

Post-hurricane mangrove regeneration along subsidy-stress in the FCE

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Research Questions

How do post-hurricane regeneration rates vary among mangroves?

- How do growth rates of three dominant mangrove species (*Rhizophora mangle*, *Avicennia germinans*, and *Laguncularia racemosa*) within two life stages (seedlings and saplings) vary in riverine mangrove forests post-hurricane disturbance?
- How do mangrove regeneration rates vary along a phosphorus (P) fertility gradient in the Florida Everglades?

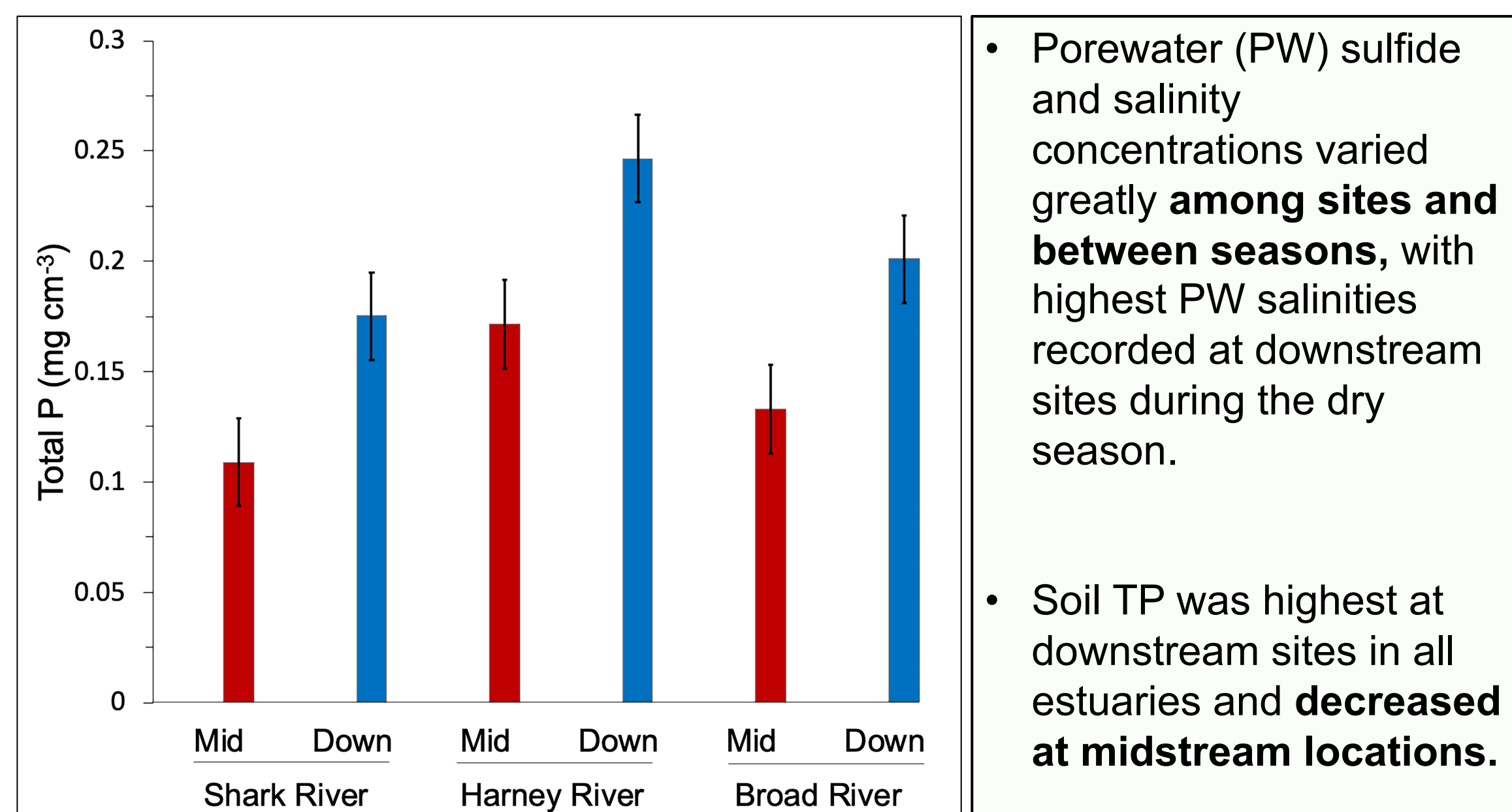
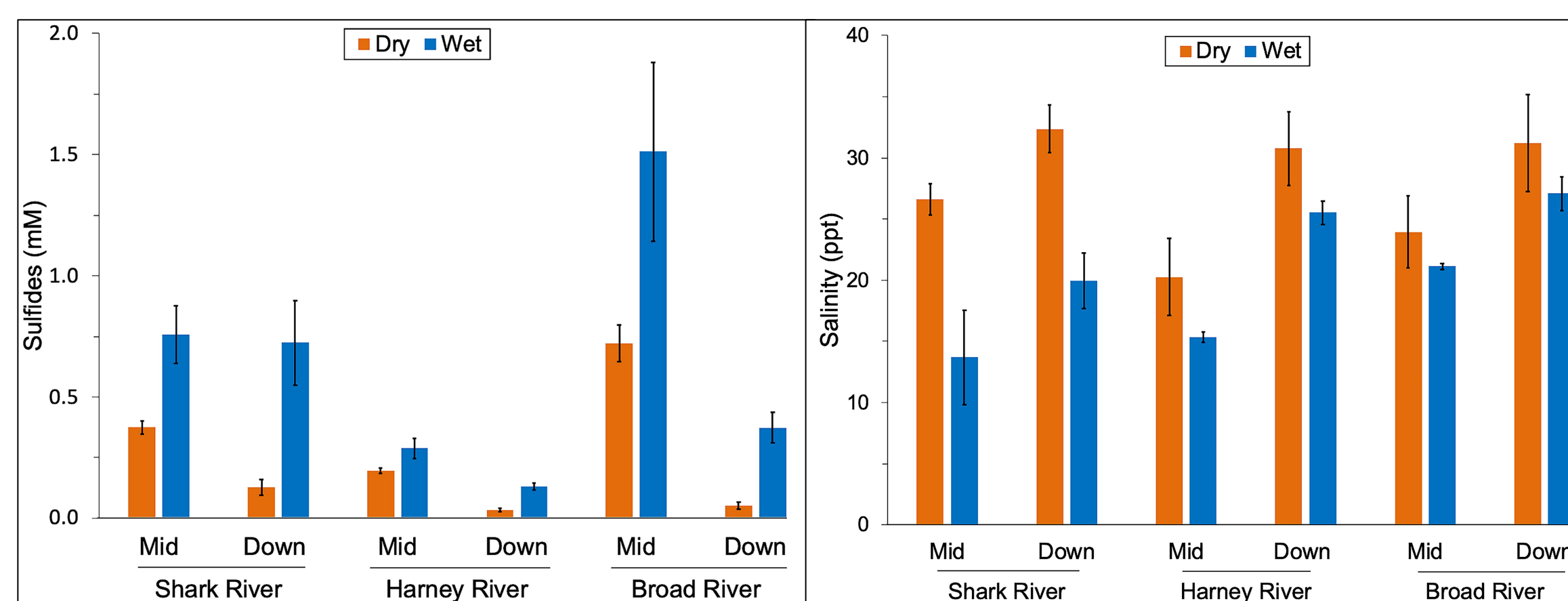
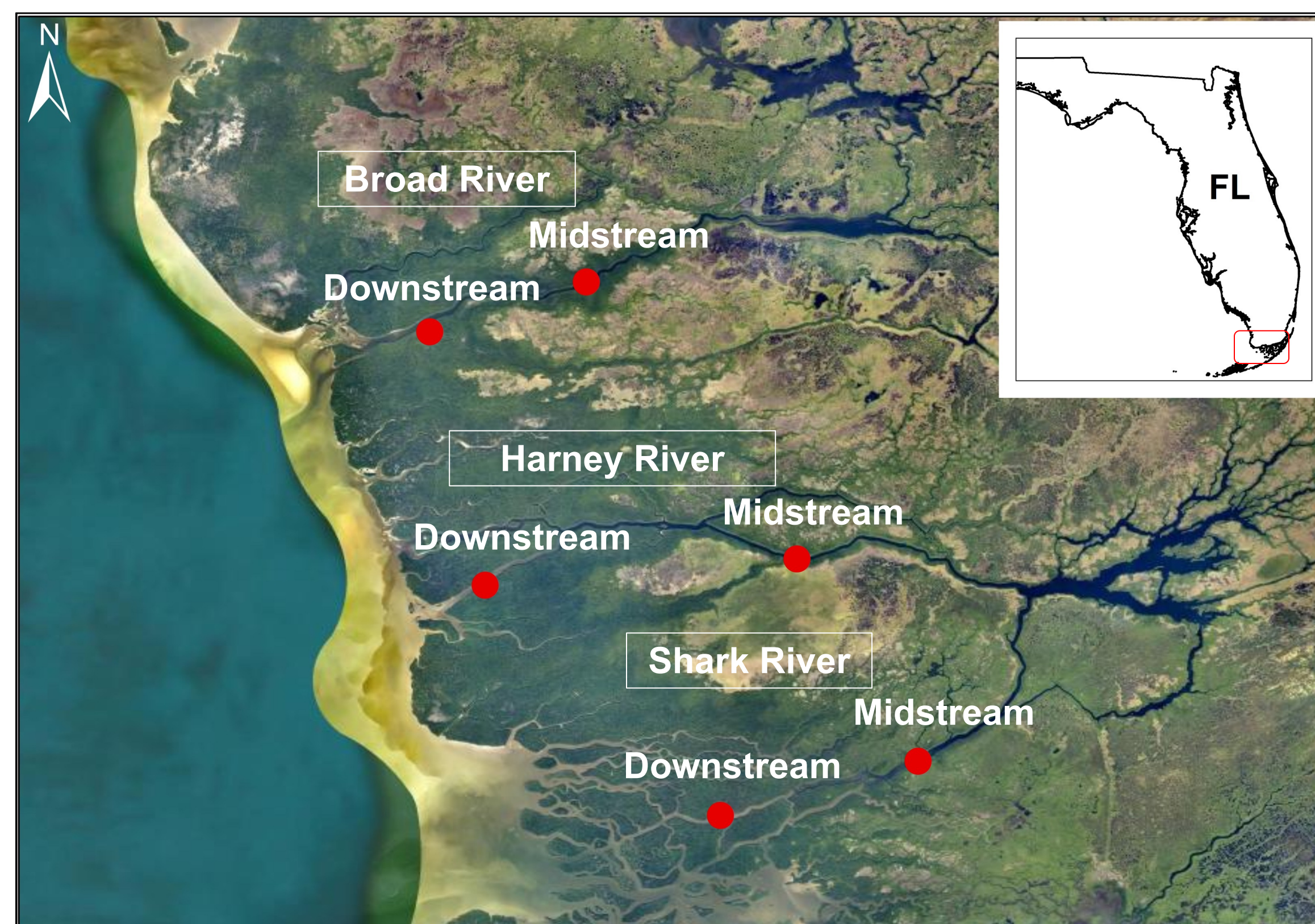
Background

