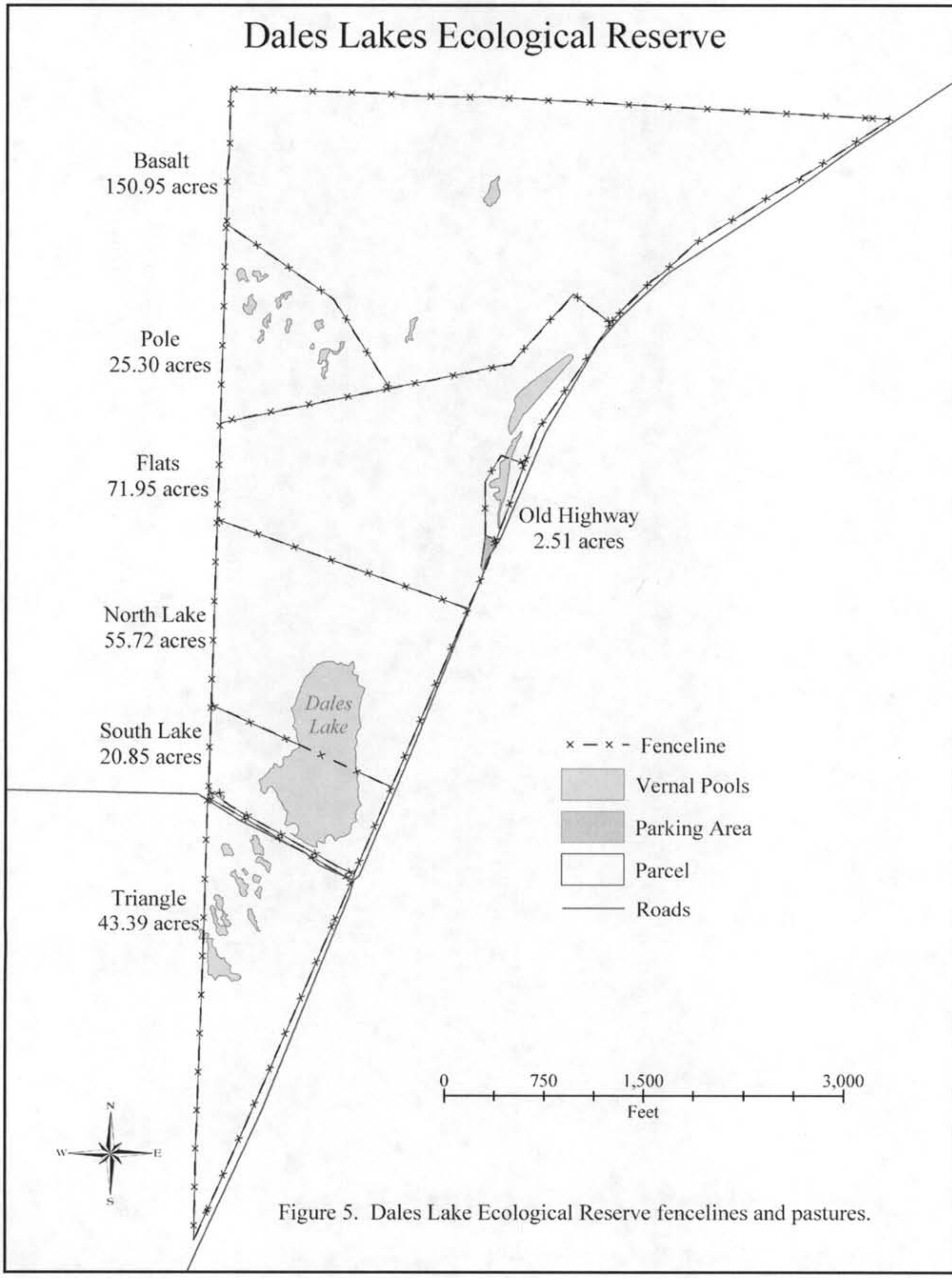

Figure 5. Dales Lake Ecological Reserve fencelines and pastures.

Table 1 Dales Lake Ecological Reserve - Grazing and Burning Plan

	1998/99				1999/00				2000/01				2001/02			
Pasture	FG	SG1	SG2	Burn	FG	SG1	SG2	Burn	FG	SG1	SG2	Burn	FG	SG1	SG2	Burn
Basalt				X								X				
Pole				X						X		X		X		
Flats				X		X				X		X	X	X		
O.H.				X								X				
North Lk		X	X			X				X	X		X	X		
South Lk																
Triangle		X								X						

Dales Lake Ecological Reserve - Grazing and Burning Plan

	2002/03				2003/04											
Pasture	FG	SG1	SG2	Burn	FG	SG1	SG2	Burn	FG	SG1	SG2	Burn	FG	SG1	SG2	Burn
Basalt		X				X		X								
Pole		X				X		X								
Flats	X	X			X	X		X								
O.H.								X								
North Lk	X	X			X											
South Lk																
Triangle		X				X		X								

1. FG = Late Fall Grazing 2. SG1 = Early Spring Grazing 3. SG2 = Late Spring Grazing

There is no way to know what herbivores were involved in the development and evolution of the native plant communities in this area. These communities have suffered such a high degree of modification during the past two hundred years that we may never know the original composition of these plant communities. As a consequence there is no 'original community' which can be held up as a target or goal towards which the current vegetational composition can be shifted. Instead, inferences regarding pre-European grazing regimes have been used to guide the development of the grazing plan. The standard that will allow progress to be assessed is the decline of non-native species and increase of natives. The grazing treatment that results in the highest cover and diversity of natives with minimal or no impact to special status species will be preferred.

Grazing Plan

Permanent plots have been established throughout DLER within the pastures. Establishment and monitoring of these plots is discussed in the vegetation section. DLER has been divided into seven pastures, shown in Figure 5. Four pastures–Basalt, Flats, North Lake and South Lake–are being monitored during this project. Three pastures–Pole, Old Highway and Triangle–contain vernal pools created by Pacific Gas and Electric Company (PG&E) as mitigation for pools damaged during a pipeline expansion project. These three pastures were grazed and monitored under the direction of personnel from PG&E once during April, 2000, with the cooperation of the Department of Fish and Game. These pastures were not grazed in the Spring of 2001. Once PG&E has completed their vernal pool mitigation requirements these pastures will be integrated into this grazing study.

The proposed grazing and burning plan (Table 1) is the best estimate of the schedule for the grazing treatments in each pasture from 1998-1999 through 2003-2004. The plan is subject to revision and modification each year as the current and cumulative impacts of grazing are evaluated and as changes of the season necessitate adjustments. In pastures subjected to burning, the applied grazing treatment will be modified to develop sufficient fuel load prior to burning. Specific numbers of cattle, days of grazing, and timing of the grazing will be developed approximately one month prior to the first grazing treatment. This will allow the grazing treatment to consider important seasonal variables such as total rainfall, distribution of rainfall, winter temperatures, plant growth rates, and development.

Stocking rates and use by cattle are being measured in animal days per acre (AD/A); this method is more exact than the use of Animal Unit Months (AUMs) and allows direct comparison of applied grazing pressure in trials of varying sized pastures (Savory 1988). The stocking rate depends upon four variables (1) volume of forage, (2) time it must last, (3) landscape and production goals, and (4) animal size (Savory 1988). These four variables are the driving factors which influence the selection of the number of animals placed in the pasture, their time in, and the desired impacts. Desired impacts are not just the clipping of plants through grazing, but also include: trampling effects on plant litter, soil disturbance (compression and turnover), hoof printing which increases microsite variability, and dunging and urinating which facilitates nutrient cycling and redistribution (Savory 1988). Monitoring of impacts by grazing animals is being conducted as part of the permanent monitoring for upland plants by using a nested quadrat sampling protocol. At each intersection point a 2-meter square area is being monitored for amount of dunging, trampling and hoof printing. Clipping effects are being managed to promote a long term reduction in the relative proportions of non-native annual grasses and forbs and a concomitant increase in native annual and perennial grasses, and forbs. The area of ground squirrel spoil piles is being recorded because they have important impacts on soil structure, development and nutrient cycling.

Fire

Burning was not originally part of this grazing experiment. However, when adjacent Denny Land & Cattle Company (DL&CC) property was undergoing a prescribed burn in 1999, the opportunity arose to participate and the three most northern pastures of DLER were burned. Then in June 2000, a prescribed burn on adjacent DL&CC property accidentally crossed the DLER western boundary fence and burned part of the pasture used as a control. On BLM lands, a wildfire in 1999 burned the pool bottoms and surrounding uplands of Hog Lake and Hoggett. These unplanned burns broadened the scope of this project by allowing collection of pre-burn and post-burn data.

There are plans for further prescribed burns on DLER; however, their probability of occurrence is not at all certain. Table 1 shows the burn plans for 2000-01 and 2003-4. The California Department of Forestry and Fire Protection uses prescribed burns as training sessions for their crews' first priority, wildfire suppression, and control. Scheduling can be difficult and a prescribed burn may have to be postponed because of adverse weather conditions or because the crews are out fighting wildfires. In addition, the Air Resources Board, which regulates prescribed burns, is currently revising the rules and may reduce prescribed burning efforts. Therefore, opportunities to observe the effects of fire, whether prescribed burns or uncontrolled wildfires, will be incorporated into this study as they arise.

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Appendix 1: Abbreviated Classification of Four Locally Found Vernal Pool Branchiopods and some Arthropod Relatives

(per Belk and Brtek 1995, Martin and Belk 1988, Sassaman 1995, Ruppert and Barnes 1994)

Phylum: Arthropoda
- Sub-phylum: Crustacea
  - Class: Branchiopoda (means gill-feet)
    - Order: Anostraca (fairy shrimps)
        - Family: Artemiidae
        - Family: Branchinectidae
          - Genus: *Branchinecta*
            - ***Branchinecta lynchi***
        - Family: Branchipodidae
        - Family: Chirocephalidae
        - Family: Linderiellidae
          - Genus: *Linderiella*
            - ***Linderiella occidentalis***
        - Family: Polyartemiidae
        - Family: Streptocephalidae
        - Family: Thamnocephalidae
    - Order: Conchostraca (clam shrimps)
      - Sub-order: Laevicaudata
        - Family: Lynceidae
      - Sub-order: Spinicaudata
        - Family: Cyclestheriidae
        - Family: Cyzicidae
          - Genus: *Cyzicus*
            - ***Cyzicus californicus***
        - Family: Leptestheriidae
        - Family: Limnadiidae
    - Order: Notostraca (tadpole shrimps)
        - Family: Triopsidae
          - Genus: *Lepidurus*
            - ***Lepidurus packardi***
    - Order: "Cladocera" (water fleas) [for current classification see Fryer 1987]
  - Class: Cirripedia (barnacles)
  - Class: Malacostraca
    - Order: Isopoda (sowbugs, pillbugs, roly-polys)
    - Order: Decapoda (shrimps, lobsters, crabs)
- Sub-phylum: Uniramia
  - Class: Chilopoda (centipedes)
  - Class: Insecta (insects)
- Sub-phylum: Chelicerata
  - Class: Arachnida
    - Order: Scorpiones (scorpions)
    - Order: Araneae (spiders)

Appendix 2: Indicator Plant Species Selected for Monitoring

Native Species

Blennosperma nanum
Brodiaea minor
Chlorogalum angustifolium
Clarkia purpurea ssp. *quadrivulnera*
Damasonium californicum
Deschampsia danthonioides
Downingia bicornuta
Downingia cuspidata
Eleocharis macrostachya
Elymus multisetus
Gastridium ventricosum
Gratiola heterosepala
Hemizonia fitchii
Isoetes spp.
Lasthenia fremontii
Lasthenia californica
Lasthenia glaberrima
Layia fremontii
Legenere limosa
Marsilea vestita ssp. *vestita*
Navarretia heterandra
Navarretia intertexta ssp. *intertexta*
Navarretia leucocephala ssp. *leucocephala*
Orcuttia tenuis
Paronychia ahartii
Plantago erecta
Plagiobothrys stipitatus var. *micranthus*
Poa secunda var. *secunda*
Pogogyne zizyphoroides
Sagittaria sanfordii

Non-native Plant Species

Aira caryophyllea
Avena barbata
Avena fatua
Avena sativa
Bromus hordeaceus

Bromus japonicus
Bromus madritensis var. *rubrens*
Erodium botrys
Erodium brachycarpum
Erodium cicutarium
Hypocharis glabra
Lolium multiflorum
Poa bulbosa
Rumex crispus
Taeniatherum caput-medusae
Trifolium hirtum
Vulpia bromoides
Hordeum marinum ssp. *gussoneanum*
Vulpia myuros var. *hirsuta*

APPENDIX 2

Community Interactions and Grazing Effects on Seven Rare Vernal Pool Plants and Macroinvertebrates in Tehama County

1999 Annual Report
Results and Discussion

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Abstract

Results and discussion are presented for the water quality, branchiopod, and vegetational monitoring conducted as part of a vernal pool grazing study in Tehama County, California. A previous report contains the introduction, materials and methods to accompany the results and discussion presented here. Water quality measurements (temperature, pH, dissolved oxygen, conductivity, and salinity) have been recorded at bimonthly intervals during the 1998 and 1999 vernal pool seasons. Temperature has also been recorded hourly within the pools during the time they are inundated. Branchiopods (*Branchinecta lynchi*, *Linderiella occidentalis*, and *Lepidurus packardi*) have been quantitatively sampled at bimonthly intervals in the pools. Preliminary results suggest that branchiopods are not randomly distributed throughout an individual pool, but have preferred habitat locations within the pool as well as water column preferences. Pools may be grouped by branchiopod density differences and these may be related to vegetational mosaic patterns which exist in the pool. Vegetation is being monitored in the surrounding habitat (upland mounds and flats) and in the pools using permanent transects and quadrats. Over 1300 permanent quadrats have been established in 1999 resulting in the collection of over 20,000 individual observations. Examples of the vegetational data collected are presented. Special status plant species (*Orcuttia tenuis, Sagittaria sanfordii, Paronychia ahartii, Gratiola heterosepala*, and *Legenere limosa*) have been the subject of monitoring efforts. To date *Orcuttia tenuis*, *Paronychia ahartii* and *Sagittaria sanfordii* have full scale monitoring programs. *Gratiola heterosepala* and *Legenere limosa* have not been encountered. Grazing was implemented in 1999 although not at the scale originally planned. The grazing that was implemented avoided impacts to the swimming phase of branchiopods. Ecological effects of the 1999 grazing will not be quantitatively expressible until the 2000 data set is analyzed. One prescribed fire was implemented at Dales Lake Ecological Reserve and two wildfires burned at the Hog Lake Plateau and Spring Branch Plains. These wildfires provide a unique opportunity to assess what happens to branchiopods and vernal pool plants when pools burn. Grazing may be important in developing and maintaining vegetational mosaics in these vernal pools and in the uplands. These mosaics may in turn be important in maintaining plant species diversity and are speculated to have some relationship to observed differences in branchiopod densities.

Introduction

The 1999 Annual Report, in combination with the 1998 Annual Report, describes the work made feasible by two United States Fish and Wildlife Service (USFWS) Section 6 Program grants, EP96-5 and EP97-7, awarded to the California Department of Fish and Game (CDFG). The project, whose purpose is to study the effects of grazing on vernal pools in Tehama County, was conducted under two contracts with California State University, Chico, FG7502R1 and FG7512R1, respectively. Since the project is ongoing, these first two reports may be viewed as progress reports.

Work under these two contracts spans the two years from January 1998 to December 1999. In this area the vernal pool season spans approximately November 1st through July 1st. At the suggestion of the contract manager, Mr. Craig Martz, the 1999 Annual Report builds upon the 1998 Annual Report and presents data analysis methods, results, and discussion of the project to date. The 1998 Annual Report contains detailed descriptions of the goals and objectives, monitoring plans, proposed hypotheses, and sampling designs. For concise summaries of first and second year activities, see Eggeman (1999) and Lis and Eggeman (2000).

Water Quality

Results

Water quality measurements are presented in Tables 1-9 for nine pools sampled during the 1997/98 and 1998/99 data collection seasons. During the first season, the early fall rains coupled with the above average rainfall water-year, caused the large pools, Dales Lake and Hog Lake, to hold water until late August. This is extremely unusual for pools that are typically dry by July 1. In contrast, the second season began later in the fall, and pool dry-down occurred in most pools by mid-June, 1999. Technical problems precluded the collection of water quality measurements beyond April 20, 1999. Thus the 1998/99 data in Tables 1-9 are slightly truncated but appear even more so when compared to the unusually long season of 1997/98.

Temperature has been recorded using two methods: first, as part of the bimonthly water quality measurement collection (see Tables 1-9 and Figures 1-8), and second, as hourly readings using submerged data loggers (Figures 9-16). The logger recordings are quite extensive and are not presented here in their entirety. Figures 9-16 depict a four or five week period for each pool. Because of logger defects and theft, the time period graphed for Spring Branch pools 2, 3, and 4 (Figures 14-16) does not match the time period graphed for the other pools (Figures 9-13).

The logger data plots for each pool can be compared to the corresponding time segment on the full season plots in Figures 1-8. The hourly plots clearly show the wide diurnal temperature fluctuations these pools undergo. The deeper pools such as Dales Lake (Figure 9), Hog Lake (Figure 10), and Spring Branch 1 (Figure 13) show diurnal amplitude changes that are smaller than the amplitude changes of the shallower pools, Hoggett (Figure 11) and Sevenmile Lake (Figure 12). These temperature shifts, both diurnally and annually, will be more informative as additional seasons of branchiopod data are collected and compared.

The hydrogen ion concentration of the pool, or pH, does not change dramatically within a season. In most cases the pH begins between 7.0 and 7.5 and increases slowly until it approaches or slightly exceeds 8.0. As the season progresses the pools diverge, in their measured pH changes, and can be placed into two response groups. In one group--Dales Lake, Hog Lake, Hoggett, and Sevenmile Lake--(Tables 1, 3, 4, 5, respectively) pH fluctuates around 8.0 and slowly declines to the slightly acidic range of 6.5 to 6.9. The other pools--Halfpint, Spring Branch 1, 2, 3 and 4 (Tables 2, 6, 7, 8 and 9, respectively), decline towards 7.0 and then have a more sudden shift toward alkalinity increasing to as much as 9.6 as the pools dry. This last shift towards alkalinity does not occur until very late in the vernal pool season. Otherwise, the pools display a pH range that is relatively stable until very late in the season.

Dissolved oxygen readings range between 5 and 10 mg/l throughout the vernal pool season (Tables 1-9). There appears to be a small spike in March where dissolved oxygen exceeds 10 mg/l that may correspond with a flush of plant growth in the pool. In late spring toward the end of the season, there is a slight decline in dissolved oxygen coinciding with increasing water temperature. Because warmer water holds less oxygen than colder water, these declines in dissolved oxygen may be caused by the thermal conditions.

Specific conductance remains relatively stable in the pool. There is a peak very early in the season which may coincide with the filling of the pools and the mixing of solutes into the water from an unvegetated pool. As the season proceeds and the small plants begin to establish themselves, specific conductance declines slightly and continues a slow decline as the pool bottom becomes increasingly vegetated. Certain pools that do not show this trend for specific conductance are Spring Branch 1, 3 and 4. These pools do not develop a densely vegetated bottom mat and sediments and ions are more likely to be repeatedly re-suspended as the winds agitate the pool bottoms. In the final weeks of pool dry-down, specific conductance suddenly spikes to high values as the concentration of the solutes increases.

Salinity remained <0.1 ppt throughout the season and only reached 0.1 ppt in the final stages of pool dry-down.

Discussion

Water temperature is a critical variable that has important implications for branchiopod species that inhabit the pool. Eriksen and Belk (1999) provide temperature ranges for the many branchiopod species. Period of cool water temperatures coupled with duration of inundation are two important factors that determine occupation of the pool by branchiopods. Lampert and Sommer (1997) comment that the direct effects of temperature on the ecology of a species have often been overemphasized and that care must be taken when making these cause and effect interpretations.

In addition, diurnal temperature amplitude changes may be important cues to hatching branchiopods. As a pool fills, the diurnal temperature reaches a steady state related to the depth of the pool and may be a possible indicator of inundation to the encysted fairy shrimps. Pool inundation and other environmental stimuli induce the hatching process, but only within a limited temperature range (Belk 1977a), and not all California species have the same range (Eriksen and Belk 1999).

In aquatic ecosystems, particularly freshwater lakes and streams, the carbonate-bicarbonate-carbon dioxide equilibrium is primarily responsible for the buffering capacity of a freshwater pool or lake (Lampert and Sommer 1997). The degree of dissociation of carbonic acid (H_2CO_3) depends on the pH (Lampert and Sommer 1997). At a pH of 8.0 and in the range between 7.0 and 9.0 bicarbonate (HCO_3^-) predominates in the solution equilibrium of the reactants and products: H_2CO_3, HCO_3^-, CO_3^{2-}, H^+. This dominance of bicarbonate is critical to the aquatic plants, most of which can only use free CO_2 and HCO_3^- for photosynthesis (Lampert and Sommer 1997).

At a pH of <6.0 and >10.0 bicarbonate drops below 50% of the equilibrium components and inhibits photosynthesis. A review of Tables 1-9 indicates that the pH of any pool rarely exceeds these limits for extended periods during the vernal pool season. As Kopecko and Lathrop (1975) and Keeley (1990) have found, the diurnal fluctuation of pH in vernal pools can range between 6.0 and 7.0 in the pre-dawn morning, increase by 2 to 4 pH units by early afternoon, and decline again to pre-dawn values overnight. These diurnal changes surpass the seasonal oscillation of pH in vernal pools and few other ecosystems exhibit such dramatic diurnal fluctuations (Keeley 1990 and references therein).

The diurnal pH variation depends upon the mass of photosynthetic vegetation which depletes the water of free CO_2 and supersaturates the water with O_2 (Keeley 1983). Thus, the amplitude of the diurnal fluctuation is zero or very small early in the season and increases as the season progresses. Also, as algae grow, seeds germinate, and corms, bulbs or other rootstocks rehydrate and grow, photosynthesis increases. As a result, the temperature increases, photosynthesis increases, the amplitude of diurnal pH fluctuations increases, and pool volume decreases, all contributing to an inhospitable environment for vernal pool branchiopods. As a result, branchiopods complete their life cycle before pool conditions deteriorate (Eriksen and Belk 1999).

Our water quality measurements indicate that pH, dissolved oxygen, specific conductance, and salinity vary within a relatively defined range. Whether or not these ranges can be used to define pool classes has not been determined. Recording the diurnal pH would be more useful in classifying pools but would require the installation of a continuous recording data logger. Additional monitoring may show that pools can be classified based on similarities in water quality, branchiopod species, plant species, geomorphology, or vegetational mosaic patterns.

Table 1 Dales Lake						
First and Second Season Water Quality Measurements						
Date	**Time**	**Temperature °C**	**pH**	**Dissolved oxygen mg/l**	**Specific conductance uS/cm**	**Salinity ppt**
First Season						
10/16/1997	1240	9.1	7.2	NA	27.3	0.0
12/30/1997	1215	8.8	7.7	NA	27.6	0.0
1/9/1998	0957	7.3	7.6	NA	25.3	0.0
1/20/1998	1120	8.9	7.7	NA	24.7	0.0
2/3/1998	1003	9.6	7.8	NA	22.4	0.0
2/17/1998	1010	7.5	7.1	NA	23.8	0.0
3/3/1998	1031	12.2	7.4	NA	24.9	0.0
3/17/1998	1056	18.4	6.5	6.4	25.8	0.0
3/31/1998	1103	11.4	6.5	10.2	21.8	0.0
4/14/1998	1033	11.5	6.5	8.6	22.4	0.0
4/28/1998	1035	21.8	6.2	7.0	18.3	0.0
5/12/1998	1041	15.0	6.3	8.2	15.2	0.0
5/26/1998	1103	14.5	6.6	8.6	23.5	0.0
6/9/1998	1052	26.2	6.5	7.6	20.5	0.0
6/26/1998	1107	24.4	7.0	7.6	35.3	0.0
7/10/1998	1106	25.3	6.4	6.6	41.4	0.0
7/28/1998	1046	28.8	7.2	5.4	63.4	0.0
8/20/1998	1120	27.0	7.0	8.2	130.5	0.1
Second Season						
12/2/1998	1117	9.7	7.7	8.8	38.8	0.0
12/14/1998	1155	9.5	7.4	9.2	35.7	0.0
12/28/1998	1242	8.4	7.9	9.2	32.6	0.0
1/11/1999	1129	6.1	7.2	9.6	33.7	0.0
1/25/1999	1110	5.7	7.5	9.2	33.2	0.0
2/10/1999	1035	7.3	7.5	7.0	28.0	0.0
2/23/1999	1146	10.8	8.2	9.4	28.1	0.0
3/22/1999	1114	14.1	9.2	10.8	30.4	0.0
4/7/1999	1124	15.4	9.7	9.0	21.8	0.0
4/20/1999	1156	21.3	8.4	7.0	24.4	0.0

Table 2 Halfpint						
Second Season Water Quality Measurements						
Date	Time	Temperature	pH	Dissolved	Specific	Salinity
		°C		oxygen	conductance	ppt
				mg/l	uS/cm	
Second Season						
12/28/1998	1145	10.6	7.4	10.0	46.5	0.0
1/11/1999	1030	5.4	7.3	9.0	55.1	0.0
1/25/1999	1020	5.0	7.3	8.6	52.1	0.0
2/10/1999	1200	10.0	7.6	8.2	30.7	0.0
2/23/1999	1050	11.6	7.4	9.0	35.0	0.0
3/22/1999	1030	17.0	8.0	11.8	55.6	0.0
4/7/1999	1055	17.3	8.5	7.2	96.5	0.0

Table 3 Hog Lake First and Second Season Water Quality Measurements						
Date	Time	Temperature °C	pH	Dissolved oxygen mg/l	Specific conductance uS/cm	Salinity ppt
First Season						
10/16/1997	1455	9.4	7.3	NA	47.1	0.0
12/30/1997	1250	9.2	7.7	NA	44.5	0.0
1/9/1998	1026	7.1	7.4	NA	39.2	0.0
1/20/1998	1156	8.5	7.9	NA	40.1	0.0
2/3/1998	1046	9.3	8.0	NA	36.2	0.0
2/17/1998	1043	6.8	7.1	NA	41.5	0.0
3/3/1998	1118	13.5	7.8	NA	39.5	0.0
3/17/1998	1130	18.8	8.5	9.6	41.4	0.0
3/31/1998	1200	10.5	7.0	9.0	42.1	0.0
4/14/1998	1153	11.9	6.9	8.2	41.8	0.0
4/28/1998	1113	22.4	7.0	5.2	40.6	0.0
5/12/1998	1150	14.7	6.7	8.6	32.9	0.0
5/26/1998	1149	17.9	6.6	8.6	23.5	0.0
6/9/1998	1122	24.0	6.4	6.8	29.5	0.0
6/26/1998	1142	23.7	6.8	5.6	29.7	0.0
7/10/1998	1210	26.9	6.4	5.4	37.8	0.0
7/28/1998	1129	30.2	6.5	6.2	40.7	0.0
8/20/1998	1205	21.7	6.5	5.4	75.4	0.0
9/4/1998	1230	30.0	6.8	3.0	179.4	0.1
Second Season						
12/2/1998	1209	9.4	7.4	8.2	55.8	0.0
12/14/1998	1315	9.4	7.7	8.6	51.5	0.0
12/28/1998	1420	7.6	7.6	10.1	54.3	0.0
1/11/1999	1402	7.2	7.5	9.4	57.8	0.0
1/25/1999	1233	8.6	7.5	9.2	35.5	0.0
2/10/1999	1310	8.6	7.6	6.9	43.0	0.0
2/23/1999	1315	10.1	7.7	8.6	42.8	0.0
3/22/1999	1224	13.6	8.6	12.4	55.0	0.0
4/7/1999	1326	16.0	9.7	9.8	51.9	0.0
4/20/1999	1256	23.6	8.8	6.8	51.1	0.0

Table 4 Hoggett						
First and Second Season Water Quality Measurements						
Date	Time	Temperature °C	pH	Dissolved oxygen mg/l	Specific conductance uS/cm	Salinity ppt
First Season						
1/8/1998	1320	7.6	8.4	NA	34.0	0.0
1/9/1998	1045	7.8	7.4	NA	32.8	0.0
1/20/1998	1221	8.2	7.9	NA	29.4	0.0
2/3/1998	1102	9.4	8.0	NA	21.1	0.0
2/17/1998	1102	6.6	7.3	NA	30.1	0.0
3/3/1998	1129	13.8	8.9	NA	30.3	0.0
3/17/1998	1156	17.5	8.7	9.2	30.8	0.0
3/31/1998	1142	10.5	6.8	8.8	34.1	0.0
4/14/1998	1215	13.3	6.9	7.8	36.8	0.0
4/28/1998	1134	24.1	6.5	4.4	38.5	0.0
5/12/1998	1209	15.3	6.1	7.6	28.0	0.0
5/26/1998	1211	18.2	6.4	7.4	42.2	0.0
6/9/1998	1140	24.2	6.3	7.4	42.5	0.0
6/26/1998	1222	23.9	6.6	6.4	62.2	0.0
Second Season						
12/2/1998	1223	9.5	7.7	10.2	36.5	0.0
12/14/1998	1429	10.7	7.7	7.8	41.1	0.0
12/28/1998	1528	9.8	7.7	9.4	52.0	0.0
1/11/1999	1458	7.5	7.6	9.0	47.7	0.0
1/25/1999	1334	8.5	7.5	9.6	47.8	0.0
2/10/1999	1405	9.5	7.6	7.0	27.8	0.0
2/23/1999	1408	14.2	8.2	9.0	29.0	0.0
3/22/1999	1305	14.9	9.5	11.6	31.2	0.0
4/7/1999	1415	18.8	10.2	9.0	37.1	0.0
4/20/1999	1319	23.7	9.5	8.6	47.3	0.0

Table 5 Sevenmile Lake First and Second Season Water Quality Measurements						
Date	**Time**	**Temperature** °C	**pH**	**Dissolved oxygen** mg/l	**Specific conductance** uS/cm	**Salinity** ppt
First Season						
10/17/1997	1323	8.4	7.8	NA	27.6	0.0
12/30/1997	1339	11.1	8.8	NA	27.8	0.0
1/9/1998	1306	8.0	7.3	NA	30.3	0.0
1/20/1998	1316	7.9	8.1	NA	26.1	0.0
2/3/1998	1142	9.5	7.8	NA	18.5	0.0
2/17/1998	1142	6.5	7.3	NA	23.4	0.0
3/3/1998	1249	12.6	8.7	NA	25.4	0.0
3/17/1998	1241	19.9	9.0	9.6	27.0	0.0
3/31/1998	1226	9.8	7.4	8.4	22.7	0.0
4/14/1998	1301	14.1	8.0	8.6	27.1	0.0
4/28/1998	1228	25.1	8.5	6.8	27.2	0.0
5/12/1998	1257	14.8	6.7	8.6	22.5	0.0
5/26/1998	1257	20.0	7.9	8.2	24.6	0.0
6/9/1998	1217	27.5	8.0	8.6	24.2	0.0
6/26/1998	1309	28.9	7.5	8.6	34.8	0.0
7/10/1998	1323	29.6	7.1	7.2	48.8	0.0
Second Season						
12/2/1998	1320	9.7	8.8	11.2	37.1	0.0
12/14/1998	1543	10.5	8.2	8.8	42.6	0.0
1/11/1999	1616	8.4	9.1	12.0	40.3	0.0
1/25/1999	1453	9.8	8.8	12.6	50.1	0.0
2/10/1999	1538	11.2	8.7	9.4	26.8	0.0
2/23/1999	1502	15.0	9.7	11.2	31.6	0.0
3/22/1999	1410	13.5	10.0	13.4	35.2	0.0
4/7/1999	1515	18.3	10.4	8.8	29.4	0.0
4/20/1999	1413	26.1	9.3	9.4	36.3	0.0

Table 6 Spring Branch 1						
First and Second Season Water Quality Measurements						
Date	Time	Temperature °C	pH	Dissolved oxygen mg/l	Specific conductance uS/cm	Salinity ppt
First Season						
10/17/1997	1633	8.7	7.1	NA	29.8	0.0
12/30/1997	1500	10.4	7.8	NA	31.6	0.0
1/9/1998	1306	8.0	7.3	NA	30.3	0.0
1/20/1998	1454	10.2	7.8	NA	32.1	0.0
2/3/1998	1343	10.0	7.7	NA	25.1	0.0
2/17/1998	1254	7.8	7.0	NA	32.2	0.0
3/3/1998	1424	15.6	7.5	NA	32.7	0.0
3/17/1998	1417	21.4	7.2	8.8	35.1	0.0
3/31/1998	1337	12.4	7.1	8.4	32.4	0.0
4/14/1998	1421	15.5	7.2	8.6	30.4	0.0
4/28/1998	1355	27.4	7.3	3.4	34.5	0.0
5/12/1998	1412	17.3	7.2	6.4	32.6	0.0
5/26/1998	1510	17.0	6.8	6.2	33.7	0.0
6/9/1998	1440	27.7	6.9	5.6	38.8	0.0
6/26/1998	1424	24.5	7.5	6.2	42.5	0.0
7/10/1998	1501	25.0	9.2	5.6	49.8	0.0
7/28/1998	1320	25.8	9.3	4.4	88.3	0.0
Second Season						
12/2/1998	1430	10.1	7.4	8.2	32.7	0.0
12/16/1998	1110	9.4	7.1	8.4	33.8	0.0
12/30/1998	1308	8.2	8.1	9.0	34.5	0.0
1/14/1999	1152	7.4	7.3	9.0	35.2	0.0
1/27/1999	1031	6.3	7.5	9.6	26.3	0.0
2/11/1999	1048	7.5	7.8	8.6	27.6	0.0
2/24/1999	1100	11.6	7.9	8.8	29.1	0.0
3/15/1999	1105	12.8	8.2	9.0	32.0	0.0
4/6/1999	1355	15.2	8.7	8.2	31.7	0.0
4/22/1999	1149	18.5	8.3	6.4	48.2	0.0

Table 7 Spring Branch 2						
First and Second Season Water Quality Measurements						
Date	Time	Temperature °C	pH	Dissolved oxygen mg/l	Specific conductance uS/cm	Salinity ppt
First Season						
10/17/1997	1700	8.9	7.1	NA	21.8	0.0
12/30/1997	1515	10.1	7.5	NA	21.5	0.0
1/9/1998	1320	8.2	7.3	NA	20.9	0.0
1/20/1998	1510	10.1	7.9	NA	22.4	0.0
2/3/1998	1356	10.1	7.8	NA	18.2	0.0
2/17/1998	1306	8.1	7.3	NA	21.8	0.0
3/3/1998	1443	16.1	8.3	NA	20.2	0.0
3/17/1998	1437	21.2	8.3	9.0	19.1	0.0
3/31/1998	1351	11.6	7.3	7.2	17.4	0.0
4/14/1998	1440	17.4	7.3	8.2	17.1	0.0
4/28/1998	1412	26.5	7.8	2.8	19.3	0.0
5/12/1998	1431	18.0	7.4	9.6	15.2	0.0
5/26/1998	1456	15.6	7.1	7.0	18.8	0.0
6/9/1998	1425	27.9	8.3	8.2	25.0	0.0
6/26/1998	1500	29.5	8.7	7.4	28.3	0.0
7/10/1998	1536	32.7	9.3	7.6	38.8	0.0
7/28/1998	1346	34.0	9.3	7.8	61.0	0.0
Second Season						
12/2/1998	1502	10.2	7.5	9.8	32.3	0.0
12/16/1998	1205	10.2	7.7	8.6	29.8	0.0
12/30/1998	1412	7.2	7.9	9.6	30.1	0.0
1/14/1999	1213	7.5	7.4	9.6	30.9	0.0
1/27/1999	1141	5.9	8.2	10.0	28.5	0.0
2/11/1999	1208	7.5	7.5	10.0	23.8	0.0
2/24/1999	1129	12.5	7.9	9.4	23.4	0.0
3/15/1999	1204	13.5	8.6	8.0	22.6	0.0
4/6/1999	1315	13.9	9.1	9.2	20.3	0.0
4/22/1999	1221	18.7	8.9	8.8	19.5	0.0

Table 8 Spring Branch 3						
First and Second Season Water Quality Measurements						
Date	**Time**	**Temperature** °C	**pH**	**Dissolved oxygen** mg/l	**Specific conductance** uS/cm	**Salinity** ppt
First Season						
1/16/1998	1221	9.9	7.5	NA	28.6	0.0
1/20/1998	1532	9.0	7.7	NA	28.8	0.0
2/3/1998	1410	9.9	7.5	NA	17.5	0.0
2/17/1998	1324	7.5	7.3	NA	29.8	0.0
3/3/1998	1502	14.4	8.0	NA	25.3	0.0
3/17/1998	1458	19.4	7.6	8.4	33.8	0.0
3/31/1998	1411	10.9	7.3	8.8	27.4	0.0
4/14/1998	1506	12.7	7.1	10.2	27.4	0.0
4/28/1998	1433	18.5	6.6	NA	53.5	0.0
5/12/1998	1449	16.2	7.0	5.6	56.8	0.0
5/26/1998	1429	15.6	7.0	6.4	46.2	0.0
6/9/1998	1406	23.4	7.0	8.2	35.5	0.0
6/26/1998	1523	24.7	9.3	9.2	49.2	0.0
7/10/1998	1603	25.4	9.6	7.4	78.4	0.0
Second Season						
12/2/1998	1528	10.1	7.5	9.4	34.8	0.0
12/16/1998	1304	10.8	7.6	8.4	35.2	0.0
12/30/1998	1510	7.5	8.0	10.4	35.2	0.0
1/14/1999	1309	7.8	7.8	9.6	37.3	0.0
1/27/1999	1319	7.3	7.9	10.2	34.9	0.0
2/11/1999	1311	5.7	7.7	11.2	21.4	0.0
2/24/1999	1207	12.3	8.5	8.8	25.8	0.0
3/15/1999	1305	14.1	9.2	8.8	29.6	0.0
4/6/1999	1251	11.2	9.4	10.2	32.8	0.0
4/22/1999	1343	18.3	9.1	9.2	50.0	0.0

Table 9 Spring Branch 4						
First and Second Season Water Quality Measurements						
Date	Time	Temperature °C	pH	Dissolved oxygen mg/l	Specific conductance uS/cm	Salinity ppt
First Season						
1/16/1998	1121	9.9	7.9	NA	31.0	0.0
1/20/1998	1556	8.4	7.4	NA	30.8	0.0
2/3/1998	1425	9.9	7.5	NA	24.7	0.0
2/17/1998	1342	8.0	7.4	NA	34.3	0.0
3/3/1998	1526	13.3	7.7	NA	31.5	0.0
3/17/1998	1517	16.5	7.2	8.2	33.2	0.0
3/31/1998	1429	11.8	7.2	8.8	33.3	0.0
4/14/1998	1524	13.0	7.3	9.8	33.0	0.0
4/28/1998	1452	22.1	7.2	NA	36.1	0.0
5/12/1998	1506	16.9	7.6	NA	30.4	0.0
5/26/1998	1415	16.3	7.1	6.0	35.2	0.0
6/9/1998	1349	23.4	7.0	8.2	34.7	0.0
6/26/1998	1547	25.8	8.5	8.2	36.3	0.0
7/10/1998	1623	31.0	9.6	7.4	47.0	0.0
7/28/1998	1508	30.5	9.4	11.4	70.6	0.0
Second Season						
12/2/1998	1550	10.2	7.5	8.8	36.4	0.0
12/16/1998	1345	8.7	7.7	8.4	37.0	0.0
12/30/1998	1538	6.7	8.0	10.4	36.9	0.0
1/14/1999	1343	7.2	7.9	9.0	37.2	0.0
1/27/1999	1351	6.7	7.8	10.6	34.7	0.0
2/11/1999	1355	6.3	7.7	9.0	25.3	0.0
2/24/1999	1236	12.1	8.1	10.8	32.6	0.0
3/15/1999	1347	11.7	8.2	8.0	34.7	0.0
4/6/1999	1120	9.5	9.0	8.2	35.2	0.0
4/22/1999	1317	17.4	8.9	8.4	38.9	0.0

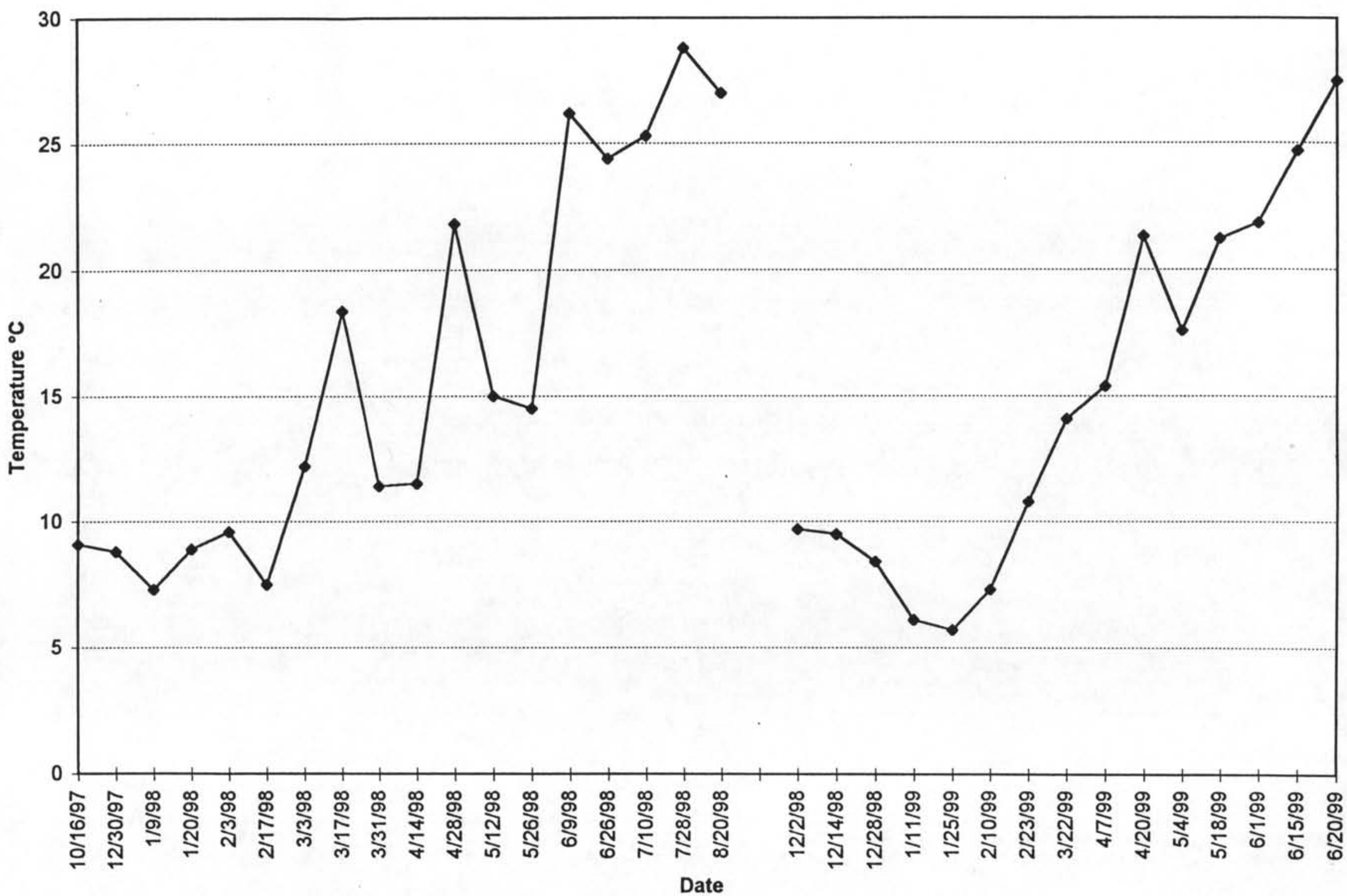

Figure 1 Dales Lake first and second season temperatures

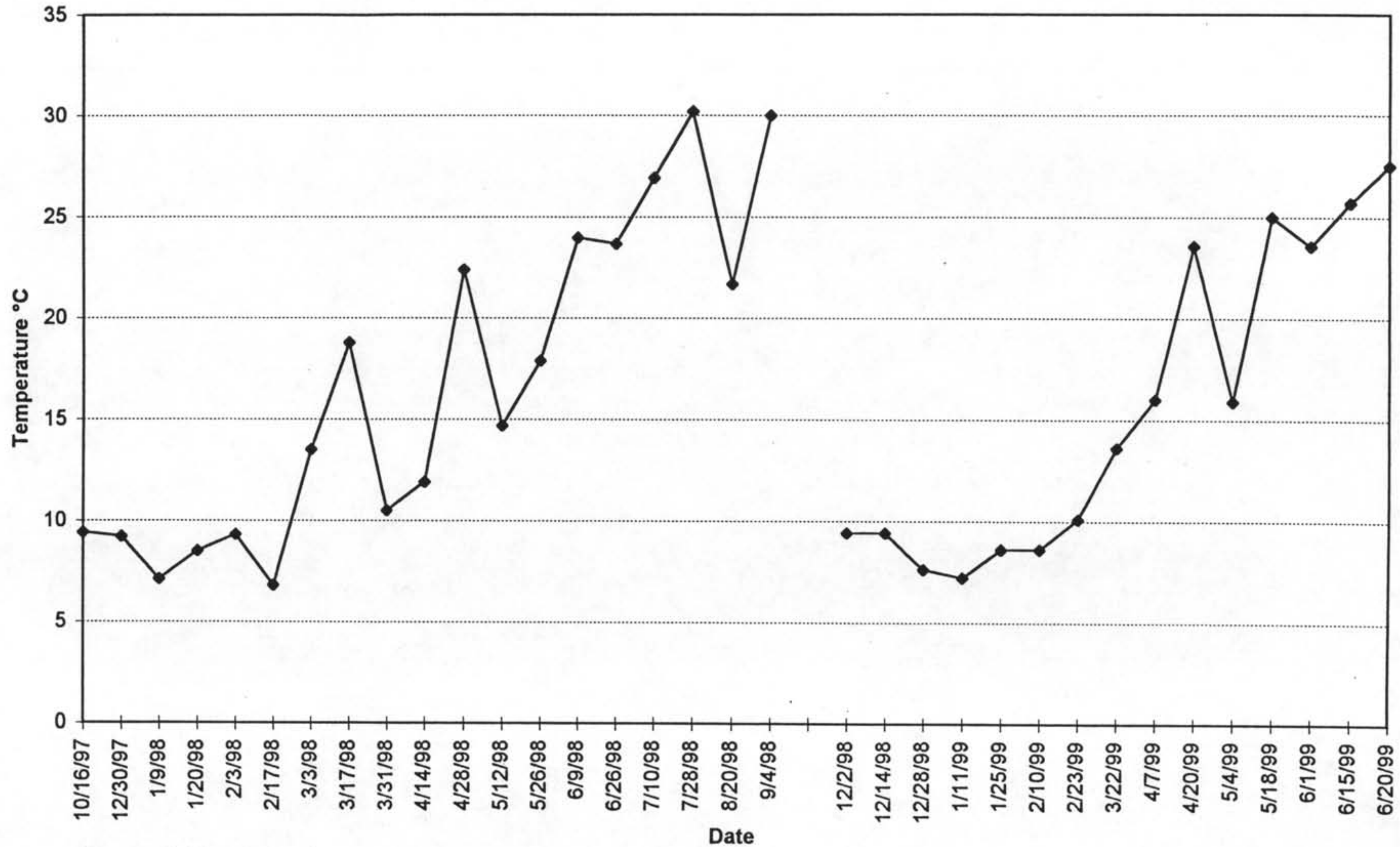

Figure 2 Hog Lake first and second season temperatures

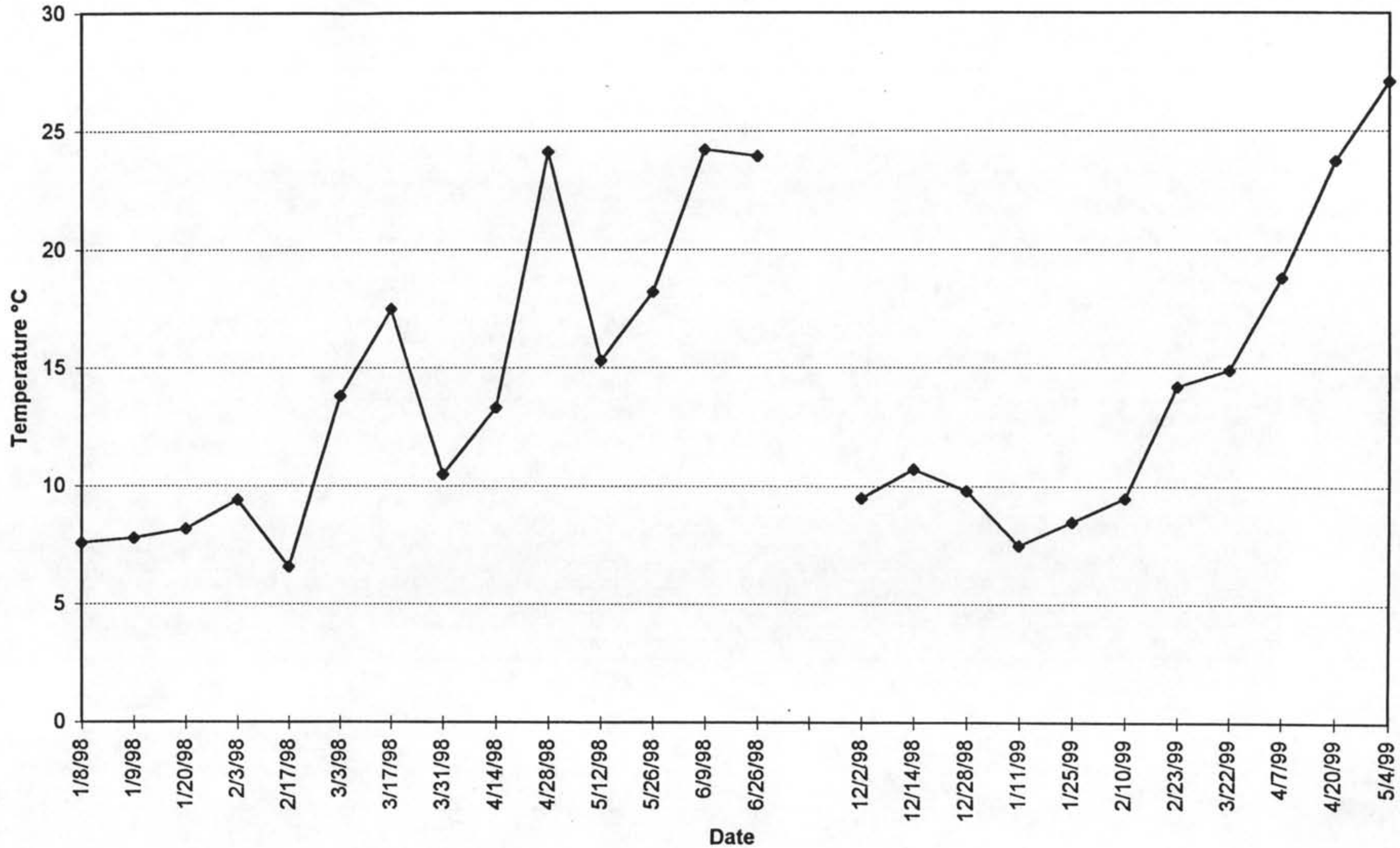

Figure 3 Hoggett first and second season temperatures

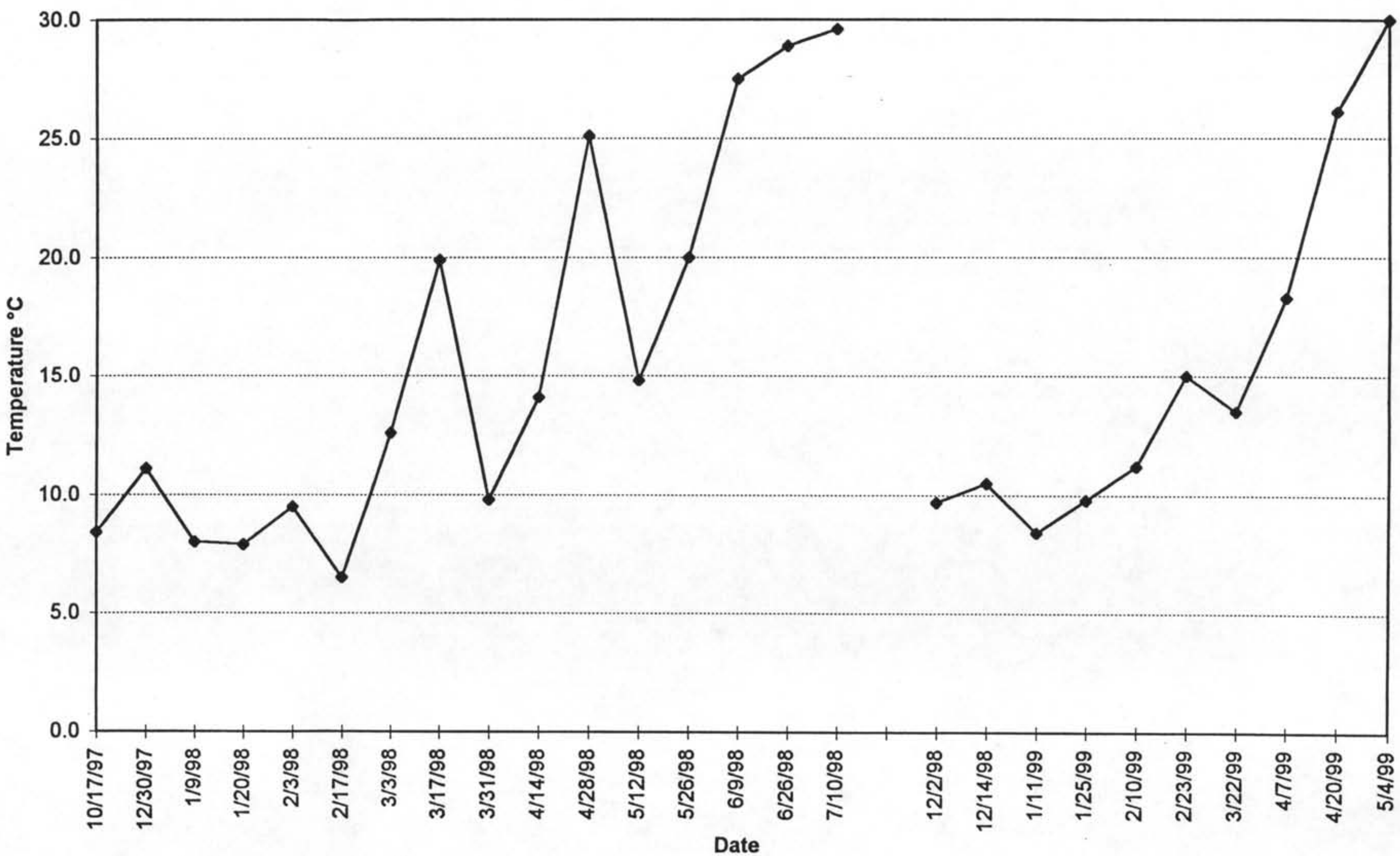

Figure 4 Sevenmile Lake first and second season temperatures

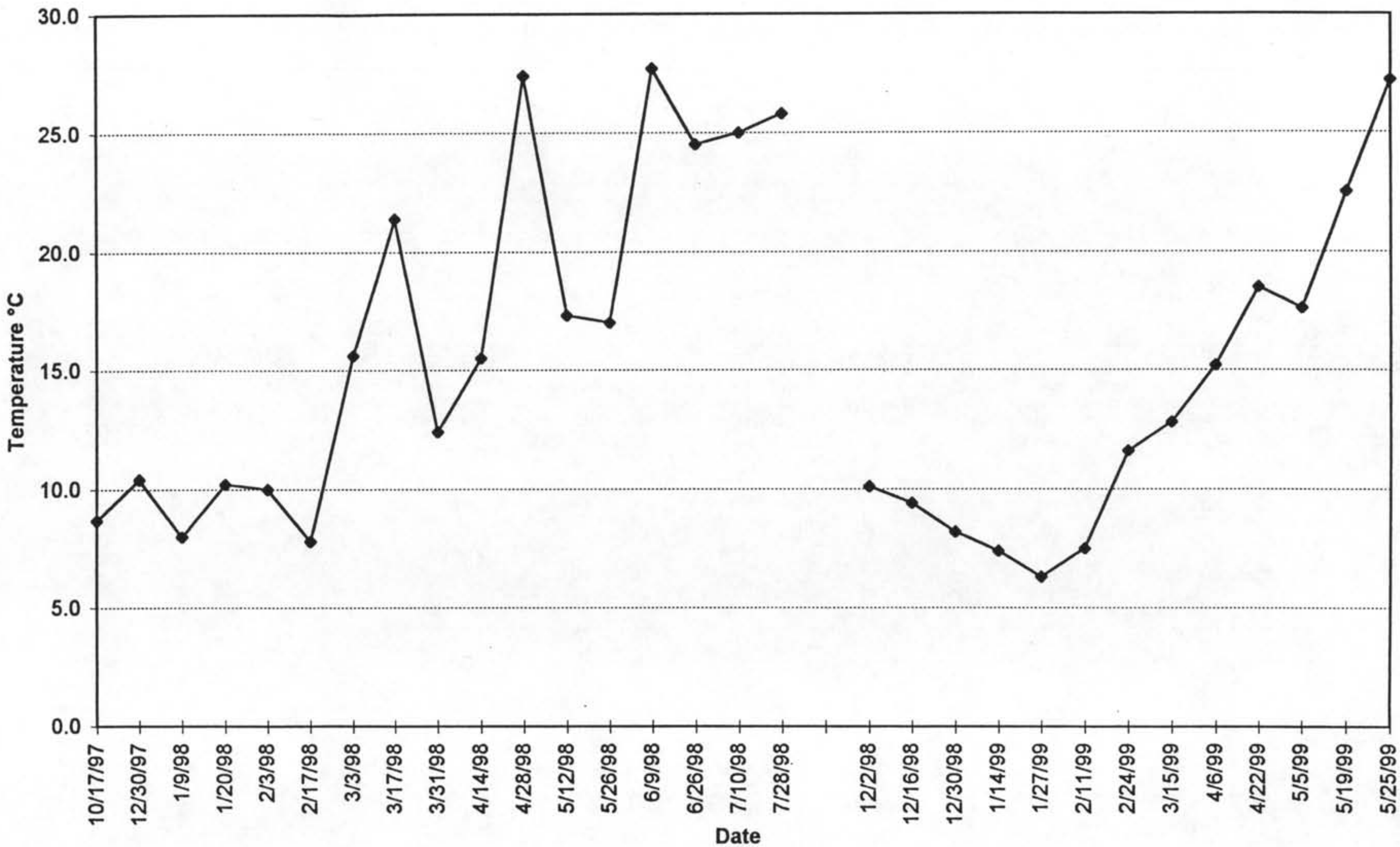

Figure 5 Spring Branch 1 first and second season temperatures

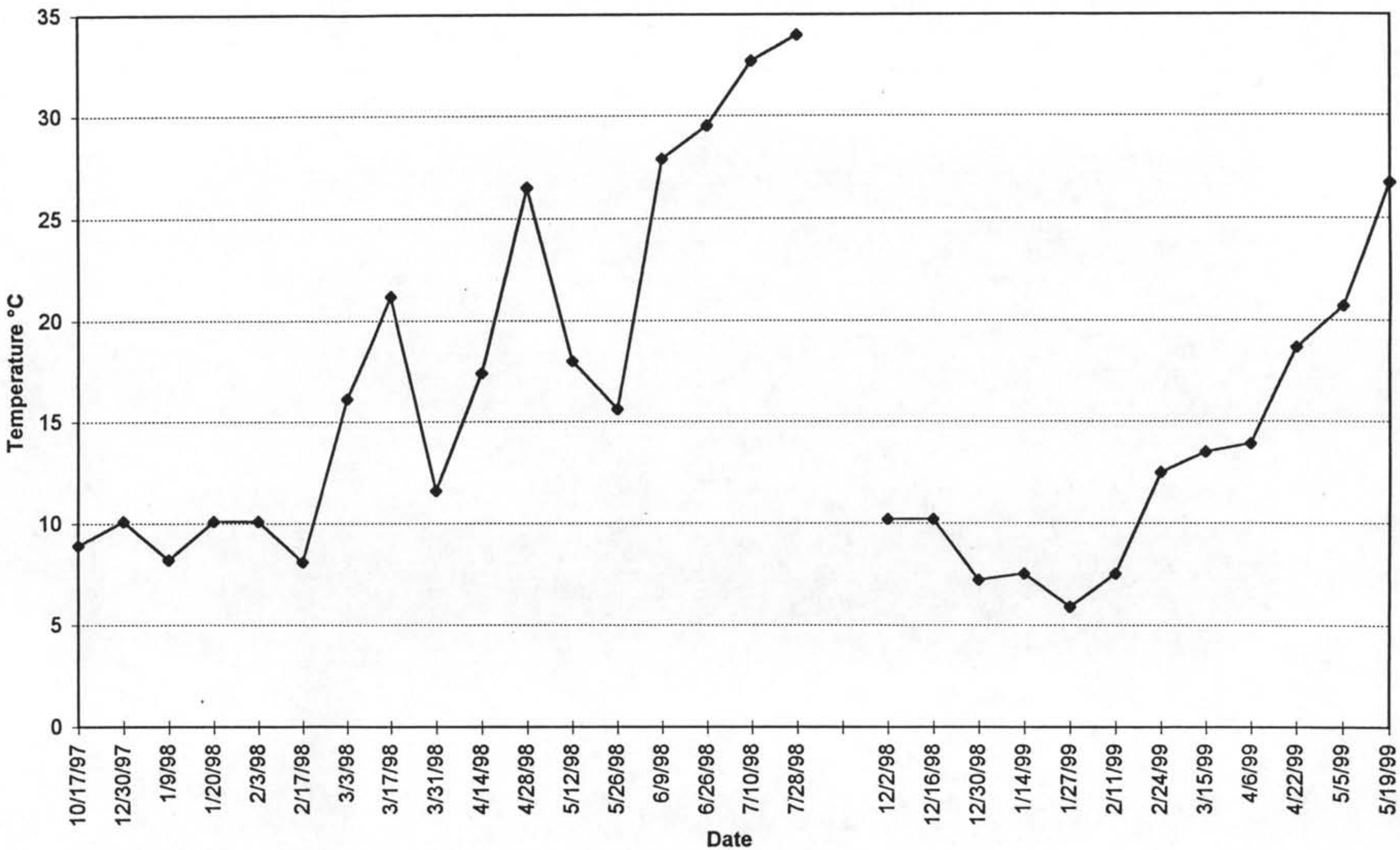

Figure 6 Spring Branch 2 first and second season temperatures

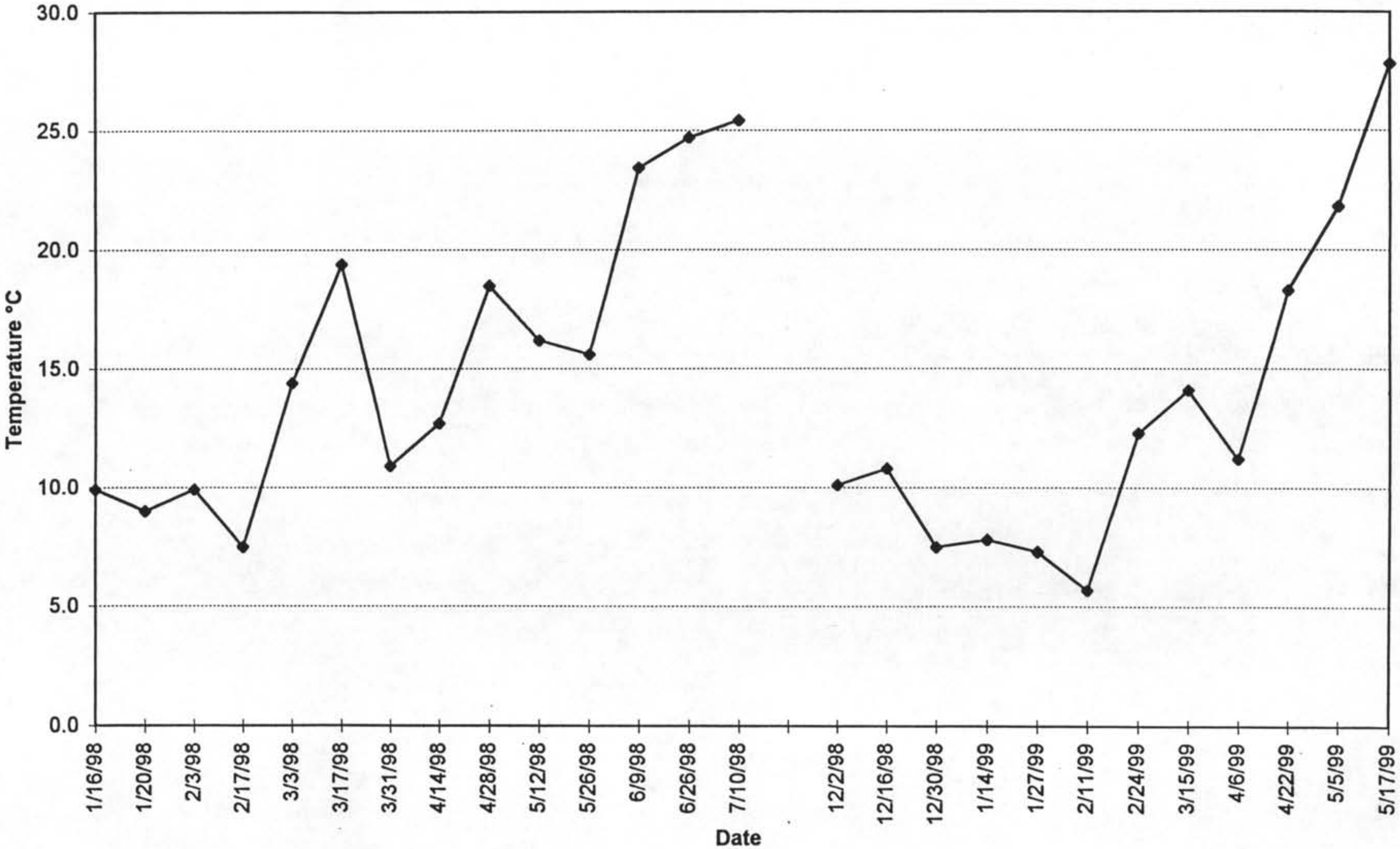

Figure 7 Spring Branch 3 first and second season temperatures

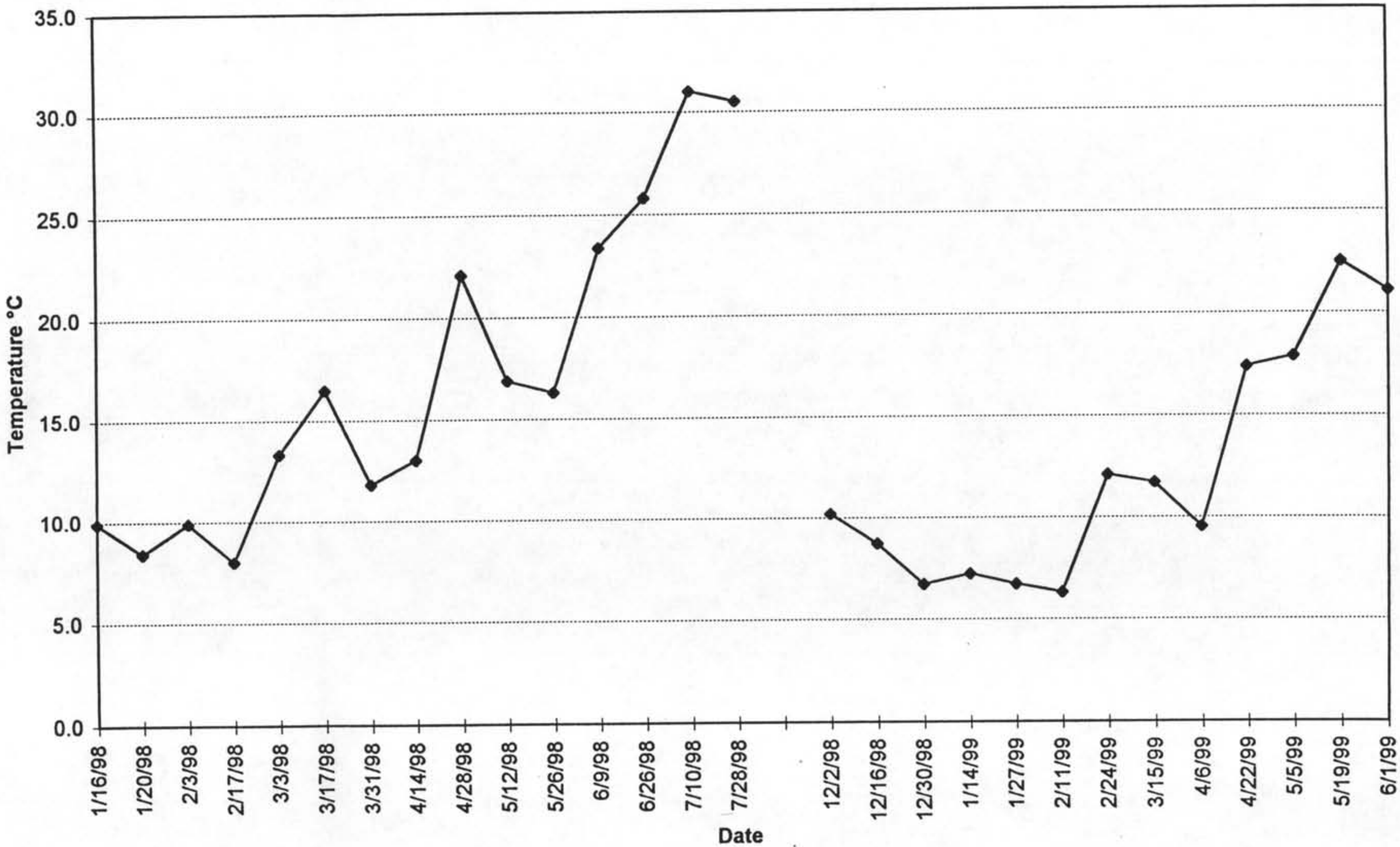

Figure 8 Spring Branch 4 first and second season temperatures

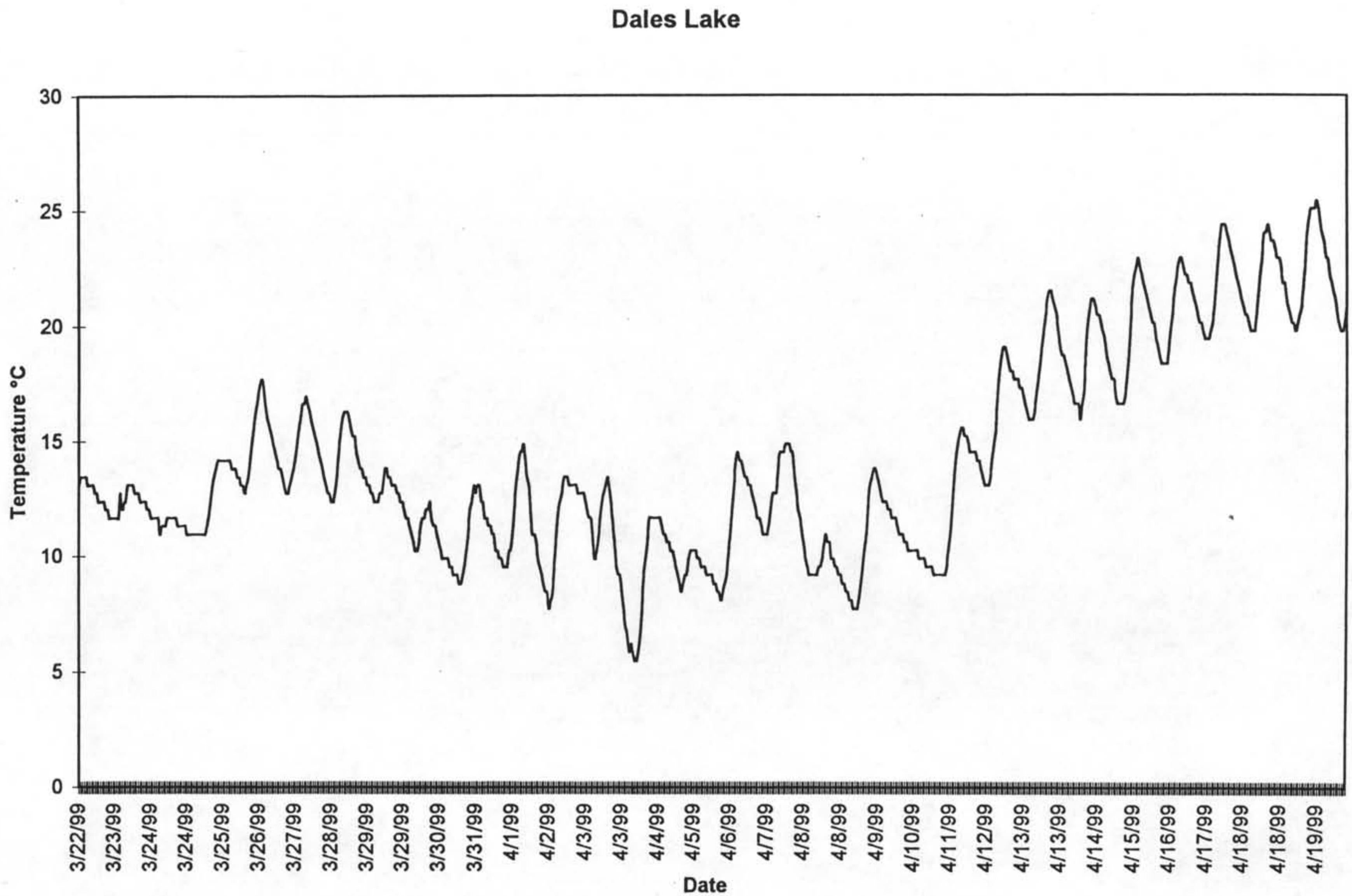

Figure 9 Four weeks (697 points) of temperature readings recorded hourly by data logger

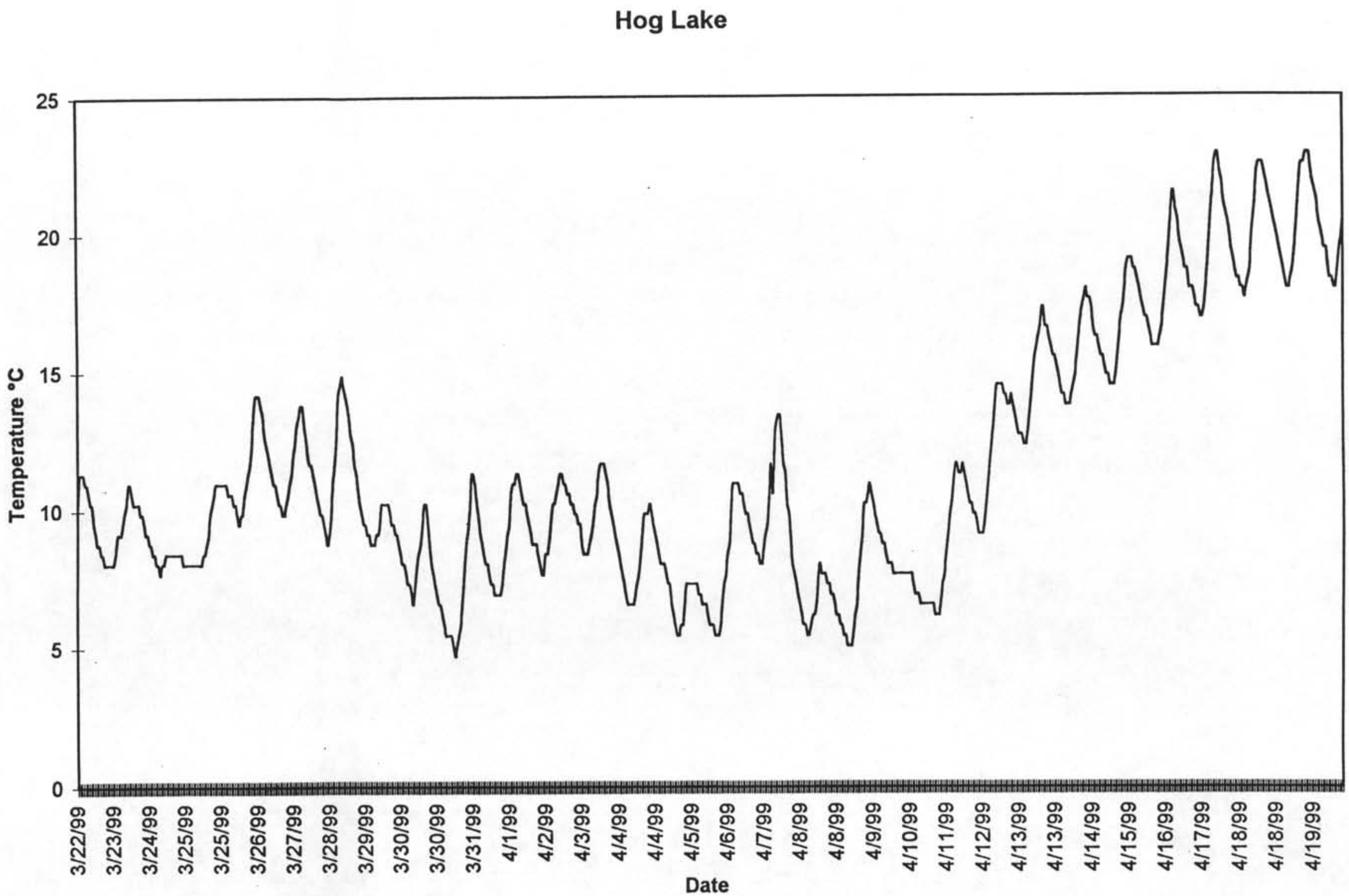

Figure 10 Four weeks (697 points) of temperature readings recorded hourly by data logger

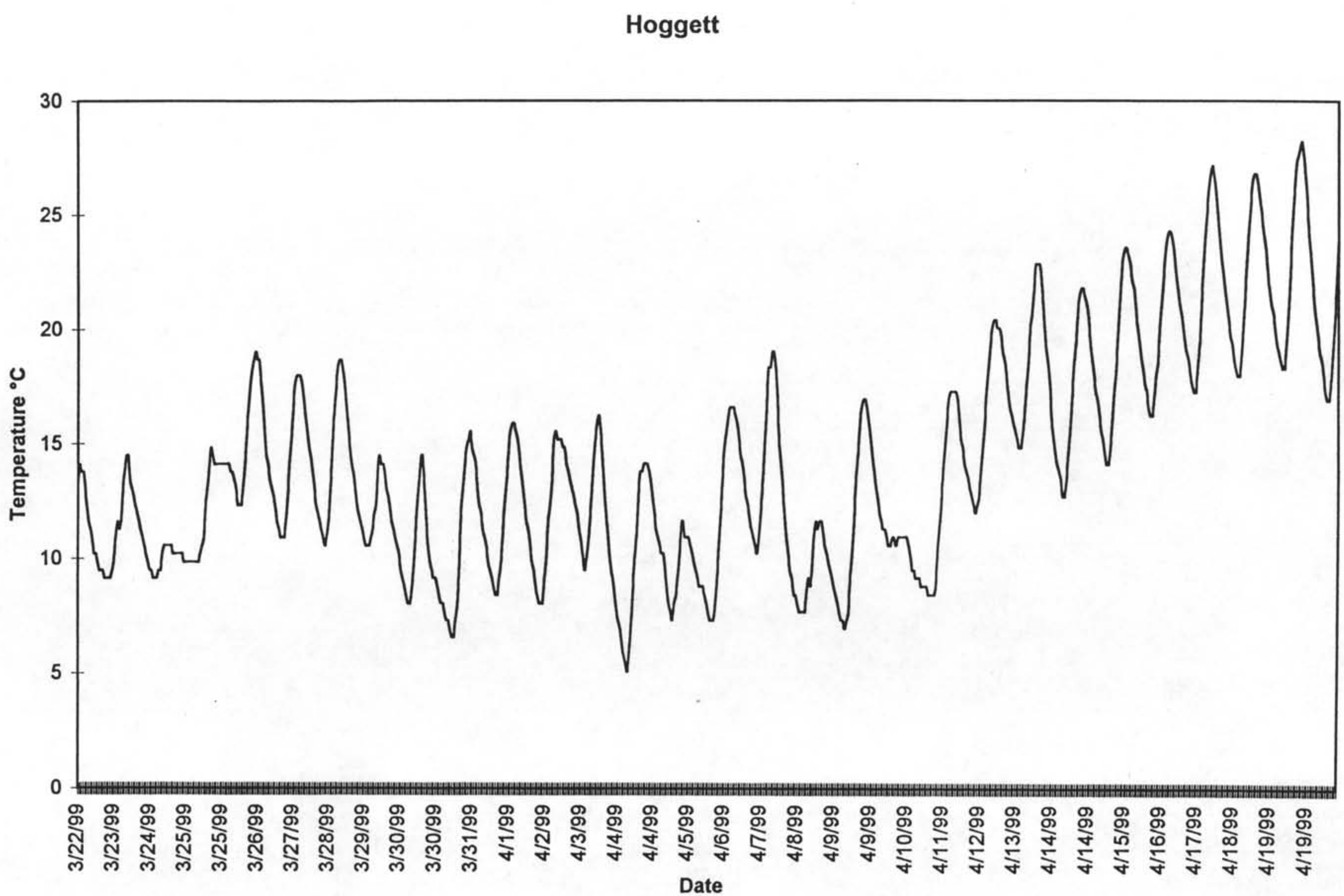

Figure 11 Four weeks (697 points) of temperature readings recorded hourly by data logger

