Determining Sources of Water Column Phosphorus Concentration Spikes in Taylor River

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Abstract

This study is being conducted in Taylor River in the southern mangrove ecotone region of Taylor Slough in the Everglades National Park. Taylor River is located in this ecotone region between two FCE-LTER water quality monitoring stations (Figure 1). In this study we hope to determine the source of phosphorous concentration spikes which occur during periods of decreased freshwater flow and longer water residence times (Table 1). A 3 km pond vs. creek transect was formed from TS/Ph 6, the northern end member and TS/Ph 7 which is located at the mouth of Taylor River that feeds into Little Madeira Bay (Figure 2). A total of 13 sample sites, 6 ponds and 7 creeks, will be analyzed for water quality. In addition, floc cores will be taken from each of the 6 ponds and analyzed for total phosphorous, nitrogen and carbon.

This system is characterized by a series of interconnected creeks and ponds that make up the larger Taylor River. We have observed relationships between salinity and increased phosphorus concentrations in the long-term data collected at these two sites; these findings appear to be supported by the scientific literature. During the wet season months from June to November, there is a distinct freshwater input on the mangrove estuary from the north. This freshwater pulse essentially "flushes" most of the river and lowers salinity to less than 1 ppt. However, during dry months from December to May, water residence times increase dramatically and salinity can increase to over 35 ppt.. We hypothesize that the P concentration spikes observed during these months is a result of benthic process and longer water residence times in the river rather than P input from Florida Bay.

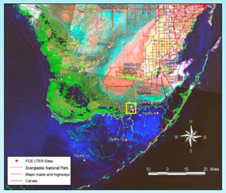

Figure 1. Landsat image of Taylor Slough highlighting LTER water quality monitoring stations.

Figure 3.Aerial photograph of lower Taylor River.

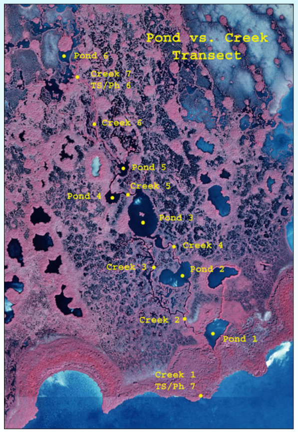

Figure 2. Landsat Image of Taylor River detailing collection points.

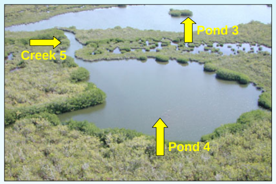

Figure 4.Aerial photograph of middle Taylor River.

Study Area

- ➢Study area is a 3 km transect of Taylor River. This system is characterized by interconnected creeks and ponds.
- ➢13 collection points were chosen of which there are 7 creeks and 6 ponds (Figure 1).
- ➢Located in north-eastern Florida Bay, Taylor River feeds directly into Little Madeira Bay (Figure 2).
- ➢Distinct wet (June – Nov.) / dry (Dec. – May) season with a micro-tidal range of <0.05m
- ➢Dwarf mangrove forest (1-2m canopy)
- ➢Highly oligotrophic system – P limited

Hypothesis

➢**Hypothesis 1** (temporal) – Phosphorus concentrations will increase in the water column throughout the onset of dry season and decrease with the return of freshwater flow from the north.

➢**Hypothesis 2** (spatial) – Water column P concentrations are coming from internal benthic sources rather than Florida Bay input and will be significantly higher in Ponds than in Creeks.

➢**Hypothesis 3** (mechanism) – Phosphorus concentration spikes are a result of accumulation and decomposition of the floc layer in the ponds

➢**Hypothesis 3a** (temporal) – Accumulation and decomposition of the floc layer is regulated by water residence times.

➢**Hypothesis 3b** (spatial) – Accumulation and decomposition of the floc layer is regulated by water level.

