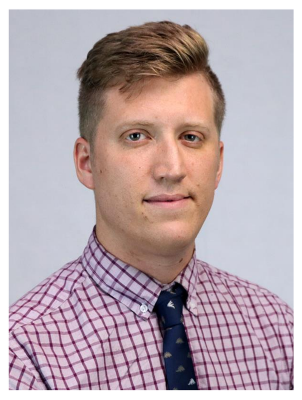

Decomposition of Red Mangrove Leaf Litter in Litterbags

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INTRODUCTION

In south Florida mangrove swamps, peat accumulates from decomposed fallen mangrove leaves in the leaf litter layer. In inundated basin sites, peat forms with a thick leaf mat; whereas no leaf mat forms in tidally-exposed fringe sites (Figure 1: Schultz 2015). Red mangrove (*Rhizophora mangle*) leaves experience high rates of consumption from macrodetritivores (>1mm), such as the coffee bean snail (Figure 3: Proffitt & Devlin 2005). The goal of this project is to measure and compare surficial (0 mm depth) and subsurface (15 mm depth) leaf decomposition in three non-riverine mangrove swamp substrates (Figure 1) to understand decomposition rates of *R. mangle* without the influence of macrodetrivitores.

HYPOTHESES

- In the fringe site, surficial peat decomposition will be higher than subsurface peat decomposition in the fringe site.
- There will be no difference between surficial and subsurface peat decomposition in inundated field sites (intermediate and basin sites).

METHODS

- Decomposition of R. mangle leaf litter was assessed through litterbag deployments (Bocock and Gilbert 1957) in three field locations (Figure 1).
  - Litterbags were created with 1 mm mesh size to exclude influences of macrodetritivores.
  - Fresh *R. mangle* leaves were collected to create 36 litterbags that contained 50 leaves each. Each litterbag was weighed for initial organic mass weight.
  - Eighteen replicates were created by tethering two litterbags together with one litterbag exposed on the swamp surface (0mm depth) and one in the subsurface (15mm depth).
  - Six replicates were deployed at each field site in January 2020, collected at set intervals (1, 2, 3, 6, 9 and 12 months), and transported to the lab for analysis.
- Leaf litter (>1mm) was dried at 50°C for 48 hours and weighed to obtain dry weights.
- Dry weights were divided by initial weights to obtain percentage of organic mass remaining, a proxy for leaf litter decomposition rates.
- Regressions, ANOVA, and ANCOVA were conducted to compare decomposition rates.

