

A Biological Monitoring Program for the Lake Trafford Restoration Project in Collier County, Florida

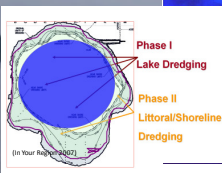
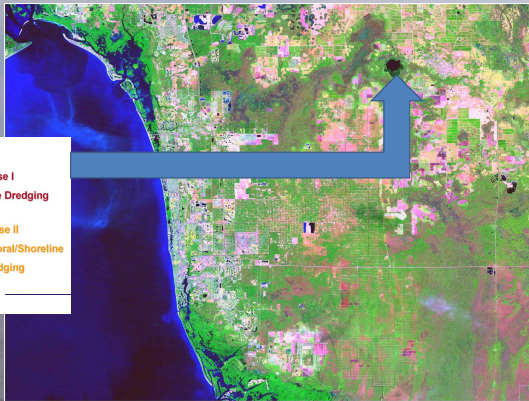


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Background

Lake Trafford is a shallow, subtropical lake subjected to increasing anthropogenic nutrient loading over the last several decades, resulting in a shift away from a clear, macrophyte-dominated system state to a turbid plankton-dominated one, resulting in algal blooms and fish kills. The Big Cypress Basin of the South Florida Water Management District has implemented a restoration project that involves hydraulic dredging of sediment from the lake.

The goal of the biological monitoring program is to characterize the post-dredging floral and faunal communities within Lake Trafford, including the littoral zone and open water areas for the purpose of establishing a benchmark of post-restoration lake condition. This program will include assessing submerged aquatic vegetation (SAV), phytoplankton, macroinvertebrate indicators, and small forage fishes of the littoral zone.



Post-Dredging Monitoring Plan

The Lake Trafford biological monitoring program will assess submerged vegetation, macroinvertebrate indicators, small forage fishes of the littoral zone, algal communities, and implement a pilot study for reestablishing native submerged vegetation using tape grass (*Vallisneria americana*).

- Submerged aquatic vegetation (SAV) will be estimated using side-scanning radar and ground-truthed with a petite ponar dredge, hand rake, and visual assessment;
- monthly phytoplankton community samples will be processed to determine both total algal biomass and relative species abundances;
- benthic macroinvertebrates will be sampled from both the open water dredged zone and the littoral zone using a petite ponar dredge and dip nets. A macroinvertebrate species list and community profile will be developed, along with data on lake bottom sediments to provide a baseline for post-dredging change;
- forage fish communities will be sampled using breder traps, minnow traps, dip nets and small seines; and
- the Trophic State Index (TSI) and the Lake Condition Index (LCI) will be utilized to determine the overall condition of the lake.

Vegetation

Emergent and submergent aquatic vegetation (SAV) appeared to be absent from the open water portions of Lake Trafford during the period of May-November 2007. During a period of extreme low waters in June and July 2007, the littoral zone consisting of deep organic muck was exposed and became colonized by native terrestrial herbaceous vegetation. The dominant plant species were wild millet (*Echinochloa walteri*) and unidentified sedge (*Cyperus* sp.). These plants disappeared as water levels came back up in September and October and showed up as dead plant material in some dredge samples collected in November 2007. No live SAV was detected from any of the dredge samples or in two perpendicular transect surveys using a BioAcoustics™ Echo-Sounder conducted in November 2007. The complete absence of native vegetation on the lake bottom is a concern for restoration since SAV tends to stabilize sediments, improve water quality, and provides fish and invertebrate habitat. Perhaps more importantly, the absence of any desirable native SAV may allow the rapid re-invasion of non-native aquatic plants like *Hydrilla*, *Hygrophila*, or any number of other problematic exotic species. Currently a SAV restoration feasibility study is being implemented using tape grass (*Vallisneria americana*), in cooperation with the South Florida Water Management District and Florida Fish and Wildlife Conservation Commission. The shallow sandy areas in the littoral zone experienced some natural regeneration of SAVs during the low water conditions. Long-term restoration plans also include planting of emergent bulrush (*Scirpus* spp.) and SAV and monitoring of biological conditions over time.



History

The lake was historically sand bottomed and supported a healthy population of native macrophytes before *Hydrilla verticillata* was introduced in 1969. From the 1970's to the 1980's, copper diaquaden was used to kill the *Hydrilla*. Chemical herbicide treatments continued into the 1990's (Lake Trafford and You 2000). The resulting necromass of *Hydrilla* accumulated in the lake bottom (Flaig 2000). Modifications within the watershed have included increased agriculture and urbanization, both of which can increase nutrient loading (Henderson-Sellers and Markland 1987), along with septic tank leakage (Rutter 1996). In the 1990's the lake experienced several incidents of depleted oxygen and fish die-offs, including a massive event in April 1996, killing an estimated 50,000 fish (Flaig 2000). Lake Trafford fish kills have been linked to hyper-eutrophic conditions in the lake. The lake water exhibited high phosphorus and algae concentrations.

