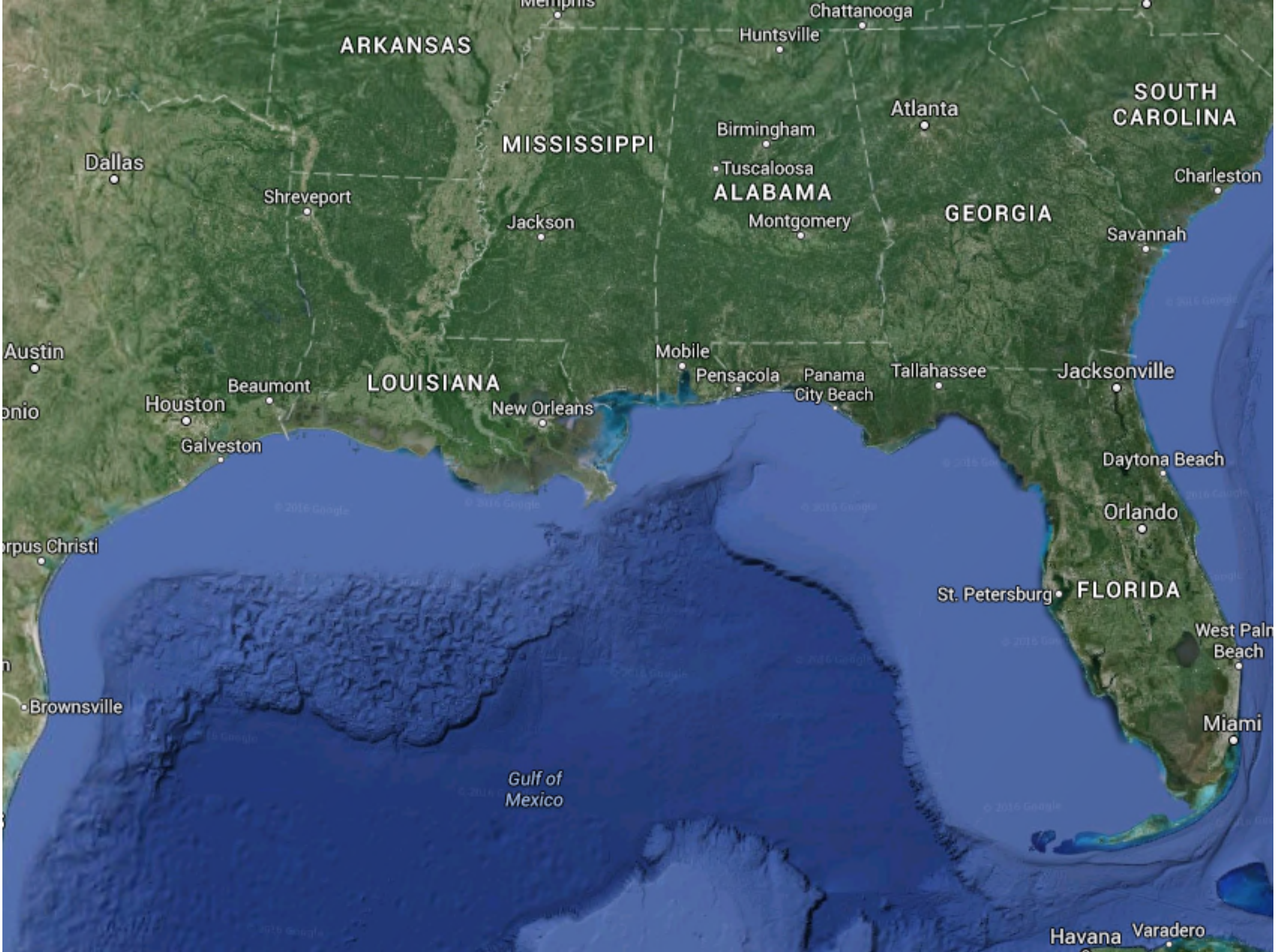
Nitrogen Fixation in Seagrass Bed Sediments Dominated by *Thalassia testudinum* and *Halodule wrightii*

Rachel Capps