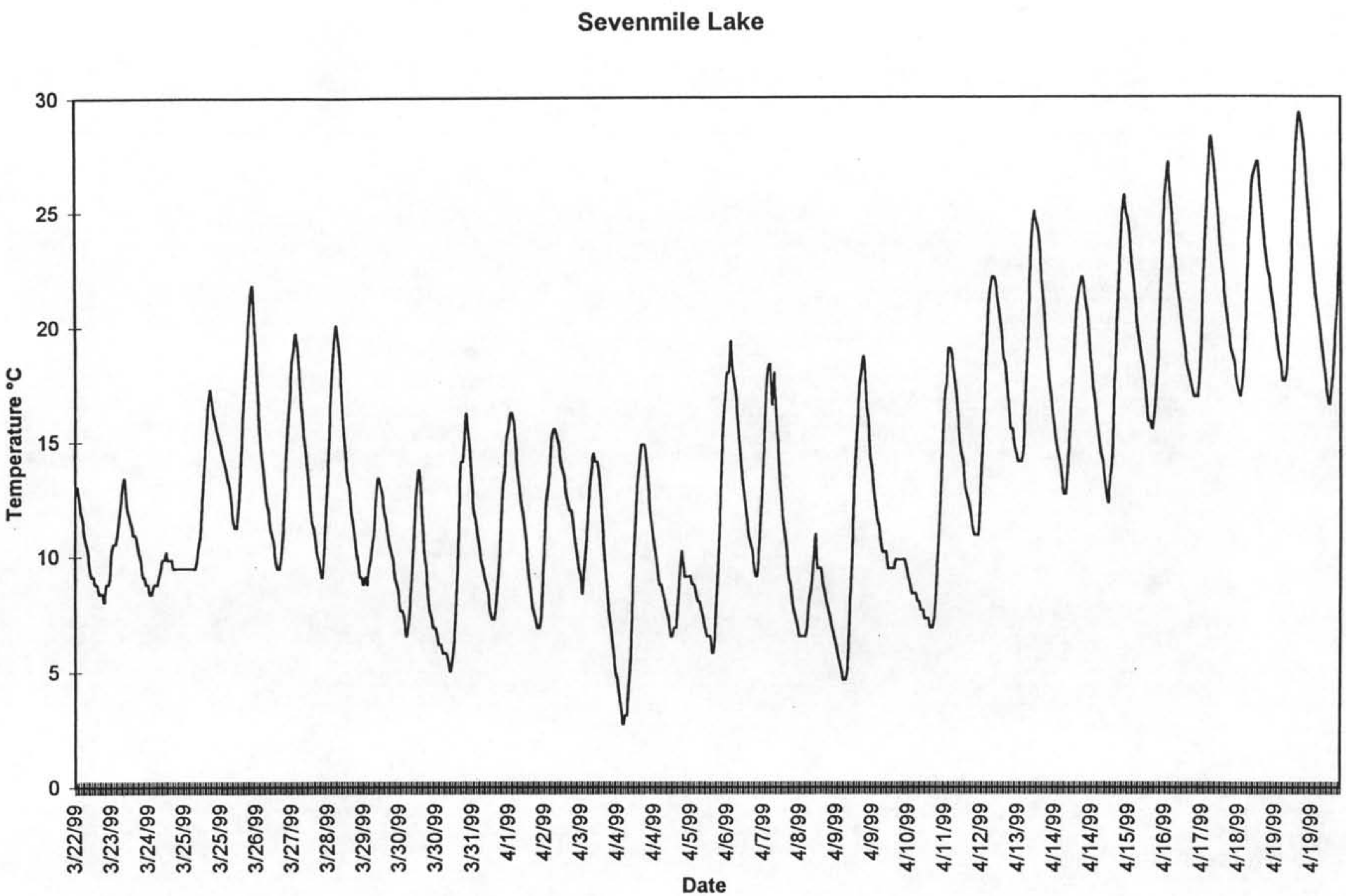

Figure 12 Four weeks (696 points) of temperature readings recorded hourly by data logger

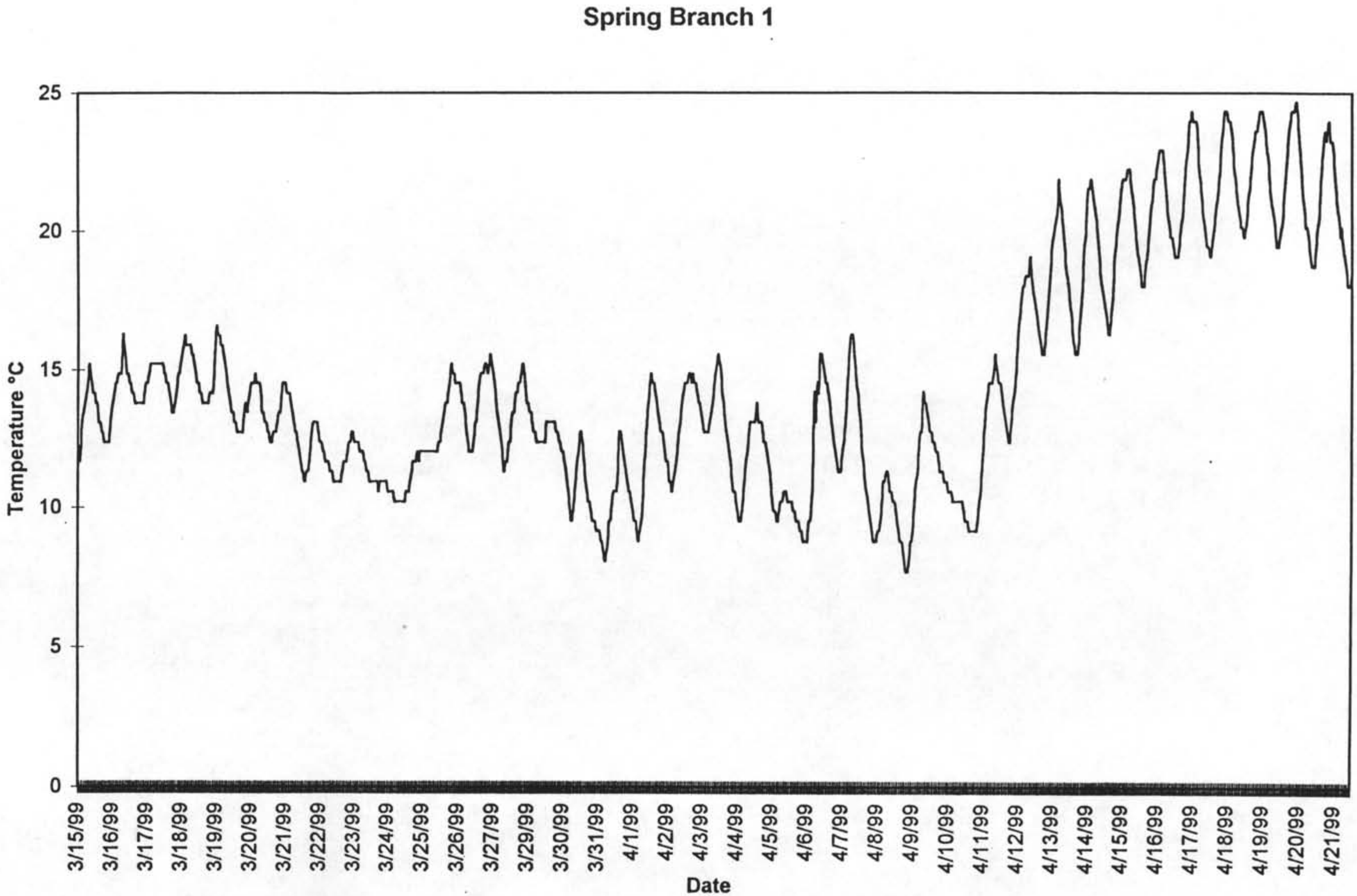

Figure 13 Five weeks (912 points) of temperature readings recorded hourly by data logger

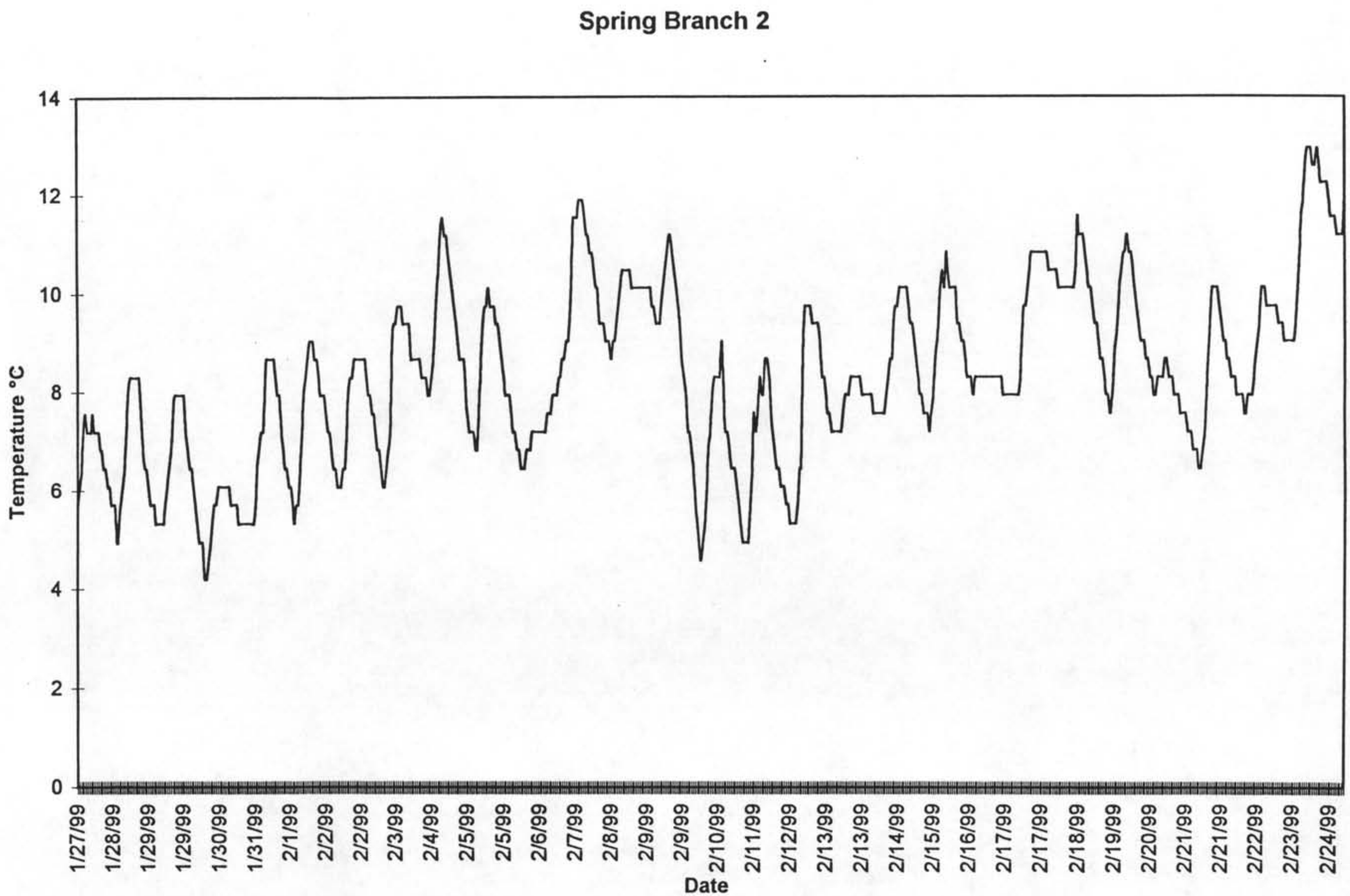

Figure 14 Four weeks (673 points) of temperature readings recorded hourly by data logger

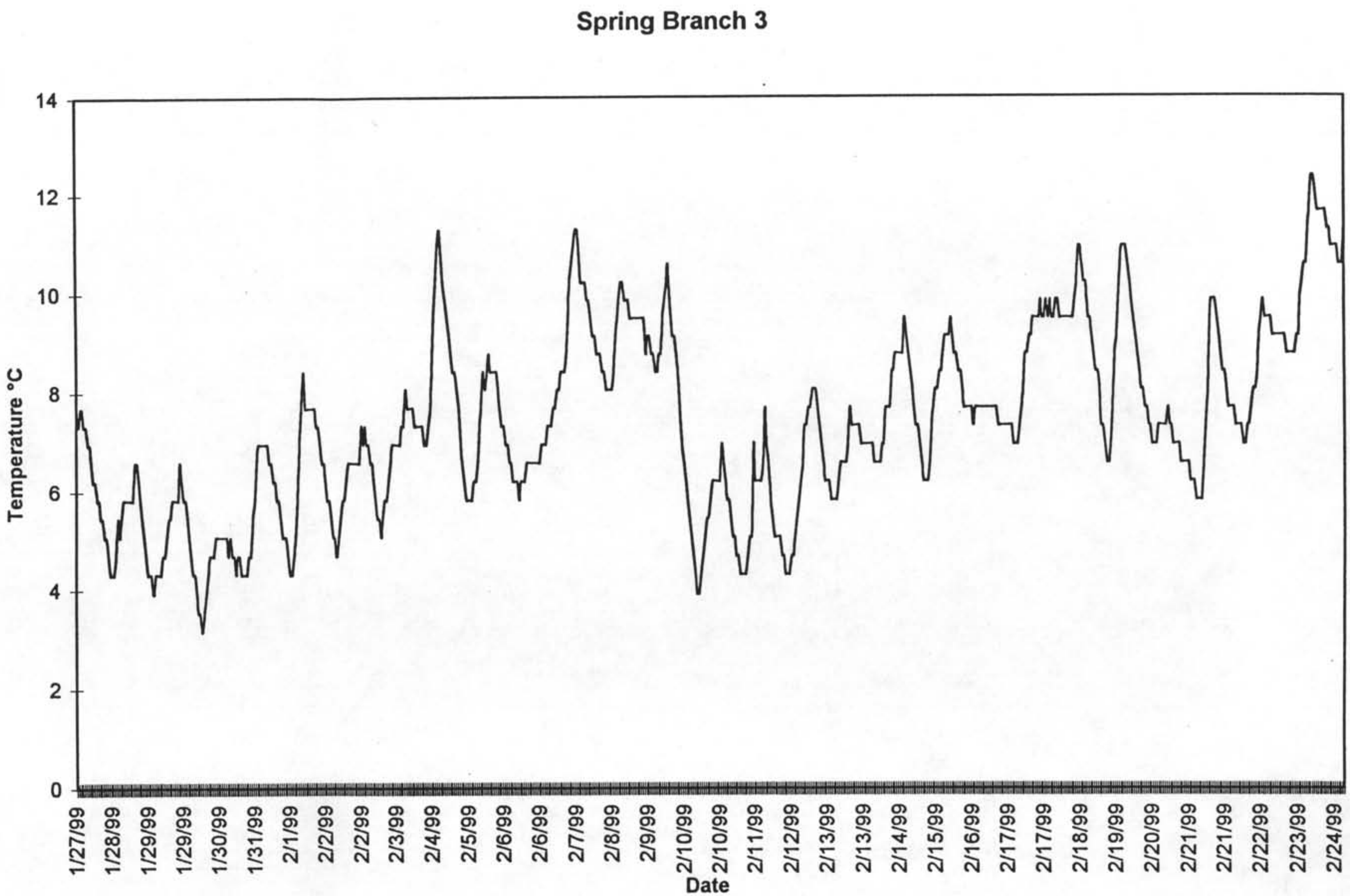

Figure 15 Four weeks (671 points) of temperature readings recorded hourly by data logger

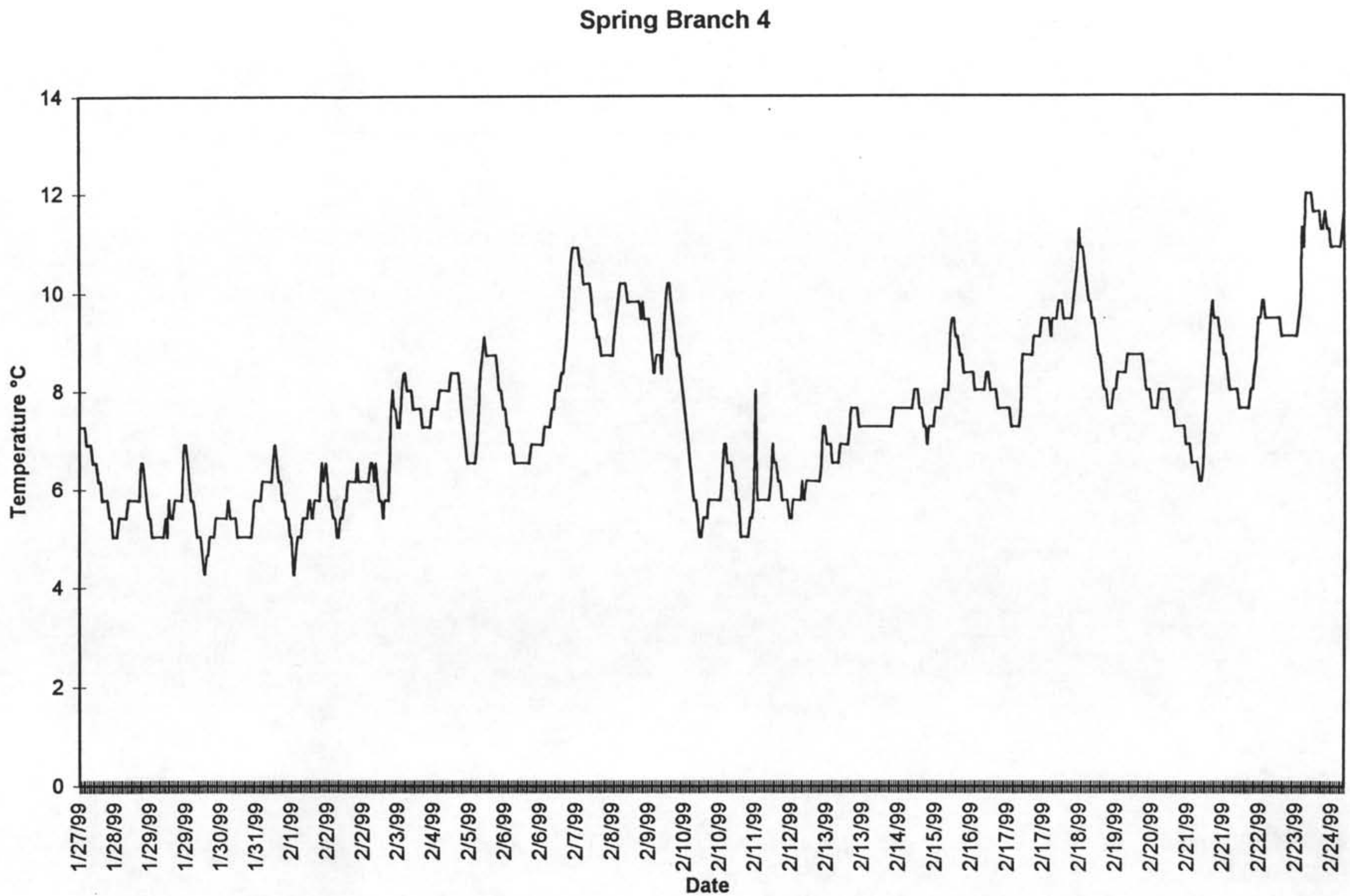

Figure 16 Four weeks (672 points) of temperature readings recorded hourly by data logger

Branchiopods

Results

Previously, branchiopod sampling focused on surveying pools for presence or absence (Brendonck and Riddoch 1997, and references therein; Eng et al. 1990; King et al. 1996). Gallagher (1996) sampled branchiopods biweekly and Hildrew (1985) sampled every 2-3 days. This project's investigators now have first-hand knowledge that methods of obtaining accurate fairy shrimp counts are cumbersome and time-consuming. Figures 17-24 illustrate the range of fairy shrimp densities obtained by our quantitative sampling method. All graphs display the mean, standard error of the mean, and one standard deviation. Because one biologist conducted the fairy shrimp surveys throughout the season, the sampling and counting method became very consistent with time.

The sampling method was developed during the first fairy shrimp surveys in late November and early December, 1998. Observations were collected and tabulated to determine what sample size within an acceptable error could be collected in the available time. Besides statistical error, constraints that affected sampling included time allotment per pool, pool depth and turbidity, and weather conditions. Reducing the potential for error significantly increases the number of samples required (Green 1979). In order to estimate the species population mean to within ±10% with 95% confidence intervals, the initial data on both *Linderiella occidentalis* and *Branchinecta lynchi* were evaluated using the following equation for the confidence limits on the sample mean:

$$m \pm t_{1-(1/2)\alpha}(s/\_n)$$

where m = sample mean, t = t-statistic, α = probability of error, s = standard deviation of sample and n = sample number. Using the sample data, m, s, and α are known, and t can be approximated for large sample sizes of n, so that the equation can be solved for n. These computations showed that 16 samples per pool would produce the desired results within an acceptable error.

The **Materials and Methods** section of the 1998 Annual Report presents a technique for estimating densities of branchiopods too numerous to count. This technique involved counting the number of fairy shrimps within randomly chosen squares of a grid (see 1998 Annual Report). We tested this method and found it significantly overestimated fairy shrimp densities. We abandoned this method in favor of making actual counts.

In the first season of sampling, *Linderiella occidentalis* was identified and surveyed in six of the pools: Dales Lake (DL), Hog Lake (HL), Hoggett (Hgt), Sevenmile Lake (SML), Spring Branch 1 (SB1) and Spring Branch 4 (SB4). By reviewing survey results, pools inhabited by *L. occidentalis* can be placed into three groups. The first group includes pools DL and SB1, characterized by a high density of *L. occidentalis* with a mean > $60/m^3$ for the first three surveys between December and the end of January (Figures 17, 21). The second group, HL and SML, have medium densities of *L. occidentalis* with the mean ranging between $4/m^3$ and $40/m^3$ (Figures 18, 20). The third group, Hgt and SB4, never exceeds a mean of $5/m^3$ at any time of the season (Figures 19, 24).

Branchinecta lynchi was identified only in Spring Branch 2 (Figure 22) and occurs in densities ranging between 20 and $30/m^3$. These values decrease rapidly in mid-January and decline to values near zero by late January.

Despite the fact that Spring Branch 3 is a medium-sized pool and holds water for several months, no branchiopods were collected the entire season (Figure 23).

Lepidurus packardi is routinely collected in DL, HL, SB1 and SB2. Their tendency to inhabit the benthic zone of the pool complicates sampling for this species. Data on *L. packardi* is being assembled and will be presented in the next report when two seasons of data can be combined and compared for a more definitive assessment of their numbers.

Discussion

Sampling vernal pool branchiopods is fraught with problems, particularly when working with pools on public lands. During waterfowl hunting season, if hunters and dogs are around a pool, sampling is delayed. Rainy or windy conditions also make surveying fairy shrimps difficult; it is nearly impossible to make accurate counts on a bobbing raft. Also, *Linderiella occidentalis* appear to seek refuge in deeper water, grassy areas or around rocks during rough weather conditions. When strong winds blow across the pool, fairy shrimps can usually be found at the leeward side. At Hog Lake for instance, when the wind blows fairy shrimps can usually be found in the protected cove.

One of our early hypotheses was that branchiopods would be uniformly distributed throughout the pool. This has not been the case. Branchiopods appear to prefer certain areas of the pool as well as certain levels of the water column. The majority of *Linderiella occidentalis* are typically found at depths of 20-40 cm while *Branchinecta lynchi* prefers the deeper, colder water at 45-60 cm.

Vegetation density and persistence from one season to the next also influences branchiopod distribution. *Eleocharis spp.* and *Eryngium spp.* both grow in vernal pools late in the season, dry during the summer, and are still present as rain fills the pools in the fall. As these now submerged plants start to decay, algae grow and form dense mats around them. Repeated branchiopod sampling revealed that unless there is sufficient water column above these decaying plants, more fairy shrimps will be found in areas of open water with no or low-growing vegetation. We developed the concept of 'vegetation mosaic' to characterize where branchiopods reside in pools.

The birds-eye view of a vernal pool shows that certain plant species grow together in bands and islands, much like the pattern created by inlaid bands of color in a mosaic table-top. Preliminarily, we've classified this vegetation mosaic into three grades summarized in Table 10. Grade I vegetation, dense, persistent, and tall, consists mostly of *Eleocharis* and *Eryngium*, and occurs in regions of the pool that are inundated for six or more months. The soil is deep and the water column is almost completely occluded with vegetation. Open water measures 0-6 cm. Grade II vegetation, dense, non-persistent, and short, consists mostly of 50-70% *Isoetes*, *Orcuttia*, *Pilularia*, and *Marsilea*, and 50-30% *Eleocharis*, *Eryngium*, and *Downingia.* These types occur in regions of the pool that are inundated for 4-6 months, the soil is 3-6 cm deep, and the water column is deep and mostly open measuring 7-30+ cm. Grade III vegetation, sparse, non-persistent, and short, consists of *Isoetes*, *Orcuttia*, *Pilularia*, *Marsilea*, and *Downingia* in combination with areas of exposed bedrock or hardpan. The soil depth is 0-3 cm and the water column is deep and open measuring 7-30+ cm. Spatially, these three grades are distributed across the pool bottom in varying patterns having either distinct boundaries or fuzzy transition zones. This spatial distribution is strongly influenced by the pool bottom substrate and location in pool which influences the inundation period. The difference between the maximum elevation of pool surface water and the top of the canopy of the vegetation grade results in a measure of the depth of the open water column. In our observations, variations in these components are correlated with greater or lesser densities of branchiopods.

Grades II and III of the vegetation mosaic have the highest branchiopod densities and are the most preferred habitat. Grade I is less preferred. We observed this for both *Linderiella occidentalis* and *Branchinecta lynchi*. The preferred grades also appear to hold true for *Lepidurus packardi*. Rogers (1996) observed that *Eubranchipus bundyi* occurred in sparsely vegetated areas in 30+ cm deep water in Grass Lake, Siskiyou County, California. These four species appear to prefer the conditions of grades two and three, although it is unclear what particular factors of these grades are important.

Since branchiopods are more plentiful in some areas of the pool, random sampling within a pool cannot accurately estimate branchiopod densities because fairy shrimps are not uniformly distributed. With the quantitative sampling method employed we will be able to compute mean density of branchiopods per unit volume of water and correlate this with other pool variables that influence branchiopod distribution. Characterizing the vegetation mosaic and corresponding pool depth may help determine why certain pools harbor particular species with varying densities.

Table 10
Description of Grades Comprising Vegetation Mosaic

Grade	I	II	III
Vegetation Traits	Dense Persistent Tall (20+ cm)	Dense Non-persistent Short (5 cm)	Sparse Non-persistent Short (5 cm)
Length of Inundation	> 6 months	4-6 months	Variable
Species Composition	90% *Eleocharis* 5-10% *Eryngium* 0-5% *Orcuttia* + *Downingia*	50-70% *Isoetes, Orcuttia, Pilularia, Marsilea* 30-50% *Eleocharis, Eryngium, Downingia*	*Isoetes, Orcuttia, Pilularia, Marsilea, Downingia*
Total Cover	90-100%	80-100%	0-30%
Soil Depth	>6 cm	3-6 cm	0-3 cm or exposed bedrock
Depth of Open Water Column above Vegetation	0-6 cm	7-30 cm	7-30+ cm

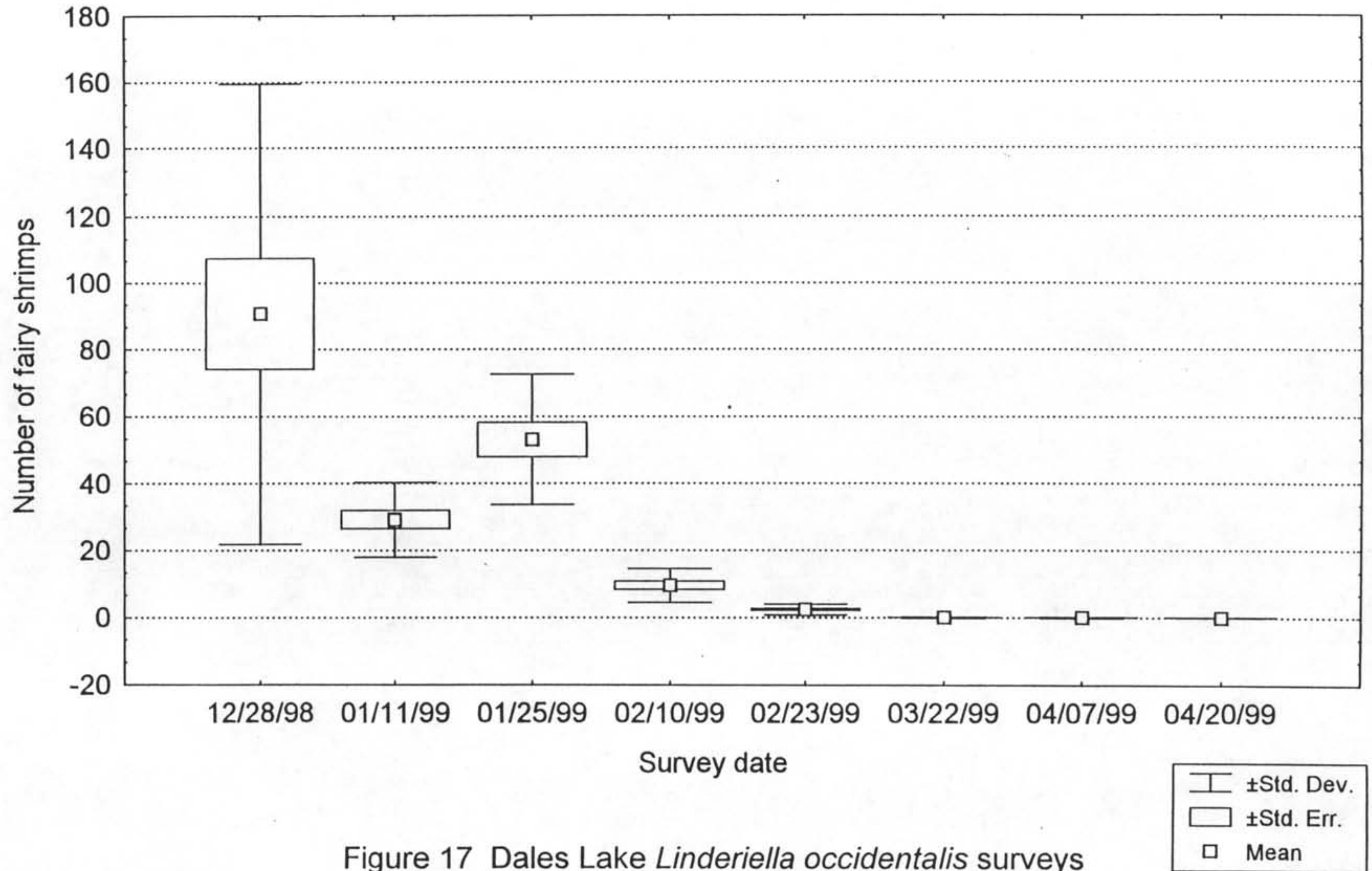

Figure 17 Dales Lake *Linderiella occidentalis* surveys

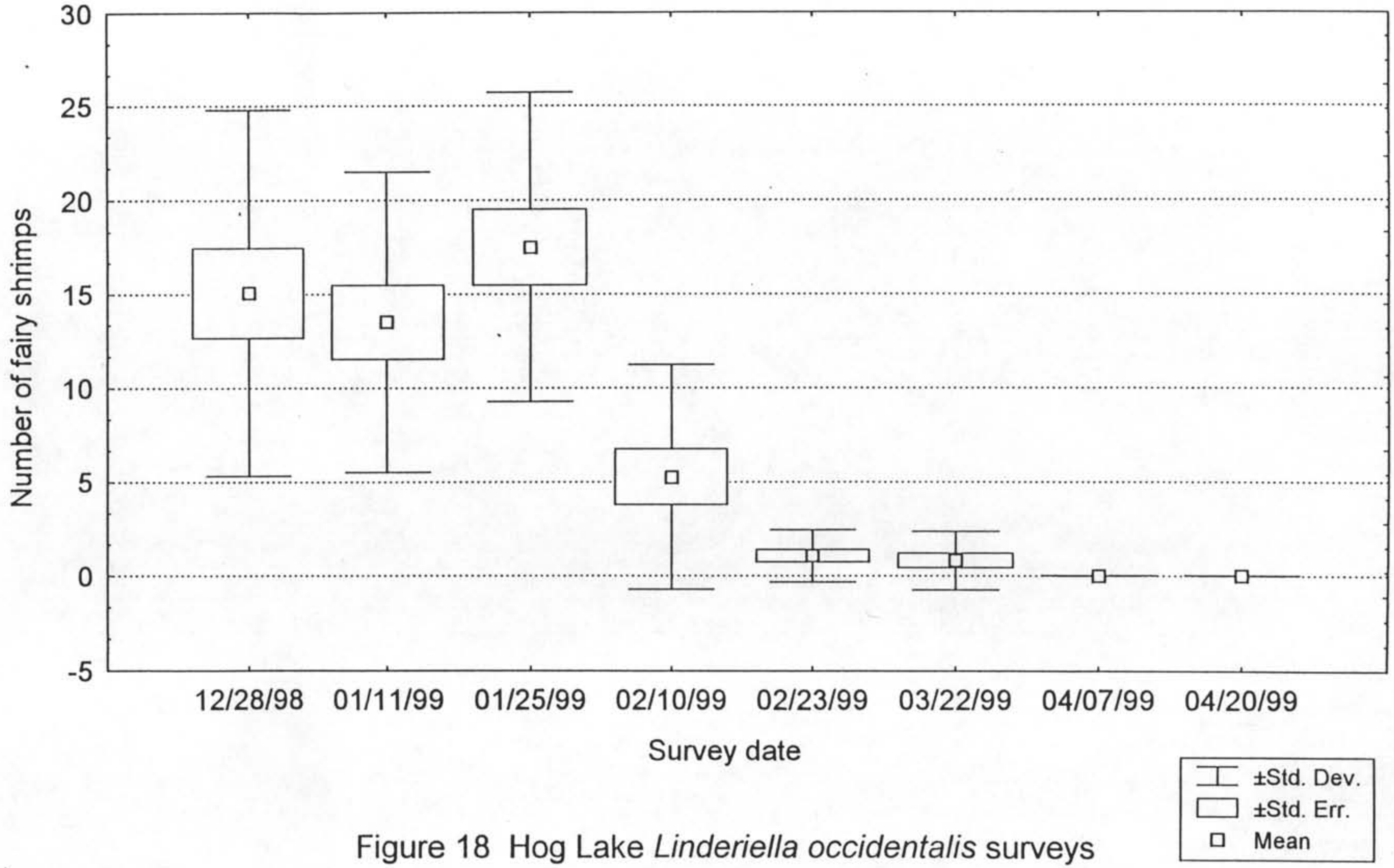

Figure 18 Hog Lake *Linderiella occidentalis* surveys

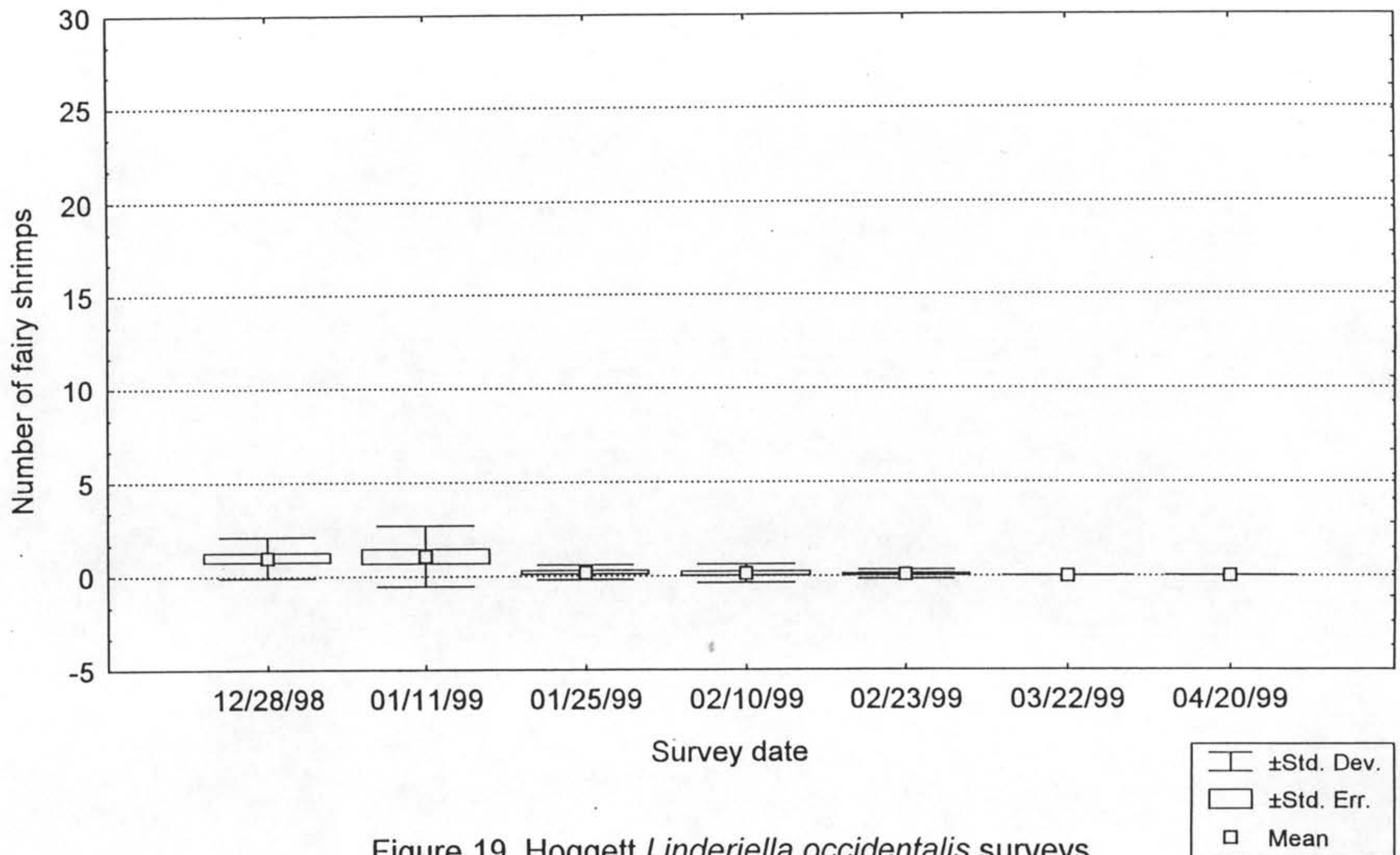

Figure 19 Hoggett *Linderiella occidentalis* surveys

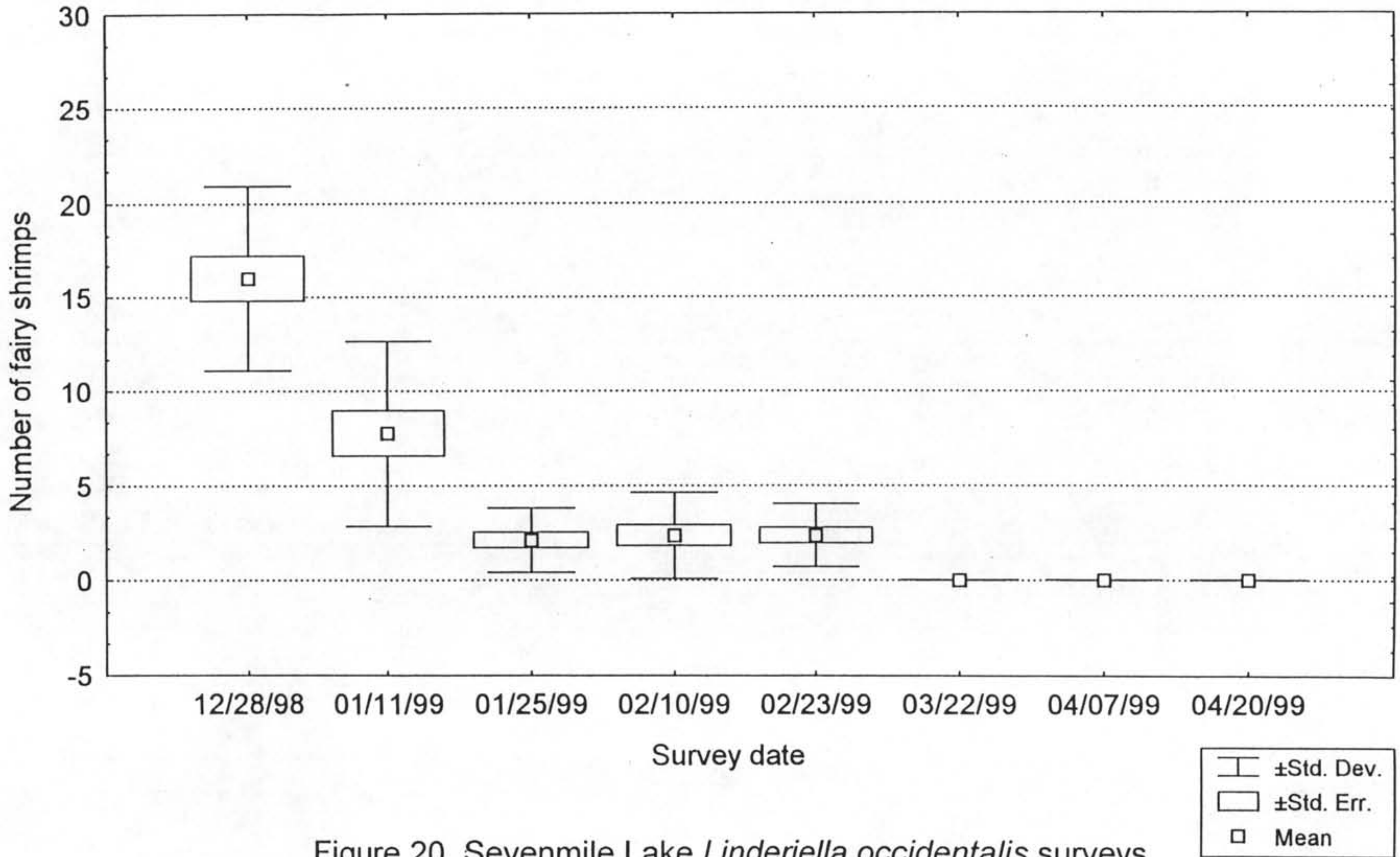

Figure 20 Sevenmile Lake *Linderiella occidentalis* surveys

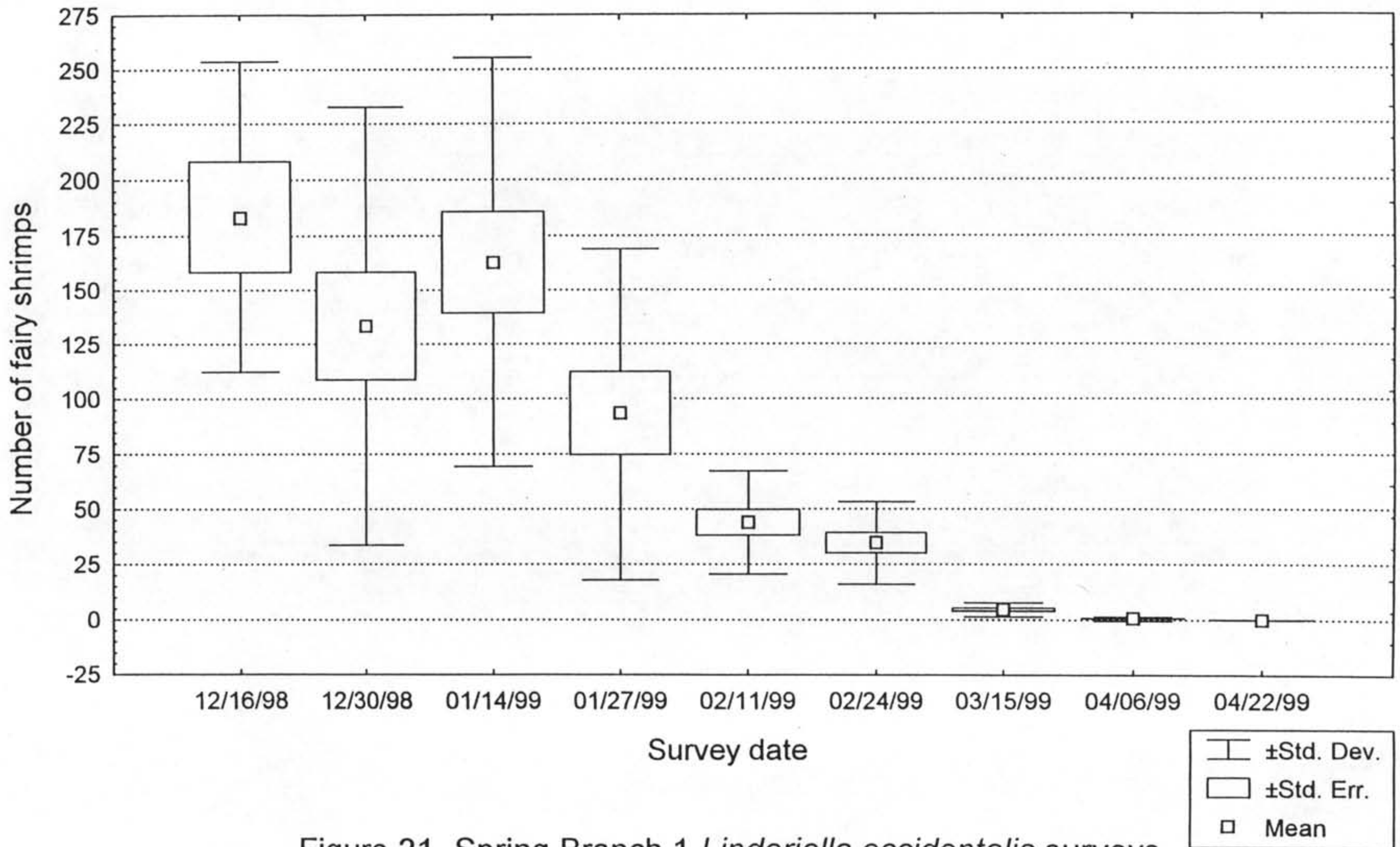

Figure 21 Spring Branch 1 *Linderiella occidentalis* surveys

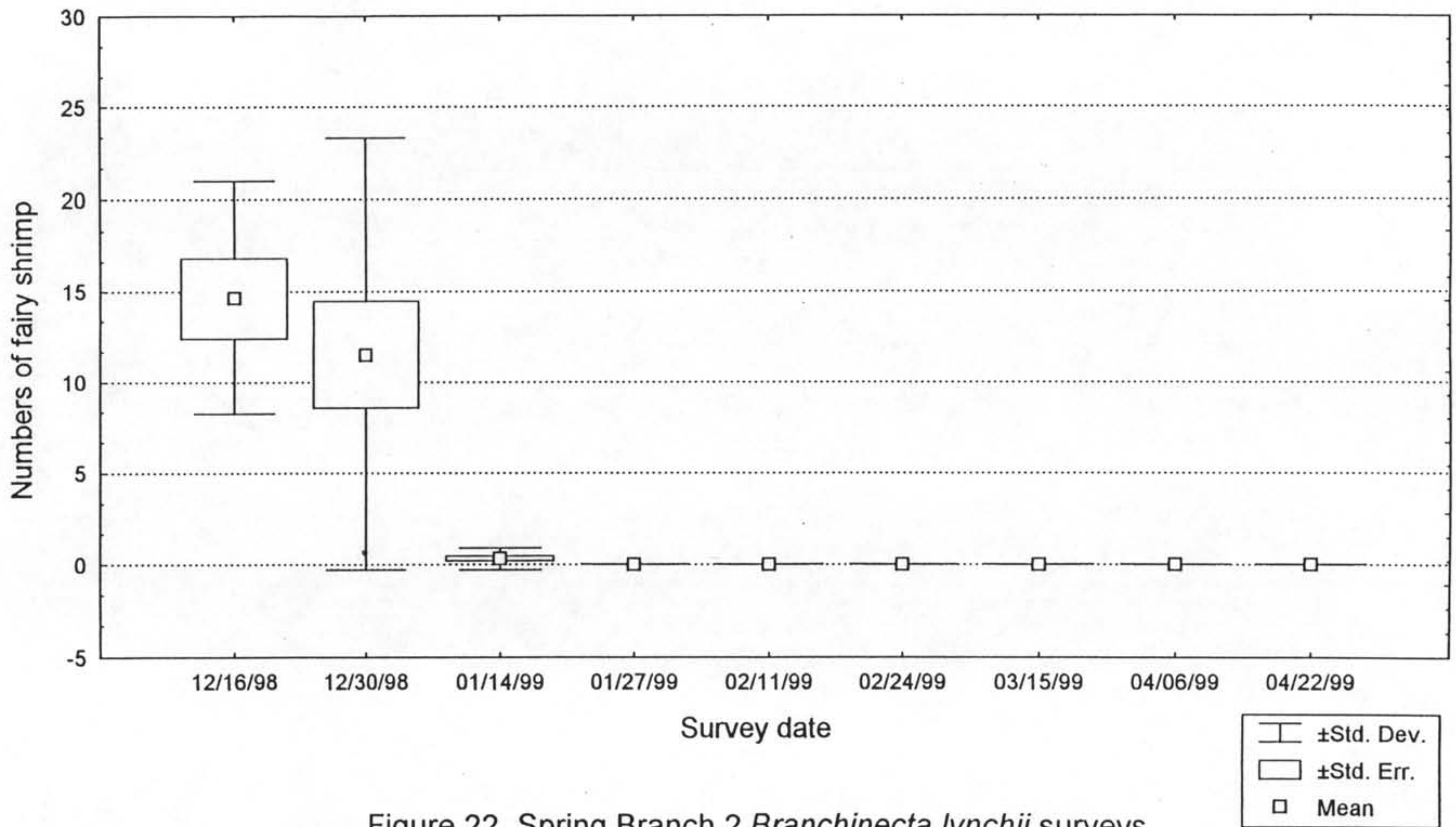

Figure 22 Spring Branch 2 *Branchinecta lynchii* surveys

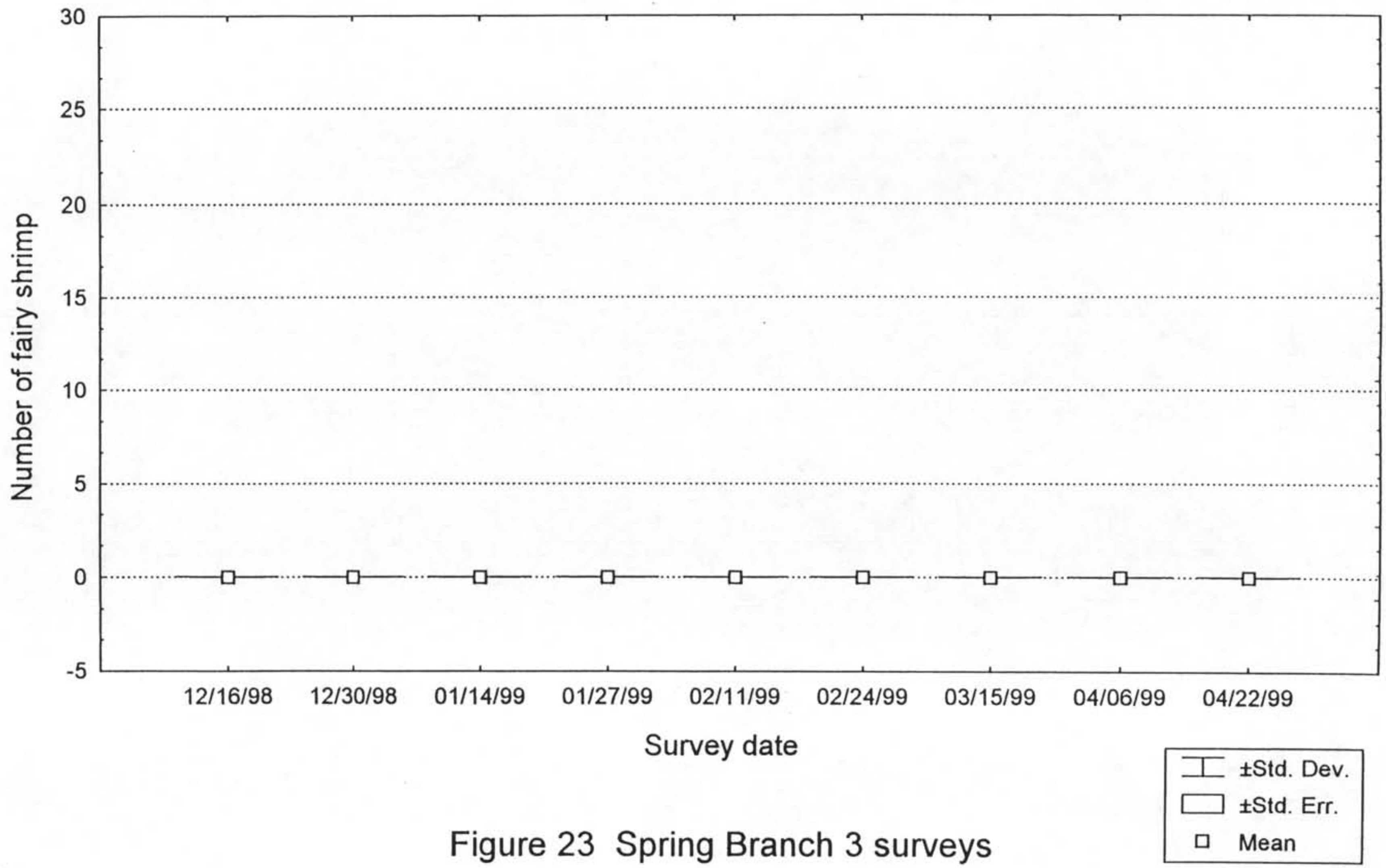

Figure 23 Spring Branch 3 surveys

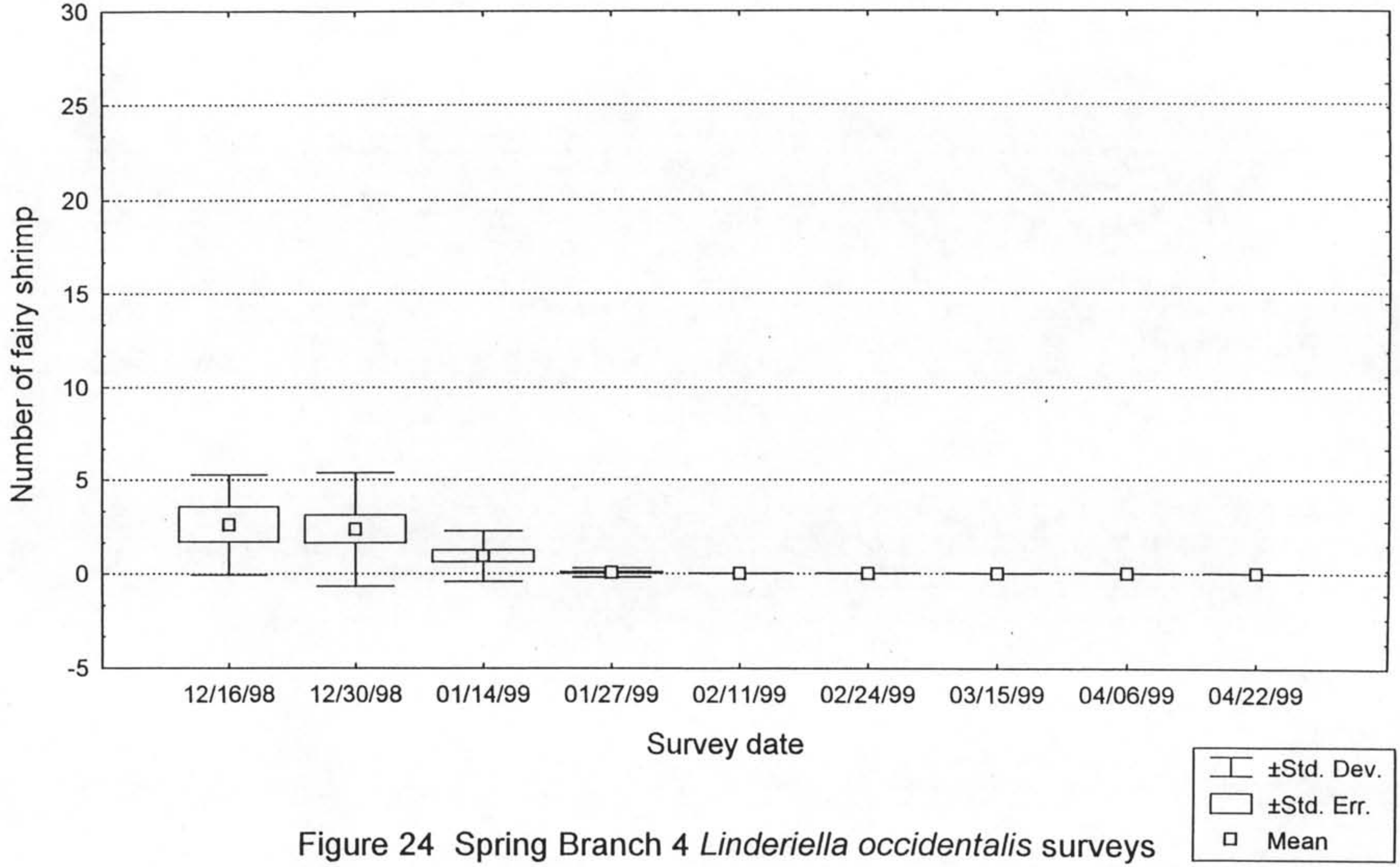

Figure 24 Spring Branch 4 *Linderiella occidentalis* surveys

Vegetation

Results

Vegetation data collection was extensive during the first season with the establishment of over 1300 permanent quadrats in the uplands, wetland flats, and pools. At Dales Lake Ecological Reserve, 22 permanent transects with a total of 704 permanent quadrats were laid out and vegetational data collected (Figure 25). At Hog Lake and Hoggett, five permanent transects of approximately 90 meters each in length have 156 permanent quadrats along them. At Sevenmile Lake, eight permanent transects have 192 permanent quadrats associated with them. In the Spring Branch Plains, eight permanent transects contain the remaining 250 quadrats.

In addition, 325 $2m^2$ quadrats have been monitored for ground squirrel spoils, rock cover, cattle hoof-printing, and dunging. In the upland quadrats, approximately ten plant species have been designated as indicator species for evaluation. In the flats, sixteen indicator plant species are evaluated. Depending upon site conditions, some pools may have varying proportions of indicator species. The total vegetation data collection for the first season was approximately 20,000 individual observations.

The primary goal of the botanical data collection is to determine baseline conditions of the indicator species and follow the compositional changes in vegetation over time. Because these quadrats are read only once per year there are no trends that can be reported following the first year of data collection. In addition, delays in fence installation due to wet weather resulted in only one pasture at Dales Lake being grazed in the spring of 1999. Delays in the finalization of the Environmental Assessment at the Hog Lake Plateau by the Bureau of Land Management have resulted in the collection of only pre-grazing data because no grazing has yet taken place.

Rather than attempt to present a multitude of graphs and summary statistics from the first year of data collection, three graphs of representative data have been included to illustrate the types of data being collected. The examples shown are quadrat readings of transect DN1 upland mounds (Figure 26) and flats (Figure 27) and quadrats along transect DLN19 (Figure 28), all from Dales Lake Ecological Reserve (DLER). The mean, standard error of the mean, and standard deviation of the absolute cover, data collected along these transects are illustrated in Figures 26-28.

The data from the upland mounds (Figure 26) summarizes 16 quadrats. In this particular location *Bromus hordeaceus* (BRHO) is the dominant grass species followed by *Taeniatherum caput-medusae* (TACA), and *Bromus madritensis* ssp. *rubens* (BRMAR). Over 60% of the total cover is composed of these three non-native grasses. The mean bare ground comprises 30% of the quadrats and the remaining 10% is made up of other non-native and native grasses and forbs. The bare ground component on these mounds is typically bare due to ground squirrel spoil piles. Ground squirrels are very active in this area and excavate the upland mounds quite extensively. There is no rock cover on these mounds.

The data from the flats of transect DN1 is shown in Figure 27. In this location *Blennosperma nanum* var. *nanum* (BLNAN) and *Aira caryophyllea* (AICA) dominate the cover, followed by *Brodiaea minor* (BRMI) and *Bromus hordeaceus*. Bare ground has a mean of approximately 25% and a large standard deviation because these flats are frequently saturated during the wet season and excavated by ground squirrels during the dry season. Although the flats have a greater percentage of native indicator species, it is apparent that non-natives (*Aira caryophyllea, Bromus hordeaceus, Taeniatherum caput-medusae*, and *Vulpia myuros* var. *hirsuta* [VUMYH]) make up nearly 40% of the total cover.

Figure 28 shows vegetation data from a typical section of Dales Lake dominated by the State and Federally listed *Orcuttia tenuis* (ORTE). The mean cover of *O. tenuis* here is slightly under 40%. Rock and bare ground occupy approximately 30% and another 15% is made up of *Marsilea vestita* (MAVE), *Eryngium castrense* (ERCA), *Eleocharis macrostachya* (ELMA) and *Damasonium californicum* (DACA). The last 15% is comprised primarily of *Isoetes* spp. and a few other species in trace amounts that are not among the indicator species.

Data on two special status plant species, *Sagittaria sanfordii* and *Paronychia ahartii,* have been collected but no trends are apparent in this first year of data. One half of each pair of *Paronychia* plots were burned in 1999. None of the *Paronychia* plots have been grazed. The data collected in 2000 will indicate whether the burning had any effect on the *Paronychia* population in the subsequent year. *Legenere limosa* and *Gratiola heterosepala* were surprisingly and conspicuously absent from all vernal pool transects read in 1999.

Discussion

This project was started at a favorable time because both Dales Lake Ecological Reserve and Hog Lake Plateau containing Hog Lake and Hoggett have been free of grazing and burning impacts for six and five years, respectively. Therefore, the pools and surrounding uplands are showing the results of complete grazing exclusion. In contrast, the parcels surrounding Sevenmile Lake and the Spring Branch Plains pools have been grazed consistently for many years. The contrasting data sets may provide interesting results particularly in light of the suggested pool groupings and types that are emerging as a result of the water quality and branchiopod monitoring. Once the second year of plant data can be analyzed and compared with the first year data, it may be possible to have a better determination on the variability within quadrats and among adjacent quadrats, and between quadrats sets on a transect.

The monitoring of the special status plant species is difficult due to the widely divergent habit of each special status species. *Orcuttia tenuis* and *Paronychia ahartii* are easily monitored as part of the transect layout or with special monitoring plots. We are testing a method to monitor *Sagittaria sanfordii* that will require at least two years of data to determine whether the method will work. *Gratiola heterosepala* did not appear within the 1999 transects although they cross habitable sites within the pool. A special monitoring protocol may need to be instigated for this taxon. *Legenere limosa* is the most difficult to discern floating within a tangle of vernal pool vegetation. A special monitoring plan will be implemented if a repeatable method can be developed.

In laying out the transects for these vernal pools, the observed vegetational mosaic was considered important to vegetational dynamics to an unknown degree. Following the first year of vegetation data collection the importance of the vegetational mosaic is still unknown. The branchiopod data, however, suggests this mosaic may be important to fairy shrimps as well.

Grazing impacts are important for maintaining higher levels of species diversity and in the creation and maintenance of macro-patterns and micro-patterns of vegetational composition and distribution (Bakker 1998). This is the vegetational mosaic. The questions surrounding the structure and maintenance of the mosaic are part of this project by determining whether certain native or non-native species are increasing in the absence of grazing and whether indicator plant diversity is declining over time. If grazing can be used to retard or reverse the increase of these dominant species then the vegetational mosaic can be maintained in the pool and in the surrounding habitat. If the branchiopods are being positively influenced by the vegetational mosaic then maintenance of this mosaic may be beneficial to maintenance of their populations over time.

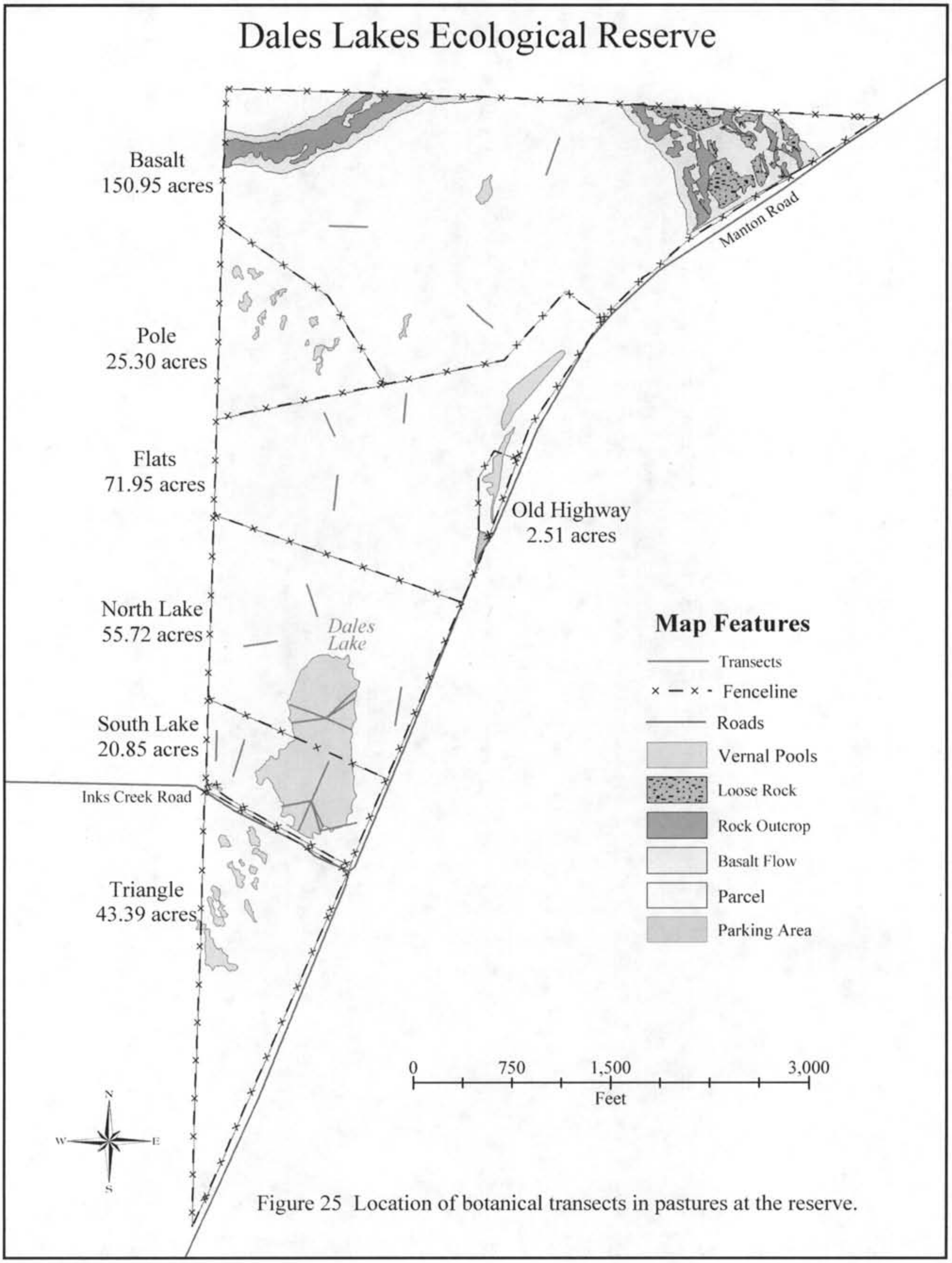

Figure 25 Location of botanical transects in pastures at the reserve.

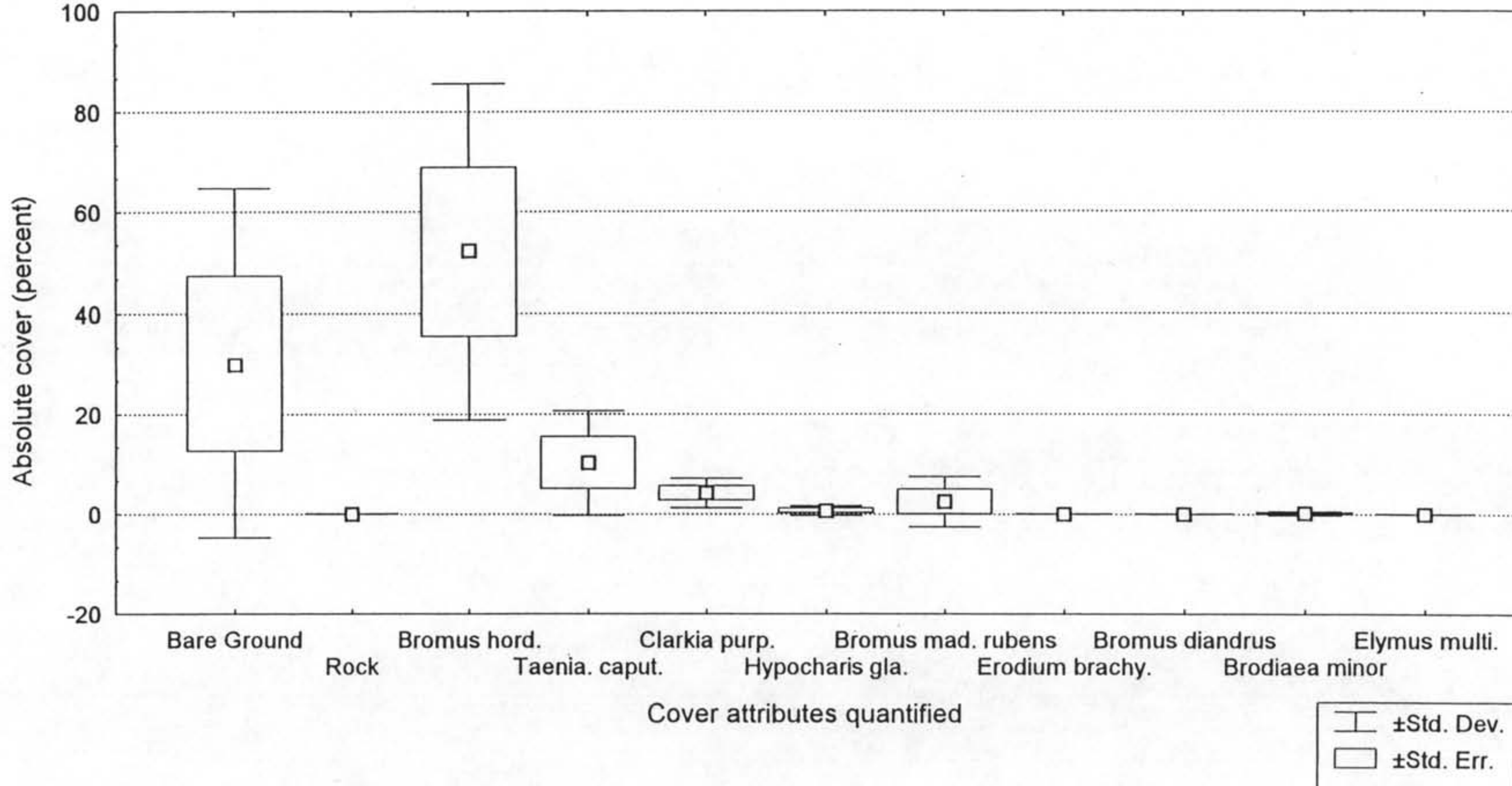

Figure 26 Dales Lake, Transect DN1, upland mounds

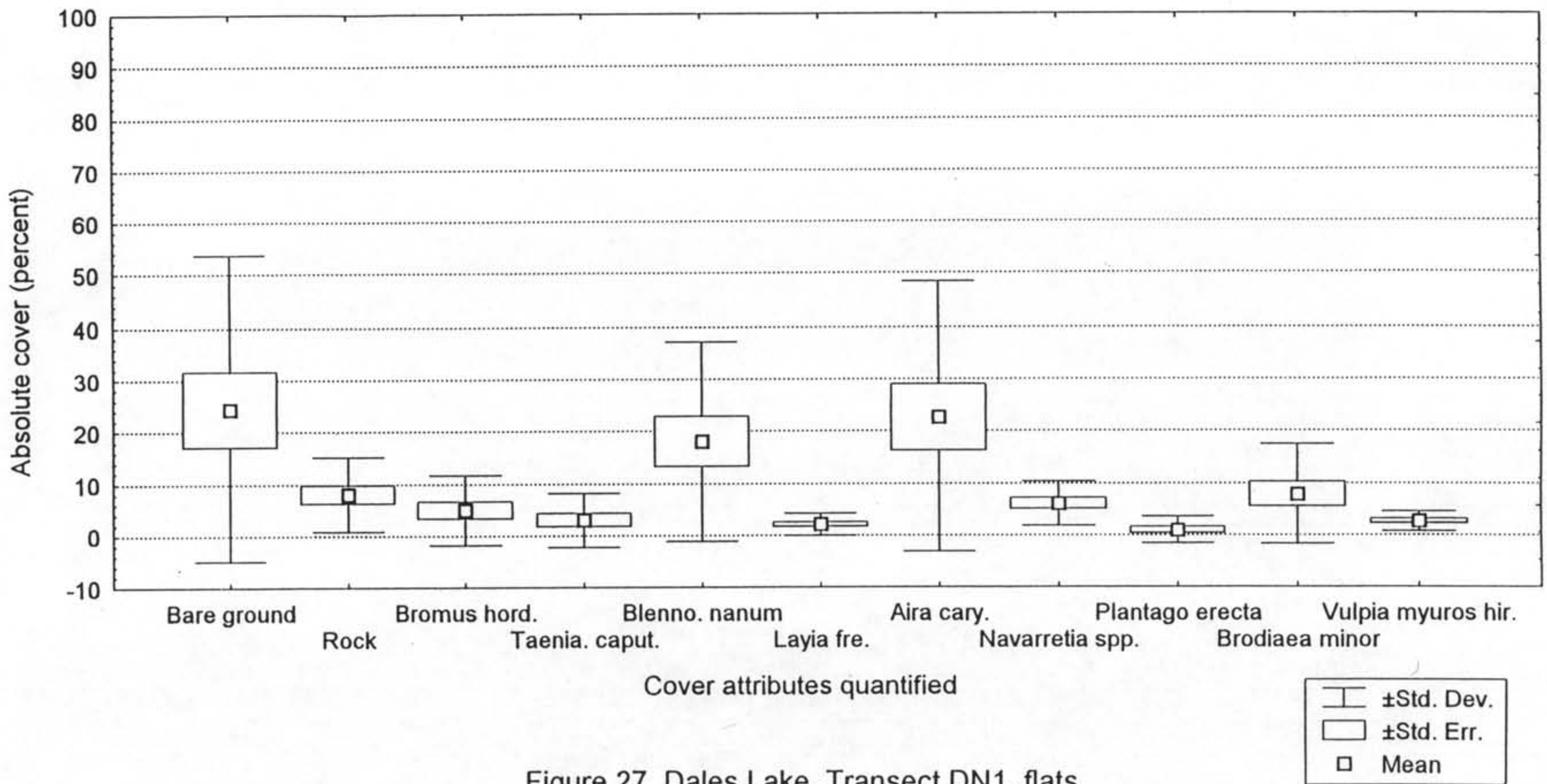

Figure 27 Dales Lake, Transect DN1, flats

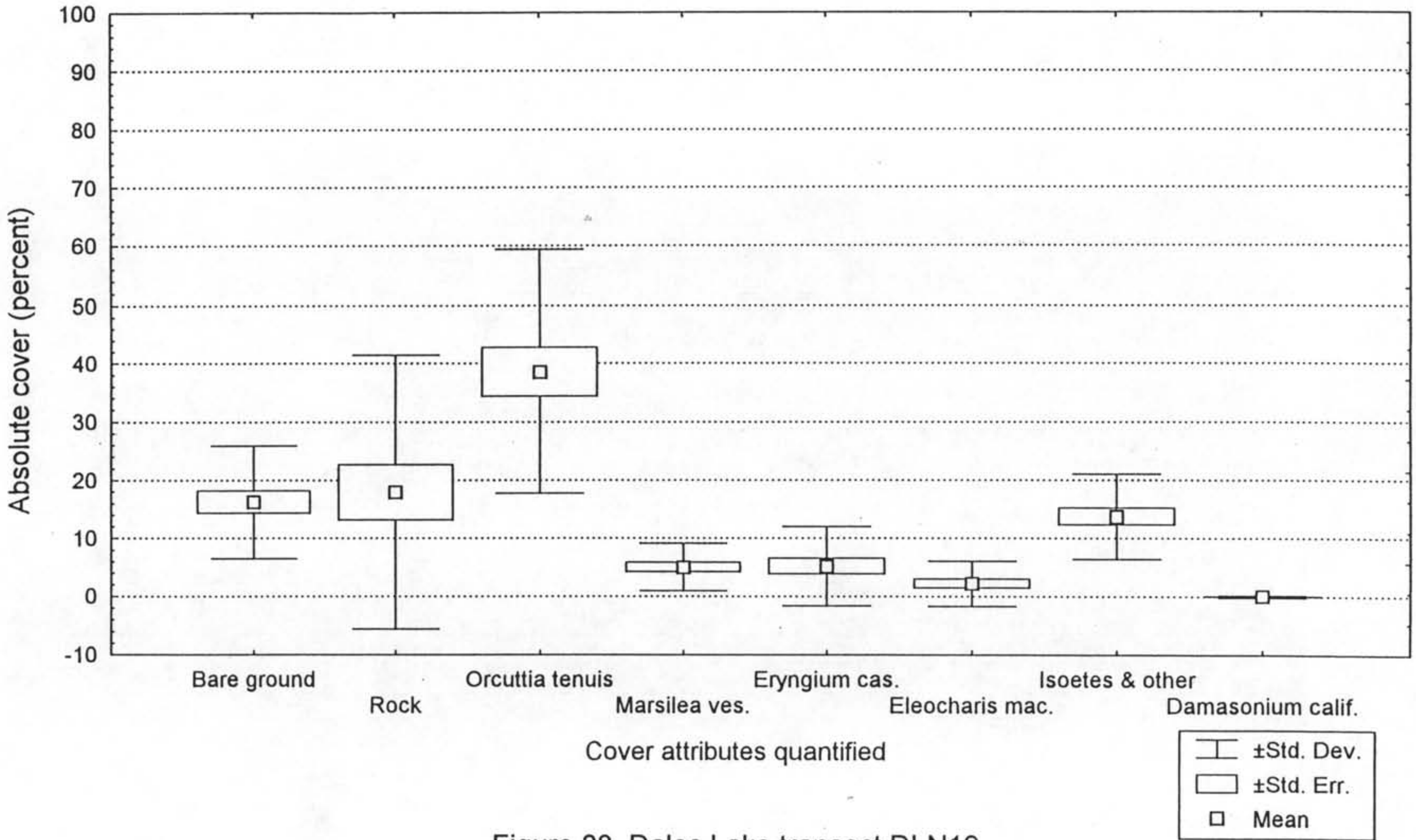

Figure 28 Dales Lake transect DLN19

Grazing and Fire

Results

The amount of grazing that was implemented in 1999 was less than originally planned. Rain delays in the late summer and fall of 1998 disrupted the formation of pastures at Dales Lake Ecological Reserve. Also, the Bureau of Land Management Hog Lake Plateau parcels containing Hog Lake and Hoggett were not grazed as was originally anticipated. Therefore, no results from the effects of grazing on the vegetation transects will be available until the data of 2000 are analyzed in conjunction with the 1999 data set. Because grazing occurs around the pools after the branchiopods have declined, the cattle are likely to have little or no impact upon the swimming phase of the vernal pool branchiopods.

A prescribed burn was implemented at Dales Lake Ecological Reserve in June 1999. The botanical data was collected prior to the burn. In August 1999 at Hog Lake Plateau, a wildfire burned the surrounding uplands and pools of both Hog Lake and Hoggett. At Spring Branch Plains a wildfire burned the surrounding uplands and partially burned Spring Branch 1 and Spring Branch 2. The botanical data was collected before either of these burns. Thus the pre-burn data from 1999 will be particularly interesting when compared to the post-burn 2000 data. This is also a unique opportunity to determine if branchiopod populations are adversely affected when fires burn through dry vernal pools.

Discussion

Although the grazing experiments and monitoring did not occur as planned in 1999, the prescribed burns and unforeseen wildfires added an unexpected dimension to this project. Records have not been searched to determine when Hog Lake, Hoggett, Spring Branch 1 and Spring Branch 2 were last burned by wildfires. The grazing that was implemented appears to have been successful in the reduction of *Taeniatherum caput-medusae* and many other non-native annual grasses. Whether the continued application of grazing and/or burning can sustain the reduction and lead to control and an increase of native species remains to be seen.

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Appendix 1: List of Project Pool Names and Their Geographical Areas

Pool Name	Geographical Area	Owner/Manager
Dales Lake	Dales Lake Ecological Reserve	Department of Fish and Game
Halfpint	Dales Lake Ecological Reserve	Department of Fish and Game
Hog Lake	Hog Lake Plateau	Bureau of Land Management
Hoggett	Hog Lake Plateau	Bureau of Land Management
Sevenmile Lake	Hog Lake Plateau	Bureau of Land Management
Spring Branch 1	Spring Branch Plains	Bureau of Land Management
Spring Branch 2	Spring Branch Plains	Bureau of Land Management
Spring Branch 3	Spring Branch Plains	Bureau of Land Management
Spring Branch 4	Spring Branch Plains	Bureau of Land Management

Appendix 2: Definitions of Acronyms used in Figures 26-28.

AICA	*Aira caryophyllea*
BG	Bare ground
BLNANA	*Blennosperma nanum* var. *nanum*
BRDI	*Bromus diandrus*
BRHO	*Bromus hordeaceus*
BRMARU	*Bromus madritensis* ssp. *rubens*
BRMI	*Brodiaea minor*
CLPU	*Clarkia purpurea*
DACA	*Damasonium californicum*
ELMA	*Eleocharis macrostachya*
ELMU	*Elymus multisetus*
ERBR	*Erodium brachycarpum*
ERCA	*Eryngium castrense*
HYGL	*Hypocharis glabra*
IS&oth	*Isoetes* spp. and *Pilularia* spp.
LAFR	*Layia fremontii*
MAVE	*Marsilea vestita*
NAspp	*Navarretia* spp.
ORTE	*Orcuttia tenuis*
PLER	*Plantago erecta*
TACA	*Taeniatherum caput-medusae*
VUMYHI	*Vulpia myuros* var. *hirsuta*

APPENDIX 3

Indicator Plant Species Selected for Monitoring

Native Species

Blennosperma nanum
Brodiaea minor
Chlorogalum angustifolium
Clarkia purpurea ssp. *quadrivulnera*
Damasonium californicum
Deschampsia danthonioides
Downingia bicornuta
Downingia cuspidata
Eleocharis macrostachya
Elymus multisetus
Gastridium ventricosum
Gratiola heterosepala
Hemizonia fitchii
Isoetes spp.
Lasthenia fremontii
Lasthenia californica
Lasthenia glaberrima
Layia fremontii
Legenere limosa
Marsilea vestita ssp. *vestita*
Navarretia heterandra
Navarretia intertexta ssp. *intertexta*
Navarretia leucocephala ssp. *leucocephala*
Orcuttia tenuis
Paronychia ahartii
Plantago erecta
Plagiobothrys stipitatus var. *micranthus*
Poa secunda var. *secunda*
Pogogyne zizyphoroides
Sagittaria sanfordii

Non-native Plant Species

Aira caryophyllea
Avena barbata
Avena fatua
Avena sativa
Bromus hordeaceus
Bromus japonicus
Bromus madritensis var. *rubrens*
Erodium botrys
Erodium brachycarpum
Erodium cicutarium
Hypocharis glabra
Lolium multiflorum
Poa bulbosa
Rumex crispus
Taeniatherum caput-medusae
Trifolium hirtum
Vulpia bromoides
Hordeum marinum ssp. *gussoneanum*
Vulpia myuros var. *hirsuta*

APPENDIX 4

Acronyms used in vegetation figures

AS	*Alopecurus saccatus*
BG	Bare ground
DD	*Deschampsia danthonioides*
DMCA	*Damasonium californicum*
DOCU	*Downingia cuspidata*
EMC	*Eleocharis macrostachya*
EC	*Eryngium castrense*
GV	*Gastridium ventriculosum*
LM	*Lolium multiflorum*
MV	*Marsilea vestita*
N	*Navarretia* spp.
O	Other (in vernal pools predominantly *Isoetes* spp. and *Pilularia* spp.)
OT	*Orcuttia tenuis*
P	*Poa sp.*
R	Rock Cover
SS	*Sagittaria sanfordii*
TC	*Taeniatherum caput-medusae*

APPENDIX 5

Vegetation Zone Data

Vegetation Data for Dales Lake North Transects
(See Appendix 4 for codes to column headings.)