In 2002, Lake Trafford was designated as "Impaired" due to chronic low oxygen levels and excessive nutrients. The Florida Department of Environmental Protection is currently developing total maximum daily loads or TMDLs to ensure long-term water quality protection (FDEP 2008).

The restoration process was initiated through the cooperation and efforts of the Lake Trafford Task Force, the Friends of Lake Trafford (grassroots group), Audubon Society, Conservancy of Southwest Florida, and federal, state and local agencies. The Big Cypress Basin of the South Florida Water Management District and Florida Department of Environmental Protection made this restoration procedure possible by funding this project. Through these joined endeavors the lake's health and the sustainability of native plant and animal communities will be promoted (SFWMD).

The lake restoration has proceeded in two phases. Phase I: the removal of over three million cubic yards of sediments from the deeper portions of the lake, was complete in 2006. Phase II: the removal of an estimated additional one million cubic yards of sediment from the shallow littoral zone. Phase II was scheduled to be completed in 2007 but extremely low water levels postponed the completion of the dredging.

Monitoring

Collier County Pollution Control has collected and analyzed monthly water samples from the lake since 1996. The Florida Fish and Wildlife Conservation Commission (FWWC) has conducted game fish surveys annually during the past decade. The FDEP - Bureau of Aquatic Plant Management conducts periodic surveys of aquatic plant species to monitor invasive exotic plant coverage and control programs.

Preliminary Results

Substrate

In 2007, following completion of Phase I of the dredging, the lake substrate was variable from site to site but was dominated by reddish and gray clays mixed with fine silt and muck in the northern half of Lake Trafford. The substrate in the southern half of the Lake was dominated by clay/sand mix or sand but there were some areas with muck and clay, especially to the southeast. Very little sand was evident in any of the samples collected or in the 24 petite Ponar dredge samples collected for macroinvertebrate analysis. Shallower areas near the vegetated shoreline had deep organic muck and during the extreme dry period of June and July these areas were partly exposed. In the fall of 2007, heavy rainfall events resulted in flooding of the littoral zone but by the Spring of 2008 extremely low water conditions returned exposing much of the littoral zone. It appeared that muck from the littoral zone was washed into deeper pockets by wind and wave action during the fall/winter high water conditions. Some of the previously dredged areas had muck re-deposited, but large sandbar areas were exposed in the shallower littoral zone.

Aquatic Fauna

Macroinvertebrate communities collected from the 24 benthic grab samples indicated that there are large differences between the north side of the lake where dry and hard sediments predominate and the south side of the lake where many sites were dominated by sand. The 12 north-lake samples contained only two taxa of diptera (2 species and 72 total organisms) larvae including the predaceous midge, *Chaoborus punctipennis* and the chironomid, *Coelotanypus tricolor*. Shannon diversity was very low ($H' = 0.65$) and the LCI score for the north side of the lake was 3.56 which places it in the "very poor" category (<18). The 12 south lake samples contained a total of nine species (190 individuals) including crustaceans, (*Hyalella azteca* and unidentified ostracods), several diptera larvae (including *Chaoborus* and *Coelotanypus*), and oligochaete worms. The Shannon diversity for the south side was nearly three times higher than the north side ($H' = 1.82$) and the LCI score was 16.64 but still in the very poor category. The fall 2007 benthic sampling the entire Lake Trafford system falls into the "very poor" category. Preliminary fish sampling from the littoral zone in 2007, indicated a paucity of small fishes, with only tolerant eastern mosquitofish, *Gambusia holbrooki*. This was not unexpected due to the low water levels, exacerbated by the recent dredging activities as well as the lack of SAV, emergent, and floating vegetation. The sampling of the littoral zone was conducted again with seines in May and June 2008. Ten species of fish were collected including three exotics (*Cichlasoma urophthalmus*, *Tilapia mariae*, and *Rasbora daniconius*) and seven natives (*Lepomis platyphimus*, *Fundulus seminolis*, *Lucania goodei*, *Micropterus dolomieu*, *Ambloplites sicculus*, *Gambusia holbrooki*, and *Pomoxis nigromaculatus*) and a larval blue shrimp (*Palaeomonetes paltosus*).

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