Hydrogeochemical Conditions of Two Estuarine Mangrove Lake Drainage Systems in the Everglades

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• Mangrove lakes region located to the west of Taylor Slough boundary.

• Small creeks connect the lakes to each other, as well as to Florida Bay.

• Due to close proximity of Taylor Slough, there may be a fresh groundwater influence to the lakes that could be increased with further restoration.
Mangrove Lakes Background

- Shallow throughout (~1.8m max depth)
  - Extensive SAV beds (historically), waterfowl wintering, habitat for American Crocodile

- Degradation of water quality throughout last century
  - Loss of SAV described in West Lake (Craighead 1971)
  - 20-30 psu increase in mean salinity along north shore of Florida Bay (Mclvor et al. 1994)
Hypotheses

• Groundwater discharges to the surface water of the lakes

• Groundwater discharge is a source of phosphorus delivered to the southern Everglades Mangrove Lakes region.
Methods

- Water budgets for both drainages and individual lakes will be calculated on a daily, weekly, monthly and annually basis.

\[ P - ET - Q_{out} + \Delta S = GW + R \]

- Data provided by the weather tower installed on site (August 2014) and flow meters
PET Calculation

- Thornthwaite Equation

\[
PET = 1.62 \left( \frac{10Ta}{I} \right)^a
\]

\[
I = \sum_{i=1}^{12} \left( \frac{Ta_i}{5} \right)^{1.5}
\]

\[a = 0.49239 + (1.792 \times 10^{-2}) I - (7.71 \times 10^{-5}) I^2 + (6.75 \times 10^{-7}) I^3\]
4 groundwater wells (in peat at top of limestone surface) and 4 surface water stations installed between June 2014 and September 2014

Aqua Troll 200 pressure transducers – measure at 30 minute increments
Surface Water Sampling

- November 2013 – September 2017
- Bimonthly sampling
  - Temp, pH, Salinity, Conductivity, DO
  - Alkalinity, Cations, Anions, TP, TN, TOC,
Results

Precipitation vs PET

Annual
Precip: 85 cm
PET: 144 cm

Date
Jun-16	Jul-16	Aug-16	Sep-16	Oct-16	Nov-16	Dec-16
Jan-16	Feb-16	Mar-16	Apr-16	May-16

Precip
PET
Potential Groundwater Discharge

GW-SW (mm)

Date

July 2014 to May 2016

West Lake
Cuthbert Lake
Long Lake
GW Discharge

Date

Jan-16  Feb-16  Mar-16  Apr-16  May-16  Jun-16  Jul-16  Aug-16  Sep-16  Oct-16  Nov-16  Dec-16

GW Discharge (cfs)

West Lake
Cuthbert Lake
Oyster Drainage

Results
GW Discharge

Results

GW Discharge (cfs)

West Lake
Cuthbert Lake
Oyster Drainage

Date

Jan-16
Feb-16
Mar-16
Apr-16
May-16
Jun-16
Jul-16
Aug-16
Sep-16
Oct-16
Nov-16
Dec-16
GW Discharge

Results

GW Discharge (cfs)

Date

West Lake
Cuthbert Lake
Oyster Drainage

Jan-16 Feb-16 Mar-16 Apr-16 May-16 Jun-16 Jul-16 Aug-16 Sep-16 Oct-16 Nov-16 Dec-16
Results

**Groundwater**

\[ y = 0.0418x + 0.061 \]

\[ R^2 = 0.3508 \]

**Surface Water**

\[ y = 0.0348x + 1.5582 \]

\[ R^2 = 0.11 \]
Results

GW and SW Salinity

West Lake

Cuthbert Lake

Long Lake

Seven Palm

Salinity (psu)

Salinity (psu)

Salinity (psu)

Salinity (psu)
**Results**

**GW and SW Salinity**

- **West Lake**
  - Salinity vs. Date
  - WL-SW and WL-GW

- **Cuthbert Lake**
  - Salinity vs. Date
  - CL-SW and CL-GW

- **Long Lake**
  - Salinity vs. Date
  - LL-SW and LL-GW

- **Seven Palm**
  - Salinity vs. Date
  - SP-SW and SP-GW
Conclusions

• GW DOES discharge to the mangrove lakes SW.

• GW discharge seems to be dominated by marine inputs from Florida Bay in the West Lake drainage and Taylor Slough (freshwater source) in Seven Palm Lake drainage.

• GW discharge is likely a source of P delivered to the West Lake region.
Questions?

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