Center for Environmental Diagnostics and Bioremediation

University of West Florida, Pensacola, Florida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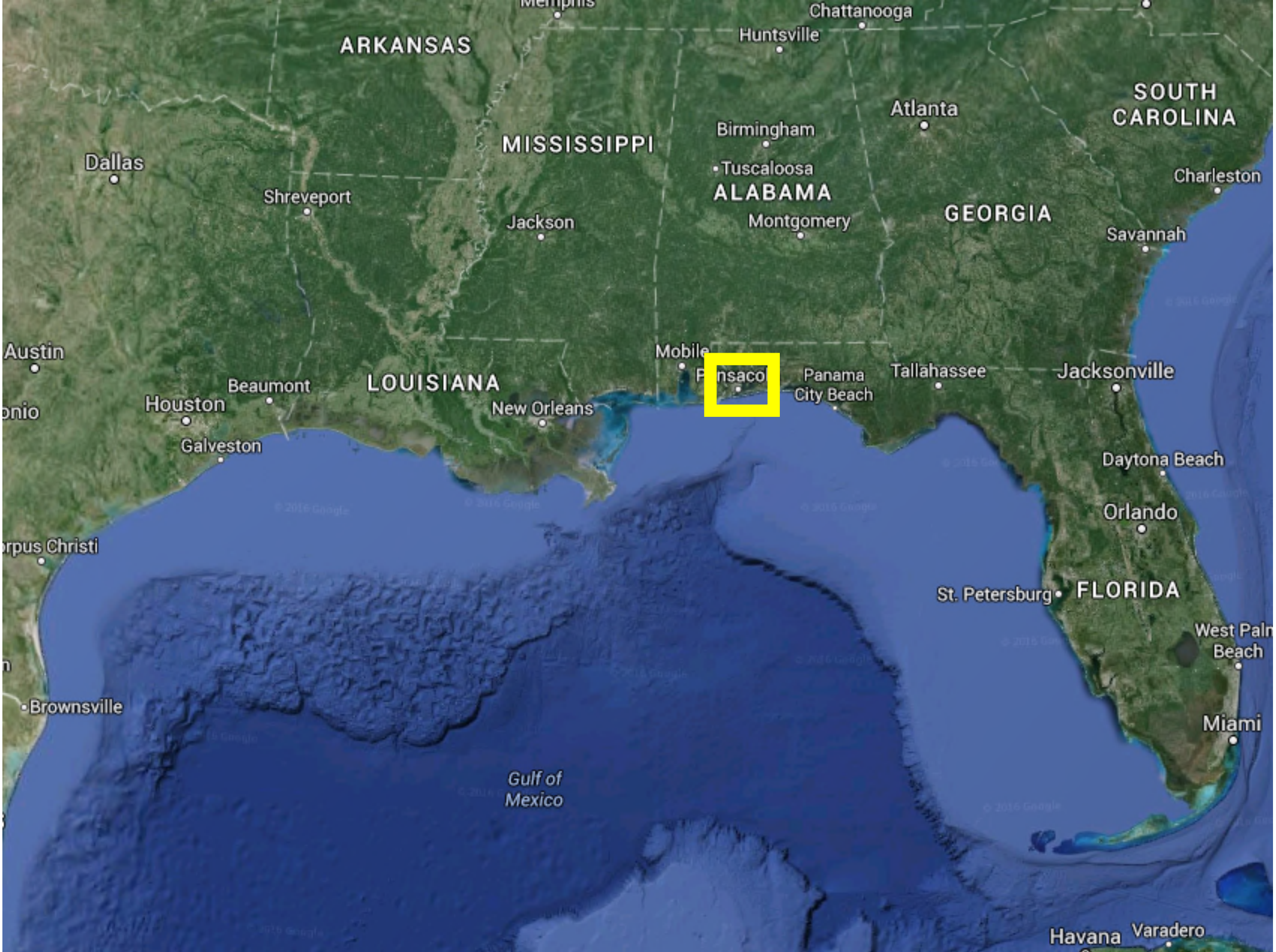
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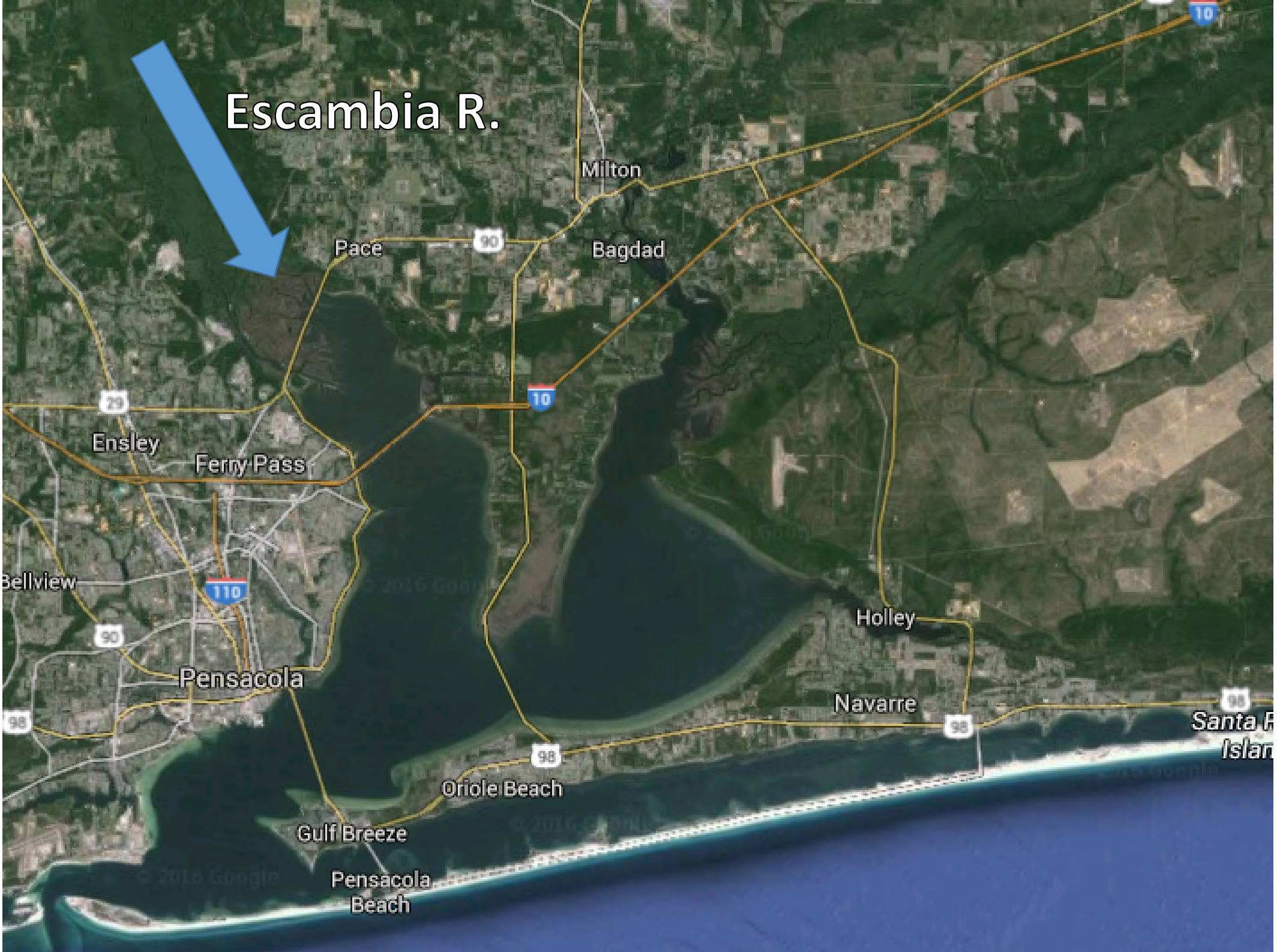
