Appendix 1. Description of the study sites. Values in parentheses are standard errors. * All hydroperiod data are for the period 1977-2002 at plot A. Water depth averages include negative numbers for depth below ground surface. ** Soil samples are means from the three study plots and standard errors reflect inter-plot heterogeneity. *** Data reprinted from Busch et al. (1998).

| Description | | Site 6 | Site 23 | Site 50 |
|---|---|---|---|---|
| Latitude (N) | | 25° 38.22’ | 25 ° 41.25’ | 25 ° 41.46’ |
| Longitude (W) | | 80 ° 44.05’ | 80 ° 37.06’ | 80 ° 45.58’ |
| Hydroperiod (days)* | | 349.6 | 319.8 | 259.8 |
| Frequency of dry-down* | | 8/25 | 11/25 | 17/25 |
| Mean water depth with SE (cm)* | | 46.9 (1.2) | 26.8 (1.3) | 17.4 (1.8) |
| Max-min water depth (cm)* | | -18.4 – 114.2 | -48.7 – 93.5 | -69.0 – 91.1 |
| Soil total phosphorus (µg/g)** | | 385.6 (86.6) | 128.0 (42.9) | 207.8 (21.8) |
| Soil total nitrogen (%)** | | 3.2 (0.2) | 0.5 (0.2) | 0.9 (0.1) |
| Soil organic carbon (%)** | | 41.5 (2.9) | 16.1 (1.5) | 15.9 (0.7) |
| Plant Cover (species, common name, stems/m$^2$ unless otherwise noted)*** | | | | |
| *Eleocharis cellulosa* | spikerush | 137.9 | 55.9 | 46.1 |
| *Rhyncospora tracyi* | Tracy’s beakrush | 14.4 | 37.2 | 44.5 |
| *Cladium jamaicense* | sawgrass | 2.9 | 3.8 | 15.8 |
| *Panicum hemitomon* | maidencane | 12.9 | 2.5 | 5.8 |
| *Utricularia* spp. (% cover) | bladderwort | 24.9 | 18.1 | 19.1 |
| Float mat volume (ml/m$^2$) | | 1,689 | 3,415 | 2,555 |

Appendix 2: Analysis of the role of upstream flow through control structures in determining water depth at our study sites.

In this appendix, we report analyses of the relationship between flow rates from the S-12 structures in Shark River Slough, culverts east of L-67-E into Northeast Shark River Slough, and precipitation with water depth at our three study sites. Precipitation records were obtained from the Tamiami Ranger Station (formerly Forty-Mile Bend; Fig. 13-1 in Trexler et al. 2003), the closest rain gauge to our study sites that was continuously monitored between 1977 and 2002. Flow rates were obtained from the South Florida Water Management District and U.S. Geological Service, but end in 1999 when monitoring of culverts was stopped. Backwards stepwise multiple regression was used to assess the relative contribution of each water source to water depth at the study sites.

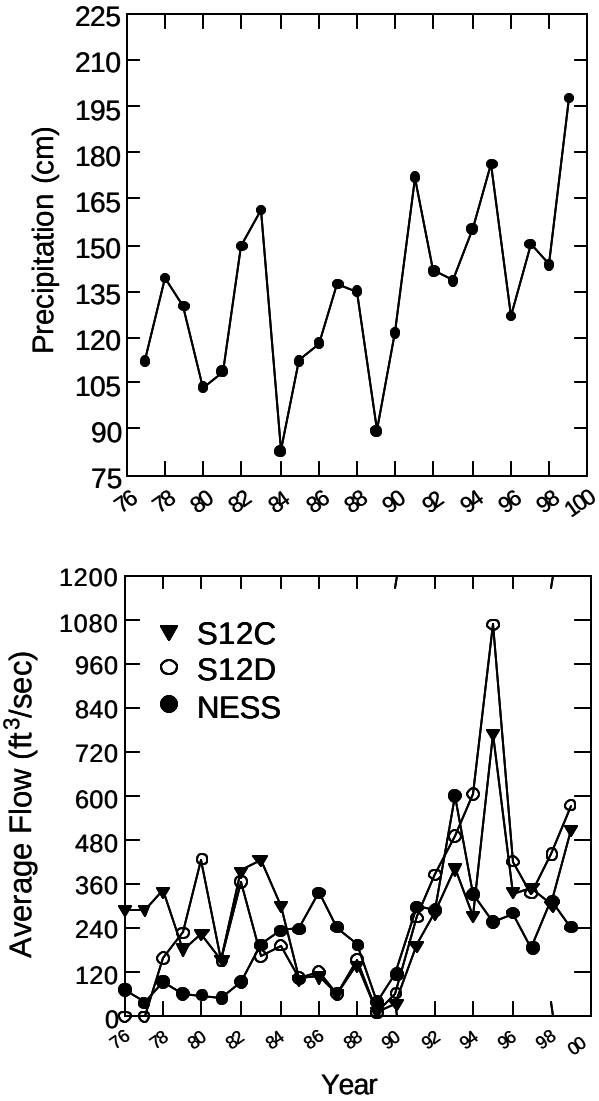
**Results:** Control structures S-12A, B, C, and D permit water to enter the Shark River Slough upstream of sites 6 and 50, while water enters Northeast Shark River Slough through a series of about 20 culverts. Average monthly water depths at Sites 6 and 50 could be predicted best by water flow through structures S-12C and S-12D, while regional rainfall yielded little indication of an influence (Multiple regression results, **Site 6**: Precipitation $t_{1,263} = 0.796$, $P = 0.427$; S-12A $t_{1,263} = -0.732$, $P = 0.465$; S-12B $t_{1,263} = -0.940$, $P = 0.348$; S-12C $t_{1,263} = 6.473$, $P < 0.001$; S-12D $t_{1,263} = 4.630$, $P < 0.001$; $R^2 = 0.525$; **Site 50**: Precipitation $t_{1,263} = -0.257$, $P = 0.797$; S-12A $t_{1,263} = 0.014$, $P = 0.989$; S-12B $t_{1,263} = -1.323$, $P = 0.187$; S-12C $t_{1,263} = 6.919$, $P < 0.001$; S-12D $t_{1,263} = 4.227$, $P < 0.001$; $R^2 = 0.559$). Average monthly water depth at Site 23 was influenced by regional rainfall, water flow through the NESS culverts, and also flow through