TRANS	DATE	QUAD	SEC	BG	R	OT	EMC	MV	AS	PT	C	P	DMCA	DD	DOCU	GV	N	O	SS	EC	0
DLN22	8/11/1999	Z1	Z1E	20	0	15	44	1	0	0	0	0	0	0	0	0	0	10	0	10	100
DLN22	8/11/1999	Z1	Z1N	25	0	3	30	2	0	0	0	0	0	0	0	0	0	34	0	6	100
DLN22	8/11/1999	Z1	Z1S	15	0	15	49	4	0	0	0	0	0	0	0	0	0	10	0	7	100
DLN22	8/11/1999	Z1	Z1W	20	0	12	58	0	0	0	0	0	0	0	0	0	0	5	0	5	100
DLN22	8/11/1999	Z2	Z2E	15	0	20	0	20	0	0	0	0	0	0	0	0	0	30	0	15	100
DLN22	8/11/1999	Z2	Z2N	5	5	20	15	10	0	0	0	0	0	0	0	0	0	45	0	0	100
DLN22	8/11/1999	Z2	Z2S	5	0	20	0	20	0	0	0	0	0	0	0	0	0	35	0	20	100
DLN22	8/11/1999	Z2	Z2W	10	0	5	0	15	0	0	0	0	1	0	0	0	0	49	0	20	100
DLN22	8/11/1999	Z3	Z3E	15	0	40	20	3	0	0	0	0	0	0	0	0	0	12	0	10	100
DLN22	8/11/1999	Z3	Z3N	15	1	30	7	5	0	0	0	0	0	0	0	0	0	34	0	8	100
DLN22	8/11/1999	Z3	Z3S	15	8	30	10	7	0	0	0	0	0	0	0	0	0	27	0	3	100
DLN22	8/11/1999	Z3	Z3W	15	5	25	0	10	0	0	0	0	0	0	0	0	0	40	0	5	100
DLN22	8/11/1999	Z4	Z4E	15	8	40	0	12	0	0	0	0	0	0	0	0	0	22	0	3	100
DLN22	8/11/1999	Z4	Z4N	20	8	40	0	5	0	0	0	0	0	0	0	0	0	22	0	5	100
DLN22	8/11/1999	Z4	Z4S	15	3	50	0	8	0	0	0	0	0	0	0	0	0	19	0	5	100
DLN22	8/11/1999	Z4	Z4W	20	5	55	0	10	0	0	0	0	0	0	0	0	0	0	0	10	100
DLN22	8/11/1999	Z5	Z5E	5	75	15	0	1	0	0	0	0	0	0	0	0	0	4	0	0	100
DLN22	8/11/1999	Z5	Z5N	39	30	20	0	1	0	0	0	0	0	0	0	0	0	10	0	0	100
DLN22	8/11/1999	Z5	Z5S	19	50	20	0	1	0	0	0	0	0	0	0	0	0	10	0	0	100
DLN22	8/11/1999	Z5	Z5W	24	40	20	0	1	0	0	0	0	0	0	0	0	0	15	0	0	100
DLN22	8/11/1999	Z6	Z6E	67	20	3	0	1	0	0	0	0	0	0	0	0	0	9	0	0	100
DLN22	8/11/1999	Z6	Z6N	57	25	2	0	1	0	0	0	0	0	0	0	0	0	15	0	0	100
DLN22	8/11/1999	Z6	Z6S	57	25	1	0	2	0	0	0	0	0	0	0	0	0	15	0	0	100
DLN22	8/11/1999	Z6	Z6W	58	30	1	0	1	0	0	0	0	0	0	0	0	0	10	0	0	100
DLN22	7/19/2000	Z1	Z1E	30	0	0	44	0	0	0	0	0	0	0	0	0	0	10	1	15	100
DLN22	7/19/2000	Z1	Z1N	25	0	0	66	1	0	0	0	0	0	0	1	0	0	0	2	5	100
DLN22	7/19/2000	Z1	Z1S	25	0	0	44	0	0	0	0	0	0	0	0	0	0	15	1	15	100
DLN22	7/19/2000	Z1	Z1W	25	0	0	64	0	0	0	0	0	2	0	0	0	0	5	1	3	100
DLN22	7/19/2000	Z2	Z2E	20	0	0	1	1	0	0	0	0	0	0	0	0	0	74	0	4	100
DLN22	7/19/2000	Z2	Z2N	10	5	3	56	0	0	0	0	0	0	0	0	0	0	25	0	1	100
DLN22	7/19/2000	Z2	Z2S	20	0	0	0	1	0	0	0	0	0	0	1	0	0	75	1	2	100
DLN22	7/19/2000	Z2	Z2W	20	4	5	20	1	0	0	0	0	0	0	0	0	0	46	0	4	100
DLN22	7/19/2000	Z3	Z3E	5	0	55	5	0	0	0	0	0	0	0	0	0	0	20	0	15	100
DLN22	7/19/2000	Z3	Z3N	10	5	53	5	2	0	0	0	0	0	0	0	0	0	20	0	5	100
DLN22	7/19/2000	Z3	Z3S	10	3	51	5	0	0	0	0	0	1	0	0	0	0	20	0	10	100
DLN22	7/19/2000	Z3	Z3W	10	10	55	0	0	0	0	0	0	0	0	0	0	0	20	0	5	100
DLN22	7/19/2000	Z4	Z4E	15	10	60	0	0	0	0	0	0	3	0	0	0	0	7	0	5	100
DLN22	7/19/2000	Z4	Z4N	20	12	50	0	2	0	0	0	0	1	0	0	0	0	12	0	3	100
DLN22	7/19/2000	Z4	Z4S	15	5	68	0	0	0	0	0	0	2	0	0	0	0	7	0	3	100
DLN22	7/19/2000	Z4	Z4W	12	1	60	0	3	0	0	0	0	0	0	0	0	0	20	0	4	100
DLN22	7/19/2000	Z5	Z5E	12	70	8	0	5	0	0	0	0	0	0	0	0	0	5	0	0	100

DLN22	7/19/2000	Z5	Z5N	14	70	12	0	1	0	0	0	0	0	0	0	0	0	3	0	0	100
DLN22	7/19/2000	Z5	Z5S	20	50	20	0	5	0	0	0	0	1	0	0	0	0	4	0	0	100
DLN22	7/19/2000	Z5	Z5W	17	60	15	0	3	0	0	0	0	0	0	0	0	0	5	0	0	100
DLN22	7/19/2000	Z6	Z6E	15	25	2	0	10	0	0	0	0	0	0	0	0	0	45	0	3	100
DLN22	7/19/2000	Z6	Z6N	25	15	1	0	8	0	0	0	0	0	0	0	0	0	50	0	1	100
DLN22	7/19/2000	Z6	Z6S	10	30	1	0	10	0	0	0	0	0	0	0	0	2	41	0	6	100
DLN22	7/19/2000	Z6	Z6W	15	25	0	0	5	0	0	0	0	0	0	0	0	2	48	0	5	100
DLN22	7/17/2001	Z1	Z1E	30	0	10	44	0	0	0	0	0	0	0	0	0	0	10	1	5	100
DLN22	7/17/2001	Z1	Z1N	30	0	10	38	0	0	0	0	0	2	0	0	0	0	10	0	10	100
DLN22	7/17/2001	Z1	Z1S	30	0	10	41	0	0	0	0	0	1	0	0	0	0	10	0	8	100
DLN22	7/17/2001	Z1	Z1W	25	0	5	59	0	0	0	0	0	1	0	0	0	0	5	0	5	100
DLN22	7/17/2001	Z2	Z2E	15	0	34	1	0	0	0	0	0	0	0	0	0	0	30	0	20	100
DLN22	7/17/2001	Z2	Z2N	5	5	55	5	0	0	0	0	0	0	0	0	0	0	25	0	5	100
DLN22	7/17/2001	Z2	Z2S	25	8	31	1	0	0	0	0	0	0	0	0	0	0	25	0	10	100
DLN22	7/17/2001	Z2	Z2W	10	4	41	10	0	0	0	0	0	0	0	0	0	0	25	0	10	100
DLN22	7/17/2001	Z3	Z3E	10	1	54	10	0	0	0	0	0	0	0	0	0	0	20	0	5	100
DLN22	7/17/2001	Z3	Z3N	0	3	63	2	0	0	0	0	0	0	0	0	0	0	30	0	2	100
DLN22	7/17/2001	Z3	Z3S	5	5	60	5	1	0	0	0	0	0	0	0	0	0	20	0	4	100
DLN22	7/17/2001	Z3	Z3W	10	3	63	1	0	0	0	0	0	0	0	0	0	0	20	0	3	100
DLN22	7/17/2001	Z4	Z4E	5	20	55	0	2	0	0	0	0	1	0	0	0	0	11	0	6	100
DLN22	7/17/2001	Z4	Z4N	10	40	42	0	0	0	0	0	0	0	0	0	0	0	5	0	3	100
DLN22	7/17/2001	Z4	Z4S	10	45	27	0	4	0	0	0	0	0	0	0	0	0	10	0	4	100
DLN22	7/17/2001	Z4	Z4W	15	30	42	0	3	0	0	0	0	0	0	0	0	0	5	0	5	100
DLN22	7/17/2001	Z5	Z5E	6	60	10	0	10	0	0	0	0	0	0	0	0	0	14	0	0	100
DLN22	7/17/2001	Z5	Z5N	5	50	15	0	5	0	0	0	0	0	0	0	0	0	25	0	0	100
DLN22	7/17/2001	Z5	Z5S	5	55	10	0	6	0	0	0	0	0	0	0	0	0	24	0	0	100
DLN22	7/17/2001	Z5	Z5W	10	40	10	0	4	0	0	0	0	0	0	0	0	0	36	0	0	100
DLN22	7/17/2001	Z6	Z6E	30	15	0	0	15	0	0	0	0	0	0	0	0	10	25	0	5	100
DLN22	7/17/2001	Z6	Z6N	42	20	0	0	10	0	0	0	0	0	0	0	0	4	20	0	4	100
DLN22	7/17/2001	Z6	Z6S	20	40	0	0	15	0	0	0	0	0	0	0	0	8	15	0	2	100
DLN22	7/17/2001	Z6	Z6W	30	45	0	0	5	0	0	0	0	0	0	0	0	10	9	0	1	100
DLN22	8/21/2003	Z1	Z1E	40	0	3	10	0	0	0	0	0	0	0	0	0	0	17	0	30	100
DLN22	8/21/2003	Z1	Z1N	35	0	8	15	0	0	0	0	0	2	0	0	0	0	3	12	25	100
DLN22	8/21/2003	Z1	Z1S	50	0	2	12	0	0	0	0	0	0	0	0	0	0	9	2	25	100
DLN22	8/21/2003	Z1	Z1W	40	0	4	18	0	0	0	0	0	0	0	0	0	0	8	10	20	100
DLN22	8/21/2003	Z2	Z2E	68	0	0	2	0	0	0	0	0	0	0	0	0	0	12	0	18	100
DLN22	8/21/2003	Z2	Z2N	51	10	0	5	10	0	0	0	0	0	0	0	0	0	12	0	12	100
DLN22	8/21/2003	Z2	Z2S	76	0	0	1	0	0	0	0	0	0	0	0	0	0	10	3	10	100
DLN22	8/21/2003	Z2	Z2W	65	6	0	2	0	0	0	0	0	0	0	0	0	0	15	0	12	100
DLN22	8/21/2003	Z3	Z3E	10	2	40	0	0	0	0	0	0	0	0	0	0	0	33	0	15	100
DLN22	8/21/2003	Z3	Z3N	5	2	40	0	0	0	0	0	0	0	0	0	0	0	43	0	10	100
DLN22	8/21/2003	Z3	Z3S	20	18	35	0	0	0	0	0	0	0	0	0	0	0	12	0	15	100
DLN22	8/21/2003	Z3	Z3W	8	5	50	0	0	0	0	0	0	0	0	0	0	0	33	0	4	100
DLN22	8/21/2003	Z4	Z4E	4	10	10	0	0	0	0	0	0	0	0	0	0	0	51	0	25	100
DLN22	8/21/2003	Z4	Z4N	35	10	10	0	6	0	0	0	0	0	0	0	0	0	24	0	15	100
DLN22	8/21/2003	Z4	Z4S	10	15	25	0	0	0	0	0	0	0	0	0	0	0	45	0	5	100

DLN22	8/21/2003	Z4	Z4W	10	3	13	0	4	0	0	0	0	0	0	0	0	0	45	0	25	100
DLN22	8/21/2003	Z5	Z5E	5	55	25	0	8	0	0	0	0	0	0	0	0	0	7	0	0	100
DLN22	8/21/2003	Z5	Z5N	5	45	40	0	5	0	0	0	0	0	0	0	0	0	5	0	0	100
DLN22	8/21/2003	Z5	Z5S	5	40	47	0	3	0	0	0	0	0	0	0	0	0	5	0	0	100
DLN22	8/21/2003	Z5	Z5W	8	35	50	0	2	0	0	0	0	0	0	0	0	0	5	0	0	100
DLN22	8/21/2003	Z6	Z6S	35	45	5	0	10	0	0	0	0	0	0	0	0	1	0	0	4	100
DLN22	8/21/2003	Z6	Z6N	40	40	10	0	5	0	0	0	0	0	0	0	0	0	4	0	1	100
DLN22	8/21/2003	Z6	Z6E	31	25	25	0	5	0	0	0	0	0	0	0	0	2	10	0	2	100
DLN22	8/21/2003	Z6	Z6W	50	30	2	0	5	0	0	0	0	0	0	0	0	0	8	0	5	100
DLN21	8/10/1999	Z1	Z1E	5	0	25	8	10	0	0	0	0	0	0	0	0	0	49	0	3	100
DLN21	8/10/1999	Z1	Z1N	43	0	5	15	8	0	0	0	0	0	0	0	0	0	25	0	4	100
DLN21	8/10/1999	Z1	Z1S	3	0	30	6	10	0	0	0	0	0	0	0	0	0	45	0	6	100
DLN21	8/10/1999	Z1	Z1W	31	0	12	20	5	0	0	0	0	0	0	0	0	0	25	0	7	100
DLN21	8/10/1999	Z2	Z2E	45	0	0	50	1	0	0	0	0	0	0	0	0	0	4	0	0	100
DLN21	8/10/1999	Z2	Z2N	32	0	0	60	0	0	0	0	0	0	0	0	0	0	8	0	0	100
DLN21	8/10/1999	Z2	Z2S	22	0	0	75	0	0	0	0	0	0	0	0	0	0	3	0	0	100
DLN21	8/10/1999	Z2	Z2W	44	0	0	50	0	0	0	0	0	0	0	0	0	0	5	0	1	100
DLN21	8/10/1999	Z3	Z3E	22	6	3	50	8	0	0	0	0	0	0	0	0	0	10	0	1	100
DLN21	8/10/1999	Z3	Z3N	21	0	2	55	10	0	0	0	0	0	0	0	0	0	5	0	7	100
DLN21	8/10/1999	Z3	Z3S	17	0	5	55	6	0	0	0	0	1	0	0	0	0	15	0	1	100
DLN21	8/10/1999	Z3	Z3W	11	0	3	60	15	0	0	0	0	0	0	0	0	0	6	0	5	100
DLN21	8/10/1999	Z4	Z4E	47	10	15	10	5	0	0	0	0	0	0	0	0	0	12	0	1	100
DLN21	8/10/1999	Z4	Z4N	62	3	15	2	6	0	0	0	0	0	0	0	0	0	10	0	2	100
DLN21	8/10/1999	Z4	Z4S	50	2	15	3	4	0	0	0	0	0	0	0	0	0	25	0	1	100
DLN21	8/10/1999	Z4	Z4W	41	6	20	0	7	0	0	0	0	0	0	0	0	0	25	0	1	100
DLN21	8/10/1999	Z5	Z5E	11	55	3	0	25	0	0	0	0	0	0	0	0	0	4	0	2	100
DLN21	8/10/1999	Z5	Z5N	14	50	2	0	25	0	0	0	0	0	0	0	0	0	5	0	4	100
DLN21	8/10/1999	Z5	Z5S	26	30	4	0	35	0	0	0	0	0	0	0	0	0	4	0	1	100
DLN21	8/10/1999	Z5	Z5W	5	59	4	0	25	0	0	0	0	0	0	0	0	0	5	0	2	100
DLN21	8/10/1999	Z6	Z6E	23	65	5	0	2	0	0	0	0	0	0	0	0	0	5	0	0	100
DLN21	8/10/1999	Z6	Z6N	60	30	4	0	1	0	0	0	0	0	0	0	0	0	5	0	0	100
DLN21	8/10/1999	Z6	Z6S	30	60	4	0	0	0	0	0	0	0	0	0	0	0	6	0	0	100
DLN21	8/10/1999	Z6	Z6W	13	75	6	0	1	0	0	0	0	0	0	0	0	0	5	0	0	100
DLN21	7/19/2000	Z1	Z1E	10	0	4	25	1	0	0	0	0	0	0	0	0	0	58	0	2	100
DLN21	7/19/2000	Z1	Z1N	10	0	3	25	1	0	0	0	0	0	0	0	0	0	56	0	5	100
DLN21	7/19/2000	Z1	Z1S	40	0	3	10	1	0	0	0	0	0	0	0	0	0	41	0	5	100
DLN21	7/19/2000	Z1	Z1W	25	0	6	30	1	0	0	0	0	0	0	0	0	0	33	0	5	100
DLN21	7/19/2000	Z2	Z2E	25	0	0	63	0	0	0	0	0	1	0	1	0	0	0	10	0	100
DLN21	7/19/2000	Z2	Z2N	20	0	0	75	0	0	0	0	0	2	0	1	0	0	0	2	0	100
DLN21	7/19/2000	Z2	Z2S	15	0	0	80	0	0	0	0	0	0	0	0	0	0	0	5	0	100
DLN21	7/19/2000	Z2	Z2W	25	0	0	72	0	0	0	0	0	1	0	1	0	0	0	1	0	100
DLN21	7/19/2000	Z3	Z3E	20	0	10	61	1	0	0	0	0	2	0	1	0	0	0	0	5	100
DLN21	7/19/2000	Z3	Z3N	20	0	0	68	0	0	0	0	0	2	0	0	0	0	0	0	10	100
DLN21	7/19/2000	Z3	Z3S	10	0	10	65	1	0	0	0	0	3	0	1	0	0	9	0	1	100
DLN21	7/19/2000	Z3	Z3W	15	0	0	74	0	0	0	0	0	5	0	0	0	0	0	1	5	100
DLN21	7/19/2000	Z4	Z4E	12	3	62	8	0	0	0	0	0	0	0	0	0	0	10	0	5	100

DLN21	7/19/2000	Z4	Z4N	10	5	64	4	0	0	0	0	0	4	0	0	0	0	10	0	3	100
DLN21	7/19/2000	Z4	Z4S	22	35	32	3	0	0	0	0	0	0	0	0	0	0	4	0	4	100
DLN21	7/19/2000	Z4	Z4W	29	40	20	0	0	0	0	0	0	5	0	0	0	0	5	0	1	100
DLN21	7/19/2000	Z5	Z5E	0	70	19	0	4	0	0	0	0	2	0	0	0	0	0	0	5	100
DLN21	7/19/2000	Z5	Z5N	9	55	25	0	5	0	0	0	0	3	0	0	0	0	0	0	3	100
DLN21	7/19/2000	Z5	Z5S	0	70	19	0	5	0	0	0	0	2	0	0	0	0	0	0	4	100
DLN21	7/19/2000	Z5	Z5W	6	70	18	0	3	0	0	0	0	1	0	0	0	0	0	0	2	100
DLN21	7/19/2000	Z6	Z6E	6	70	16	0	0	0	0	0	0	0	0	0	0	0	8	0	0	100
DLN21	7/19/2000	Z6	Z6N	21	55	20	0	0	0	0	0	0	0	0	0	0	0	4	0	0	100
DLN21	7/19/2000	Z6	Z6S	15	50	15	0	0	0	0	0	0	0	0	0	0	0	20	0	0	100
DLN21	7/19/2000	Z6	Z6W	5	50	22	0	0	0	0	0	0	0	0	0	0	0	23	0	0	100
DLN21	7/17/2001	Z1	Z1E	15	0	35	20	0	0	0	0	0	0	0	0	0	0	20	0	10	100
DLN21	7/17/2001	Z1	Z1N	15	0	39	20	1	0	0	0	0	0	0	0	0	0	20	0	5	100
DLN21	7/17/2001	Z1	Z1S	25	0	40	15	0	0	0	0	0	0	0	0	0	0	15	0	5	100
DLN21	7/17/2001	Z1	Z1W	20	0	35	15	0	0	0	0	0	0	0	0	0	0	20	0	10	100
DLN21	7/17/2001	Z2	Z2E	40	0	0	50	0	0	0	0	0	0	0	0	0	0	5	5	0	100
DLN21	7/17/2001	Z2	Z2N	40	0	0	50	0	0	0	0	0	0	0	0	0	0	5	5	0	100
DLN21	7/17/2001	Z2	Z2S	65	0	0	30	0	0	0	0	0	0	0	0	0	0	0	5	0	100
DLN21	7/17/2001	Z2	Z2W	25	0	0	62	0	0	0	0	0	0	0	0	0	0	0	10	3	100
DLN21	7/17/2001	Z3	Z3E	15	0	3	57	1	0	0	0	0	2	0	0	0	0	20	0	2	100
DLN21	7/17/2001	Z3	Z3N	39	0	2	43	0	0	0	0	0	0	0	0	0	0	0	1	15	100
DLN21	7/17/2001	Z3	Z3S	10	2	10	55	1	0	0	0	0	2	0	0	0	0	15	0	5	100
DLN21	7/17/2001	Z3	Z3W	20	0	10	46	0	0	0	0	0	4	0	0	0	0	15	0	5	100
DLN21	7/17/2001	Z4	Z4E	10	25	35	10	1	0	0	0	0	3	0	0	0	0	10	0	6	100
DLN21	7/17/2001	Z4	Z4N	12	3	56	4	4	0	0	0	0	6	0	0	0	0	10	0	5	100
DLN21	7/17/2001	Z4	Z4S	7	15	62	6	3	0	0	0	0	0	0	0	0	0	5	0	2	100
DLN21	7/17/2001	Z4	Z4W	5	20	59	0	3	0	0	0	0	5	0	0	0	0	5	0	3	100
DLN21	7/17/2001	Z5	Z5E	5	55	16	0	8	0	0	0	0	0	0	0	0	0	4	0	12	100
DLN21	7/17/2001	Z5	Z5N	5	50	16	0	6	0	0	0	0	3	0	0	0	0	10	0	10	100
DLN21	7/17/2001	Z5	Z5S	8	60	11	4	5	0	0	0	0	0	0	0	0	0	2	0	10	100
DLN21	7/17/2001	Z5	Z5W	6	55	11	0	10	0	0	0	0	0	0	0	0	0	10	0	8	100
DLN21	7/17/2001	Z6	Z6E	4	60	5	0	5	0	0	0	0	0	0	0	0	0	25	0	1	100
DLN21	7/17/2001	Z6	Z6N	10	68	4	0	3	0	0	0	0	0	0	0	0	0	15	0	0	100
DLN21	7/17/2001	Z6	Z6S	10	64	6	0	0	0	0	0	0	0	0	0	0	0	20	0	0	100
DLN21	7/17/2001	Z6	Z6W	0	59	10	0	0	0	0	0	0	0	0	0	0	0	30	0	1	100
DLN21	8/21/2003	Z1	Z1E	55	0	0	10	0	0	0	0	0	0	0	0	0	0	20	0	15	100
DLN21	8/21/2003	Z1	Z1N	60	0	1	6	0	0	0	0	0	0	0	0	0	0	15	0	18	100
DLN21	8/21/2003	Z1	Z1S	78	0	0	1	0	0	0	0	0	0	0	0	0	0	10	0	11	100
DLN21	8/21/2003	Z1	Z1W	59	0	0	1	0	0	0	0	0	0	0	0	0	0	15	0	25	100
DLN21	8/21/2003	Z2	Z2E	30	0	25	1	0	0	0	0	0	0	0	0	0	0	4	40	0	100
DLN21	8/21/2003	Z2	Z2N	45	0	25	4	0	0	0	0	0	0	0	0	0	0	6	20	0	100
DLN21	8/21/2003	Z2	Z2S	35	0	50	0	0	0	0	0	0	0	0	0	0	0	0	15	0	100
DLN21	8/21/2003	Z2	Z2W	26	0	50	2	0	0	0	0	0	0	0	0	0	0	2	20	0	100
DLN21	8/21/2003	Z3	Z3E	10	8	10	30	2	0	0	0	0	0	0	0	0	0	24	6	10	100
DLN21	8/21/2003	Z3	Z3N	30	0	5	32	0	0	0	0	0	3	0	0	0	0	10	0	20	100
DLN21	8/21/2003	Z3	Z3W	20	0	5	20	0	0	0	0	0	0	0	0	0	0	10	10	35	100

DLN21	8/21/2003	Z3	Z4S	15	0	12	25	0	0	0	0	0	0	0	0	0	0	30	8	10	100
DLN21	8/21/2003	Z4	Z4E	4	35	15	0	1	0	0	0	0	0	0	0	0	0	30	0	15	100
DLN21	8/21/2003	Z4	Z4N	9	8	30	0	2	0	0	0	0	1	0	0	0	0	25	0	25	100
DLN21	8/21/2003	Z4	Z4S	5	25	25	0	0	0	0	0	0	0	0	0	0	0	35	0	10	100
DLN21	8/21/2003	Z4	Z4W	10	20	25	0	0	0	0	0	0	0	0	0	0	0	25	0	20	100
DLN21	8/21/2003	Z5	Z5E	5	50	5	0	10	0	0	0	0	1	0	0	0	0	14	0	15	100
DLN21	8/21/2003	Z5	Z5N	5	55	10	2	3	0	0	0	0	1	0	0	0	0	9	0	15	100
DLN21	8/21/2003	Z5	Z5S	5	45	15	0	13	0	0	0	0	0	0	0	0	0	2	0	20	100
DLN21	8/21/2003	Z5	Z5W	10	50	10	0	10	0	0	0	0	0	0	0	0	0	5	0	15	100
DLN21	8/21/2003	Z6	Z6E	9	60	25	0	1	0	0	0	0	0	0	0	0	0	5	0	0	100
DLN21	8/21/2003	Z6	Z6N	10	50	30	0	2	0	0	0	0	0	0	0	0	0	8	0	0	100
DLN21	8/21/2003	Z6	Z6S	20	50	23	0	2	0	0	0	0	0	0	0	0	0	5	0	0	100
DLN21	8/21/2003	Z6	Z6W	5	60	30	0	0	0	0	0	0	0	0	0	0	0	5	0	0	100
DLN21	8/24/2003	Z2	Z2E	30	0	25	1	0	0	0	0	0	0	0	0	0	0	4	40	0	100
DLN21	8/24/2003	Z2	Z2N	45	0	25	4	0	0	0	0	0	0	0	0	0	0	6	20	0	100
DLN21	8/24/2003	Z2	Z2S	35	0	50	0	0	0	0	0	0	0	0	0	0	0	0	15	0	100
DLN21	8/24/2003	Z2	Z2W	26	0	50	2	0	0	0	0	0	0	0	0	0	0	2	20	0	100
DLN21	8/24/2003	Z3	Z3E	10	8	10	30	2	0	0	0	0	0	0	0	0	0	24	6	10	100
DLN21	8/24/2003	Z3	Z3N	30	0	5	32	0	0	0	0	0	3	0	0	0	0	10	0	20	100
DLN21	8/24/2003	Z3	Z3S	15	0	12	25	0	0	0	0	0	0	0	0	0	0	30	8	10	100
DLN21	8/24/2003	Z3	Z3W	20	0	5	20	0	0	0	0	0	0	0	0	0	0	10	10	35	100
DLN21	8/31/2003	Z1	Z1E	55	0	0	10	0	0	0	0	0	0	0	0	0	0	20	0	15	100
DLN21	8/31/2003	Z1	Z1N	60	0	1	6	0	0	0	0	0	0	0	0	0	0	15	0	18	100
DLN21	8/31/2003	Z1	Z1S	78	0	0	1	0	0	0	0	0	0	0	0	0	0	10	0	11	100
DLN21	8/31/2003	Z1	Z1W	59	0	0	1	0	0	0	0	0	0	0	0	0	0	15	0	25	100
DLN20	8/10/1999	Z1	Z1E	4	0	55	0	10	0	0	0	0	0	0	0	0	0	30	0	1	100
DLN20	8/10/1999	Z1	Z1N	22	0	40	0	12	0	0	0	0	0	0	0	0	0	25	0	1	100
DLN20	8/10/1999	Z1	Z1S	6	0	45	3	10	0	0	0	0	0	0	0	0	0	35	0	1	100
DLN20	8/10/1999	Z1	Z1W	29	0	25	0	10	0	0	0	0	0	0	0	0	0	35	0	1	100
DLN20	8/10/1999	Z2	Z2E	25	0	45	2	7	0	0	0	0	0	0	0	0	0	18	0	3	100
DLN20	8/10/1999	Z2	Z2N	29	0	35	1	12	0	0	0	0	0	0	0	0	0	20	0	3	100
DLN20	8/10/1999	Z2	Z2S	24	2	35	6	15	0	0	0	0	0	0	0	0	0	15	0	3	100
DLN20	8/10/1999	Z2	Z2W	32	0	30	2	10	0	0	0	0	1	0	0	0	0	25	0	0	100
DLN20	8/10/1999	Z3	Z3E	48	0	10	6	8	0	0	0	0	0	0	0	0	0	25	0	3	100
DLN20	8/10/1999	Z3	Z3N	41	0	15	10	7	0	0	0	0	0	0	0	0	0	15	0	12	100
DLN20	8/10/1999	Z3	Z3S	39	0	25	12	4	0	0	0	0	0	0	0	0	0	10	0	10	100
DLN20	8/10/1999	Z3	Z3W	40	0	25	8	6	0	0	0	0	0	0	0	0	0	15	0	6	100
DLN20	8/10/1999	Z4	Z4E	49	0	30	7	6	0	0	0	0	0	0	0	0	0	8	0	0	100
DLN20	8/10/1999	Z4	Z4N	54	0	10	15	6	0	0	0	0	0	0	0	0	0	5	0	10	100
DLN20	8/10/1999	Z4	Z4S	36	0	40	4	8	0	0	0	0	0	0	0	0	0	12	0	0	100
DLN20	8/10/1999	Z4	Z4W	28	0	15	40	6	0	0	0	0	0	0	0	0	0	7	0	4	100
DLN20	8/10/1999	Z5	Z5E	39	16	20	0	15	0	0	0	0	0	0	0	0	0	10	0	0	100
DLN20	8/10/1999	Z5	Z5N	12	50	20	0	6	0	0	0	0	3	0	0	0	0	5	0	4	100
DLN20	8/10/1999	Z5	Z5S	31	18	30	0	12	0	0	0	0	0	0	0	0	0	6	0	3	100
DLN20	8/10/1999	Z5	Z5W	20	25	30	0	8	0	0	0	0	0	0	0	0	0	10	0	7	100
DLN20	8/10/1999	Z6	Z6E	20	60	12	0	1	0	0	0	0	0	0	0	0	0	7	0	0	100

DLN20	8/10/1999	Z6	Z6N	31	55	5	0	1	0	0	0	0	0	0	0	0	0	8	0	0	100
DLN20	8/10/1999	Z6	Z6S	12	70	10	0	0	0	0	0	0	0	0	0	0	0	8	0	0	100
DLN20	8/10/1999	Z6	Z6W	21	65	7	0	2	0	0	0	0	0	0	0	0	0	5	0	0	100
DLN20	7/19/2000	Z1	Z1E	10	0	0	5	0	0	0	0	0	0	0	0	0	0	81	0	4	100
DLN20	7/19/2000	Z1	Z1N	38	0	0	1	0	0	0	0	0	0	0	0	0	0	60	0	1	100
DLN20	7/19/2000	Z1	Z1S	25	0	0	10	1	0	0	0	0	0	0	0	0	0	62	0	2	100
DLN20	7/19/2000	Z1	Z1W	25	0	0	5	0	0	0	0	0	0	0	0	0	0	68	0	2	100
DLN20	7/19/2000	Z2	Z2E	5	3	61	5	1	0	0	0	0	0	0	0	0	0	15	0	10	100
DLN20	7/19/2000	Z2	Z2N	5	0	69	3	2	0	0	0	0	0	0	1	0	0	10	0	10	100
DLN20	7/19/2000	Z2	Z2S	5	5	50	20	1	0	0	0	0	0	0	0	0	0	13	0	6	100
DLN20	7/19/2000	Z2	Z2W	10	0	30	5	3	0	0	0	0	0	0	0	0	0	47	0	5	100
DLN20	7/19/2000	Z3	Z3E	5	0	59	5	1	0	0	0	0	0	0	0	0	0	20	0	10	100
DLN20	7/19/2000	Z3	Z3N	10	0	54	5	2	0	0	0	0	1	0	0	0	0	20	0	8	100
DLN20	7/19/2000	Z3	Z3S	5	0	58	5	2	0	0	0	0	0	0	0	0	0	20	0	10	100
DLN20	7/19/2000	Z3	Z3W	5	0	51	10	3	0	0	0	0	0	0	1	0	0	20	0	10	100
DLN20	7/19/2000	Z4	Z4E	6	15	50	10	5	0	0	0	0	6	0	0	0	0	8	0	0	100
DLN20	7/19/2000	Z4	Z4N	15	0	55	6	0	0	0	0	0	3	0	0	0	0	11	0	10	100
DLN20	7/19/2000	Z4	Z4S	10	20	50	5	5	0	0	0	0	2	0	0	0	0	8	0	0	100
DLN20	7/19/2000	Z4	Z4W	10	0	50	18	3	0	0	0	0	4	0	0	0	0	9	0	6	100
DLN20	7/19/2000	Z5	Z5E	4	32	50	0	8	0	0	0	0	2	0	0	0	0	0	0	4	100
DLN20	7/19/2000	Z5	Z5N	0	30	50	0	5	0	0	0	0	4	0	0	0	0	5	0	6	100
DLN20	7/19/2000	Z5	Z5S	0	15	65	0	6	0	0	0	0	3	0	0	0	0	3	0	8	100
DLN20	7/19/2000	Z5	Z5W	0	30	53	0	5	0	0	0	0	4	0	0	0	0	2	0	6	100
DLN20	7/19/2000	Z6	Z6E	18	60	12	0	0	0	0	0	0	0	0	0	0	0	10	0	0	100
DLN20	7/19/2000	Z6	Z6N	12	70	15	0	0	0	0	0	0	0	0	0	0	0	3	0	0	100
DLN20	7/19/2000	Z6	Z6S	15	65	15	0	0	0	0	0	0	0	0	0	0	0	5	0	0	100
DLN20	7/19/2000	Z6	Z6W	4	75	15	0	0	0	0	0	0	0	0	0	0	0	5	0	1	100
DLN20	7/17/2001	Z1	Z1E	15	0	61	1	0	0	0	0	0	0	0	0	0	0	20	0	3	100
DLN20	7/17/2001	Z1	Z1N	10	0	63	1	1	0	0	0	0	0	0	0	0	0	20	0	5	100
DLN20	7/17/2001	Z1	Z1S	15	0	48	10	2	0	0	0	0	0	0	0	0	0	20	0	5	100
DLN20	7/17/2001	Z1	Z1W	20	0	50	10	0	0	0	0	0	0	0	0	0	0	15	0	5	100
DLN20	7/17/2001	Z2	Z2E	15	7	51	1	1	0	0	0	0	0	0	0	0	0	20	0	5	100
DLN20	7/17/2001	Z2	Z2N	15	2	54	1	0	0	0	0	0	5	0	0	0	0	20	0	3	100
DLN20	7/17/2001	Z2	Z2S	35	10	20	5	0	0	0	0	0	0	0	0	0	0	25	0	5	100
DLN20	7/17/2001	Z2	Z2W	10	10	53	5	0	0	0	0	0	0	0	0	0	0	20	0	2	100
DLN20	7/17/2001	Z3	Z3E	10	0	60	1	1	0	0	0	0	0	0	0	0	0	20	0	8	100
DLN20	7/17/2001	Z3	Z3N	25	4	50	2	1	0	0	0	0	0	0	0	0	0	15	0	3	100
DLN20	7/17/2001	Z3	Z3S	25	2	50	1	2	0	0	0	0	0	0	0	0	0	15	0	5	100
DLN20	7/17/2001	Z3	Z3W	20	3	49	4	2	0	0	0	0	0	0	0	0	0	20	0	2	100
DLN20	7/17/2001	Z4	Z4E	30	10	30	12	4	0	0	0	0	4	0	0	0	0	5	0	5	100
DLN20	7/17/2001	Z4	Z4N	30	8	5	10	4	0	0	0	0	0	0	0	0	0	33	0	10	100
DLN20	7/17/2001	Z4	Z4S	10	30	30	6	0	0	0	0	0	0	0	0	0	0	22	0	2	100
DLN20	7/17/2001	Z4	Z4W	20	0	18	30	2	0	0	0	0	0	0	0	0	0	22	0	8	100
DLN20	7/17/2001	Z5	Z5E	10	25	45	0	2	0	0	0	0	1	0	0	0	0	13	0	4	100
DLN20	7/17/2001	Z5	Z5N	10	50	25	0	5	0	0	0	0	0	0	0	0	0	2	0	8	100
DLN20	7/17/2001	Z5	Z5S	6	50	35	0	4	0	0	0	0	0	0	0	0	0	0	0	5	100

DLN20	7/17/2001	Z5	Z5W	10	40	30	0	5	0	0	0	0	1	0	0	0	0	8	0	6	100
DLN20	7/17/2001	Z6	Z6E	0	74	4	0	2	0	0	0	0	0	0	0	0	0	20	0	0	100
DLN20	7/17/2001	Z6	Z6N	0	80	5	0	0	0	0	0	0	0	0	0	0	0	15	0	0	100
DLN20	7/17/2001	Z6	Z6S	0	82	3	0	0	0	0	0	0	0	0	0	0	0	15	0	0	100
DLN20	7/17/2001	Z6	Z6W	0	74	4	0	10	0	0	0	0	0	0	0	0	0	10	0	2	100
DLN20	8/4/2003	Z1	Z1E	60	3	2	4	1	0	0	0	0	0	0	0	0	0	10	4	16	100
DLN20	8/4/2003	Z1	Z1N	51	0	0	4	3	0	0	0	0	0	0	0	0	0	12	0	30	100
DLN20	8/4/2003	Z1	Z1S	62	5	1	6	0	0	0	0	0	0	0	0	0	0	18	2	6	100
DLN20	8/4/2003	Z1	Z1W	40	10	8	5	1	0	0	0	0	0	0	0	0	0	10	6	20	100
DLN20	8/4/2003	Z2	Z2E	24	4	3	8	1	0	0	0	0	0	0	0	0	0	40	0	20	100
DLN20	8/4/2003	Z2	Z2N	54	0	1	5	2	0	0	0	0	0	0	0	0	0	20	0	18	100
DLN20	8/4/2003	Z2	Z2S	42	10	2	12	2	0	0	0	0	0	0	0	0	0	25	0	7	100
DLN20	8/4/2003	Z2	Z2W	45	5	0	10	0	0	0	0	0	0	0	0	0	0	25	0	15	100
DLN20	8/4/2003	Z3	Z3E	5	0	15	0	0	0	0	0	0	0	0	0	0	0	49	6	25	100
DLN20	8/4/2003	Z3	Z3N	12	2	25	0	1	0	0	0	0	0	0	0	0	0	40	0	20	100
DLN20	8/4/2003	Z3	Z3S	20	0	10	0	2	0	0	0	0	0	0	0	0	0	50	0	18	100
DLN20	8/4/2003	Z3	Z3W	10	0	10	0	2	0	0	0	0	0	0	0	0	0	58	0	20	100
DLN20	8/4/2003	Z4	Z4E	5	3	50	0	0	0	0	0	0	0	0	0	0	0	37	0	5	100
DLN20	8/4/2003	Z4	Z4N	4	0	71	0	0	0	0	0	0	0	0	0	0	0	0	0	25	100
DLN20	8/4/2003	Z4	Z4S	10	10	50	0	1	0	0	0	0	0	0	0	0	0	19	0	10	100
DLN20	8/4/2003	Z4	Z4W	10	0	70	0	0	0	0	0	0	0	0	0	0	0	0	0	20	100
DLN20	8/4/2003	Z5	Z5E	5	40	45	0	0	0	0	0	0	0	0	0	0	0	10	0	0	100
DLN20	8/4/2003	Z5	Z5N	5	50	25	0	0	0	0	0	0	0	0	0	0	0	20	0	0	100
DLN20	8/4/2003	Z5	Z5S	5	55	30	0	0	0	0	0	0	0	0	0	0	0	10	0	0	100
DLN20	8/4/2003	Z5	Z5W	4	65	15	0	0	0	0	0	0	0	0	0	0	0	10	0	6	100
DLN20	8/4/2003	Z6	Z6E	3	20	15	3	2	0	0	0	0	0	0	2	0	0	30	0	25	100
DLN20	8/4/2003	Z6	Z6N	3	30	30	0	2	0	0	0	0	0	0	0	0	0	15	0	20	100
DLN20	8/4/2003	Z6	Z6S	2	40	25	0	0	0	0	0	0	0	0	0	0	0	18	0	15	100
DLN20	8/4/2003	Z6	Z6W	2	25	30	0	0	0	0	0	0	2	0	1	0	0	25	0	15	100
DLN19	8/10/1999	Z1	Z1E	12	0	55	4	6	0	0	0	0	0	0	0	0	0	13	0	10	100
DLN19	8/10/1999	Z1	Z1N	15	0	60	0	7	0	0	0	0	0	0	0	0	0	8	0	10	100
DLN19	8/10/1999	Z1	Z1S	15	0	35	7	8	0	0	0	0	0	0	0	0	0	20	0	15	100
DLN19	8/10/1999	Z1	Z1W	5	5	55	0	10	0	0	0	0	0	0	0	0	0	0	0	25	100
DLN19	8/10/1999	Z2	Z2E	15	0	55	5	7	0	0	0	0	0	0	0	0	0	12	0	6	100
DLN19	8/10/1999	Z2	Z2N	25	0	25	15	5	0	0	0	0	0	0	0	0	0	20	0	10	100
DLN19	8/10/1999	Z2	Z2S	15	0	50	0	5	0	0	0	0	0	0	0	0	0	15	0	15	100
DLN19	8/10/1999	Z2	Z2W	10	0	50	0	5	0	0	0	0	0	0	0	0	0	31	0	4	100
DLN19	8/10/1999	Z3	Z3E	20	0	55	5	7	0	0	0	0	0	0	0	0	0	8	0	5	100
DLN19	8/10/1999	Z3	Z3N	15	0	55	2	8	0	0	0	0	0	0	0	0	0	20	0	0	100
DLN19	8/10/1999	Z3	Z3S	30	0	25	10	8	0	0	0	0	0	0	0	0	0	12	0	15	100
DLN19	8/10/1999	Z3	Z3W	5	0	80	5	5	0	0	0	0	0	0	0	0	0	5	0	0	100
DLN19	8/10/1999	Z4	Z4E	15	15	45	0	5	0	0	0	0	0	0	0	0	0	15	0	5	100
DLN19	8/10/1999	Z4	Z4N	5	10	50	0	10	0	0	0	0	0	0	0	0	0	20	0	5	100
DLN19	8/10/1999	Z4	Z4S	10	10	50	0	8	0	0	0	0	1	0	0	0	0	21	0	0	100
DLN19	8/10/1999	Z4	Z4W	5	0	60	0	15	0	0	0	0	0	0	0	0	0	20	0	0	100
DLN19	8/10/1999	Z5	Z5E	33	40	10	0	2	0	0	0	0	0	0	0	0	0	15	0	0	100

DLN19	8/10/1999	Z5	Z5N	20	50	20	0	0	0	0	0	0	0	0	0	0	0	10	0	0	100
DLN19	8/10/1999	Z5	Z5S	5	75	10	0	0	0	0	0	0	0	0	0	0	0	10	0	0	100
DLN19	8/10/1999	Z5	Z5W	5	45	35	0	0	0	0	0	0	0	0	0	0	0	15	0	0	100
DLN19	8/10/1999	Z6	Z6E	35	50	10	0	0	0	0	0	0	0	0	0	0	0	5	0	0	100
DLN19	8/10/1999	Z6	Z6N	20	45	10	0	0	0	0	0	0	0	0	0	0	0	0	0	25	100
DLN19	8/10/1999	Z6	Z6S	20	50	15	0	0	0	0	0	0	0	0	0	0	0	15	0	0	100
DLN19	8/10/1999	Z6	Z6W	35	35	10	0	0	0	0	0	0	0	0	0	0	0	20	0	0	100
DLN19	7/18/2000	Z1	Z1E	20	0	10	6	1	0	0	0	0	0	0	0	0	0	58	0	5	100
DLN19	7/18/2000	Z1	Z1N	20	0	25	0	1	0	0	0	0	0	0	0	0	0	46	0	8	100
DLN19	7/18/2000	Z1	Z1S	37	0	2	4	1	0	0	0	0	1	0	0	0	0	50	0	5	100
DLN19	7/18/2000	Z1	Z1W	25	0	15	3	0	0	0	0	0	0	0	0	0	0	47	0	10	100
DLN19	7/18/2000	Z2	Z2E	25	0	23	15	1	0	0	0	0	0	0	1	0	0	20	0	15	100
DLN19	7/18/2000	Z2	Z2N	15	0	25	25	3	0	0	0	0	2	0	1	0	0	14	0	15	100
DLN19	7/18/2000	Z2	Z2S	15	0	50	1	1	0	0	0	0	0	0	0	0	0	28	0	5	100
DLN19	7/18/2000	Z2	Z2W	10	0	25	3	2	0	0	0	0	1	0	0	0	0	54	0	5	100
DLN19	7/18/2000	Z3	Z3E	15	0	63	3	2	0	0	0	0	0	0	0	0	0	15	0	2	100
DLN19	7/18/2000	Z3	Z3N	5	0	66	2	0	0	0	0	0	2	0	0	0	0	25	0	0	100
DLN19	7/18/2000	Z3	Z3S	5	0	69	2	0	0	0	0	0	0	0	0	0	0	20	0	4	100
DLN19	7/18/2000	Z3	Z3W	5	0	72	5	0	0	0	0	0	0	0	0	0	0	15	0	3	100
DLN19	7/18/2000	Z4	Z4E	8	20	49	0	5	0	0	0	0	5	0	0	0	0	8	0	5	100
DLN19	7/18/2000	Z4	Z4N	0	15	74	1	6	0	0	0	0	1	0	0	0	0	0	0	3	100
DLN19	7/18/2000	Z4	Z4S	6	12	63	0	3	0	0	0	0	4	0	0	0	0	10	0	2	100
DLN19	7/18/2000	Z4	Z4W	0	2	75	0	4	0	0	0	0	4	0	0	0	0	10	0	5	100
DLN19	7/18/2000	Z5	Z5E	9	55	25	0	2	0	0	0	0	5	0	0	0	0	3	0	1	100
DLN19	7/18/2000	Z5	Z5N	10	70	15	0	0	0	0	0	0	0	0	0	0	0	5	0	0	100
DLN19	7/18/2000	Z5	Z5S	17	60	15	0	0	0	0	0	0	6	0	0	0	0	2	0	0	100
DLN19	7/18/2000	Z5	Z5W	7	75	12	0	0	0	0	0	0	4	0	0	0	0	2	0	0	100
DLN19	7/18/2000	Z6	Z6E	20	45	6	0	0	0	0	0	0	0	0	0	0	0	25	0	4	100
DLN19	7/18/2000	Z6	Z6N	17	65	8	0	0	0	0	0	0	0	0	0	0	0	10	0	0	100
DLN19	7/18/2000	Z6	Z6S	16	60	10	0	0	0	0	0	0	0	0	0	0	0	12	0	2	100
DLN19	7/18/2000	Z6	Z6W	27	50	5	0	0	0	0	0	0	0	0	0	0	0	15	0	3	100
DLN19	7/17/2001	Z1	Z1E	10	0	60	0	0	0	0	0	0	0	0	0	0	0	20	0	10	100
DLN19	7/17/2001	Z1	Z1N	10	0	55	0	0	0	0	0	0	0	0	0	0	0	25	0	10	100
DLN19	7/17/2001	Z1	Z1S	10	0	59	0	0	0	0	0	0	0	0	0	0	0	25	0	6	100
DLN19	7/17/2001	Z1	Z1W	10	1	54	0	0	0	0	0	0	0	0	0	0	0	25	0	10	100
DLN19	7/17/2001	Z2	Z2E	10	5	55	10	0	0	0	0	0	0	0	0	0	0	15	0	5	100
DLN19	7/17/2001	Z2	Z2N	10	3	52	10	0	0	0	0	0	0	0	0	0	0	20	0	5	100
DLN19	7/17/2001	Z2	Z2S	25	2	58	0	0	0	0	0	0	0	0	0	0	0	10	0	5	100
DLN19	7/17/2001	Z2	Z2W	30	10	44	1	0	0	0	0	0	0	0	0	0	0	10	0	5	100
DLN19	7/17/2001	Z3	Z3E	10	1	52	15	2	0	0	0	0	0	0	0	0	0	15	0	5	100
DLN19	7/17/2001	Z3	Z3N	15	0	47	10	0	0	0	0	0	0	0	0	0	0	25	0	3	100
DLN19	7/17/2001	Z3	Z3S	10	0	50	5	0	0	0	0	0	0	0	0	0	0	20	0	15	100
DLN19	7/17/2001	Z3	Z3W	15	0	47	8	0	0	0	0	0	0	0	0	0	0	20	0	10	100
DLN19	7/17/2001	Z4	Z4E	18	40	30	0	5	0	0	0	0	2	0	0	0	0	0	0	5	100
DLN19	7/17/2001	Z4	Z4N	5	25	55	0	5	0	0	0	0	0	0	0	0	0	5	0	5	100
DLN19	7/17/2001	Z4	Z4S	25	25	40	0	3	0	0	0	0	0	0	0	0	0	5	0	2	100

DLN19	7/17/2001	Z4	Z4W	20	20	50	0	5	0	0	0	0	0	0	0	0	0	5	0	0	100
DLN19	7/17/2001	Z5	Z5E	5	30	10	0	3	0	0	0	0	0	0	0	0	0	49	0	3	100
DLN19	7/17/2001	Z5	Z5N	5	50	15	0	4	0	0	0	0	0	0	0	0	0	25	0	1	100
DLN19	7/17/2001	Z5	Z5S	0	60	10	0	3	0	0	0	0	0	0	0	0	0	27	0	0	100
DLN19	7/17/2001	Z5	Z5W	10	65	12	0	3	0	0	0	0	0	0	0	0	0	10	0	0	100
DLN19	7/17/2001	Z6	Z6E	15	50	0	0	0	0	0	0	0	0	0	0	0	0	31	0	4	100
DLN19	7/17/2001	Z6	Z6N	5	80	3	0	0	0	0	0	0	0	0	0	0	0	12	0	0	100
DLN19	7/17/2001	Z6	Z6S	10	40	0	0	0	0	0	0	0	0	0	0	0	0	47	0	3	100
DLN19	7/17/2001	Z6	Z6W	10	55	0	0	0	0	0	0	0	0	0	0	0	0	33	0	2	100
DLN19	8/4/2003	Z1	Z1E	15	2	15	0	0	0	0	0	0	0	0	0	0	0	36	12	20	100
DLN19	8/4/2003	Z1	Z1N	40	0	1	0	3	0	0	0	0	0	0	0	0	0	34	2	20	100
DLN19	8/4/2003	Z1	Z1S	48	0	0	0	2	0	0	0	0	0	0	0	0	0	30	0	20	100
DLN19	8/4/2003	Z1	Z1W	30	0	0	0	4	0	0	0	0	0	0	0	0	0	23	3	40	100
DLN19	8/4/2003	Z2	Z2E	10	0	5	10	0	0	0	0	0	0	0	0	0	0	50	0	25	100
DLN19	8/4/2003	Z2	Z2N	6	3	8	10	0	0	0	0	0	0	0	0	0	0	43	0	30	100
DLN19	8/4/2003	Z2	Z2S	10	0	10	0	0	0	0	0	0	0	0	0	0	0	55	0	25	100
DLN19	8/4/2003	Z2	Z2W	5	3	12	0	0	0	0	0	0	0	0	0	0	0	60	0	20	100
DLN19	8/4/2003	Z3	Z3E	6	0	65	3	2	0	0	0	0	0	0	2	0	0	10	0	12	100
DLN19	8/4/2003	Z3	Z3N	8	1	55	2	2	0	0	0	0	0	0	0	0	0	24	0	8	100
DLN19	8/4/2003	Z3	Z3S	6	0	60	3	0	0	0	0	0	0	0	2	0	0	9	0	20	100
DLN19	8/4/2003	Z3	Z3W	5	5	55	1	0	0	0	0	0	0	0	0	0	0	24	0	10	100
DLN19	8/4/2003	Z4	Z4E	6	20	49	0	5	0	0	0	0	0	0	0	0	0	0	0	20	100
DLN19	8/4/2003	Z4	Z4N	4	16	60	0	2	0	0	0	0	0	0	0	0	0	4	0	14	100
DLN19	8/4/2003	Z4	Z4S	5	20	58	0	0	0	0	0	0	0	0	0	0	0	0	0	17	100
DLN19	8/4/2003	Z4	Z4W	6	10	70	0	1	0	0	0	0	0	0	0	0	0	3	0	10	100
DLN19	8/4/2003	Z5	Z5E	20	40	15	0	0	0	0	0	0	0	0	0	0	0	15	0	10	100
DLN19	8/4/2003	Z5	Z5N	15	60	10	0	0	0	0	0	0	0	0	0	0	0	15	0	0	100
DLN19	8/4/2003	Z5	Z5S	5	45	20	0	0	0	0	0	0	0	0	0	0	0	25	0	5	100
DLN19	8/4/2003	Z5	Z5W	15	50	20	0	0	0	0	0	0	0	0	0	0	0	10	0	5	100
DLN19	8/4/2003	Z6	Z6E	15	40	30	0	1	0	0	0	0	0	0	0	0	0	9	0	5	100
DLN19	8/4/2003	Z6	Z6N	2	45	40	0	1	0	0	0	0	0	0	0	0	0	10	0	2	100
DLN19	8/4/2003	Z6	Z6S	5	50	43	0	2	0	0	0	0	0	0	0	0	0	0	0	0	100
DLN19	8/4/2003	Z6	Z6W	4	50	40	0	1	0	0	0	0	0	0	0	0	0	5	0	0	100
DLN18	8/10/1999	Z1	Z1E	5	0	40	0	10	0	0	0	0	1	0	0	0	0	44	0	0	100
DLN18	8/10/1999	Z1	Z1N	5	0	55	0	15	0	0	0	0	1	0	0	0	0	19	0	5	100
DLN18	8/10/1999	Z1	Z1S	0	0	55	0	20	0	0	0	0	0	0	0	0	0	25	0	0	100
DLN18	8/10/1999	Z1	Z1W	5	0	40	0	12	0	0	0	0	0	0	0	0	0	42	0	1	100
DLN18	8/10/1999	Z2	Z2E	10	0	25	10	15	0	0	0	0	1	0	0	0	0	4	0	35	100
DLN18	8/10/1999	Z2	Z2N	15	0	25	0	15	0	0	0	0	0	0	0	0	0	20	0	25	100
DLN18	8/10/1999	Z2	Z2S	10	0	40	0	15	0	0	0	0	0	0	0	0	0	25	0	10	100
DLN18	8/10/1999	Z2	Z2W	0	0	30	0	20	0	0	0	0	0	0	0	0	0	30	0	20	100
DLN18	8/10/1999	Z3	Z3E	40	0	10	40	0	0	0	0	0	0	0	0	0	0	0	0	10	100
DLN18	8/10/1999	Z3	Z3N	59	0	5	30	0	0	0	0	0	1	0	0	0	0	0	0	5	100
DLN18	8/10/1999	Z3	Z3S	34	0	10	50	0	0	0	0	0	1	0	0	0	0	0	0	5	100
DLN18	8/10/1999	Z3	Z3W	43	0	0	50	2	0	0	0	0	0	0	0	0	0	0	0	5	100
DLN18	8/10/1999	Z4	Z4E	10	20	20	0	25	0	0	0	0	0	0	0	0	0	10	0	15	100

DLN18	8/10/1999	Z4	Z4N	35	10	25	0	15	0	0	0	0	0	0	0	0	0	15	0	0	100
DLN18	8/10/1999	Z4	Z4S	12	20	30	0	15	0	0	0	0	0	0	0	0	0	15	0	8	100
DLN18	8/10/1999	Z4	Z4W	5	20	20	0	25	0	0	0	0	0	0	0	0	0	20	0	10	100
DLN18	8/10/1999	Z5	Z5E	20	50	25	0	0	0	0	0	0	0	0	0	0	0	5	0	0	100
DLN18	8/10/1999	Z5	Z5N	24	35	25	0	1	0	0	0	0	0	0	0	0	0	15	0	0	100
DLN18	8/10/1999	Z5	Z5S	10	30	35	0	5	0	0	0	0	0	0	0	0	0	20	0	0	100
DLN18	8/10/1999	Z5	Z5W	15	40	25	0	5	0	0	0	0	0	0	0	0	0	15	0	0	100
DLN18	8/10/1999	Z6	Z6E	35	20	25	0	0	0	0	0	0	0	0	0	0	0	15	0	5	100
DLN18	8/10/1999	Z6	Z6N	18	35	30	0	1	0	0	0	0	0	0	0	0	1	15	0	0	100
DLN18	8/10/1999	Z6	Z6S	44	25	20	0	0	0	0	0	0	0	0	0	0	1	10	0	0	100
DLN18	8/10/1999	Z6	Z6W	46	15	20	0	3	0	0	0	0	0	0	0	0	1	15	0	0	100
DLN18	7/19/2000	Z1	Z1E	29	0	10	0	1	0	0	0	0	0	0	0	0	0	60	0	0	100
DLN18	7/19/2000	Z1	Z1N	73	0	4	0	0	0	0	0	0	0	0	0	0	0	20	0	3	100
DLN18	7/19/2000	Z1	Z1S	87	0	3	0	0	0	0	0	0	0	0	0	0	0	10	0	0	100
DLN18	7/19/2000	Z1	Z1W	90	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0	0	100
DLN18	7/19/2000	Z2	Z2E	32	0	55	1	1	0	0	0	0	1	0	0	0	0	10	0	0	100
DLN18	7/19/2000	Z2	Z2N	15	25	50	0	1	0	0	0	0	0	0	0	0	0	9	0	0	100
DLN18	7/19/2000	Z2	Z2S	28	0	60	0	1	0	0	0	0	1	0	0	0	0	10	0	0	100
DLN18	7/19/2000	Z2	Z2W	36	5	45	0	2	0	0	0	0	0	0	1	0	0	10	0	1	100
DLN18	7/19/2000	Z3	Z3E	30	0	6	15	0	0	0	0	0	4	0	0	0	0	20	0	25	100
DLN18	7/19/2000	Z3	Z3N	25	0	10	20	0	0	0	0	0	3	0	0	0	0	32	0	10	100
DLN18	7/19/2000	Z3	Z3S	25	0	5	35	0	0	0	0	0	3	0	0	0	0	12	0	20	100
DLN18	7/19/2000	Z3	Z3W	35	0	5	42	0	0	0	0	0	3	0	0	0	0	10	0	5	100
DLN18	7/19/2000	Z4	Z4E	2	20	20	1	15	0	0	0	0	10	0	0	0	0	22	0	10	100
DLN18	7/19/2000	Z4	Z4N	5	10	12	3	8	0	0	0	0	3	0	0	0	0	53	0	6	100
DLN18	7/19/2000	Z4	Z4S	5	20	25	2	12	0	0	0	0	6	0	0	0	0	26	0	4	100
DLN18	7/19/2000	Z4	Z4W	4	12	10	2	10	0	0	0	0	10	0	0	0	0	48	0	4	100
DLN18	7/19/2000	Z5	Z5E	6	65	25	0	0	0	0	0	0	0	0	0	0	0	3	0	1	100
DLN18	7/19/2000	Z5	Z5N	29	35	20	0	0	0	0	0	0	0	0	0	0	0	10	0	6	100
DLN18	7/19/2000	Z5	Z5S	5	40	35	0	4	0	0	0	0	1	0	0	0	0	7	0	8	100
DLN18	7/19/2000	Z5	Z5W	22	37	30	0	2	0	0	0	0	0	0	0	0	0	5	0	4	100
DLN18	7/19/2000	Z6	Z6E	47	15	0	0	0	0	0	0	0	0	0	0	0	1	35	0	2	100
DLN18	7/19/2000	Z6	Z6N	46	20	2	0	6	0	0	0	0	0	0	0	0	0	25	0	1	100
DLN18	7/19/2000	Z6	Z6S	49	20	3	0	0	0	0	0	0	0	0	0	0	1	25	0	2	100
DLN18	7/19/2000	Z6	Z6W	44	25	0	0	5	0	0	0	0	0	0	0	0	0	18	0	8	100
DLN18	7/17/2001	Z1	Z1E	10	0	62	0	0	0	0	0	0	0	0	0	0	0	25	0	3	100
DLN18	7/17/2001	Z1	Z1N	10	0	65	0	0	0	0	0	0	0	0	0	0	0	20	0	5	100
DLN18	7/17/2001	Z1	Z1S	10	0	67	0	0	0	0	0	0	0	0	0	0	0	20	0	3	100
DLN18	7/17/2001	Z1	Z1W	10	0	65	0	0	0	0	0	0	0	0	0	0	0	15	0	10	100
DLN18	7/17/2001	Z2	Z2E	10	3	51	1	0	0	0	0	0	0	0	0	0	0	30	0	5	100
DLN18	7/17/2001	Z2	Z2N	15	4	53	1	1	0	0	0	0	0	0	0	0	0	20	0	6	100
DLN18	7/17/2001	Z2	Z2S	10	0	59	1	0	0	0	0	0	0	0	0	0	0	20	0	10	100
DLN18	7/17/2001	Z2	Z2W	15	4	35	1	0	0	0	0	0	0	0	0	0	0	30	0	15	100
DLN18	7/17/2001	Z3	Z3E	45	0	5	35	5	0	0	0	0	5	0	0	0	0	0	0	5	100
DLN18	7/17/2001	Z3	Z3N	38	0	5	40	0	0	0	0	0	10	0	0	0	0	5	0	2	100
DLN18	7/17/2001	Z3	Z3S	35	0	1	57	0	0	0	0	0	5	0	0	0	0	0	0	2	100

DLN18	7/17/2001	Z3	Z3W	35	0	1	58	0	0	0	0	0	3	0	0	0	0	0	0	3	100
DLN18	7/17/2001	Z4	Z4E	5	45	10	2	10	0	0	0	0	4	0	0	0	0	19	0	5	100
DLN18	7/17/2001	Z4	Z4N	8	30	15	6	5	0	0	0	0	0	0	0	0	0	31	0	5	100
DLN18	7/17/2001	Z4	Z4S	10	40	17	2	4	0	0	0	0	7	0	0	0	0	15	0	5	100
DLN18	7/17/2001	Z4	Z4W	10	60	10	4	4	0	0	0	0	0	0	0	0	0	7	0	5	100
DLN18	7/17/2001	Z5	Z5E	2	55	6	0	0	0	0	0	0	0	0	0	0	0	29	0	8	100
DLN18	7/17/2001	Z5	Z5N	5	40	5	0	0	0	0	0	0	0	0	0	0	0	44	0	6	100
DLN18	7/17/2001	Z5	Z5S	5	45	4	0	3	0	0	0	0	0	0	0	0	0	33	0	10	100
DLN18	7/17/2001	Z5	Z5W	4	50	3	0	4	0	0	0	0	0	0	0	0	0	33	0	6	100
DLN18	7/17/2001	Z6	Z6E	45	25	0	0	0	0	0	0	0	0	0	5	0	6	19	0	0	100
DLN18	7/17/2001	Z6	Z6N	35	30	0	0	2	0	0	0	0	0	0	0	0	10	23	0	0	100
DLN18	7/17/2001	Z6	Z6S	55	20	0	0	0	0	0	0	0	0	0	10	0	5	10	0	0	100
DLN18	7/17/2001	Z6	Z6W	38	25	0	0	2	0	0	0	0	0	0	10	0	15	8	0	2	100
DLN18	8/4/2003	Z1	Z1E	59	1	1	0	1	0	0	0	0	0	0	0	0	0	30	0	8	100
DLN18	8/4/2003	Z1	Z1N	24	0	1	0	0	0	0	0	0	0	0	0	0	0	50	0	25	100
DLN18	8/4/2003	Z1	Z1S	38	0	2	0	0	0	0	0	0	0	0	0	0	0	45	0	15	100
DLN18	8/4/2003	Z1	Z1W	31	0	4	0	0	0	0	0	0	0	0	0	0	0	40	0	25	100
DLN18	8/4/2003	Z2	Z2E	4	4	12	0	0	0	0	0	0	0	0	0	0	0	55	0	25	100
DLN18	8/4/2003	Z2	Z2N	17	10	6	0	5	0	0	0	0	0	0	0	0	0	50	0	12	100
DLN18	8/4/2003	Z2	Z2S	15	5	10	0	0	0	0	0	0	0	0	0	0	0	62	0	8	100
DLN18	8/4/2003	Z2	Z2W	9	5	16	0	0	0	0	0	0	0	0	0	0	0	60	0	10	100
DLN18	8/4/2003	Z3	Z3E	12	0	46	2	1	0	0	0	0	1	0	0	0	0	15	5	18	100
DLN18	8/4/2003	Z3	Z3N	18	0	39	1	2	0	0	0	0	5	0	0	0	0	10	0	25	100
DLN18	8/4/2003	Z3	Z3S	20	0	21	8	0	0	0	0	0	3	0	0	0	0	8	5	35	100
DLN18	8/4/2003	Z3	Z3W	20	0	37	4	3	0	0	0	0	4	0	0	0	0	6	6	20	100
DLN18	8/4/2003	Z4	Z4E	8	66	6	6	0	0	0	0	0	0	0	0	0	0	4	0	10	100
DLN18	8/4/2003	Z4	Z4N	10	30	20	20	1	0	0	0	0	0	0	0	0	0	9	0	10	100
DLN18	8/4/2003	Z4	Z4S	5	75	6	6	1	0	0	0	0	0	0	0	0	0	3	0	4	100
DLN18	8/4/2003	Z4	Z4W	15	30	16	12	3	0	0	0	0	0	0	0	0	0	16	0	8	100
DLN18	8/4/2003	Z5	Z5W	35	25	10	0	1	0	0	0	0	0	0	6	0	2	6	0	15	100
DLN18	8/4/2003	Z5	Z5E	47	30	5	0	1	0	0	0	0	0	0	10	0	2	2	0	3	100
DLN18	8/4/2003	Z5	Z5S	35	35	10	0	4	0	0	0	0	0	0	5	0	2	4	0	5	100
DLN18	8/4/2003	Z5	Z5N	45	25	2	0	1	0	0	0	0	0	0	10	0	10	0	0	7	100
DLN18	8/4/2003	Z6	Z6E	15	40	20	0	0	0	0	0	0	0	0	0	0	0	20	0	5	100
DLN18	8/4/2003	Z6	Z6N	20	40	15	0	0	0	0	0	0	0	0	0	0	0	15	0	10	100
DLN18	8/4/2003	Z6	Z6S	10	30	20	0	1	0	0	0	0	0	0	1	0	0	18	0	20	100
DLN18	8/4/2003	Z6	Z6W	18	30	15	0	0	0	0	0	0	0	0	0	0	0	25	0	12	100

Vegetation Data for Dales Lake South Transects
(See Appendix 4 for codes to column headings.)

TRANS	DATE	QUAD	SEC	BG	R	OT	EMC	MV	AS	PT	C	P	DMCA	DD	DOCU	GV	N	O	SS	EC	0
DLS16	5/29/1999	Z1	Z1E	25	0	15	0	0	0	0	0	0	10	0	15	0	0	34	0	1	100
DLS16	5/29/1999	Z1	Z1N	10	0	20	0	0	0	0	0	0	2	0	20	0	0	46	0	2	100
DLS16	5/29/1999	Z1	Z1S	8	0	30	0	0	0	0	0	0	4	0	10	0	0	47	0	1	100
DLS16	5/29/1999	Z1	Z1W	25	0	20	0	0	0	0	0	0	5	0	15	0	0	35	0	0	100
DLS16	5/29/1999	Z2	Z2E	10	0	0	6	3	0	0	0	0	2	0	65	0	0	10	0	4	100
DLS16	5/29/1999	Z2	Z2N	35	0	0	25	0	0	0	0	0	4	0	12	0	0	4	0	20	100
DLS16	5/29/1999	Z2	Z2S	20	0	0	5	2	0	0	0	0	5	0	60	0	0	2	0	6	100
DLS16	5/29/1999	Z2	Z2W	35	0	0	25	0	0	0	0	0	5	0	15	0	0	0	0	20	100
DLS16	5/29/1999	Z3	Z3E	5	0	0	60	0	0	0	0	0	0	0	0	0	0	5	0	30	100
DLS16	5/29/1999	Z3	Z3N	15	0	0	70	0	0	0	0	0	0	0	0	0	0	0	0	15	100
DLS16	5/29/1999	Z3	Z3S	5	0	0	60	0	0	0	0	0	0	0	0	0	0	5	0	30	100
DLS16	5/29/1999	Z3	Z3W	10	0	0	65	0	0	0	0	0	0	0	0	0	0	5	0	20	100
DLS16	5/29/1999	Z4	Z4E	5	1	0	60	0	0	0	0	0	0	0	0	0	2	27	0	5	100
DLS16	5/29/1999	Z4	Z4N	15	0	0	60	0	0	0	0	0	0	0	0	0	2	17	0	6	100
DLS16	5/29/1999	Z4	Z4S	25	0	0	35	0	0	0	0	0	0	0	0	0	2	30	0	8	100
DLS16	5/29/1999	Z4	Z4W	5	0	0	50	0	0	0	0	0	0	0	0	0	4	26	0	15	100
DLS16	5/29/1999	Z5	Z5E	60	0	40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100
DLS16	5/29/1999	Z5	Z5N	67	3	30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100
DLS16	5/29/1999	Z5	Z5S	62	3	35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100
DLS16	5/29/1999	Z5	Z5W	75	0	25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100
DLS16	5/29/1999	Z6	Z6E	60	0	40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100
DLS16	5/29/1999	Z6	Z6N	60	0	40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100
DLS16	5/29/1999	Z6	Z6S	65	0	35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100
DLS16	5/29/1999	Z6	Z6W	75	0	25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100
DLS16	7/18/2000	Z1	Z1E	30	1	54	0	0	0	0	0	0	0	0	0	0	0	15	0	0	100
DLS16	7/18/2000	Z1	Z1N	45	0	40	0	0	0	0	0	0	0	0	0	0	0	10	0	5	100
DLS16	7/18/2000	Z1	Z1S	43	5	45	0	0	0	0	0	0	2	0	0	0	0	5	0	0	100
DLS16	7/18/2000	Z1	Z1W	59	0	30	0	0	0	0	0	0	0	0	0	0	0	10	0	1	100
DLS16	7/18/2000	Z2	Z2E	20	0	25	0	0	0	0	0	0	2	0	0	0	0	49	0	4	100
DLS16	7/18/2000	Z2	Z2N	15	0	23	0	0	0	0	0	0	2	0	0	0	0	50	0	10	100
DLS16	7/18/2000	Z2	Z2S	15	0	41	0	0	0	0	0	0	2	0	0	0	0	40	0	2	100
DLS16	7/18/2000	Z2	Z2W	15	0	38	0	0	0	0	0	0	1	0	0	0	0	45	0	1	100
DLS16	7/18/2000	Z3	Z3E	10	0	30	0	0	0	0	0	0	2	0	0	0	0	53	0	5	100
DLS16	7/18/2000	Z3	Z3N	5	0	20	0	1	0	0	0	0	1	0	0	0	0	63	0	10	100
DLS16	7/18/2000	Z3	Z3S	5	0	20	0	1	0	0	0	0	1	0	0	0	0	71	0	2	100
DLS16	7/18/2000	Z3	Z3W	5	0	64	0	0	0	0	0	0	0	0	0	0	0	25	0	6	100
DLS16	7/18/2000	Z4	Z4E	10	0	0	40	5	0	0	0	0	0	0	0	0	0	30	0	15	100
DLS16	7/18/2000	Z4	Z4N	0	0	0	60	0	0	0	0	0	0	0	0	0	0	25	0	15	100
DLS16	7/18/2000	Z4	Z4S	25	0	0	25	0	0	0	0	0	0	0	0	0	0	40	0	10	100
DLS16	7/18/2000	Z4	Z4W	20	0	0	40	0	0	0	0	0	0	0	0	0	0	15	0	25	100

DLS16	7/18/2000	Z5	Z5E	0	0	0	60	0	0	0	0	0	0	0	0	0	0	10	0	30	100
DLS16	7/18/2000	Z5	Z5N	0	0	0	60	0	0	0	0	0	0	0	0	0	0	15	0	25	100
DLS16	7/18/2000	Z5	Z5S	0	0	0	40	0	0	0	0	0	0	0	0	0	0	15	0	45	100
DLS16	7/18/2000	Z5	Z5W	0	0	0	45	0	0	0	0	0	0	0	0	0	0	35	0	20	100
DLS16	7/18/2000	Z6	Z6E	10	0	0	5	0	0	0	0	0	0	70	0	0	0	10	0	5	100
DLS16	7/18/2000	Z6	Z6N	0	0	0	5	0	0	0	0	0	0	75	0	0	0	10	0	10	100
DLS16	7/18/2000	Z6	Z6S	0	0	0	1	0	0	0	0	0	0	89	0	0	0	5	0	5	100
DLS16	7/18/2000	Z6	Z6W	0	0	0	7	0	0	0	0	0	0	68	0	0	0	10	0	15	100
DLS16	6/19/2001	Z1	Z1E	10	0	80	0	0	0	0	0	0	0	0	0	0	0	10	0	0	100
DLS16	6/19/2001	Z1	Z1N	15	2	25	0	0	0	0	0	0	1	0	0	0	0	49	0	8	100
DLS16	6/19/2001	Z1	Z1S	35	5	40	0	0	0	0	0	0	2	0	0	0	0	18	0	0	100
DLS16	6/19/2001	Z1	Z1W	40	1	50	0	0	0	0	0	0	0	0	0	0	0	7	0	2	100
DLS16	6/19/2001	Z2	Z2E	35	0	20	0	0	0	0	0	0	1	0	0	0	0	40	0	4	100
DLS16	6/19/2001	Z2	Z2N	35	0	8	0	0	0	0	0	0	2	0	0	0	0	40	0	15	100
DLS16	6/19/2001	Z2	Z2S	40	0	6	0	0	0	0	0	0	4	0	0	0	0	47	0	3	100
DLS16	6/19/2001	Z2	Z2W	60	0	20	0	0	0	0	0	0	0	0	0	0	0	12	0	8	100
DLS16	6/19/2001	Z3	Z3E	35	0	5	0	1	0	0	0	0	1	0	0	0	0	43	0	15	100
DLS16	6/19/2001	Z3	Z3N	20	0	5	0	1	0	0	0	0	4	0	0	0	0	35	0	35	100
DLS16	6/19/2001	Z3	Z3S	55	0	15	0	1	0	0	0	0	1	0	0	0	0	23	0	5	100
DLS16	6/19/2001	Z3	Z3W	30	0	5	0	5	0	0	0	0	2	0	0	0	0	43	0	15	100
DLS16	6/19/2001	Z4	Z4E	35	0	0	33	4	0	0	0	0	0	0	6	0	0	10	0	12	100
DLS16	6/19/2001	Z4	Z4N	20	0	0	40	0	0	0	0	0	0	0	10	0	0	10	0	20	100
DLS16	6/19/2001	Z4	Z4S	50	0	0	20	4	0	0	0	0	0	0	5	0	0	9	0	12	100
DLS16	6/19/2001	Z4	Z4W	20	0	0	40	0	0	0	0	0	4	0	10	0	0	6	0	20	100
DLS16	6/19/2001	Z5	Z5E	30	0	0	25	0	0	0	0	0	0	0	10	0	0	20	0	15	100
DLS16	6/19/2001	Z5	Z5N	10	0	0	15	0	0	0	0	0	0	0	5	0	0	52	0	18	100
DLS16	6/19/2001	Z5	Z5S	25	0	0	20	0	0	0	0	0	0	0	10	0	0	20	0	25	100
DLS16	6/19/2001	Z5	Z5W	25	0	0	15	0	0	0	0	0	0	0	10	0	0	30	0	20	100
DLS16	6/19/2001	Z6	Z6E	10	0	0	4	0	0	0	0	0	0	25	0	0	0	61	0	0	100
DLS16	6/19/2001	Z6	Z6N	10	0	0	5	0	0	0	0	0	0	25	0	0	0	56	0	4	100
DLS16	6/19/2001	Z6	Z6S	10	0	0	4	0	0	0	0	0	0	20	0	0	0	66	0	0	100
DLS16	6/19/2001	Z6	Z6W	20	0	0	5	0	0	0	0	0	0	46	0	0	0	25	0	4	100
DLS16	7/23/2003	Z1	Z1E	15	5	40	0	0	0	0	0	0	0	0	0	0	0	38	0	2	100
DLS16	7/23/2003	Z1	Z1N	20	0	40	0	0	0	0	0	0	0	0	0	0	0	34	0	6	100
DLS16	7/23/2003	Z1	Z1S	20	0	30	0	0	0	0	0	0	0	0	0	0	0	46	0	4	100
DLS16	7/23/2003	Z1	Z1W	75	10	4	0	0	0	0	0	0	0	0	0	0	0	10	0	1	100
DLS16	7/23/2003	Z2	Z2E	42	0	20	0	0	0	0	0	0	0	0	0	0	0	35	0	3	100
DLS16	7/23/2003	Z2	Z2N	20	0	20	0	0	0	0	0	0	0	0	0	0	0	55	0	5	100
DLS16	7/23/2003	Z2	Z2S	35	0	20	0	0	0	0	0	0	0	0	0	0	0	35	0	10	100
DLS16	7/23/2003	Z2	Z2W	28	0	25	0	0	0	0	0	0	0	0	0	0	0	35	0	12	100
DLS16	7/23/2003	Z3	Z3E	15	0	20	0	2	0	0	0	0	0	0	0	0	0	43	0	20	100
DLS16	7/23/2003	Z3	Z3N	23	0	25	0	2	0	0	0	0	0	0	0	0	0	40	0	10	100
DLS16	7/23/2003	Z3	Z3S	25	0	17	0	3	0	0	0	0	0	0	0	0	0	30	0	25	100
DLS16	7/23/2003	Z3	Z3W	30	0	11	0	4	0	0	0	0	0	0	0	0	0	25	0	30	100
DLS16	7/23/2003	Z4	Z4E	28	0	0	48	0	0	0	0	0	0	0	0	0	0	10	0	14	100

DLS16	7/23/2003	Z4	Z4N	30	0	0	52	0	0	0	0	0	0	0	0	0	0	0	0	18	100
DLS16	7/23/2003	Z4	Z4S	35	0	0	38	0	0	0	0	0	0	0	0	0	0	2	0	25	100
DLS16	7/23/2003	Z4	Z4W	20	0	0	59	0	0	0	0	0	0	0	0	0	0	5	0	16	100
DLS16	7/23/2003	Z5	Z5E	36	0	0	6		0	0	0	0	0	0	0	0	0	3	0	55	100
DLS16	7/23/2003	Z5	Z5N	45	0	0	4		0	0	0	0	0	0	0	0	0	1	0	50	100
DLS16	7/23/2003	Z5	Z5S	42	0	2	10		0	0	0	0	0	0	0	0	0	1	0	45	100
DLS16	7/23/2003	Z5	Z5W	44	0	4	8		0	0	0	0	0	0	0	0	0	4	0	40	100
DLS16	7/23/2003	Z6	Z6E	30	0	0	55	0	0	0	0	0	0	1	6	0	1	5	0	2	100
DLS16	7/23/2003	Z6	Z6N	33	0	0	50	0	0	0	0	0	0	3	5	0	0	8	0	1	100
DLS16	7/23/2003	Z6	Z6S	49	0	0	35	0	0	0	0	0	0	0	3	0	0	10	0	3	100
DLS16	7/23/2003	Z6	Z6W	35	0	0	48	0	0	0	0	0	0	2	0	0	5	10	0	0	100
DLS15	5/28/1999	Z1	Z1E	15	2	30	0	0	0	0	0	0	5	0	30	0	0	18	0	0	100
DLS15	5/28/1999	Z1	Z1N	40	0	20	0	0	0	0	0	0	1	0	25	0	0	13	0	1	100
DLS15	5/28/1999	Z1	Z1S	30	0	25	0	0	0	0	0	0	4	0	25	0	0	16	0	0	100
DLS15	5/28/1999	Z1	Z1W	10	0	15	0	0	0	0	0	0	2	0	35	0	0	38	0	0	100
DLS15	5/28/1999	Z2	Z2E	20	0	0	25	0	0	0	0	0	3	0	35	0	0	12	0	5	100
DLS15	5/28/1999	Z2	Z2N	15	0	4	25	4	0	0	0	0	0	0	35	0	0	12	0	5	100
DLS15	5/28/1999	Z2	Z2S	15	0	0	40	0	0	0	0	0	2	0	5	0	0	28	0	10	100
DLS15	5/28/1999	Z2	Z2W	25	0	0	25	0	0	0	0	0	3	0	25	0	0	17	0	5	100
DLS15	5/28/1999	Z3	Z3E	20	0	0	55	0	0	0	0	0	0	0	0	0	1	14	0	10	100
DLS15	5/28/1999	Z3	Z3N	15	0	0	55	0	0	0	0	0	0	0	0	0	0	20	0	10	100
DLS15	5/28/1999	Z3	Z3S	15	0	0	45	0	0	0	0	0	0	0	0	0	1	19	0	20	100
DLS15	5/28/1999	Z3	Z3W	15	0	0	50	0	0	0	0	0	0	0	0	0	0	25	0	10	100
DLS15	5/28/1999	Z4	Z4E	2	0	0	0	0	0	0	0	0	0	0	0	0	2	93	0	3	100
DLS15	5/28/1999	Z4	Z4N	25	0	0	0	0	0	0	0	0	0	0	0	0	10	50	0	15	100
DLS15	5/28/1999	Z4	Z4S	5	0	0	0	0	0	0	0	0	0	0	0	0	20	65	0	10	100
DLS15	5/28/1999	Z4	Z4W	5	1	0	0	0	0	0	0	0	0	0	0	0	10	74	0	10	100
DLS15	5/28/1999	Z5	Z5E	60	0	40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100
DLS15	5/28/1999	Z5	Z5N	60	0	40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100
DLS15	5/28/1999	Z5	Z5S	65	0	35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100
DLS15	5/28/1999	Z5	Z5W	65	0	35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100
DLS15	5/28/1999	Z6	Z6E	80	0	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100
DLS15	5/28/1999	Z6	Z6N	65	0	35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100
DLS15	5/28/1999	Z6	Z6S	70	0	30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100
DLS15	5/28/1999	Z6	Z6W	80	0	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100
DLS15	7/18/2000	Z1	Z1E	15	0	66	0	0	0	0	0	0	0	0	0	0	0	15	0	4	100
DLS15	7/18/2000	Z1	Z1N	15	0	65	0	0	0	0	0	0	0	0	0	0	0	15	0	5	100
DLS15	7/18/2000	Z1	Z1S	20	0	63	0	0	0	0	0	0	0	0	0	0	0	15	0	2	100
DLS15	7/18/2000	Z1	Z1W	15	0	64	0	0	0	0	0	0	0	0	0	0	0	20	0	1	100
DLS15	7/18/2000	Z2	Z2E	25	0	29	0	0	0	0	0	0	1	0	0	0	0	35	0	10	100
DLS15	7/18/2000	Z2	Z2N	10	0	29	0	0	0	0	0	0	1	0	0	0	0	55	0	5	100
DLS15	7/18/2000	Z2	Z2S	15	0	53	0	0	0	0	0	0	1	0	0	0	0	30	0	1	100
DLS15	7/18/2000	Z2	Z2W	25	0	44	0	0	0	0	0	0	2	0	0	0	0	25	0	4	100
DLS15	7/18/2000	Z3	Z3E	10	0	15	0	0	0	0	0	0	4	0	0	0	0	70	0	1	100
DLS15	7/18/2000	Z3	Z3N	20	0	31	0	0	0	0	0	0	3	0	0	0	0	45	0	1	100