- Hurricane Irma, a Category 3 storm, made landfall on September 2017 on the southwest Florida coast near Marco Island.
- Hurricanes act as a stressor and a subsidy to mangroves by bringing abrupt changes to ecosystem structure and function (e.g., defoliation, tree mortality, sediment deposition, nutrient input, etc.).
- The Florida Coastal Everglades is an oligotrophic, P-limited environment, with increasing P concentrations in downstream mangrove forests.
- This is the first study to quantify post-hurricane mangrove regeneration rates of seedlings and saplings for all three dominant mangrove species in riverine mangroves in the Florida Everglades.

Methods

- The study was conducted in the Everglades National Park from July 2020 to January 2021.
- Mangrove sites were established at two locations (mid- and downstream) along each of the three estuaries: Shark, Harney and Broad Rivers in southwestern Everglades.
- Mangrove areas in these estuarine locations were severely affected by Hurricane Irma changing ecosystem structure and function.
- Stem elongation growth rates of seedlings and saplings (10 tagged individuals each) were measured biannually in four 1x1 m plots and duplicate 2x2 m plots in each site, respectively.
- Mangroves are considered seedlings under 1-m tall.
- Saplings are considered juvenile plants with heights over 1-m tall, but under 1.8-m and <2.5 cm DBH.