FIELD SITE

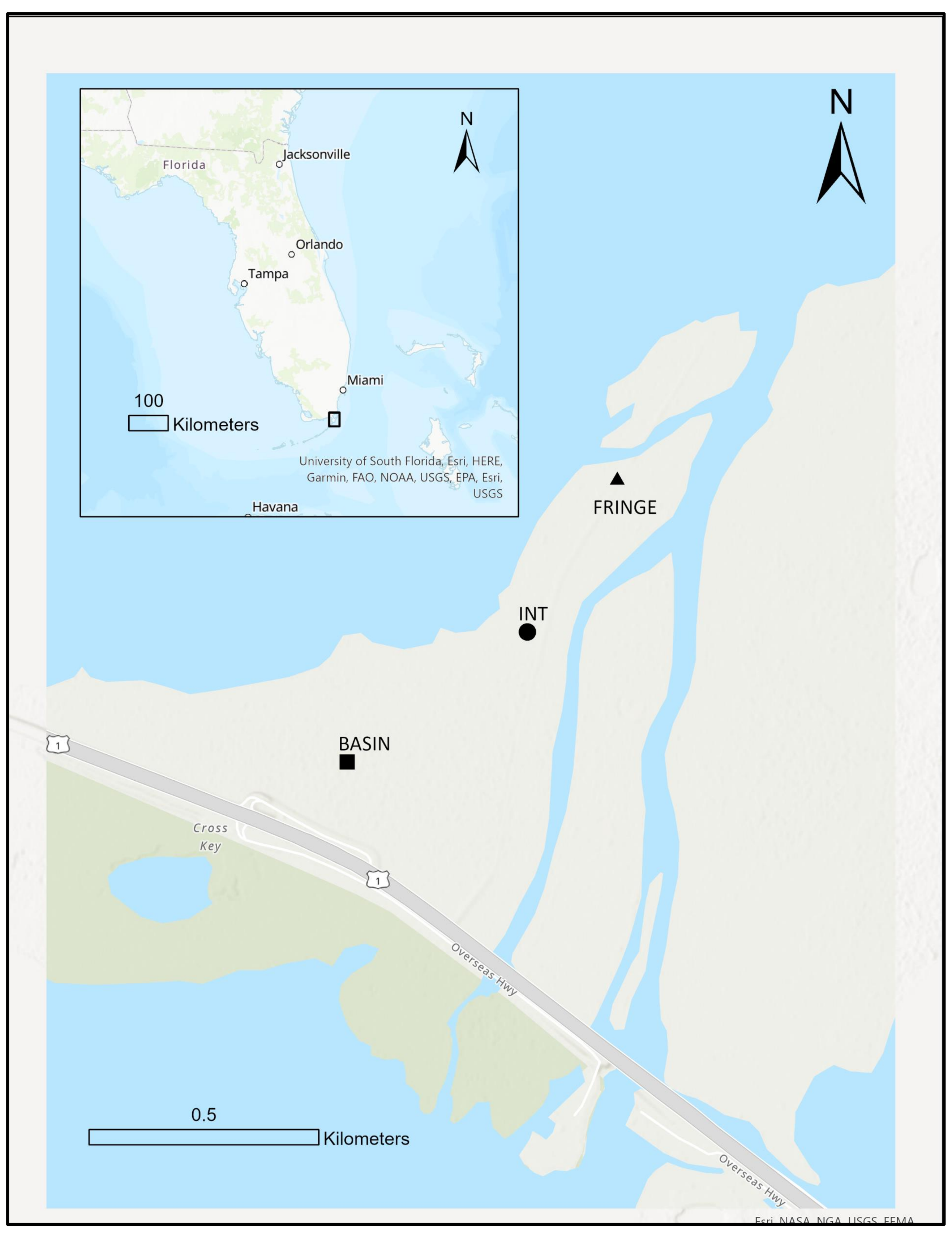

Figure 1. Litterbags were deployed in three locations within a mangrove swamp in Barnes Sound, Key Largo, Florida: (1) an inundated interior basin [BASIN] site, (2) a tidally influenced fringe [FRINGE] site, and (3) an intermediate [INT] site that displayed characteristics of both basin and fringe.

RESULTS

- Regression plots were created for each dataset (Figure 2).
- ANOVA shows that both decomposition rates in the fringe site, and surficial in the basin site were significant ($p<0.05$: Figure 2A, C). Average decomposition rate in the fringe sites was significant ($p<0.01$: Figure 2F).
- ANCOVA shows that there were no significant differences between surficial and subsurface decomposition within nor between sites (Figure 2A-E). There was no significance of average decomposition between sites (P = 0.92: Figure 2F)..