DLS15	7/18/2000	Z3	Z3S	20	0	32	0	0	0	0	0	0	2	0	0	0	0	45	0	1	100
DLS15	7/18/2000	Z3	Z3W	15	0	25	0	0	0	0	0	0	3	0	0	0	0	55	0	2	100
DLS15	7/18/2000	Z4	Z4E	10	0	0	50	0	0	0	0	0	0	0	0	0	0	15	0	25	100
DLS15	7/18/2000	Z4	Z4N	28	0	0	40	0	0	0	0	0	0	0	0	0	0	22	0	10	100
DLS15	7/18/2000	Z4	Z4S	10	0	0	60	0	0	0	0	0	0	0	0	0	0	10	0	20	100
DLS15	7/18/2000	Z4	Z4W	25	0	0	50	0	0	0	0	0	0	0	0	0	0	15	0	10	100
DLS15	7/18/2000	Z5	Z5E	0	0	0	15	0	0	0	0	0	0	45	0	0	0	30	0	10	100
DLS15	7/18/2000	Z5	Z5N	0	0	0	30	0	0	0	0	0	0	50	0	0	0	15	0	5	100
DLS15	7/18/2000	Z5	Z5S	0	0	0	10	0	0	0	0	0	0	25	0	0	0	45	0	20	100
DLS15	7/18/2000	Z5	Z5W	0	0	0	20	0	0	0	0	0	0	25	0	0	0	30	0	25	100
DLS15	7/18/2000	Z6	Z6E	0	0	0	0	0	0	0	0	0	0	40	0	0	0	48	0	12	100
DLS15	7/18/2000	Z6	Z6N	10	1	0	0	0	0	0	0	0	0	15	0	0	0	64	0	10	100
DLS15	7/18/2000	Z6	Z6S	0	0	0	0	0	0	0	0	0	0	15	0	0	5	74	0	6	100
DLS15	7/18/2000	Z6	Z6W	0	0	0	0	0	0	0	0	0	0	45	0	0	0	40	0	15	100
DLS15	6/19/2001	Z1	Z1E	50	0	12	0	0	0	0	0	0	3	0	0	0	0	30	0	5	100
DLS15	6/19/2001	Z1	Z1N	60	0	10	0	0	0	0	0	0	1	0	0	0	0	22	0	7	100
DLS15	6/19/2001	Z1	Z1S	40	0	10	0	0	0	0	0	0	0	0	0	0	0	45	0	5	100
DLS15	6/19/2001	Z1	Z1W	60	0	20	0	0	0	0	0	0	1	0	0	0	0	17	0	2	100
DLS15	6/19/2001	Z2	Z2E	40	0	5	0	5	0	0	0	0	3	0	0	0	0	22	0	25	100
DLS15	6/19/2001	Z2	Z2N	25	0	5	0	0	0	0	0	0	5	0	0	0	0	45	0	20	100
DLS15	6/19/2001	Z2	Z2S	45	0	10	0	0	0	0	0	0	5	0	0	0	0	35	0	5	100
DLS15	6/19/2001	Z2	Z2W	35	0	25	0	0	0	0	0	0	5	0	0	0	0	25	0	10	100
DLS15	6/19/2001	Z3	Z3E	45	0	5	0	0	0	0	0	0	5	0	0	0	0	40	0	5	100
DLS15	6/19/2001	Z3	Z3N	50	0	10	0	0	0	0	0	0	2	0	0	0	0	33	0	5	100
DLS15	6/19/2001	Z3	Z3S	35	0	10	0	0	0	0	0	0	5	0	0	0	0	40	0	10	100
DLS15	6/19/2001	Z3	Z3W	65	0	4	0	0	0	0	0	0	10	0	0	0	0	17	0	4	100
DLS15	6/19/2001	Z4	Z4E	20	0	0	30	0	0	0	0	0	10	0	15	0	0	10	0	15	100
DLS15	6/19/2001	Z4	Z4N	30	0	1	25	5	0	0	0	0	6	0	0	0	0	23	0	10	100
DLS15	6/19/2001	Z4	Z4S	10	0	0	25	1	0	0	0	0	3	0	15	0	0	26	0	20	100
DLS15	6/19/2001	Z4	Z4W	15	0	0	20	4	0	0	0	0	0	0	10	0	0	36	0	15	100
DLS15	6/19/2001	Z5	Z5E	0	0	0	0	0	0	0	0	0	0	99	0	0	0	0	0	1	100
DLS15	6/19/2001	Z5	Z5N	0	0	0	0	0	0	0	0	0	0	95	0	0	0	0	0	5	100
DLS15	6/19/2001	Z5	Z5S	0	0	0	0	0	0	0	0	0	0	90	0	0	0	0	0	10	100
DLS15	6/19/2001	Z5	Z5W	0	0	0	0	0	0	0	0	0	0	94	0	0	0	0	0	6	100
DLS15	6/19/2001	Z6	Z6E	0	0	0	0	0	0	0	0	0	0	96	0	0	0	2	0	2	100
DLS15	6/19/2001	Z6	Z6N	0	0	0	0	0	0	0	0	0	0	75	0	0	5	12	0	8	100
DLS15	6/19/2001	Z6	Z6S	0	0	0	0	0	0	0	0	0	0	93	0	0	0	4	0	3	100
DLS15	6/19/2001	Z6	Z6W	0	0	0	0	0	0	0	0	0	0	84	0	0	1	10	0	5	100
DLS15	7/23/2003	Z1	Z1E	20	1	25	0	0	0	0	0	0	0	0	0	0	0	44	0	10	100
DLS15	7/23/2003	Z1	Z1N	10	0	35	0	0	0	0	0	0	0	0	0	0	0	40	0	15	100
DLS15	7/23/2003	Z1	Z1S	15	0	40	0	0	0	0	0	0	0	0	0	0	0	40	0	5	100
DLS15	7/23/2003	Z1	Z1W	15	0	30	0	0	0	0	0	0	0	0	0	0	0	45	0	10	100
DLS15	7/23/2003	Z2	Z2E	20	0	23	0	0	0	0	0	0	2	0	0	0	0	40	0	15	100
DLS15	7/23/2003	Z2	Z2N	7	0	20	0	3	0	0	0	0	0	0	0	0	0	65	0	5	100
DLS15	7/23/2003	Z2	Z2S	15	0	48	0	0	0	0	0	0	0	0	0	0	0	30	0	7	100

DLS15	7/23/2003	Z2	Z2W	22	0	25	0	0	0	0	0	0	0	0	0	0	0	50	0	3	100
DLS15	7/23/2003	Z4	Z4E	42	0	0	40	0	0	0	0	0	0	0	0	0	0	3	0	15	100
DLS15	7/23/2003	Z4	Z4N	58	1	0	20	0	0	0	0	0	0	0	0	0	0	5	0	16	100
DLS15	7/23/2003	Z4	Z4S	38	0	0	40	0	0	0	0	0	0	0	0	0	0	4	0	18	100
DLS15	7/23/2003	Z4	Z4W	51	0	0	35	0	0	0	0	0	0	0	0	0	0	2	0	12	100
DLS15	7/23/2003	Z5	Z5E	15	0	18	0	0	0	0	0	0	0	0	0	0	0	52	0	15	100
DLS15	7/23/2003	Z5	Z5N	55	0	12	0	0	0	0	0	0	0	0	3	0	0	10	0	20	100
DLS15	7/23/2003	Z5	Z5S	12	0	8	0	0	0	0	0	0	0	0	0	0	0	55	0	25	100
DLS15	7/23/2003	Z5	Z5W	20	0	10	0	0	0	0	0	0	0	0	0	0	0	50	0	20	100
DLS15	7/23/2003	Z6	Z6E	60	0	0	12	0	0	0	0	0	0	0	8	0	0	20	0	0	100
DLS15	7/23/2003	Z6	Z6N	40	0	0	20	0	0	0	0	0	0	0	30	0	5	5	0	0	100
DLS15	7/23/2003	Z6	Z6S	38	0	0	25	0	0	0	0	0	0	0	6	0	1	30	0	0	100
DLS15	7/23/2003	Z6	Z6W	53	0	0	18	0	0	0	0	0	0	0	15	0	1	13	0	0	100
DLS14	5/28/1999	Z1	Z1E	15	25	8	0	5	0	0	0	0	0	0	10	0	0	32	0	5	100
DLS14	5/28/1999	Z1	Z1N	10	15	5	0	3	0	0	0	0	0	0	10	0	0	52	0	5	100
DLS14	5/28/1999	Z1	Z1S	20	15	8	0	0	0	0	0	0	0	0	20	0	0	32	0	5	100
DLS14	5/28/1999	Z1	Z1W	15	15	10	0	5	0	0	0	0	0	0	10	0	0	40	0	5	100
DLS14	5/28/1999	Z2	Z2E	25	10	30	0	5	0	0	0	0	0	0	3	0	0	19	0	8	100
DLS14	5/28/1999	Z2	Z2N	25	5	25	1	1	0	0	0	0	0	0	5	0	0	31	0	7	100
DLS14	5/28/1999	Z2	Z2S	15	10	10	3	5	0	0	0	0	0	0	8	0	0	29	0	20	100
DLS14	5/28/1999	Z2	Z2W	20	5	30	0	5	0	0	0	0	0	0	3	0	0	32	0	5	100
DLS14	5/28/1999	Z3	Z3E	20	5	10	0	5	0	0	0	0	0	0	5	0	0	45	0	10	100
DLS14	5/28/1999	Z3	Z3N	35	10	20	0	1	0	0	0	0	0	0	3	0	0	31	0	0	100
DLS14	5/28/1999	Z3	Z3S	25	15	15	3	1	0	0	0	0	0	0	10	0	3	23	0	5	100
DLS14	5/28/1999	Z3	Z3W	30	5	15	2	3	0	0	0	0	0	0	3	0	0	42	0	0	100
DLS14	5/28/1999	Z4	Z4E	10	0	40	0	3	0	0	0	0	0	0	5	0	0	37	0	5	100
DLS14	5/28/1999	Z4	Z4N	15	5	25	0	3	0	0	0	0	0	0	5	0	0	42	0	5	100
DLS14	5/28/1999	Z4	Z4S	25	2	30	0	3	0	0	0	0	0	0	3	0	1	36	0	0	100
DLS14	5/28/1999	Z4	Z4W	20	0	50	0	5	0	0	0	0	0	0	15	0	0	8	0	2	100
DLS14	5/28/1999	Z5	Z5E	60	0	40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100
DLS14	5/28/1999	Z5	Z5N	60	10	30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100
DLS14	5/28/1999	Z5	Z5S	68	2	30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100
DLS14	5/28/1999	Z5	Z5W	80	0	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100
DLS14	5/28/1999	Z6	Z6E	65	5	30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100
DLS14	5/28/1999	Z6	Z6N	57	6	35	0	0	0	0	0	0	0	0	0	0	0	0	0	2	100
DLS14	5/28/1999	Z6	Z6S	67	3	30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100
DLS14	5/28/1999	Z6	Z6W	70	0	30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100
DLS14	7/18/2000	Z1	Z1E	32	0	50	0	0	0	0	0	0	3	0	0	0	0	15	0	0	100
DLS14	7/18/2000	Z1	Z1N	30	5	60	0	0	0	0	0	0	0	0	0	0	0	5	0	0	100
DLS14	7/18/2000	Z1	Z1S	52	2	40	0	0	0	0	0	0	1	0	0	0	0	5	0	0	100
DLS14	7/18/2000	Z1	Z1W	41	3	50	0	0	0	0	0	0	1	0	0	0	0	5	0	0	100
DLS14	7/18/2000	Z2	Z2E	48	20	25	0	0	0	0	0	0	1	0	0	0	0	5	0	1	100
DLS14	7/18/2000	Z2	Z2N	10	10	68	0	0	0	0	0	0	0	0	0	0	0	10	0	2	100
DLS14	7/18/2000	Z2	Z2S	66	2	25	0	2	0	0	0	0	0	0	0	0	0	5	0	0	100
DLS14	7/18/2000	Z2	Z2W	10	3	69	0	0	0	0	0	0	0	0	0	0	0	15	0	3	100

DLS14	7/18/2000	Z3	Z3E	20	25	36	0	1	0	0	0	0	0	0	0	0	0	10	0	8	100
DLS14	7/18/2000	Z3	Z3N	25	15	40	0	0	0	0	0	0	0	0	0	0	0	15	0	5	100
DLS14	7/18/2000	Z3	Z3S	20	15	38	0	2	0	0	0	0	0	0	0	0	0	10	0	15	100
DLS14	7/18/2000	Z3	Z3W	20	15	43	0	2	0	0	0	0	0	0	0	0	0	15	0	5	100
DLS14	7/18/2000	Z4	Z4E	50	15	15	0	5	0	0	0	0	0	0	0	0	0	10	0	5	100
DLS14	7/18/2000	Z4	Z4N	29	6	20	0	10	0	0	0	0	0	0	0	0	0	30	0	5	100
DLS14	7/18/2000	Z4	Z4S	18	7	25	0	10	0	0	0	0	0	0	0	0	0	30	0	10	100
DLS14	7/18/2000	Z4	Z4W	25	5	35	0	10	0	0	0	0	0	0	0	0	0	24	0	1	100
DLS14	7/18/2000	Z5	Z5E	50	10	8	0	10	0	0	0	0	0	0	0	0	0	12	0	10	100
DLS14	7/18/2000	Z5	Z5N	52	15	10	0	5	0	0	0	0	0	0	0	0	0	18	0	0	100
DLS14	7/18/2000	Z5	Z5S	40	20	15	3	5	0	0	0	0	0	0	0	0	0	14	0	3	100
DLS14	7/18/2000	Z5	Z5W	62	12	10	0	0	0	0	0	0	0	0	0	0	0	15	0	1	100
DLS14	7/18/2000	Z6	Z6E	33	1	35	0	5	0	0	0	0	3	0	0	0	0	20	0	3	100
DLS14	7/18/2000	Z6	Z6N	30	7	36	0	5	0	0	0	0	12	0	0	0	0	10	0	0	100
DLS14	7/18/2000	Z6	Z6S	55	3	20	0	5	0	0	0	0	2	0	0	0	0	15	0	0	100
DLS14	7/18/2000	Z6	Z6W	40	0	40	0	5	0	0	0	0	5	0	0	0	0	10	0	0	100
DLS14	6/19/2001	Z1	Z1E	20	0	30	0	0	0	0	0	0	1	0	0	0	0	46	0	3	100
DLS14	6/19/2001	Z1	Z1N	40	5	30	0	0	0	0	0	0	0	0	0	0	0	25	0	0	100
DLS14	6/19/2001	Z1	Z1S	30	0	45	0	0	0	0	0	0	0	0	0	0	0	25	0	0	100
DLS14	6/19/2001	Z1	Z1W	40	0	20	0	0	0	0	0	0	0	0	0	0	0	39	0	1	100
DLS14	6/19/2001	Z2	Z2E	20	10	20	0	0	0	0	0	0	0	0	0	0	0	49	0	1	100
DLS14	6/19/2001	Z2	Z2N	20	10	15	0	0	0	0	0	0	0	0	0	0	0	35	0	20	100
DLS14	6/19/2001	Z2	Z2S	35	2	20	0	2	0	0	0	0	0	0	0	0	0	37	0	4	100
DLS14	6/19/2001	Z2	Z2W	25	1	10	0	4	0	0	0	0	0	0	0	0	0	40	0	20	100
DLS14	6/19/2001	Z3	Z3E	5	20	5	0	1	0	0	0	0	0	0	0	0	0	61	0	8	100
DLS14	6/19/2001	Z3	Z3N	30	10	5	0	3	0	0	0	0	0	0	0	0	0	42	0	10	100
DLS14	6/19/2001	Z3	Z3S	20	15	5	0	2	0	0	0	0	0	0	0	0	0	48	0	10	100
DLS14	6/19/2001	Z3	Z3W	15	15	10	0	3	0	0	0	0	0	0	0	0	0	52	0	5	100
DLS14	6/19/2001	Z4	Z4E	15	10	20	0	6	0	0	0	0	0	0	3	0	0	42	0	4	100
DLS14	6/19/2001	Z4	Z4N	20	6	15	0	2	0	0	0	0	0	0	4	0	0	48	0	5	100
DLS14	6/19/2001	Z4	Z4S	10	18	12	4	4	0	0	0	0	0	0	4	0	0	38	0	10	100
DLS14	6/19/2001	Z4	Z4W	10	4	10	0	4	0	0	0	0	0	0	3	0	0	66	0	3	100
DLS14	6/19/2001	Z5	Z5E	15	8	5	0	6	0	0	0	0	0	0	10	0	10	41	0	5	100
DLS14	6/19/2001	Z5	Z5N	15	10	4	0	0	0	0	0	0	0	0	15	0	3	53	0	0	100
DLS14	6/19/2001	Z5	Z5S	10	20	6	5	4	0	0	0	0	0	0	10	0	25	20	0	0	100
DLS14	6/19/2001	Z5	Z5W	10	10	3	0	1	0	0	0	0	0	0	15	0	3	58	0	0	100
DLS14	6/19/2001	Z6	Z6E	25	0	5	0	6	0	0	0	0	0	0	15	0	0	49	0	0	100
DLS14	6/19/2001	Z6	Z6N	15	6	10	0	5	0	0	0	0	1	0	10	0	0	53	0	0	100
DLS14	6/19/2001	Z6	Z6S	35	2	4	0	2	0	0	0	0	0	0	15	0	0	42	0	0	100
DLS14	6/19/2001	Z6	Z6W	15	0	10	0	10	0	0	0	0	0	0	15	0	0	50	0	0	100
DLS14	7/16/2002	Z2	Z2E	12	4	20	0	0	0	0	0	0	0	0	0	0	0	62	0	2	100
DLS14	7/16/2002	Z2	Z2N	15	8	25	0	0	0	0	0	0	0	0	0	0	0	40	0	12	100
DLS14	7/16/2002	Z2	Z2S	20	0	30	0	2	0	0	0	0	0	0	0	0	0	44	0	4	100
DLS14	7/16/2002	Z2	Z2W	10	0	50	0	0	0	0	0	0	0	0	0	0	0	25	0	15	100
DLS14	7/16/2003	Z1	Z1E	10	0	45	0	0	0	0	0	0	2	0	0	0	0	37	0	6	100

DLS14	7/16/2003	Z1	Z1N	10	3	30	0	0	0	0	0	0	0	0	0	0	0	55	0	2	100
DLS14	7/16/2003	Z1	Z1S	10	0	60	0	0	0	0	0	0	2	0	0	0	0	27	0	1	100
DLS14	7/16/2003	Z1	Z1W	5	1	50	0	0	0	0	0	0	0	0	0	0	0	38	0	6	100
DLS14	7/16/2003	Z3	Z3E	5	25	35	0	0	0	0	0	0	0	0	0	0	0	31	0	4	100
DLS14	7/16/2003	Z3	Z3N	25	13	20	0	1	0	0	0	0	0	0	0	0	0	40	0	1	100
DLS14	7/16/2003	Z3	Z3S	20	12	40	0	0	0	0	0	0	0	0	0	0	0	23	0	5	100
DLS14	7/16/2003	Z3	Z3W	15	10	37	0	2	0	0	0	0	0	0	0	0	0	34	0	2	100
DLS14	7/16/2003	Z4	Z4E	27	1	50	0	1	0	0	0	0	0	0	0	0	0	20	0	1	100
DLS14	7/16/2003	Z4	Z4N	35	0	40	0	5	0	0	0	0	0	0	0	0	0	20	0	0	100
DLS14	7/16/2003	Z4	Z4S	39	0	30	0	1	0	0	0	0	0	0	0	0	0	30	0	0	100
DLS14	7/16/2003	Z4	Z4W	29	0	40	0	1	0	0	0	0	0	0	0	0	0	30	0	0	100
DLS14	7/16/2003	Z5	Z5E	25	1	60	0	1	0	0	0	0	0	0	0	0	0	10	0	3	100
DLS14	7/16/2003	Z5	Z5N	25	15	40	0	0	0	0	0	0	0	0	0	0	0	20	0	0	100
DLS14	7/16/2003	Z5	Z5S	10	20	60	0	0	0	0	0	0	0	0	0	0	0	8	0	2	100
DLS14	7/16/2003	Z5	Z5W	20	10	50	0	0	0	0	0	0	0	0	0	0	0	20	0	0	100
DLS14	7/16/2003	Z6	Z6E	24	10	55	0	0	0	0	0	0	0	0	0	0	0	10	0	1	100
DLS14	7/16/2003	Z6	Z6N	10	10	69	0	0	0	0	0	0	0	0	0	0	0	10	0	1	100
DLS14	7/16/2003	Z6	Z6S	16	10	60	0	1	0	0	0	0	0	0	0	0	0	10	0	3	100
DLS14	7/16/2003	Z6	Z6W	20	5	60	0	0	0	0	0	0	0	0	0	0	0	15	0	0	100
DLS13	7/7/1999	Z1	Z1E	15	0	10	0	0	0	0	0	0	0	0	60	0	0	13	0	2	100
DLS13	7/7/1999	Z1	Z1N	10	0	15	0	0	0	0	0	0	0	0	50	0	0	20	0	5	100
DLS13	7/7/1999	Z1	Z1S	15	0	10	0	0	0	0	0	0	0	0	65	0	0	5	0	5	100
DLS13	7/7/1999	Z1	Z1W	20	0	15	0	0	0	0	0	0	0	0	45	0	0	17	0	3	100
DLS13	7/7/1999	Z2	Z2E	10	2	25	0	15	0	0	0	0	2	0	25	0	0	19	0	2	100
DLS13	7/7/1999	Z2	Z2N	5	10	30	0	15	0	0	0	0	2	0	20	0	0	15	0	3	100
DLS13	7/7/1999	Z2	Z2S	10	15	25	0	10	0	0	0	0	2	0	25	0	0	9	0	4	100
DLS13	7/7/1999	Z2	Z2W	10	10	30	0	15	0	0	0	0	2	0	20	0	0	10	0	3	100
DLS13	7/7/1999	Z3	Z3E	20	0	0	40	3	0	0	0	0	0	0	0	0	0	22	0	15	100
DLS13	7/7/1999	Z3	Z3N	10	5	0	45	3	0	0	0	0	0	0	0	0	0	17	0	20	100
DLS13	7/7/1999	Z3	Z3S	35	0	0	35	0	0	0	0	0	0	0	0	0	0	15	0	15	100
DLS13	7/7/1999	Z3	Z3W	10	10	0	35	3	0	0	0	0	0	0	0	0	0	17	0	25	100
DLS13	7/7/1999	Z4	Z4E	10	0	1	0	0	0	0	0	0	0	0	0	0	5	59	0	25	100
DLS13	7/7/1999	Z4	Z4N	0	0	0	0	0	0	0	0	0	0	0	0	0	5	60	0	35	100
DLS13	7/7/1999	Z4	Z4S	5	0	1	0	0	0	0	0	0	0	0	0	0	5	54	0	35	100
DLS13	7/7/1999	Z4	Z4W	3	0	0	0	0	0	0	0	0	0	0	0	0	2	65	0	30	100
DLS13	7/7/1999	Z5	Z5E	70	0	30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100
DLS13	7/7/1999	Z5	Z5N	55	10	35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100
DLS13	7/7/1999	Z5	Z5S	70	0	30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100
DLS13	7/7/1999	Z5	Z5W	60	0	40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100
DLS13	7/7/1999	Z6	Z6E	60	5	35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100
DLS13	7/7/1999	Z6	Z6N	60	0	40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100
DLS13	7/7/1999	Z6	Z6S	65	0	35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100
DLS13	7/7/1999	Z6	Z6W	60	0	40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100
DLS13	7/18/2000	Z1	Z1E	43	0	50	0	0	0	0	0	0	0	0	0	0	0	5	0	2	100
DLS13	7/18/2000	Z1	Z1N	20	4	59	0	0	0	0	0	0	2	0	0	0	0	10	0	5	100

DLS13	7/18/2000	Z1	Z1S	54	0	35	0	0	0	0	0	0	0	0	0	0	0	10	0	1	100
DLS13	7/18/2000	Z1	Z1W	53	0	40	0	0	0	0	0	0	1	0	0	0	0	5	0	1	100
DLS13	7/18/2000	Z2	Z2E	15	2	64	0	0	0	0	0	0	4	0	0	0	0	10	0	5	100
DLS13	7/18/2000	Z2	Z2N	15	0	67	0	0	0	0	0	0	1	0	0	0	0	15	0	2	100
DLS13	7/18/2000	Z2	Z2S	15	0	66	0	0	0	0	0	0	1	0	0	0	0	15	0	3	100
DLS13	7/18/2000	Z2	Z2W	15	0	65	0	0	0	0	0	0	0	0	0	0	0	15	0	5	100
DLS13	7/18/2000	Z3	Z3E	20	0	59	0	0	0	0	0	0	0	0	0	0	0	15	0	6	100
DLS13	7/18/2000	Z3	Z3N	10	0	62	0	0	0	0	0	0	0	0	0	0	0	20	0	8	100
DLS13	7/18/2000	Z3	Z3S	15	0	65	0	0	0	0	0	0	0	0	0	0	0	15	0	5	100
DLS13	7/18/2000	Z3	Z3W	20	0	65	0	0	0	0	0	0	0	0	0	0	0	10	0	5	100
DLS13	7/18/2000	Z4	Z4E	12	4	60	0	3	0	0	0	0	6	0	0	0	0	15	0	0	100
DLS13	7/18/2000	Z4	Z4N	0	4	65	0	0	0	0	0	0	12	0	0	0	0	17	0	2	100
DLS13	7/18/2000	Z4	Z4S	8	16	55	0	2	0	0	0	0	4	0	0	0	0	12	0	3	100
DLS13	7/18/2000	Z4	Z4W	10	5	60	0	5	0	0	0	0	4	0	0	0	0	15	0	1	100
DLS13	7/18/2000	Z5	Z5E	6	0	0	50	4	0	0	0	0	0	0	0	0	0	30	0	10	100
DLS13	7/18/2000	Z5	Z5N	5	10	0	50	0	0	0	0	0	0	0	0	0	0	5	0	30	100
DLS13	7/18/2000	Z5	Z5S	15	0	0	30	0	0	0	0	0	0	0	0	0	0	25	0	30	100
DLS13	7/18/2000	Z5	Z5W	10	8	0	30	2	0	0	0	0	0	0	0	0	0	25	0	25	100
DLS13	7/18/2000	Z6	Z6E	3	0	0	0	0	0	0	0	12	0	0	0	0	0	79	0	6	100
DLS13	7/18/2000	Z6	Z6N	10	0	0	0	0	0	0	0	15	0	0	0	0	0	50	0	25	100
DLS13	7/18/2000	Z6	Z6S	10	0	0	0	0	0	0	0	6	0	0	0	0	0	59	0	25	100
DLS13	7/18/2000	Z6	Z6W	15	2	0	0	0	0	0	0	3	0	0	0	0	0	72	0	8	100
DLS13	6/19/2001	Z1	Z1E	30	0	50	0	0	0	0	0	0	0	0	0	0	0	19	0	1	100
DLS13	6/19/2001	Z1	Z1N	15	10	25	0	0	0	0	0	0	0	0	0	0	0	40	0	10	100
DLS13	6/19/2001	Z1	Z1S	25	0	40	0	0	0	0	0	0	0	0	0	0	0	32	0	3	100
DLS13	6/19/2001	Z1	Z1W	25	0	50	0	0	0	0	0	0	2	0	0	0	0	22	0	1	100
DLS13	6/19/2001	Z2	Z2E	30	0	5	0	0	0	0	0	0	2	0	0	0	0	38	0	25	100
DLS13	6/19/2001	Z2	Z2N	35	0	10	0	0	0	0	0	0	1	0	0	0	0	39	0	15	100
DLS13	6/19/2001	Z2	Z2S	20	0	10	0	0	0	0	0	0	1	0	0	0	0	49	0	20	100
DLS13	6/19/2001	Z2	Z2W	25	0	10	0	0	0	0	0	0	0	0	0	0	0	40	0	25	100
DLS13	6/19/2001	Z3	Z3E	5	0	6	0	0	0	0	0	0	0	0	0	0	0	59	0	30	100
DLS13	6/19/2001	Z3	Z3N	35	0	3	0	0	0	0	0	0	0	0	0	0	0	37	0	25	100
DLS13	6/19/2001	Z3	Z3S	5	0	15	0	0	0	0	0	0	0	0	0	0	0	60	0	20	100
DLS13	6/19/2001	Z3	Z3W	20	0	25	0	0	0	0	0	0	0	0	0	0	0	35	0	20	100
DLS13	6/19/2001	Z4	Z4E	50	3	15	0	5	0	0	0	0	0	0	0	0	0	25	0	2	100
DLS13	6/19/2001	Z4	Z4N	20	4	8	0	2	0	0	0	0	3	0	10	0	0	51	0	2	100
DLS13	6/19/2001	Z4	Z4S	30	17	16	0	5	0	0	0	0	0	0	5	0	0	24	0	3	100
DLS13	6/19/2001	Z4	Z4W	40	7	20	0	4	0	0	0	0	0	0	0	0	0	25	0	4	100
DLS13	6/19/2001	Z5	Z5E	20	0	0	25	5	0	0	0	0	0	0	25	0	0	15	0	10	100
DLS13	6/19/2001	Z5	Z5N	20	8	0	40	3	0	0	0	0	0	2	10	0	0	11	0	6	100
DLS13	6/19/2001	Z5	Z5S	15	0	0	35	0	0	0	0	0	0	0	15	0	0	20	0	15	100
DLS13	6/19/2001	Z5	Z5W	20	11	0	25	3	0	0	0	0	0	2	10	0	0	14	0	15	100
DLS13	6/19/2001	Z6	Z6E	5	0	0	0	0	0	0	0	0	0	5	10	0	10	64	0	6	100
DLS13	6/19/2001	Z6	Z6N	10	0	0	0	0	0	0	0	0	0	40	15	0	15	16	0	4	100
DLS13	6/19/2001	Z6	Z6S	5	0	0	0	0	0	0	0	0	0	2	10	0	15	54	0	14	100

DLS13	6/19/2001	Z6	Z6W	15	0	0	0	0	0	0	0	0	0	15	5	0	10	45	0	10	100
DLS13	7/16/2003	Z1	Z1E	10	0	50	0	0	0	0	0	0	0	0	0	0	0	32	0	8	100
DLS13	7/16/2003	Z1	Z1N	10	9	40	0	0	0	0	0	0	0	0	0	0	0	23	0	18	100
DLS13	7/16/2003	Z1	Z1S	6	0	50	0	0	0	0	0	0	0	0	0	0	0	38	0	6	100
DLS13	7/16/2003	Z1	Z1W	14	0	70	0	0	0	0	0	0	0	0	0	0	0	11	0	5	100
DLS13	7/16/2003	Z2	Z2E	6	1	50	0	0	0	0	0	0	0	0	0	0	0	37	0	6	100
DLS13	7/16/2003	Z2	Z2N	10	0	48	0	0	0	0	0	0	0	0	0	0	0	32	0	10	100
DLS13	7/16/2003	Z2	Z2S	15	0	45	0	0	0	0	0	0	0	0	0	0	0	25	0	15	100
DLS13	7/16/2003	Z2	Z2W	10	0	38	0	0	0	0	0	0	0	0	0	0	0	44	0	8	100
DLS13	7/16/2003	Z3	Z3E	20	0	55	2	0	0	0	0	0	0	0	0	0	0	21	0	2	100
DLS13	7/16/2003	Z3	Z3N	40	0	35	0	0	0	0	0	0	0	0	0	0	0	13	0	12	100
DLS13	7/16/2003	Z3	Z3S	25	0	42	0	2	0	0	0	0	0	0	0	0	0	27	0	4	100
DLS13	7/16/2003	Z3	Z3W	30	0	44	0	0	0	0	0	0	0	0	0	0	0	23	0	3	100
DLS13	7/16/2003	Z4	Z4E	50	0	0	0	0	0	0	0	0	0	0	0	0	3	7	0	40	100
DLS13	7/16/2003	Z4	Z4N	50	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0	40	100
DLS13	7/16/2003	Z4	Z4S	30	0	0	0	0	0	0	0	0	0	0	0	0	15	30	0	25	100
DLS13	7/16/2003	Z4	Z4W	20	0	0	0	0	0	0	0	0	0	0	0	0	15	30	0	35	100
DLS13	7/16/2003	Z5	Z5E	5	0	0	75	0	0	0	0	0	0	0	0	0	0	0	0	20	100
DLS13	7/16/2003	Z5	Z5N	5	15	0	60	0	0	0	0	0	0	0	0	0	0	0	0	20	100
DLS13	7/16/2003	Z5	Z5S	15	0	0	50	0	0	0	0	0	0	0	0	0	0	0	0	35	100
DLS13	7/16/2003	Z5	Z5W	10	5	0	40	0	0	0	0	0	0	0	0	0	0	0	0	45	100
DLS13	7/16/2003	Z6	Z6E	26	2	0	50	2	0	0	0	0	0	0	0	0	0	10	0	10	100
DLS13	7/16/2003	Z6	Z6N	23	10	0	50	1	0	0	0	0	0	0	0	0	0	15	0	1	100
DLS13	7/16/2003	Z6	Z6S	8	25	0	35	2	0	0	0	0	0	0	0	0	0	20	0	10	100
DLS13	7/16/2003	Z6	Z6W	4	10	0	50	1	0	0	0	0	0	0	0	0	0	20	0	15	100

Vegetation Data for Hog Lake Transects
(See Appendix 4 for codes to column headings.)

TRANS	DATE	QUAD	SEC	BG	R	OT	EMC	MV	AS	PT	C	P	DMCA	DD	DOCU	GV	N	O	SS	EC	0
HL3	6/3/1999	Z4	Z4E	10	10	0	0	0	0	0	0	0	0	0	0	0	0	60	0	20	100
HL3	6/3/1999	Z4	Z4N	5	10	2	0	2	0	0	0	0	0	0	0	0	0	56	0	25	100
HL3	6/3/1999	Z4	Z4S	10	10	0	0	3	0	0	0	0	0	0	0	0	0	42	0	35	100
HL3	6/3/1999	Z4	Z4W	10	30	1	0	0	0	0	0	0	0	0	0	0	0	24	0	35	100
HL3	6/3/1999	Z5	Z5E	5	5	0	0	1	0	0	0	0	0	0	1	0	0	43	0	45	100
HL3	6/3/1999	Z5	Z5N	15	5	0	0	2	0	0	0	0	0	0	0	0	0	48	0	30	100
HL3	6/3/1999	Z5	Z5S	10	5	0	0	1	0	0	0	0	0	0	0	0	0	44	0	40	100
HL3	6/3/1999	Z5	Z5W	10	0	0	0	4	0	0	0	0	0	0	0	0	0	46	0	40	100
HL3	6/3/1999	Z6	Z6E	10	0	1	0	3	0	0	0	0	0	0	2	0	0	59	0	25	100
HL3	6/3/1999	Z6	Z6N	10	0	1	0	2	0	0	0	0	0	0	1	0	0	61	0	25	100
HL3	6/3/1999	Z6	Z6S	5	0	1	0	3	0	0	0	0	0	0	1	0	0	65	0	25	100
HL3	6/3/1999	Z6	Z6W	10	0	1	0	3	0	0	0	0	5	0	1	0	0	60	0	20	100
HL3	7/7/1999	Z7	Z7E	65	0	15	5	0	0	0	0	0	10	0	0	0	0	5	0	0	100
HL3	7/7/1999	Z7	Z7N	71	0	4	5	0	0	0	0	0	5	0	0	0	0	15	0	0	100
HL3	7/7/1999	Z7	Z7S	60	0	10	5	0	0	0	0	0	10	0	0	0	0	15	0	0	100
HL3	7/7/1999	Z7	Z7W	55	10	10	5	0	0	0	0	0	5	0	0	0	0	15	0	0	100
HL3	7/7/1999	Z8	Z8E	0	15	8	10	5	0	0	0	0	3	0	0	0	0	59	0	0	100
HL3	7/7/1999	Z8	Z8N	0	55	8	5	0	0	0	0	0	3	0	0	0	0	29	0	0	100
HL3	7/7/1999	Z8	Z8S	0	0	15	15	0	0	0	0	0	5	0	0	0	0	65	0	0	100
HL3	7/7/1999	Z8	Z8W	0	6	15	10	0	0	0	0	0	5	0	0	0	0	64	0	0	100
HL3	7/7/1999	Z9	Z9E	7	0	0	90	0	0	0	0	0	0	0	0	0	0	3	0	0	100
HL3	7/7/1999	Z9	Z9N	40	0	0	50	0	0	0	0	0	0	0	0	0	0	10	0	0	100
HL3	7/7/1999	Z9	Z9S	17	0	0	80	0	0	0	0	0	0	0	0	0	0	3	0	0	100
HL3	7/7/1999	Z9	Z9W	45	0	0	45	0	0	0	0	0	0	0	0	0	0	10	0	0	100
HL3	5/18/2000	Z4	Z4E	30	15	0	0	0	0	0	0	0	1	0	2	0	0	27	0	25	100
HL3	5/18/2000	Z4	Z4N	15	8	5	0	0	0	0	0	0	0	0	2	1	0	59	0	10	100
HL3	5/18/2000	Z4	Z4S	15	10	0	0	0	0	0	0	0	0	0	2	0	3	50	0	20	100
HL3	5/18/2000	Z4	Z4W	0	20	0	0	0	0	0	0	0	0	0	5	1	2	32	0	40	100
HL3	5/18/2000	Z5	Z5E	0	5	0	0	0	0	0	0	0	0	0	0	0	0	65	0	30	100
HL3	5/18/2000	Z5	Z5N	5	7	0	0	0	0	0	0	0	0	0	0	0	0	40	0	48	100
HL3	5/18/2000	Z5	Z5S	3	6	0	0	0	0	0	0	0	0	0	0	0	0	51	0	40	100
HL3	5/18/2000	Z5	Z5W	2	8	0	0	0	0	0	0	0	0	0	0	0	0	40	0	50	100
HL3	5/18/2000	Z6	Z6E	43	0	0	0	1	0	0	0	0	0	0	0	0	0	56	0	0	100
HL3	5/18/2000	Z6	Z6N	70	10	4	0	0	0	0	0	0	1	0	0	0	0	10	0	5	100
HL3	5/18/2000	Z6	Z6S	55	1	5	0	0	0	0	0	0	10	0	0	0	0	25	0	4	100
HL3	5/18/2000	Z6	Z6W	42	0	4	0	1	0	0	0	0	15	0	0	0	0	30	0	8	100
HL3	5/18/2000	Z7	Z7E	35	0	5	20	0	0	0	0	0	10	0	0	0	0	15	0	15	100
HL3	5/18/2000	Z7	Z7N	25	5	10	15	0	0	0	0	0	15	0	0	0	0	10	0	20	100
HL3	5/18/2000	Z7	Z7S	25	0	5	20	0	0	0	0	0	15	0	0	0	0	10	0	25	100
HL3	5/18/2000	Z7	Z7W	30	10	5	15	0	0	0	0	0	10	0	0	0	0	10	0	20	100
HL3	5/18/2000	Z8	Z8E	5	15	5	10	0	0	0	0	0	25	0	0	0	0	15	0	25	100
HL3	5/18/2000	Z8	Z8N	5	40	10	10	0	0	0	0	0	5	0	0	0	0	20	0	10	100

HL3	5/18/2000	Z8	Z8S	37	0	5	10	0	0	0	0	0	8	0	0	0	0	15	0	25	100
HL3	5/18/2000	Z8	Z8W	30	15	15	10	0	0	0	0	0	5	0	0	0	0	15	0	10	100
HL3	5/18/2000	Z9	Z9E	10	0	0	90	0	0	0	0	0	0	0	0	0	0	0	0	0	100
HL3	5/18/2000	Z9	Z9N	20	0	0	55	0	0	0	0	0	0	0	0	0	0	0	0	25	100
HL3	5/18/2000	Z9	Z9S	10	0	0	90	0	0	0	0	0	0	0	0	0	0	0	0	0	100
HL3	5/18/2000	Z9	Z9W	10	0	0	80	0	0	0	0	0	0	0	0	0	0	0	0	10	100
HL3	5/10/2001	Z4	Z4E	30	10	0	0	0	0	0	0	0	0	0	1	0	1	48	0	10	100
HL3	5/10/2001	Z4	Z4N	25	10	0	0	0	0	0	0	0	0	0	1	0	1	53	0	10	100
HL3	5/10/2001	Z4	Z4S	30	10	0	0	2	0	0	0	0	0	0	1	0	10	37	0	10	100
HL3	5/10/2001	Z4	Z4W	10	30	0	0	0	0	0	0	0	0	0	1	0	15	29	0	15	100
HL3	5/10/2001	Z5	Z5E	10	6	0	0	0	0	0	0	0	0	0	0	0	0	74	0	10	100
HL3	5/10/2001	Z5	Z5N	5	10	0	0	0	0	0	0	0	0	0	0	0	0	60	0	25	100
HL3	5/10/2001	Z5	Z5S	10	8	0	0	0	0	0	0	0	0	0	0	0	0	47	0	35	100
HL3	5/10/2001	Z5	Z5W	15	3	0	0	0	0	0	0	0	0	0	0	0	0	47	0	35	100
HL3	5/10/2001	Z6	Z6E	10	10	2	0	1	0	0	0	0	1	0	1	0	0	70	0	5	100
HL3	5/10/2001	Z6	Z6N	10	5	3	0	1	0	0	0	0	0	0	0	0	0	71	0	10	100
HL3	5/10/2001	Z6	Z6S	10	0	1	0	0	0	0	0	0	1	0	0	0	0	86	0	2	100
HL3	5/10/2001	Z6	Z6W	10	0	1	0	1	0	0	0	0	2	0	1	0	0	75	0	10	100
HL3	5/10/2001	Z7	Z7E	30	5	2	10	1	0	0	0	0	10	0	0	0	0	22	0	20	100
HL3	5/10/2001	Z7	Z7N	10	50	5	5	1	0	0	0	0	2	0	0	0	0	17	0	10	100
HL3	5/10/2001	Z7	Z7S	35	0	3	15	0	0	0	0	0	10	0	0	0	0	27	0	10	100
HL3	5/10/2001	Z7	Z7W	20	5	5	5	0	0	0	0	0	15	0	0	0	0	35	0	15	100
HL3	5/10/2001	Z8	Z8E	15	0	5	10	0	0	0	0	0	2	0	0	0	0	38	0	30	100
HL3	5/10/2001	Z8	Z8N	30	2	15	3	1	0	0	0	0	5	0	0	0	0	34	0	10	100
HL3	5/10/2001	Z8	Z8S	40	3	5	10	0	0	0	0	0	8	0	0	0	0	24	0	10	100
HL3	5/10/2001	Z8	Z8W	30	15	10	10	1	0	0	0	0	5	0	0	0	0	14	0	15	100
HL3	5/10/2001	Z9	Z9E	20	0	0	75	0	0	0	0	0	0	0	1	0	0	0	2	2	100
HL3	5/10/2001	Z9	Z9N	20	0	0	75	0	0	0	0	0	0	0	1	0	0	0	2	2	100
HL3	5/10/2001	Z9	Z9S	20	0	0	73	0	0	0	0	0	0	0	2	0	0	0	2	3	100
HL3	5/10/2001	Z9	Z9W	25	0	0	68	0	0	0	0	0	0	0	1	0	0	0	1	5	100
HL3	7/1/2003	Z4	Z4E	20	12	0	0	0	0	1	0	0	0	0	0	0	2	25	0	40	100
HL3	7/1/2003	Z4	Z4N	47	12	0	0	0	0	0	0	0	0	0	0	0	1	25	0	15	100
HL3	7/1/2003	Z4	Z4S	12	6	0	0	3	0	0	0	0	0	0	0	0	5	59	0	15	100
HL3	7/1/2003	Z4	Z4W	8	33	0	0	0	0	0	0	0	0	0	5	0	6	23	0	25	100
HL3	7/1/2003	Z5	Z5E	10	12	0	0	0	0	0	0	0	0	0	0	0	1	37	0	40	100
HL3	7/1/2003	Z5	Z5N	30	8	0	0	0	0	0	0	0	0	0	0	0	0	37	0	25	100
HL3	7/1/2003	Z5	Z5S	20	5	0	0	1	0	0	0	0	0	0	1	0	0	33	0	40	100
HL3	7/1/2003	Z5	Z5W	10	0	0	0	0	0	0	0	0	0	0	4	0	0	56	0	30	100
HL3	7/1/2003	Z6	Z6E	15	10	10	0	2	0	0	0	0	1	0	10	0	0	49	0	3	100
HL3	7/1/2003	Z6	Z6N	3	5	15	1	5	0	0	0	0	0	0	5	0	0	60	0	6	100
HL3	7/1/2003	Z6	Z6S	11	0	20	0	2	0	0	0	0	1	0	8	0	0	53	0	5	100
HL3	7/1/2003	Z6	Z6W	4	5	15	1	3	0	0	0	0	0	0	10	0	0	57	0	5	100
HL3	7/22/2003	Z7	Z7E	25	0	15	3	4	0	0	0	0	3	0	3	0	0	27	0	20	100
HL3	7/22/2003	Z7	Z7N	20	0	10	2	2	0	0	0	0	0	0	4	0	0	47	0	15	100
HL3	7/22/2003	Z7	Z7S	12	6	10	8	4	0	0	0	0	2	0	7	0	0	26	0	25	100
HL3	7/22/2003	Z7	Z7W	15	12	15	6	2	0	0	0	0	0	0	0	0	0	20	0	30	100
HL3	7/22/2003	Z8	Z8E	17	10	15	2	3	0	0	0	0	2	0	4	0	0	37	0	10	100

HL3	7/22/2003	Z8	Z8N	5	42	15	2	3	0	0	0	0	4	0	0	0	0	15	0	14	100
HL3	7/22/2003	Z8	Z8S	14	0	18	3	0	0	0	0	0	5	0	0	0	0	44	0	16	100
HL3	7/22/2003	Z8	Z8W	10	11	40	2	0	0	0	0	0	4	0	0	0	0	23	0	10	100
HL3	7/22/2003	Z9	Z9E	20	0	0	68	0	0	0	0	0	0	0	0	0	0	0	10	2	100
HL3	7/22/2003	Z9	Z9N	34	0	0	55	0	0	0	0	0	1	0	1	0	0	0	6	3	100
HL3	7/22/2003	Z9	Z9S	15	0	0	69	0	0	0	0	0	2	0	0	0	0	0	12	2	100
HL3	7/22/2003	Z9	Z9W	19	0	0	60	0	0	0	0	0	1	0	0	0	0	0	5	15	100
HL2	6/3/1999	Z4	Z4E	15	0	0	0	3	0	0	0	0	0	0	0	0	0	62	0	20	100
HL2	6/3/1999	Z4	Z4N	10	0	0	0	0	0	0	0	0	0	0	0	0	0	60	0	30	100
HL2	6/3/1999	Z4	Z4S	10	0	0	0	0	0	0	0	0	0	0	0	0	0	65	0	25	100
HL2	6/3/1999	Z4	Z4W	15	0	0	0	3	0	0	0	0	0	0	0	0	0	47	0	35	100
HL2	6/3/1999	Z5	Z5E	25	0	0	0	0	0	0	0	0	0	0	2	0	0	33	0	40	100
HL2	6/3/1999	Z5	Z5N	20	0	0	0	0	0	0	0	0	0	0	2	0	0	58	0	20	100
HL2	6/3/1999	Z5	Z5S	20	0	0	0	0	0	0	0	0	0	0	0	0	0	55	0	25	100
HL2	6/3/1999	Z5	Z5W	20	0	0	0	0	0	0	0	0	0	0	0	0	0	55	0	25	100
HL2	6/3/1999	Z6	Z6E	15	10	1	0	3	0	0	0	0	1	0	1	0	0	44	0	25	100
HL2	6/3/1999	Z6	Z6N	20	0	1	0	1	0	0	0	0	3	0	1	0	0	64	0	10	100
HL2	6/3/1999	Z6	Z6S	30	5	1	0	2	0	0	0	0	3	0	2	0	0	47	0	10	100
HL2	6/3/1999	Z6	Z6W	25	0	1	0	1	0	0	0	0	15	0	3	0	0	30	0	25	100
HL2	6/3/1999	Z7	Z7E	55	5	30	0	0	0	0	0	0	5	0	0	0	0	0	0	5	100
HL2	6/3/1999	Z7	Z7N	47	5	45	0	0	0	0	0	0	0	0	0	0	0	0	0	3	100
HL2	6/3/1999	Z7	Z7S	30	0	55	0	0	0	0	0	0	5	0	0	0	0	0	0	10	100
HL2	6/3/1999	Z7	Z7W	48	5	12	0	0	0	0	0	0	5	0	0	0	0	0	0	30	100
HL2	6/3/1999	Z8	Z8E	35	0	20	20	0	0	0	0	0	15	0	0	0	0	0	0	10	100
HL2	6/3/1999	Z8	Z8N	40	0	30	5	0	0	0	0	0	20	0	0	0	0	0	0	5	100
HL2	6/3/1999	Z8	Z8S	45	0	15	15	0	0	0	0	0	15	0	0	0	0	0	0	10	100
HL2	6/3/1999	Z8	Z8W	46	0	25	10	0	0	0	0	0	15	0	0	0	0	0	0	4	100
HL2	6/3/1999	Z9	Z9E	15	0	10	20	5	0	0	0	0	15	0	0	0	0	0	0	35	100
HL2	6/3/1999	Z9	Z9N	25	0	15	10	5	0	0	0	0	15	0	0	0	0	0	0	30	100
HL2	6/3/1999	Z9	Z9S	11	10	35	8	6	0	0	0	0	5	0	0	0	0	0	0	25	100
HL2	6/3/1999	Z9	Z9W	10	15	25	5	15	0	0	0	0	10	0	0	0	0	0	0	20	100
HL2	7/14/2000	Z4	Z4E	15	0	0	0	0	0	0	0	0	0	0	1	2	1	71	0	10	100
HL2	7/14/2000	Z4	Z4N	20	0	0	0	0	0	0	0	0	0	0	5	1	1	43	0	30	100
HL2	7/14/2000	Z4	Z4S	15	0	0	0	0	0	0	0	0	0	0	3	1	0	69	0	12	100
HL2	7/14/2000	Z4	Z4W	25	0	0	0	0	0	0	0	0	0	0	5	1	0	54	0	15	100
HL2	7/14/2000	Z5	Z5E	10	4	0	0	0	0	0	0	0	0	0	0	0	0	36	0	50	100
HL2	7/14/2000	Z5	Z5N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	75	0	25	100
HL2	7/14/2000	Z5	Z5S	10	0	0	0	0	0	0	0	0	0	0	0	0	0	50	0	40	100
HL2	7/14/2000	Z5	Z5W	0	0	0	0	0	0	0	0	0	0	0	0	0	0	60	0	40	100
HL2	7/14/2000	Z6	Z6E	5	10	2	0	0	0	0	0	0	0	0	0	0	0	58	0	25	100
HL2	7/14/2000	Z6	Z6N	5	0	2	0	0	0	0	0	0	0	0	0	0	0	68	0	25	100
HL2	7/14/2000	Z6	Z6S	12	4	5	0	2	0	0	0	0	0	0	0	0	0	62	0	15	100
HL2	7/14/2000	Z6	Z6W	15	0	3	0	2	0	0	0	0	1	0	0	0	0	49	0	30	100
HL2	7/14/2000	Z7	Z7E	40	5	20	0	0	0	0	0	0	5	0	0	0	0	20	0	10	100
HL2	7/14/2000	Z7	Z7N	15	3	52	0	0	0	0	0	0	10	0	0	0	0	10	0	10	100
HL2	7/14/2000	Z7	Z7S	10	0	15	0	0	0	0	0	0	10	0	0	0	0	15	0	50	100
HL2	7/14/2000	Z7	Z7W	25	10	25	0	0	0	0	0	0	10	0	0	0	0	15	0	15	100

HL2	7/14/2000	Z8	Z8E	40	5	20	0	0	0	0	0	0	5	0	0	0	0	20	0	10	100
HL2	7/14/2000	Z8	Z8N	15	3	52	0	0	0	0	0	0	10	0	0	0	0	10	0	10	100
HL2	7/14/2000	Z8	Z8S	10	0	15	0	0	0	0	0	0	10	0	0	0	0	15	0	50	100
HL2	7/14/2000	Z8	Z8W	25	10	25	0	0	0	0	0	0	10	0	0	0	0	15	0	15	100
HL2	7/14/2000	Z9	Z9E	10	15	5	25	0	0	0	0	0	10	0	0	0	0	5	0	30	100
HL2	7/14/2000	Z9	Z9N	5	25	20	10	0	0	0	0	0	5	0	0	0	0	15	0	20	100
HL2	7/14/2000	Z9	Z9S	10	0	0	10	0	0	0	0	0	10	0	0	0	0	20	0	50	100
HL2	7/14/2000	Z9	Z9W	10	20	23	5	2	0	0	0	0	10	0	0	0	0	20	0	10	100
HL2	6/5/2001	Z4	Z4E	25	0	0	0	0	0	0	0	0	0	0	1	0	5	64	0	5	100
HL2	6/5/2001	Z4	Z4N	35	0	0	0	1	0	0	0	0	0	0	2	0	5	56	0	1	100
HL2	6/5/2001	Z4	Z4S	30	0	0	0	0	0	0	0	0	0	0	1	0	1	58	0	10	100
HL2	6/5/2001	Z4	Z4W	10	0	0	0	0	0	0	0	0	0	0	2	0	0	83	0	5	100
HL2	6/5/2001	Z5	Z5E	15	0	0	0	0	0	0	0	0	0	0	1	0	0	34	0	50	100
HL2	6/5/2001	Z5	Z5N	20	0	0	0	0	0	0	0	0	0	0	0	0	0	45	0	35	100
HL2	6/5/2001	Z5	Z5S	15	0	0	0	0	0	0	0	0	0	0	0	0	0	35	0	50	100
HL2	6/5/2001	Z5	Z5W	15	0	0	0	0	0	0	0	0	0	0	0	0	0	35	0	50	100
HL2	6/5/2001	Z6	Z6E	15	10	0	0	0	0	0	0	0	0	0	0	0	0	20	0	55	100
HL2	6/5/2001	Z6	Z6N	20	0	0	0	0	0	0	0	0	0	0	2	0	0	53	0	25	100
HL2	6/5/2001	Z6	Z6S	25	5	1	0	2	0	0	0	0	0	0	1	0	0	46	0	20	100
HL2	6/5/2001	Z6	Z6W	15	0	0	0	2	0	0	0	0	0	0	2	0	0	36	0	45	100
HL2	6/5/2001	Z7	Z7E	10	2	38	0	0	0	0	0	0	5	0	10	0	0	15	0	20	100
HL2	6/5/2001	Z7	Z7N	5	3	35	0	0	0	0	0	0	2	0	20	0	0	15	0	20	100
HL2	6/5/2001	Z7	Z7S	35	2	25	0	0	0	0	0	0	15	0	5	0	0	3	0	15	100
HL2	6/5/2001	Z7	Z7W	15	0	35	0	0	0	0	0	0	7	0	3	0	0	25	0	15	100
HL2	6/5/2001	Z8	Z8E	40	0	0	10	0	0	0	0	0	5	0	10	0	0	10	0	25	100
HL2	6/5/2001	Z8	Z8N	20	2	20	0	0	0	0	0	0	10	0	25	0	0	8	0	15	100
HL2	6/5/2001	Z8	Z8S	45	3	6	15	0	0	0	0	0	8	0	15	0	0	3	0	5	100
HL2	6/5/2001	Z8	Z8W	50	0	10	1	0	0	0	0	0	5	0	5	0	0	4	0	25	100
HL2	6/5/2001	Z9	Z9E	25	0	20	20	0	0	0	0	0	0	0	10	0	0	5	0	20	100
HL2	6/5/2001	Z9	Z9N	25	3	25	10	0	0	0	0	0	5	0	10	0	0	12	0	10	100
HL2	6/5/2001	Z9	Z9S	25	10	20	5	0	0	0	0	0	10	0	5	0	0	5	0	20	100
HL2	6/5/2001	Z9	Z9W	10	0	35	0	1	0	0	0	0	15	0	5	0	0	14	0	20	100
HL2	7/1/2003	Z4	Z4E	61	0	1	0	0	1	0	0	0	0	0	6	0	2	25	0	4	100
HL2	7/1/2003	Z4	Z4N	67	0	1	0	1	0	0	0	0	0	0	0	0	1	25	0	5	100
HL2	7/1/2003	Z4	Z4S	71	0	0	0	0	0	0	0	0	0	0	4	0	1	20	0	4	100
HL2	7/1/2003	Z4	Z4W	73	2	1	0	2	0	0	0	0	0	0	0	0	1	15	0	6	100
HL2	7/1/2003	Z5	Z5E	12	0	0	0	0	0	0	0	0	0	0	3	0	0	65	0	20	100
HL2	7/1/2003	Z5	Z5N	10	0	0	0	0	0	0	0	0	0	0	4	0	0	61	0	25	100
HL2	7/1/2003	Z5	Z5S	15	0	0	0	0	0	0	0	0	0	0	3	0	0	67	0	15	100
HL2	7/1/2003	Z5	Z5W	5	0	0	0	0	0	0	0	0	0	0	3	0	0	72	0	20	100
HL2	7/1/2003	Z6	Z6E	25	1	6	0	0	0	0	0	0	0	0	8	0	0	48	0	12	100
HL2	7/1/2003	Z6	Z6N	30	4	0	0	0	0	0	0	0	0	0	8	0	0	52	0	6	100
HL2	7/1/2003	Z6	Z6S	15	2	5	0	0	0	0	0	0	0	0	6	0	0	64	0	8	100
HL2	7/1/2003	Z6	Z6W	20	18	4	0	0	0	0	0	0	0	0	6	0	0	42	0	10	100
HL2	7/2/2003	Z8	Z8E	3	0	45	0	0	0	0	0	0	0	0	4	0	0	38	0	10	100
HL2	7/2/2003	Z8	Z8N	3	1	40	0	0	0	0	0	0	2	0	0	0	0	50	0	4	100
HL2	7/2/2003	Z8	Z8S	4	0	50	3	0	0	0	0	0	0	0	2	0	0	31	0	10	100

HL2	7/2/2003	Z8	Z8W	5	0	55	0	0	0	0	0	0	2	0	3	0	0	27	0	8	100
HL2	7/22/2003	Z7	Z7E	3	12	25	0	0	0	0	0	0	5	0	6	0	0	29	0	20	100
HL2	7/22/2003	Z7	Z7N	2	8	40	0	0	0	0	0	0	1	0	2	0	0	44	0	3	100
HL2	7/22/2003	Z7	Z7S	6	0	28	0	0	0	0	0	0	2	0	4	0	0	40	0	20	100
HL2	7/22/2003	Z7	Z7W	4	4	40	0	0	0	0	0	0	4	0	3	0	0	20	0	25	100
HL2	7/22/2003	Z9	Z9E	6	15	40	4	0	0	0	0	0	0	0	5	0	0	22	0	8	100
HL2	7/22/2003	Z9	Z9N	12	7	35	2	0	0	0	0	0	3	0	8	0	0	21	0	12	100
HL2	7/22/2003	Z9	Z9S	5	12	40	1	0	0	0	0	0	3	0	6	0	0	23	0	10	100
HL2	7/22/2003	Z9	Z9W	6	8	25	4	5	0	0	0	0	5	0	6	0	0	21	0	20	100
HL1	6/2/1999	Z4	Z4E	20	0	1	0	1	0	0	0	0	0	0	0	0	0	58	0	20	100
HL1	6/2/1999	Z4	Z4N	5	2	10	0	0	0	0	0	0	0	0	0	0	0	83	0	0	100
HL1	6/2/1999	Z4	Z4S	10	0	5	0	1	0	0	0	0	0	0	0	0	0	79	0	5	100
HL1	6/2/1999	Z4	Z4W	5	3	5	0	0	0	0	0	0	0	0	0	0	0	79	0	8	100
HL1	6/2/1999	Z5	Z5E	10	20	1	0	0	0	0	0	0	0	0	0	0	0	44	0	25	100
HL1	6/2/1999	Z5	Z5N	5	5	1	0	0	0	0	0	0	0	0	0	0	0	59	0	30	100
HL1	6/2/1999	Z5	Z5S	10	5	1	0	1	0	0	0	0	0	0	0	0	0	73	0	10	100
HL1	6/2/1999	Z5	Z5W	15	25	1	0	0	0	0	0	0	0	0	0	0	0	44	0	15	100
HL1	6/2/1999	Z6	Z6E	10	15	15	5	0	0	0	0	0	0	0	0	0	0	25	0	30	100
HL1	6/2/1999	Z6	Z6N	5	10	10	0	0	0	0	0	0	0	0	0	0	0	50	0	25	100
HL1	6/2/1999	Z6	Z6S	10	30	0	10	0	0	0	0	0	0	0	0	0	0	30	0	20	100
HL1	6/2/1999	Z6	Z6W	15	10	5	0	0	0	0	0	0	0	0	0	0	0	35	0	35	100
HL1	6/2/1999	Z7	Z7E	15	15	5	0	0	0	0	0	0	0	0	1	0	0	34	0	30	100
HL1	6/2/1999	Z7	Z7N	10	2	10	0	0	0	0	0	0	0	0	0	0	0	48	0	30	100
HL1	6/2/1999	Z7	Z7S	20	5	10	0	0	0	0	0	0	0	0	0	0	0	50	0	15	100
HL1	6/2/1999	Z7	Z7W	10	10	10	0	0	0	0	0	0	0	0	1	0	0	39	0	30	100
HL1	6/2/1999	Z8	Z8E	5	15	10	0	0	0	0	0	0	0	0	2	0	0	53	0	15	100
HL1	6/2/1999	Z8	Z8N	10	5	2	0	5	0	0	0	0	0	0	2	0	0	56	0	20	100
HL1	6/2/1999	Z8	Z8S	5	15	10	0	0	0	0	0	0	1	0	3	0	0	51	0	15	100
HL1	6/2/1999	Z8	Z8W	10	5	2	0	2	0	0	0	0	0	0	2	0	0	54	0	25	100
HL1	5/18/2000	Z4	Z4E	25	2	0	0	0	0	0	0	0	0	0	0	0	0	58	0	15	100
HL1	5/18/2000	Z4	Z4N	20	0	0	0	0	0	0	0	0	0	0	0	0	0	78	0	2	100
HL1	5/18/2000	Z4	Z4S	30	2	0	0	0	0	0	0	0	0	0	0	0	0	63	0	5	100
HL1	5/18/2000	Z4	Z4W	20	3	0	0	0	0	0	0	0	0	0	0	0	0	72	0	5	100
HL1	5/18/2000	Z5	Z5E	15	25	0	0	0	0	0	0	0	0	0	2	0	0	33	0	25	100
HL1	5/18/2000	Z5	Z5N	15	10	0	0	0	0	0	0	0	0	0	5	0	0	55	0	15	100
HL1	5/18/2000	Z5	Z5S	20	7	0	0	0	0	0	0	0	0	0	3	0	0	60	0	10	100
HL1	5/18/2000	Z5	Z5W	20	20	0	0	0	0	0	0	0	0	0	5	0	0	45	0	10	100
HL1	5/18/2000	Z6	Z6E	15	15	0	0	0	0	0	0	0	0	0	3	0	0	57	0	10	100
HL1	5/18/2000	Z6	Z6N	20	10	0	0	0	0	0	0	0	0	0	2	0	0	58	0	10	100
HL1	5/18/2000	Z6	Z6S	5	25	0	0	0	0	0	0	0	0	0	2	0	0	63	0	5	100
HL1	5/18/2000	Z6	Z6W	10	15	0	0	0	0	0	0	0	0	0	3	0	0	62	0	10	100
HL1	5/18/2000	Z7	Z7E	15	15	0	0	0	0	0	0	0	0	0	0	0	0	45	0	25	100
HL1	5/18/2000	Z7	Z7N	15	3	0	0	0	0	0	0	0	0	0	0	0	0	52	0	30	100
HL1	5/18/2000	Z7	Z7S	15	3	0	0	0	0	0	0	0	0	0	0	0	0	32	0	50	100
HL1	5/18/2000	Z7	Z7W	15	5	0	0	0	0	0	0	0	0	0	0	0	0	50	0	30	100
HL1	5/18/2000	Z8	Z8E	5	15	2	0	0	0	0	0	0	0	0	0	0	0	68	0	10	100
HL1	5/18/2000	Z8	Z8N	5	4	5	0	1	0	0	0	0	0	0	0	0	0	55	0	30	100

HL1	5/18/2000	Z8	Z8S	20	15	5	0	0	0	0	0	0	0	0	0	0	0	45	0	15	100
HL1	5/18/2000	Z8	Z8W	5	15	5	0	1	0	0	0	0	0	0	0	0	0	49	0	25	100
HL1	5/9/2001	Z4	Z4E	40	0	0	0	0	0	0	0	0	0	0	0	0	0	50	0	10	100
HL1	5/9/2001	Z4	Z4N	50	10	0	0	0	0	0	0	0	0	0	0	0	0	40	0	0	100
HL1	5/9/2001	Z4	Z4S	50	5	0	0	0	0	0	0	0	0	0	0	0	0	35	0	10	100
HL1	5/9/2001	Z4	Z4W	50	8	0	0	0	0	0	0	0	0	0	0	0	0	42	0	0	100
HL1	5/9/2001	Z5	Z5E	10	30	0	0	0	0	0	0	0	0	0	3	0	0	42	0	15	100
HL1	5/9/2001	Z5	Z5N	15	20	0	0	0	0	0	0	0	0	0	2	0	0	53	0	10	100
HL1	5/9/2001	Z5	Z5S	25	10	0	0	0	0	0	0	0	0	0	1	0	0	56	0	8	100
HL1	5/9/2001	Z5	Z5W	5	25	0	0	0	0	0	0	0	0	0	2	0	0	58	0	10	100
HL1	5/9/2001	Z6	Z6E	0	25	0	3	0	0	0	0	0	0	0	0	0	0	52	0	20	100
HL1	5/9/2001	Z6	Z6N	15	8	0	0	0	0	0	0	0	0	0	0	0	0	57	0	20	100
HL1	5/9/2001	Z6	Z6S	5	20	0	2	0	0	0	0	0	0	0	0	0	0	68	0	5	100
HL1	5/9/2001	Z6	Z6W	5	10	0	0	0	0	0	0	0	0	0	0	0	0	65	0	20	100
HL1	5/9/2001	Z7	Z7E	5	10	0	0	0	0	0	0	0	0	0	0	0	0	60	0	25	100
HL1	5/9/2001	Z7	Z7N	10	2	0	0	0	0	0	0	0	0	0	0	0	0	63	0	25	100
HL1	5/9/2001	Z7	Z7S	10	2	0	0	0	0	0	0	0	0	0	0	0	0	63	0	25	100
HL1	5/9/2001	Z7	Z7W	15	10	0	0	0	0	0	0	0	0	0	0	0	0	55	0	20	100
HL1	5/9/2001	Z8	Z8E	15	25	1	0	0	0	0	0	0	0	0	0	0	0	44	0	15	100
HL1	5/9/2001	Z8	Z8N	10	5	0	0	1	0	0	0	0	0	0	0	0	0	49	0	35	100
HL1	5/9/2001	Z8	Z8S	20	20	0	0	0	0	0	0	0	0	0	0	0	0	45	0	15	100
HL1	5/9/2001	Z8	Z8W	20	4	0	0	2	0	0	0	0	0	0	0	0	0	64	0	10	100
HL1	7/1/2003	Z4	Z4E	73	1	1	0	1	1	0	0	0	0	0	3	0	3	12	0	5	100
HL1	7/1/2003	Z4	Z4N	69	5	3	0	0	0	1	0	0	0	0	0	0	1	20	0	1	100
HL1	7/1/2003	Z4	Z4S	80	2	2	0	1	1	0	0	0	0	0	0	0	2	11	0	1	100
HL1	7/1/2003	Z4	Z4W	64	6	0	0	0	1	0	0	0	0	0	5	0	1	20	0	3	100
HL1	7/1/2003	Z5	Z5E	15	25	4	0	0	0	0	0	0	0	0	0	0	0	51	0	5	100
HL1	7/1/2003	Z5	Z5N	53	18	4	0	0	0	0	0	0	0	0	0	0	0	10	0	15	100
HL1	7/1/2003	Z5	Z5S	25	6	3	0	0	0	0	0	0	0	0	4	0	0	55	0	7	100
HL1	7/1/2003	Z5	Z5W	45	10	2	0	0	0	0	0	0	0	0	0	0	0	43	0	0	100
HL1	7/1/2003	Z6	Z6E	6	10	10	0	0	0	0	0	0	0	0	0	0	0	54	0	20	100
HL1	7/1/2003	Z6	Z6N	10	12	4	3	0	0	0	0	0	0	0	0	0	0	61	0	10	100
HL1	7/1/2003	Z6	Z6S	8	15	6	4	0	0	0	0	0	0	0	0	0	0	52	0	15	100
HL1	7/1/2003	Z6	Z6W	10	20	2	0	0	0	0	0	0	0	0	0	0	0	48	0	20	100
HL1	7/1/2003	Z7	Z7E	10	5	1	0	0	0	0	0	0	0	0	0	0	0	64	0	20	100
HL1	7/1/2003	Z7	Z7N	10	3	2	0	0	0	0	0	0	0	0	0	0	0	79	0	6	100
HL1	7/1/2003	Z7	Z7S	5	10	8	0	0	0	0	0	0	0	0	0	0	0	69	0	8	100
HL1	7/1/2003	Z7	Z7W	5	15	0	0	0	0	0	0	0	0	0	0	0	0	76	0	4	100
HL1	7/1/2003	Z8	Z8E	10	20	5	0	0	0	0	0	0	0	0	2	0	0	48	0	15	100
HL1	7/1/2003	Z8	Z8N	20	0	2	1	1	0	0	0	0	0	4	0	0	0	57	0	15	100
HL1	7/1/2003	Z8	Z8S	15	6	3	1	3	0	0	0	0	0	0	2	0	0	60	0	10	100
HL1	7/1/2003	Z8	Z8W	15	0	1	0	1	0	0	0	0	0	0	3	0	0	80	0	0	100

Vegetation Data for Hoggett Transects
(See Appendix 4 for codes to column headings.)

TRANS	DATE	QUAD	SEC	BG	R	TC	LM	EC	EM	GV	DD	N	DOCU	HF	DT	O	0
HGT1	6/20/2003	Z4	Z4E	15	10	6	20	0	0	0	0	2	0	8	0	39	100
HGT1	6/20/2003	Z4	Z4N	30	0	10	20	0	0	0	0	4	0	5	0	31	100
HGT1	6/20/2003	Z4	Z4S	20	0	4	20	0	0	0	0	2	0	15	0	39	100
HGT1	6/20/2003	Z4	Z4W	25	4	3	10	0	0	0	3	5	0	6	0	44	100
HGT1	6/20/2003	Z5	Z5E	25	0	0	10	6	0	0	25	3	20	5	0	6	100
HGT1	6/20/2003	Z5	Z5N	25	0	0	5	6	0	0	30	1	20	3	0	10	100
HGT1	6/20/2003	Z5	Z5S	10	7	0	5	3	0	0	40	1	25	7	0	2	100
HGT1	6/20/2003	Z5	Z5W	20	0	0	4	8	0	0	40	1	20	6	0	1	100
HGT1	6/20/2003	Z6	Z6E	30	8	0	0	25	3	0	1	15	5	0	0	13	100
HGT1	6/20/2003	Z6	Z6N	15	5	0	0	25	4	0	3	15	8	0	0	25	100
HGT1	6/20/2003	Z6	Z6S	20	13	0	0	15	1	0	2	20	6	0	0	23	100
HGT1	6/20/2003	Z6	Z6W	25	0	0	0	20	2	0	1	20	5	0	0	27	100
HGT2	6/20/2003	Z4	Z4E	60	0	0	0	8	5	0	1	0	8	0	0	18	100
HGT2	6/20/2003	Z4	Z4N	30	0	0	0	15	0	0	3	0	5	0	0	47	100
HGT2	6/20/2003	Z4	Z4S	40	0	0	1	15	5	0	2	0	10	0	0	27	100
HGT2	6/20/2003	Z4	Z4W	50	0	0	0	10	0	0	0	0	20	0	0	20	100
HGT2	6/20/2003	Z5	Z5E	50	12	0	0	10	1	0	0	6	5	0	0	16	100
HGT2	6/20/2003	Z5	Z5N	50	10	0	0	10	2	0	0	2	10	0	0	16	100
HGT2	6/20/2003	Z5	Z5S	60	4	0	0	6	0	0	0	10	6	0	0	14	100
HGT2	6/20/2003	Z5	Z5W	50	6	0	0	10	5	0	4	0	10	0	0	15	100
HGT2	6/20/2003	Z6	Z6E	50	1	0	0	20	1	0	0	0	5	0	0	23	100
HGT2	6/20/2003	Z6	Z6N	25	12	0	0	15	10	0	0	0	10	0	0	28	100
HGT2	6/20/2003	Z6	Z6S	45	3	0	0	12	1	0	0	0	10	0	0	29	100
HGT2	6/20/2003	Z6	Z6W	35	0	0	0	16	1	0	0	0	6	0	0	42	100
HGT1	5/10/2001	Z4	Z4E	40	15	25	5	0	0	0	0	0	0	0	0	15	100
HGT1	5/10/2001	Z4	Z4N	50	0	5	5	3	0	0	0	0	0	0	0	37	100
HGT1	5/10/2001	Z4	Z4S	40	0	25	5	0	0	0	0	0	0	0	0	30	100
HGT1	5/10/2001	Z4	Z4W	50	3	5	5	0	0	0	0	0	0	0	0	37	100
HGT1	5/10/2001	Z5	Z5E	30	0	0	25	15	0	0	1	0	0	0	0	29	100
HGT1	5/10/2001	Z5	Z5N	20	0	0	40	15	0	0	1	2	0	0	0	22	100
HGT1	5/10/2001	Z5	Z5S	20	4	0	25	15	0	0	0	0	0	0	0	36	100
HGT1	5/10/2001	Z5	Z5W	20	0	1	69	10	0	0	0	0	0	0	0	0	100
HGT1	5/10/2001	Z6	Z6E	20	5	0	10	20	5	1	20	5	0	0	0	14	100
HGT1	5/10/2001	Z6	Z6N	30	4	0	15	12	5	0	20	5	0	0	0	9	100
HGT1	5/10/2001	Z6	Z6S	25	20	0	10	10	5	2	20	5	0	0	0	3	100
HGT1	5/10/2001	Z6	Z6W	35	3	0	5	15	5	0	20	6	0	0	0	11	100
HGT2	5/10/2001	Z4	Z4E	35	0	0	24	5	10	0	25	0	0	0	0	1	100
HGT2	5/10/2001	Z4	Z4N	40	0	0	15	5	5	1	34	0	0	0	0	0	100
HGT2	5/10/2001	Z4	Z4S	25	0	0	48	5	15	1	5	0	0	0	0	1	100
HGT2	5/10/2001	Z4	Z4W	25	6	0	30	12	1	1	23	0	0	0	0	2	100

HGT2	5/10/2001	Z5	Z5E	30	15	0	2	5	10	2	5	10	1	0	0	20	100
HGT2	5/10/2001	Z5	Z5N	30	10	0	10	15	5	1	5	3	1	0	0	20	100
HGT2	5/10/2001	Z5	Z5S	50	5	0	0	20	2	2	1	10	1	0	0	9	100
HGT2	5/10/2001	Z5	Z5W	25	5	0	0	5	10	5	1	5	0	0	0	44	100
HGT2	5/10/2001	Z6	Z6E	40	0	0	0	10	10	5	0	0	1	0	0	34	100
HGT2	5/10/2001	Z6	Z6N	25	10	0	0	25	10	0	0	0	2	0	0	28	100
HGT2	5/10/2001	Z6	Z6S	55	0	0	0	5	5	5	0	0	1	0	0	29	100
HGT2	5/10/2001	Z6	Z6W	30	0	0	0	15	10	1	0	0	1	0	0	43	100
HGT1	5/11/2000	Z4	Z4E	20	15	5	40	0	0	0	0	0	0	20	0	0	100
HGT1	5/11/2000	Z4	Z4N	45	0	15	16	0	0	0	1	5	0	8	0	10	100
HGT1	5/11/2000	Z4	Z4S	45	0	10	27	0	0	0	0	3	0	15	0	0	100
HGT1	5/11/2000	Z4	Z4W	35	3	10	16	0	10	0	1	5	0	20	0	0	100
HGT1	5/11/2000	Z5	Z5E	20	0	3	10	15	0	0	42	0	0	5	0	5	100
HGT1	5/11/2000	Z5	Z5N	14	0	0	14	25	1	0	35	1	0	5	0	5	100
HGT1	5/11/2000	Z5	Z5S	10	5	0	8	15	0	0	51	1	0	5	0	5	100
HGT1	5/11/2000	Z5	Z5W	15	0	0	12	10	0	0	55	1	0	2	0	5	100
HGT1	5/11/2000	Z6	Z6E	35	6	0	0	20	15	0	10	5	0	0	0	9	100
HGT1	5/11/2000	Z6	Z6N	30	8	0	0	15	10	0	0	0	5	0	0	32	100
HGT1	5/11/2000	Z6	Z6S	20	12	0	0	15	10	0	15	15	0	0	0	13	100
HGT1	5/11/2000	Z6	Z6W	30	2	0	0	25	15	0	10	1	0	0	0	17	100
HGT2	5/11/2000	Z4	Z4E	30	0	0	5	3	3	0	59	0	0	0	0	0	100
HGT2	5/11/2000	Z4	Z4N	15	0	0	3	5	0	0	76	0	0	0	0	1	100
HGT2	5/11/2000	Z4	Z4S	35	0	0	10	8	7	0	38	1	0	0	0	1	100
HGT2	5/11/2000	Z4	Z4W	10	5	0	15	3	0	0	63	1	0	0	0	3	100
HGT2	5/11/2000	Z5	Z5E	30	15	0	0	15	5	1	2	10	2	0	0	20	100
HGT2	5/11/2000	Z5	Z5N	40	5	0	0	15	10	0	0	3	1	0	0	26	100
HGT2	5/11/2000	Z5	Z5S	25	7	0	0	20	1	2	1	5	1	0	0	38	100
HGT2	5/11/2000	Z5	Z5W	15	0	0	0	10	15	0	0	2	1	0	0	57	100
HGT2	5/11/2000	Z6	Z6E	30	0	0	0	20	15	2	0	0	4	0	0	29	100
HGT2	5/11/2000	Z6	Z6N	30	8	0	0	15	10	0	0	0	5	0	0	32	100
HGT2	5/11/2000	Z6	Z6S	25	0	0	0	10	15	1	0	0	5	0	0	44	100
HGT2	5/11/2000	Z6	Z6W	25	3	0	0	9	8	0	0	0	2	0	0	53	100
HGT1	7/9/1999	Z4	Z4E	4	0	20	55	0	6	0	0	1	0	0	1	13	100
HGT1	7/9/1999	Z4	Z4N	12	2	0	45	0	4	1	0	3	0	0	1	32	100
HGT1	7/9/1999	Z4	Z4S	8	5	3	65	0	6	0	0	1	0	0	0	12	100
HGT1	7/9/1999	Z4	Z4W	8	0	0	60	0	5	0	0	3	0	0	0	24	100
HGT1	7/9/1999	Z5	Z5E	5	0	0	8	10	6	0	0	0	0	0	55	16	100
HGT1	7/9/1999	Z5	Z5N	6	0	0	5	4	4	0	0	0	0	0	55	26	100
HGT1	7/9/1999	Z5	Z5S	4	0	0	2	20	1	0	0	0	0	0	60	13	100
HGT1	7/9/1999	Z5	Z5W	0	3	0	3	8	4	0	0	0	0	0	65	17	100
HGT1	7/9/1999	Z6	Z6E	20	0	0	0	5	40	0	0	2	0	0	4	29	100
HGT1	7/9/1999	Z6	Z6N	0	0	0	0	25	30	0	0	2	0	0	1	42	100
HGT1	7/9/1999	Z6	Z6S	10	7	0	0	9	35	0	0	4	0	0	2	33	100
HGT1	7/9/1999	Z6	Z6W	6	10	0	0	4	10	0	0	5	0	0	1	64	100
HGT2	7/9/1999	Z4	Z4E	0	0	0	5	1	10	0	0	1	0	0	40	43	100

HGT2	7/9/1999	Z4	Z4N	0	0	0	5	3	6	0	0	0	0	0	30	56	100
HGT2	7/9/1999	Z4	Z4S	0	0	0	5	1	10	0	40	1	0	0	0	43	100
HGT2	7/9/1999	Z4	Z4W	0	0	0	2	0	5	0	0	1	0	0	30	62	100
HGT2	7/9/1999	Z5	Z5E	0	15	0	0	5	40	0	0	8	0	0	0	32	100
HGT2	7/9/1999	Z5	Z5N	0	8	0	0	6	35	0	0	0	0	0	0	51	100
HGT2	7/9/1999	Z5	Z5S	0	10	0	0	8	35	0	0	8	0	0	0	39	100
HGT2	7/9/1999	Z5	Z5W	0	5	0	0	2	40	0	0	0	0	0	0	53	100
HGT2	7/9/1999	Z6	Z6E	0	0	0	0	8	25	0	0	0	0	0	0	67	100
HGT2	7/9/1999	Z6	Z6N	0	10	0	0	12	20	0	0	0	0	0	0	58	100
HGT2	7/9/1999	Z6	Z6S	0	0	0	0	10	15	0	0	0	0	0	0	75	100
HGT2	7/9/1999	Z6	Z6W	0	0	0	0	4	30	0	0	0	0	0	0	66	100

Vegetation Data for Sevenmile Lake Transects
(See Appendix 4 for codes to column headings.)