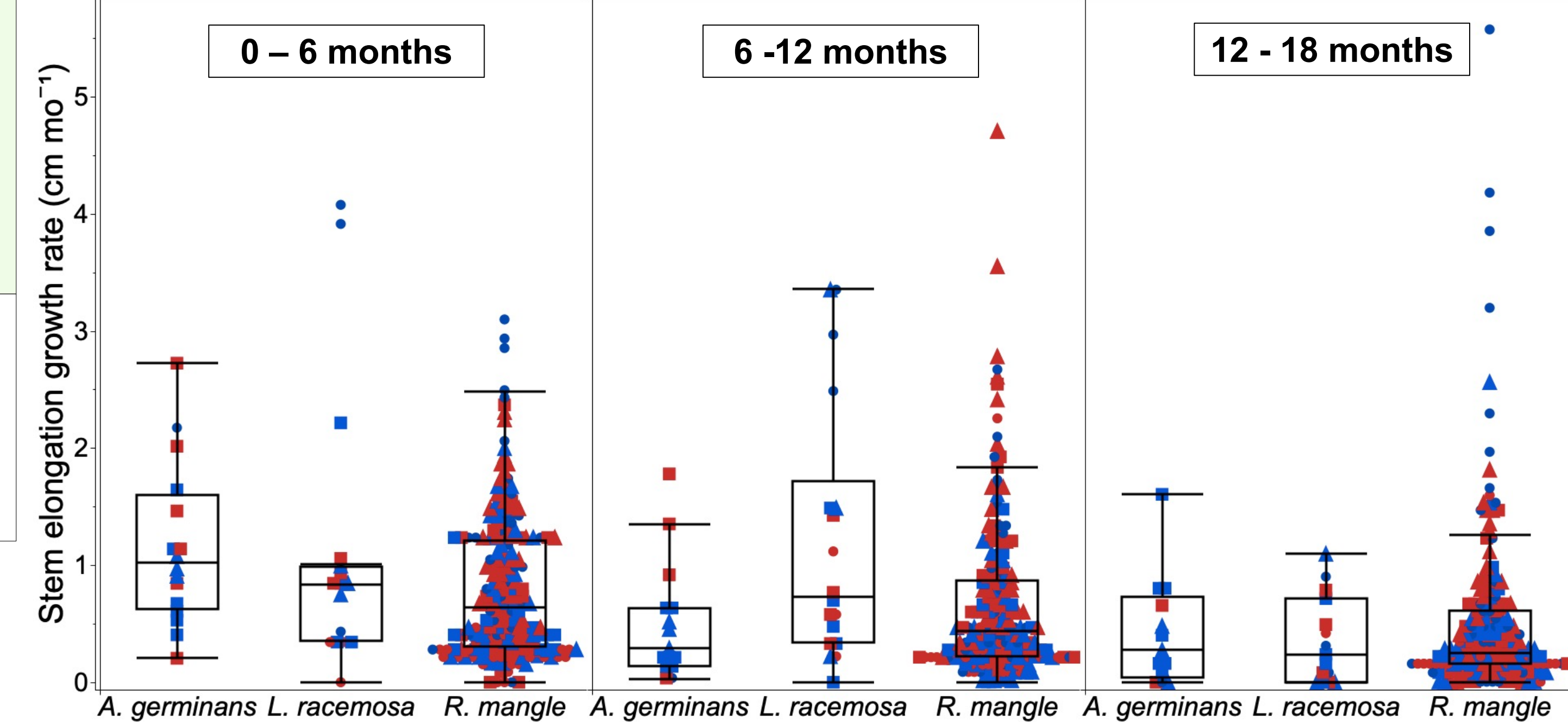
Site Characteristics



- Porewater (PW) sulfide and salinity concentrations varied greatly among sites and between seasons, with highest PW salinities recorded at downstream sites during the dry season.
- Soil TP was highest at downstream sites in all estuaries and decreased at midstream locations.