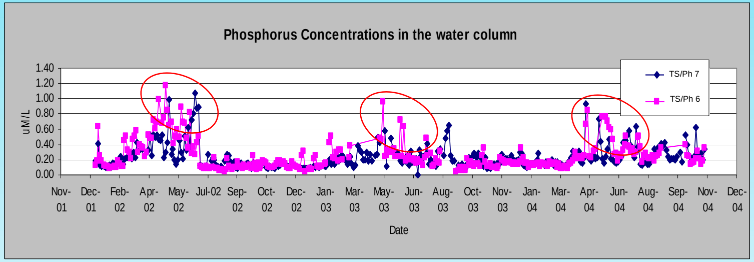

Table 1.Graph of 3 years highlighting dry season water phosphorus concentration spikes at TS/Ph 6 and TS/Ph 7.

Methods

Figure 5. Sarah Ridgway collecting at site Creek 4.

Figure 6. Excess water decanted from core.

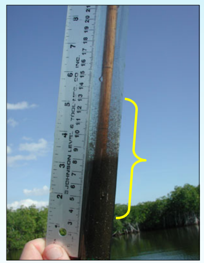

Figure 7. Floc height measured and recorded in cm.

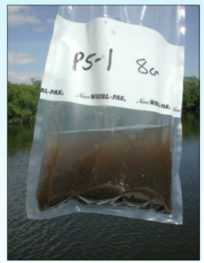

Figure 8. Floc collection bag from Pond 5.

Water Quality:

- ➢Grab samples taken monthly from each of the 13 collection sites along the transect.
- ➢Salinity and Time recorded
- ➢Filtered through a Whatman 4μ filter.
- ➢Analyzed for TN, TP, TOC, N&N, NO_3, NO_2, NH_4, SRP, AND DOC.

Floc Samples:

- ➢3 triplicate 2.5 cm cores taken monthly from each of the 6 ponds.
- ➢Floc height measured and recorded.
- ➢Sample is dried at 70° for 72 hours and weighed for gdw..
- ➢Samples are analyzed for total phosphorus, nitrogen and carbon.

Some Preliminary Results

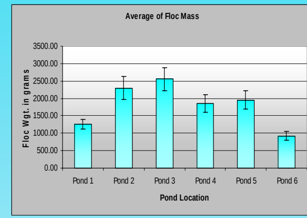

Table 2. Average Floc Mass collected from 3 months of sampling per pond.

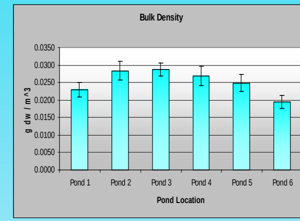

Table 3. Bulk Density for 3 months of sampling per pond.

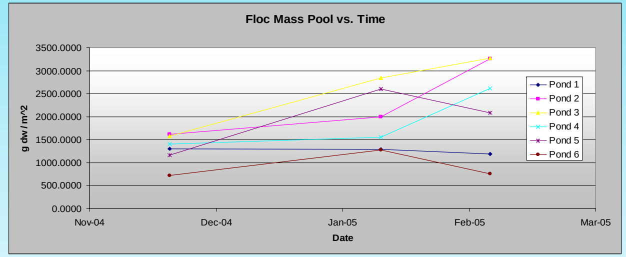

Table 4. Change in Floc Mass Pool over time. Note the relatively small change in mass in Ponds 1 and 6.

Discussion

Floc mass appears to be highest in the interior ponds as well as showing the largest increase in mass over time (Table 4). Data from nutrient analyses of water quality and floc are forthcoming. Concentrations of several other organic and inorganic nutrients will also aid in profiling nutrient dynamics in this salt/freshwater interface. Water level and discharge rates will be obtained from two USGS stations located in close proximity to the two FCE-LTER WQ monitoring sites.

While the data presented here are preliminary, the aforementioned conclusions are very interesting, and more intriguing results will come with further sample analysis.

Acknowledgements

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