structures S-12C and S-12D (Multiple regression results, **Site 23**: Precipitation $t_{1,262} = 2.620$, $P = 0.009$; S-12A $t_{1,262} = -0.455$, $P = 0.650$; S-12B $t_{1,262} = -0.944$, $P = 0.346$; S-12C $t_{1,262} = 5.092$, $P < 0.001$; S-12D $t_{1,262} = 3.562$, $P < 0.001$; NESS $t_{1,262} = 8.541$, $P < 0.001$; $R^2 = 0.546$). Rainfall affected water level at the study sites, but primarily through its influence on flows from the north. Low rainfall years (annual total < 1m) occurred in 1984 and 1989, and water flow into the Park was low from all sources in 1989 and 1990 (Fig. A1). Rainfall and water flow into the Park were relatively high (for this study period) from 1992 through 1999 (Fig. A1). Water flow into Northeast Shark River Slough, relative to the sum of flows through the S-12 structures into Northwest Shark River Slough, increased after 1983.

**Discussion:** The environmental factors controlling water depth at our three study sites differed between the northwestern and northeastern sections of Shark River Slough. Water depth at sites 6 and 50 was correlated with flow from water delivery structures S-12C and S-12D. While it would be desirable to have precipitation data from gauges closer to the sites, we found no evidence that such information would alter our finding that precipitation affected these sites largely or solely through its influence on management of flow through the water control structures. Northeast Shark River Slough differed in this regard, where our measure of regional rainfall did improve our regression model of water-depth fluctuation. That analysis also indicated management actions that changed flows through the culverts upstream of Site 23 affected water fluctuations there. The additional influence of water deliveries from S-12C and S-12D must have been through groundwater or from back-flow around the L-67E levee. The combined flow through the S-12 structures greatly exceeded the combined flow through the culverts for most of the study, with the possible exception of 1985 through 1987. Flow into

Northeast Shark River Slough was increased after 1984 as a result of the Experimental Water Delivery Program, and its primary effect in our data was manifested as increasing the annual minimum water depths at Site 23.

Figure A1. Regional patterns of precipitation and water flow into the study areas between 1977 and 1999. A. Annual rainfall (summation of daily values) collected at the Tamiami Ranger Station (aka, Forty-Mile Bend) gauging station. This was the closest rain gauge to the study continuously monitored through the study period. B. Average flow of water into Everglades National Park through selected water structures. These sites were chosen because of their influence on the study sites; structures S-12A and S-12B were not plotted to limit the clutter on this graph.



Appendix 3. Summary of fishes collected at the three study sites. Sites 6 and 23 were sampled from 1978 through 2002, while site 50 was sampled from 1985 through 2002. Sum indicates the total number of specimens of each species collected during the study period, max is the maximum number collected in a single $m^2$ sample, and mean is the average number per $m^2$ for the study period. Column totals are the total fish collected at a site (sum), the maximum number of fish in a single sample (max), and the average number of fish of all species for the entire study period (mean).