TRANS	DATE	QUAD	SEC	BG	R	OT	EMC	EC	MV	AS	PT	C	P	DMCA	DD	DOCU	GV	N	O	SS	0
SML8	6/8/1999	Z1	Z1E	7	4	24	10	3	0	0	0	0	0	5	0	3	0	0	44	0	100
SML8	6/8/1999	Z1	Z1N	5	4	15	2	3	0	0	0	0	0	6	0	1	0	0	64	0	100
SML8	6/8/1999	Z1	Z1S	15	2	15	5	12	0	0	0	0	0	1	0	8	0	0	42	0	100
SML8	6/8/1999	Z1	Z1W	9	8	35	2	1	0	0	0	0	0	1	0	2	0	0	42	0	100
SML8	6/8/1999	Z2	Z2E	15	38	8	2	4	0	0	0	0	0	0	0	1	0	0	32	0	100
SML8	6/8/1999	Z2	Z2N	30	11	17	6	20	0	0	0	0	0	2	0	6	0	0	8	0	100
SML8	6/8/1999	Z2	Z2S	27	10	15	1	7	0	0	0	0	0	1	0	2	0	0	37	0	100
SML8	6/8/1999	Z2	Z2W	16	18	30	1	13	0	0	0	0	0	2	0	5	0	0	15	0	100
SML8	6/8/1999	Z3	Z3E	44	5	2	30	10	0	0	0	0	0	0	0	4	0	0	5	0	100
SML8	6/8/1999	Z3	Z3N	35	5	2	40	10	0	0	0	0	0	0	0	2	0	0	6	0	100
SML8	6/8/1999	Z3	Z3S	34	0	2	40	20	0	0	0	0	0	0	0	1	0	0	3	0	100
SML8	6/8/1999	Z3	Z3W	38	10	1	30	15	0	0	0	0	0	0	0	1	0	0	5	0	100
SML8	6/8/1999	Z4	Z4E	35	8	15	5	0	0	0	0	0	0	0	0	0	0	0	37	0	100
SML8	6/8/1999	Z4	Z4N	69	5	10	1	0	0	0	0	0	0	0	0	0	0	0	15	0	100
SML8	6/8/1999	Z4	Z4S	40	5	5	20	0	0	0	0	0	0	0	0	0	0	0	30	0	100
SML8	6/8/1999	Z4	Z4W	30	0	5	15	0	0	0	0	0	0	0	0	0	0	0	50	0	100
SML8	7/7/2000	Z1	Z1E	4	7	10	4	0	0	0	0	0	0	20	0	0	0	0	55	0	100
SML8	7/7/2000	Z1	Z1N	0	6	25	0	0	0	0	0	0	0	10	0	0	0	0	59	0	100
SML8	7/7/2000	Z1	Z1S	12	8	20	10	0	0	0	0	0	0	25	0	0	0	0	25	0	100
SML8	7/7/2000	Z1	Z1W	3	12	30	0	0	0	0	0	0	0	12	0	0	0	0	43	0	100
SML8	7/7/2000	Z2	Z2E	10	25	25	12	5	0	0	0	0	0	3	0	0	0	0	20	0	100
SML8	7/7/2000	Z2	Z2N	12	18	10	30	5	0	0	0	0	0	15	0	0	0	0	10	0	100
SML8	7/7/2000	Z2	Z2S	4	20	30	6	0	0	0	0	0	0	4	0	0	0	0	36	0	100
SML8	7/7/2000	Z2	Z2W	5	25	18	12	3	0	0	0	0	0	5	0	0	0	0	32	0	100
SML8	7/7/2000	Z3	Z3E	15	5	2	25	48	0	0	0	0	0	0	0	0	0	0	5	0	100
SML8	7/7/2000	Z3	Z3N	20	5	5	10	55	0	0	0	0	0	0	0	0	0	0	5	0	100
SML8	7/7/2000	Z3	Z3S	15	3	3	35	39	0	0	0	0	0	0	0	0	0	0	5	0	100
SML8	7/7/2000	Z3	Z3W	15	5	5	20	50	0	0	0	0	0	0	0	0	0	0	5	0	100
SML8	7/7/2000	Z4	Z4E	68	5	20	2	0	0	0	0	0	0	0	0	0	0	0	5	0	100
SML8	7/7/2000	Z4	Z4N	62	2	30	1	0	0	0	0	0	0	0	0	0	0	0	5	0	100
SML8	7/7/2000	Z4	Z4S	58	2	20	3	5	0	0	0	0	0	0	0	0	0	2	10	0	100
SML8	7/7/2000	Z4	Z4W	20	1	59	5	5	0	0	0	0	0	0	0	0	0	2	8	0	100
SML8	6/5/2001	Z1	Z1E	20	8	62	0	0	0	0	0	0	0	10	0	0	0	0	0	0	100
SML8	6/5/2001	Z1	Z1N	10	6	64	0	0	0	0	0	0	0	20	0	0	0	0	0	0	100
SML8	6/5/2001	Z1	Z1S	25	5	65	0	0	0	0	0	0	0	5	0	0	0	0	0	0	100
SML8	6/5/2001	Z1	Z1W	20	20	58	0	0	0	0	0	0	0	2	0	0	0	0	0	0	100
SML8	6/5/2001	Z2	Z2E	25	35	15	1	8	0	0	0	0	0	2	0	0	0	0	14	0	100
SML8	6/5/2001	Z2	Z2N	15	12	51	4	15	0	0	0	0	0	3	0	0	0	0	0	0	100
SML8	6/5/2001	Z2	Z2S	40	10	24	0	5	0	0	0	0	0	1	0	0	0	0	20	0	100
SML8	6/5/2001	Z2	Z2W	20	10	61	0	6	0	0	0	0	0	3	0	0	0	0	0	0	100
SML8	6/5/2001	Z3	Z3E	25	4	10	41	10	0	0	0	0	0	0	0	0	0	0	10	0	100
SML8	6/5/2001	Z3	Z3N	15	3	10	20	10	0	0	0	0	0	0	0	0	0	0	42	0	100

SML8	6/5/2001	Z3	Z3S	25	5	5	35	20	0	0	0	0	0	0	0	0	0	0	10	0	100
SML8	6/5/2001	Z3	Z3W	30	5	5	40	10	0	0	0	0	0	0	0	0	0	0	10	0	100
SML8	6/5/2001	Z4	Z4E	10	5	5	1	1	0	0	0	0	0	0	0	0	0	1	77	0	100
SML8	6/5/2001	Z4	Z4N	15	4	5	0	2	0	0	0	0	0	0	0	0	0	3	71	0	100
SML8	6/5/2001	Z4	Z4S	25	2	20	1	2	0	0	0	0	0	0	0	0	0	5	45	0	100
SML8	6/5/2001	Z4	Z4W	25	0	25	10	4	0	0	0	0	0	0	0	0	0	5	31	0	100
SML8	7/2/2003	Z1	Z1E	3	5	40	0	0	1	0	0	0	0	1	0	0	0	0	50	0	100
SML8	7/2/2003	Z1	Z1N	14	6	30	0	1	1	0	0	0	0	0	0	0	0	0	48	0	100
SML8	7/2/2003	Z1	Z1S	4	4	25	0	0	1	0	0	0	0	1	0	0	0	0	65	0	100
SML8	7/2/2003	Z1	Z1W	2	20	20	1	0	1	0	0	0	0	1	0	0	0	0	55	0	100
SML8	7/2/2003	Z2	Z2E	1	50	15	0	14	0	0	0	0	0	0	0	0	0	0	20	0	100
SML8	7/2/2003	Z2	Z2N	5	30	30	0	5	0	0	0	0	0	0	0	0	0	0	30	0	100
SML8	7/2/2003	Z2	Z2S	1	15	20	0	4	0	0	0	0	0	0	0	0	0	0	60	0	100
SML8	7/2/2003	Z2	Z2W	4	35	20	0	10	1	0	0	0	0	0	0	0	0	0	30	0	100
SML8	7/2/2003	Z3	Z3E	5	4	70	2	6	0	0	0	0	0	0	0	0	0	0	13	0	100
SML8	7/2/2003	Z3	Z3N	10	5	50	0	10	0	0	0	0	0	0	0	0	0	0	25	0	100
SML8	7/2/2003	Z3	Z3S	5	5	45	10	20	0	0	0	0	0	0	0	0	0	0	15	0	100
SML8	7/2/2003	Z3	Z3W	15	10	25	8	8	0	0	0	0	0	1	0	0	0	0	33	0	100
SML8	7/2/2003	Z4	Z4E	15	6	20	0	0	0	0	0	0	0	0	0	0	0	2	57	0	100
SML8	7/2/2003	Z4	Z4N	20	3	25	0	0	0	0	0	0	0	0	0	0	0	5	47	0	100
SML8	7/2/2003	Z4	Z4S	0	4	30	2	2	0	0	0	0	0	0	0	0	0	3	59	0	100
SML8	7/2/2003	Z4	Z4W	0	0	30	15	5	0	0	0	0	0	0	0	0	0	10	40	0	100
SML7	6/8/1999	Z1	Z1E	2	5	42	3	1	0	0	0	0	0	3	0	1	0	0	43	0	100
SML7	6/8/1999	Z1	Z1N	6	0	30	10	0	0	0	0	0	0	5	0	1	0	0	48	0	100
SML7	6/8/1999	Z1	Z1S	3	0	30	12	0	0	0	0	0	0	1	0	1	0	0	53	0	100
SML7	6/8/1999	Z1	Z1W	2	1	20	10	0	0	0	0	0	0	2	0	0	0	0	65	0	100
SML7	6/8/1999	Z2	Z2E	1	9	40	0	0	0	0	0	0	0	1	0	0	0	0	49	0	100
SML7	6/8/1999	Z2	Z2N	1	2	51	0	2	0	0	0	0	0	3	0	1	0	0	40	0	100
SML7	6/8/1999	Z2	Z2S	1	2	64	0	0	0	0	0	0	0	2	0	1	0	0	30	0	100
SML7	6/8/1999	Z2	Z2W	3	4	45	0	0	0	0	0	0	0	2	0	1	0	0	45	0	100
SML7	6/8/1999	Z3	Z3E	65	5	5	25	0	0	0	0	0	0	0	0	0	0	0	0	0	100
SML7	6/8/1999	Z3	Z3N	50	15	10	15	5	0	0	0	0	0	0	0	0	0	0	5	0	100
SML7	6/8/1999	Z3	Z3S	48	15	2	15	20	0	0	0	0	0	0	0	0	0	0	0	0	100
SML7	6/8/1999	Z3	Z3W	40	25	5	10	20	0	0	0	0	0	0	0	0	0	0	0	0	100
SML7	6/8/1999	Z4	Z4E	30	30	5	20	15	0	0	0	0	0	0	0	0	0	0	0	0	100
SML7	6/8/1999	Z4	Z4N	25	20	25	5	20	0	0	0	0	0	0	0	0	0	0	5	0	100
SML7	6/8/1999	Z4	Z4S	25	25	20	5	25	0	0	0	0	0	0	0	0	0	0	0	0	100
SML7	6/8/1999	Z4	Z4W	25	25	15	5	30	0	0	0	0	0	0	0	0	0	0	0	0	100
SML7	7/7/2000	Z1	Z1E	3	5	58	3	6	0	0	0	0	0	1	0	0	0	0	24	0	100
SML7	7/7/2000	Z1	Z1N	0	2	60	0	0	0	0	0	0	0	1	0	0	0	0	37	0	100
SML7	7/7/2000	Z1	Z1S	10	0	45	0	3	0	0	0	0	0	2	0	0	0	0	40	0	100
SML7	7/7/2000	Z1	Z1W	5	4	50	0	1	0	0	0	0	0	1	0	0	0	0	39	0	100
SML7	7/7/2000	Z2	Z2E	4	10	60	0	0	0	0	0	0	0	0	0	0	0	0	26	0	100
SML7	7/7/2000	Z2	Z2N	3	4	75	0	0	0	0	0	0	0	3	0	0	0	0	15	0	100
SML7	7/7/2000	Z2	Z2S	5	5	80	0	0	0	0	0	0	0	2	0	0	0	0	8	0	100
SML7	7/7/2000	Z2	Z2W	4	6	70	0	0	0	0	0	0	0	3	0	0	0	0	17	0	100
SML7	7/7/2000	Z3	Z3E	38	4	25	5	10	0	0	0	0	0	3	0	0	0	0	15	0	100

SML7	7/7/2000	Z3	Z3N	20	10	32	5	20	0	0	0	0	0	3	0	0	0	0	10	0	100
SML7	7/7/2000	Z3	Z3S	20	15	15	30	15	0	0	0	0	0	0	0	0	0	0	5	0	100
SML7	7/7/2000	Z3	Z3W	20	25	5	30	15	0	0	0	0	0	0	0	0	0	0	5	0	100
SML7	7/7/2000	Z4	Z4E	15	25	10	10	34	0	0	0	0	0	1	0	0	0	0	5	0	100
SML7	7/7/2000	Z4	Z4N	25	25	15	10	10	0	0	0	0	0	10	0	0	0	0	5	0	100
SML7	7/7/2000	Z4	Z4S	20	15	15	20	10	0	0	0	0	0	10	0	0	0	0	10	0	100
SML7	7/7/2000	Z4	Z4W	5	30	15	35	5	0	0	0	0	0	5	0	0	0	0	5	0	100
SML7	6/5/2001	Z1	Z1E	16	6	63	10	1	0	0	0	0	0	1	0	0	0	0	3	0	100
SML7	6/5/2001	Z1	Z1N	15	0	79	3	0	0	0	0	0	0	3	0	0	0	0	0	0	100
SML7	6/5/2001	Z1	Z1S	16	0	79	1	0	0	0	0	0	0	2	0	0	0	0	2	0	100
SML7	6/5/2001	Z1	Z1W	15	0	78	1	0	0	0	0	0	0	1	0	0	0	0	5	0	100
SML7	6/5/2001	Z2	Z2E	25	10	57	0	0	0	0	0	0	0	3	0	0	0	0	5	0	100
SML7	6/5/2001	Z2	Z2N	10	5	83	0	0	0	0	0	0	0	2	0	0	0	0	0	0	100
SML7	6/5/2001	Z2	Z2S	25	3	64	0	0	0	0	0	0	0	3	0	0	0	0	5	0	100
SML7	6/5/2001	Z2	Z2W	50	8	30	0	0	0	0	0	0	0	2	0	0	0	0	10	0	100
SML7	6/5/2001	Z3	Z3E	40	5	25	3	0	0	0	0	0	0	5	0	0	0	0	22	0	100
SML7	6/5/2001	Z3	Z3N	5	10	20	5	0	0	0	0	0	0	30	0	0	0	0	30	0	100
SML7	6/5/2001	Z3	Z3S	15	8	30	10	2	0	0	0	0	0	5	0	0	0	0	30	0	100
SML7	6/5/2001	Z3	Z3W	10	30	40	5	0	0	0	0	0	0	10	0	0	0	0	5	0	100
SML7	6/5/2001	Z4	Z4E	0	25	20	49	0	0	0	0	0	0	1	0	0	0	0	5	0	100
SML7	6/5/2001	Z4	Z4N	5	20	58	5	0	0	0	0	0	0	2	0	0	0	0	10	0	100
SML7	6/5/2001	Z4	Z4S	5	20	35	3	5	0	0	0	0	0	3	0	0	0	0	29	0	100
SML7	6/5/2001	Z4	Z4W	0	50	22	5	10	0	0	0	0	0	3	0	0	0	0	10	0	100
SML7	7/2/2003	Z1	Z1E	13	6	45	0	0	0	0	0	0	0	1	0	0	0	0	35	0	100
SML7	7/2/2003	Z1	Z1N	4	0	55	0	0	0	0	0	0	0	1	0	0	0	0	40	0	100
SML7	7/2/2003	Z1	Z1S	12	0	50	0	0	0	0	0	0	0	3	0	0	0	0	35	0	100
SML7	7/2/2003	Z1	Z1W	8	0	50	0	0	0	0	0	0	0	2	0	0	0	0	40	0	100
SML7	7/2/2003	Z2	Z2E	3	10	30	0	0	0	0	0	0	0	2	0	0	0	0	55	0	100
SML7	7/2/2003	Z2	Z2N	8	2	45	0	0	0	0	0	0	0	5	0	0	0	0	40	0	100
SML7	7/2/2003	Z2	Z2S	1	1	37	0	0	0	0	0	0	0	1	0	0	0	0	60	0	100
SML7	7/2/2003	Z2	Z2W	10	4	30	0	0	0	0	0	0	0	1	0	0	0	0	55	0	100
SML7	7/2/2003	Z3	Z3E	3	3	35	0	4	0	0	0	0	0	3	0	0	0	0	52	0	100
SML7	7/2/2003	Z3	Z3N	5	10	30	0	0	0	0	0	0	0	25	0	0	0	0	30	0	100
SML7	7/2/2003	Z3	Z3S	12	10	50	5	6	0	0	0	0	0	12	0	0	0	0	5	0	100
SML7	7/2/2003	Z3	Z3W	10	18	50	0	0	0	0	0	0	0	10	0	0	0	0	12	0	100
SML7	7/2/2003	Z4	Z4E	8	20	40	12	0	0	0	0	0	0	10	0	0	0	0	10	0	100
SML7	7/2/2003	Z4	Z4N	5	18	45	7	0	0	0	0	0	0	5	0	0	0	0	20	0	100
SML7	7/2/2003	Z4	Z4S	5	15	35	10	6	0	0	0	0	0	6	0	0	0	0	23	0	100
SML7	7/2/2003	Z4	Z4W	4	35	35	8	10	0	0	0	0	0	4	0	0	0	0	4	0	100
SML6	6/4/1999	Z1	Z1E	40	4	6	25	6	0	0	0	0	0	2	0	8	0	0	9	0	100
SML6	6/4/1999	Z1	Z1N	25	10	4	20	12	0	0	0	0	0	0	0	15	0	0	14	0	100
SML6	6/4/1999	Z1	Z1S	45	7	7	10	3	0	0	0	0	0	0	0	12	0	0	16	0	100
SML6	6/4/1999	Z1	Z1W	8	0	38	25	8	0	0	0	0	0	0	0	15	0	0	6	0	100
SML6	6/4/1999	Z2	Z2E	6	45	6	5	20	0	0	0	0	0	0	0	2	0	0	16	0	100
SML6	6/4/1999	Z2	Z2N	0	30	25	0	15	0	0	0	0	0	6	0	2	0	0	22	0	100
SML6	6/4/1999	Z2	Z2S	0	6	10	7	8	0	0	0	0	0	0	0	3	0	0	66	0	100
SML6	6/4/1999	Z2	Z2W	0	30	5	1	12	0	0	0	0	0	2	0	4	0	0	46	0	100

SML6	6/4/1999	Z3	Z3E	40	25	30	0	0	5	0	0	0	0	0	0	0	0	0	0	0	100
SML6	6/4/1999	Z3	Z3N	20	30	40	0	0	10	0	0	0	0	0	0	0	0	0	0	0	100
SML6	6/4/1999	Z3	Z3S	35	25	25	0	0	15	0	0	0	0	0	0	0	0	0	0	0	100
SML6	6/4/1999	Z3	Z3W	30	25	40	0	0	5	0	0	0	0	0	0	0	0	0	0	0	100
SML6	6/4/1999	Z4	Z4E	50	10	40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100
SML6	6/4/1999	Z4	Z4N	38	20	40	2	0	0	0	0	0	0	0	0	0	0	0	0	0	100
SML6	6/4/1999	Z4	Z4S	38	10	45	2	5	0	0	0	0	0	0	0	0	0	0	0	0	100
SML6	6/4/1999	Z4	Z4W	25	50	15	5	5	0	0	0	0	0	0	0	0	0	0	0	0	100
SML6	7/7/2000	Z1	Z1E	33	6	15	10	6	0	0	0	0	0	20	0	0	0	0	10	0	100
SML6	7/7/2000	Z1	Z1N	40	7	10	20	0	0	0	0	0	0	5	0	0	0	0	18	0	100
SML6	7/7/2000	Z1	Z1S	25	10	30	1	8	0	0	0	0	0	6	0	0	0	0	20	0	100
SML6	7/7/2000	Z1	Z1W	15	2	20	15	12	0	0	0	0	0	0	0	0	0	0	36	0	100
SML6	7/7/2000	Z2	Z2E	4	35	16	15	15	0	0	0	0	0	2	0	0	0	0	13	0	100
SML6	7/7/2000	Z2	Z2N	8	25	35	0	1	0	0	0	0	0	18	0	0	0	0	13	0	100
SML6	7/7/2000	Z2	Z2S	15	6	30	10	8	0	0	0	0	0	1	0	0	0	0	30	0	100
SML6	7/7/2000	Z2	Z2W	5	40	25	4	6	0	0	0	0	0	2	0	0	0	0	18	0	100
SML6	7/7/2000	Z3	Z3E	10	25	46	0	0	4	0	0	0	0	0	0	0	0	0	15	0	100
SML6	7/7/2000	Z3	Z3N	15	30	35	0	0	5	0	0	0	0	0	0	0	0	0	15	0	100
SML6	7/7/2000	Z3	Z3S	10	25	45	0	0	5	0	0	0	0	0	0	0	0	0	15	0	100
SML6	7/7/2000	Z3	Z3W	15	30	37	0	0	3	0	0	0	0	0	0	0	0	0	15	0	100
SML6	7/7/2000	Z4	Z4E	35	15	44	0	0	0	0	0	0	0	1	0	0	0	0	5	0	100
SML6	7/7/2000	Z4	Z4N	30	25	34	1	0	0	0	0	0	0	0	0	0	0	0	10	0	100
SML6	7/7/2000	Z4	Z4S	35	12	40	4	1	0	0	0	0	0	0	0	0	0	0	8	0	100
SML6	7/7/2000	Z4	Z4W	20	35	31	3	5	0	0	0	0	0	0	0	0	0	0	6	0	100
SML6	6/5/2001	Z1	Z1E	60	7	20	2	0	0	0	0	0	0	10	0	0	0	0	1	0	100
SML6	6/5/2001	Z1	Z1N	20	10	63	0	0	0	0	0	0	0	5	0	0	0	0	2	0	100
SML6	6/5/2001	Z1	Z1S	25	10	53	2	0	0	0	0	0	0	5	0	0	0	0	5	0	100
SML6	6/5/2001	Z1	Z1W	6	4	78	8	0	0	0	0	0	0	2	0	0	0	0	2	0	100
SML6	6/5/2001	Z2	Z2E	0	50	15	7	6	0	0	0	0	0	5	0	0	0	0	17	0	100
SML6	6/5/2001	Z2	Z2N	0	27	35	0	0	0	0	0	0	0	4	0	0	0	0	34	0	100
SML6	6/5/2001	Z2	Z2S	0	5	60	5	3	0	0	0	0	0	3	0	0	0	0	24	0	100
SML6	6/5/2001	Z2	Z2W	0	30	25	3	0	0	0	0	0	0	5	0	0	0	0	37	0	100
SML6	6/5/2001	Z3	Z3E	5	30	25	0	0	3	0	0	0	0	0	0	0	0	0	37	0	100
SML6	6/5/2001	Z3	Z3N	5	30	25	0	0	5	0	0	0	0	0	0	0	0	0	35	0	100
SML6	6/5/2001	Z3	Z3S	5	30	25	0	0	3	0	0	0	0	0	0	0	0	0	37	0	100
SML6	6/5/2001	Z3	Z3W	5	30	30	0	0	3	0	0	0	0	0	0	0	0	0	32	0	100
SML6	6/5/2001	Z4	Z4E	30	8	30	1	1	0	0	0	0	0	0	0	0	0	0	30	0	100
SML6	6/5/2001	Z4	Z4N	15	30	25	0	0	0	0	0	0	0	0	0	0	0	0	30	0	100
SML6	6/5/2001	Z4	Z4S	25	10	30	3	2	0	0	0	0	0	0	0	0	0	0	30	0	100
SML6	6/5/2001	Z4	Z4W	5	60	20	5	1	0	0	0	0	0	0	0	0	0	0	9	0	100
SML6	7/2/2003	Z1	Z1E	1	5	15	0	0	0	0	0	0	0	0	0	0	0	0	79	0	100
SML6	7/2/2003	Z1	Z1N	3	12	19	0	1	0	0	0	0	0	0	0	0	0	0	65	0	100
SML6	7/2/2003	Z1	Z1S	4	15	10	0	1	0	0	0	0	0	0	0	0	0	0	70	0	100
SML6	7/2/2003	Z1	Z1W	2	0	22	16	0	0	0	0	0	0	0	0	0	0	0	60	0	100
SML6	7/2/2003	Z2	Z2E	5	55	0	2	12	0	0	0	0	0	1	0	0	0	0	25	0	100
SML6	7/2/2003	Z2	Z2N	3	35	35	0	0	0	0	0	0	0	2	0	0	0	0	25	0	100
SML6	7/2/2003	Z2	Z2S	9	5	60	0	1	0	0	0	0	0	0	0	0	0	0	25	0	100

SML6	7/2/2003	Z2	Z2W	4	30	45	0	0	0	0	0	0	0	1	0	0	0	0	20	0	100
SML6	7/2/2003	Z3	Z3E	10	20	30	0	0	0	0	0	0	0	0	0	0	0	0	40	0	100
SML6	7/2/2003	Z3	Z3N	2	40	40	0	0	3	0	0	0	0	0	0	0	0	0	15	0	100
SML6	7/2/2003	Z3	Z3S	10	25	45	0	0	1	0	0	0	0	0	0	0	0	0	19	0	100
SML6	7/2/2003	Z3	Z3W	6	30	30	0	0	1	0	0	0	0	0	0	0	0	0	33	0	100
SML6	7/2/2003	Z4	Z4E	20	5	30	0	0	0	0	0	0	0	0	0	0	0	0	45	0	100
SML6	7/2/2003	Z4	Z4N	25	15	25	0	0	0	0	0	0	0	0	0	0	0	0	35	0	100
SML6	7/2/2003	Z4	Z4S	10	10	50	0	0	0	0	0	0	0	0	0	0	0	0	30	0	100
SML6	7/2/2003	Z4	Z4W	25	35	30	0	0	0	0	0	0	0	0	0	0	0	0	10	0	100
SML5	6/4/1999	Z1	Z1E	8	2	55	10	4	0	0	0	0	0	0	0	12	0	0	9	0	100
SML5	6/4/1999	Z1	Z1N	3	4	30	6	1	0	0	0	0	0	2	0	8	0	0	46	0	100
SML5	6/4/1999	Z1	Z1S	0	20	60	3	1	0	0	0	0	0	1	0	1	0	0	14	0	100
SML5	6/4/1999	Z1	Z1W	0	4	54	5	1	0	0	0	0	0	1	0	5	0	0	30	0	100
SML5	6/4/1999	Z2	Z2E	2	18	20	0	0	16	0	0	0	0	5	0	3	0	0	36	0	100
SML5	6/4/1999	Z2	Z2N	15	18	15	0	4	12	0	0	0	0	4	0	2	0	0	30	0	100
SML5	6/4/1999	Z2	Z2S	8	26	30	0	0	10	0	0	0	0	1	0	1	0	0	24	0	100
SML5	6/4/1999	Z2	Z2W	3	21	40	0	0	6	0	0	0	0	0	0	4	0	0	26	0	100
SML5	6/4/1999	Z3	Z3E	25	10	50	0	0	15	0	0	0	0	0	0	0	0	0	0	0	100
SML5	6/4/1999	Z3	Z3N	45	10	35	0	0	10	0	0	0	0	0	0	0	0	0	0	0	100
SML5	6/4/1999	Z3	Z3S	45	15	30	5	0	5	0	0	0	0	0	0	0	0	0	0	0	100
SML5	6/4/1999	Z3	Z3W	30	15	40	0	0	15	0	0	0	0	0	0	0	0	0	0	0	100
SML5	6/4/1999	Z4	Z4E	75	5	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100
SML5	6/4/1999	Z4	Z4N	47	15	35	0	0	3	0	0	0	0	0	0	0	0	0	0	0	100
SML5	6/4/1999	Z4	Z4S	60	20	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100
SML5	6/4/1999	Z4	Z4W	68	5	25	0	0	2	0	0	0	0	0	0	0	0	0	0	0	100
SML5	7/7/2000	Z1	Z1E	5	2	50	6	5	0	0	0	0	0	10	0	0	0	0	22	0	100
SML5	7/7/2000	Z1	Z1N	10	5	50	3	0	0	0	0	0	0	5	0	0	0	0	27	0	100
SML5	7/7/2000	Z1	Z1S	2	20	52	0	0	0	0	0	0	0	1	0	0	0	0	25	0	100
SML5	7/7/2000	Z1	Z1W	3	8	42	0	0	0	0	0	0	0	7	0	0	0	0	40	0	100
SML5	7/7/2000	Z2	Z2E	3	20	45	0	0	12	0	0	0	0	6	0	0	0	0	14	0	100
SML5	7/7/2000	Z2	Z2N	2	35	25	2	4	10	0	0	0	0	4	0	0	0	0	18	0	100
SML5	7/7/2000	Z2	Z2S	4	40	30	0	0	10	0	0	0	0	2	0	0	0	0	14	0	100
SML5	7/7/2000	Z2	Z2W	0	25	38	1	1	15	0	0	0	0	5	0	0	0	0	15	0	100
SML5	7/7/2000	Z3	Z3E	25	10	47	0	0	8	0	0	0	0	0	0	0	0	0	10	0	100
SML5	7/7/2000	Z3	Z3N	25	15	57	0	0	3	0	0	0	0	0	0	0	0	0	0	0	100
SML5	7/7/2000	Z3	Z3S	25	20	40	0	5	10	0	0	0	0	0	0	0	0	0	0	0	100
SML5	7/7/2000	Z3	Z3W	20	15	57	0	0	8	0	0	0	0	0	0	0	0	0	0	0	100
SML5	7/7/2000	Z4	Z4E	77	6	10	1	0	4	0	0	0	0	0	0	0	0	0	2	0	100
SML5	7/7/2000	Z4	Z4N	36	15	35	0	0	4	0	0	0	0	0	0	0	0	0	10	0	100
SML5	7/7/2000	Z4	Z4S	54	25	15	2	0	2	0	0	0	0	0	0	0	0	0	2	0	100
SML5	7/7/2000	Z4	Z4W	62	2	25	1	0	5	0	0	0	0	0	0	0	0	0	5	0	100
SML5	6/5/2001	Z1	Z1E	35	5	45	4	0	0	0	0	0	0	6	0	0	0	0	5	0	100
SML5	6/5/2001	Z1	Z1N	30	8	50	0	0	0	0	0	0	0	2	0	0	0	0	10	0	100
SML5	6/5/2001	Z1	Z1S	8	30	50	0	0	0	0	0	0	0	2	0	0	0	0	10	0	100
SML5	6/5/2001	Z1	Z1W	18	7	60	1	1	0	0	0	0	0	1	0	0	0	0	12	0	100
SML5	6/5/2001	Z2	Z2E	2	25	20	0	0	6	0	0	0	0	2	0	0	0	0	45	0	100
SML5	6/5/2001	Z2	Z2N	0	30	10	5	3	6	0	0	0	0	5	0	0	0	0	41	0	100

SML5	6/5/2001	Z2	Z2S	0	32	14	0	0	4	0	0	0	0	2	0	0	0	0	48	0	100
SML5	6/5/2001	Z2	Z2W	2	38	10	1	0	10	0	0	0	0	3	0	0	0	0	36	0	100
SML5	6/5/2001	Z3	Z3E	15	8	20	0	0	10	0	0	0	0	0	0	0	0	0	47	0	100
SML5	6/5/2001	Z3	Z3N	15	10	25	0	0	3	0	0	0	0	0	0	0	0	0	47	0	100
SML5	6/5/2001	Z3	Z3S	10	15	20	2	0	5	0	0	0	0	0	0	0	0	0	48	0	100
SML5	6/5/2001	Z3	Z3W	10	15	30	0	0	10	0	0	0	0	0	0	0	0	0	35	0	100
SML5	6/5/2001	Z4	Z4E	30	10	5	0	0	5	0	0	0	0	0	0	0	0	0	50	0	100
SML5	6/5/2001	Z4	Z4N	20	10	10	0	0	5	0	0	0	0	0	0	0	0	0	55	0	100
SML5	6/5/2001	Z4	Z4S	15	25	20	0	0	2	0	0	0	0	0	0	0	0	0	38	0	100
SML5	6/5/2001	Z4	Z4W	20	0	25	0	0	5	0	0	0	0	0	0	0	0	0	50	0	100
SML5	7/2/2003	Z1	Z1E	0	4	30	0	1	0	0	0	0	0	0	0	0	0	0	65	0	100
SML5	7/2/2003	Z1	Z1N	10	6	24	0	0	0	0	0	0	0	0	0	0	0	0	60	0	100
SML5	7/2/2003	Z1	Z1S	0	30	40	0	0	0	0	0	0	0	0	0	0	0	0	30	0	100
SML5	7/2/2003	Z1	Z1W	4	6	35	0	0	0	0	0	0	0	0	0	0	0	0	55	0	100
SML5	7/2/2003	Z2	Z2E	3	25	25	0	0	3	0	0	0	0	1	0	0	0	0	43	0	100
SML5	7/2/2003	Z2	Z2N	10	10	20	3	6	0	0	0	0	0	1	0	0	0	0	50	0	100
SML5	7/2/2003	Z2	Z2S	3	40	27	0	0	0	0	0	0	0	0	0	0	0	0	30	0	100
SML5	7/2/2003	Z2	Z2W	2	20	30	1	0	0	0	0	0	0	2	0	0	0	0	45	0	100
SML5	7/2/2003	Z3	Z3E	5	8	35	0	0	3	0	0	0	0	0	0	0	0	0	49	0	100
SML5	7/2/2003	Z3	Z3N	20	10	35	0	1	1	0	0	0	0	0	0	0	0	0	33	0	100
SML5	7/2/2003	Z3	Z3S	2	15	30	0	0	2	0	0	0	0	0	0	0	0	0	51	0	100
SML5	7/2/2003	Z3	Z3W	10	12	30	0	0	2	0	0	0	0	0	0	0	0	0	46	0	100
SML5	7/2/2003	Z4	Z4E	40	8	4	0	1	0	0	0	0	0	0	0	0	0	0	47	0	100
SML5	7/2/2003	Z4	Z4N	5	10	15	0	1	0	0	0	0	0	0	0	0	0	0	69	0	100
SML5	7/2/2003	Z4	Z4S	5	22	6	0	1	0	0	0	0	0	0	0	0	0	0	66	0	100
SML5	7/2/2003	Z4	Z4W	10	0	10	0	1	10	0	0	0	0	0	0	0	0	0	69	0	100
SML8	8/18/2006	Z3	Z3N	1	2	25	1	5	0	0	0	0	0	0	0	0	0	0	66	0	100
SML8	8/18/2006	Z3	Z3W	6	8	22	7	8	0	0	0	0	0	0	0	0	0	0	49	0	100
SML8	8/18/2006	Z3	Z3S	11	1	5	12	24	0	0	0	0	0	0	0	0	0	0	47	0	100
SML8	8/18/2006	Z3	Z3E	5	7	9	6	5	0	0	0	0	0	0	0	0	0	0	68	0	100

Vegetation Data for Spring Branch Pools 1, 2, 3, 4 Transects
(See Appendix 4 for codes to column headings.)

TRANS	DATE	QUAD	SEC	BG	R	OT	EMC	MV	AS	PT	C	P	DMCA	DD	DOCU	GV	N	O	SS	EC	0
SB1-1	7/22/1999	Z3	Z3E	32	0	3	60	0	0	0	2	0	0	0	0	0	0	3	0	0	100
SB1-1	7/22/1999	Z3	Z3N	35	0	10	50	0	0	0	0	0	0	0	0	0	0	5	0	0	100
SB1-1	7/22/1999	Z3	Z3S	35	0	0	65	0	0	0	0	0	0	0	0	0	0	0	0	0	100
SB1-1	7/22/1999	Z3	Z3W	29	1	5	60	0	0	0	0	0	0	0	0	0	0	5	0	0	100
SB1-1	7/22/1999	Z4	Z4E	37	5	45	0	0	0	0	0	0	0	0	0	0	0	3	0	10	100
SB1-1	7/22/1999	Z4	Z4N	35	2	25	0	0	0	0	0	0	0	0	0	0	0	3	0	35	100
SB1-1	7/22/1999	Z4	Z4S	39	3	45	0	0	0	0	0	0	0	0	0	0	0	3	0	10	100
SB1-1	7/22/1999	Z4	Z4W	37	2	25	0	0	0	0	1	0	0	0	0	0	0	5	0	30	100
SB1-1	7/22/1999	Z5	Z5E	68	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	30	100
SB1-1	7/22/1999	Z5	Z5N	58	0	25	2	0	0	0	0	0	0	0	0	0	0	0	0	15	100
SB1-1	7/22/1999	Z5	Z5S	61	0	25	0	0	0	0	0	0	0	0	0	0	0	4	0	10	100
SB1-1	7/22/1999	Z5	Z5W	31	0	40	1	0	0	0	0	0	0	0	0	0	0	3	0	25	100
SB1-1	8/22/2000	Z3	Z3E	55	0	10	35	0	0	0	0	0	0	0	0	0	0	0	0	0	100
SB1-1	8/22/2000	Z3	Z3N	45	0	5	50	0	0	0	0	0	0	0	0	0	0	0	0	0	100
SB1-1	8/22/2000	Z3	Z3S	30	0	0	70	0	0	0	0	0	0	0	0	0	0	0	0	0	100
SB1-1	8/22/2000	Z3	Z3W	25	5	0	70	0	0	0	0	0	0	0	0	0	0	0	0	0	100
SB1-1	8/22/2000	Z4	Z4E	15	3	0	0	0	0	0	0	0	0	0	0	0	0	74	0	8	100
SB1-1	8/22/2000	Z4	Z4N	10	0	0	0	0	0	0	0	0	0	0	0	0	0	80	0	10	100
SB1-1	8/22/2000	Z4	Z4S	15	4	0	0	0	0	0	0	0	0	0	0	0	0	75	0	6	100
SB1-1	8/22/2000	Z4	Z4W	15	0	0	0	0	0	0	0	0	0	0	0	0	0	65	0	20	100
SB1-1	7/9/2001	Z3	Z3E	51	0	4	25	0	5	0	0	0	0	0	15	0	0	0	0	0	100
SB1-1	7/9/2001	Z3	Z3N	41	0	2	25	0	2	0	0	0	0	0	30	0	0	0	0	0	100
SB1-1	7/9/2001	Z3	Z3S	38	0	0	40	0	1	0	0	0	0	0	20	0	0	0	0	1	100
SB1-1	7/9/2001	Z3	Z3W	39	5	0	45	0	0	0	0	0	0	0	10	0	0	0	0	1	100
SB1-1	7/9/2001	Z4	Z4E	50	3	0	1	0	25	0	0	0	0	0	1	0	0	15	0	5	100
SB1-1	7/9/2001	Z4	Z4N	53	0	0	1	0	15	0	0	0	0	0	1	0	0	20	0	10	100
SB1-1	7/9/2001	Z4	Z4S	54	4	0	1	0	25	0	0	0	0	0	2	0	0	10	0	4	100
SB1-1	7/9/2001	Z4	Z4W	53	1	0	1	0	10	0	0	0	0	0	0	0	0	15	0	20	100
SB1-1	7/9/2001	Z5	Z5E	59	0	0	0	0	20	0	0	0	0	0	0	0	1	5	0	15	100
SB1-1	7/9/2001	Z5	Z5N	60	0	0	0	0	20	0	0	0	0	0	0	0	0	5	0	15	100
SB1-1	7/9/2001	Z5	Z5S	52	1	0	0	0	30	0	0	0	0	0	0	0	2	5	0	10	100
SB1-1	7/9/2001	Z5	Z5W	52	0	0	1	0	25	0	0	0	0	0	0	0	2	5	0	15	100
SB1-1	7/30/2003	Z3	Z3E	43	0	30	10	0	0	0	0	0	0	0	0	0	0	14	0	3	100
SB1-1	7/30/2003	Z3	Z3N	46	1	35	5	0	0	0	0	0	0	0	2	0	0	10	0	1	100
SB1-1	7/30/2003	Z3	Z3S	68	3	3	16	0	0	0	0	0	0	0	3	0	0	6	0	1	100
SB1-1	7/30/2003	Z3	Z3W	67	5	1	15	0	0	0	0	0	0	0	2	0	0	8	0	2	100
SB1-1	7/30/2003	Z4	Z4E	73	3	10	12	0	0	0	0	0	0	0	2	0	0	0	0	0	100
SB1-1	7/30/2003	Z4	Z4N	72	1	4	12	0	0	0	0	0	0	0	3	0	0	8	0	0	100
SB1-1	7/30/2003	Z4	Z4S	71	5	6	8	0	0	0	0	0	0	0	0	0	0	10	0	0	100
SB1-1	7/30/2003	Z4	Z4W	62	1	1	14	0	0	0	0	0	0	0	2	0	0	20	0	0	100
SB1-1	7/30/2003	Z5	Z5E	57	2	0	1	0	0	0	0	0	0	0	4	0	0	6	0	30	100
SB1-1	7/30/2003	Z5	Z5N	62	1	1	0	0	0	0	0	0	0	0	6	0	0	10	0	20	100

SB1-1	7/30/2003	Z5	Z5S	57	1	1	2	0	0	0	0	0	0	0	4	0	0	15	0	20	100
SB1-1	7/30/2003	Z5	Z5W	55	3	1	0	0	0	0	0	0	0	0	8	0	0	8	0	25	100
SB1-2	7/22/1999	Z3	Z3E	58	4	30	0	0	0	0	2	0	0	0	0	0	0	6	0	0	100
SB1-2	7/22/1999	Z3	Z3N	47	1	50	0	0	0	0	0	0	0	0	0	0	0	2	0	0	100
SB1-2	7/22/1999	Z3	Z3S	52	3	40	2	0	0	0	0	0	0	0	0	0	0	3	0	0	100
SB1-2	7/22/1999	Z3	Z3W	52	3	40	0	0	0	0	0	0	0	0	0	0	0	5	0	0	100
SB1-2	7/22/1999	Z4	Z4E	53	0	35	5	0	0	0	4	0	0	0	0	0	0	3	0	0	100
SB1-2	7/22/1999	Z4	Z4N	40	0	40	5	0	0	0	5	0	0	0	0	0	0	10	0	0	100
SB1-2	7/22/1999	Z4	Z4S	56	0	25	5	0	0	0	7	0	0	0	0	0	0	7	0	0	100
SB1-2	7/22/1999	Z4	Z4W	50	0	25	5	0	0	0	5	0	0	0	0	0	0	15	0	0	100
SB1-2	7/22/1999	Z5	Z5E	53	0	2	10	0	0	0	3	0	0	0	0	0	0	2	0	30	100
SB1-2	7/22/1999	Z5	Z5N	27	0	5	10	0	0	0	3	0	0	0	0	0	0	5	0	50	100
SB1-2	7/22/1999	Z5	Z5S	41	0	2	7	0	0	0	2	0	0	0	0	0	0	3	0	45	100
SB1-2	7/22/1999	Z5	Z5W	30	0	3	10	0	0	0	2	0	0	0	0	0	0	5	0	50	100
SB1-2	8/22/2000	Z3	Z3E	10	0	75	5	0	0	0	0	0	0	0	0	0	0	10	0	0	100
SB1-2	8/22/2000	Z3	Z3N	10	2	75	0	2	0	0	0	0	0	0	0	0	0	11	0	0	100
SB1-2	8/22/2000	Z3	Z3S	15	2	70	2	0	0	0	0	0	0	0	0	0	0	11	0	0	100
SB1-2	8/22/2000	Z3	Z3W	10	4	60	0	0	0	0	0	0	0	0	0	0	0	26	0	0	100
SB1-2	8/22/2000	Z4	Z4E	25	0	5	10	0	0	0	0	0	0	0	0	0	0	60	0	0	100
SB1-2	8/22/2000	Z4	Z4N	25	0	5	25	0	0	0	0	0	0	0	0	0	0	45	0	0	100
SB1-2	8/22/2000	Z4	Z4S	50	0	1	20	0	0	0	0	0	0	0	0	0	0	29	0	0	100
SB1-2	8/22/2000	Z4	Z4W	40	0	3	20	0	0	0	0	0	0	0	0	0	0	37	0	0	100
SB1-2	8/22/2000	Z5	Z5E	20	0	0	5	0	0	0	0	0	0	0	0	0	0	35	0	40	100
SB1-2	8/22/2000	Z5	Z5N	30	0	0	15	0	0	0	0	0	0	0	0	0	0	15	0	40	100
SB1-2	8/22/2000	Z5	Z5S	30	0	0	15	0	0	0	0	0	0	0	0	0	0	25	0	30	100
SB1-2	8/22/2000	Z5	Z5W	20	0	0	15	0	0	0	0	0	0	0	0	0	0	45	0	20	100
SB1-2	7/10/2001	Z3	Z3E	65	2	10	15	0	0	0	1	0	0	0	2	0	0	5	0	0	100
SB1-2	7/10/2001	Z3	Z3N	43	1	10	1	0	0	0	1	0	0	0	0	0	0	43	0	1	100
SB1-2	7/10/2001	Z3	Z3S	47	2	5	5	0	0	0	1	0	0	0	0	0	0	40	0	0	100
SB1-2	7/10/2001	Z3	Z3W	44	3	7	1	0	0	0	1	0	0	0	0	0	0	44	0	0	100
SB1-2	7/10/2001	Z4	Z4E	40	0	5	10	0	30	0	2	0	0	0	0	0	0	13	0	0	100
SB1-2	7/10/2001	Z4	Z4N	40	0	4	10	0	25	0	5	0	0	0	0	0	0	16	0	0	100
SB1-2	7/10/2001	Z4	Z4S	50	0	3	12	0	20	0	1	0	0	0	2	0	0	12	0	0	100
SB1-2	7/10/2001	Z4	Z4W	48	0	5	10	0	20	0	2	0	0	0	0	0	0	15	0	0	100
SB1-2	7/10/2001	Z5	Z5E	10	0	0	1	0	15	0	0	0	0	0	0	0	0	39	0	35	100
SB1-2	7/10/2001	Z5	Z5N	20	0	0	2	0	10	0	0	0	0	0	0	0	0	53	0	15	100
SB1-2	7/10/2001	Z5	Z5S	25	0	0	3	0	20	0	0	0	0	0	0	0	0	27	0	25	100
SB1-2	7/10/2001	Z5	Z5W	20	0	0	2	0	20	0	0	0	0	0	0	0	0	48	0	10	100
SB1-2	7/30/2003	Z3	Z3E	60	3	20	5	0	0	0	0	0	0	0	0	0	0	12	0	0	100
SB1-2	7/30/2003	Z3	Z3N	73	1	10	4	0	0	0	0	0	0	0	0	0	0	12	0	0	100
SB1-2	7/30/2003	Z3	Z3S	54	3	8	15	0	0	0	0	0	0	0	0	0	0	20	0	0	100
SB1-2	7/30/2003	Z3	Z3W	75	3	3	4	0	0	0	0	0	0	0	0	0	0	15	0	0	100
SB1-2	7/30/2003	Z4	Z4E	71	0	16	5	0	0	1	0	0	0	0	0	0	0	6	0	1	100
SB1-2	7/30/2003	Z4	Z4N	75	0	16	4	0	0	0	0	0	0	0	0	0	0	4	0	1	100
SB1-2	7/30/2003	Z4	Z4S	74	0	18	1	0	0	1	0	0	0	0	0	0	0	5	0	1	100
SB1-2	7/30/2003	Z4	Z4W	86	0	4	8	0	0	0	0	0	0	0	0	0	0	0	0	2	100
SB1-2	7/30/2003	Z5	Z5E	38	0	0	12	0	0	0	0	0	0	0	5	0	0	15	0	30	100

SB1-2	7/30/2003	Z5	Z5N	52	0	0	12	0	0	0	0	0	0	0	4	0	0	12	0	20	100
SB1-2	7/30/2003	Z5	Z5S	20	0	0	40	0	0	0	0	0	0	0	10	0	0	5	0	25	100
SB1-2	7/30/2003	Z5	Z5W	37	0	0	25	0	0	0	0	0	0	0	8	0	0	12	0	18	100
SB2-1	7/21/1999	Z1	Z1E	59	5	6	1	4	0	0	0	0	0	0	0	0	0	25	0	0	100
SB2-1	7/21/1999	Z1	Z1N	65	0	4	0	1	0	0	0	0	0	0	0	0	0	30	0	0	100
SB2-1	7/21/1999	Z1	Z1S	35	8	7	20	5	0	0	0	0	0	0	0	0	0	25	0	0	100
SB2-1	7/21/1999	Z1	Z1W	49	0	4	10	2	0	0	0	0	0	0	0	0	0	35	0	0	100
SB2-1	7/21/1999	Z2	Z2E	38	0	6	40	0	0	0	0	0	0	0	0	0	0	15	0	1	100
SB2-1	7/21/1999	Z2	Z2N	40	0	5	25	0	0	0	0	0	0	0	0	0	0	30	0	0	100
SB2-1	7/21/1999	Z2	Z2S	46	0	4	25	0	0	0	0	0	0	0	0	0	0	25	0	0	100
SB2-1	7/21/1999	Z2	Z2W	42	0	8	30	0	0	0	0	0	0	0	0	0	0	20	0	0	100
SB2-1	7/21/1999	Z3	Z3E	63	0	18	6	0	0	0	0	0	0	0	0	0	0	12	0	1	100
SB2-1	7/21/1999	Z3	Z3N	73	0	10	2	0	0	0	0	0	0	0	0	0	0	15	0	0	100
SB2-1	7/21/1999	Z3	Z3S	65	0	20	5	0	0	0	0	0	0	0	0	0	0	10	0	0	100
SB2-1	7/21/1999	Z3	Z3W	65	3	15	2	0	0	0	0	0	0	0	0	0	0	15	0	0	100
SB2-1	7/21/1999	Z4	Z4E	63	0	2	0	0	0	0	0	0	0	0	0	0	0	35	0	0	100
SB2-1	7/21/1999	Z4	Z4N	49	0	1	0	0	0	0	0	0	0	0	0	0	0	50	0	0	100
SB2-1	7/21/1999	Z4	Z4S	58	0	2	0	0	0	0	0	0	0	0	0	0	0	40	0	0	100
SB2-1	7/21/1999	Z4	Z4W	44	0	6	0	0	0	0	0	0	0	0	0	0	0	50	0	0	100
SB2-1	8/22/2000	Z1	Z1E	30	7	10	1	2	0	0	0	0	0	0	0	0	0	50	0	0	100
SB2-1	8/22/2000	Z1	Z1N	43	0	6	1	10	0	0	0	0	0	0	0	0	0	40	0	0	100
SB2-1	8/22/2000	Z1	Z1S	16	4	15	20	5	0	0	0	0	0	0	0	0	0	40	0	0	100
SB2-1	8/22/2000	Z1	Z1W	30	0	8	12	5	0	0	0	0	0	0	0	0	0	45	0	0	100
SB2-1	8/22/2000	Z2	Z2E	20	0	30	10	0	0	0	0	0	0	0	0	0	0	34	0	6	100
SB2-1	8/22/2000	Z2	Z2N	35	0	25	15	0	0	0	0	0	0	0	0	0	0	25	0	0	100
SB2-1	8/22/2000	Z2	Z2S	25	0	40	15	0	0	0	0	0	0	0	0	0	0	20	0	0	100
SB2-1	8/22/2000	Z2	Z2W	15	0	40	15	0	0	0	0	0	0	0	0	0	0	30	0	0	100
SB2-1	8/22/2000	Z3	Z3E	15	0	35	20	0	0	0	0	0	0	0	0	0	0	30	0	0	100
SB2-1	8/22/2000	Z3	Z3N	59	1	25	5	0	0	0	0	0	0	0	0	0	0	10	0	0	100
SB2-1	8/22/2000	Z3	Z3S	20	0	35	20	0	0	0	0	0	0	0	0	0	0	25	0	0	100
SB2-1	8/22/2000	Z3	Z3W	53	7	35	5	0	0	0	0	0	0	0	0	0	0	0	0	0	100
SB2-1	8/22/2000	Z4	Z4E	10	1	4	0	0	0	0	0	0	0	0	0	0	0	85	0	0	100
SB2-1	8/22/2000	Z4	Z4N	22	0	3	0	0	0	0	0	0	0	0	0	0	0	75	0	0	100
SB2-1	8/22/2000	Z4	Z4S	14	1	5	0	0	0	0	0	0	0	0	0	0	0	80	0	0	100
SB2-1	8/22/2000	Z4	Z4W	12	0	8	0	0	0	0	0	0	0	0	0	0	0	80	0	0	100
SB2-1	6/15/2001	Z1	Z1E	20	3	5	0	1	0	0	0	0	0	0	0	0	0	71	0	0	100
SB2-1	6/15/2001	Z1	Z1N	10	0	5	0	1	0	0	0	0	0	0	0	0	0	84	0	0	100
SB2-1	6/15/2001	Z1	Z1S	6	3	6	10	3	0	0	0	0	0	0	0	0	0	72	0	0	100
SB2-1	6/15/2001	Z1	Z1W	15	0	5	6	2	0	0	0	0	0	0	0	0	0	72	0	0	100
SB2-1	6/15/2001	Z2	Z2E	40	0	8	18	0	0	0	0	0	0	0	8	0	0	24	0	2	100
SB2-1	6/15/2001	Z2	Z2N	32	0	10	20	0	0	0	0	0	0	0	1	0	0	37	0	0	100
SB2-1	6/15/2001	Z2	Z2S	40	0	10	8	0	0	0	0	0	0	0	8	0	0	33	0	1	100
SB2-1	6/15/2001	Z2	Z2W	30	0	15	10	0	0	0	0	0	0	0	6	0	0	39	0	0	100
SB2-1	6/15/2001	Z3	Z3E	25	0	40	8	2	0	0	0	0	0	0	0	0	0	17	0	8	100
SB2-1	6/15/2001	Z3	Z3N	35	0	10	5	0	0	0	0	0	0	0	0	0	0	50	0	0	100
SB2-1	6/15/2001	Z3	Z3S	20	0	50	8	0	0	0	0	0	0	0	0	0	0	19	0	3	100
SB2-1	6/15/2001	Z3	Z3W	45	5	8	4	0	0	0	0	0	0	0	0	0	0	36	0	2	100

SB2-1	6/15/2001	Z4	Z4E	40	0	8	0	0	0	0	0	0	0	0	0	0	0	52	0	0	100
SB2-1	6/15/2001	Z4	Z4N	55	1	4	0	0	0	0	0	0	0	0	0	0	0	40	0	0	100
SB2-1	6/15/2001	Z4	Z4S	30	0	5	0	0	0	0	0	0	0	0	0	0	0	65	0	0	100
SB2-1	6/15/2001	Z4	Z4W	15	1	4	0	0	0	0	0	0	0	0	0	0	0	80	0	0	100
SB2-1	7/10/2003	Z1	Z1E	40	10	15	0	0	0	0	0	0	0	0	0	0	0	34	0	1	100
SB2-1	7/10/2003	Z1	Z1N	60	0	10	0	1	0	0	0	0	0	0	0	0	0	29	0	0	100
SB2-1	7/10/2003	Z1	Z1S	60	2	10	1	3	0	0	0	0	0	0	0	0	0	23	0	1	100
SB2-1	7/10/2003	Z1	Z1W	40	0	20	1	0	0	0	0	0	0	0	0	0	0	39	0	0	100
SB2-1	7/10/2003	Z2	Z2E	55	0	10	2	0	0	0	0	0	0	0	0	0	0	31	0	2	100
SB2-1	7/10/2003	Z2	Z2N	30	0	20	10	0	0	0	0	0	0	0	0	0	0	39	0	1	100
SB2-1	7/10/2003	Z2	Z2S	30	0	30	6	0	0	0	0	0	0	0	0	0	0	34	0	0	100
SB2-1	7/10/2003	Z2	Z2W	23	0	20	10	0	0	0	0	0	0	0	0	0	0	45	0	2	100
SB2-1	7/10/2003	Z3	Z3E	58	0	8	2	2	0	0	0	0	0	0	0	0	0	25	0	5	100
SB2-1	7/10/2003	Z3	Z3N	60	0	15	0	0	0	0	0	0	0	0	0	0	0	25	0	0	100
SB2-1	7/10/2003	Z3	Z3S	56	0	12	2	2	0	0	0	0	0	0	0	0	0	25	0	3	100
SB2-1	7/10/2003	Z3	Z3W	60	12	15	1	0	0	0	0	0	0	0	0	0	0	10	0	2	100
SB2-1	7/10/2003	Z4	Z4E	42	1	12	0	0	0	0	0	0	0	0	0	0	0	45	0	0	100
SB2-1	7/10/2003	Z4	Z4N	59	0	6	0	0	0	0	0	0	0	0	0	0	0	35	0	0	100
SB2-1	7/10/2003	Z4	Z4S	87	1	2	0	0	0	0	0	0	0	0	0	0	0	10	0	0	100
SB2-1	7/10/2003	Z4	Z4W	80	1	4	0	0	0	0	0	0	0	0	0	0	0	15	0	0	100
SB2-2	7/21/1999	Z1	Z1E	75	1	1	7	0	0	1	0	0	0	0	0	0	1	10	0	4	100
SB2-2	7/21/1999	Z1	Z1N	77	0	3	1	0	1	1	0	0	0	0	0	0	0	15	0	2	100
SB2-2	7/21/1999	Z1	Z1S	85	0	1	3	0	0	1	0	0	0	0	0	0	1	8	0	1	100
SB2-2	7/21/1999	Z1	Z1W	80	0	6	1	0	1	1	0	0	0	0	0	0	0	10	0	1	100
SB2-2	7/21/1999	Z2	Z2E	48	0	12	10	5	0	3	0	0	0	0	0	0	0	20	0	2	100
SB2-2	7/21/1999	Z2	Z2N	60	0	6	4	4	0	1	0	0	0	0	0	0	0	20	0	5	100
SB2-2	7/21/1999	Z2	Z2S	47	0	6	25	3	0	2	0	0	0	0	0	0	0	15	0	2	100
SB2-2	7/21/1999	Z2	Z2W	63	0	10	5	4	0	2	0	0	0	0	0	0	0	15	0	1	100
SB2-2	7/21/1999	Z3	Z3E	24	0	0	70	0	0	0	0	0	0	0	0	0	0	3	0	3	100
SB2-2	7/21/1999	Z3	Z3N	34	0	0	55	0	0	0	0	0	0	0	0	0	0	5	0	6	100
SB2-2	7/21/1999	Z3	Z3S	28	0	1	60	0	0	2	0	0	0	0	0	0	0	4	0	5	100
SB2-2	7/21/1999	Z3	Z3W	32	0	3	50	0	0	1	0	0	0	0	0	0	0	4	0	10	100
SB2-2	7/21/1999	Z4	Z4E	57	1	20	5	0	0	0	0	0	0	0	0	0	0	15	0	2	100
SB2-2	7/21/1999	Z4	Z4N	58	0	20	0	1	0	0	0	0	0	0	0	0	0	20	0	1	100
SB2-2	7/21/1999	Z4	Z4S	55	0	20	1	3	0	0	0	0	0	0	0	0	0	20	0	1	100
SB2-2	7/21/1999	Z4	Z4W	49	0	20	0	6	0	0	0	0	0	0	0	0	0	25	0	0	100
SB2-2	8/22/2000	Z1	Z1E	66	0	2	5	0	0	0	0	6	0	0	0	0	12	5	0	4	100
SB2-2	8/22/2000	Z1	Z1N	73	2	0	1	0	1	0	0	2	0	0	0	0	8	8	0	5	100
SB2-2	8/22/2000	Z1	Z1S	88	0	1	1	0	0	0	0	1	0	0	0	0	5	3	0	1	100
SB2-2	8/22/2000	Z1	Z1W	74	0	4	1	0	2	0	0	3	0	0	0	0	10	3	0	3	100
SB2-2	8/22/2000	Z2	Z2E	15	0	8	6	5	0	10	0	22	0	0	0	0	0	28	0	6	100
SB2-2	8/22/2000	Z2	Z2N	18	0	4	8	2	0	8	0	20	0	0	0	0	0	30	0	10	100
SB2-2	8/22/2000	Z2	Z2S	6	0	10	8	6	0	10	0	20	0	0	0	0	0	22	0	18	100
SB2-2	8/22/2000	Z2	Z2W	12	0	10	10	5	0	15	0	20	0	0	0	0	0	23	0	5	100
SB2-2	8/22/2000	Z3	Z3E	10	0	0	75	0	0	0	0	0	0	0	0	0	0	0	0	15	100
SB2-2	8/22/2000	Z3	Z3N	10	0	0	63	0	0	0	0	0	0	0	0	0	0	2	0	25	100
SB2-2	8/22/2000	Z3	Z3S	15	0	1	53	0	0	3	0	3	0	0	0	0	0	5	0	20	100

SB2-2	8/22/2000	Z3	Z3W	10	0	1	51	0	0	5	0	3	0	0	0	0	0	5	0	25	100
SB2-2	8/22/2000	Z4	Z4E	49	0	25	3	0	0	0	0	2	0	0	0	0	0	15	0	6	100
SB2-2	8/22/2000	Z4	Z4N	60	0	25	0	0	0	0	0	0	0	0	0	0	0	15	0	0	100
SB2-2	8/22/2000	Z4	Z4S	42	0	35	0	1	0	0	0	3	0	0	0	0	0	19	0	0	100
SB2-2	8/22/2000	Z4	Z4W	45	0	40	0	0	0	0	0	0	0	0	0	0	0	15	0	0	100
SB2-2	6/15/2001	Z1	Z1E	47	0	0	4	0	3	4	0	0	0	0	4	0	15	20	0	3	100
SB2-2	6/15/2001	Z1	Z1N	45	1	0	1	0	5	4	0	0	0	0	0	0	20	22	0	2	100
SB2-2	6/15/2001	Z1	Z1S	64	0	0	3	0	0	2	0	0	0	0	3	0	18	10	0	0	100
SB2-2	6/15/2001	Z1	Z1W	60	0	0	0	0	2	10	0	0	0	0	0	0	15	9	0	4	100
SB2-2	6/15/2001	Z2	Z2E	25	0	4	10	3	0	12	0	0	0	0	20	0	0	6	0	20	100
SB2-2	6/15/2001	Z2	Z2N	25	0	5	6	3	0	6	0	0	0	0	20	0	0	17	0	18	100
SB2-2	6/15/2001	Z2	Z2S	30	0	4	10	4	0	10	0	0	0	0	15	0	0	11	0	16	100
SB2-2	6/15/2001	Z2	Z2W	20	0	5	5	4	0	8	0	0	0	0	15	0	0	28	0	15	100
SB2-2	6/15/2001	Z3	Z3E	20	0	0	69	0	0	0	0	0	0	0	0	0	0	1	0	10	100
SB2-2	6/15/2001	Z3	Z3N	25	0	0	55	0	0	0	0	0	0	0	0	0	0	5	0	15	100
SB2-2	6/15/2001	Z3	Z3S	25	0	0	54	1	0	5	0	0	0	0	0	0	0	5	0	10	100
SB2-2	6/15/2001	Z3	Z3W	20	0	0	55	0	0	5	0	0	0	0	0	0	0	5	0	15	100
SB2-2	6/15/2001	Z4	Z4E	30	0	4	2	2	1	0	0	0	0	0	0	0	0	53	0	8	100
SB2-2	6/15/2001	Z4	Z4N	40	0	5	0	0	1	0	0	0	0	0	0	0	0	52	0	2	100
SB2-2	6/15/2001	Z4	Z4S	25	0	5	0	2	0	0	0	0	0	0	0	0	0	67	0	1	100
SB2-2	6/15/2001	Z4	Z4W	30	0	5	0	1	1	0	0	0	0	0	0	0	0	62	0	1	100
SB2-2	7/11/2003	Z1	Z1E	78	1	10	0	0	0	0	0	0	0	0	0	0	4	6	0	1	100
SB2-2	7/11/2003	Z1	Z1N	77	1	3	0	0	0	0	0	0	0	0	0	0	4	5	0	10	100
SB2-2	7/11/2003	Z1	Z1S	80	0	12	0	0	0	0	0	0	0	0	0	0	5	3	0	0	100
SB2-2	7/11/2003	Z1	Z1W	85	0	5	0	0	0	0	0	0	0	0	0	0	2	4	0	4	100
SB2-2	7/11/2003	Z2	Z2E	30	0	20	0	6	0	2	0	0	0	0	0	0	0	24	0	18	100
SB2-2	7/11/2003	Z2	Z2N	30	0	12	0	5	0	2	0	0	0	0	0	0	0	31	0	20	100
SB2-2	7/11/2003	Z2	Z2S	20	0	35	0	5	0	3	0	0	0	0	0	0	0	27	0	10	100
SB2-2	7/11/2003	Z2	Z2W	30	0	26	0	3	0	3	0	0	0	0	0	0	0	32	0	6	100
SB2-2	7/11/2003	Z3	Z3E	15	0	0	65	0	0	0	0	0	0	0	0	0	0	0	0	20	100
SB2-2	7/11/2003	Z3	Z3N	20	0	0	50	0	0	0	0	0	0	0	0	0	0	0	0	30	100
SB2-2	7/11/2003	Z3	Z3S	18	0	0	55	1	0	1	0	0	0	0	0	0	0	0	0	25	100
SB2-2	7/11/2003	Z3	Z3W	16	0	0	40	0	0	4	0	0	0	0	0	0	0	0	0	40	100
SB2-2	7/11/2003	Z4	Z4E	24	0	0	60	0	0	0	0	0	0	0	0	0	0	15	0	1	100
SB2-2	7/11/2003	Z4	Z4N	30	0	0	45	0	0	0	0	0	0	0	0	0	0	25	0	0	100
SB2-2	7/11/2003	Z4	Z4S	25	0	0	45	0	0	0	0	0	0	0	0	0	0	29	0	1	100
SB2-2	7/11/2003	Z4	Z4W	25	0	0	35	0	0	0	0	0	0	0	0	0	0	40	0	0	100
SB3-1	7/21/1999	Z1	Z1E	60	16	0	0	0	8	0	0	10	0	0	0	0	0	6	0	0	100
SB3-1	7/21/1999	Z1	Z1N	76	12	0	0	0	2	0	0	6	0	0	0	0	0	4	0	0	100
SB3-1	7/21/1999	Z1	Z1S	78	3	0	0	0	10	0	0	4	0	0	0	0	0	5	0	0	100
SB3-1	7/21/1999	Z1	Z1W	88	2	0	0	0	4	0	0	2	0	0	0	0	0	4	0	0	100
SB3-1	7/21/1999	Z2	Z2E	82	0	0	1	0	2	0	0	10	0	0	0	0	0	5	0	0	100
SB3-1	7/21/1999	Z2	Z2N	79	0	0	5	0	0	0	0	10	0	0	0	0	0	6	0	0	100
SB3-1	7/21/1999	Z2	Z2S	82	6	0	1	0	1	0	0	8	0	0	0	0	0	2	0	0	100
SB3-1	7/21/1999	Z2	Z2W	74	7	0	2	0	2	0	0	12	0	0	0	0	0	3	0	0	100
SB3-1	7/21/1999	Z3	Z3E	85	0	0	10	0	0	0	0	0	0	0	0	0	0	5	0	0	100
SB3-1	7/21/1999	Z3	Z3N	82	4	0	8	0	0	0	0	0	0	0	0	0	0	6	0	0	100

SB3-1	7/21/1999	Z3	Z3S	81	3	0	8	0	0	0	0	0	0	0	0	0	0	8	0	0	100
SB3-1	7/21/1999	Z3	Z3W	82	0	0	10	0	0	0	0	0	0	0	0	0	0	8	0	0	100
SB3-1	7/21/1999	Z4	Z4E	88	0	0	0	0	0	0	0	0	0	0	0	0	0	12	0	0	100
SB3-1	7/21/1999	Z4	Z4N	95	0	0	0	1	0	0	0	0	0	0	0	0	0	4	0	0	100
SB3-1	7/21/1999	Z4	Z4S	90	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0	0	100
SB3-1	7/21/1999	Z4	Z4W	95	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0	100
SB3-1	8/22/2000	Z1	Z1E	59	10	0	3	0	25	0	0	0	0	0	0	0	0	3	0	0	100
SB3-1	8/22/2000	Z1	Z1N	66	10	0	3	0	15	0	0	6	0	0	0	0	0	0	0	0	100
SB3-1	8/22/2000	Z1	Z1S	79	5	0	2	0	10	0	0	0	0	0	0	0	0	4	0	0	100
SB3-1	8/22/2000	Z1	Z1W	77	2	0	4	0	12	0	0	5	0	0	0	0	0	0	0	0	100
SB3-1	8/22/2000	Z2	Z2E	79	0	0	3	0	2	0	0	15	0	0	0	0	0	1	0	0	100
SB3-1	8/22/2000	Z2	Z2N	80	0	0	4	0	4	0	0	10	0	0	0	0	0	2	0	0	100
SB3-1	8/22/2000	Z2	Z2S	66	6	0	5	0	5	0	0	16	0	0	0	0	0	2	0	0	100
SB3-1	8/22/2000	Z2	Z2W	66	5	0	10	0	5	0	0	12	0	0	0	0	0	2	0	0	100
SB3-1	8/22/2000	Z3	Z3E	35	0	0	45	0	0	0	0	10	0	0	0	0	0	10	0	0	100
SB3-1	8/22/2000	Z3	Z3N	55	5	0	25	0	0	0	0	5	0	0	0	0	0	10	0	0	100
SB3-1	8/22/2000	Z3	Z3S	20	5	0	50	0	0	0	0	15	0	0	0	0	0	10	0	0	100
SB3-1	8/22/2000	Z3	Z3W	25	0	0	55	0	0	0	0	10	0	0	0	0	0	10	0	0	100
SB3-1	8/22/2000	Z4	Z4E	94	1	0	0	2	0	0	0	1	0	0	0	0	0	2	0	0	100
SB3-1	8/22/2000	Z4	Z4N	93	2	0	0	1	0	0	0	1	0	0	0	0	0	3	0	0	100
SB3-1	8/22/2000	Z4	Z4S	95	1	0	0	0	0	0	0	1	0	0	0	0	0	3	0	0	100
SB3-1	8/22/2000	Z4	Z4W	95	1	0	0	0	0	0	0	1	0	0	0	0	0	3	0	0	100
SB3-1	6/7/2001	Z1	Z1E	54	10	0	1	0	10	0	0	0	0	0	15	0	0	10	0	0	100
SB3-1	6/7/2001	Z1	Z1N	58	10	0	0	0	10	0	0	0	0	0	12	0	0	10	0	0	100
SB3-1	6/7/2001	Z1	Z1S	71	4	0	1	0	8	0	0	0	0	0	6	0	0	10	0	0	100
SB3-1	6/7/2001	Z1	Z1W	72	2	0	1	0	10	0	0	0	0	0	5	0	0	10	0	0	100
SB3-1	6/7/2001	Z2	Z2E	68	1	0	4	0	15	0	0	0	0	0	12	0	0	0	0	0	100
SB3-1	6/7/2001	Z2	Z2N	75	0	0	10	0	12	0	0	0	0	0	3	0	0	0	0	0	100
SB3-1	6/7/2001	Z2	Z2S	79	3	0	4	0	6	0	0	0	0	0	8	0	0	0	0	0	100
SB3-1	6/7/2001	Z2	Z2W	70	5	0	5	0	15	0	0	0	0	0	5	0	0	0	0	0	100
SB3-1	6/7/2001	Z3	Z3E	86	0	0	4	0	0	0	0	0	0	0	10	0	0	0	0	0	100
SB3-1	6/7/2001	Z3	Z3N	77	5	0	3	0	0	0	0	0	0	0	15	0	0	0	0	0	100
SB3-1	6/7/2001	Z3	Z3S	68	5	0	4	0	3	0	0	0	0	0	20	0	0	0	0	0	100
SB3-1	6/7/2001	Z3	Z3W	80	0	0	3	0	2	0	0	0	0	0	15	0	0	0	0	0	100
SB3-1	6/7/2001	Z4	Z4E	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100
SB3-1	6/7/2001	Z4	Z4N	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100
SB3-1	6/7/2001	Z4	Z4S	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100
SB3-1	6/7/2001	Z4	Z4W	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100
SB3-1	7/30/2003	Z1	Z1E	47	12	0	10	0	6	0	0	0	0	0	0	0	0	25	0	0	100
SB3-1	7/30/2003	Z1	Z1N	58	10	0	2	0	6	0	0	0	0	0	8	0	0	16	0	0	100
SB3-1	7/30/2003	Z1	Z1S	65	5	0	6	0	4	0	0	0	0	0	5	0	0	15	0	0	100
SB3-1	7/30/2003	Z1	Z1W	76	0	0	5	1	4	0	0	0	0	0	4	0	0	10	0	0	100
SB3-1	7/30/2003	Z2	Z2E	43	10	0	25	0	0	0	0	0	0	0	10	0	0	12	0	0	100
SB3-1	7/30/2003	Z2	Z2N	34	0	0	40	0	0	0	0	0	0	0	12	0	0	14	0	0	100
SB3-1	7/30/2003	Z2	Z2S	44	6	0	40	0	0	0	0	0	0	0	10	0	0	0	0	0	100
SB3-1	7/30/2003	Z2	Z2W	20	8	0	50	0	0	0	0	0	0	0	12	0	0	10	0	0	100
SB3-1	7/30/2003	Z3	Z3E	10	0	0	64	0	0	0	0	0	0	0	12	0	0	14	0	0	100

SB3-1	7/30/2003	Z3	Z3N	6	8	0	41	0	0	0	0	0	0	0	15	0	0	30	0	0	100
SB3-1	7/30/2003	Z3	Z3S	15	0	0	55	0	0	0	0	0	0	0	20	0	0	10	0	0	100
SB3-1	7/30/2003	Z3	Z3W	14	0	0	58	0	0	0	0	0	0	0	16	0	0	12	0	0	100
SB3-1	7/30/2003	Z4	Z4E	87	1	0	0	0	0	0	0	0	0	0	2	0	0	10	0	0	100
SB3-1	7/30/2003	Z4	Z4N	94	1	0	0	0	0	0	0	0	0	0	1	0	0	4	0	0	100
SB3-1	7/30/2003	Z4	Z4S	94	1	0	0	0	0	0	0	0	0	0	2	0	0	3	0	0	100
SB3-1	7/30/2003	Z4	Z4W	87	0	0	0	0	0	0	0	0	0	0	3	0	0	10	0	0	100
SB4-1	7/21/1999	Z1	Z1E	92	1	0	0	0	2	0	0	3	0	0	0	0	0	2	0	0	100
SB4-1	7/21/1999	Z1	Z1N	88	5	0	0	0	0	0	0	4	0	0	0	0	0	3	0	0	100
SB4-1	7/21/1999	Z1	Z1S	79	15	0	0	0	1	0	0	2	0	0	0	0	0	3	0	0	100
SB4-1	7/21/1999	Z1	Z1W	89	7	0	0	0	0	0	0	2	0	0	0	0	0	2	0	0	100
SB4-1	7/21/1999	Z2	Z2E	94	1	0	0	0	0	0	0	4	0	0	0	0	0	1	0	0	100
SB4-1	7/21/1999	Z2	Z2N	88	6	0	0	0	0	0	0	5	0	0	0	0	0	1	0	0	100
SB4-1	7/21/1999	Z2	Z2S	97	0	0	0	0	0	0	0	2	0	0	0	0	0	1	0	0	100
SB4-1	7/21/1999	Z2	Z2W	91	4	0	0	0	0	0	0	3	0	0	0	0	0	2	0	0	100
SB4-1	7/21/1999	Z3	Z3E	85	1	0	8	0	0	0	0	2	0	0	0	0	0	4	0	0	100
SB4-1	7/21/1999	Z3	Z3N	82	0	0	15	0	0	0	0	0	0	0	0	0	0	3	0	0	100
SB4-1	7/21/1999	Z3	Z3S	77	8	0	12	0	0	0	0	0	0	0	0	0	0	3	0	0	100
SB4-1	7/21/1999	Z3	Z3W	86	3	0	10	0	0	0	0	0	0	0	0	0	0	1	0	0	100
SB4-1	7/21/1999	Z4	Z4E	74	0	0	25	0	0	0	0	0	0	0	0	0	0	1	0	0	100
SB4-1	7/21/1999	Z4	Z4N	68	0	0	30	0	0	0	0	0	0	0	0	0	0	2	0	0	100
SB4-1	7/21/1999	Z4	Z4S	68	0	0	30	0	0	0	0	0	0	0	0	0	0	2	0	0	100
SB4-1	7/21/1999	Z4	Z4W	60	1	0	35	0	0	0	0	0	0	0	0	0	0	4	0	0	100
SB4-1	7/21/1999	Z5	Z5E	89	2	0	5	2	0	0	0	0	0	0	0	0	0	2	0	0	100
SB4-1	7/21/1999	Z5	Z5N	90	2	0	0	2	0	0	0	0	0	0	0	0	0	6	0	0	100
SB4-1	7/21/1999	Z5	Z5S	86	0	0	8	3	0	0	0	0	0	0	0	0	0	3	0	0	100
SB4-1	7/21/1999	Z5	Z5W	93	0	0	2	2	0	0	0	0	0	0	0	0	0	3	0	0	100
SB4-1	8/22/2000	Z1	Z1E	87	1	0	0	0	0	0	0	8	0	0	0	0	0	4	0	0	100
SB4-1	8/22/2000	Z1	Z1N	92	0	0	0	0	0	0	0	6	0	0	0	0	0	2	0	0	100
SB4-1	8/22/2000	Z1	Z1S	81	10	0	0	0	0	0	0	5	0	0	0	0	0	4	0	0	100
SB4-1	8/22/2000	Z1	Z1W	82	10	0	0	0	0	0	0	8	0	0	0	0	0	0	0	0	100
SB4-1	8/22/2000	Z2	Z2E	74	15	0	0	0	0	0	0	10	0	0	0	0	0	1	0	0	100
SB4-1	8/22/2000	Z2	Z2N	64	8	0	0	0	0	0	0	25	0	0	0	0	0	3	0	0	100
SB4-1	8/22/2000	Z2	Z2S	84	6	0	0	0	0	0	0	10	0	0	0	0	0	0	0	0	100
SB4-1	8/22/2000	Z2	Z2W	77	3	0	0	0	0	0	0	20	0	0	0	0	0	0	0	0	100
SB4-1	8/22/2000	Z3	Z3E	42	0	0	8	0	0	0	0	50	0	0	0	0	0	0	0	0	100
SB4-1	8/22/2000	Z3	Z3N	68	2	0	5	0	0	0	0	25	0	0	0	0	0	0	0	0	100
SB4-1	8/22/2000	Z3	Z3S	65	5	0	10	0	0	0	0	20	0	0	0	0	0	0	0	0	100
SB4-1	8/22/2000	Z3	Z3W	70	5	0	5	0	0	0	0	20	0	0	0	0	0	0	0	0	100
SB4-1	8/22/2000	Z4	Z4E	20	0	0	30	0	0	0	0	5	0	0	0	0	0	45	0	0	100
SB4-1	8/22/2000	Z4	Z4N	15	0	0	35	0	0	0	0	10	0	0	0	0	0	40	0	0	100
SB4-1	8/22/2000	Z4	Z4S	20	0	0	20	0	0	0	0	5	0	0	0	0	0	55	0	0	100
SB4-1	8/22/2000	Z4	Z4W	34	1	0	25	0	0	0	0	5	0	0	0	0	0	35	0	0	100
SB4-1	8/22/2000	Z5	Z5E	76	4	0	8	2	0	0	0	0	0	0	0	0	0	10	0	0	100
SB4-1	8/22/2000	Z5	Z5N	80	4	0	1	0	0	0	0	0	0	0	0	0	0	15	0	0	100
SB4-1	8/22/2000	Z5	Z5S	43	0	0	10	2	0	0	0	0	0	0	0	0	0	45	0	0	100
SB4-1	8/22/2000	Z5	Z5W	66	0	0	1	3	0	0	0	0	0	0	0	0	0	30	0	0	100

SB4-1	6/7/2001	Z1	Z1E	80	2	0	0	0	8	0	0	0	0	0	10	0	0	0	0	0	100
SB4-1	6/7/2001	Z1	Z1N	82	0	0	0	0	8	0	0	0	0	0	10	0	0	0	0	0	100
SB4-1	6/7/2001	Z1	Z1S	68	12	0	0	0	10	0	0	0	0	0	10	0	0	0	0	0	100
SB4-1	6/7/2001	Z1	Z1W	76	10	0	0	0	6	0	0	0	0	0	8	0	0	0	0	0	100
SB4-1	6/7/2001	Z2	Z2E	78	12	0	0	0	0	0	0	0	0	0	10	0	0	0	0	0	100
SB4-1	6/7/2001	Z2	Z2N	82	8	0	0	0	0	0	0	0	0	0	10	0	0	0	0	0	100
SB4-1	6/7/2001	Z2	Z2S	82	8	0	0	0	0	0	0	0	0	0	10	0	0	0	0	0	100
SB4-1	6/7/2001	Z2	Z2W	82	5	0	0	0	1	0	0	0	0	0	12	0	0	0	0	0	100
SB4-1	6/7/2001	Z3	Z3E	90	0	0	5	0	0	0	0	0	0	0	5	0	0	0	0	0	100
SB4-1	6/7/2001	Z3	Z3N	92	0	0	3	0	0	0	0	0	0	0	5	0	0	0	0	0	100
SB4-1	6/7/2001	Z3	Z3S	91	3	0	3	0	0	0	0	0	0	0	3	0	0	0	0	0	100
SB4-1	6/7/2001	Z3	Z3W	87	5	0	3	0	0	0	0	0	0	0	5	0	0	0	0	0	100
SB4-1	6/7/2001	Z4	Z4E	55	0	0	40	0	0	0	0	0	0	0	5	0	0	0	0	0	100
SB4-1	6/7/2001	Z4	Z4N	73	0	0	25	0	0	0	0	0	0	0	2	0	0	0	0	0	100
SB4-1	6/7/2001	Z4	Z4S	72	0	0	25	0	0	0	0	0	0	0	3	0	0	0	0	0	100
SB4-1	6/7/2001	Z4	Z4W	63	0	0	35	0	0	0	0	0	0	0	2	0	0	0	0	0	100
SB4-1	6/7/2001	Z5	Z5E	92	2	0	5	0	0	0	0	0	0	0	1	0	0	0	0	0	100
SB4-1	6/7/2001	Z5	Z5N	96	2	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	100
SB4-1	6/7/2001	Z5	Z5S	94	0	0	5	0	0	0	0	0	0	0	1	0	0	0	0	0	100
SB4-1	6/7/2001	Z5	Z5W	98	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	100
SB4-1	7/30/2003	Z1	Z1E	76	5	0	0	0	3	0	0	0	0	0	8	0	0	8	0	0	100
SB4-1	7/30/2003	Z1	Z1N	82	1	0	0	0	5	0	0	0	0	0	0	0	0	12	0	0	100
SB4-1	7/30/2003	Z1	Z1S	71	10	0	0	0	4	0	0	0	0	0	5	0	0	10	0	0	100
SB4-1	7/30/2003	Z1	Z1W	69	12	0	0	0	3	0	0	0	0	0	2	0	0	14	0	0	100
SB4-1	7/30/2003	Z2	Z2E	66	20	0	0	0	0	0	0	0	0	0	12	0	0	2	0	0	100
SB4-1	7/30/2003	Z2	Z2N	74	6	0	0	0	0	0	0	0	0	0	12	0	0	8	0	0	100
SB4-1	7/30/2003	Z2	Z2S	75	7	0	0	0	0	0	0	0	0	0	10	0	0	8	0	0	100
SB4-1	7/30/2003	Z2	Z2W	77	2	0	0	0	0	0	0	0	0	0	15	0	0	6	0	0	100
SB4-1	7/30/2003	Z3	Z3E	77	0	0	6	0	0	0	0	0	0	0	5	0	0	12	0	0	100
SB4-1	7/30/2003	Z3	Z3N	76	0	0	8	0	0	0	0	0	0	0	4	0	0	12	0	0	100
SB4-1	7/30/2003	Z3	Z3S	64	4	0	14	0	0	0	0	0	0	0	3	0	0	15	0	0	100
SB4-1	7/30/2003	Z3	Z3W	66	6	0	10	0	0	0	0	0	0	0	2	0	0	16	0	0	100
SB4-1	7/30/2003	Z4	Z4E	72	0	0	10	1	0	0	0	0	0	0	2	0	0	15	0	0	100
SB4-1	7/30/2003	Z4	Z4N	78	0	0	10	0	0	0	0	0	0	0	0	0	0	12	0	0	100
SB4-1	7/30/2003	Z4	Z4S	55	1	0	15	0	0	0	0	0	0	0	4	0	0	25	0	0	100
SB4-1	7/30/2003	Z4	Z4W	81	0	0	8	1	0	0	0	0	0	0	2	0	0	8	0	0	100
SB4-1	7/30/2003	Z5	Z5E	79	1	0	6	0	0	0	0	0	0	0	4	0	0	10	0	0	100
SB4-1	7/30/2003	Z5	Z5N	84	3	0	4	0	0	0	0	0	0	0	3	0	0	6	0	0	100
SB4-1	7/30/2003	Z5	Z5S	86	0	0	10	0	0	0	0	0	0	0	2	0	0	2	0	0	100
SB4-1	7/30/2003	Z5	Z5W	92	0	0	2	0	0	0	0	0	0	0	3	0	0	3	0	0	100

