# Water Quality in Big Cypress National Preserve (BICY) and Everglades National Park (EVER)

## Trends and Spatial Characteristics of Selected Constituents

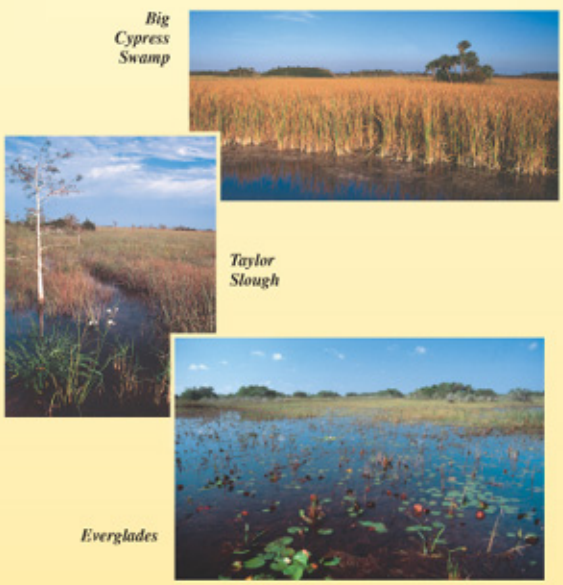
**Water quality varies spatially across the region because of natural variations in geology, hydrology, and vegetation and because of differences in water management and land use. Although water quality in BICY and EVER is generally good, major physical alteration of the landscape and associated water management practices in the watershed have altered its quality.**

The National Park Service (NPS) maintains hydrologic monitoring stations for measuring the water level (stage) and water quality in BICY and EVER (fig. 1). The data collected at these stations provide a historical baseline for assessing hydrologic conditions and making a wide range of management decisions. We have assessed selected water-quality data at these stations and at nearby canal sites for the period of record, 1959-2000, to define baseline conditions and to evaluate whether long-term trends have occurred.


**Figure 1**–Major features and sampling sites in Big Cypress National Preserve and Everglades National Park.

### Methods and Approach

- Data collected primarily by the South Florida Water Management (SFWMD) and the U.S. Geological Survey (USGS).
- For analysis of trends, we focused on specific conductance, chloride, sulfate, total phosphorus, and total nitrogen at sites with the longest record of water-quality data.
- For trend analysis, we used the USGS S-ESTREND software--uncensored seasonal Kendall test for specific conductance, chloride, and total nitrogen, and Tobit regression test for sulfate and total phosphorus (which have numerous data reported at "less-than" values).
- For evaluation of spatial patterns in water quality, we used median concentrations of selected constituents over a 10-year baseline period (1991-2000).




### Major Results from the Analysis of the Historic Water-Quality Data Include:

- Long-term changes in water levels, flows, water management, and upstream land use can affect water quality in BICY and EVER, based on analysis of available data (1960-2000).
- Specific conductance and concentrations of chloride increased in the Taylor Slough (TSB) and Shark River Slough (P-33) over the period of record; for example, chloride concentrations more than doubled from 1960 to 1990 (fig 2), primarily due to greater canal transport of high-dissolved solids water into the sloughs. Chloride did not show a long-term trend at the Everglades reference site P-34 or at Bridge 105 in BICY.

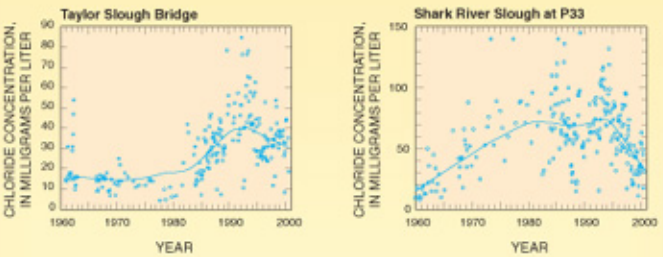



**Figure 2**–Chloride concentrations and loess smooth line at Taylor Slough Bridge and in Shark River Slough at P-33.

- Some of the long-term trends in sulfate and total phosphorus (fig. 3) were likely attributable to high percentages of "less-than" and zero values and to changes in reporting levels over the period of record, rather than to real environmental changes.
- High spikes in nutrient concentrations were evident during dry periods (figs. 4 and 5), and attributable to increased canal inflows of water that is nutrient-rich relative to marsh inflows, to increased nutrient releases from break-down of organic bottom sediment, or to increased build-up of nutrient waste from concentrations of aquatic biota and wildlife in remaining ponds.