Results

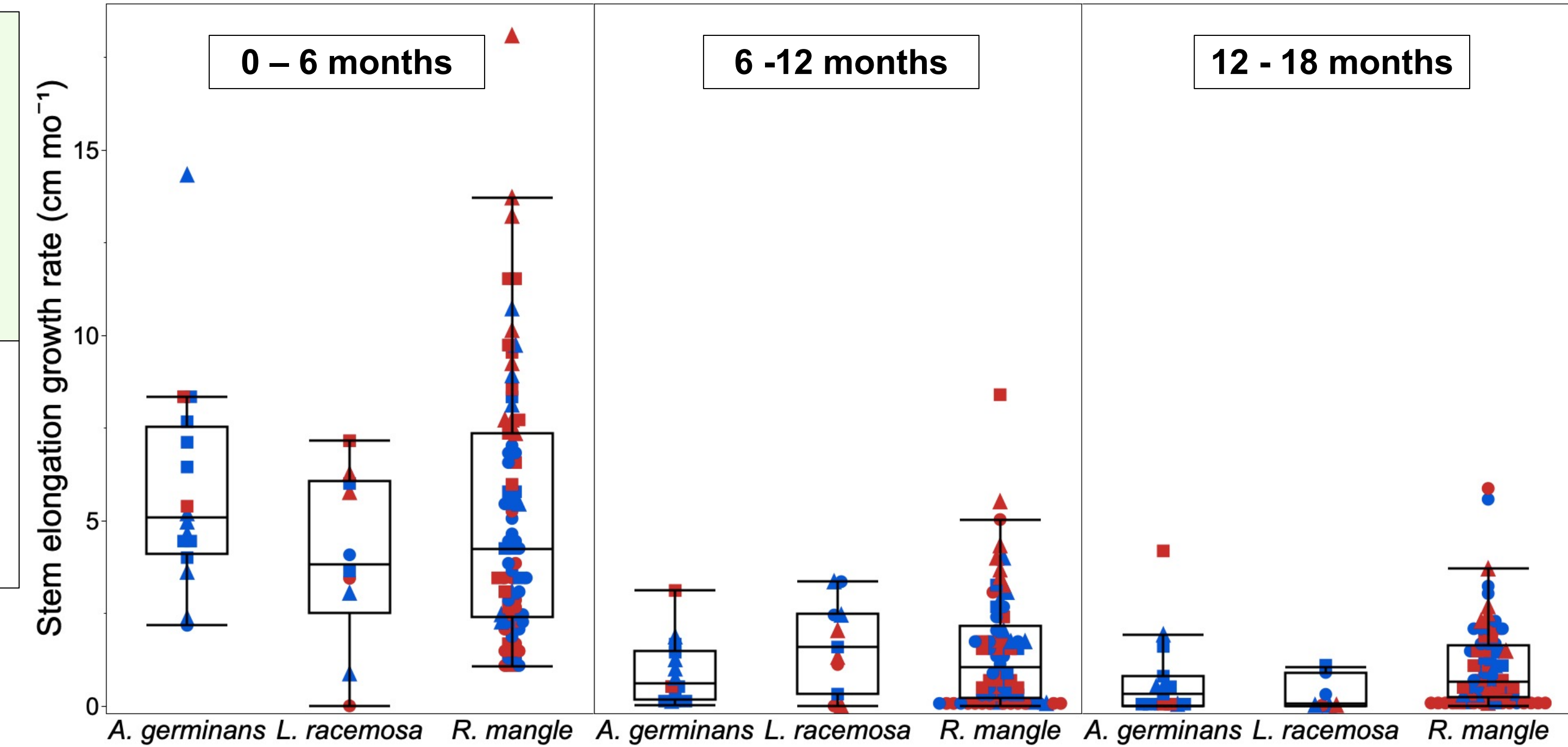
Seedlings



- Stem elongation (SE) growth rates decreased over time in seedlings of all species.
- No significant differences in SE rates among species.