APPENDIX 6

Branchiopod Inventory Data

Dales Lake Ecological Reserve
Branchiopod Inventory

SHRIMP__	DEPTH_CM	MONTH	DAY	YEAR	COLLDATE	DATETEXT
145.000	140.000	12.000	14.000	1998.000	12/14/1998	DEC14_98
132.000	160.000	12.000	14.000	1998.000	12/14/1998	DEC14_98
132.000	180.000	12.000	14.000	1998.000	12/14/1998	DEC14_98
132.000	200.000	12.000	14.000	1998.000	12/14/1998	DEC14_98
132.000	190.000	12.000	14.000	1998.000	12/14/1998	DEC14_98
145.000	180.000	12.000	14.000	1998.000	12/14/1998	DEC14_98
145.000	190.000	12.000	14.000	1998.000	12/14/1998	DEC14_98
119.000	190.000	12.000	14.000	1998.000	12/14/1998	DEC14_98
132.000	170.000	12.000	28.000	1998.000	12/28/1998	DEC28_98
30.000	230.000	12.000	28.000	1998.000	12/28/1998	DEC28_98
172.000	300.000	12.000	28.000	1998.000	12/28/1998	DEC28_98
145.000	350.000	12.000	28.000	1998.000	12/28/1998	DEC28_98
106.000	360.000	12.000	28.000	1998.000	12/28/1998	DEC28_98
45.000	395.000	12.000	28.000	1998.000	12/28/1998	DEC28_98
185.000	410.000	12.000	28.000	1998.000	12/28/1998	DEC28_98
238.000	400.000	12.000	28.000	1998.000	12/28/1998	DEC28_98
50.000	440.000	12.000	28.000	1998.000	12/28/1998	DEC28_98
30.000	450.000	12.000	28.000	1998.000	12/28/1998	DEC28_98
42.000	440.000	12.000	28.000	1998.000	12/28/1998	DEC28_98
37.000	450.000	12.000	28.000	1998.000	12/28/1998	DEC28_98
45.000	490.000	12.000	28.000	1998.000	12/28/1998	DEC28_98
48.000	495.000	12.000	28.000	1998.000	12/28/1998	DEC28_98
30.000	515.000	12.000	28.000	1998.000	12/28/1998	DEC28_98
172.000	530.000	12.000	28.000	1998.000	12/28/1998	DEC28_98
35.000	550.000	12.000	28.000	1998.000	12/28/1998	DEC28_98
29.000	185.000	1.000	11.000	1999.000	1/11/1999	JAN11_99
45.000	190.000	1.000	11.000	1999.000	1/11/1999	JAN11_99
17.000	170.000	1.000	11.000	1999.000	1/11/1999	JAN11_99
29.000	170.000	1.000	11.000	1999.000	1/11/1999	JAN11_99
17.000	165.000	1.000	11.000	1999.000	1/11/1999	JAN11_99
34.000	170.000	1.000	11.000	1999.000	1/11/1999	JAN11_99
26.000	180.000	1.000	11.000	1999.000	1/11/1999	JAN11_99
31.000	190.000	1.000	11.000	1999.000	1/11/1999	JAN11_99
41.000	200.000	1.000	11.000	1999.000	1/11/1999	JAN11_99
40.000	240.000	1.000	11.000	1999.000	1/11/1999	JAN11_99
27.000	215.000	1.000	11.000	1999.000	1/11/1999	JAN11_99
35.000	245.000	1.000	11.000	1999.000	1/11/1999	JAN11_99
49.000	235.000	1.000	11.000	1999.000	1/11/1999	JAN11_99
18.000	240.000	1.000	11.000	1999.000	1/11/1999	JAN11_99
18.000	245.000	1.000	11.000	1999.000	1/11/1999	JAN11_99
10.000	205.000	1.000	11.000	1999.000	1/11/1999	JAN11_99
32.000	200.000	1.000	25.000	1999.000	1/25/1999	JAN25_99
30.000	255.000	1.000	25.000	1999.000	1/25/1999	JAN25_99
38.000	340.000	1.000	25.000	1999.000	1/25/1999	JAN25_99
57.000	380.000	1.000	25.000	1999.000	1/25/1999	JAN25_99
75.000	440.000	1.000	25.000	1999.000	1/25/1999	JAN25_99
100.000	485.000	1.000	25.000	1999.000	1/25/1999	JAN25_99
34.000	490.000	1.000	25.000	1999.000	1/25/1999	JAN25_99
58.000	500.000	1.000	25.000	1999.000	1/25/1999	JAN25_99
42.000	545.000	1.000	25.000	1999.000	1/25/1999	JAN25_99
60.000	490.000	1.000	25.000	1999.000	1/25/1999	JAN25_99
100.000	470.000	1.000	25.000	1999.000	1/25/1999	JAN25_99
74.000	480.000	1.000	25.000	1999.000	1/25/1999	JAN25_99
85.000	405.000	1.000	25.000	1999.000	1/25/1999	JAN25_99
79.000	385.000	1.000	25.000	1999.000	1/25/1999	JAN25_99
48.000	265.000	1.000	25.000	1999.000	1/25/1999	JAN25_99
31.000	245.000	1.000	25.000	1999.000	1/25/1999	JAN25_99

9.000	255.000	2.000	10.000	1999.000	2/10/1999	FEB10_99
8.000	345.000	2.000	10.000	1999.000	2/10/1999	FEB10_99
6.000	415.000	2.000	10.000	1999.000	2/10/1999	FEB10_99
10.000	385.000	2.000	10.000	1999.000	2/10/1999	FEB10_99
4.000	390.000	2.000	10.000	1999.000	2/10/1999	FEB10_99
7.000	385.000	2.000	10.000	1999.000	2/10/1999	FEB10_99
4.000	430.000	2.000	10.000	1999.000	2/10/1999	FEB10_99
7.000	365.000	2.000	10.000	1999.000	2/10/1999	FEB10_99
16.000	325.000	2.000	10.000	1999.000	2/10/1999	FEB10_99
5.000	345.000	2.000	10.000	1999.000	2/10/1999	FEB10_99
7.000	330.000	2.000	10.000	1999.000	2/10/1999	FEB10_99
20.000	290.000	2.000	10.000	1999.000	2/10/1999	FEB10_99
17.000	290.000	2.000	10.000	1999.000	2/10/1999	FEB10_99
17.000	285.000	2.000	10.000	1999.000	2/10/1999	FEB10_99
6.000	270.000	2.000	10.000	1999.000	2/10/1999	FEB10_99
9.000	245.000	2.000	10.000	1999.000	2/10/1999	FEB10_99
1.000	230.000	2.000	23.000	1999.000	2/23/1999	FEB23_99
1.000	230.000	2.000	23.000	1999.000	2/23/1999	FEB23_99
1.000	270.000	2.000	23.000	1999.000	2/23/1999	FEB23_99
4.000	270.000	2.000	23.000	1999.000	2/23/1999	FEB23_99
3.000	295.000	2.000	23.000	1999.000	2/23/1999	FEB23_99
0.000	310.000	2.000	23.000	1999.000	2/23/1999	FEB23_99
1.000	310.000	2.000	23.000	1999.000	2/23/1999	FEB23_99
2.000	280.000	2.000	23.000	1999.000	2/23/1999	FEB23_99
6.000	255.000	2.000	23.000	1999.000	2/23/1999	FEB23_99
3.000	285.000	2.000	23.000	1999.000	2/23/1999	FEB23_99
3.000	280.000	2.000	23.000	1999.000	2/23/1999	FEB23_99
5.000	240.000	2.000	23.000	1999.000	2/23/1999	FEB23_99
1.000	255.000	2.000	23.000	1999.000	2/23/1999	FEB23_99
3.000	270.000	2.000	23.000	1999.000	2/23/1999	FEB23_99
1.000	245.000	2.000	23.000	1999.000	2/23/1999	FEB23_99
3.000	270.000	2.000	23.000	1999.000	2/23/1999	FEB23_99
1.000	215.000	3.000	22.000	1999.000	3/22/1999	MAR22_99
0.000	250.000	3.000	22.000	1999.000	3/22/1999	MAR22_99
0.000	280.000	3.000	22.000	1999.000	3/22/1999	MAR22_99
0.000	285.000	3.000	22.000	1999.000	3/22/1999	MAR22_99
0.000	370.000	3.000	22.000	1999.000	3/22/1999	MAR22_99
0.000	350.000	3.000	22.000	1999.000	3/22/1999	MAR22_99
0.000	325.000	3.000	22.000	1999.000	3/22/1999	MAR22_99
0.000	300.000	3.000	22.000	1999.000	3/22/1999	MAR22_99
0.000	205.000	3.000	22.000	1999.000	3/22/1999	MAR22_99
0.000	170.000	3.000	22.000	1999.000	3/22/1999	MAR22_99
0.000	200.000	3.000	22.000	1999.000	3/22/1999	MAR22_99
0.000	215.000	3.000	22.000	1999.000	3/22/1999	MAR22_99
0.000	240.000	3.000	22.000	1999.000	3/22/1999	MAR22_99
0.000	220.000	3.000	22.000	1999.000	3/22/1999	MAR22_99
0.000	200.000	3.000	22.000	1999.000	3/22/1999	MAR22_99
0.000	190.000	3.000	22.000	1999.000	3/22/1999	MAR22_99
0.000	180.000	4.000	7.000	1999.000	4/7/1999	APR07_99
0.000	250.000	4.000	7.000	1999.000	4/7/1999	APR07_99
0.000	280.000	4.000	7.000	1999.000	4/7/1999	APR07_99
0.000	310.000	4.000	7.000	1999.000	4/7/1999	APR07_99
0.000	330.000	4.000	7.000	1999.000	4/7/1999	APR07_99
0.000	370.000	4.000	7.000	1999.000	4/7/1999	APR07_99
0.000	370.000	4.000	7.000	1999.000	4/7/1999	APR07_99
0.000	410.000	4.000	7.000	1999.000	4/7/1999	APR07_99
0.000	560.000	4.000	7.000	1999.000	4/7/1999	APR07_99
0.000	530.000	4.000	7.000	1999.000	4/7/1999	APR07_99
0.000	530.000	4.000	7.000	1999.000	4/7/1999	APR07_99
1.000	500.000	4.000	7.000	1999.000	4/7/1999	APR07_99
0.000	470.000	4.000	7.000	1999.000	4/7/1999	APR07_99

0.000	310.000	4.000	7.000	1999.000	4/7/1999	APR07_99
0.000	250.000	4.000	7.000	1999.000	4/7/1999	APR07_99
0.000	220.000	4.000	7.000	1999.000	4/7/1999	APR07_99
0.000	200.000	4.000	20.000	1999.000	4/20/1999	APR20_99
0.000	230.000	4.000	20.000	1999.000	4/20/1999	APR20_99
0.000	290.000	4.000	20.000	1999.000	4/20/1999	APR20_99
0.000	290.000	4.000	20.000	1999.000	4/20/1999	APR20_99
0.000	360.000	4.000	20.000	1999.000	4/20/1999	APR20_99
0.000	410.000	4.000	20.000	1999.000	4/20/1999	APR20_99
0.000	440.000	4.000	20.000	1999.000	4/20/1999	APR20_99
0.000	510.000	4.000	20.000	1999.000	4/20/1999	APR20_99
0.000	460.000	4.000	20.000	1999.000	4/20/1999	APR20_99
0.000	430.000	4.000	20.000	1999.000	4/20/1999	APR20_99
0.000	320.000	4.000	20.000	1999.000	4/20/1999	APR20_99
0.000	270.000	4.000	20.000	1999.000	4/20/1999	APR20_99
0.000	240.000	4.000	20.000	1999.000	4/20/1999	APR20_99
0.000	220.000	4.000	20.000	1999.000	4/20/1999	APR20_99
0.000	195.000	4.000	20.000	1999.000	4/20/1999	APR20_99
0.000	160.000	4.000	20.000	1999.000	4/20/1999	APR20_99
0.000	230.000	12.000	15.000	1999.000	12/15/1999	DEC15_99
0.000	185.000	12.000	15.000	1999.000	12/15/1999	DEC15_99
0.000	135.000	12.000	15.000	1999.000	12/15/1999	DEC15_99
0.000	85.000	12.000	15.000	1999.000	12/15/1999	DEC15_99
0.000	130.000	12.000	15.000	1999.000	12/15/1999	DEC15_99
0.000	170.000	12.000	15.000	1999.000	12/15/1999	DEC15_99
0.000	215.000	12.000	15.000	1999.000	12/15/1999	DEC15_99
0.000	210.000	12.000	15.000	1999.000	12/15/1999	DEC15_99
0.000	195.000	12.000	29.000	1999.000	12/29/1999	DEC29_99
0.000	225.000	12.000	29.000	1999.000	12/29/1999	DEC29_99
0.000	225.000	12.000	29.000	1999.000	12/29/1999	DEC29_99
1.000	220.000	12.000	29.000	1999.000	12/29/1999	DEC29_99
1.000	230.000	12.000	29.000	1999.000	12/29/1999	DEC29_99
3.000	210.000	12.000	29.000	1999.000	12/29/1999	DEC29_99
0.000	180.000	12.000	29.000	1999.000	12/29/1999	DEC29_99
2.000	190.000	12.000	29.000	1999.000	12/29/1999	DEC29_99
0.000	255.000	12.000	29.000	1999.000	12/29/1999	DEC29_99
0.000	220.000	12.000	29.000	1999.000	12/29/1999	DEC29_99
0.000	195.000	12.000	29.000	1999.000	12/29/1999	DEC29_99
1.000	240.000	12.000	29.000	1999.000	12/29/1999	DEC29_99
0.000	240.000	12.000	29.000	1999.000	12/29/1999	DEC29_99
5.000	215.000	12.000	29.000	1999.000	12/29/1999	DEC29_99
0.000	265.000	12.000	29.000	1999.000	12/29/1999	DEC29_99
12.000	220.000	12.000	29.000	1999.000	12/29/1999	DEC29_99
0.000	185.000	1.000	26.000	2000.000	1/26/2000	JAN26_00
0.000	260.000	1.000	26.000	2000.000	1/26/2000	JAN26_00
0.000	290.000	1.000	26.000	2000.000	1/26/2000	JAN26_00
0.000	335.000	1.000	26.000	2000.000	1/26/2000	JAN26_00
0.000	385.000	1.000	26.000	2000.000	1/26/2000	JAN26_00
0.000	400.000	1.000	26.000	2000.000	1/26/2000	JAN26_00
0.000	425.000	1.000	26.000	2000.000	1/26/2000	JAN26_00
0.000	430.000	1.000	26.000	2000.000	1/26/2000	JAN26_00
0.000	265.000	2.000	15.000	2000.000	2/15/2000	FEB15_00
0.000	250.000	2.000	15.000	2000.000	2/15/2000	FEB15_00
1.000	340.000	2.000	15.000	2000.000	2/15/2000	FEB15_00
2.000	360.000	2.000	15.000	2000.000	2/15/2000	FEB15_00
1.000	385.000	2.000	15.000	2000.000	2/15/2000	FEB15_00
1.000	400.000	2.000	15.000	2000.000	2/15/2000	FEB15_00
0.000	525.000	2.000	15.000	2000.000	2/15/2000	FEB15_00
0.000	550.000	2.000	15.000	2000.000	2/15/2000	FEB15_00
1.000	450.000	2.000	15.000	2000.000	2/15/2000	FEB15_00
0.000	420.000	2.000	15.000	2000.000	2/15/2000	FEB15_00

0.000	375.000	2.000	15.000	2000.000	2/15/2000	FEB15_00
0.000	365.000	2.000	15.000	2000.000	2/15/2000	FEB15_00
0.000	325.000	2.000	15.000	2000.000	2/15/2000	FEB15_00
0.000	335.000	2.000	15.000	2000.000	2/15/2000	FEB15_00
0.000	260.000	2.000	15.000	2000.000	2/15/2000	FEB15_00
1.000	290.000	2.000	15.000	2000.000	2/15/2000	FEB15_00
0.000	145.000	2.000	15.000	2000.000	2/15/2000	FEB15_00
0.000	200.000	2.000	15.000	2000.000	2/15/2000	FEB15_00
0.000	190.000	2.000	15.000	2000.000	2/15/2000	FEB15_00
0.000	235.000	2.000	15.000	2000.000	2/15/2000	FEB15_00
0.000	235.000	2.000	15.000	2000.000	2/15/2000	FEB15_00
0.000	260.000	2.000	15.000	2000.000	2/15/2000	FEB15_00
0.000	250.000	2.000	15.000	2000.000	2/15/2000	FEB15_00
0.000	280.000	2.000	15.000	2000.000	2/15/2000	FEB15_00
0.000	310.000	2.000	15.000	2000.000	2/15/2000	FEB15_00
0.000	280.000	2.000	15.000	2000.000	2/15/2000	FEB15_00
0.000	335.000	2.000	15.000	2000.000	2/15/2000	FEB15_00
1.000	330.000	2.000	15.000	2000.000	2/15/2000	FEB15_00
0.000	370.000	2.000	15.000	2000.000	2/15/2000	FEB15_00
0.000	370.000	2.000	15.000	2000.000	2/15/2000	FEB15_00
0.000	400.000	2.000	15.000	2000.000	2/15/2000	FEB15_00
0.000	390.000	2.000	15.000	2000.000	2/15/2000	FEB15_00
0.000	225.000	2.000	24.000	2000.000	2/24/2000	FEB24_00
3.000	275.000	2.000	24.000	2000.000	2/24/2000	FEB24_00
1.000	300.000	2.000	24.000	2000.000	2/24/2000	FEB24_00
0.000	300.000	2.000	24.000	2000.000	2/24/2000	FEB24_00
0.000	300.000	2.000	24.000	2000.000	2/24/2000	FEB24_00
0.000	300.000	2.000	24.000	2000.000	2/24/2000	FEB24_00
0.000	325.000	2.000	24.000	2000.000	2/24/2000	FEB24_00
0.000	325.000	2.000	24.000	2000.000	2/24/2000	FEB24_00
0.000	360.000	2.000	24.000	2000.000	2/24/2000	FEB24_00
1.000	370.000	2.000	24.000	2000.000	2/24/2000	FEB24_00
0.000	365.000	2.000	24.000	2000.000	2/24/2000	FEB24_00
0.000	400.000	2.000	24.000	2000.000	2/24/2000	FEB24_00
0.000	400.000	2.000	24.000	2000.000	2/24/2000	FEB24_00
1.000	415.000	2.000	24.000	2000.000	2/24/2000	FEB24_00
0.000	370.000	2.000	24.000	2000.000	2/24/2000	FEB24_00
0.000	395.000	2.000	24.000	2000.000	2/24/2000	FEB24_00
0.000	265.000	2.000	24.000	2000.000	2/24/2000	FEB24_00
0.000	270.000	2.000	24.000	2000.000	2/24/2000	FEB24_00
0.000	275.000	2.000	24.000	2000.000	2/24/2000	FEB24_00
0.000	280.000	2.000	24.000	2000.000	2/24/2000	FEB24_00
0.000	265.000	2.000	24.000	2000.000	2/24/2000	FEB24_00
1.000	265.000	2.000	24.000	2000.000	2/24/2000	FEB24_00
1.000	245.000	2.000	24.000	2000.000	2/24/2000	FEB24_00
0.000	235.000	2.000	24.000	2000.000	2/24/2000	FEB24_00
0.000	230.000	2.000	24.000	2000.000	2/24/2000	FEB24_00
0.000	235.000	2.000	24.000	2000.000	2/24/2000	FEB24_00
0.000	240.000	2.000	24.000	2000.000	2/24/2000	FEB24_00
0.000	245.000	2.000	24.000	2000.000	2/24/2000	FEB24_00
1.000	260.000	2.000	24.000	2000.000	2/24/2000	FEB24_00
0.000	265.000	2.000	24.000	2000.000	2/24/2000	FEB24_00
0.000	270.000	2.000	24.000	2000.000	2/24/2000	FEB24_00
0.000	250.000	2.000	24.000	2000.000	2/24/2000	FEB24_00
0.000	195.000	3.000	21.000	2000.000	3/21/2000	MAR21_00
0.000	240.000	3.000	21.000	2000.000	3/21/2000	MAR21_00
0.000	230.000	3.000	21.000	2000.000	3/21/2000	MAR21_00
0.000	220.000	3.000	21.000	2000.000	3/21/2000	MAR21_00
0.000	230.000	3.000	21.000	2000.000	3/21/2000	MAR21_00
0.000	180.000	3.000	21.000	2000.000	3/21/2000	MAR21_00
0.000	165.000	3.000	21.000	2000.000	3/21/2000	MAR21_00

0.000	145.000	3.000	21.000	2000.000	3/21/2000	MAR21_00
0.000	410.000	3.000	21.000	2000.000	3/21/2000	MAR21_00
0.000	310.000	3.000	21.000	2000.000	3/21/2000	MAR21_00
0.000	320.000	3.000	21.000	2000.000	3/21/2000	MAR21_00
0.000	350.000	3.000	21.000	2000.000	3/21/2000	MAR21_00
0.000	320.000	3.000	21.000	2000.000	3/21/2000	MAR21_00
0.000	340.000	3.000	21.000	2000.000	3/21/2000	MAR21_00
0.000	320.000	3.000	21.000	2000.000	3/21/2000	MAR21_00
0.000	390.000	4.000	4.000	2000.000	4/4/2000	APR04_00
0.000	400.000	4.000	4.000	2000.000	4/4/2000	APR04_00
0.000	450.000	4.000	4.000	2000.000	4/4/2000	APR04_00
0.000	445.000	4.000	4.000	2000.000	4/4/2000	APR04_00
0.000	475.000	4.000	4.000	2000.000	4/4/2000	APR04_00
0.000	530.000	4.000	4.000	2000.000	4/4/2000	APR04_00
0.000	540.000	4.000	4.000	2000.000	4/4/2000	APR04_00
0.000	520.000	4.000	4.000	2000.000	4/4/2000	APR04_00
0.000	360.000	4.000	4.000	2000.000	4/4/2000	APR04_00
0.000	450.000	4.000	4.000	2000.000	4/4/2000	APR04_00
0.000	530.000	4.000	4.000	2000.000	4/4/2000	APR04_00
0.000	540.000	4.000	4.000	2000.000	4/4/2000	APR04_00
0.000	550.000	4.000	4.000	2000.000	4/4/2000	APR04_00
0.000	540.000	4.000	4.000	2000.000	4/4/2000	APR04_00
0.000	520.000	4.000	4.000	2000.000	4/4/2000	APR04_00
0.000	480.000	4.000	4.000	2000.000	4/4/2000	APR04_00

Hog Lake Branchiopod Inventory

SHRIMP__	DEPTH_MM	MONTH	DAY	YEAR	COLLDATE	DATETEXT
92.000	215.000	12.000	14.000	1998.000	12/14/1998	DEC14_98
92.000	350.000	12.000	14.000	1998.000	12/14/1998	DEC14_98
119.000	410.000	12.000	14.000	1998.000	12/14/1998	DEC14_98
106.000	480.000	12.000	14.000	1998.000	12/14/1998	DEC14_98
66.000	450.000	12.000	14.000	1998.000	12/14/1998	DEC14_98
79.000	390.000	12.000	14.000	1998.000	12/14/1998	DEC14_98
106.000	360.000	12.000	14.000	1998.000	12/14/1998	DEC14_98
106.000	310.000	12.000	14.000	1998.000	12/14/1998	DEC14_98
17.000	530.000	12.000	28.000	1998.000	12/28/1998	DEC28_98
32.000	650.000	12.000	28.000	1998.000	12/28/1998	DEC28_98
22.000	710.000	12.000	28.000	1998.000	12/28/1998	DEC28_98
25.000	730.000	12.000	28.000	1998.000	12/28/1998	DEC28_98
6.000	725.000	12.000	28.000	1998.000	12/28/1998	DEC28_98
9.000	730.000	12.000	28.000	1998.000	12/28/1998	DEC28_98
5.000	800.000	12.000	28.000	1998.000	12/28/1998	DEC28_98
14.000	750.000	12.000	28.000	1998.000	12/28/1998	DEC28_98
35.000	725.000	12.000	28.000	1998.000	12/28/1998	DEC28_98
9.000	715.000	12.000	28.000	1998.000	12/28/1998	DEC28_98
10.000	655.000	12.000	28.000	1998.000	12/28/1998	DEC28_98
22.000	600.000	12.000	28.000	1998.000	12/28/1998	DEC28_98
17.000	560.000	12.000	28.000	1998.000	12/28/1998	DEC28_98
5.000	575.000	12.000	28.000	1998.000	12/28/1998	DEC28_98
6.000	560.000	12.000	28.000	1998.000	12/28/1998	DEC28_98
7.000	550.000	12.000	28.000	1998.000	12/28/1998	DEC28_98
14.000	365.000	1.000	11.000	1999.000	1/11/1999	JAN11_99
22.000	385.000	1.000	11.000	1999.000	1/11/1999	JAN11_99
10.000	415.000	1.000	11.000	1999.000	1/11/1999	JAN11_99
20.000	480.000	1.000	11.000	1999.000	1/11/1999	JAN11_99
7.000	500.000	1.000	11.000	1999.000	1/11/1999	JAN11_99
9.000	490.000	1.000	11.000	1999.000	1/11/1999	JAN11_99
1.000	520.000	1.000	11.000	1999.000	1/11/1999	JAN11_99
9.000	520.000	1.000	11.000	1999.000	1/11/1999	JAN11_99
20.000	550.000	1.000	11.000	1999.000	1/11/1999	JAN11_99
15.000	505.000	1.000	11.000	1999.000	1/11/1999	JAN11_99
31.000	515.000	1.000	11.000	1999.000	1/11/1999	JAN11_99
8.000	530.000	1.000	11.000	1999.000	1/11/1999	JAN11_99
15.000	570.000	1.000	11.000	1999.000	1/11/1999	JAN11_99
23.000	570.000	1.000	11.000	1999.000	1/11/1999	JAN11_99
7.000	560.000	1.000	11.000	1999.000	1/11/1999	JAN11_99
5.000	545.000	1.000	11.000	1999.000	1/11/1999	JAN11_99
14.000	425.000	1.000	25.000	1999.000	1/25/1999	JAN25_99
8.000	460.000	1.000	25.000	1999.000	1/25/1999	JAN25_99
27.000	515.000	1.000	25.000	1999.000	1/25/1999	JAN25_99
25.000	545.000	1.000	25.000	1999.000	1/25/1999	JAN25_99
15.000	625.000	1.000	25.000	1999.000	1/25/1999	JAN25_99
7.000	710.000	1.000	25.000	1999.000	1/25/1999	JAN25_99
10.000	690.000	1.000	25.000	1999.000	1/25/1999	JAN25_99
20.000	720.000	1.000	25.000	1999.000	1/25/1999	JAN25_99
6.000	710.000	1.000	25.000	1999.000	1/25/1999	JAN25_99
18.000	705.000	1.000	25.000	1999.000	1/25/1999	JAN25_99
9.000	675.000	1.000	25.000	1999.000	1/25/1999	JAN25_99
33.000	630.000	1.000	25.000	1999.000	1/25/1999	JAN25_99
22.000	570.000	1.000	25.000	1999.000	1/25/1999	JAN25_99
27.000	520.000	1.000	25.000	1999.000	1/25/1999	JAN25_99
23.000	495.000	1.000	25.000	1999.000	1/25/1999	JAN25_99

16.000	375.000	1.000	25.000	1999.000	1/25/1999	JAN25_99
10.000	425.000	2.000	10.000	1999.000	2/10/1999	FEB10_99
17.000	515.000	2.000	10.000	1999.000	2/10/1999	FEB10_99
7.000	540.000	2.000	10.000	1999.000	2/10/1999	FEB10_99
21.000	555.000	2.000	10.000	1999.000	2/10/1999	FEB10_99
3.000	535.000	2.000	10.000	1999.000	2/10/1999	FEB10_99
4.000	620.000	2.000	10.000	1999.000	2/10/1999	FEB10_99
1.000	625.000	2.000	10.000	1999.000	2/10/1999	FEB10_99
5.000	640.000	2.000	10.000	1999.000	2/10/1999	FEB10_99
1.000	555.000	2.000	10.000	1999.000	2/10/1999	FEB10_99
1.000	510.000	2.000	10.000	1999.000	2/10/1999	FEB10_99
2.000	515.000	2.000	10.000	1999.000	2/10/1999	FEB10_99
3.000	455.000	2.000	10.000	1999.000	2/10/1999	FEB10_99
1.000	425.000	2.000	10.000	1999.000	2/10/1999	FEB10_99
5.000	360.000	2.000	10.000	1999.000	2/10/1999	FEB10_99
2.000	360.000	2.000	10.000	1999.000	2/10/1999	FEB10_99
1.000	355.000	2.000	10.000	1999.000	2/10/1999	FEB10_99
0.000	360.000	2.000	23.000	1999.000	2/23/1999	FEB23_99
0.000	370.000	2.000	23.000	1999.000	2/23/1999	FEB23_99
0.000	320.000	2.000	23.000	1999.000	2/23/1999	FEB23_99
0.000	260.000	2.000	23.000	1999.000	2/23/1999	FEB23_99
0.000	210.000	2.000	23.000	1999.000	2/23/1999	FEB23_99
0.000	180.000	2.000	23.000	1999.000	2/23/1999	FEB23_99
0.000	380.000	2.000	23.000	1999.000	2/23/1999	FEB23_99
0.000	265.000	2.000	23.000	1999.000	2/23/1999	FEB23_99
2.000	350.000	2.000	23.000	1999.000	2/23/1999	FEB23_99
2.000	340.000	2.000	23.000	1999.000	2/23/1999	FEB23_99
0.000	335.000	2.000	23.000	1999.000	2/23/1999	FEB23_99
3.000	310.000	2.000	23.000	1999.000	2/23/1999	FEB23_99
2.000	285.000	2.000	23.000	1999.000	2/23/1999	FEB23_99
4.000	320.000	2.000	23.000	1999.000	2/23/1999	FEB23_99
1.000	290.000	2.000	23.000	1999.000	2/23/1999	FEB23_99
3.000	305.000	2.000	23.000	1999.000	2/23/1999	FEB23_99
0.000	440.000	3.000	22.000	1999.000	3/22/1999	MAR22_99
0.000	505.000	3.000	22.000	1999.000	3/22/1999	MAR22_99
2.000	510.000	3.000	22.000	1999.000	3/22/1999	MAR22_99
3.000	525.000	3.000	22.000	1999.000	3/22/1999	MAR22_99
0.000	465.000	3.000	22.000	1999.000	3/22/1999	MAR22_99
0.000	395.000	3.000	22.000	1999.000	3/22/1999	MAR22_99
5.000	400.000	3.000	22.000	1999.000	3/22/1999	MAR22_99
0.000	380.000	3.000	22.000	1999.000	3/22/1999	MAR22_99
0.000	350.000	3.000	22.000	1999.000	3/22/1999	MAR22_99
0.000	350.000	3.000	22.000	1999.000	3/22/1999	MAR22_99
0.000	420.000	3.000	22.000	1999.000	3/22/1999	MAR22_99
0.000	430.000	3.000	22.000	1999.000	3/22/1999	MAR22_99
0.000	450.000	3.000	22.000	1999.000	3/22/1999	MAR22_99
0.000	480.000	3.000	22.000	1999.000	3/22/1999	MAR22_99
3.000	435.000	3.000	22.000	1999.000	3/22/1999	MAR22_99
0.000	435.000	3.000	22.000	1999.000	3/22/1999	MAR22_99
0.000	320.000	4.000	7.000	1999.000	4/7/1999	APR07_99
0.000	330.000	4.000	7.000	1999.000	4/7/1999	APR07_99
0.000	410.000	4.000	7.000	1999.000	4/7/1999	APR07_99
0.000	400.000	4.000	7.000	1999.000	4/7/1999	APR07_99
0.000	420.000	4.000	7.000	1999.000	4/7/1999	APR07_99
0.000	320.000	4.000	7.000	1999.000	4/7/1999	APR07_99
0.000	320.000	4.000	7.000	1999.000	4/7/1999	APR07_99
0.000	410.000	4.000	7.000	1999.000	4/7/1999	APR07_99
0.000	245.000	4.000	20.000	1999.000	4/20/1999	APR20_99

0.000	210.000	4.000	20.000	1999.000	4/20/1999	APR20_99
0.000	175.000	4.000	20.000	1999.000	4/20/1999	APR20_99
0.000	200.000	4.000	20.000	1999.000	4/20/1999	APR20_99
0.000	170.000	4.000	20.000	1999.000	4/20/1999	APR20_99
0.000	250.000	4.000	20.000	1999.000	4/20/1999	APR20_99
0.000	330.000	4.000	20.000	1999.000	4/20/1999	APR20_99
0.000	440.000	4.000	20.000	1999.000	4/20/1999	APR20_99
0.000	470.000	4.000	20.000	1999.000	4/20/1999	APR20_99
0.000	510.000	4.000	20.000	1999.000	4/20/1999	APR20_99
0.000	540.000	4.000	20.000	1999.000	4/20/1999	APR20_99
0.000	290.000	4.000	20.000	1999.000	4/20/1999	APR20_99
0.000	260.000	4.000	20.000	1999.000	4/20/1999	APR20_99
0.000	195.000	4.000	20.000	1999.000	4/20/1999	APR20_99
0.000	190.000	4.000	20.000	1999.000	4/20/1999	APR20_99
0.000	190.000	4.000	20.000	1999.000	4/20/1999	APR20_99
3.000	185.000	12.000	15.000	1999.000	12/15/1999	DEC15_99
4.000	240.000	12.000	15.000	1999.000	12/15/1999	DEC15_99
7.000	250.000	12.000	15.000	1999.000	12/15/1999	DEC15_99
9.000	240.000	12.000	15.000	1999.000	12/15/1999	DEC15_99
22.000	285.000	12.000	15.000	1999.000	12/15/1999	DEC15_99
11.000	260.000	12.000	15.000	1999.000	12/15/1999	DEC15_99
4.000	250.000	12.000	15.000	1999.000	12/15/1999	DEC15_99
14.000	245.000	12.000	15.000	1999.000	12/15/1999	DEC15_99
0.000	210.000	12.000	15.000	1999.000	12/15/1999	DEC15_99
1.000	215.000	12.000	15.000	1999.000	12/15/1999	DEC15_99
11.000	210.000	12.000	15.000	1999.000	12/15/1999	DEC15_99
0.000	185.000	12.000	15.000	1999.000	12/15/1999	DEC15_99
2.000	195.000	12.000	15.000	1999.000	12/15/1999	DEC15_99
5.000	235.000	12.000	15.000	1999.000	12/15/1999	DEC15_99
6.000	250.000	12.000	15.000	1999.000	12/15/1999	DEC15_99
5.000	230.000	12.000	15.000	1999.000	12/15/1999	DEC15_99
10.000	280.000	12.000	15.000	1999.000	12/15/1999	DEC15_99
12.000	255.000	12.000	15.000	1999.000	12/15/1999	DEC15_99
13.000	300.000	12.000	15.000	1999.000	12/15/1999	DEC15_99
14.000	315.000	12.000	15.000	1999.000	12/15/1999	DEC15_99
11.000	290.000	12.000	15.000	1999.000	12/15/1999	DEC15_99
4.000	285.000	12.000	15.000	1999.000	12/15/1999	DEC15_99
11.000	295.000	12.000	15.000	1999.000	12/15/1999	DEC15_99
10.000	305.000	12.000	15.000	1999.000	12/15/1999	DEC15_99
9.000	340.000	12.000	15.000	1999.000	12/15/1999	DEC15_99
10.000	330.000	12.000	15.000	1999.000	12/15/1999	DEC15_99
8.000	245.000	12.000	15.000	1999.000	12/15/1999	DEC15_99
13.000	345.000	12.000	15.000	1999.000	12/15/1999	DEC15_99
22.000	210.000	12.000	15.000	1999.000	12/15/1999	DEC15_99
13.000	230.000	12.000	15.000	1999.000	12/15/1999	DEC15_99
21.000	235.000	12.000	15.000	1999.000	12/15/1999	DEC15_99
12.000	215.000	12.000	15.000	1999.000	12/15/1999	DEC15_99
35.000	375.000	1.000	26.000	2000.000	1/26/2000	JAN26_00
36.000	320.000	1.000	26.000	2000.000	1/26/2000	JAN26_00
31.000	340.000	1.000	26.000	2000.000	1/26/2000	JAN26_00
25.000	390.000	1.000	26.000	2000.000	1/26/2000	JAN26_00
28.000	380.000	1.000	26.000	2000.000	1/26/2000	JAN26_00
33.000	330.000	1.000	26.000	2000.000	1/26/2000	JAN26_00
48.000	365.000	1.000	26.000	2000.000	1/26/2000	JAN26_00
10.000	365.000	1.000	26.000	2000.000	1/26/2000	JAN26_00
23.000	390.000	1.000	26.000	2000.000	1/26/2000	JAN26_00
41.000	440.000	1.000	26.000	2000.000	1/26/2000	JAN26_00
27.000	470.000	1.000	26.000	2000.000	1/26/2000	JAN26_00

27.000	455.000	1.000	26.000	2000.000	1/26/2000	JAN26_00
20.000	400.000	1.000	26.000	2000.000	1/26/2000	JAN26_00
43.000	330.000	1.000	26.000	2000.000	1/26/2000	JAN26_00
90.000	370.000	1.000	26.000	2000.000	1/26/2000	JAN26_00
84.000	400.000	1.000	26.000	2000.000	1/26/2000	JAN26_00
11.000	235.000	2.000	15.000	2000.000	2/15/2000	FEB15_00
17.000	235.000	2.000	15.000	2000.000	2/15/2000	FEB15_00
25.000	270.000	2.000	15.000	2000.000	2/15/2000	FEB15_00
13.000	295.000	2.000	15.000	2000.000	2/15/2000	FEB15_00
12.000	320.000	2.000	15.000	2000.000	2/15/2000	FEB15_00
21.000	280.000	2.000	15.000	2000.000	2/15/2000	FEB15_00
16.000	295.000	2.000	15.000	2000.000	2/15/2000	FEB15_00
13.000	240.000	2.000	15.000	2000.000	2/15/2000	FEB15_00
21.000	250.000	2.000	15.000	2000.000	2/15/2000	FEB15_00
15.000	245.000	2.000	15.000	2000.000	2/15/2000	FEB15_00
17.000	250.000	2.000	15.000	2000.000	2/15/2000	FEB15_00
20.000	230.000	2.000	15.000	2000.000	2/15/2000	FEB15_00
9.000	250.000	2.000	15.000	2000.000	2/15/2000	FEB15_00
25.000	290.000	2.000	15.000	2000.000	2/15/2000	FEB15_00
46.000	285.000	2.000	15.000	2000.000	2/15/2000	FEB15_00
10.000	275.000	2.000	15.000	2000.000	2/15/2000	FEB15_00
3.000	385.000	2.000	24.000	2000.000	2/24/2000	FEB24_00
5.000	385.000	2.000	24.000	2000.000	2/24/2000	FEB24_00
3.000	385.000	2.000	24.000	2000.000	2/24/2000	FEB24_00
3.000	430.000	2.000	24.000	2000.000	2/24/2000	FEB24_00
5.000	380.000	2.000	24.000	2000.000	2/24/2000	FEB24_00
0.000	415.000	2.000	24.000	2000.000	2/24/2000	FEB24_00
3.000	560.000	2.000	24.000	2000.000	2/24/2000	FEB24_00
1.000	440.000	2.000	24.000	2000.000	2/24/2000	FEB24_00
10.000	425.000	2.000	24.000	2000.000	2/24/2000	FEB24_00
4.000	400.000	2.000	24.000	2000.000	2/24/2000	FEB24_00
4.000	510.000	2.000	24.000	2000.000	2/24/2000	FEB24_00
2.000	470.000	2.000	24.000	2000.000	2/24/2000	FEB24_00
4.000	510.000	2.000	24.000	2000.000	2/24/2000	FEB24_00
0.000	420.000	2.000	24.000	2000.000	2/24/2000	FEB24_00
1.000	525.000	2.000	24.000	2000.000	2/24/2000	FEB24_00
1.000	520.000	2.000	24.000	2000.000	2/24/2000	FEB24_00
0.000	440.000	3.000	21.000	2000.000	3/21/2000	MAR21_00
0.000	390.000	3.000	21.000	2000.000	3/21/2000	MAR21_00
0.000	470.000	3.000	21.000	2000.000	3/21/2000	MAR21_00
0.000	550.000	3.000	21.000	2000.000	3/21/2000	MAR21_00
0.000	630.000	3.000	21.000	2000.000	3/21/2000	MAR21_00
6.000	550.000	3.000	21.000	2000.000	3/21/2000	MAR21_00
1.000	510.000	3.000	21.000	2000.000	3/21/2000	MAR21_00
0.000	500.000	3.000	21.000	2000.000	3/21/2000	MAR21_00
0.000	435.000	3.000	21.000	2000.000	3/21/2000	MAR21_00
0.000	500.000	3.000	21.000	2000.000	3/21/2000	MAR21_00
0.000	550.000	3.000	21.000	2000.000	3/21/2000	MAR21_00
0.000	550.000	3.000	21.000	2000.000	3/21/2000	MAR21_00
0.000	470.000	3.000	21.000	2000.000	3/21/2000	MAR21_00
0.000	450.000	3.000	21.000	2000.000	3/21/2000	MAR21_00
0.000	400.000	3.000	21.000	2000.000	3/21/2000	MAR21_00
2.000	320.000	3.000	21.000	2000.000	3/21/2000	MAR21_00
0.000	195.000	4.000	4.000	2000.000	4/4/2000	APR04_00
0.000	220.000	4.000	4.000	2000.000	4/4/2000	APR04_00
0.000	340.000	4.000	4.000	2000.000	4/4/2000	APR04_00
0.000	200.000	4.000	4.000	2000.000	4/4/2000	APR04_00
0.000	200.000	4.000	4.000	2000.000	4/4/2000	APR04_00

0.000	290.000	4.000	4.000	2000.000	4/4/2000	APR04_00
0.000	350.000	4.000	4.000	2000.000	4/4/2000	APR04_00
0.000	420.000	4.000	4.000	2000.000	4/4/2000	APR04_00
0.000	430.000	4.000	4.000	2000.000	4/4/2000	APR04_00
0.000	510.000	4.000	4.000	2000.000	4/4/2000	APR04_00
0.000	460.000	4.000	4.000	2000.000	4/4/2000	APR04_00
0.000	470.000	4.000	4.000	2000.000	4/4/2000	APR04_00
0.000	480.000	4.000	4.000	2000.000	4/4/2000	APR04_00
0.000	470.000	4.000	4.000	2000.000	4/4/2000	APR04_00
0.000	445.000	4.000	4.000	2000.000	4/4/2000	APR04_00
0.000	385.000	4.000	4.000	2000.000	4/4/2000	APR04_00
0.000	370.000	4.000	19.000	2000.000	4/19/2000	APR19_00
0.000	510.000	4.000	19.000	2000.000	4/19/2000	APR19_00
0.000	480.000	4.000	19.000	2000.000	4/19/2000	APR19_00
0.000	595.000	4.000	19.000	2000.000	4/19/2000	APR19_00
0.000	350.000	4.000	19.000	2000.000	4/19/2000	APR19_00
0.000	545.000	5.000	2.000	2000.000	5/2/2000	MAY02_00
0.000	560.000	5.000	2.000	2000.000	5/2/2000	MAY02_00
0.000	595.000	5.000	2.000	2000.000	5/2/2000	MAY02_00

SHRIMP__	DEPTH_MM	MONTH	DAY	YEAR	COLLDATE	DATETEXT
0.000	350.000	12.000	14.000	1998.000	12/14/1998	DEC14_98
1.000	360.000	12.000	14.000	1998.000	12/14/1998	DEC14_98
1.000	385.000	12.000	14.000	1998.000	12/14/1998	DEC14_98
1.000	410.000	12.000	14.000	1998.000	12/14/1998	DEC14_98
0.000	370.000	12.000	14.000	1998.000	12/14/1998	DEC14_98
0.000	390.000	12.000	14.000	1998.000	12/14/1998	DEC14_98
1.000	345.000	12.000	14.000	1998.000	12/14/1998	DEC14_98
0.000	325.000	12.000	14.000	1998.000	12/14/1998	DEC14_98
0.000	295.000	12.000	28.000	1998.000	12/28/1998	DEC28_98
0.000	290.000	12.000	28.000	1998.000	12/28/1998	DEC28_98
4.000	330.000	12.000	28.000	1998.000	12/28/1998	DEC28_98
0.000	340.000	12.000	28.000	1998.000	12/28/1998	DEC28_98
1.000	370.000	12.000	28.000	1998.000	12/28/1998	DEC28_98
1.000	325.000	12.000	28.000	1998.000	12/28/1998	DEC28_98
1.000	365.000	12.000	28.000	1998.000	12/28/1998	DEC28_98
1.000	315.000	12.000	28.000	1998.000	12/28/1998	DEC28_98
1.000	360.000	12.000	28.000	1998.000	12/28/1998	DEC28_98
3.000	315.000	12.000	28.000	1998.000	12/28/1998	DEC28_98
0.000	330.000	12.000	28.000	1998.000	12/28/1998	DEC28_98
1.000	355.000	12.000	28.000	1998.000	12/28/1998	DEC28_98
0.000	345.000	12.000	28.000	1998.000	12/28/1998	DEC28_98
1.000	365.000	12.000	28.000	1998.000	12/28/1998	DEC28_98
1.000	350.000	12.000	28.000	1998.000	12/28/1998	DEC28_98
1.000	345.000	12.000	28.000	1998.000	12/28/1998	DEC28_98
0.000	230.000	1.000	11.000	1999.000	1/11/1999	JAN11_99
0.000	245.000	1.000	11.000	1999.000	1/11/1999	JAN11_99
0.000	250.000	1.000	11.000	1999.000	1/11/1999	JAN11_99
0.000	265.000	1.000	11.000	1999.000	1/11/1999	JAN11_99
1.000	290.000	1.000	11.000	1999.000	1/11/1999	JAN11_99
0.000	280.000	1.000	11.000	1999.000	1/11/1999	JAN11_99
0.000	310.000	1.000	11.000	1999.000	1/11/1999	JAN11_99
3.000	340.000	1.000	11.000	1999.000	1/11/1999	JAN11_99
0.000	340.000	1.000	11.000	1999.000	1/11/1999	JAN11_99
0.000	320.000	1.000	11.000	1999.000	1/11/1999	JAN11_99
5.000	325.000	1.000	11.000	1999.000	1/11/1999	JAN11_99
4.000	365.000	1.000	11.000	1999.000	1/11/1999	JAN11_99
1.000	310.000	1.000	11.000	1999.000	1/11/1999	JAN11_99
0.000	440.000	1.000	11.000	1999.000	1/11/1999	JAN11_99
2.000	340.000	1.000	11.000	1999.000	1/11/1999	JAN11_99
1.000	330.000	1.000	11.000	1999.000	1/11/1999	JAN11_99
1.000	320.000	1.000	25.000	1999.000	1/25/1999	JAN25_99
1.000	305.000	1.000	25.000	1999.000	1/25/1999	JAN25_99
0.000	350.000	1.000	25.000	1999.000	1/25/1999	JAN25_99
0.000	385.000	1.000	25.000	1999.000	1/25/1999	JAN25_99
0.000	385.000	1.000	25.000	1999.000	1/25/1999	JAN25_99
0.000	370.000	1.000	25.000	1999.000	1/25/1999	JAN25_99
0.000	385.000	1.000	25.000	1999.000	1/25/1999	JAN25_99
0.000	405.000	1.000	25.000	1999.000	1/25/1999	JAN25_99
0.000	365.000	1.000	25.000	1999.000	1/25/1999	JAN25_99
1.000	415.000	1.000	25.000	1999.000	1/25/1999	JAN25_99
0.000	395.000	1.000	25.000	1999.000	1/25/1999	JAN25_99
0.000	445.000	1.000	25.000	1999.000	1/25/1999	JAN25_99
0.000	375.000	1.000	25.000	1999.000	1/25/1999	JAN25_99
0.000	365.000	1.000	25.000	1999.000	1/25/1999	JAN25_99
0.000	340.000	1.000	25.000	1999.000	1/25/1999	JAN25_99
0.000	325.000	1.000	25.000	1999.000	1/25/1999	JAN25_99
0.000	350.000	2.000	10.000	1999.000	2/10/1999	FEB10_99
0.000	370.000	2.000	10.000	1999.000	2/10/1999	FEB10_99
0.000	400.000	2.000	10.000	1999.000	2/10/1999	FEB10_99
0.000	440.000	2.000	10.000	1999.000	2/10/1999	FEB10_99

0.000	405.000	2.000	10.000	1999.000	2/10/1999	FEB10_99
0.000	350.000	2.000	10.000	1999.000	2/10/1999	FEB10_99
0.000	320.000	2.000	10.000	1999.000	2/10/1999	FEB10_99
2.000	270.000	2.000	10.000	1999.000	2/10/1999	FEB10_99
0.000	325.000	2.000	10.000	1999.000	2/10/1999	FEB10_99
0.000	380.000	2.000	10.000	1999.000	2/10/1999	FEB10_99
0.000	420.000	2.000	10.000	1999.000	2/10/1999	FEB10_99
0.000	385.000	2.000	10.000	1999.000	2/10/1999	FEB10_99
0.000	390.000	2.000	10.000	1999.000	2/10/1999	FEB10_99
0.000	355.000	2.000	10.000	1999.000	2/10/1999	FEB10_99
0.000	330.000	2.000	10.000	1999.000	2/10/1999	FEB10_99
0.000	270.000	2.000	10.000	1999.000	2/10/1999	FEB10_99
0.000	260.000	2.000	23.000	1999.000	2/23/1999	FEB23_99
0.000	255.000	2.000	23.000	1999.000	2/23/1999	FEB23_99
0.000	245.000	2.000	23.000	1999.000	2/23/1999	FEB23_99
0.000	265.000	2.000	23.000	1999.000	2/23/1999	FEB23_99
0.000	290.000	2.000	23.000	1999.000	2/23/1999	FEB23_99
0.000	275.000	2.000	23.000	1999.000	2/23/1999	FEB23_99
0.000	270.000	2.000	23.000	1999.000	2/23/1999	FEB23_99
0.000	335.000	2.000	23.000	1999.000	2/23/1999	FEB23_99
0.000	405.000	2.000	23.000	1999.000	2/23/1999	FEB23_99
0.000	425.000	2.000	23.000	1999.000	2/23/1999	FEB23_99
0.000	430.000	2.000	23.000	1999.000	2/23/1999	FEB23_99
0.000	375.000	2.000	23.000	1999.000	2/23/1999	FEB23_99
0.000	340.000	2.000	23.000	1999.000	2/23/1999	FEB23_99
0.000	295.000	2.000	23.000	1999.000	2/23/1999	FEB23_99
1.000	350.000	2.000	23.000	1999.000	2/23/1999	FEB23_99
0.000	285.000	2.000	23.000	1999.000	2/23/1999	FEB23_99
0.000	315.000	3.000	22.000	1999.000	3/22/1999	MAR22_99
0.000	380.000	3.000	22.000	1999.000	3/22/1999	MAR22_99
0.000	320.000	3.000	22.000	1999.000	3/22/1999	MAR22_99
0.000	310.000	3.000	22.000	1999.000	3/22/1999	MAR22_99
0.000	325.000	3.000	22.000	1999.000	3/22/1999	MAR22_99
0.000	310.000	3.000	22.000	1999.000	3/22/1999	MAR22_99
0.000	310.000	3.000	22.000	1999.000	3/22/1999	MAR22_99
0.000	355.000	3.000	22.000	1999.000	3/22/1999	MAR22_99
0.000	360.000	3.000	22.000	1999.000	3/22/1999	MAR22_99
0.000	390.000	3.000	22.000	1999.000	3/22/1999	MAR22_99
0.000	340.000	3.000	22.000	1999.000	3/22/1999	MAR22_99
0.000	370.000	3.000	22.000	1999.000	3/22/1999	MAR22_99
0.000	330.000	3.000	22.000	1999.000	3/22/1999	MAR22_99
0.000	335.000	3.000	22.000	1999.000	3/22/1999	MAR22_99
0.000	350.000	3.000	22.000	1999.000	3/22/1999	MAR22_99
0.000	350.000	3.000	22.000	1999.000	3/22/1999	MAR22_99
0.000	300.000	4.000	20.000	1999.000	4/20/1999	APR20_99
0.000	310.000	4.000	20.000	1999.000	4/20/1999	APR20_99
0.000	400.000	4.000	20.000	1999.000	4/20/1999	APR20_99
0.000	410.000	4.000	20.000	1999.000	4/20/1999	APR20_99
0.000	335.000	4.000	20.000	1999.000	4/20/1999	APR20_99
0.000	75.000	12.000	15.000	2000.000	12/15/2000	DEC15_00
0.000	80.000	12.000	15.000	2000.000	12/15/2000	DEC15_00
0.000	110.000	12.000	15.000	2000.000	12/15/2000	DEC15_00
0.000	110.000	12.000	15.000	2000.000	12/15/2000	DEC15_00
0.000	110.000	12.000	15.000	2000.000	12/15/2000	DEC15_00
0.000	70.000	12.000	29.000	2000.000	12/29/2000	DEC29_00
0.000	360.000	1.000	26.000	2000.000	1/26/2000	JAN26_00
0.000	400.000	1.000	26.000	2000.000	1/26/2000	JAN26_00
0.000	400.000	1.000	26.000	2000.000	1/26/2000	JAN26_00
0.000	400.000	1.000	26.000	2000.000	1/26/2000	JAN26_00
0.000	385.000	1.000	26.000	2000.000	1/26/2000	JAN26_00
0.000	420.000	1.000	26.000	2000.000	1/26/2000	JAN26_00
0.000	370.000	1.000	26.000	2000.000	1/26/2000	JAN26_00
0.000	390.000	1.000	26.000	2000.000	1/26/2000	JAN26_00

2.000	200.000	2.000	15.000	2000.000	2/15/2000	FEB15_00
3.000	240.000	2.000	15.000	2000.000	2/15/2000	FEB15_00
3.000	225.000	2.000	15.000	2000.000	2/15/2000	FEB15_00
3.000	290.000	2.000	15.000	2000.000	2/15/2000	FEB15_00
1.000	265.000	2.000	15.000	2000.000	2/15/2000	FEB15_00
1.000	265.000	2.000	15.000	2000.000	2/15/2000	FEB15_00
1.000	255.000	2.000	15.000	2000.000	2/15/2000	FEB15_00
10.000	260.000	2.000	15.000	2000.000	2/15/2000	FEB15_00
7.000	270.000	2.000	15.000	2000.000	2/15/2000	FEB15_00
5.000	240.000	2.000	15.000	2000.000	2/15/2000	FEB15_00
2.000	240.000	2.000	15.000	2000.000	2/15/2000	FEB15_00
0.000	280.000	2.000	15.000	2000.000	2/15/2000	FEB15_00
3.000	250.000	2.000	15.000	2000.000	2/15/2000	FEB15_00
	235.000	2.000	15.000	2000.000	2/15/2000	FEB15_00
0.000	245.000	2.000	15.000	2000.000	2/15/2000	FEB15_00
4.000	235.000	2.000	15.000	2000.000	2/15/2000	FEB15_00
3.000	160.000	2.000	24.000	2000.000	2/24/2000	FEB24_00
0.000	160.000	2.000	24.000	2000.000	2/24/2000	FEB24_00
0.000	230.000	2.000	24.000	2000.000	2/24/2000	FEB24_00
0.000	280.000	2.000	24.000	2000.000	2/24/2000	FEB24_00
0.000	255.000	2.000	24.000	2000.000	2/24/2000	FEB24_00
0.000	185.000	2.000	24.000	2000.000	2/24/2000	FEB24_00
0.000	240.000	2.000	24.000	2000.000	2/24/2000	FEB24_00
0.000	245.000	2.000	24.000	2000.000	2/24/2000	FEB24_00
0.000	195.000	2.000	24.000	2000.000	2/24/2000	FEB24_00
2.000	230.000	2.000	24.000	2000.000	2/24/2000	FEB24_00
2.000	240.000	2.000	24.000	2000.000	2/24/2000	FEB24_00
2.000	260.000	2.000	24.000	2000.000	2/24/2000	FEB24_00
0.000	245.000	2.000	24.000	2000.000	2/24/2000	FEB24_00
0.000	320.000	2.000	24.000	2000.000	2/24/2000	FEB24_00
0.000	330.000	2.000	24.000	2000.000	2/24/2000	FEB24_00
0.000	270.000	2.000	24.000	2000.000	2/24/2000	FEB24_00
0.000	310.000	3.000	21.000	2000.000	3/21/2000	MAR21_00
0.000	300.000	3.000	21.000	2000.000	3/21/2000	MAR21_00
0.000	235.000	3.000	21.000	2000.000	3/21/2000	MAR21_00
0.000	250.000	3.000	21.000	2000.000	3/21/2000	MAR21_00
0.000	200.000	3.000	21.000	2000.000	3/21/2000	MAR21_00
0.000	210.000	3.000	21.000	2000.000	3/21/2000	MAR21_00
0.000	220.000	3.000	21.000	2000.000	3/21/2000	MAR21_00
0.000	230.000	3.000	21.000	2000.000	3/21/2000	MAR21_00
0.000	170.000	3.000	21.000	2000.000	3/21/2000	MAR21_00
0.000	180.000	3.000	21.000	2000.000	3/21/2000	MAR21_00
0.000	280.000	3.000	21.000	2000.000	3/21/2000	MAR21_00
0.000	190.000	3.000	21.000	2000.000	3/21/2000	MAR21_00
0.000	210.000	3.000	21.000	2000.000	3/21/2000	MAR21_00
0.000	210.000	3.000	21.000	2000.000	3/21/2000	MAR21_00
0.000	210.000	3.000	21.000	2000.000	3/21/2000	MAR21_00
0.000	265.000	3.000	21.000	2000.000	3/21/2000	MAR21_00
0.000	250.000	4.000	4.000	2000.000	4/4/2000	APR04_00
0.000	250.000	4.000	4.000	2000.000	4/4/2000	APR04_00
0.000	200.000	4.000	4.000	2000.000	4/4/2000	APR04_00
0.000	230.000	4.000	4.000	2000.000	4/4/2000	APR04_00
0.000	245.000	4.000	4.000	2000.000	4/4/2000	APR04_00
0.000	275.000	4.000	4.000	2000.000	4/4/2000	APR04_00
0.000	240.000	4.000	4.000	2000.000	4/4/2000	APR04_00
0.000	300.000	4.000	4.000	2000.000	4/4/2000	APR04_00
0.000	220.000	4.000	19.000	2000.000	4/19/2000	APR19_00
0.000	230.000	4.000	19.000	2000.000	4/19/2000	APR19_00
0.000	260.000	4.000	19.000	2000.000	4/19/2000	APR19_00
0.000	230.000	4.000	19.000	2000.000	4/19/2000	APR19_00
0.000	270.000	4.000	19.000	2000.000	4/19/2000	APR19_00

SHRIMP__	DEPTH_CM	MONTH	DAY	YEAR	COLLDATE	DATETEXT
92.000	180.000	12.000	14.000	1998.000	12/14/1998	DEC14_98
92.000	200.000	12.000	14.000	1998.000	12/14/1998	DEC14_98
119.000	205.000	12.000	14.000	1998.000	12/14/1998	DEC14_98
119.000	225.000	12.000	14.000	1998.000	12/14/1998	DEC14_98
79.000	195.000	12.000	14.000	1998.000	12/14/1998	DEC14_98
79.000	175.000	12.000	14.000	1998.000	12/14/1998	DEC14_98
119.000	140.000	12.000	14.000	1998.000	12/14/1998	DEC14_98
79.000	125.000	12.000	14.000	1998.000	12/14/1998	DEC14_98
20.000	170.000	12.000	28.000	1998.000	12/28/1998	DEC28_98
15.000	230.000	12.000	28.000	1998.000	12/28/1998	DEC28_98
10.000	275.000	12.000	28.000	1998.000	12/28/1998	DEC28_98
15.000	285.000	12.000	28.000	1998.000	12/28/1998	DEC28_98
13.000	265.000	12.000	28.000	1998.000	12/28/1998	DEC28_98
15.000	245.000	12.000	28.000	1998.000	12/28/1998	DEC28_98
17.000	250.000	12.000	28.000	1998.000	12/28/1998	DEC28_98
10.000	300.000	12.000	28.000	1998.000	12/28/1998	DEC28_98
25.000	290.000	12.000	28.000	1998.000	12/28/1998	DEC28_98
22.000	255.000	12.000	28.000	1998.000	12/28/1998	DEC28_98
24.000	270.000	12.000	28.000	1998.000	12/28/1998	DEC28_98
15.000	275.000	12.000	28.000	1998.000	12/28/1998	DEC28_98
17.000	260.000	12.000	28.000	1998.000	12/28/1998	DEC28_98
18.000	260.000	12.000	28.000	1998.000	12/28/1998	DEC28_98
10.000	230.000	12.000	28.000	1998.000	12/28/1998	DEC28_98
10.000	225.000	12.000	28.000	1998.000	12/28/1998	DEC28_98
0.000	170.000	1.000	11.000	1999.000	1/11/1999	JAN11_99
13.000	195.000	1.000	11.000	1999.000	1/11/1999	JAN11_99
9.000	220.000	1.000	11.000	1999.000	1/11/1999	JAN11_99
8.000	235.000	1.000	11.000	1999.000	1/11/1999	JAN11_99
19.000	240.000	1.000	11.000	1999.000	1/11/1999	JAN11_99
3.000	240.000	1.000	11.000	1999.000	1/11/1999	JAN11_99
9.000	240.000	1.000	11.000	1999.000	1/11/1999	JAN11_99
9.000	275.000	1.000	11.000	1999.000	1/11/1999	JAN11_99
5.000	285.000	1.000	11.000	1999.000	1/11/1999	JAN11_99
6.000	290.000	1.000	11.000	1999.000	1/11/1999	JAN11_99
7.000	300.000	1.000	11.000	1999.000	1/11/1999	JAN11_99
6.000	295.000	1.000	11.000	1999.000	1/11/1999	JAN11_99
15.000	290.000	1.000	11.000	1999.000	1/11/1999	JAN11_99
4.000	275.000	1.000	11.000	1999.000	1/11/1999	JAN11_99
9.000	280.000	1.000	11.000	1999.000	1/11/1999	JAN11_99
2.000	285.000	1.000	11.000	1999.000	1/11/1999	JAN11_99
2.000	245.000	1.000	25.000	1999.000	1/25/1999	JAN25_99
3.000	270.000	1.000	25.000	1999.000	1/25/1999	JAN25_99
1.000	290.000	1.000	25.000	1999.000	1/25/1999	JAN25_99
0.000	265.000	1.000	25.000	1999.000	1/25/1999	JAN25_99
1.000	270.000	1.000	25.000	1999.000	1/25/1999	JAN25_99
2.000	280.000	1.000	25.000	1999.000	1/25/1999	JAN25_99
4.000	320.000	1.000	25.000	1999.000	1/25/1999	JAN25_99
4.000	340.000	1.000	25.000	1999.000	1/25/1999	JAN25_99
1.000	275.000	1.000	25.000	1999.000	1/25/1999	JAN25_99
3.000	265.000	1.000	25.000	1999.000	1/25/1999	JAN25_99
2.000	255.000	1.000	25.000	1999.000	1/25/1999	JAN25_99
1.000	250.000	1.000	25.000	1999.000	1/25/1999	JAN25_99
5.000	275.000	1.000	25.000	1999.000	1/25/1999	JAN25_99
5.000	240.000	1.000	25.000	1999.000	1/25/1999	JAN25_99
0.000	225.000	1.000	25.000	1999.000	1/25/1999	JAN25_99
0.000	215.000	1.000	25.000	1999.000	1/25/1999	JAN25_99
3.000	290.000	2.000	10.000	1999.000	2/10/1999	FEB10_99
0.000	325.000	2.000	10.000	1999.000	2/10/1999	FEB10_99
1.000	310.000	2.000	10.000	1999.000	2/10/1999	FEB10_99

2.000	335.000	2.000	10.000	1999.000	2/10/1999	FEB10_99
1.000	365.000	2.000	10.000	1999.000	2/10/1999	FEB10_99
4.000	380.000	2.000	10.000	1999.000	2/10/1999	FEB10_99
2.000	375.000	2.000	10.000	1999.000	2/10/1999	FEB10_99
2.000	440.000	2.000	10.000	1999.000	2/10/1999	FEB10_99
4.000	430.000	2.000	10.000	1999.000	2/10/1999	FEB10_99
5.000	410.000	2.000	10.000	1999.000	2/10/1999	FEB10_99
9.000	420.000	2.000	10.000	1999.000	2/10/1999	FEB10_99
1.000	400.000	2.000	10.000	1999.000	2/10/1999	FEB10_99
2.000	370.000	2.000	10.000	1999.000	2/10/1999	FEB10_99
1.000	325.000	2.000	10.000	1999.000	2/10/1999	FEB10_99
1.000	280.000	2.000	10.000	1999.000	2/10/1999	FEB10_99
0.000	300.000	2.000	10.000	1999.000	2/10/1999	FEB10_99
1.000	205.000	2.000	23.000	1999.000	2/23/1999	FEB23_99
1.000	185.000	2.000	23.000	1999.000	2/23/1999	FEB23_99
1.000	205.000	2.000	23.000	1999.000	2/23/1999	FEB23_99
4.000	205.000	2.000	23.000	1999.000	2/23/1999	FEB23_99
3.000	240.000	2.000	23.000	1999.000	2/23/1999	FEB23_99
0.000	240.000	2.000	23.000	1999.000	2/23/1999	FEB23_99
1.000	290.000	2.000	23.000	1999.000	2/23/1999	FEB23_99
2.000	280.000	2.000	23.000	1999.000	2/23/1999	FEB23_99
6.000	285.000	2.000	23.000	1999.000	2/23/1999	FEB23_99
3.000	335.000	2.000	23.000	1999.000	2/23/1999	FEB23_99
3.000	325.000	2.000	23.000	1999.000	2/23/1999	FEB23_99
5.000	295.000	2.000	23.000	1999.000	2/23/1999	FEB23_99
1.000	210.000	2.000	23.000	1999.000	2/23/1999	FEB23_99
3.000	195.000	2.000	23.000	1999.000	2/23/1999	FEB23_99
1.000	200.000	2.000	23.000	1999.000	2/23/1999	FEB23_99
3.000	160.000	2.000	23.000	1999.000	2/23/1999	FEB23_99
0.000	180.000	3.000	22.000	1999.000	3/22/1999	MAR22_99
0.000	190.000	3.000	22.000	1999.000	3/22/1999	MAR22_99
0.000	200.000	3.000	22.000	1999.000	3/22/1999	MAR22_99
0.000	190.000	3.000	22.000	1999.000	3/22/1999	MAR22_99
0.000	200.000	3.000	22.000	1999.000	3/22/1999	MAR22_99
0.000	250.000	3.000	22.000	1999.000	3/22/1999	MAR22_99
0.000	240.000	3.000	22.000	1999.000	3/22/1999	MAR22_99
0.000	260.000	3.000	22.000	1999.000	3/22/1999	MAR22_99
0.000	230.000	3.000	22.000	1999.000	3/22/1999	MAR22_99
0.000	240.000	3.000	22.000	1999.000	3/22/1999	MAR22_99
0.000	260.000	3.000	22.000	1999.000	3/22/1999	MAR22_99
0.000	235.000	3.000	22.000	1999.000	3/22/1999	MAR22_99
0.000	210.000	3.000	22.000	1999.000	3/22/1999	MAR22_99
0.000	230.000	3.000	22.000	1999.000	3/22/1999	MAR22_99
0.000	210.000	3.000	22.000	1999.000	3/22/1999	MAR22_99
0.000	130.000	3.000	22.000	1999.000	3/22/1999	MAR22_99
0.000	250.000	4.000	7.000	1999.000	4/7/1999	APR07_99
0.000	250.000	4.000	7.000	1999.000	4/7/1999	APR07_99
0.000	240.000	4.000	7.000	1999.000	4/7/1999	APR07_99
0.000	260.000	4.000	7.000	1999.000	4/7/1999	APR07_99
0.000	210.000	4.000	20.000	1999.000	4/20/1999	APR20_99
0.000	205.000	4.000	20.000	1999.000	4/20/1999	APR20_99
0.000	220.000	4.000	20.000	1999.000	4/20/1999	APR20_99
0.000	215.000	4.000	20.000	1999.000	4/20/1999	APR20_99
0.000	190.000	4.000	20.000	1999.000	4/20/1999	APR20_99
0.000	210.000	4.000	20.000	1999.000	4/20/1999	APR20_99
0.000	240.000	4.000	20.000	1999.000	4/20/1999	APR20_99
0.000	195.000	4.000	20.000	1999.000	4/20/1999	APR20_99
1.000	220.000	12.000	15.000	1999.000	12/15/1999	DEC15_99
1.000	240.000	12.000	15.000	1999.000	12/15/1999	DEC15_99
10.000	245.000	12.000	15.000	1999.000	12/15/1999	DEC15_99
13.000	230.000	12.000	15.000	1999.000	12/15/1999	DEC15_99
17.000	250.000	12.000	15.000	1999.000	12/15/1999	DEC15_99

14.000	280.000	12.000	15.000	1999.000	12/15/1999	DEC15_99
18.000	275.000	12.000	15.000	1999.000	12/15/1999	DEC15_99
13.000	310.000	12.000	15.000	1999.000	12/15/1999	DEC15_99
18.000	305.000	12.000	15.000	1999.000	12/15/1999	DEC15_99
12.000	310.000	12.000	15.000	1999.000	12/15/1999	DEC15_99
9.000	305.000	12.000	15.000	1999.000	12/15/1999	DEC15_99
8.000	310.000	12.000	15.000	1999.000	12/15/1999	DEC15_99
9.000	310.000	12.000	15.000	1999.000	12/15/1999	DEC15_99
11.000	325.000	12.000	15.000	1999.000	12/15/1999	DEC15_99
4.000	315.000	12.000	15.000	1999.000	12/15/1999	DEC15_99
4.000	305.000	12.000	15.000	1999.000	12/15/1999	DEC15_99
5.000	220.000	12.000	29.000	1999.000	12/29/1999	DEC29_99
2.000	220.000	12.000	29.000	1999.000	12/29/1999	DEC29_99
10.000	225.000	12.000	29.000	1999.000	12/29/1999	DEC29_99
6.000	200.000	12.000	29.000	1999.000	12/29/1999	DEC29_99
6.000	185.000	12.000	29.000	1999.000	12/29/1999	DEC29_99
10.000	205.000	12.000	29.000	1999.000	12/29/1999	DEC29_99
14.000	205.000	12.000	29.000	1999.000	12/29/1999	DEC29_99
6.000	195.000	12.000	29.000	1999.000	12/29/1999	DEC29_99
2.000	215.000	12.000	29.000	1999.000	12/29/1999	DEC29_99
15.000	215.000	12.000	29.000	1999.000	12/29/1999	DEC29_99
13.000	220.000	12.000	29.000	1999.000	12/29/1999	DEC29_99
17.000	215.000	12.000	29.000	1999.000	12/29/1999	DEC29_99
13.000	220.000	12.000	29.000	1999.000	12/29/1999	DEC29_99
15.000	190.000	12.000	29.000	1999.000	12/29/1999	DEC29_99
6.000	220.000	12.000	29.000	1999.000	12/29/1999	DEC29_99
11.000	205.000	12.000	29.000	1999.000	12/29/1999	DEC29_99
1.000	260.000	1.000	26.000	2000.000	1/26/2000	JAN26_00
2.000	250.000	1.000	26.000	2000.000	1/26/2000	JAN26_00
1.000	260.000	1.000	26.000	2000.000	1/26/2000	JAN26_00
5.000	270.000	1.000	26.000	2000.000	1/26/2000	JAN26_00
3.000	285.000	1.000	26.000	2000.000	1/26/2000	JAN26_00
2.000	270.000	1.000	26.000	2000.000	1/26/2000	JAN26_00
4.000	305.000	1.000	26.000	2000.000	1/26/2000	JAN26_00
2.000	330.000	1.000	26.000	2000.000	1/26/2000	JAN26_00
3.000	315.000	1.000	26.000	2000.000	1/26/2000	JAN26_00
4.000	330.000	1.000	26.000	2000.000	1/26/2000	JAN26_00
0.000	330.000	1.000	26.000	2000.000	1/26/2000	JAN26_00
0.000	300.000	1.000	26.000	2000.000	1/26/2000	JAN26_00
0.000	285.000	1.000	26.000	2000.000	1/26/2000	JAN26_00
2.000	270.000	1.000	26.000	2000.000	1/26/2000	JAN26_00
0.000	260.000	1.000	26.000	2000.000	1/26/2000	JAN26_00
0.000	225.000	1.000	26.000	2000.000	1/26/2000	JAN26_00
2.000	180.000	2.000	15.000	2000.000	2/15/2000	FEB15_00
4.000	220.000	2.000	15.000	2000.000	2/15/2000	FEB15_00
0.000	250.000	2.000	15.000	2000.000	2/15/2000	FEB15_00
1.000	260.000	2.000	15.000	2000.000	2/15/2000	FEB15_00
2.000	250.000	2.000	15.000	2000.000	2/15/2000	FEB15_00
1.000	250.000	2.000	15.000	2000.000	2/15/2000	FEB15_00
1.000	265.000	2.000	15.000	2000.000	2/15/2000	FEB15_00
1.000	280.000	2.000	15.000	2000.000	2/15/2000	FEB15_00
0.000	290.000	2.000	15.000	2000.000	2/15/2000	FEB15_00
4.000	265.000	2.000	15.000	2000.000	2/15/2000	FEB15_00
1.000	270.000	2.000	15.000	2000.000	2/15/2000	FEB15_00
1.000	280.000	2.000	15.000	2000.000	2/15/2000	FEB15_00
0.000	275.000	2.000	15.000	2000.000	2/15/2000	FEB15_00
0.000	285.000	2.000	15.000	2000.000	2/15/2000	FEB15_00
3.000	295.000	2.000	15.000	2000.000	2/15/2000	FEB15_00
4.000	275.000	2.000	15.000	2000.000	2/15/2000	FEB15_00
0.000	210.000	2.000	24.000	2000.000	2/24/2000	FEB24_00
2.000	235.000	2.000	24.000	2000.000	2/24/2000	FEB24_00
0.000	230.000	2.000	24.000	2000.000	2/24/2000	FEB24_00

1.000	230.000	2.000	24.000	2000.000	2/24/2000	FEB24_00
4.000	260.000	2.000	24.000	2000.000	2/24/2000	FEB24_00
3.000	240.000	2.000	24.000	2000.000	2/24/2000	FEB24_00
3.000	250.000	2.000	24.000	2000.000	2/24/2000	FEB24_00
3.000	245.000	2.000	24.000	2000.000	2/24/2000	FEB24_00
1.000	230.000	2.000	24.000	2000.000	2/24/2000	FEB24_00
2.000	230.000	2.000	24.000	2000.000	2/24/2000	FEB24_00
0.000	230.000	2.000	24.000	2000.000	2/24/2000	FEB24_00
0.000	230.000	2.000	24.000	2000.000	2/24/2000	FEB24_00
3.000	225.000	2.000	24.000	2000.000	2/24/2000	FEB24_00
2.000	205.000	2.000	24.000	2000.000	2/24/2000	FEB24_00
0.000	190.000	2.000	24.000	2000.000	2/24/2000	FEB24_00
0.000	190.000	2.000	24.000	2000.000	2/24/2000	FEB24_00
0.000	350.000	3.000	21.000	2000.000	3/21/2000	MAR21_00
0.000	360.000	3.000	21.000	2000.000	3/21/2000	MAR21_00
0.000	360.000	3.000	21.000	2000.000	3/21/2000	MAR21_00
0.000	360.000	3.000	21.000	2000.000	3/21/2000	MAR21_00
0.000	390.000	3.000	21.000	2000.000	3/21/2000	MAR21_00
0.000	380.000	3.000	21.000	2000.000	3/21/2000	MAR21_00
0.000	320.000	3.000	21.000	2000.000	3/21/2000	MAR21_00
0.000	320.000	3.000	21.000	2000.000	3/21/2000	MAR21_00
0.000	305.000	3.000	21.000	2000.000	3/21/2000	MAR21_00
0.000	305.000	3.000	21.000	2000.000	3/21/2000	MAR21_00
0.000	305.000	3.000	21.000	2000.000	3/21/2000	MAR21_00
0.000	270.000	3.000	21.000	2000.000	3/21/2000	MAR21_00
0.000	245.000	3.000	21.000	2000.000	3/21/2000	MAR21_00
0.000	220.000	3.000	21.000	2000.000	3/21/2000	MAR21_00
0.000	170.000	3.000	21.000	2000.000	3/21/2000	MAR21_00
0.000	130.000	3.000	21.000	2000.000	3/21/2000	MAR21_00
0.000	250.000	4.000	4.000	2000.000	4/4/2000	APR04_00
0.000	280.000	4.000	4.000	2000.000	4/4/2000	APR04_00
0.000	260.000	4.000	4.000	2000.000	4/4/2000	APR04_00
0.000	250.000	4.000	4.000	2000.000	4/4/2000	APR04_00
0.000	270.000	4.000	4.000	2000.000	4/4/2000	APR04_00
0.000	260.000	4.000	4.000	2000.000	4/4/2000	APR04_00
0.000	260.000	4.000	4.000	2000.000	4/4/2000	APR04_00
0.000	260.000	4.000	4.000	2000.000	4/4/2000	APR04_00
0.000	220.000	4.000	19.000	2000.000	4/19/2000	APR19_00
0.000	285.000	4.000	19.000	2000.000	4/19/2000	APR19_00
0.000	270.000	4.000	19.000	2000.000	4/19/2000	APR19_00
0.000	190.000	4.000	19.000	2000.000	4/19/2000	APR19_00
0.000	175.000	4.000	19.000	2000.000	4/19/2000	APR19_00
0.000	225.000	5.000	2.000	2000.000	5/2/2000	MAY02_00
0.000	240.000	5.000	2.000	2000.000	5/2/2000	MAY02_00
0.000	280.000	5.000	2.000	2000.000	5/2/2000	MAY02_00

SHRIMP__	DEPTH_CM	MONTH	DAY	YEAR	COLLDATE	DATETEXT
92.000	180.000	12.000	14.000	1998.000	12/14/1998	DEC14_98
92.000	200.000	12.000	14.000	1998.000	12/14/1998	DEC14_98
119.000	205.000	12.000	14.000	1998.000	12/14/1998	DEC14_98
119.000	225.000	12.000	14.000	1998.000	12/14/1998	DEC14_98
79.000	195.000	12.000	14.000	1998.000	12/14/1998	DEC14_98
79.000	175.000	12.000	14.000	1998.000	12/14/1998	DEC14_98
119.000	140.000	12.000	14.000	1998.000	12/14/1998	DEC14_98
79.000	125.000	12.000	14.000	1998.000	12/14/1998	DEC14_98
20.000	170.000	12.000	28.000	1998.000	12/28/1998	DEC28_98
15.000	230.000	12.000	28.000	1998.000	12/28/1998	DEC28_98
10.000	275.000	12.000	28.000	1998.000	12/28/1998	DEC28_98
15.000	285.000	12.000	28.000	1998.000	12/28/1998	DEC28_98
13.000	265.000	12.000	28.000	1998.000	12/28/1998	DEC28_98
15.000	245.000	12.000	28.000	1998.000	12/28/1998	DEC28_98
17.000	250.000	12.000	28.000	1998.000	12/28/1998	DEC28_98
10.000	300.000	12.000	28.000	1998.000	12/28/1998	DEC28_98
25.000	290.000	12.000	28.000	1998.000	12/28/1998	DEC28_98
22.000	255.000	12.000	28.000	1998.000	12/28/1998	DEC28_98
24.000	270.000	12.000	28.000	1998.000	12/28/1998	DEC28_98
15.000	275.000	12.000	28.000	1998.000	12/28/1998	DEC28_98
17.000	260.000	12.000	28.000	1998.000	12/28/1998	DEC28_98
18.000	260.000	12.000	28.000	1998.000	12/28/1998	DEC28_98
10.000	230.000	12.000	28.000	1998.000	12/28/1998	DEC28_98
10.000	225.000	12.000	28.000	1998.000	12/28/1998	DEC28_98
0.000	170.000	1.000	11.000	1999.000	1/11/1999	JAN11_99
13.000	195.000	1.000	11.000	1999.000	1/11/1999	JAN11_99
9.000	220.000	1.000	11.000	1999.000	1/11/1999	JAN11_99
8.000	235.000	1.000	11.000	1999.000	1/11/1999	JAN11_99
19.000	240.000	1.000	11.000	1999.000	1/11/1999	JAN11_99
3.000	240.000	1.000	11.000	1999.000	1/11/1999	JAN11_99
9.000	240.000	1.000	11.000	1999.000	1/11/1999	JAN11_99
9.000	275.000	1.000	11.000	1999.000	1/11/1999	JAN11_99
5.000	285.000	1.000	11.000	1999.000	1/11/1999	JAN11_99
6.000	290.000	1.000	11.000	1999.000	1/11/1999	JAN11_99
7.000	300.000	1.000	11.000	1999.000	1/11/1999	JAN11_99
6.000	295.000	1.000	11.000	1999.000	1/11/1999	JAN11_99
15.000	290.000	1.000	11.000	1999.000	1/11/1999	JAN11_99
4.000	275.000	1.000	11.000	1999.000	1/11/1999	JAN11_99
9.000	280.000	1.000	11.000	1999.000	1/11/1999	JAN11_99
2.000	285.000	1.000	11.000	1999.000	1/11/1999	JAN11_99
2.000	245.000	1.000	25.000	1999.000	1/25/1999	JAN25_99
3.000	270.000	1.000	25.000	1999.000	1/25/1999	JAN25_99
1.000	290.000	1.000	25.000	1999.000	1/25/1999	JAN25_99
0.000	265.000	1.000	25.000	1999.000	1/25/1999	JAN25_99
1.000	270.000	1.000	25.000	1999.000	1/25/1999	JAN25_99
2.000	280.000	1.000	25.000	1999.000	1/25/1999	JAN25_99
4.000	320.000	1.000	25.000	1999.000	1/25/1999	JAN25_99
4.000	340.000	1.000	25.000	1999.000	1/25/1999	JAN25_99
1.000	275.000	1.000	25.000	1999.000	1/25/1999	JAN25_99
3.000	265.000	1.000	25.000	1999.000	1/25/1999	JAN25_99
2.000	255.000	1.000	25.000	1999.000	1/25/1999	JAN25_99
1.000	250.000	1.000	25.000	1999.000	1/25/1999	JAN25_99
5.000	275.000	1.000	25.000	1999.000	1/25/1999	JAN25_99
5.000	240.000	1.000	25.000	1999.000	1/25/1999	JAN25_99
0.000	225.000	1.000	25.000	1999.000	1/25/1999	JAN25_99
0.000	215.000	1.000	25.000	1999.000	1/25/1999	JAN25_99
3.000	290.000	2.000	10.000	1999.000	2/10/1999	FEB10_99
0.000	325.000	2.000	10.000	1999.000	2/10/1999	FEB10_99
1.000	310.000	2.000	10.000	1999.000	2/10/1999	FEB10_99