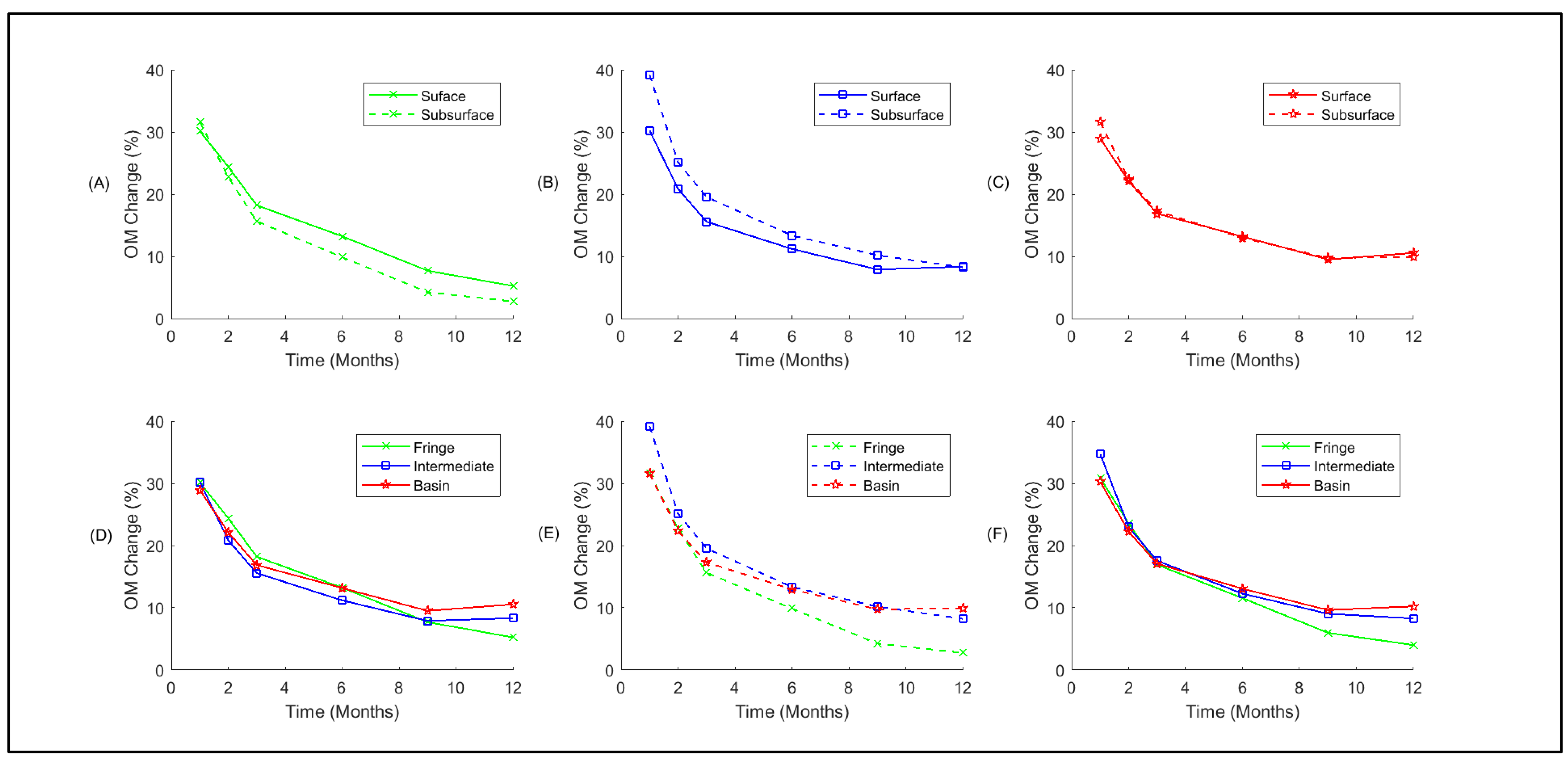

Figure 2. Regression plots for the percent organic matter change for surficial and subsurface decomposition of R. mangle leaves over a 12-month time interval: (A) fringe site, (B) intermediate site, and (C) basin site. Combined plots for (D) surficial decomposition and (E) subsurface decomposition. (F) Average percent change of organic matter across mangrove swamp sites: fringe, intermediate, and basin.

DISCUSSION AND CONCLUSIONS

- Basin sites are normally inundated and thus shield the leaf mat from detritivory. The significant decrease in basin surficial decomposition may have occurred due to spring low tides. However, there is no difference between basin surficial and subsurface decomposition rates.
- The exclusion of macrodetrivitores in the fringe site may have decreased the surficial decomposition rate of *R. mangle* leaf litter because there was no difference with the subsurface decomposition rate.
- Detritivory from macrodetritivores, such as the coffee bean snail, may affect leaf mat thickness and peat accumulation rates in south Florida mangrove swamps (Figure 3).

*Figure 3. Coffee bean snails (*Melampus coffeus*) consuming R. mangle leaf detritus on mangrove swamp substrate.*

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REFERENCES

Bocock KL, Gilbert OJW (1957) The Disappearance of Leaf Litter Under Different Woodland Conditions. Plant and Soil 9(2): 179-185.

Proffitt CE, Devlin DJ (2005) Grazing by the Intertidal Gastropod *Melampus coffeus* Greatly Increases Mangrove Leaf Litter Degradation Rates. Marine Ecology Progress Series 296:209-218.

Schultz E (2015) Characterizing the Taphonomically Active Zone in Subtropical Peat from Barnes Sound in Key Largo, Florida. Master's Thesis, Texas A&M University.