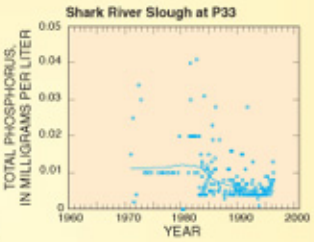



**Figure 3**–Total phosphorus concentration at P-33.

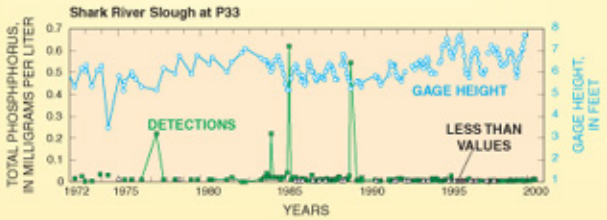



**Figure 4**–Total phosphorus concentration versus water level at P-33.

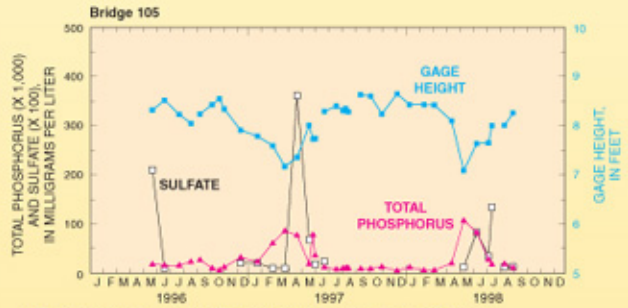



**Figure 5**–Water level at Bridge 105 on Tamiami Trail in BICY and concentrations of total phosphorus (have been multiplied times 1,000) and sulfate (have been multiplied times 100).

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USGS science for a changing world

- Long-term changes in water quality over the period of record are less pronounced in the western Everglades and the Big Cypress Swamp, however, seasonal and drought-related changes are evident.
- Water quality varies spatially across the region because of natural variations in geology, hydrology, and vegetation and because of differences in water management and land use.
- Nutrient concentrations are relatively low in BICY and EVER compared to concentrations in parts of the northern Everglades which are near agricultural and urban lands.
- Concentrations of total phosphorus (fig. 6) generally are higher in BICY (median values, 1991-2000, were mostly above 0.015 mg/L) than in EVER (median values, 1991-2000, below 0.01 mg/L), probably because of higher phosphorus in natural sources such as shallow soils, rocks, and ground water in the Big Cypress region than in the Everglades region.
- Concentrations of chloride and sulfate (fig. 6), on the other hand, are higher in EVER (median values in Shark River Slough, 1991-2000, mostly above 2 mg/L sulfate and 50 mg/L chloride), than in BICY (median values, 1991-2000, less than 1 mg/L sulfate and at most sites less than 20 mg/L chloride), probably because of the canal transport system that conveys more water from agricultural sources into EVER than into BICY.
- Trace elements and contaminants such as pesticides and other toxic organics are in relatively low concentrations in BICY and EVER compared with concentrations in parts of the northern Everglades which are near agricultural and urban sources.
- Concentrations of pesticides rarely exceeded aquatic life criteria in BICY and EVER (table). Atrazine was the only pesticide that exceeded the criteria (in 2 out of 304 samples). The pesticides heptachlor expoxide, lindane, and p, p'-DDE exceeded criteria in canal bed sediments in 1, 2, and 16 percent of the samples, respectively.