2.000	335.000	2.000	10.000	1999.000	2/10/1999	FEB10_99
1.000	365.000	2.000	10.000	1999.000	2/10/1999	FEB10_99
4.000	380.000	2.000	10.000	1999.000	2/10/1999	FEB10_99
2.000	375.000	2.000	10.000	1999.000	2/10/1999	FEB10_99
2.000	440.000	2.000	10.000	1999.000	2/10/1999	FEB10_99
4.000	430.000	2.000	10.000	1999.000	2/10/1999	FEB10_99
5.000	410.000	2.000	10.000	1999.000	2/10/1999	FEB10_99
9.000	420.000	2.000	10.000	1999.000	2/10/1999	FEB10_99
1.000	400.000	2.000	10.000	1999.000	2/10/1999	FEB10_99
2.000	370.000	2.000	10.000	1999.000	2/10/1999	FEB10_99
1.000	325.000	2.000	10.000	1999.000	2/10/1999	FEB10_99
1.000	280.000	2.000	10.000	1999.000	2/10/1999	FEB10_99
0.000	300.000	2.000	10.000	1999.000	2/10/1999	FEB10_99
1.000	205.000	2.000	23.000	1999.000	2/23/1999	FEB23_99
1.000	185.000	2.000	23.000	1999.000	2/23/1999	FEB23_99
1.000	205.000	2.000	23.000	1999.000	2/23/1999	FEB23_99
4.000	205.000	2.000	23.000	1999.000	2/23/1999	FEB23_99
3.000	240.000	2.000	23.000	1999.000	2/23/1999	FEB23_99
0.000	240.000	2.000	23.000	1999.000	2/23/1999	FEB23_99
1.000	290.000	2.000	23.000	1999.000	2/23/1999	FEB23_99
2.000	280.000	2.000	23.000	1999.000	2/23/1999	FEB23_99
6.000	285.000	2.000	23.000	1999.000	2/23/1999	FEB23_99
3.000	335.000	2.000	23.000	1999.000	2/23/1999	FEB23_99
3.000	325.000	2.000	23.000	1999.000	2/23/1999	FEB23_99
5.000	295.000	2.000	23.000	1999.000	2/23/1999	FEB23_99
1.000	210.000	2.000	23.000	1999.000	2/23/1999	FEB23_99
3.000	195.000	2.000	23.000	1999.000	2/23/1999	FEB23_99
1.000	200.000	2.000	23.000	1999.000	2/23/1999	FEB23_99
3.000	160.000	2.000	23.000	1999.000	2/23/1999	FEB23_99
0.000	180.000	3.000	22.000	1999.000	3/22/1999	MAR22_99
0.000	190.000	3.000	22.000	1999.000	3/22/1999	MAR22_99
0.000	200.000	3.000	22.000	1999.000	3/22/1999	MAR22_99
0.000	190.000	3.000	22.000	1999.000	3/22/1999	MAR22_99
0.000	200.000	3.000	22.000	1999.000	3/22/1999	MAR22_99
0.000	250.000	3.000	22.000	1999.000	3/22/1999	MAR22_99
0.000	240.000	3.000	22.000	1999.000	3/22/1999	MAR22_99
0.000	260.000	3.000	22.000	1999.000	3/22/1999	MAR22_99
0.000	230.000	3.000	22.000	1999.000	3/22/1999	MAR22_99
0.000	240.000	3.000	22.000	1999.000	3/22/1999	MAR22_99
0.000	260.000	3.000	22.000	1999.000	3/22/1999	MAR22_99
0.000	235.000	3.000	22.000	1999.000	3/22/1999	MAR22_99
0.000	210.000	3.000	22.000	1999.000	3/22/1999	MAR22_99
0.000	230.000	3.000	22.000	1999.000	3/22/1999	MAR22_99
0.000	210.000	3.000	22.000	1999.000	3/22/1999	MAR22_99
0.000	130.000	3.000	22.000	1999.000	3/22/1999	MAR22_99
0.000	250.000	4.000	7.000	1999.000	4/7/1999	APR07_99
0.000	250.000	4.000	7.000	1999.000	4/7/1999	APR07_99
0.000	240.000	4.000	7.000	1999.000	4/7/1999	APR07_99
0.000	260.000	4.000	7.000	1999.000	4/7/1999	APR07_99
0.000	210.000	4.000	20.000	1999.000	4/20/1999	APR20_99
0.000	205.000	4.000	20.000	1999.000	4/20/1999	APR20_99
0.000	220.000	4.000	20.000	1999.000	4/20/1999	APR20_99
0.000	215.000	4.000	20.000	1999.000	4/20/1999	APR20_99
0.000	190.000	4.000	20.000	1999.000	4/20/1999	APR20_99
0.000	210.000	4.000	20.000	1999.000	4/20/1999	APR20_99
0.000	240.000	4.000	20.000	1999.000	4/20/1999	APR20_99
0.000	195.000	4.000	20.000	1999.000	4/20/1999	APR20_99
1.000	220.000	12.000	15.000	1999.000	12/15/1999	DEC15_99
1.000	240.000	12.000	15.000	1999.000	12/15/1999	DEC15_99
10.000	245.000	12.000	15.000	1999.000	12/15/1999	DEC15_99
13.000	230.000	12.000	15.000	1999.000	12/15/1999	DEC15_99
17.000	250.000	12.000	15.000	1999.000	12/15/1999	DEC15_99

14.000	280.000	12.000	15.000	1999.000	12/15/1999	DEC15_99
18.000	275.000	12.000	15.000	1999.000	12/15/1999	DEC15_99
13.000	310.000	12.000	15.000	1999.000	12/15/1999	DEC15_99
18.000	305.000	12.000	15.000	1999.000	12/15/1999	DEC15_99
12.000	310.000	12.000	15.000	1999.000	12/15/1999	DEC15_99
9.000	305.000	12.000	15.000	1999.000	12/15/1999	DEC15_99
8.000	310.000	12.000	15.000	1999.000	12/15/1999	DEC15_99
9.000	310.000	12.000	15.000	1999.000	12/15/1999	DEC15_99
11.000	325.000	12.000	15.000	1999.000	12/15/1999	DEC15_99
4.000	315.000	12.000	15.000	1999.000	12/15/1999	DEC15_99
4.000	305.000	12.000	15.000	1999.000	12/15/1999	DEC15_99
5.000	220.000	12.000	29.000	1999.000	12/29/1999	DEC29_99
2.000	220.000	12.000	29.000	1999.000	12/29/1999	DEC29_99
10.000	225.000	12.000	29.000	1999.000	12/29/1999	DEC29_99
6.000	200.000	12.000	29.000	1999.000	12/29/1999	DEC29_99
6.000	185.000	12.000	29.000	1999.000	12/29/1999	DEC29_99
10.000	205.000	12.000	29.000	1999.000	12/29/1999	DEC29_99
14.000	205.000	12.000	29.000	1999.000	12/29/1999	DEC29_99
6.000	195.000	12.000	29.000	1999.000	12/29/1999	DEC29_99
2.000	215.000	12.000	29.000	1999.000	12/29/1999	DEC29_99
15.000	215.000	12.000	29.000	1999.000	12/29/1999	DEC29_99
13.000	220.000	12.000	29.000	1999.000	12/29/1999	DEC29_99
17.000	215.000	12.000	29.000	1999.000	12/29/1999	DEC29_99
13.000	220.000	12.000	29.000	1999.000	12/29/1999	DEC29_99
15.000	190.000	12.000	29.000	1999.000	12/29/1999	DEC29_99
6.000	220.000	12.000	29.000	1999.000	12/29/1999	DEC29_99
11.000	205.000	12.000	29.000	1999.000	12/29/1999	DEC29_99
1.000	260.000	1.000	26.000	2000.000	1/26/2000	JAN26_00
2.000	250.000	1.000	26.000	2000.000	1/26/2000	JAN26_00
1.000	260.000	1.000	26.000	2000.000	1/26/2000	JAN26_00
5.000	270.000	1.000	26.000	2000.000	1/26/2000	JAN26_00
3.000	285.000	1.000	26.000	2000.000	1/26/2000	JAN26_00
2.000	270.000	1.000	26.000	2000.000	1/26/2000	JAN26_00
4.000	305.000	1.000	26.000	2000.000	1/26/2000	JAN26_00
2.000	330.000	1.000	26.000	2000.000	1/26/2000	JAN26_00
3.000	315.000	1.000	26.000	2000.000	1/26/2000	JAN26_00
4.000	330.000	1.000	26.000	2000.000	1/26/2000	JAN26_00
0.000	330.000	1.000	26.000	2000.000	1/26/2000	JAN26_00
0.000	300.000	1.000	26.000	2000.000	1/26/2000	JAN26_00
0.000	285.000	1.000	26.000	2000.000	1/26/2000	JAN26_00
2.000	270.000	1.000	26.000	2000.000	1/26/2000	JAN26_00
0.000	260.000	1.000	26.000	2000.000	1/26/2000	JAN26_00
0.000	225.000	1.000	26.000	2000.000	1/26/2000	JAN26_00
2.000	180.000	2.000	15.000	2000.000	2/15/2000	FEB15_00
4.000	220.000	2.000	15.000	2000.000	2/15/2000	FEB15_00
0.000	250.000	2.000	15.000	2000.000	2/15/2000	FEB15_00
1.000	260.000	2.000	15.000	2000.000	2/15/2000	FEB15_00
2.000	250.000	2.000	15.000	2000.000	2/15/2000	FEB15_00
1.000	250.000	2.000	15.000	2000.000	2/15/2000	FEB15_00
1.000	265.000	2.000	15.000	2000.000	2/15/2000	FEB15_00
1.000	280.000	2.000	15.000	2000.000	2/15/2000	FEB15_00
0.000	290.000	2.000	15.000	2000.000	2/15/2000	FEB15_00
4.000	265.000	2.000	15.000	2000.000	2/15/2000	FEB15_00
1.000	270.000	2.000	15.000	2000.000	2/15/2000	FEB15_00
1.000	280.000	2.000	15.000	2000.000	2/15/2000	FEB15_00
0.000	275.000	2.000	15.000	2000.000	2/15/2000	FEB15_00
0.000	285.000	2.000	15.000	2000.000	2/15/2000	FEB15_00
3.000	295.000	2.000	15.000	2000.000	2/15/2000	FEB15_00
4.000	275.000	2.000	15.000	2000.000	2/15/2000	FEB15_00
0.000	210.000	2.000	24.000	2000.000	2/24/2000	FEB24_00
2.000	235.000	2.000	24.000	2000.000	2/24/2000	FEB24_00
0.000	230.000	2.000	24.000	2000.000	2/24/2000	FEB24_00

1.000	230.000	2.000	24.000	2000.000	2/24/2000	FEB24_00
4.000	260.000	2.000	24.000	2000.000	2/24/2000	FEB24_00
3.000	240.000	2.000	24.000	2000.000	2/24/2000	FEB24_00
3.000	250.000	2.000	24.000	2000.000	2/24/2000	FEB24_00
3.000	245.000	2.000	24.000	2000.000	2/24/2000	FEB24_00
1.000	230.000	2.000	24.000	2000.000	2/24/2000	FEB24_00
2.000	230.000	2.000	24.000	2000.000	2/24/2000	FEB24_00
0.000	230.000	2.000	24.000	2000.000	2/24/2000	FEB24_00
0.000	230.000	2.000	24.000	2000.000	2/24/2000	FEB24_00
3.000	225.000	2.000	24.000	2000.000	2/24/2000	FEB24_00
2.000	205.000	2.000	24.000	2000.000	2/24/2000	FEB24_00
0.000	190.000	2.000	24.000	2000.000	2/24/2000	FEB24_00
0.000	190.000	2.000	24.000	2000.000	2/24/2000	FEB24_00
0.000	350.000	3.000	21.000	2000.000	3/21/2000	MAR21_00
0.000	360.000	3.000	21.000	2000.000	3/21/2000	MAR21_00
0.000	360.000	3.000	21.000	2000.000	3/21/2000	MAR21_00
0.000	360.000	3.000	21.000	2000.000	3/21/2000	MAR21_00
0.000	390.000	3.000	21.000	2000.000	3/21/2000	MAR21_00
0.000	380.000	3.000	21.000	2000.000	3/21/2000	MAR21_00
0.000	320.000	3.000	21.000	2000.000	3/21/2000	MAR21_00
0.000	320.000	3.000	21.000	2000.000	3/21/2000	MAR21_00
0.000	305.000	3.000	21.000	2000.000	3/21/2000	MAR21_00
0.000	305.000	3.000	21.000	2000.000	3/21/2000	MAR21_00
0.000	305.000	3.000	21.000	2000.000	3/21/2000	MAR21_00
0.000	270.000	3.000	21.000	2000.000	3/21/2000	MAR21_00
0.000	245.000	3.000	21.000	2000.000	3/21/2000	MAR21_00
0.000	220.000	3.000	21.000	2000.000	3/21/2000	MAR21_00
0.000	170.000	3.000	21.000	2000.000	3/21/2000	MAR21_00
0.000	130.000	3.000	21.000	2000.000	3/21/2000	MAR21_00
0.000	250.000	4.000	4.000	2000.000	4/4/2000	APR04_00
0.000	280.000	4.000	4.000	2000.000	4/4/2000	APR04_00
0.000	260.000	4.000	4.000	2000.000	4/4/2000	APR04_00
0.000	250.000	4.000	4.000	2000.000	4/4/2000	APR04_00
0.000	270.000	4.000	4.000	2000.000	4/4/2000	APR04_00
0.000	260.000	4.000	4.000	2000.000	4/4/2000	APR04_00
0.000	260.000	4.000	4.000	2000.000	4/4/2000	APR04_00
0.000	260.000	4.000	4.000	2000.000	4/4/2000	APR04_00
0.000	220.000	4.000	19.000	2000.000	4/19/2000	APR19_00
0.000	285.000	4.000	19.000	2000.000	4/19/2000	APR19_00
0.000	270.000	4.000	19.000	2000.000	4/19/2000	APR19_00
0.000	190.000	4.000	19.000	2000.000	4/19/2000	APR19_00
0.000	175.000	4.000	19.000	2000.000	4/19/2000	APR19_00
0.000	225.000	5.000	2.000	2000.000	5/2/2000	MAY02_00
0.000	240.000	5.000	2.000	2000.000	5/2/2000	MAY02_00
0.000	280.000	5.000	2.000	2000.000	5/2/2000	MAY02_00

SHRIMP__	DEPTH_MM	MONTH	DAY	YEAR	COLLDATE	DATETEXT
145.000	260.000	12.000	16.000	1998.000	12/16/1998	DEC16_98
224.000	170.000	12.000	16.000	1998.000	12/16/1998	DEC16_98
224.000	220.000	12.000	16.000	1998.000	12/16/1998	DEC16_98
132.000	160.000	12.000	16.000	1998.000	12/16/1998	DEC16_98
92.000	515.000	12.000	16.000	1998.000	12/16/1998	DEC16_98
145.000	510.000	12.000	16.000	1998.000	12/16/1998	DEC16_98
185.000	430.000	12.000	16.000	1998.000	12/16/1998	DEC16_98
317.000	270.000	12.000	16.000	1998.000	12/16/1998	DEC16_98
317.000	195.000	12.000	30.000	1998.000	12/30/1998	DEC30_98
290.000	265.000	12.000	30.000	1998.000	12/30/1998	DEC30_98
172.000	260.000	12.000	30.000	1998.000	12/30/1998	DEC30_98
158.000	295.000	12.000	30.000	1998.000	12/30/1998	DEC30_98
185.000	370.000	12.000	30.000	1998.000	12/30/1998	DEC30_98
22.000	440.000	12.000	30.000	1998.000	12/30/1998	DEC30_98
20.000	505.000	12.000	30.000	1998.000	12/30/1998	DEC30_98
55.000	520.000	12.000	30.000	1998.000	12/30/1998	DEC30_98
7.000	460.000	12.000	30.000	1998.000	12/30/1998	DEC30_98
4.000	395.000	12.000	30.000	1998.000	12/30/1998	DEC30_98
33.000	290.000	12.000	30.000	1998.000	12/30/1998	DEC30_98
145.000	225.000	12.000	30.000	1998.000	12/30/1998	DEC30_98
145.000	295.000	12.000	30.000	1998.000	12/30/1998	DEC30_98
185.000	310.000	12.000	30.000	1998.000	12/30/1998	DEC30_98
185.000	285.000	12.000	30.000	1998.000	12/30/1998	DEC30_98
211.000	210.000	12.000	30.000	1998.000	12/30/1998	DEC30_98
330.000	215.000	1.000	14.000	1999.000	1/14/1999	JAN14_99
248.000	400.000	1.000	14.000	1999.000	1/14/1999	JAN14_99
152.000	365.000	1.000	14.000	1999.000	1/14/1999	JAN14_99
129.000	430.000	1.000	14.000	1999.000	1/14/1999	JAN14_99
18.000	530.000	1.000	14.000	1999.000	1/14/1999	JAN14_99
47.000	485.000	1.000	14.000	1999.000	1/14/1999	JAN14_99
67.000	585.000	1.000	14.000	1999.000	1/14/1999	JAN14_99
80.000	550.000	1.000	14.000	1999.000	1/14/1999	JAN14_99
135.000	570.000	1.000	14.000	1999.000	1/14/1999	JAN14_99
185.000	440.000	1.000	14.000	1999.000	1/14/1999	JAN14_99
218.000	480.000	1.000	14.000	1999.000	1/14/1999	JAN14_99
182.000	550.000	1.000	14.000	1999.000	1/14/1999	JAN14_99
152.000	560.000	1.000	14.000	1999.000	1/14/1999	JAN14_99
182.000	505.000	1.000	14.000	1999.000	1/14/1999	JAN14_99
122.000	425.000	1.000	14.000	1999.000	1/14/1999	JAN14_99
353.000	225.000	1.000	14.000	1999.000	1/14/1999	JAN14_99
42.000	415.000	1.000	27.000	1999.000	1/27/1999	JAN27_99
39.000	440.000	1.000	27.000	1999.000	1/27/1999	JAN27_99
131.000	470.000	1.000	27.000	1999.000	1/27/1999	JAN27_99
129.000	450.000	1.000	27.000	1999.000	1/27/1999	JAN27_99
224.000	370.000	1.000	27.000	1999.000	1/27/1999	JAN27_99
238.000	330.000	1.000	27.000	1999.000	1/27/1999	JAN27_99
178.000	255.000	1.000	27.000	1999.000	1/27/1999	JAN27_99
102.000	220.000	1.000	27.000	1999.000	1/27/1999	JAN27_99
26.000	150.000	1.000	27.000	1999.000	1/27/1999	JAN27_99
4.000	150.000	1.000	27.000	1999.000	1/27/1999	JAN27_99
14.000	140.000	1.000	27.000	1999.000	1/27/1999	JAN27_99
27.000	160.000	1.000	27.000	1999.000	1/27/1999	JAN27_99
38.000	150.000	1.000	27.000	1999.000	1/27/1999	JAN27_99
103.000	215.000	1.000	27.000	1999.000	1/27/1999	JAN27_99
152.000	215.000	1.000	27.000	1999.000	1/27/1999	JAN27_99
48.000	225.000	1.000	27.000	1999.000	1/27/1999	JAN27_99
48.000	230.000	2.000	11.000	1999.000	2/11/1999	FEB11_99
78.000	295.000	2.000	11.000	1999.000	2/11/1999	FEB11_99
76.000	355.000	2.000	11.000	1999.000	2/11/1999	FEB11_99
44.000	480.000	2.000	11.000	1999.000	2/11/1999	FEB11_99
32.000	545.000	2.000	11.000	1999.000	2/11/1999	FEB11_99
39.000	590.000	2.000	11.000	1999.000	2/11/1999	FEB11_99

19.000	825.000	2.000	11.000	1999.000	2/11/1999	FEB11_99
6.000	900.000	2.000	11.000	1999.000	2/11/1999	FEB11_99
24.000	690.000	2.000	11.000	1999.000	2/11/1999	FEB11_99
18.000	540.000	2.000	11.000	1999.000	2/11/1999	FEB11_99
72.000	450.000	2.000	11.000	1999.000	2/11/1999	FEB11_99
60.000	420.000	2.000	11.000	1999.000	2/11/1999	FEB11_99
56.000	350.000	2.000	11.000	1999.000	2/11/1999	FEB11_99
59.000	260.000	2.000	11.000	1999.000	2/11/1999	FEB11_99
59.000	215.000	2.000	11.000	1999.000	2/11/1999	FEB11_99
11.000	165.000	2.000	11.000	1999.000	2/11/1999	FEB11_99
6.000	240.000	2.000	24.000	1999.000	2/24/1999	FEB24_99
5.000	220.000	2.000	24.000	1999.000	2/24/1999	FEB24_99
15.000	220.000	2.000	24.000	1999.000	2/24/1999	FEB24_99
28.000	220.000	2.000	24.000	1999.000	2/24/1999	FEB24_99
45.000	340.000	2.000	24.000	1999.000	2/24/1999	FEB24_99
65.000	260.000	2.000	24.000	1999.000	2/24/1999	FEB24_99
40.000	340.000	2.000	24.000	1999.000	2/24/1999	FEB24_99
21.000	420.000	2.000	24.000	1999.000	2/24/1999	FEB24_99
51.000	410.000	2.000	24.000	1999.000	2/24/1999	FEB24_99
73.000	310.000	2.000	24.000	1999.000	2/24/1999	FEB24_99
33.000	260.000	2.000	24.000	1999.000	2/24/1999	FEB24_99
43.000	320.000	2.000	24.000	1999.000	2/24/1999	FEB24_99
31.000	330.000	2.000	24.000	1999.000	2/24/1999	FEB24_99
31.000	355.000	2.000	24.000	1999.000	2/24/1999	FEB24_99
36.000	320.000	2.000	24.000	1999.000	2/24/1999	FEB24_99
30.000	280.000	2.000	24.000	1999.000	2/24/1999	FEB24_99
3.000	270.000	3.000	15.000	1999.000	3/15/1999	MAR15_99
1.000	320.000	3.000	15.000	1999.000	3/15/1999	MAR15_99
7.000	330.000	3.000	15.000	1999.000	3/15/1999	MAR15_99
5.000	330.000	3.000	15.000	1999.000	3/15/1999	MAR15_99
1.000	500.000	3.000	15.000	1999.000	3/15/1999	MAR15_99
7.000	475.000	3.000	15.000	1999.000	3/15/1999	MAR15_99
7.000	490.000	3.000	15.000	1999.000	3/15/1999	MAR15_99
3.000	520.000	3.000	15.000	1999.000	3/15/1999	MAR15_99
0.000	480.000	3.000	15.000	1999.000	3/15/1999	MAR15_99
2.000	425.000	3.000	15.000	1999.000	3/15/1999	MAR15_99
2.000	325.000	3.000	15.000	1999.000	3/15/1999	MAR15_99
10.000	320.000	3.000	15.000	1999.000	3/15/1999	MAR15_99
7.000	285.000	3.000	15.000	1999.000	3/15/1999	MAR15_99
8.000	205.000	3.000	15.000	1999.000	3/15/1999	MAR15_99
2.000	160.000	3.000	15.000	1999.000	3/15/1999	MAR15_99
9.000	170.000	3.000	15.000	1999.000	3/15/1999	MAR15_99
0.000	175.000	4.000	6.000	1999.000	4/6/1999	APR06_99
1.000	220.000	4.000	6.000	1999.000	4/6/1999	APR06_99
0.000	280.000	4.000	6.000	1999.000	4/6/1999	APR06_99
0.000	360.000	4.000	6.000	1999.000	4/6/1999	APR06_99
3.000	460.000	4.000	6.000	1999.000	4/6/1999	APR06_99
1.000	470.000	4.000	6.000	1999.000	4/6/1999	APR06_99
1.000	550.000	4.000	6.000	1999.000	4/6/1999	APR06_99
1.000	745.000	4.000	6.000	1999.000	4/6/1999	APR06_99
0.000	575.000	4.000	6.000	1999.000	4/6/1999	APR06_99
0.000	470.000	4.000	6.000	1999.000	4/6/1999	APR06_99
0.000	410.000	4.000	6.000	1999.000	4/6/1999	APR06_99
0.000	355.000	4.000	6.000	1999.000	4/6/1999	APR06_99
3.000	310.000	4.000	6.000	1999.000	4/6/1999	APR06_99
0.000	205.000	4.000	6.000	1999.000	4/6/1999	APR06_99
0.000	150.000	4.000	6.000	1999.000	4/6/1999	APR06_99
0.000	110.000	4.000	6.000	1999.000	4/6/1999	APR06_99
0.000	505.000	4.000	22.000	1999.000	4/22/1999	APR22_99
0.000	550.000	4.000	22.000	1999.000	4/22/1999	APR22_99
0.000	380.000	4.000	22.000	1999.000	4/22/1999	APR22_99
0.000	340.000	4.000	22.000	1999.000	4/22/1999	APR22_99
0.000	410.000	4.000	22.000	1999.000	4/22/1999	APR22_99
0.000	440.000	4.000	22.000	1999.000	4/22/1999	APR22_99
0.000	360.000	4.000	22.000	1999.000	4/22/1999	APR22_99

0.000	245.000	4.000	22.000	1999.000	4/22/1999	APR22_99
23.000	410.000	12.000	14.000	1999.000	12/14/1999	DEC14_99
35.000	420.000	12.000	14.000	1999.000	12/14/1999	DEC14_99
57.000	340.000	12.000	14.000	1999.000	12/14/1999	DEC14_99
28.000	335.000	12.000	14.000	1999.000	12/14/1999	DEC14_99
47.000	270.000	12.000	14.000	1999.000	12/14/1999	DEC14_99
77.000	230.000	12.000	14.000	1999.000	12/14/1999	DEC14_99
88.000	180.000	12.000	14.000	1999.000	12/14/1999	DEC14_99
30.000	225.000	12.000	14.000	1999.000	12/14/1999	DEC14_99
50.000	220.000	12.000	14.000	1999.000	12/14/1999	DEC14_99
44.000	210.000	12.000	14.000	1999.000	12/14/1999	DEC14_99
31.000	345.000	12.000	14.000	1999.000	12/14/1999	DEC14_99
9.000	515.000	12.000	14.000	1999.000	12/14/1999	DEC14_99
16.000	410.000	12.000	14.000	1999.000	12/14/1999	DEC14_99
24.000	300.000	12.000	14.000	1999.000	12/14/1999	DEC14_99
15.000	300.000	12.000	14.000	1999.000	12/14/1999	DEC14_99
24.000	215.000	12.000	14.000	1999.000	12/14/1999	DEC14_99
43.000	300.000	12.000	28.000	1999.000	12/28/1999	DEC28_99
13.000	365.000	12.000	28.000	1999.000	12/28/1999	DEC28_99
14.000	335.000	12.000	28.000	1999.000	12/28/1999	DEC28_99
17.000	180.000	12.000	28.000	1999.000	12/28/1999	DEC28_99
12.000	175.000	12.000	28.000	1999.000	12/28/1999	DEC28_99
28.000	205.000	12.000	28.000	1999.000	12/28/1999	DEC28_99
58.000	205.000	12.000	28.000	1999.000	12/28/1999	DEC28_99
24.000	260.000	12.000	28.000	1999.000	12/28/1999	DEC28_99
19.000	350.000	12.000	28.000	1999.000	12/28/1999	DEC28_99
29.000	560.000	12.000	28.000	1999.000	12/28/1999	DEC28_99
36.000	285.000	12.000	28.000	1999.000	12/28/1999	DEC28_99
20.000	290.000	12.000	28.000	1999.000	12/28/1999	DEC28_99
23.000	275.000	12.000	28.000	1999.000	12/28/1999	DEC28_99
11.000	230.000	12.000	28.000	1999.000	12/28/1999	DEC28_99
17.000	325.000	12.000	28.000	1999.000	12/28/1999	DEC28_99
12.000	405.000	12.000	28.000	1999.000	12/28/1999	DEC28_99
35.000	250.000	1.000	12.000	2000.000	1/12/2000	JAN12_00
25.000	360.000	1.000	12.000	2000.000	1/12/2000	JAN12_00
15.000	390.000	1.000	12.000	2000.000	1/12/2000	JAN12_00
15.000	430.000	1.000	12.000	2000.000	1/12/2000	JAN12_00
15.000	190.000	1.000	12.000	2000.000	1/12/2000	JAN12_00
15.000	230.000	1.000	12.000	2000.000	1/12/2000	JAN12_00
5.000	220.000	1.000	12.000	2000.000	1/12/2000	JAN12_00
35.000	370.000	1.000	12.000	2000.000	1/12/2000	JAN12_00
3.000	245.000	1.000	27.000	2000.000	1/27/2000	JAN27_00
17.000	320.000	1.000	27.000	2000.000	1/27/2000	JAN27_00
4.000	425.000	1.000	27.000	2000.000	1/27/2000	JAN27_00
8.000	595.000	1.000	27.000	2000.000	1/27/2000	JAN27_00
0.000	460.000	1.000	27.000	2000.000	1/27/2000	JAN27_00
2.000	415.000	1.000	27.000	2000.000	1/27/2000	JAN27_00
3.000	410.000	1.000	27.000	2000.000	1/27/2000	JAN27_00
11.000	370.000	1.000	27.000	2000.000	1/27/2000	JAN27_00
8.000	285.000	1.000	27.000	2000.000	1/27/2000	JAN27_00
16.000	255.000	1.000	27.000	2000.000	1/27/2000	JAN27_00
1.000	220.000	1.000	27.000	2000.000	1/27/2000	JAN27_00
2.000	195.000	1.000	27.000	2000.000	1/27/2000	JAN27_00
2.000	140.000	1.000	27.000	2000.000	1/27/2000	JAN27_00
3.000	215.000	1.000	27.000	2000.000	1/27/2000	JAN27_00
3.000	265.000	1.000	27.000	2000.000	1/27/2000	JAN27_00
9.000	290.000	1.000	27.000	2000.000	1/27/2000	JAN27_00
2.000	180.000	2.000	8.000	2000.000	2/8/2000	FEB08_00
1.000	220.000	2.000	8.000	2000.000	2/8/2000	FEB08_00
4.000	275.000	2.000	8.000	2000.000	2/8/2000	FEB08_00
2.000	280.000	2.000	8.000	2000.000	2/8/2000	FEB08_00
5.000	370.000	2.000	8.000	2000.000	2/8/2000	FEB08_00
1.000	405.000	2.000	8.000	2000.000	2/8/2000	FEB08_00
7.000	420.000	2.000	8.000	2000.000	2/8/2000	FEB08_00
5.000	470.000	2.000	8.000	2000.000	2/8/2000	FEB08_00

8.000	430.000	2.000	8.000	2000.000	2/8/2000	FEB08_00
11.000	500.000	2.000	8.000	2000.000	2/8/2000	FEB08_00
6.000	370.000	2.000	8.000	2000.000	2/8/2000	FEB08_00
11.000	345.000	2.000	8.000	2000.000	2/8/2000	FEB08_00
1.000	345.000	2.000	8.000	2000.000	2/8/2000	FEB08_00
3.000	345.000	2.000	8.000	2000.000	2/8/2000	FEB08_00
4.000	360.000	2.000	8.000	2000.000	2/8/2000	FEB08_00
3.000	370.000	2.000	8.000	2000.000	2/8/2000	FEB08_00
0.000	250.000	2.000	25.000	2000.000	2/25/2000	FEB25_00
1.000	235.000	2.000	25.000	2000.000	2/25/2000	FEB25_00
3.000	255.000	2.000	25.000	2000.000	2/25/2000	FEB25_00
1.000	260.000	2.000	25.000	2000.000	2/25/2000	FEB25_00
0.000	260.000	2.000	25.000	2000.000	2/25/2000	FEB25_00
1.000	250.000	2.000	25.000	2000.000	2/25/2000	FEB25_00
3.000	265.000	2.000	25.000	2000.000	2/25/2000	FEB25_00
3.000	300.000	2.000	25.000	2000.000	2/25/2000	FEB25_00
1.000	300.000	2.000	25.000	2000.000	2/25/2000	FEB25_00
0.000	280.000	2.000	25.000	2000.000	2/25/2000	FEB25_00
2.000	290.000	2.000	25.000	2000.000	2/25/2000	FEB25_00
0.000	285.000	2.000	25.000	2000.000	2/25/2000	FEB25_00
0.000	275.000	2.000	25.000	2000.000	2/25/2000	FEB25_00
0.000	275.000	2.000	25.000	2000.000	2/25/2000	FEB25_00
1.000	240.000	2.000	25.000	2000.000	2/25/2000	FEB25_00
3.000	250.000	2.000	25.000	2000.000	2/25/2000	FEB25_00
0.000	290.000	3.000	22.000	2000.000	3/22/2000	MAR22_00
0.000	270.000	3.000	22.000	2000.000	3/22/2000	MAR22_00
0.000	270.000	3.000	22.000	2000.000	3/22/2000	MAR22_00
0.000	315.000	3.000	22.000	2000.000	3/22/2000	MAR22_00
0.000	440.000	3.000	22.000	2000.000	3/22/2000	MAR22_00
0.000	470.000	3.000	22.000	2000.000	3/22/2000	MAR22_00
0.000	500.000	3.000	22.000	2000.000	3/22/2000	MAR22_00
0.000	550.000	3.000	22.000	2000.000	3/22/2000	MAR22_00
0.000	660.000	3.000	22.000	2000.000	3/22/2000	MAR22_00
0.000	740.000	3.000	22.000	2000.000	3/22/2000	MAR22_00
0.000	670.000	3.000	22.000	2000.000	3/22/2000	MAR22_00
0.000	420.000	3.000	22.000	2000.000	3/22/2000	MAR22_00
0.000	270.000	3.000	22.000	2000.000	3/22/2000	MAR22_00
0.000	395.000	3.000	22.000	2000.000	3/22/2000	MAR22_00
0.000	380.000	3.000	22.000	2000.000	3/22/2000	MAR22_00
0.000	370.000	3.000	22.000	2000.000	3/22/2000	MAR22_00
0.000	360.000	4.000	6.000	2000.000	4/6/2000	APR06_00
0.000	450.000	4.000	6.000	2000.000	4/6/2000	APR06_00
0.000	440.000	4.000	6.000	2000.000	4/6/2000	APR06_00
0.000	430.000	4.000	6.000	2000.000	4/6/2000	APR06_00
0.000	450.000	4.000	6.000	2000.000	4/6/2000	APR06_00
0.000	525.000	4.000	6.000	2000.000	4/6/2000	APR06_00
0.000	450.000	4.000	6.000	2000.000	4/6/2000	APR06_00
0.000	450.000	4.000	6.000	2000.000	4/6/2000	APR06_00
0.000	380.000	4.000	6.000	2000.000	4/6/2000	APR06_00
0.000	360.000	4.000	6.000	2000.000	4/6/2000	APR06_00
0.000	230.000	4.000	6.000	2000.000	4/6/2000	APR06_00
0.000	260.000	4.000	19.000	2000.000	4/19/2000	APR19_00
0.000	255.000	4.000	19.000	2000.000	4/19/2000	APR19_00
0.000	420.000	4.000	19.000	2000.000	4/19/2000	APR19_00
0.000	315.000	4.000	19.000	2000.000	4/19/2000	APR19_00
0.000	360.000	4.000	19.000	2000.000	4/19/2000	APR19_00
0.000	385.000	5.000	2.000	2000.000	5/2/2000	MAY02_00
0.000	505.000	5.000	2.000	2000.000	5/2/2000	MAY02_00
0.000	440.000	5.000	2.000	2000.000	5/2/2000	MAY02_00
0.000	275.000	5.000	2.000	2000.000	5/2/2000	MAY02_00

SHRIMP__	DEPTH_MM	MONTH	DAY	YEAR	COLLDATE	DATETEXT
5.000	380.000	12.000	16.000	1998.000	12/16/1998	DEC16_98
12.000	420.000	12.000	16.000	1998.000	12/16/1998	DEC16_98
22.000	475.000	12.000	16.000	1998.000	12/16/1998	DEC16_98
16.000	500.000	12.000	16.000	1998.000	12/16/1998	DEC16_98
20.000	500.000	12.000	16.000	1998.000	12/16/1998	DEC16_98
22.000	455.000	12.000	16.000	1998.000	12/16/1998	DEC16_98
9.000	365.000	12.000	16.000	1998.000	12/16/1998	DEC16_98
11.000	210.000	12.000	16.000	1998.000	12/16/1998	DEC16_98
5.000	280.000	12.000	30.000	1998.000	12/30/1998	DEC30_98
3.000	320.000	12.000	30.000	1998.000	12/30/1998	DEC30_98
0.000	320.000	12.000	30.000	1998.000	12/30/1998	DEC30_98
0.000	300.000	12.000	30.000	1998.000	12/30/1998	DEC30_98
0.000	420.000	12.000	30.000	1998.000	12/30/1998	DEC30_98
4.000	465.000	12.000	30.000	1998.000	12/30/1998	DEC30_98
7.000	460.000	12.000	30.000	1998.000	12/30/1998	DEC30_98
12.000	500.000	12.000	30.000	1998.000	12/30/1998	DEC30_98
9.000	500.000	12.000	30.000	1998.000	12/30/1998	DEC30_98
17.000	490.000	12.000	30.000	1998.000	12/30/1998	DEC30_98
9.000	545.000	12.000	30.000	1998.000	12/30/1998	DEC30_98
25.000	565.000	12.000	30.000	1998.000	12/30/1998	DEC30_98
13.000	590.000	12.000	30.000	1998.000	12/30/1998	DEC30_98
35.000	570.000	12.000	30.000	1998.000	12/30/1998	DEC30_98
38.000	545.000	12.000	30.000	1998.000	12/30/1998	DEC30_98
7.000	535.000	12.000	30.000	1998.000	12/30/1998	DEC30_98
0.000	400.000	1.000	14.000	1999.000	1/14/1999	JAN14_99
1.000	445.000	1.000	14.000	1999.000	1/14/1999	JAN14_99
0.000	485.000	1.000	14.000	1999.000	1/14/1999	JAN14_99
0.000	485.000	1.000	14.000	1999.000	1/14/1999	JAN14_99
0.000	430.000	1.000	14.000	1999.000	1/14/1999	JAN14_99
2.000	420.000	1.000	14.000	1999.000	1/14/1999	JAN14_99
0.000	400.000	1.000	14.000	1999.000	1/14/1999	JAN14_99
0.000	470.000	1.000	14.000	1999.000	1/14/1999	JAN14_99
1.000	565.000	1.000	14.000	1999.000	1/14/1999	JAN14_99
0.000	560.000	1.000	14.000	1999.000	1/14/1999	JAN14_99
0.000	560.000	1.000	14.000	1999.000	1/14/1999	JAN14_99
0.000	510.000	1.000	14.000	1999.000	1/14/1999	JAN14_99
0.000	510.000	1.000	14.000	1999.000	1/14/1999	JAN14_99
1.000	490.000	1.000	14.000	1999.000	1/14/1999	JAN14_99
0.000	455.000	1.000	14.000	1999.000	1/14/1999	JAN14_99
0.000	490.000	1.000	14.000	1999.000	1/14/1999	JAN14_99
0.000	305.000	1.000	27.000	1999.000	1/27/1999	JAN27_99
0.000	200.000	1.000	27.000	1999.000	1/27/1999	JAN27_99
0.000	200.000	1.000	27.000	1999.000	1/27/1999	JAN27_99
0.000	230.000	1.000	27.000	1999.000	1/27/1999	JAN27_99
0.000	300.000	1.000	27.000	1999.000	1/27/1999	JAN27_99
0.000	390.000	1.000	27.000	1999.000	1/27/1999	JAN27_99
0.000	405.000	1.000	27.000	1999.000	1/27/1999	JAN27_99
0.000	395.000	1.000	27.000	1999.000	1/27/1999	JAN27_99
0.000	530.000	1.000	27.000	1999.000	1/27/1999	JAN27_99
0.000	485.000	1.000	27.000	1999.000	1/27/1999	JAN27_99
0.000	550.000	1.000	27.000	1999.000	1/27/1999	JAN27_99
0.000	370.000	1.000	27.000	1999.000	1/27/1999	JAN27_99
0.000	480.000	1.000	27.000	1999.000	1/27/1999	JAN27_99
0.000	480.000	1.000	27.000	1999.000	1/27/1999	JAN27_99
0.000	480.000	1.000	27.000	1999.000	1/27/1999	JAN27_99
0.000	480.000	1.000	27.000	1999.000	1/27/1999	JAN27_99
0.000	320.000	2.000	11.000	1999.000	2/11/1999	FEB11_99
0.000	360.000	2.000	11.000	1999.000	2/11/1999	FEB11_99
0.000	350.000	2.000	11.000	1999.000	2/11/1999	FEB11_99
0.000	370.000	2.000	11.000	1999.000	2/11/1999	FEB11_99

0.000	355.000	2.000	11.000	1999.000	2/11/1999	FEB11_99
0.000	355.000	2.000	11.000	1999.000	2/11/1999	FEB11_99
0.000	435.000	2.000	11.000	1999.000	2/11/1999	FEB11_99
0.000	470.000	2.000	11.000	1999.000	2/11/1999	FEB11_99
0.000	510.000	2.000	11.000	1999.000	2/11/1999	FEB11_99
0.000	560.000	2.000	11.000	1999.000	2/11/1999	FEB11_99
0.000	570.000	2.000	11.000	1999.000	2/11/1999	FEB11_99
0.000	580.000	2.000	11.000	1999.000	2/11/1999	FEB11_99
0.000	570.000	2.000	11.000	1999.000	2/11/1999	FEB11_99
0.000	260.000	2.000	11.000	1999.000	2/11/1999	FEB11_99
0.000	215.000	2.000	11.000	1999.000	2/11/1999	FEB11_99
0.000	165.000	2.000	11.000	1999.000	2/11/1999	FEB11_99
0.000	200.000	2.000	24.000	1999.000	2/24/1999	FEB24_99
0.000	210.000	2.000	24.000	1999.000	2/24/1999	FEB24_99
0.000	270.000	2.000	24.000	1999.000	2/24/1999	FEB24_99
0.000	350.000	2.000	24.000	1999.000	2/24/1999	FEB24_99
0.000	300.000	2.000	24.000	1999.000	2/24/1999	FEB24_99
0.000	280.000	3.000	15.000	1999.000	3/15/1999	MAR15_99
0.000	380.000	3.000	15.000	1999.000	3/15/1999	MAR15_99
0.000	420.000	3.000	15.000	1999.000	3/15/1999	MAR15_99
0.000	460.000	3.000	15.000	1999.000	3/15/1999	MAR15_99
0.000	460.000	3.000	15.000	1999.000	3/15/1999	MAR15_99
0.000	490.000	3.000	15.000	1999.000	3/15/1999	MAR15_99
0.000	490.000	3.000	15.000	1999.000	3/15/1999	MAR15_99
0.000	510.000	3.000	15.000	1999.000	3/15/1999	MAR15_99
0.000	490.000	3.000	15.000	1999.000	3/15/1999	MAR15_99
0.000	510.000	3.000	15.000	1999.000	3/15/1999	MAR15_99
0.000	540.000	3.000	15.000	1999.000	3/15/1999	MAR15_99
0.000	530.000	3.000	15.000	1999.000	3/15/1999	MAR15_99
0.000	560.000	3.000	15.000	1999.000	3/15/1999	MAR15_99
0.000	550.000	3.000	15.000	1999.000	3/15/1999	MAR15_99
0.000	560.000	3.000	15.000	1999.000	3/15/1999	MAR15_99
0.000	525.000	3.000	15.000	1999.000	3/15/1999	MAR15_99
0.000	390.000	4.000	6.000	1999.000	4/6/1999	APR06_99
0.000	395.000	4.000	6.000	1999.000	4/6/1999	APR06_99
0.000	380.000	4.000	6.000	1999.000	4/6/1999	APR06_99
0.000	410.000	4.000	6.000	1999.000	4/6/1999	APR06_99
0.000	430.000	4.000	6.000	1999.000	4/6/1999	APR06_99
0.000	445.000	4.000	6.000	1999.000	4/6/1999	APR06_99
0.000	445.000	4.000	6.000	1999.000	4/6/1999	APR06_99
0.000	440.000	4.000	6.000	1999.000	4/6/1999	APR06_99
0.000	300.000	4.000	22.000	1999.000	4/22/1999	APR22_99
0.000	280.000	4.000	22.000	1999.000	4/22/1999	APR22_99
0.000	210.000	4.000	22.000	1999.000	4/22/1999	APR22_99
0.000	260.000	4.000	22.000	1999.000	4/22/1999	APR22_99
0.000	260.000	4.000	22.000	1999.000	4/22/1999	APR22_99
0.000	230.000	4.000	22.000	1999.000	4/22/1999	APR22_99
0.000	240.000	4.000	22.000	1999.000	4/22/1999	APR22_99
0.000	250.000	4.000	22.000	1999.000	4/22/1999	APR22_99
9.000	260.000	12.000	14.000	1999.000	12/14/1999	DEC14_99
62.000	200.000	12.000	14.000	1999.000	12/14/1999	DEC14_99
49.000	115.000	12.000	14.000	1999.000	12/14/1999	DEC14_99
93.000	115.000	12.000	14.000	1999.000	12/14/1999	DEC14_99
65.000	200.000	12.000	14.000	1999.000	12/14/1999	DEC14_99
50.000	250.000	12.000	14.000	1999.000	12/14/1999	DEC14_99
73.000	255.000	12.000	14.000	1999.000	12/14/1999	DEC14_99
110.000	270.000	12.000	14.000	1999.000	12/14/1999	DEC14_99
125.000	270.000	12.000	14.000	1999.000	12/14/1999	DEC14_99
74.000	240.000	12.000	14.000	1999.000	12/14/1999	DEC14_99
78.000	240.000	12.000	14.000	1999.000	12/14/1999	DEC14_99
76.000	225.000	12.000	14.000	1999.000	12/14/1999	DEC14_99
45.000	200.000	12.000	14.000	1999.000	12/14/1999	DEC14_99
52.000	215.000	12.000	14.000	1999.000	12/14/1999	DEC14_99

52.000	200.000	12.000	14.000	1999.000	12/14/1999	DEC14_99
24.000	215.000	12.000	14.000	1999.000	12/14/1999	DEC14_99
17.000	270.000	12.000	28.000	1999.000	12/28/1999	DEC28_99
29.000	250.000	12.000	28.000	1999.000	12/28/1999	DEC28_99
31.000	255.000	12.000	28.000	1999.000	12/28/1999	DEC28_99
31.000	205.000	12.000	28.000	1999.000	12/28/1999	DEC28_99
31.000	260.000	12.000	28.000	1999.000	12/28/1999	DEC28_99
26.000	270.000	12.000	28.000	1999.000	12/28/1999	DEC28_99
43.000	245.000	12.000	28.000	1999.000	12/28/1999	DEC28_99
27.000	250.000	12.000	28.000	1999.000	12/28/1999	DEC28_99
22.000	255.000	12.000	28.000	1999.000	12/28/1999	DEC28_99
12.000	240.000	12.000	28.000	1999.000	12/28/1999	DEC28_99
34.000	255.000	12.000	28.000	1999.000	12/28/1999	DEC28_99
44.000	230.000	12.000	28.000	1999.000	12/28/1999	DEC28_99
53.000	245.000	12.000	28.000	1999.000	12/28/1999	DEC28_99
30.000	210.000	12.000	28.000	1999.000	12/28/1999	DEC28_99
43.000	195.000	12.000	28.000	1999.000	12/28/1999	DEC28_99
32.000	205.000	12.000	28.000	1999.000	12/28/1999	DEC28_99
11.000	155.000	1.000	12.000	2000.000	1/12/2000	JAN12_00
3.000	165.000	1.000	12.000	2000.000	1/12/2000	JAN12_00
11.000	185.000	1.000	12.000	2000.000	1/12/2000	JAN12_00
6.000	230.000	1.000	12.000	2000.000	1/12/2000	JAN12_00
3.000	225.000	1.000	12.000	2000.000	1/12/2000	JAN12_00
2.000	240.000	1.000	12.000	2000.000	1/12/2000	JAN12_00
1.000	225.000	1.000	12.000	2000.000	1/12/2000	JAN12_00
4.000	215.000	1.000	12.000	2000.000	1/12/2000	JAN12_00
2.000	195.000	1.000	12.000	2000.000	1/12/2000	JAN12_00
12.000	185.000	1.000	12.000	2000.000	1/12/2000	JAN12_00
7.000	185.000	1.000	12.000	2000.000	1/12/2000	JAN12_00
6.000	165.000	1.000	12.000	2000.000	1/12/2000	JAN12_00
12.000	185.000	1.000	12.000	2000.000	1/12/2000	JAN12_00
11.000	155.000	1.000	12.000	2000.000	1/12/2000	JAN12_00
22.000	195.000	1.000	12.000	2000.000	1/12/2000	JAN12_00
7.000	205.000	1.000	12.000	2000.000	1/12/2000	JAN12_00
0.000	445.000	1.000	27.000	2000.000	1/27/2000	JAN27_00
0.000	500.000	1.000	27.000	2000.000	1/27/2000	JAN27_00
0.000	550.000	1.000	27.000	2000.000	1/27/2000	JAN27_00
0.000	420.000	1.000	27.000	2000.000	1/27/2000	JAN27_00
0.000	370.000	1.000	27.000	2000.000	1/27/2000	JAN27_00
0.000	345.000	1.000	27.000	2000.000	1/27/2000	JAN27_00
0.000	325.000	1.000	27.000	2000.000	1/27/2000	JAN27_00
0.000	280.000	1.000	27.000	2000.000	1/27/2000	JAN27_00
2.000	265.000	1.000	27.000	2000.000	1/27/2000	JAN27_00
2.000	250.000	1.000	27.000	2000.000	1/27/2000	JAN27_00
1.000	295.000	1.000	27.000	2000.000	1/27/2000	JAN27_00
1.000	320.000	1.000	27.000	2000.000	1/27/2000	JAN27_00
0.000	305.000	1.000	27.000	2000.000	1/27/2000	JAN27_00
1.000	255.000	1.000	27.000	2000.000	1/27/2000	JAN27_00
1.000	240.000	1.000	27.000	2000.000	1/27/2000	JAN27_00
0.000	245.000	1.000	27.000	2000.000	1/27/2000	JAN27_00
0.000	210.000	2.000	8.000	2000.000	2/8/2000	FEB08_00
0.000	340.000	2.000	8.000	2000.000	2/8/2000	FEB08_00
0.000	315.000	2.000	8.000	2000.000	2/8/2000	FEB08_00
0.000	360.000	2.000	8.000	2000.000	2/8/2000	FEB08_00
0.000	380.000	2.000	8.000	2000.000	2/8/2000	FEB08_00
0.000	465.000	2.000	8.000	2000.000	2/8/2000	FEB08_00
0.000	520.000	2.000	8.000	2000.000	2/8/2000	FEB08_00
0.000	515.000	2.000	8.000	2000.000	2/8/2000	FEB08_00
0.000	400.000	2.000	8.000	2000.000	2/8/2000	FEB08_00
0.000	400.000	2.000	8.000	2000.000	2/8/2000	FEB08_00
0.000	400.000	2.000	8.000	2000.000	2/8/2000	FEB08_00
0.000	440.000	2.000	8.000	2000.000	2/8/2000	FEB08_00
0.000	430.000	2.000	8.000	2000.000	2/8/2000	FEB08_00

0.000	445.000	2.000	8.000	2000.000	2/8/2000	FEB08_00
0.000	445.000	2.000	8.000	2000.000	2/8/2000	FEB08_00
0.000	415.000	2.000	8.000	2000.000	2/8/2000	FEB08_00
0.000	410.000	2.000	25.000	2000.000	2/25/2000	FEB25_00
0.000	445.000	2.000	25.000	2000.000	2/25/2000	FEB25_00
0.000	430.000	2.000	25.000	2000.000	2/25/2000	FEB25_00
0.000	425.000	2.000	25.000	2000.000	2/25/2000	FEB25_00
0.000	440.000	2.000	25.000	2000.000	2/25/2000	FEB25_00
0.000	455.000	2.000	25.000	2000.000	2/25/2000	FEB25_00
0.000	420.000	2.000	25.000	2000.000	2/25/2000	FEB25_00
0.000	415.000	2.000	25.000	2000.000	2/25/2000	FEB25_00
0.000	430.000	2.000	25.000	2000.000	2/25/2000	FEB25_00
0.000	410.000	2.000	25.000	2000.000	2/25/2000	FEB25_00
0.000	410.000	2.000	25.000	2000.000	2/25/2000	FEB25_00
0.000	430.000	2.000	25.000	2000.000	2/25/2000	FEB25_00
0.000	440.000	2.000	25.000	2000.000	2/25/2000	FEB25_00
0.000	460.000	2.000	25.000	2000.000	2/25/2000	FEB25_00
0.000	440.000	2.000	25.000	2000.000	2/25/2000	FEB25_00
0.000	445.000	2.000	25.000	2000.000	2/25/2000	FEB25_00
0.000	295.000	3.000	22.000	2000.000	3/22/2000	MAR22_00
0.000	295.000	3.000	22.000	2000.000	3/22/2000	MAR22_00
0.000	340.000	3.000	22.000	2000.000	3/22/2000	MAR22_00
0.000	370.000	3.000	22.000	2000.000	3/22/2000	MAR22_00
0.000	315.000	3.000	22.000	2000.000	3/22/2000	MAR22_00
0.000	390.000	3.000	22.000	2000.000	3/22/2000	MAR22_00
0.000	340.000	3.000	22.000	2000.000	3/22/2000	MAR22_00
0.000	330.000	3.000	22.000	2000.000	3/22/2000	MAR22_00
0.000	350.000	3.000	22.000	2000.000	3/22/2000	MAR22_00
0.000	335.000	3.000	22.000	2000.000	3/22/2000	MAR22_00
0.000	330.000	3.000	22.000	2000.000	3/22/2000	MAR22_00
0.000	320.000	3.000	22.000	2000.000	3/22/2000	MAR22_00
0.000	320.000	3.000	22.000	2000.000	3/22/2000	MAR22_00
0.000	310.000	3.000	22.000	2000.000	3/22/2000	MAR22_00
0.000	330.000	3.000	22.000	2000.000	3/22/2000	MAR22_00
0.000	345.000	3.000	22.000	2000.000	3/22/2000	MAR22_00
0.000	265.000	4.000	6.000	2000.000	4/6/2000	APR06_00
0.000	390.000	4.000	6.000	2000.000	4/6/2000	APR06_00
0.000	290.000	4.000	6.000	2000.000	4/6/2000	APR06_00
0.000	240.000	4.000	6.000	2000.000	4/6/2000	APR06_00
0.000	260.000	4.000	6.000	2000.000	4/6/2000	APR06_00
0.000	270.000	4.000	6.000	2000.000	4/6/2000	APR06_00
0.000	265.000	4.000	6.000	2000.000	4/6/2000	APR06_00
0.000	260.000	4.000	6.000	2000.000	4/6/2000	APR06_00
0.000	355.000	4.000	19.000	2000.000	4/19/2000	APR19_00
0.000	320.000	4.000	19.000	2000.000	4/19/2000	APR19_00
0.000	280.000	4.000	19.000	2000.000	4/19/2000	APR19_00
0.000	260.000	4.000	19.000	2000.000	4/19/2000	APR19_00
0.000	200.000	4.000	19.000	2000.000	4/19/2000	APR19_00
0.000	300.000	5.000	2.000	2000.000	5/2/2000	MAY02_00
0.000	140.000	5.000	2.000	2000.000	5/2/2000	MAY02_00
0.000	365.000	5.000	2.000	2000.000	5/2/2000	MAY02_00
0.000	410.000	5.000	2.000	2000.000	5/2/2000	MAY02_00

SHRIMP__	DEPTH_MM	MONTH	DAY	YEAR	COLLDATE	DATETEXT
0.000	145.000	12.000	16.000	1998.000	12/16/1998	DEC16_98
0.000	240.000	12.000	16.000	1998.000	12/16/1998	DEC16_98
0.000	285.000	12.000	16.000	1998.000	12/16/1998	DEC16_98
0.000	280.000	12.000	16.000	1998.000	12/16/1998	DEC16_98
0.000	255.000	12.000	16.000	1998.000	12/16/1998	DEC16_98
0.000	280.000	12.000	16.000	1998.000	12/16/1998	DEC16_98
0.000	340.000	12.000	16.000	1998.000	12/16/1998	DEC16_98
0.000	240.000	12.000	16.000	1998.000	12/16/1998	DEC16_98
0.000	520.000	12.000	30.000	1998.000	12/30/1998	DEC30_98
0.000	540.000	12.000	30.000	1998.000	12/30/1998	DEC30_98
0.000	580.000	12.000	30.000	1998.000	12/30/1998	DEC30_98
0.000	440.000	12.000	30.000	1998.000	12/30/1998	DEC30_98
0.000	340.000	12.000	30.000	1998.000	12/30/1998	DEC30_98
0.000	260.000	1.000	14.000	1999.000	1/14/1999	JAN14_99
0.000	240.000	1.000	14.000	1999.000	1/14/1999	JAN14_99
0.000	180.000	1.000	14.000	1999.000	1/14/1999	JAN14_99
0.000	480.000	1.000	14.000	1999.000	1/14/1999	JAN14_99
0.000	530.000	1.000	14.000	1999.000	1/14/1999	JAN14_99
0.000	305.000	1.000	27.000	1999.000	1/27/1999	JAN27_99
0.000	305.000	1.000	27.000	1999.000	1/27/1999	JAN27_99
0.000	305.000	1.000	27.000	1999.000	1/27/1999	JAN27_99
0.000	320.000	2.000	11.000	1999.000	2/11/1999	FEB11_99
0.000	320.000	2.000	11.000	1999.000	2/11/1999	FEB11_99
0.000	320.000	2.000	11.000	1999.000	2/11/1999	FEB11_99
0.000	200.000	2.000	24.000	1999.000	2/24/1999	FEB24_99
0.000	200.000	2.000	24.000	1999.000	2/24/1999	FEB24_99
0.000	200.000	2.000	24.000	1999.000	2/24/1999	FEB24_99
0.000	305.000	3.000	15.000	1999.000	3/15/1999	MAR15_99
0.000	480.000	3.000	15.000	1999.000	3/15/1999	MAR15_99
0.000	520.000	3.000	15.000	1999.000	3/15/1999	MAR15_99
0.000	600.000	3.000	15.000	1999.000	3/15/1999	MAR15_99
0.000	310.000	3.000	15.000	1999.000	3/15/1999	MAR15_99
0.000	390.000	4.000	6.000	1999.000	4/6/1999	APR06_99
0.000	390.000	4.000	6.000	1999.000	4/6/1999	APR06_99
0.000	390.000	4.000	6.000	1999.000	4/6/1999	APR06_99
0.000	300.000	4.000	22.000	1999.000	4/22/1999	APR22_99
0.000	300.000	4.000	22.000	1999.000	4/22/1999	APR22_99
0.000	300.000	4.000	22.000	1999.000	4/22/1999	APR22_99
0.000	310.000	12.000	14.000	1999.000	12/14/1999	DEC14_99
0.000	210.000	12.000	14.000	1999.000	12/14/1999	DEC14_99
0.000	220.000	12.000	14.000	1999.000	12/14/1999	DEC14_99
0.000	300.000	12.000	14.000	1999.000	12/14/1999	DEC14_99
0.000	295.000	12.000	14.000	1999.000	12/14/1999	DEC14_99
0.000	260.000	12.000	14.000	1999.000	12/14/1999	DEC14_99
0.000	350.000	12.000	14.000	1999.000	12/14/1999	DEC14_99
0.000	320.000	12.000	14.000	1999.000	12/14/1999	DEC14_99
0.000	270.000	12.000	14.000	1999.000	12/14/1999	DEC14_99
0.000	270.000	12.000	14.000	1999.000	12/14/1999	DEC14_99
0.000	165.000	12.000	14.000	1999.000	12/14/1999	DEC14_99
0.000	165.000	12.000	14.000	1999.000	12/14/1999	DEC14_99
0.000	150.000	12.000	14.000	1999.000	12/14/1999	DEC14_99
0.000	150.000	12.000	14.000	1999.000	12/14/1999	DEC14_99
0.000	180.000	12.000	14.000	1999.000	12/14/1999	DEC14_99
0.000	160.000	12.000	14.000	1999.000	12/14/1999	DEC14_99
0.000	200.000	12.000	28.000	1999.000	12/28/1999	DEC28_99
0.000	260.000	12.000	28.000	1999.000	12/28/1999	DEC28_99
0.000	305.000	12.000	28.000	1999.000	12/28/1999	DEC28_99
0.000	315.000	12.000	28.000	1999.000	12/28/1999	DEC28_99
0.000	230.000	12.000	28.000	1999.000	12/28/1999	DEC28_99
0.000	180.000	12.000	28.000	1999.000	12/28/1999	DEC28_99

0.000	185.000	12.000	28.000	1999.000	12/28/1999	DEC28_99
0.000	200.000	12.000	28.000	1999.000	12/28/1999	DEC28_99
0.000	220.000	1.000	12.000	2000.000	1/12/2000	JAN12_00
0.000	180.000	1.000	12.000	2000.000	1/12/2000	JAN12_00
0.000	280.000	1.000	12.000	2000.000	1/12/2000	JAN12_00
0.000	380.000	1.000	12.000	2000.000	1/12/2000	JAN12_00
0.000	180.000	1.000	12.000	2000.000	1/12/2000	JAN12_00
0.000	210.000	1.000	27.000	2000.000	1/27/2000	JAN27_00
0.000	240.000	1.000	27.000	2000.000	1/27/2000	JAN27_00
0.000	290.000	1.000	27.000	2000.000	1/27/2000	JAN27_00
0.000	335.000	1.000	27.000	2000.000	1/27/2000	JAN27_00
0.000	335.000	1.000	27.000	2000.000	1/27/2000	JAN27_00
0.000	290.000	1.000	27.000	2000.000	1/27/2000	JAN27_00
0.000	335.000	2.000	8.000	2000.000	2/8/2000	FEB08_00
0.000	430.000	2.000	8.000	2000.000	2/8/2000	FEB08_00
0.000	460.000	2.000	8.000	2000.000	2/8/2000	FEB08_00
0.000	475.000	2.000	8.000	2000.000	2/8/2000	FEB08_00
0.000	490.000	2.000	8.000	2000.000	2/8/2000	FEB08_00
0.000	490.000	2.000	8.000	2000.000	2/8/2000	FEB08_00
0.000	460.000	2.000	8.000	2000.000	2/8/2000	FEB08_00
0.000	375.000	2.000	8.000	2000.000	2/8/2000	FEB08_00
0.000	225.000	2.000	25.000	2000.000	2/25/2000	FEB25_00
0.000	250.000	2.000	25.000	2000.000	2/25/2000	FEB25_00
0.000	255.000	2.000	25.000	2000.000	2/25/2000	FEB25_00
0.000	235.000	2.000	25.000	2000.000	2/25/2000	FEB25_00
0.000	195.000	2.000	25.000	2000.000	2/25/2000	FEB25_00
0.000	185.000	2.000	25.000	2000.000	2/25/2000	FEB25_00
0.000	210.000	2.000	25.000	2000.000	2/25/2000	FEB25_00
0.000	210.000	2.000	25.000	2000.000	2/25/2000	FEB25_00
0.000	440.000	3.000	22.000	2000.000	3/22/2000	MAR22_00
0.000	400.000	3.000	22.000	2000.000	3/22/2000	MAR22_00
0.000	320.000	3.000	22.000	2000.000	3/22/2000	MAR22_00
0.000	270.000	3.000	22.000	2000.000	3/22/2000	MAR22_00
0.000	145.000	3.000	22.000	2000.000	3/22/2000	MAR22_00
0.000	170.000	3.000	22.000	2000.000	3/22/2000	MAR22_00
0.000	320.000	4.000	6.000	2000.000	4/6/2000	APR06_00
0.000	340.000	4.000	6.000	2000.000	4/6/2000	APR06_00
0.000	305.000	4.000	6.000	2000.000	4/6/2000	APR06_00
0.000	355.000	4.000	6.000	2000.000	4/6/2000	APR06_00
0.000	220.000	4.000	6.000	2000.000	4/6/2000	APR06_00

SHRIMP__	DEPTH_MM	MONTH	DAY	YEAR	COLLDATE	DATETEXT
5.000	215.000	12.000	16.000	1998.000	12/16/1998	DEC16_98
6.000	285.000	12.000	16.000	1998.000	12/16/1998	DEC16_98
6.000	400.000	12.000	16.000	1998.000	12/16/1998	DEC16_98
0.000	475.000	12.000	16.000	1998.000	12/16/1998	DEC16_98
2.000	460.000	12.000	16.000	1998.000	12/16/1998	DEC16_98
2.000	355.000	12.000	16.000	1998.000	12/16/1998	DEC16_98
0.000	245.000	12.000	16.000	1998.000	12/16/1998	DEC16_98
0.000	205.000	12.000	16.000	1998.000	12/16/1998	DEC16_98
0.000	490.000	12.000	30.000	1998.000	12/30/1998	DEC30_98
0.000	435.000	12.000	30.000	1998.000	12/30/1998	DEC30_98
2.000	495.000	12.000	30.000	1998.000	12/30/1998	DEC30_98
11.000	310.000	12.000	30.000	1998.000	12/30/1998	DEC30_98
8.000	410.000	12.000	30.000	1998.000	12/30/1998	DEC30_98
2.000	405.000	12.000	30.000	1998.000	12/30/1998	DEC30_98
2.000	420.000	12.000	30.000	1998.000	12/30/1998	DEC30_98
3.000	535.000	12.000	30.000	1998.000	12/30/1998	DEC30_98
1.000	525.000	12.000	30.000	1998.000	12/30/1998	DEC30_98
2.000	515.000	12.000	30.000	1998.000	12/30/1998	DEC30_98
3.000	400.000	12.000	30.000	1998.000	12/30/1998	DEC30_98
0.000	410.000	12.000	30.000	1998.000	12/30/1998	DEC30_98
2.000	340.000	12.000	30.000	1998.000	12/30/1998	DEC30_98
0.000	325.000	12.000	30.000	1998.000	12/30/1998	DEC30_98
2.000	215.000	12.000	30.000	1998.000	12/30/1998	DEC30_98
0.000	150.000	12.000	30.000	1998.000	12/30/1998	DEC30_98
0.000	240.000	1.000	14.000	1999.000	1/14/1999	JAN14_99
1.000	215.000	1.000	14.000	1999.000	1/14/1999	JAN14_99
0.000	280.000	1.000	14.000	1999.000	1/14/1999	JAN14_99
1.000	280.000	1.000	14.000	1999.000	1/14/1999	JAN14_99
4.000	275.000	1.000	14.000	1999.000	1/14/1999	JAN14_99
0.000	320.000	1.000	14.000	1999.000	1/14/1999	JAN14_99
1.000	300.000	1.000	14.000	1999.000	1/14/1999	JAN14_99
1.000	345.000	1.000	14.000	1999.000	1/14/1999	JAN14_99
0.000	345.000	1.000	14.000	1999.000	1/14/1999	JAN14_99
4.000	375.000	1.000	14.000	1999.000	1/14/1999	JAN14_99
0.000	450.000	1.000	14.000	1999.000	1/14/1999	JAN14_99
0.000	510.000	1.000	14.000	1999.000	1/14/1999	JAN14_99
2.000	535.000	1.000	14.000	1999.000	1/14/1999	JAN14_99
1.000	575.000	1.000	14.000	1999.000	1/14/1999	JAN14_99
0.000	575.000	1.000	14.000	1999.000	1/14/1999	JAN14_99
0.000	590.000	1.000	14.000	1999.000	1/14/1999	JAN14_99
0.000	130.000	1.000	27.000	1999.000	1/27/1999	JAN27_99
0.000	255.000	1.000	27.000	1999.000	1/27/1999	JAN27_99
0.000	310.000	1.000	27.000	1999.000	1/27/1999	JAN27_99
0.000	420.000	1.000	27.000	1999.000	1/27/1999	JAN27_99
0.000	460.000	1.000	27.000	1999.000	1/27/1999	JAN27_99
0.000	595.000	1.000	27.000	1999.000	1/27/1999	JAN27_99
0.000	675.000	1.000	27.000	1999.000	1/27/1999	JAN27_99
0.000	580.000	1.000	27.000	1999.000	1/27/1999	JAN27_99
0.000	540.000	1.000	27.000	1999.000	1/27/1999	JAN27_99
0.000	490.000	1.000	27.000	1999.000	1/27/1999	JAN27_99
0.000	390.000	1.000	27.000	1999.000	1/27/1999	JAN27_99
0.000	310.000	1.000	27.000	1999.000	1/27/1999	JAN27_99
0.000	280.000	1.000	27.000	1999.000	1/27/1999	JAN27_99
1.000	230.000	1.000	27.000	1999.000	1/27/1999	JAN27_99
0.000	180.000	1.000	27.000	1999.000	1/27/1999	JAN27_99
0.000	215.000	1.000	27.000	1999.000	1/27/1999	JAN27_99
0.000	210.000	2.000	11.000	1999.000	2/11/1999	FEB11_99
0.000	230.000	2.000	11.000	1999.000	2/11/1999	FEB11_99
0.000	240.000	2.000	11.000	1999.000	2/11/1999	FEB11_99
0.000	235.000	2.000	11.000	1999.000	2/11/1999	FEB11_99

0.000	275.000	2.000	11.000	1999.000	2/11/1999	FEB11_99
0.000	255.000	2.000	11.000	1999.000	2/11/1999	FEB11_99
0.000	305.000	2.000	11.000	1999.000	2/11/1999	FEB11_99
0.000	320.000	2.000	11.000	1999.000	2/11/1999	FEB11_99
0.000	305.000	2.000	11.000	1999.000	2/11/1999	FEB11_99
0.000	340.000	2.000	11.000	1999.000	2/11/1999	FEB11_99
0.000	365.000	2.000	11.000	1999.000	2/11/1999	FEB11_99
0.000	300.000	2.000	11.000	1999.000	2/11/1999	FEB11_99
0.000	250.000	2.000	11.000	1999.000	2/11/1999	FEB11_99
0.000	240.000	2.000	11.000	1999.000	2/11/1999	FEB11_99
0.000	200.000	2.000	11.000	1999.000	2/11/1999	FEB11_99
0.000	170.000	2.000	11.000	1999.000	2/11/1999	FEB11_99
0.000	160.000	2.000	24.000	1999.000	2/24/1999	FEB24_99
0.000	200.000	2.000	24.000	1999.000	2/24/1999	FEB24_99
0.000	200.000	2.000	24.000	1999.000	2/24/1999	FEB24_99
0.000	235.000	2.000	24.000	1999.000	2/24/1999	FEB24_99
0.000	250.000	2.000	24.000	1999.000	2/24/1999	FEB24_99
0.000	275.000	2.000	11.000	1999.000	2/11/1999	FEB11_99
0.000	285.000	2.000	24.000	1999.000	2/24/1999	FEB24_99
0.000	300.000	2.000	24.000	1999.000	2/24/1999	FEB24_99
0.000	250.000	2.000	24.000	1999.000	2/24/1999	FEB24_99
0.000	200.000	2.000	24.000	1999.000	2/24/1999	FEB24_99
0.000	320.000	2.000	24.000	1999.000	2/24/1999	FEB24_99
0.000	280.000	3.000	15.000	1999.000	3/15/1999	MAR15_99
0.000	260.000	3.000	15.000	1999.000	3/15/1999	MAR15_99
0.000	270.000	3.000	15.000	1999.000	3/15/1999	MAR15_99
0.000	270.000	3.000	15.000	1999.000	3/15/1999	MAR15_99
0.000	295.000	3.000	15.000	1999.000	3/15/1999	MAR15_99
0.000	320.000	3.000	15.000	1999.000	3/15/1999	MAR15_99
0.000	320.000	3.000	15.000	1999.000	3/15/1999	MAR15_99
0.000	290.000	3.000	15.000	1999.000	3/15/1999	MAR15_99
0.000	230.000	3.000	15.000	1999.000	3/15/1999	MAR15_99
0.000	200.000	3.000	15.000	1999.000	3/15/1999	MAR15_99
0.000	235.000	3.000	15.000	1999.000	3/15/1999	MAR15_99
0.000	250.000	3.000	15.000	1999.000	3/15/1999	MAR15_99
0.000	230.000	3.000	15.000	1999.000	3/15/1999	MAR15_99
0.000	255.000	3.000	15.000	1999.000	3/15/1999	MAR15_99
0.000	255.000	3.000	15.000	1999.000	3/15/1999	MAR15_99
0.000	200.000	3.000	15.000	1999.000	3/15/1999	MAR15_99
0.000	200.000	4.000	6.000	1999.000	4/6/1999	APR06_99
0.000	350.000	4.000	6.000	1999.000	4/6/1999	APR06_99
0.000	405.000	4.000	6.000	1999.000	4/6/1999	APR06_99
0.000	445.000	4.000	6.000	1999.000	4/6/1999	APR06_99
0.000	525.000	4.000	6.000	1999.000	4/6/1999	APR06_99
0.000	575.000	4.000	6.000	1999.000	4/6/1999	APR06_99
0.000	645.000	4.000	6.000	1999.000	4/6/1999	APR06_99
0.000	830.000	4.000	6.000	1999.000	4/6/1999	APR06_99
0.000	650.000	4.000	6.000	1999.000	4/6/1999	APR06_99
0.000	590.000	4.000	6.000	1999.000	4/6/1999	APR06_99
0.000	565.000	4.000	6.000	1999.000	4/6/1999	APR06_99
0.000	560.000	4.000	6.000	1999.000	4/6/1999	APR06_99
0.000	370.000	4.000	6.000	1999.000	4/6/1999	APR06_99
0.000	290.000	4.000	6.000	1999.000	4/6/1999	APR06_99
0.000	215.000	4.000	6.000	1999.000	4/6/1999	APR06_99
0.000	170.000	4.000	6.000	1999.000	4/6/1999	APR06_99
0.000	340.000	4.000	22.000	1999.000	4/22/1999	APR22_99
0.000	410.000	4.000	22.000	1999.000	4/22/1999	APR22_99
0.000	420.000	4.000	22.000	1999.000	4/22/1999	APR22_99
0.000	420.000	4.000	22.000	1999.000	4/22/1999	APR22_99
0.000	430.000	4.000	22.000	1999.000	4/22/1999	APR22_99
0.000	480.000	4.000	22.000	1999.000	4/22/1999	APR22_99
0.000	440.000	4.000	22.000	1999.000	4/22/1999	APR22_99
0.000	250.000	4.000	22.000	1999.000	4/22/1999	APR22_99

15.000	185.000	12.000	14.000	1999.000	12/14/1999	DEC14_99
10.000	195.000	12.000	14.000	1999.000	12/14/1999	DEC14_99
12.000	200.000	12.000	14.000	1999.000	12/14/1999	DEC14_99
3.000	185.000	12.000	14.000	1999.000	12/14/1999	DEC14_99
9.000	180.000	12.000	14.000	1999.000	12/14/1999	DEC14_99
7.000	185.000	12.000	14.000	1999.000	12/14/1999	DEC14_99
21.000	255.000	12.000	14.000	1999.000	12/14/1999	DEC14_99
12.000	315.000	12.000	14.000	1999.000	12/14/1999	DEC14_99
35.000	300.000	12.000	14.000	1999.000	12/14/1999	DEC14_99
22.000	295.000	12.000	14.000	1999.000	12/14/1999	DEC14_99
20.000	270.000	12.000	14.000	1999.000	12/14/1999	DEC14_99
16.000	280.000	12.000	14.000	1999.000	12/14/1999	DEC14_99
10.000	210.000	12.000	14.000	1999.000	12/14/1999	DEC14_99
8.000	180.000	12.000	14.000	1999.000	12/14/1999	DEC14_99
11.000	220.000	12.000	14.000	1999.000	12/14/1999	DEC14_99
21.000	230.000	12.000	14.000	1999.000	12/14/1999	DEC14_99
32.000	215.000	12.000	28.000	1999.000	12/28/1999	DEC28_99
24.000	280.000	12.000	28.000	1999.000	12/28/1999	DEC28_99
69.000	300.000	12.000	28.000	1999.000	12/28/1999	DEC28_99
73.000	370.000	12.000	28.000	1999.000	12/28/1999	DEC28_99
55.000	430.000	12.000	28.000	1999.000	12/28/1999	DEC28_99
70.000	520.000	12.000	28.000	1999.000	12/28/1999	DEC28_99
128.000	420.000	12.000	28.000	1999.000	12/28/1999	DEC28_99
205.000	340.000	12.000	28.000	1999.000	12/28/1999	DEC28_99
228.000	255.000	12.000	28.000	1999.000	12/28/1999	DEC28_99
197.000	260.000	12.000	28.000	1999.000	12/28/1999	DEC28_99
134.000	280.000	12.000	28.000	1999.000	12/28/1999	DEC28_99
150.000	315.000	12.000	28.000	1999.000	12/28/1999	DEC28_99
29.000	300.000	12.000	28.000	1999.000	12/28/1999	DEC28_99
131.000	250.000	12.000	28.000	1999.000	12/28/1999	DEC28_99
51.000	220.000	12.000	28.000	1999.000	12/28/1999	DEC28_99
119.000	190.000	12.000	28.000	1999.000	12/28/1999	DEC28_99
55.000	280.000	1.000	12.000	2000.000	1/12/2000	JAN12_00
25.000	305.000	1.000	12.000	2000.000	1/12/2000	JAN12_00
45.000	350.000	1.000	12.000	2000.000	1/12/2000	JAN12_00
45.000	350.000	1.000	12.000	2000.000	1/12/2000	JAN12_00
55.000	310.000	1.000	12.000	2000.000	1/12/2000	JAN12_00
55.000	350.000	1.000	12.000	2000.000	1/12/2000	JAN12_00
75.000	400.000	1.000	12.000	2000.000	1/12/2000	JAN12_00
75.000	360.000	1.000	12.000	2000.000	1/12/2000	JAN12_00
12.000	270.000	1.000	27.000	2000.000	1/27/2000	JAN27_00
21.000	310.000	1.000	27.000	2000.000	1/27/2000	JAN27_00
6.000	330.000	1.000	27.000	2000.000	1/27/2000	JAN27_00
16.000	335.000	1.000	27.000	2000.000	1/27/2000	JAN27_00
13.000	360.000	1.000	27.000	2000.000	1/27/2000	JAN27_00
6.000	385.000	1.000	27.000	2000.000	1/27/2000	JAN27_00
9.000	385.000	1.000	27.000	2000.000	1/27/2000	JAN27_00
10.000	400.000	1.000	27.000	2000.000	1/27/2000	JAN27_00
8.000	480.000	1.000	27.000	2000.000	1/27/2000	JAN27_00
3.000	490.000	1.000	27.000	2000.000	1/27/2000	JAN27_00
4.000	510.000	1.000	27.000	2000.000	1/27/2000	JAN27_00
6.000	480.000	1.000	27.000	2000.000	1/27/2000	JAN27_00
4.000	480.000	1.000	27.000	2000.000	1/27/2000	JAN27_00
2.000	440.000	1.000	27.000	2000.000	1/27/2000	JAN27_00
11.000	510.000	1.000	27.000	2000.000	1/27/2000	JAN27_00
5.000	545.000	1.000	27.000	2000.000	1/27/2000	JAN27_00
2.000	250.000	2.000	8.000	2000.000	2/8/2000	FEB08_00
0.000	305.000	2.000	8.000	2000.000	2/8/2000	FEB08_00
0.000	305.000	2.000	8.000	2000.000	2/8/2000	FEB08_00
0.000	350.000	2.000	8.000	2000.000	2/8/2000	FEB08_00
2.000	380.000	2.000	8.000	2000.000	2/8/2000	FEB08_00
0.000	390.000	2.000	8.000	2000.000	2/8/2000	FEB08_00
1.000	390.000	2.000	8.000	2000.000	2/8/2000	FEB08_00

0.000	370.000	2.000	8.000	2000.000	2/8/2000	FEB08_00
3.000	440.000	2.000	8.000	2000.000	2/8/2000	FEB08_00
1.000	370.000	2.000	8.000	2000.000	2/8/2000	FEB08_00
0.000	415.000	2.000	8.000	2000.000	2/8/2000	FEB08_00
1.000	445.000	2.000	8.000	2000.000	2/8/2000	FEB08_00
0.000	470.000	2.000	8.000	2000.000	2/8/2000	FEB08_00
0.000	440.000	2.000	8.000	2000.000	2/8/2000	FEB08_00
0.000	375.000	2.000	8.000	2000.000	2/8/2000	FEB08_00
0.000	305.000	2.000	8.000	2000.000	2/8/2000	FEB08_00
0.000	195.000	2.000	25.000	2000.000	2/25/2000	FEB25_00
0.000	240.000	2.000	25.000	2000.000	2/25/2000	FEB25_00
0.000	155.000	2.000	25.000	2000.000	2/25/2000	FEB25_00
0.000	165.000	2.000	25.000	2000.000	2/25/2000	FEB25_00
0.000	245.000	2.000	25.000	2000.000	2/25/2000	FEB25_00
0.000	200.000	2.000	25.000	2000.000	2/25/2000	FEB25_00
0.000	220.000	2.000	25.000	2000.000	2/25/2000	FEB25_00
0.000	250.000	2.000	25.000	2000.000	2/25/2000	FEB25_00
1.000	240.000	2.000	25.000	2000.000	2/25/2000	FEB25_00
0.000	230.000	2.000	25.000	2000.000	2/25/2000	FEB25_00
0.000	280.000	2.000	25.000	2000.000	2/25/2000	FEB25_00
0.000	250.000	2.000	25.000	2000.000	2/25/2000	FEB25_00
1.000	260.000	2.000	25.000	2000.000	2/25/2000	FEB25_00
0.000	265.000	2.000	25.000	2000.000	2/25/2000	FEB25_00
0.000	250.000	2.000	25.000	2000.000	2/25/2000	FEB25_00
0.000	220.000	2.000	25.000	2000.000	2/25/2000	FEB25_00
0.000	440.000	3.000	22.000	2000.000	3/22/2000	MAR22_00
0.000	470.000	3.000	22.000	2000.000	3/22/2000	MAR22_00
0.000	420.000	3.000	22.000	2000.000	3/22/2000	MAR22_00
0.000	420.000	3.000	22.000	2000.000	3/22/2000	MAR22_00
0.000	370.000	3.000	22.000	2000.000	3/22/2000	MAR22_00
0.000	540.000	3.000	22.000	2000.000	3/22/2000	MAR22_00
0.000	400.000	3.000	22.000	2000.000	3/22/2000	MAR22_00
0.000	450.000	3.000	22.000	2000.000	3/22/2000	MAR22_00
0.000	540.000	3.000	22.000	2000.000	3/22/2000	MAR22_00
0.000	540.000	3.000	22.000	2000.000	3/22/2000	MAR22_00
0.000	560.000	3.000	22.000	2000.000	3/22/2000	MAR22_00
0.000	550.000	3.000	22.000	2000.000	3/22/2000	MAR22_00
0.000	480.000	3.000	22.000	2000.000	3/22/2000	MAR22_00
0.000	460.000	3.000	22.000	2000.000	3/22/2000	MAR22_00
0.000	440.000	3.000	22.000	2000.000	3/22/2000	MAR22_00
0.000	420.000	3.000	22.000	2000.000	3/22/2000	MAR22_00
0.000	390.000	4.000	6.000	2000.000	4/6/2000	APR06_00
1.000	380.000	4.000	6.000	2000.000	4/6/2000	APR06_00
0.000	335.000	4.000	6.000	2000.000	4/6/2000	APR06_00
0.000	420.000	4.000	6.000	2000.000	4/6/2000	APR06_00
0.000	385.000	4.000	6.000	2000.000	4/6/2000	APR06_00
0.000	380.000	4.000	6.000	2000.000	4/6/2000	APR06_00
0.000	310.000	4.000	6.000	2000.000	4/6/2000	APR06_00
0.000	310.000	4.000	6.000	2000.000	4/6/2000	APR06_00
0.000	280.000	4.000	6.000	2000.000	4/6/2000	APR06_00
0.000	280.000	4.000	6.000	2000.000	4/6/2000	APR06_00
0.000	245.000	4.000	6.000	2000.000	4/6/2000	APR06_00
0.000	260.000	4.000	6.000	2000.000	4/6/2000	APR06_00
0.000	295.000	4.000	6.000	2000.000	4/6/2000	APR06_00
0.000	230.000	4.000	6.000	2000.000	4/6/2000	APR06_00
0.000	160.000	4.000	6.000	2000.000	4/6/2000	APR06_00
0.000	210.000	4.000	6.000	2000.000	4/6/2000	APR06_00
0.000	195.000	4.000	6.000	2000.000	4/6/2000	APR06_00
0.000	250.000	4.000	6.000	2000.000	4/6/2000	APR06_00
0.000	430.000	4.000	6.000	2000.000	4/6/2000	APR06_00
0.000	340.000	4.000	6.000	2000.000	4/6/2000	APR06_00
0.000	220.000	4.000	6.000	2000.000	4/6/2000	APR06_00
0.000	360.000	5.000	2.000	2000.000	5/2/2000	MAY02_00

0.000	490.000	5.000	2.000	2000.000	5/2/2000	MAY02_00
0.000	305.000	5.000	2.000	2000.000	5/2/2000	MAY02_00
0.000	245.000	5.000	2.000	2000.000	5/2/2000	MAY02_00

APPENDIX 7

Water Quality Data

Dales Lake Ecological Reserve					
Water Quality Measurements - Water Year 1997					
Date	Temp, °C	pH	Dissolved Oxygen (mg/l)	Conductance (µS/cm)	Salinity
10/16/1997	9.1	7.2		27.3	0.0
12/30/1997	8.8	7.7		27.6	0.0
1/9/1998	7.3	7.6		25.3	0.0
1/20/1998	8.9	7.7		24.7	0.0
2/3/1998	9.6	7.8		22.4	0.0
2/17/1998	7.5	7.1		23.8	0.0
3/3/1998	12.2	7.4		24.9	0.0
3/17/1998	18.4	6.5	6.4	25.8	0.0
3/31/1998	11.4	6.5	10.2	21.8	0.0
4/14/1998	11.5	6.5	8.6	22.4	0.0
4/28/1998	21.8	6.2	7.0	18.3	0.0
5/12/1998	15.0	6.3	8.2	15.2	0.0
5/26/1998	14.5	6.6	8.6	23.5	0.0
6/9/1998	26.2	6.5	7.6	20.5	0.0
6/26/1998	24.4	7.0	7.6	35.3	0.0
7/10/1998	25.3	6.4	6.6	41.4	0.0
7/28/1998	28.8	7.2	5.4	63.4	0.0
8/20/1998	27.0	7.0	8.2	130.5	0.1
9/4/1998	StowAway	removed.			