| Site | | 6 | | | 23 | | | 50 | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Sample size | | 2759 | | | 2364 | | | 1750 | | |
| Species | Common Name | sum | max | mean | sum | max | mean | sum | max | mean |
| *Gambusia holbrooki* | eastern mosquitofish | 15,008 | 109 | 5.44 | 6,111 | 44 | 2.59 | 2,264 | 112 | 1.29 |
| *Lucania goodei* | bluefin killifish | 12,873 | 28 | 4.67 | 4,237 | 15 | 1.79 | 1,255 | 21 | 0.72 |
| *Heterandria formosa* | least killifish | 12,903 | 83 | 4.68 | 4,289 | 35 | 1.81 | 442 | 18 | 0.25 |
| *Fundulus chrysotus* | golden topminnow | 3,498 | 16 | 1.27 | 1,223 | 6 | 0.52 | 398 | 7 | 0.23 |
| *Jordanella floridae* | Flagfish | 2,651 | 141 | 0.96 | 1,290 | 15 | 0.55 | 591 | 10 | 0.34 |
| *Poecilia latipinna* | sailfin molly | 3,120 | 81 | 1.13 | 1,144 | 21 | 0.48 | 398 | 24 | 0.23 |
| *Enneacanthus gloriosus* | bluespotted sunfish | 16 | 1 | 0.01 | 44 | 3 | 0.02 | 2 | 2 | 0.00 |
| *Lepomis punctatus* | spotted sunfish | 501 | 7 | 0.18 | 216 | 5 | 0.09 | 48 | 3 | 0.03 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| *Elassoma evergladei* | Everglades pygmy sunfish | 174 | 8 | 0.06 | 131 | 4 | 0.06 | 5 | 1 | 0.00 |
| *Lepomis gulosus* | warmouth | 13 | 1 | 0.00 | 22 | 2 | 0.01 | 1 | 1 | 0.00 |
| *Ameiurus natalis* | yellow bullhead | 16 | 1 | 0.01 | 3 | 2 | 0.00 | 12 | 1 | 0.01 |
| *Erimyzon sucetta* | lake chubsucker | 111 | 4 | 0.04 | 41 | 3 | 0.02 | 2 | 1 | 0.00 |
| *Labidesthes sicculus* | brook silverside | 11 | 6 | 0.00 | 1 | 1 | 0.00 | 4 | 4 | 0.00 |
| *Lepomis marginatus* | dollar sunfish | 90 | 4 | 0.03 | 78 | 3 | 0.03 | 4 | 1 | 0.00 |
| *Micropterus salmoides* | largemouth bass | 1 | 1 | 0.00 | 3 | 1 | 0.00 | 5 | 1 | 0.00 |
| *Belonesox belizanus* | pike killifish | 16 | 2 | 0.01 | 4 | 1 | 0.00 | 3 | 1 | 0.00 |
| *Lepomis microlophus* | redear sunfish | 16 | 2 | 0.01 | 14 | 1 | 0.01 | 5 | 1 | 0.00 |
| *Noturus gyrinus* | Tadpole madtom | 20 | 2 | 0.01 | 3 | 1 | 0.00 | 17 | 1 | 0.01 |
| *Lepomis macrochirus* | Bluegill | 5 | 1 | 0.00 | 4 | 1 | 0.00 | 0 | 0 | 0.00 |
| *Fundulus seminolis* | Seminole killifish | 0 | 0 | 0.00 | 2 | 1 | 0.00 | 0 | 0 | 0.00 |
| *Fundulus confluentus* | marsh killifish | 129 | 4 | 0.05 | 256 | 5 | 0.11 | 286 | 4 | 0.16 |
| *Cichlasoma uropthalmus* | Mayan cichlid | 16 | 3 | 0.01 | 45 | 7 | 0.02 | 43 | 2 | 0.02 |
| *Lepomus spp (juveniles)* | sunfish juvenile | 61 | 3 | 0.02 | 18 | 2 | 0.01 | 9 | 1 | 0.01 |
| *Cyprinodon variegatus* | Sheepshead minnow | 82 | 11 | 0.03 | 143 | 6 | 0.06 | 242 | 9 | 0.14 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| *Notropis petersoni* | coastal shiner | 25 | 8 | 0.01 | 2 | 1 | 0.00 | 3 | 3 | 0.00 |
| *Notropis maculatus* | taillight shiner | 3 | 1 | 0.00 | 2 | 1 | 0.00 | 0 | 0 | 0.00 |
| *Amia calva* | bowfin | 1 | 1 | 0.00 | 0 | 0 | 0.00 | 0 | 0 | 0.00 |
| *Tilapia mariae* | spotted tilapia | 1 | 1 | 0.00 | 2 | 1 | 0.00 | 1 | 1 | 0.00 |
| *Astronotus ocellatus* | oscar | 3 | 2 | 0.00 | 0 | 0 | 0.00 | 0 | 0 | 0.00 |
| | Total fish | 51,364 | 292 | 18.62 | 19,328 | 70 | 8.18 | 6,040 | 123 | 3.45 |