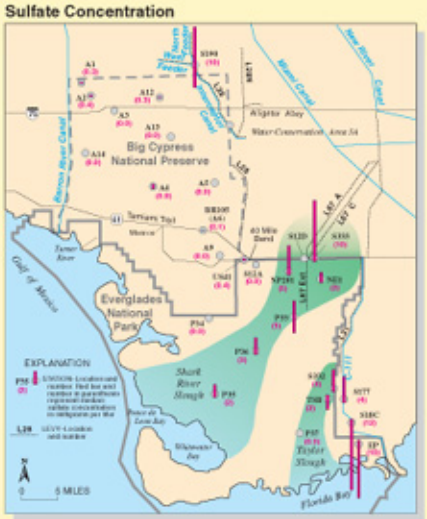
*Agricultural activities in south Florida*

**Most frequently detected pesticides and other organics in water for the period of record at selected sites in and near Big Cypress National Preserve and Everglades National Park**

| Site | Number of dectections by compounds | Number of determinations by compounds | Detections per determination | Highest measured concentration | Lowest measured concentration | Aquatic life criteria | Number of exceedances | Class III criteria, freshwater |
|---|---|---|---|---|---|---|---|---|
| Atrazine, unfiltered, µg/L | 116 | 304 | 0.382 | 13.2 | 0.01 | 1.8 | 2 | |
| Atrazine, filtered, µg/L | 90 | 99 | 0.909 | 0.87 | 0.00347 | 1.8 | 0 | |
| Metolachlor, filtered, µg/L | 83 | 99 | 0.838 | 0.0635 | 0.0036 | 7.8 | | |
| Deethylatrazine, filtered, µg/L | 73 | 99 | 0.737 | 0.0225 | 0.00107 | | | |
| Tebuthiuron, filtered, µg/L | 61 | 99 | 0.616 | 0.0494 | 0.0027 | 1.6 | 0 | |
| Endosulfan sulfate, unfiltered, µg/L | 43 | 374 | 0.115 | 0.45 | 0.0033 | | | |
| EPTC, filtered, µg/L | 29 | 99 | 0.293 | 0.0148 | 0.00081 | | | |
| 2, 6-Diethylaniline, filtered, µg/L | 23 | 99 | 0.232 | 0.0054 | 0.00098 | | | |
| Simazine, filtered, µg/L | 20 | 99 | 0.202 | 0.0979 | 0.00361 | 10 | 0 | |
| Chlorpyrifos, filtered, µg/L | 19 | 99 | 0.192 | 0.0234 | 0.00249 | | | |
| Endosulfan I, unfiltered, µg/L | 17 | 55 | 0.309 | 0.05 | 0.001 | | 0 | 0.056 |
| Malathion, filtered, µg/L | 16 | 99 | 0.162 | 0.0837 | 0.00324 | 0.1 | 0 | 0.1 |
| Hexazinone, unfiltered, µg/L | 15 | 153 | 0.098 | 0.031 | 0.019 | | | |

**Total Phosphorus**


**Sulfate Concentration**




**Chloride Concentration**

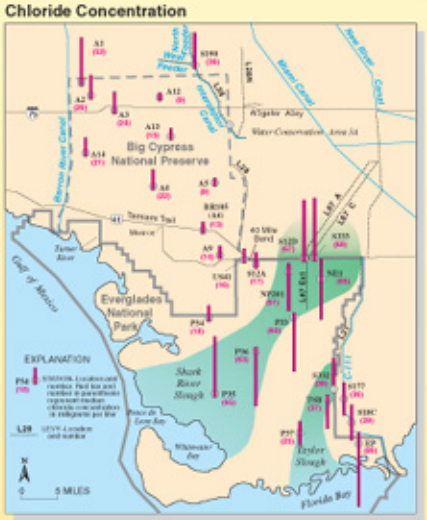



**Figure 6**–Median concentrations of total phosphorus, chloride, and sulfate at BICY and EVER sites and nearby canal sites, 1991-2000.