Hog Lake					
Water Quality Measurements - Water Year 1997					
Date	**Temp, °C**	**pH**	**Dissolved Oxygen (mg/l)**	**Conductance (µS/cm)**	**Salinity**
10/16/1997	9.4	7.3	NA	47.1	0.0
12/30/1997	9.2	7.7	NA	44.5	0.0
1/9/1998	7.1	7.4	NA	39.2	0.0
1/20/1998	8.5	7.9	NA	40.1	0.0
2/3/1998	9.3	8.0	NA	36.2	0.0
2/17/1998	6.8	7.1	NA	41.5	0.0
3/3/1998	13.5	7.8	NA	39.5	0.0
3/17/1998	18.8	8.5	9.6	41.4	0.0
3/31/1998	10.5	7.0	9.0	42.1	0.0
4/14/1998	11.9	6.9	8.2	41.8	0.0
4/28/1998	22.4	7.0	5.2	40.6	0.0
5/12/1998	14.7	6.7	8.6	32.9	0.0
5/26/1998	17.9	6.6	8.6	23.5	0.0
6/9/1998	24.0	6.4	6.8	29.5	0.0
6/26/1998	23.7	6.8	5.6	29.7	0.0
7/10/1998	26.9	6.4	5.4	37.8	0.0
7/28/1998	30.2	6.5	6.2	40.7	0.0
8/20/1998	21.7	6.5	5.4	75.4	0.0
9/4/1998	30.0	6.8	3.0	179.4	0.1
9/4/1998	Stowaway	removed.			

Hoggett

Water Quality Measurements - Water Year 1997

Date	Temp, °C	pH	Dissolved Oxygen (mg/l)	Conductance (µS/cm)	Salinity
1/8/1998	7.6	8.4	NA	34.0	0.0
1/9/1998	7.8	7.4	NA	32.8	0.0
1/20/1998	8.2	7.9	NA	29.4	0.0
2/3/1998	9.4	8.0	NA	21.1	0.0
2/17/1998	6.6	7.3	NA	30.1	0.0
3/3/1998	13.8	8.9	NA	30.3	0.0
3/17/1998	17.5	8.7	9.2	30.8	0.0
3/31/1998	10.5	6.8	8.8	34.1	0.0
4/14/1998	13.3	6.9	7.8	36.8	0.0
4/28/1998	24.1	6.5	4.4	38.5	0.0
5/12/1998	15.3	6.1	7.6	28.0	0.0
5/26/1998	18.2	6.4	7.4	42.2	0.0
6/9/1998	24.2	6.3	7.4	42.5	0.0
6/26/1998	23.9	6.6	6.4	62.2	0.0
7/10/1998	StowAway	removed.			

Sevenmile Lake					
Water Quality Measurements - Water Year 1997					
Date	**Temp, °C**	**pH**	**Dissolved Oxygen (mg/l)**	**Conductance (µS/cm)**	**Salinity**
10/17/1997	8.4	7.8	NA	27.6	0.0
12/30/1997	11.1	8.8	NA	27.8	0.0
1/9/1998	8.0	7.3	NA	30.3	0.0
1/20/1998	7.9	8.1	NA	26.1	0.0
2/3/1998	9.5	7.8	NA	18.5	0.0
2/17/1998	6.5	7.3	NA	23.4	0.0
3/3/1998	12.6	8.7	NA	25.4	0.0
3/17/1998	19.9	9.0	9.6	27.0	0.0
3/31/1998	9.8	7.4	8.4	22.7	0.0
4/14/1998	14.1	8.0	8.6	27.1	0.0
4/28/1998	25.1	8.5	6.8	27.2	0.0
5/12/1998	14.8	6.7	8.6	22.5	0.0
5/26/1998	20.0	7.9	8.2	24.6	0.0
6/9/1998	27.5	8.0	8.6	24.2	0.0
6/26/1998	28.9	7.5	8.6	34.8	0.0
7/10/1998	29.6	7.1	7.2	48.8	0.0
7/28/1998	StowAway	removed.			

Spring Branch One					
Water Quality Measurements - Water Year 2000					
Date	**Temp, °C**	**pH**	**Dissolved Oxygen (mg/l)**	**Conductance (µS/cm)**	**Salinity**
11/28/2000	10.3	7.2	8.7	55.0	0.0
12/14/2000	8.0	7.5	9.6	43.5	0.0
1/2/2001	7.0	7.1	9.8	48.0	0.0
1/16/2001	4.4	7.2	10.0	27.1	0.0
1/30/2001	6.1	7.1	8.9	23.9	0.0
2/13/2001	6.4	7.7	11.7	26.1	0.0
3/6/2001	11.9	7.0	8.0	25.8	0.0
3/20/2001	21.3	8.1	6.7	31.4	0.0
4/3/2001	15.4	7.4	9.8	45.7	0.0
4/17/2001	15.8	6.8	7.5	51.9	0.0
5/1/2001	19.3	6.5	4.2	59.9	0.0
5/17/2001	21.6	5.8	5.3	64.3	0.0
5/31/2001	24.9	9.3	7.8	88.4	0.0
6/12/2001	20.4	NA	9.1	142.8	0.1

Spring Branch 2					
Water Quality Measurements - Water Year 1997					
Date	**Temp, °C**	**pH**	**Dissolved Oxygen (mg/l)**	**Conductance (µS/cm)**	**Salinity**
10/17/1997	8.9	7.1	NA	21.8	0.0
12/30/1997	10.1	7.5	NA	21.5	0.0
1/9/1998	8.2	7.3	NA	20.9	0.0
1/20/1998	10.1	7.9	NA	22.4	0.0
2/3/1998	10.1	7.8	NA	18.2	0.0
2/17/1998	8.1	7.3	NA	21.8	0.0
3/3/1998	16.1	8.3	NA	20.2	0.0
3/17/1998	21.2	8.3	9.0	19.1	0.0
3/31/1998	11.6	7.3	7.2	17.4	0.0
4/14/1998	17.4	7.3	8.2	17.1	0.0
4/28/1998	26.5	7.8	2.8	19.3	0.0
5/12/1998	18.0	7.4	9.6	15.2	0.0
5/26/1998	15.6	7.1	7.0	18.8	0.0
6/9/1998	27.9	8.3	8.2	25.0	0.0
6/26/1998	29.5	8.7	7.4	28.3	0.0
7/10/1998	32.7	9.3	7.6	38.8	0.0
7/28/1998	34.0	9.3	7.8	61.0	0.0
8/20/1998	StowAway	removed.			

Spring Branch 3					
Water Quality Measurements - Water Year 1997					
Date	**Temp, °C**	**pH**	**Dissolved Oxygen (mg/l)**	**Conductance (µS/cm)**	**Salinity**
1/16/1998	9.9	7.5	NA	28.6	0.0
1/20/1998	9.0	7.7	NA	28.8	0.0
2/3/1998	9.9	7.5	NA	17.5	0.0
2/17/1998	7.5	7.3	NA	29.8	0.0
3/3/1998	14.4	8.0	NA	25.3	0.0
3/17/1998	19.4	7.6	8.4	33.8	0.0
3/31/1998	10.9	7.3	8.8	27.4	0.0
4/14/1998	12.7	7.1	10.2	27.4	0.0
4/28/1998	18.5	6.6	NA	53.5	0.0
5/12/1998	16.2	7.0	5.6	56.8	0.0
5/26/1998	15.6	7.0	6.4	46.2	0.0
6/9/1998	23.4	7.0	8.2	35.5	0.0
6/26/1998	24.7	9.3	9.2	49.2	0.0
7/10/1998	25.4	9.6	7.4	78.4	0.0
7/28/1998	StowAway	removed.			

Spring Branch Four					
Water Quality Measurements - Water Year 1997					
Date	**Temp, °C**	**pH**	**Dissolved Oxygen (mg/l)**	**Conductance (µS/cm)**	**Salinity**
1/16/1998	9.9	7.9	NA	31.0	0.0
1/20/1998	8.4	7.4	NA	30.8	0.0
2/3/1998	9.9	7.5	NA	24.7	0.0
2/17/1998	8.0	7.4	NA	34.3	0.0
3/3/1998	13.3	7.7	NA	31.5	0.0
3/17/1998	16.5	7.2	8.2	33.2	0.0
3/31/1998	11.8	7.2	8.8	33.3	0.0
4/14/1998	13.0	7.3	9.8	33.0	0.0
4/28/1998	22.1	7.2	NA	36.1	0.0
5/12/1998	16.9	7.6	NA	30.4	0.0
5/26/1998	16.3	7.1	6.0	35.2	0.0
6/9/1998	23.4	7.0	8.2	34.7	0.0
6/26/1998	25.8	8.5	8.2	36.3	0.0
7/10/1998	31.0	9.6	7.4	47.0	0.0
7/28/1998	30.5	9.4	11.4	70.6	0.0
8/20/1998	StowAway	removed.			

Dales Lake Ecological Reserve					
Water Quality Measurements - Water Year 1998					
Date	**Temp, °C**	**pH**	**Dissolved Oxygen (mg/l)**	**Conductance (µS/cm)**	**Salinity**
12/2/1998	9.7	7.7	8.8	38.8	0.0
12/14/1998	9.5	7.4	9.2	35.7	0.0
12/28/1998	8.4	7.9	9.2	32.6	0.0
1/11/1999	6.1	7.2	9.6	33.7	0.0
1/25/1999	5.7	7.5	9.2	33.2	0.0
2/10/1999	7.3	7.5	7.0	28.0	0.0
2/23/1999	10.8	8.2	9.4	28.1	0.0
3/22/1999	14.1	9.2	10.8	30.4	0.0
4/7/1999	15.4	9.7	9.0	21.8	0.0
4/20/1999	21.3	8.4	7.0	24.4	0.0
8/4/1999	StowAway removed.				

Hog Lake					
Water Quality Measurements - Water Year 1998					
Date	**Temp, °C**	**pH**	**Dissolved Oxygen (mg/l)**	**Conductance (µS/cm)**	**Salinity**
12/2/1998	9.4	7.4	8.2	55.8	0.0
12/14/1998	9.4	7.7	8.6	51.5	0.0
12/28/1998	7.6	7.6	10.1	54.3	0.0
1/11/1999	7.2	7.5	9.4	57.8	0.0
1/25/1999	8.6	7.5	9.2	35.5	0.0
2/10/1999	8.6	7.6	6.9	43.0	0.0
2/23/1999	10.1	7.7	8.6	42.8	0.0
3/22/1999	13.6	8.6	12.4	55.0	0.0
4/7/1999	16.0	9.7	9.8	51.9	0.0
4/20/1999	23.6	8.8	6.8	51.1	0.0
7/9/1999	StowAway	removed.			

Hoggett					
Water Quality Measurements - Water Year 1998					
Date	**Temp, °C**	**pH**	**Dissolved Oxygen (mg/l)**	**Conductance (µS/cm)**	**Salinity**
12/2/1998	9.5	7.7	10.2	36.5	0.0
12/14/1998	10.7	7.7	7.8	41.1	0.0
12/28/1998	9.8	7.7	9.4	52.0	0.0
1/11/1999	7.5	7.6	9.0	47.7	0.0
1/25/1999	8.5	7.5	9.6	47.8	0.0
2/10/1999	9.5	7.6	7.0	27.8	0.0
2/23/1999	14.2	8.2	9.0	29.0	0.0
3/22/1999	14.9	9.5	11.6	31.2	0.0
4/7/1999	18.8	10.2	9.0	37.1	0.0
4/20/1999	23.7	9.5	8.6	47.3	0.0
7/9/1999	StowAway	removed.			

Sevenmile Lake					
Water Quality Measurements - Water Year 1998					
Date	**Temp, °C**	**pH**	**Dissolved Oxygen (mg/l)**	**Conductance (µS/cm)**	**Salinity**
12/2/1998	9.7	8.8	11.2	37.1	0.0
12/14/1998	10.5	8.2	8.8	42.6	0.0
1/11/1999	8.4	9.1	12.0	40.3	0.0
1/25/1999	9.8	8.8	12.6	50.1	0.0
2/10/1999	11.2	8.7	9.4	26.8	0.0
2/23/1999	15.0	9.7	11.2	31.6	0.0
3/22/1999	13.5	10.0	13.4	35.2	0.0
4/7/1999	18.3	10.4	8.8	29.4	0.0
4/20/1999	26.1	9.3	9.4	36.3	0.0
6/3/1999	StowAway	removed.			

Spring Branch One					
Water Quality Measurements - Water Year 1998					
Date	**Temp, °C**	**pH**	**Dissolved Oxygen (mg/l)**	**Conductance (µS/cm)**	**Salinity**
12/2/1998	10.1	7.4	8.2	32.7	0.0
12/16/1998	9.4	7.1	8.4	33.8	0.0
12/30/1998	8.2	8.1	9.0	34.5	0.0
1/14/1999	7.4	7.3	9.0	35.2	0.0
1/27/1999	6.3	7.5	9.6	26.3	0.0
2/11/1999	7.5	7.8	8.6	27.6	0.0
2/24/1999	11.6	7.9	8.8	29.1	0.0
3/15/1999	12.8	8.2	9.0	32.0	0.0
4/6/1999	15.2	8.7	8.2	31.7	0.0
4/22/1999	18.5	8.3	6.4	48.2	0.0
6/1/1999	StowAway	removed.			

Spring Branch Three
Water Quality Measurements - Water Year 1998

Date	Temp, °C	pH	Dissolved Oxygen (mg/l)	Conductance (µS/cm)	Salinity
12/2/1998	10.1	7.5	9.4	34.8	0.0
12/16/1998	10.8	7.6	8.4	35.2	0.0
12/30/1998	7.5	8.0	10.4	35.2	0.0
1/14/1999	7.8	7.8	9.6	37.3	0.0
1/27/1999	7.3	7.9	10.2	34.9	0.0
2/11/1999	5.7	7.7	11.2	21.4	0.0
2/24/1999	12.3	8.5	8.8	25.8	0.0
3/15/1999	14.1	9.2	8.8	29.6	0.0
4/6/1999	11.2	9.4	10.2	32.8	0.0
4/22/1999	18.3	9.1	9.2	50.0	0.0
6/1/1999	StowAway	removed.			

Spring Branch Two					
Water Quality Measurements - Water Year 1998					
Date	**Temp, °C**	**pH**	**Dissolved Oxygen (mg/l)**	**Conductance (µS/cm)**	**Salinity**
12/2/1998	10.2	7.5	9.8	32.3	0.0
12/16/1998	10.2	7.7	8.6	29.8	0.0
12/30/1998	7.2	7.9	9.6	30.1	0.0
1/14/1999	7.5	7.4	9.6	30.9	0.0
1/27/1999	5.9	8.2	10.0	28.5	0.0
2/11/1999	7.5	7.5	10.0	23.8	0.0
2/24/1999	12.5	7.9	9.4	23.4	0.0
3/15/1999	13.5	8.6	8.0	22.6	0.0
4/6/1999	13.9	9.1	9.2	20.3	0.0
4/22/1999	18.7	8.9	8.8	19.5	0.0
6/1/1999	StowAway	removed.			

Spring Branch Four					
Water Quality Measurements - Water Year 1998					
Date	**Temp, °C**	**pH**	**Dissolved Oxygen (mg/l)**	**Conductance (µS/cm)**	**Salinity**
12/2/1998	10.2	7.5	8.8	36.4	0.0
12/16/1998	8.7	7.7	8.4	37.0	0.0
12/30/1998	6.7	8.0	10.4	36.9	0.0
1/14/1999	7.2	7.9	9.0	37.2	0.0
1/27/1999	6.7	7.8	10.6	34.7	0.0
2/11/1999	6.3	7.7	9.0	25.3	0.0
2/24/1999	12.1	8.1	10.8	32.6	0.0
3/15/1999	11.7	8.2	8.0	34.7	0.0
4/6/1999	9.5	9.0	8.2	35.2	0.0
4/22/1999	17.4	8.9	8.4	38.9	0.0
6/1/1999	StowAway removed				

Dales Lake Ecological Reserve					
Water Quality Measurements - Water Year 2000					
Date	**Temp, °C**	**pH**	**Dissolved Oxygen (mg/l)**	**Conductance (µS/cm)**	**Salinity**
1/18/2001	3.3	7.1	9.6	28.2	0.0
2/1/2001	6.6	7.1	7.9	26.1	0.0
2/15/2001	7.1	8.3	8.5	26.1	0.0
3/7/2001	14.5	7.1	6.2	28.5	0.0
3/22/2001	21.5	7.8	6.3	31.7	0.0
4/5/2001	13.6	7.6	8.0	28.4	0.0
4/20/2001	12.5	7.9	10.0	22.0	0.0
5/2/2001	14.4	7.8	11.9	23.1	0.0
5/17/2001	25.5	6.8	5.5	25.9	0.0
5/31/2001	37.8	8.3	6.0	51.6	0.0

Hog Lake

Water Quality Measurements - Water Year 2000

Date	Temp, °C	pH	Dissolved Oxygen (mg/l)	Conductance (µS/cm)	Salinity
11/30/2000	10.6	7.8	7.8	72.0	0.0
12/15/2000	11.7	7.8	9.6	64.1	0.0
1/4/2001	10.8	7.5	8.2	64.2	0.0
1/18/2001	5.2	7.0	8.5	42.8	0.0
2/1/2001	7.1	7.0	8.5	42.0	0.0
2/15/2001	8.8	8.1	8.2	38.4	0.0
3/7/2001	14.7	7.7	7.3	45.9	0.0
3/22/2001	23.4	7.9	7.9	51.8	0.0
4/5/2001	15.7	7.4	6.7	49.8	0.0
4/20/2001	12.6	7.1	9.8	37.8	0.0
5/2/2001	18.0	7.5	10.2	30.7	0.0
5/17/2001	25.7	6.8	6.6	34.8	0.0
5/31/2001	32.4	7.4	8.2	59.2	0.0
6/12/2001	30.4	7.5	10.2	80.8	0.0

Hoggett					
Water Quality Measurements - Water Year 2000					
Date	**Temp, °C**	**pH**	**Dissolved Oxygen (mg/l)**	**Conductance (µS/cm)**	**Salinity**
11/30/2000	11.1	7.8	7.2	45.7	0.0
12/15/2000	11.9	8.0	9.0	36.1	0.0
1/4/2001	11.2	7.8	8.0	37.8	0.0
1/18/2001	6.3	7.2	9.0	33.8	0.0
2/1/2001	8.8	7.3	8.4	30.5	0.0
2/15/2001	9.6	8.2	7.0	33.5	0.0
3/7/2001	16.5	8.5	5.9	37.3	0.0
3/22/2001	23.3	9.0	9.6	43.8	0.0
4/5/2001	15.5	7.3	6.6	38.0	0.0
4/20/2001	13.4	7.4	8.6	34.8	0.0
5/2/2001	17.4	7.4	12.0	62.3	0.0

Sevenmile					
Water Quality Measurements - Water Year 2000					
Date	**Temp, °C**	**pH**	**Dissolved Oxygen (mg/l)**	**Conductance (µS/cm)**	**Salinity**
11/30/2000	12.0	7.9	9.0	50.2	0.0
12/15/2000	12.8	8.2	11.6	43.3	0.0
1/4/2001	12.1	8.8	11.3	47.9	0.0
1/18/2001	6.6	7.2	11.6	25.2	0.0
2/1/2001	9.8	7.8	10.1	24.9	0.0
2/15/2001	11.6	9.6	7.9	26.3	0.0
3/7/2001	19.3	9.8	8.8	28.8	0.0
3/22/2001	26.2	9.2	9.0	37.9	0.0
4/5/2001	19.2	7.6	9.4	27.9	0.0
4/20/2001	12.8	7.3	11.2	23.0	0.0
5/2/2001	19.4	8.0	9.4	28.0	0.0

Spring Branch One					
Water Quality Measurements - Water Year 2000					
Date	**Temp, °C**	**pH**	**Dissolved Oxygen (mg/l)**	**Conductance (µS/cm)**	**Salinity**
11/28/2000	10.3	7.2	8.7	55.0	0.0
12/14/2000	8.0	7.5	9.6	43.5	0.0
1/2/2001	7.0	7.1	9.8	48.0	0.0
1/16/2001	4.4	7.2	10.0	27.1	0.0
1/30/2001	6.1	7.1	8.9	23.9	0.0
2/13/2001	6.4	7.7	11.7	26.1	0.0
3/6/2001	11.9	7.0	8.0	25.8	0.0
3/20/2001	21.3	8.1	6.7	31.4	0.0
4/3/2001	15.4	7.4	9.8	45.7	0.0
4/17/2001	15.8	6.8	7.5	51.9	0.0
5/1/2001	19.3	6.5	4.2	59.9	0.0
5/17/2001	21.6	5.8	5.3	64.3	0.0
5/31/2001	24.9	9.3	7.8	88.4	0.0
6/12/2001	20.4	NA	9.1	142.8	0.1

Spring Branch Two					
Water Quality Measurements - Water Year 2000					
Date	**Temp, °C**	**pH**	**Dissolved Oxygen (mg/l)**	**Conductance (µS/cm)**	**Salinity**
11/28/2000	14.3	7.2	7.4	63.9	0.0
12/14/2000	8.1	7.5	9.2	44.3	0.0
1/2/2001	7.2	7.5	7.8	60.4	0.0
1/16/2001	3.2	6.9	8.8	32.4	0.0
1/30/2001	6.6	6.8	8.4	27.4	0.0
2/13/2001	5.8	8.0	11.8	30.6	0.0
3/6/2001	12.6	8.1	7.7	26.4	0.0
3/20/2001	19.2	7.7	6.0	30.8	0.0
4/3/2001	11.8	7.9	8.6	31.5	0.0
4/17/2001	18.3	7.0	7.2	25.3	0.0
5/1/2001	17.9	5.7	5.8	24.9	0.0
5/17/2001	22.7	7.1	5.2	25.3	0.0
5/31/2001	30.6	8.8	7.6	30.8	0.0

Spring Branch Three					
Water Quality Measurements - Water Year 2000					
Date	**Temp, °C**	**pH**	**Dissolved Oxygen (mg/l)**	**Conductance (µS/cm)**	**Salinity**
11/28/2000	14.0	7.3	9.4	54.8	0.0
12/14/2000	7.9	7.6	10.4	47.6	0.0
1/2/2001	6.8	7.6	10.4	41.4	0.0
1/16/2001	3.9	7.1	9.7	27.4	0.0
1/30/2001	6.5	7.4	9.9	22.7	0.0
2/13/2001	6.4	8.3	12.3	26.2	0.0
3/6/2001	11.4	8.1	8.8	25.8	0.0
3/20/2001	16.2	7.0	4.7	46.4	0.0
4/3/2001	11.3	8.0	10.0	92.9	0.0
4/17/2001	15.1	6.4	6.6	95.9	0.0
5/1/2001	15.5	7.0	4.9	172.4	0.1
5/17/2001	18.4	6.8	4.4	242.3	0.1

Spring Branch Four					
Water Quality Measurements - Water Year 2000					
Date	**Temp, °C**	**pH**	**Dissolved Oxygen (mg/l)**	**Conductance (µS/cm)**	**Salinity**
11/28/2000	9.3	7.2	6.8	46.5	0.0
12/14/2000	8.0	7.5	9.2	41.6	0.0
1/2/2001	6.4	7.6	9.2	41.4	0.0
1/16/2001	4.5	7.0	8.7	30.1	0.0
1/30/2001	6.1	7.1	10.3	29.5	0.0
2/13/2001	6.1	8.2	11.8	33.5	0.0
3/6/2001	10.0	8.3	5.3	31.9	0.0
3/20/2001	14.8	7.5	2.9	47.3	0.0
4/3/2001	10.3	8.2	8.0	71.4	0.0
4/17/2001	14.5	7.2	6.0	68.9	0.0
5/1/2001	17.6	7.0	6.7	78.3	0.0
5/17/2001	19.7	6.9	6.2	76.5	0.0
5/31/2001	26.6	9.1	7.8	85.9	0.0

APPENDIX 8

A SPATIAL AND TEMPORAL INVESTIGATION OF *ELEOCHARIS MACROSTACHYA* AND *ORCUTTIA TENUIS* IN TWO VERNAL POOLS

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ABSTRACT

We investigated the possible spatial structure and temporal patterns that may determine the distribution and cover of *Eleocharis macrostachya* and *Orcuttia tenuis* within two vernal pools located in Tehama County. Rock cover, soil depth to hardpan, and basin elevation were compared with *E. macrostachya,* and *O. tenuis* cover to investigate spatial structure for these plant species. Annual *E. macrostachya* and *O. tenuis* cover were compared with annual precipitation and air temperature to find temporal patterns for these plant species.

The spatial results suggest that soil depth to hardpan, may determine E. *macrostachya* distribution. Rock cover, and basin elevation appeared to have little effect on either *E. macrostachya* or *O. tenuis* distribution.

The temporal results indicate that biotic interactions, such as life history traits and competition, may affect *E. macrostachya* and *O. tenuis* distribution and density. *Orcuttia tenuis* cover is relative stable at a 1.0 m^2 scale but varies at a 0.25 m^2 scale. This variability at a micro scale could be due to variations in annual air temperatures causing a possible “shifting mosaic steady state.” *Orcuttia tenuis* life history traits are adapted for warmer temperatures.

Even though abundance is relatively stable for *O. tenuis* and *E. macrostachya* in both pools, there is significant negative correlation and spatial structure between them indicating possible competition. *Eleocharis macrostachya* may not hinder *O. tenuis* density but may dictate its distribution within a pool through a combination of abiotic and biotic features.

Key Words: vernal pools, Tehama County, *Eleocharis macrostachya, Orcuttia tenuis,* soil depth, competition, shifting mosaic steady state

Ecologists and biogeographers define populations by geographic limits of their distribution (Ricklefs 1997). The primary objectives of population studies are to describe the spatial structure and temporal changes of populations and to collect data relevant to understanding their dynamics (Begon and Mortimer 1986). Changes in distribution and density over time and space provide knowledge needed to understand the processes that regulate population size (Ricklefs 1997). These processes can be either abiotic, for instance climate, topography, and soil depth, or biotic such as competition and life history traits. Understanding these processes is essential for the conservation and protection of vernal pool plants such as *Orcuttia tenuis* (CDFG 1991, USFWS 1997, CNPS 2001, USFWS 2003).

Vernal pools provide an excellent opportunity to explore species distribution and density in relation to abiotic processes and biotic interactions. Vernal pools are isolated wetlands with unique morphologies that fluctuated seasonally between periods of inundation and desiccation (Keeley and Zedler 1998). They support high levels of endemic species, both annual and perennials, and are considered a complex ecosystem (Holland and Dains 1990). The first reference to vernal pools and their distinctive plant associations can be attributed to Jepson (1925) and the large number of endemic species found within vernal pools to Hoover (1937). There are approximately 100 plants species commonly found in vernal pools, of which 90% are native and 55% endemic to California (Holland and Jain 1988; Keeler-Wolfe et al. 1998). An example of a plant species that is native and endemic to California vernal pools is *O. tenuis,* a small, loosely tufted, blue-green annual grass (Reeder 1993).

Vernal pools occupy areas of conflicting land use and have suffered extensive habitat destruction in the last century through urbanization and conversion to agriculture. California has already lost somewhere between 93 and 97% of its vernal pools (Holland 1978). The continued destruction of vernal pool habitat has led to the designation of this unique ecosystem as "critical habitat" in 2003 by the United States Fish and Wildlife Service (USFWS). Due to the high level of endemism and the loss of critical habitat, there are a total of 15 special status plants found in vernal pools, ten are endangered and five are threatened. *Orcuttia tenuis* is a Federal and State of California special status vernal pool plant species (CDFG 1991; USFWS 1997).

The greatest threat to *O. tenuis* is altered hydrology (USFWS 2003). Alterations in hydrology and can affect both abiotic processes and biotic interactions for vernal pool plants. Shorter inundation periods could prevent *O. tenuis* seeds from dispersing and germinating (Corbin and Schoolcraft 1989). Seeds are distributed within the pools by floating as the pools fill in the fall or winter (Crampton 1976) and they require enough standing water to allow the growth of a soil fungus over the seed in order to break dormancy (Corbin and Schoolcraft 1989). These adaptations insure that *O. tenuis* will germinate only when sufficient water is present in the pool to complete its lifecycle. Likewise, longer inundation periods could also have detrimental affect by promoting the growth of a perennial marsh species, *E. macrostachya* (Crampton 1959; Stone et al. 1988; Corbin and Schoolcraft 1989; Bauder 1989). Stone et al. (1988) reported that *E. macrostachya* competition along with hydrological modification might have caused the loss of one *O. tenuis* population in Shasta County.

Inundation periods are affected by basin morphology (Brooks and Hayashi 2002), basin depth (Zedler 1987, Bauder 1987, 2000), soil (Griggs 1981, Holland and Dains 1990, Williamson et al. 2004), and yearly precipitation (Zedler 1987, Bauder 2000). The shape and size of a basin determines the amount of subsurface water-flow into the pools and deeper basins have longer inundation periods (Keeley and Zedler 1998). In general, soils act as reservoirs for the water and moisture retention varies with soil depth (Miller and Donahue 1990). Vernal pool basins are precipitation filled and the amount and distribution of rain affects the inundation periods (Bauder 2000, 2005). Changes in any of these abiotic factors could affect the inundation period of a pool, hence the density and distribution of *O. tenuis*.

There is little information on the distribution of vernal pool plant species within an individual pool in relation to abiotic processes (basin morphology, basin elevation, and soil depth to hardpan) and biotic interactions (competition and life history traits). The purpose of this study is to gain information on the spatial structure and temporal patterns that affect *E. macrostachya* and *O. tenuis* distribution and density within individual vernal pools. The results will guide management actions to maintain populations of *O. tenuis* through the identification of critical habitat preferences, and possible competition with *E. macrostachya*.

METHODS

Introduction

We investigated cover and distribution of *E. macrostachya* and *O. tenuis* in two large deep vernal pools located in eastern Tehama County, California. This study is divided into two parts: spatial and temporal. The spatial data collected included measurements for basin elevation, morphology, and soil depth to hardpan, along with relative cover estimates for rock, *E. macrostachya,* and *O. tenuis* for both vernal pools. The temporal data included absolute cover estimates for *E. macrostachya,* and *O. tenuis* (Lis and Eggeman 2000) and historic climate date.

Study Area

Two large deep northern volcanic vernal pools were surveyed in the Northeastern Sacramento Valley Vernal Pool Region (Keeler-Wolfe et al. 1998). The first pool sampled, Sevenmile Lake (7-Mile) is owned and managed by the Bureau of Land Management (BLM) and is located approximately seven miles northeast of Red Bluff on Highway 36 (Fig. 1). Sevenmile

Lake is approximately 2.3 acres. The second pool sampled is Spring Branch 2 (SB2), is also owned by BLM. This pool is located off a dirt road called Spring Branch Road and is approximately 3.32 acres in size (Fig. 1).

Data Collection

Spatial Data

All data points were recorded with a Trimble GeoExplorer 3 GPS unit, differentially corrected and exported to a resident ArcGIS shapefile format.

Basin Morphology. The perimeter of each pool was walked with a Trimble GPS unit. The perimeter of the pool was determined by the lack of common vernal pool indictor species (i.e. *Eryngium castrense,*and *Lasthenia fremontii)*

Basin Elevation. A laser level (Topcon RL-H3C 980' Diameter- Servo Leveling) was used to map the basin elevation of the vernal pool basins. Line transects were placed every 10 m, running in a general east to west pattern through the vernal pool basin and elevation points were collected every 5 m along each transect. A total of 253 elevation points were collected along 10 transects for 7-Mile and 268 elevation points were collected along 16 transects for SB2. Additional elevation points were also collected in the upland mosaic to create a more accurate physiographic map. All elevation data for both pools were collected in fall 2005.

Relative Cover Estimates. Rock, *E. macrostachya* and *O. tenuis* cover were estimated every 5 meters along the transects within the basins. Cover was determined by using two 0.5 m^2 quadrats placed side by side at each elevation point, and was read as one meter squared. A modified cover class system was created and used to quantify cover estimates in this study (Table 1). A total of 160 1 m^2 quadrats were read for 7-Mile in October 2005 and 300 1 m^2 quadrats were read for SB2 in July of 2006.

Soil Depth to Hardpan. The measurable depth of soil to hardpan was calculated using a soil probe at the same location and time as the vegetation quadrats within the basin. The soil probe was pushed into the ground, usually between 3 and 7 times, within each 1m quadrat. Each time the soil probe was pushed into the basin floor; the ground surface level was marked and measured to the end of the probe. The maximum soil depth was recorded in centimeters for each vegetation sampling point.

Temporal Data

Absolute Cover Estimates. Permanent transects were established in 1999 from a stake (pivotal point) driven into a central area of a pool. Transects all begin from this point and traverse to the pool margin (Lis and Eggeman 1999). Sevenmile Lake has four transects and SB2 has two transects. A system of quadrats located on the permanent transects was used and marked with four permanent stakes. At each stake, four quadrats (0.25 m^2) were laid out, and the absolute cover of *O. tenuis* and *E. macrostachya* measured. Data were collected in the years 1999, 2000, 2001, 2004, and 2006.

Climate Data. The mean maximum monthly air temperature and mean monthly precipitation data was queried from the California Department of Water Resources (DWR) (http://cdec.water.ca.gov/queryTools.html) and Western Regional Climate Data Center (http://www.wrcc.dri.edu/). The data station used was Red Bluff Diversion Dam (RBD) for both queries.

Data Analysis

Spatial.

Basin Morphology. The area and perimeter of each pool was automatically calculated during the creation of the polygon shapefile. The shape value was calculated using the following equation: perimeter/(3.54 * sqrt(area)), where the value of 1.0 is equal to a circle, larger for a distended shape (Longley et al. 2001).

Basin Elevation and Soil Depth to Hardpan. The elevation points were interpolated into a Digital Elevation Model (DEM), using Hutchinson (1989) Topo splining routine implemented in ArcGIS (ESRI 2005), which interpolates a hydrologically correct surface from point, line, and polygon data. A two-group t-test was performed to determine the significant difference between means for soil depth to hardpan and basin elevation between the two pools.

Cover Estimates. Spatial dependence was investigated several ways to understand the interactions at various scales and to anticipate any issues with conducting standard normal linear statistics. Spatial autocorrelation, however, does not inflate the explained variance term (in r or r^2 relationship analysis) but can lead to inflated (artificially large) sample sizes due to non-independent samples, which may influence significance tests (P-values) and result in the inclusion of non-significant predictor variables (Legendre and Fortin 1989). A global Moran's I (Legendre and Fortin 1989) was calculated for *O. tenuis* and *E. macrostachya*. In addition to global spatial correlation, local correlation was examined using Moran's I correlograms and local indicators of spatial association (LISA) maps (Anselin 1995) for E. *macrostachya* and *O. tenuis* in both pools.

After spatial autocorrelation was examined, the point shapefiles representing cover estimates and soil data for each site were buffered by 1 m to create a 1 m diameter zone for each point and zonal statistics were calculated from the DEM. The zonal statistical result (the mean basin elevation) was added to the field data (soil depth to hardpan and cover estimates) to create a data analysis matrix for each pool. All statistical tests were performed in Systat 8.03 (1998) with a P-value of ≤ 0.05.

Since the cover estimates are ranked data, a Spearman's rank correlation matrix was used to determine if there is a significant correlation between *O. tenuis* and *E. macrostachya* with rock, soil depth, and elevation (Sokal and Rohlf 1981). Next, linear regressions were calculated in order to determine variable predictability.

Temporal

Absolute Cover Estimates. Analysis of absolute cover estimates was conducted on two scales. The first scale was at the 0.25 m^2 level, each of the four quadrats per sampling point were individually analyzed to examine micro-changes in distribution within the pool. The second scale was at 1.0 m^2 level, each of the four quadrats per sampling point were averaged to aggregate the data into one sampling point value to examine changes at the whole pool level.

A one-way Analysis of Variance (ANOVA) was used at both scales (0.25 m^2 and 1.0 m^2) to determine if there was a significance difference in mean absolute cover estimates for *O. tenuis* and *E. macrostachya* over sampling years. In addition, a Boneferroni post-hoc comparison was used to find out which years are significantly different from each other and which were not.

Climate Data. The absolute cover data and air temperature and precipitation data were combined into a data matrix and statistical tests were performed in Systat 8.03 (1998), with a P-value of ≤ 0.05. A Pearson's correlation matrix was created to significantly test the relationship between air temperature and precipitation with *O. tenuis* and *E. macrostachya*. A Pearson's correlation matrix was used instead of its nonparametric counterpart Spearman's coefficient of rank correlation because the absolute cover estimates in the temporal section of this study are not ranked data, but rather actual cover estimates (Sokal and Rohlf 1981). Data were checked for normality before analysis. Next, linear regressions were used to determine if air temperature and precipitation are significant predictor variables.

RESULTS AND DISCUSSION

Spatial Results

Basin Morphology

The area, perimeter, and shape were calculated for each pool (Table 2). Spring Branch 2 pool is the larger pool with a distended shape that could be caused by an artificial dirt dam on the southwest side of the pool. Artificial dirt dams prolong inundation, which *Orcuttia* benefits from because they provide more area suitable for *Orcuttia* growth (Griggs 1974).

Basin Elevation and Soil Depth to Hardpan

In addition to SB2 being larger than 7-Mile, it is also deeper with less soil. A t-test determined a significant difference between means for soil depth to hardpan (Fig. 2; P = 0.002) and basin elevation (Fig. 2; P = 0.000) between the two pools. Since the study pools are morphologically different, *O. tenuis* and *E. macrostachya* distribution and cover may vary between pools due to microhabitat differences.

Relative Cover Estimates.

One of the larger goals of this study was to determine if there is significant spatial structure for *O. tenuis* and *E. macrostachya* within the study pools. The value for Moran's I for global spatial autocorrelation indicates that *O. tenuis* and *E. macrostachya* have spatial structure and are significantly clustered in both pools (P = 0.01).

A local Moran's I correlogram (Fig. 3) shows that *O. tenuis* and *E. macrostachya* are both significantly clustered within a small distance. The spatial autocorrelation pattern (size of clusters) for *E. macrostachya* is different, and *O. tenuis* is similar, between study pools. This could be due to the difference in abiotic features of the study pools, which can be seen in local indicator of spatial association (LISA) maps (Figs. 4 and 5). These maps show the location of significant clusters of *E. macrostachya* and *O. tenuis* within the pools in relation to rock cover, soil depth, and basin elevations.

In addition to Moran's I determining the spatial structure of *O. tenuis* and *E. macrostachya,* a Spearman's rank correlation matrix determined there is significant negative correlation (7-Mile P = 0.00; SB2 P = 0.00) between them, which can be seen by the differing locations of the significant clusters of each species in the LISA maps (Figs. 4 and 5). A linear regression found this negative significant correlation between *O. tenuis* and *E. macrostachya* in both pools to be a significant but a weak predictor for cover (7-Mile – adjusted r^2 = 0.18, P = 0.00 and SB2 – adjusted r^2 = 0.13, P = 0.00). This negative biotic relationship between these two plants species may indicate possible competition. This result is supported by observations from Stone et al. (1988) that competition with *E. macrostachya* rather than inundation directly limits the distribution of *O. tenuis*.

The next objective was to determine which abiotic features (soil depth, rock cover, and basin elevation) might be driving the significant spatial relationship between *O. tenuis* and *E. macrostachya*. A Spearman's rank correlation matrix determined that the 7-Mile population of *O. tenuis* is significantly negatively correlated (P = 0.00) with basin elevation. A 7-Mile LISA map of *O. tenuis* cover and basin elevation shows that the significant clusters of *O. tenuis* are found in shallower depths of the pool (Fig. 4). A linear regression found basin elevation to be a weak but significant predicting variable (adjusted r^2 = 0.18, P = 0.00). This result was unexpected and a possible explanation could be that *O. tenuis* cover estimates were low due to the late seasonally sampling, however, the conditions of the plants when surveyed were approximately the same for both pools. Also, other researchers (Corbin and Schoolcraft 1989) have stated the *O. tenuis* does not desiccate and shatter until the falls rains.

A Spearman's rank correlation matrix determined that the SB2 population of *O. tenuis* has no significant correlation (P = 0.24) with basin elevation. The lack of correlation between *O. tenuis* cover and basin elevation can be seen in the location of the significant clusters of *O. tenuis* on the SB2 LISA map (Fig. 5). The significant clusters of *O. tenuis* are found in medium depths of in SB2. This result suggests basin elevation does not affect *O. tenuis* density and distribution. Like 7-Mile, this result was also unexpected, however it could have been impacted by the loss of elevation data caused by early fall rains in 2005. If this is true, the impact was slight, because the loss of elevation sample points had a little effect on the interpolation accuracy of the DEM.

The lack of positive correlations between *O. tenuis* cover and basin elevation were unexpected because research indicates *O. tenuis* prefers deep portions of a pool (Corbin and Schoolcraft 1989), and this study showed that significant *O. tenuis* clusters were located in the shallow and medium depths of the pools. This could be due to the large size of the study pools, which tend to have longer inundation periods (Brooks and Hayashi 2002). The deep portions of the study pools may have an exceptionally long inundation period that pushes *O. tenuis* to survive in the shallow and medium depths of the pool. These shallower depths must have an inundation period long enough to meet the threshold of *O. tenuis* (Holland 1987). An inundation threshold insures seeds receive enough standing water to allow the growth of a soil fungus over the seed in order to break dormancy (Reeder 1982). This result may indicate that inundation period not depth affect *O. tenuis* abundance and distribution.

A Spearman's rank correlation matrix found that *O. tenuis* has a significant positive correlation (7-Mile $P = 0.00$; SB2 $P = 0.00$) with rock and no significant correlation (7-Mile $P = 0.69$; SB2 $P = 0.53$) with soil depth to hardpan in both study pools. For SB2, a linear regression analysis found rock to be a weak but significant predicating variable with *E. macrostachya* being the strongest (adjusted $r^2 = .18$, $P = 0.00$). A linear regression analysis did not find rock cover to be a significant predicting variable. This result may suggest that *O. tenuis* can thrive in rocky areas within a pool, but does not necessarily prefer these areas. Rock cover may shape *O. tenuis* distribution within a pool by allowing more available microhabitat for *O. tenuis* that may not be suitable for other vernal pool plant species. Soil depth to hardpan appears to have little to no affect on *O. tenuis* distribution and abundance. Research on soil requirements for *O. tenuis* is not currently available indicating a need for more information on the subject.

A Spearman's rank correlation matrix found *E. macrostachya* to have no significant correlations (7-Mile $P = 0.89$; SB2 $P = 0.68$) with basin elevation in both study pools. The locations of significant *E. macrostachya* clusters in relation to elevation show this lack of correlation (Figs. 4 and 5). In these LISA maps, it appears the significant clusters of *E. macrostachya* are found in medium depths for both study pools. These results suggest that the inundation requirements for this plant are being met at this topographic gradient, which are standing water no deeper than 1 m with occasionally fluctuations down to saturated conditions throughout the growing season (USDA 2006). The deepest portions of both study pools are greater then 1 m, which supports the idea that *E. macrostachya* cover inundation depth is more important that inundation period.

A Spearman's rank correlation matrix found *E. macrostachya* has a significant negative correlation ($P = 0.00$) with rock cover and significant positive correlation ($P = 0.00$)

with soil in SB2. A significant negative correlation between soil and rock cover was found, indicating that rock cover probably has little affect on *E. macrostachya* and was eliminated from the linear regression (adjusted $r^2 = 0.23$, $P = 0.00$), which found soil depth to be a significant but weak predicting variable for *E. macrostachya* cover. In 7-Mile, a Spearman's rank correlation matrix found *E. macrostachya* has only a significant positive correlation ($P = 0.00$) with soil depth in 7-Mile. This positive correlation can be seen in a LISA map of each pool, representing the significant clusters of *E. macrostachya* in relation to soil depth to hardpan (Figs 4 and 5). These results suggest that soil depth to hardpan may determine *E. macrostachya* abundance and distribution in both study pools.

The positive correlation between *E. macrostachya* and soil depth to hardpan, may explain why *E. macrostachya* clusters are larger in SB2 compared to 7-Mile (Figs. 3 and 4). Spring Branch 2 pool has a greater mean for soil depth to hardpan compared to 7-Mile (Fig. 2), indicating soil depth may determine cluster size. The clusters of *O. tenuis* are similar in size for both pools (Figs. 3 and 4), which is expected since there is no significant correlation between *O. tenuis* and soil depth. Soil depth may form the significant spatial structure of *E. macrostachya* and *O. tenuis* in both study pools.

Temporal Results

Absolute Cover Estimates.

A one-way ANOVA found a significant difference in mean absolute cover estimates for *O. tenuis* and *E. macrostachya* over sampling years for 7-Mile, at the scale of 0.25 m^2 (*O. tenuis* $P = 0.00$; *E. macrostachya* $P = 0.01$). The mean absolute cover of the 7-Miile population of *O. tenuis* was significantly different between the years [1999 and 2001 ($P = 0.01$)], and [2001 and 2006 ($P = 0.01$)], with the year 2001 having the highest mean (Fig. 6). The mean absolute cover of the 7-Mile population of *E. macrostachya* was significantly different between the years [1999 and 2003 ($P = 0.01$)], and [2000 and 2003 ($P = 0.03$)], with the year 1999 having the highest mean and 2003 being the lowest (Fig. 6).

Orcuttia tenuis cover also varied at this micro scale (0.25 m^2) in SB2. A one-way ANOVA found a significant difference ($P = 0.01$) in mean absolute cover estimates for *O. tenuis* over sampling years for SB2, at the scale of 0.25 m^2. The mean absolute cover of *O. tenuis* was significantly different between the years [1999 and 2000 ($P = 0.03$)], [2000 and 2003 ($P = 0.01$)], and [2000 and 2006 ($P = 0.02$)], with the year 2000 having the highest mean (Fig. 7). There was no significance difference ($P = 0.96$) in mean absolute cover estimates at a micro scale (0.25 m^2) for *E. macrostachya* over sampling in years in SB2 (Fig. 7).

These results indicate that *O. tenuis* mean absolute cover at a 0.25 m^2 scale changes over time. Sevenmile Lake and SB2 have different years for high cover estimates of *O. tenuis,* which could be caused morphology differences between the study pools.

Since, *E. macrostachya* cover only varied in 7-Mile, these results indicate *E. macrostachya* may be relatively stable over time. *Eleocharis macrostachya* cover may have varied over sampling years in 7-Mile and not SB2 because of soil depth differences between the pools. Sevenmile Lake has a higher mean for soil depth to hardpan compared to SB2 (Fig. 2), which may allow for more variability in abundance and distribution for *E. macrostachya.*

A one-way ANOVA found no significant difference in mean absolute cover estimates for *O. tenuis* and *E. macrostachya* over sampling years for both study pools at an aggregated 1.0 m^2 scale. This result was puzzling since *O. tenuis* cover varied at a 0.25 m^2 scale and unexpected because research has shown that climate (Crampton 1959; Griggs 1976, 1981, Griggs and Jain

1983) and possible competition between *E. macrostachya* and *O. tenuis* (Crampton 1959, Stone et al. 1989) limited *O. tenuis* abundance. These results suggest that *E. macrostachya* and *O. tenuis* cover is relatively stable as a whole pool population in both study pools.

Even though *O. tenuis* cover is relatively stable at a 1.0 m^2 scale, changes on a micro scale (0.25 m^2) indicate a possible "shifting mosaic steady state." Bormann and Likens (1979) state "shifting mosaic steady state" is the result of yearly disturbances changing the location for a specific habitat, however, even though the actual locations change, the amount of each habitat over a large area may remain somewhat constant (steady state). Yearly disturbances that may affect *O. tenuis* cover are precipitation and air temperature.

<u>Climate Data</u>

Eleocharis macrostachya and *O. tenuis* mean absolute cover, at a 0.25 m^2 scale changes over time, which could be due to annual difference in climate. A Pearson's correlation matrix determined that there is a significant positive correlation (P = 0.02) between air temperature and *O. tenuis*, and a significant negative correlation (P = 0.02) between precipitation and *E. macrostachya* at the 0.25 m^2 scale within 7-Mile. A linear regression for *O. tenuis* mean absolute cover (adjusted r^2 = 0.03) found precipitation to be a negative predicting variable (P = 0.01) and air temperature a positive predicting variable (P = 0.00), with air temperature as the stronger predictor. For *E. macrostachya* mean absolute cover, a linear regression (adjusted r^2 = 0.02, P = 0.02) determined precipitation was the only significant predicting variable.

In SB2, a Pearson's correlation matrix found a significant positive correlation (P = 0.05) between *O. tenuis* and air temperature. A linear regression (adjusted r^2 = 0.02, P = 0.05) determined that air temperature was a significant but a weak predictor for *O. tenuis* cover. No climate correlations were found for *E. macrostachya* cover in SB2. This result was anticipated since *E. macrostachya* cover did not vary over time in SB2.

These results suggest that *O. tenuis* cover is not affected by the amount of rain per year, which are unexpected based on previous studies suggesting there is relationship between precipitation and *O. tenuis* (Crampton 1959; Griggs 1974, 1981, Griggs and Jain 1983). The lack of (SB2) and negative (7-Mile) correlation between *O. tenuis* and precipitation could be related to its lack of (SB2) and negative (7-Mile) correlation with basin elevation, since basin elevation (Zedler 1987, Bauder 1987, 2000) and yearly precipitation (Zedler 1987, Bauder 2000) are connected to the inundation period of a vernal pool. The study pools are large and deep which promote long inundation periods (Brooks and Hayashi 2002). These longer inundation periods may meet the inundation threshold for *O. tenuis* seeds (Reeder 1965, 1982, Holland 1987) across the topographic gradient, indicating the duration not the depth of inundation determines *O. tenuis* distribution.

Orcuttia tenuis cover and distribution may be determined by air temperature. The positive correlation between *O. tenuis* cover and air temperature suggests that cover will be higher in warmer years. This could possibly be due to *O. tenuis* switching from a C-3 plant to a C-4 plant in the late spring (Corbin and Schoolcraft 1989). This switch to C-4 photosynthesis allows *O. tenuis* to adapt to high intensive sunlight and use water more efficiently, therefore performing better under warmer temperatures. If the spring season stays cool, switching to C-4 photosynthesis would be disadvantageous because they consume more adenosine triphosphate (ATP) than C-3 plants; costing C-4 plants a great amount of energy (Campbell 1993). This information may also explain why *O. tenuis* significant clusters were not found in the deep parts of the pools. If a winter season lasts into late spring, and the lack of sunlight and increase precipitation will hinder the C-4 photosynthesis pathway of *O. tenuis,* especially in deep parts of the pool that are inundated longer. In this situation, *O. tenuis* cover will be higher in shallower depths causing a "shifting mosaic steady state" (Bormann and Likens 1979).

CONCLUSIONS

It is important to understand the abiotic and biotic features that limit the distribution and abundance of a species, especially for species and habitats that have a special conservation status, such as *O. tenuis* and vernal pools.

Eleocharis macrostachya and *O. tenuis* abundance is relatively stable in both pools at a 1 m^2 scale. *Orcuttia tenuis* cover varied over time in both pools at the 0.25 m^2 scale, which could be due to a combination of biotic and abiotic features. It is important to emphasize that although cover changes are occurring at a micro scale, and these changes are not reflected when the data are aggregated at a larger scale of 1.0 m^2, indicating a possible "shifting mosaic steady state" (Bormann and Likens 1979). This shifting mosaic steady state for *O. tenuis* may be caused by annual changes in air temperatures by allowing *O. tenuis* to thrive is some areas of the pool better than others in different years due to its life history traits.

Acknowledging that *O. tenuis* cover and distribution only changed at a micro-scale but not a large scale in these pools may signify that cover is not the only variable that needs to be measured for monitoring the health of *O. tenuis* populations. Vigor may also need to be monitored by measuring plant size and reproductive attributes. Tracking vigor over time could give better insight on the relationship between *O. tenuis* and air temperature.

Even though cover is relatively stable in both pools for *O. tenuis* and *E. macrostachya* at a 1.0 m scale, there is both a significant negative and spatial correlation between the two species. *Orcuttia tenuis* is not found in the same areas of a pool as *E. macrostachya.* This could be due to competition between the two plant species. Crampton (1959) found that *O. tenuis* occurs mostly in the absence of other vegetation, suggesting that *O. tenuis* is a weak or poor competitor that prefers low competition areas (Stone et al. 1988).

The results of this study show possible competition between *O. tenuis* and *E. macrostachya* however temporal data show no significant changes in cover over time for both plant species at a $1m^2$ scale. If competition is occurring between the two plant species, than *E. macrostachya* is not out-competing *O. tenuis* in all available microhabitats. Competition along an environmental stress gradient causes superior competitors to dominate benign microhabitats and poor competitors to be restricted to environmentally stressful microhabitats (Grace and Wetzel 1981, Bertness and Ellison 1987, Pennings et al. 2005). Based on the abiotic factors examined in this study, this could be true for *E. macrostachya* and *O. tenuis.*

The competition between *E. macrostachya* and *O. tenuis* is not limiting the density of *O. tenuis* but rather dictating its distribution within a pool. The results of the present data show that depth of soil to hardpan may drive *E. macrostachya* density and distribution. *Eleocharis macrostachya* can only thrive in pool areas with deep soils (soil depth > 6 cm), a benign microhabitat for a vernal pool. *Eleocharis macrostachya* is perennial species that can prevent *O. tenuis* from establishing in the areas with deep soil. Since *O. tenuis* cannot establish in areas with *E. macrostachya,* it is forced to live in the rocky areas of a pool that have shallow soils, a stressful microhabitat for a vernal pool.

Depth of soil to hardpan determines *E. macrostachya* distribution, and *E. macrostachya* drives *O. tenuis* distribution. The implication of this result for *O. tenuis* conservation strategies is to monitor sedimentation within the pools. If pools fill with sediment, it will increase the available habitat for *E. macrostachya;* hence limit available habitat for *O. tenuis.* Management activities should include erosion control by monitoring grazing activities and anthropogenic disturbances that may increase erosion in the surrounding uplands. Further vernal pool research should include examining the texture, and chemistry of the soil within a pool. In addition, transplant experiments are needed to show that *O. tenuis* will thrive in areas of high soil depth in the absence of *E. macrostachya.*

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Table 1. Estimate relative cover classes.

Class	Percent Cover
0	Absent
1	1-10%
2	10-20%
3	20-30%
4	30-40%
5	40-50%
6	50-60%
7	60-70%
8	70-80%
9	80-90%
10	90-100%

Table 2. Comparison of basin morphology for each pool.

Sevenmile Lake	Spring Branch 2 Pool
Area = 9460 m^2	Area = 13838 m^2
Perimeter = 479 m	Perimeter = 440 m
Shape = 1.15	Shape = 1.27

FIGURE LEGENDS

Fig. 1. Location of study pools in eastern Tehama County.

Fig. 2. A correlogram for *O. tenuis* and *E. macrostachya* in Sevenmile Lake and Spring Branch 2 Pool.

Fig. 3. A LISA map of significant *O. tenuis, E. macrostachya* clusters in Sevenmile Lake in relation to basin elevation and soil depth. *Orcuttia tenuis* has a significant negative correlation with *E. macrostachya* and basin elevation. *Eleocharis macrostachya* has a significant positive correlation with soil depth to hardpan.

Fig. 4. A LISA map of significant *O. tenuis*, *E. macrostachya* clusters in Spring Branch 2 Pool in relation to basin elevation and soil depth. *Orcuttia tenuis* has a significant negative correlation with *E. macrostachya* and no correlation with basin elevation. *Eleocharis macrostachya* has a significant positive correlation with soil depth to hardpan.

Fig. 5. The mean absolute cover of *O. tenuis* and *E. macrostachya* (0.25 m^2) in Sevenmile Lake and over sampling years.

Fig. 6. The mean absolute cover of *O. tenuis* and *E. macrostachya* (0.25 m^2) in Spring Branch 2 over sampling years.

Fig. 1.

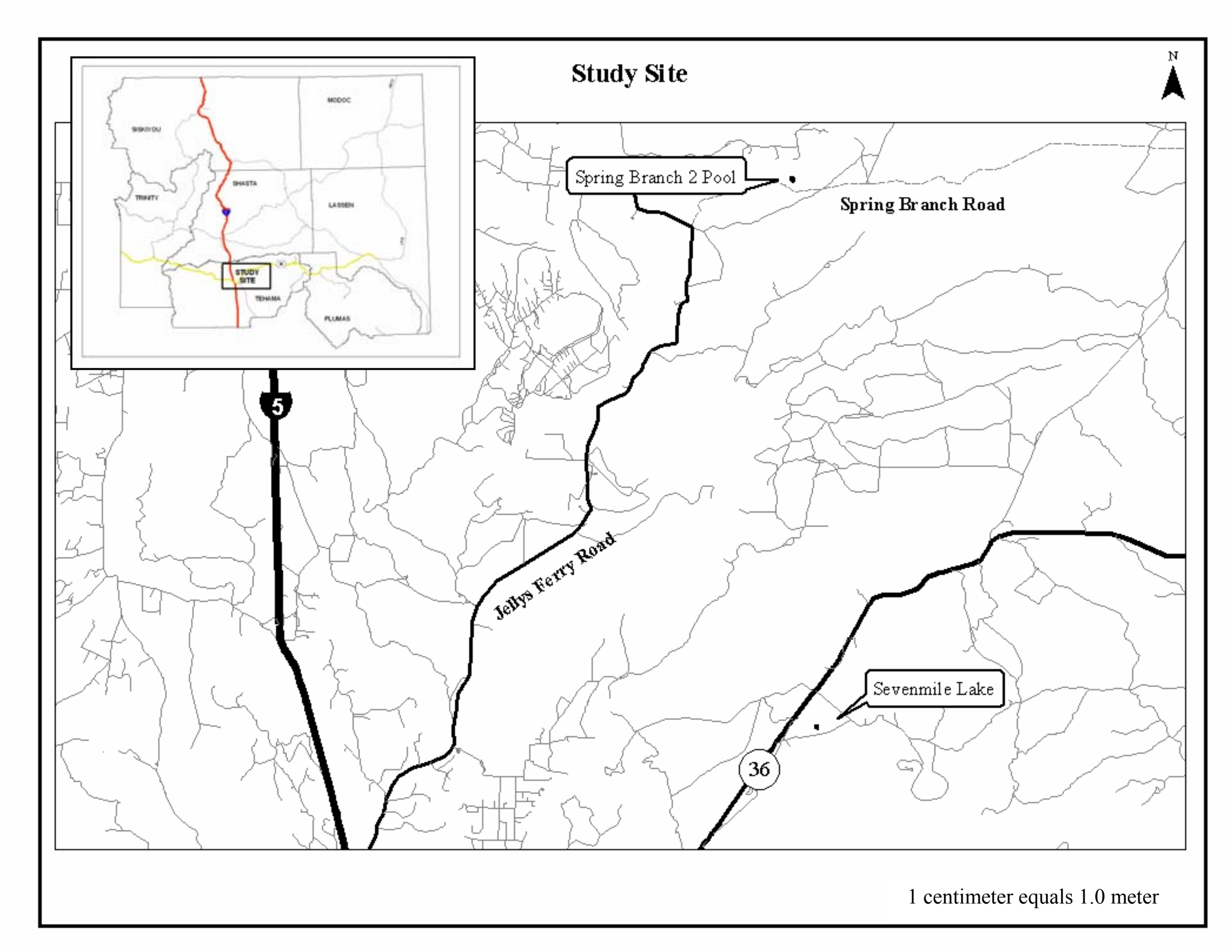
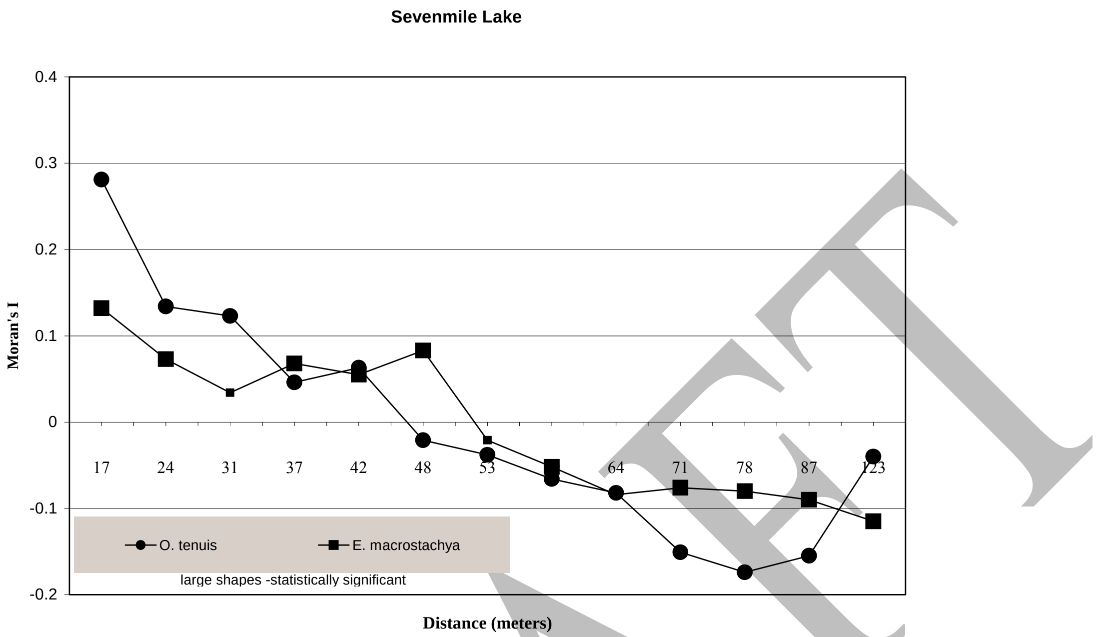

Study Site
N
Spring Branch 2 Pool
Spring Branch Road
Jellys Ferry Road
5
Sevenmile Lake
36
1 centimeter equals 1.0 meter

Fig 2.


Sevenmile Lake
0.4
0.3
0.2
0.1
0
-0.1
-0.2
Moran's I
17
24
31
37
42
48
53
64
71
78
87
123
O. tenuis
E. macrostachya
large shapes -statistically significant
Distance (meters)

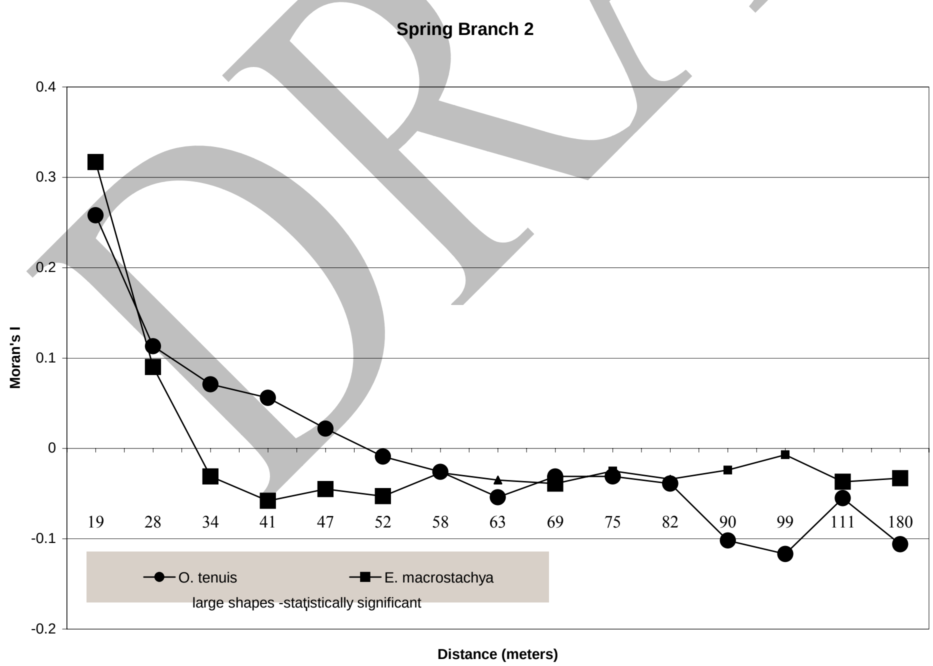
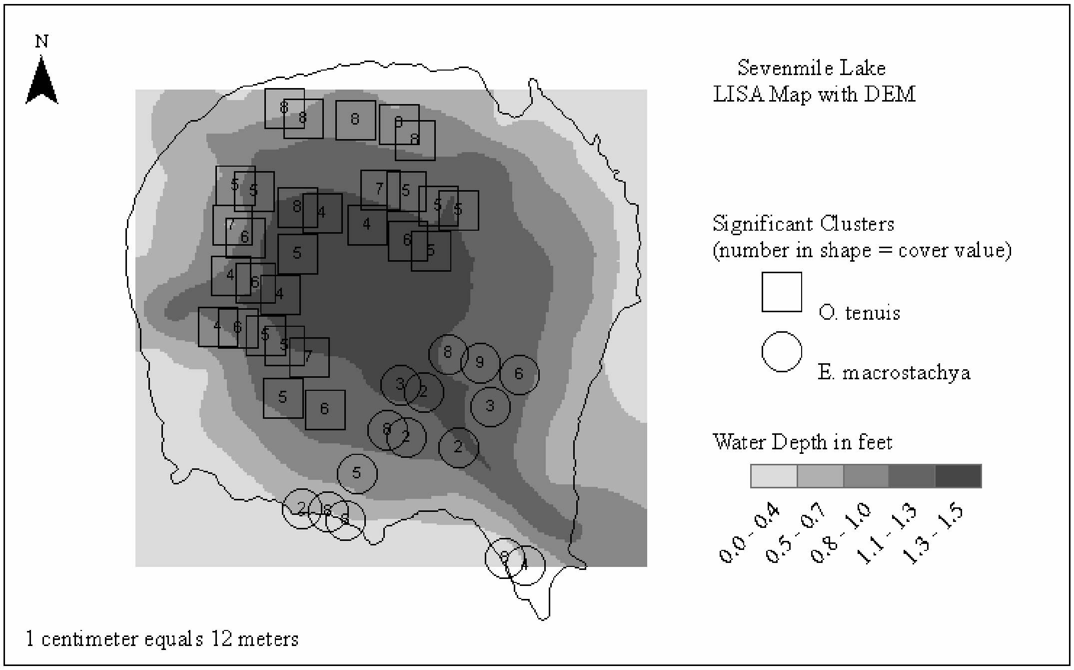

Spring Branch 2
0.4
0.3
0.2
0.1
0
-0.1
-0.2
Moran's I
19
28
34
41
47
52
58
63
69
75
82
90
99
111
180
O. tenuis
E. macrostachya
large shapes -statistically significant
Distance (meters)

Fig. 3.


N
Sevenmile Lake
LISA Map with DEM
Significant Clusters
(number in shape = cover value)
O. tenuis
E. macrostachya
Water Depth in feet
0.0 - 0.4
0.5 - 0.7
0.8 - 1.0
1.1 - 1.3
1.3 - 1.5
1 centimeter equals 12 meters

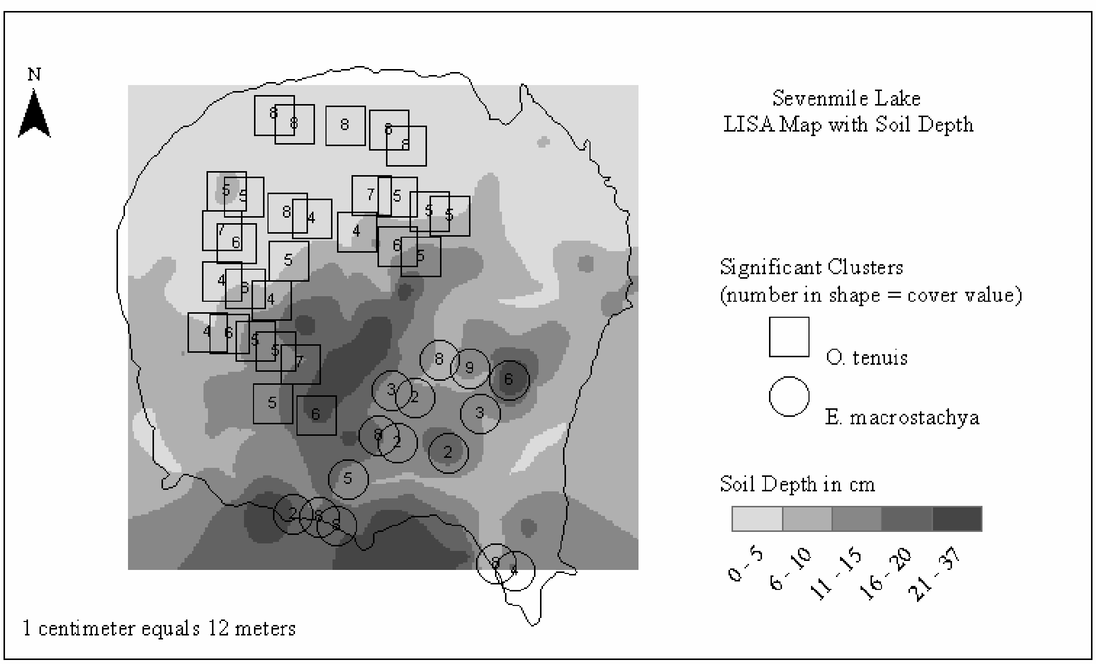

N
Sevenmile Lake
LISA Map with Soil Depth
Significant Clusters
(number in shape = cover value)
O. tenuis
E. macrostachya
Soil Depth in cm
0 - 5
6 - 10
11 - 15
16 - 20
21 - 37
1 centimeter equals 12 meters

Fig. 4.

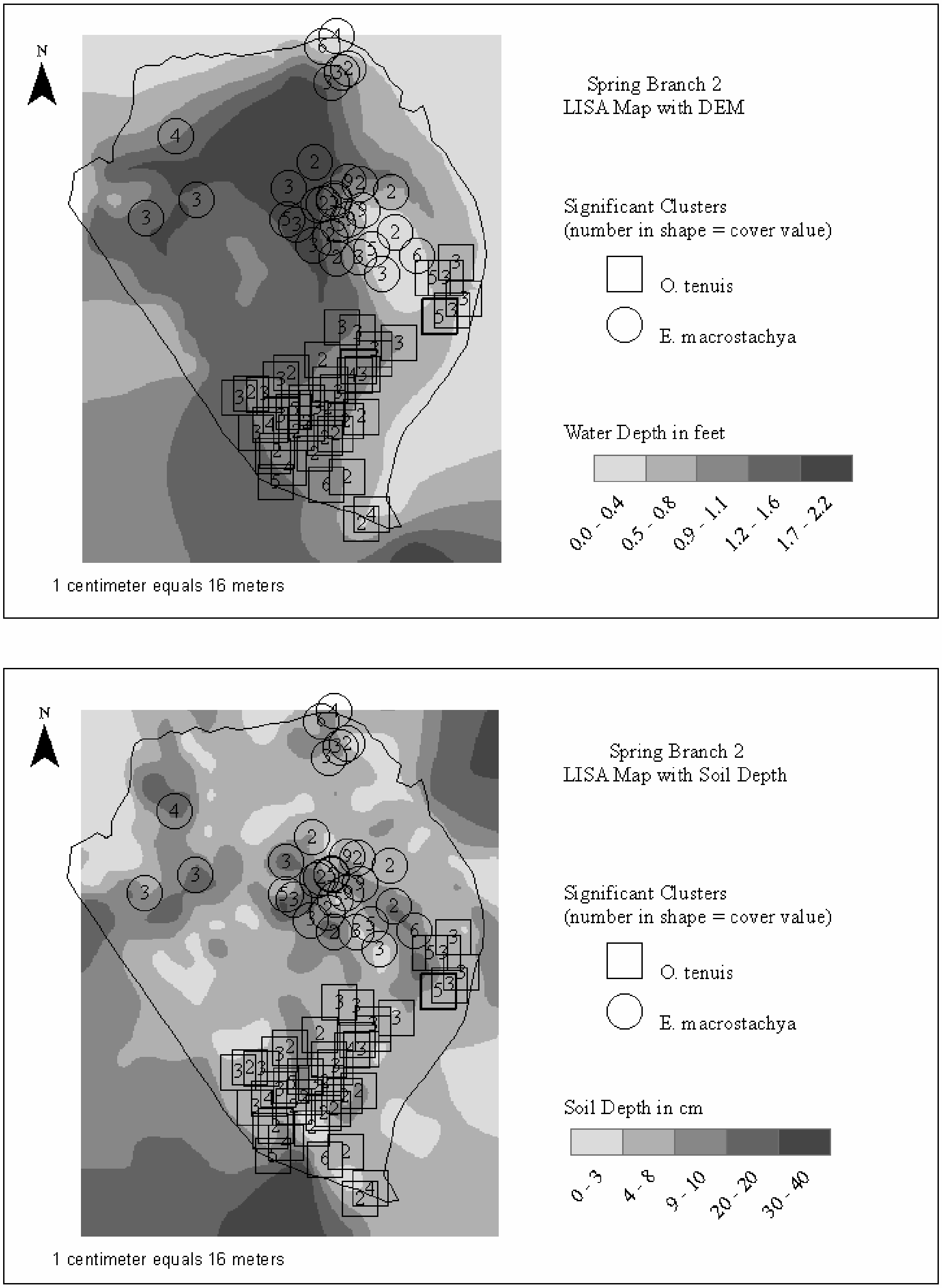
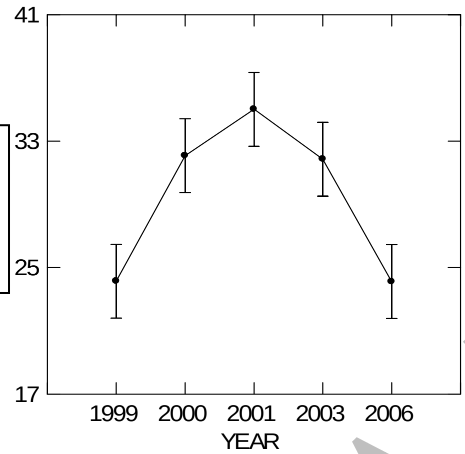

N
Spring Branch 2
LISA Map with DEM
Significant Clusters
(number in shape = cover value)
O. tenuis
E. macrostachya
Water Depth in feet
0.0 - 0.4
0.5 - 0.8
0.9 - 1.1
1.2 - 1.6
1.7 - 2.2
1 centimeter equals 16 meters
N
Spring Branch 2
LISA Map with Soil Depth
Significant Clusters
(number in shape = cover value)
O. tenuis
E. macrostachya
Soil Depth in cm
0 - 3
4 - 8
9 - 10
20 - 20
30 - 40
1 centimeter equals 16 meters

Fig 5.

Sevenmile Lake

Orcuttia
Absolute Cover



Sevenmile Lake

Eleocharis
Absolute Cover

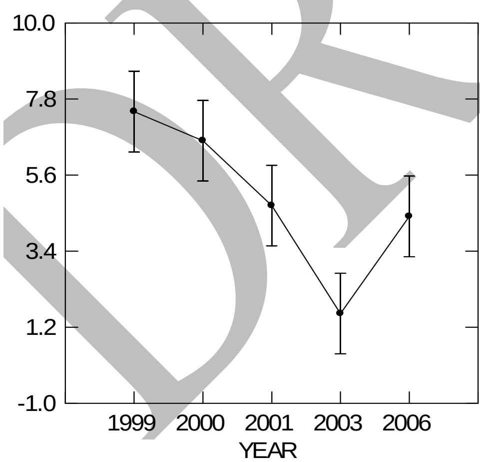
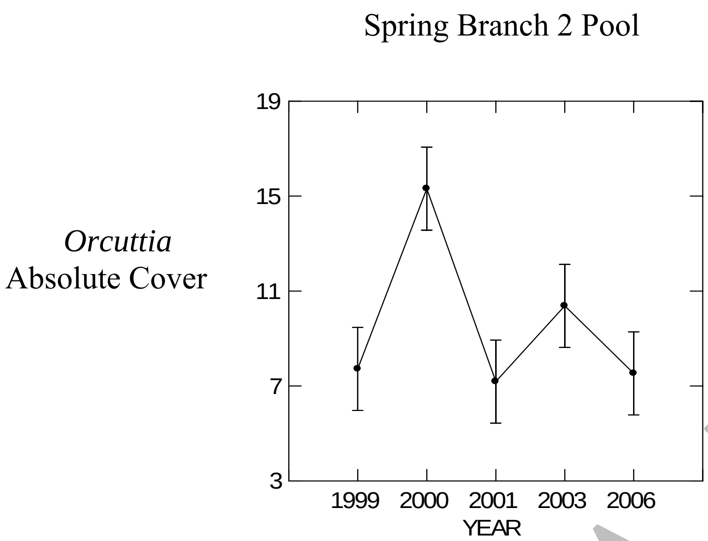
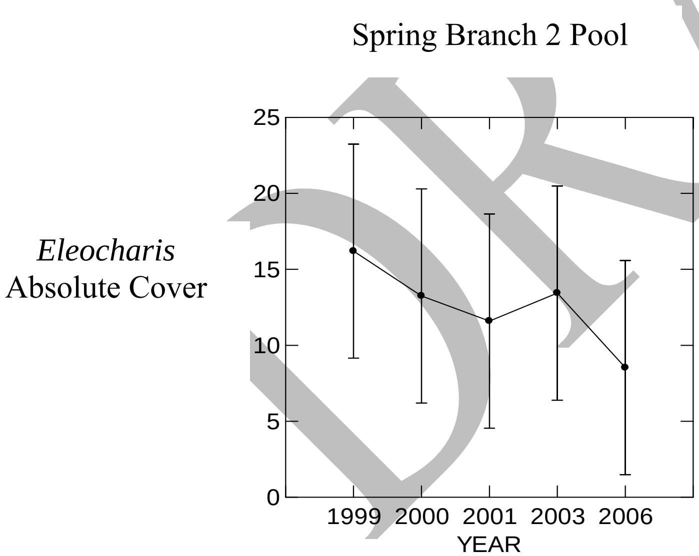


Fig. 6.


Spring Branch 2 Pool
Orcuttia
Absolute Cover
19
15
11
7
3
1999
2000
2001
2003
2006
YEAR


Spring Branch 2 Pool
Eleocharis
Absolute Cover
25
20
15
10
5
0
1999
2000
2001
2003
2006
YEAR