Median ranges
A. germinans 0.3 ~ 1
L. racemosa 0.3 ~ 0.8
R. mangle 0.3 ~ 0.7

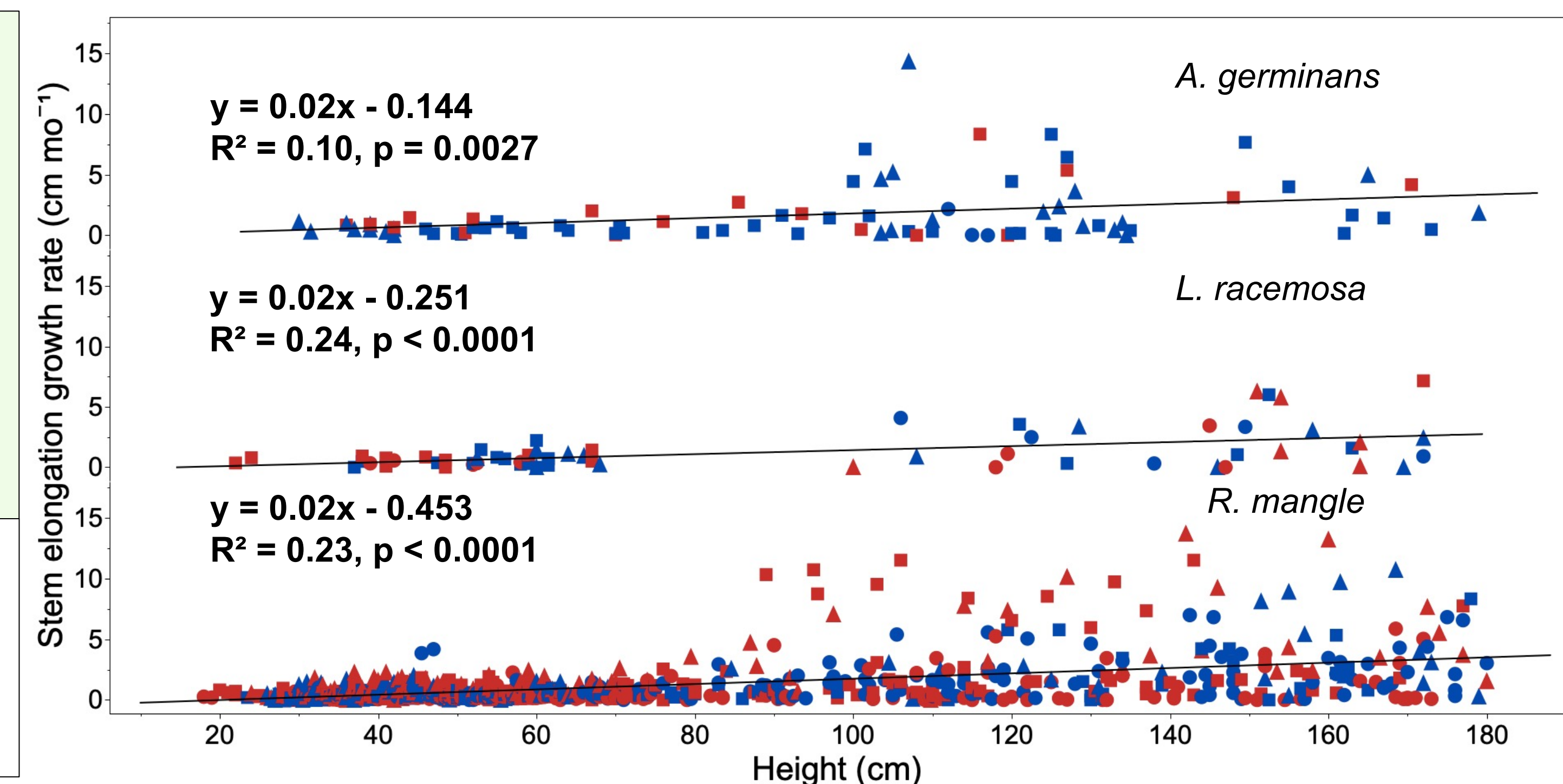
Saplings



- Sapling SE rates declined over time and became less variable after 6 months.
- R. mangle* had some of the highest SE rates.
- Species varied in SE growth rates between sites and sampling periods.

Median ranges
A. germinans 0.3 ~ 5.1
L. racemosa 0.1 ~ 3.8
R. mangle 0.7 ~ 4.2

Seedlings & Saplings



- All species showed a significant relationship between total height and SE growth rate, *L. racemosa* had the strongest relationship and *A. germinans* had the weakest.
- All species had the same total SE growth rate trends (slope = 0.02 cm mo⁻¹).

Conclusions

- Saplings and seedlings had higher stem elongation growth rates within the first six months of sampling, decreasing with time, less so for *R. mangle* at the midstream Broad River site.
- Mangrove species varied in growth rates among sites for both seedlings and saplings.
- Shark River had higher SE growth rates downstream compared to midstream for both seedlings and saplings, whereas Broad and Harney Rivers had an opposite trend (higher SE growth rates midstream).
- Total mangrove SE growth rates varied among sites but similarly increased with mangrove height for all species.