Thrope, et al. 1997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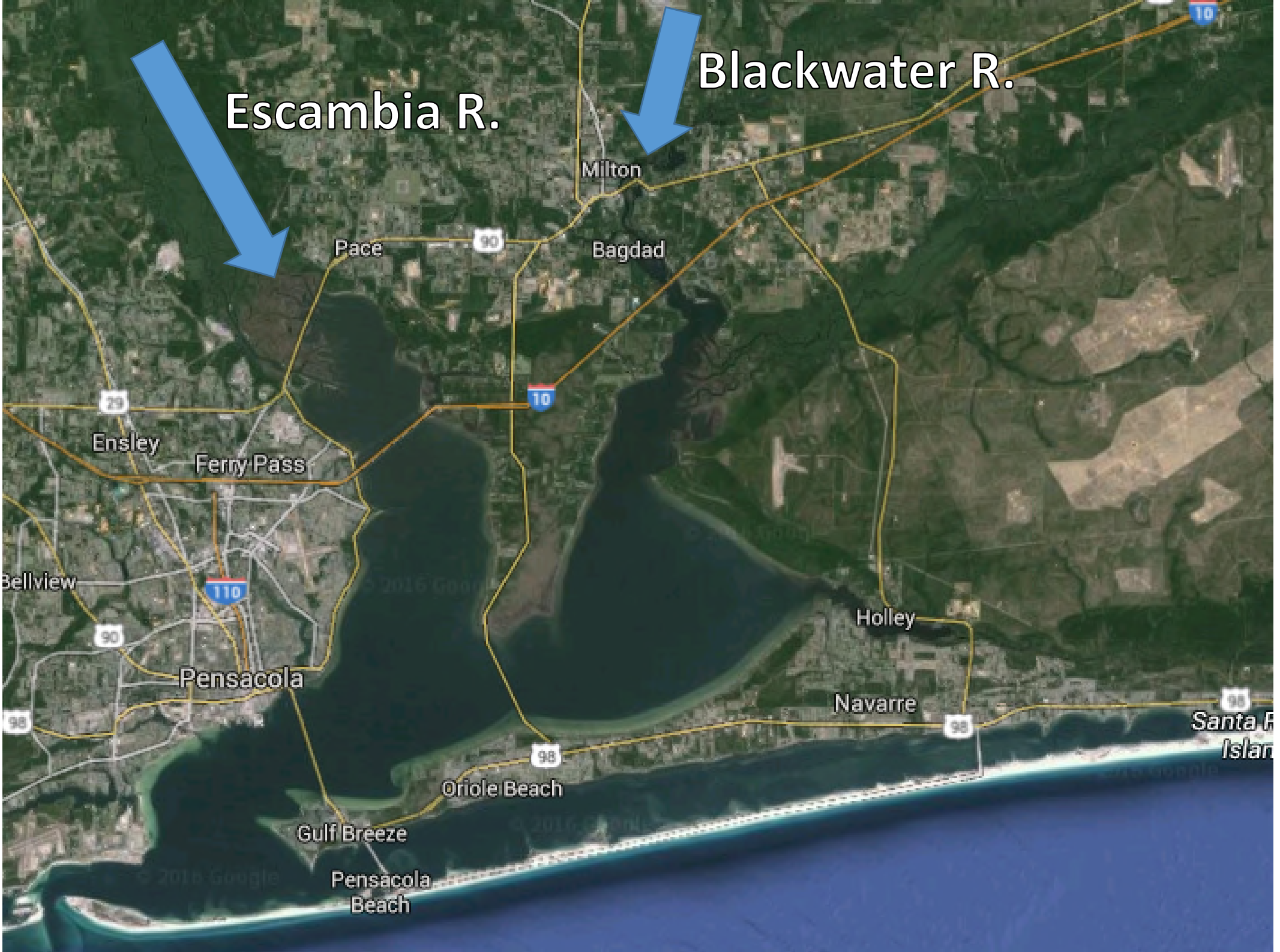
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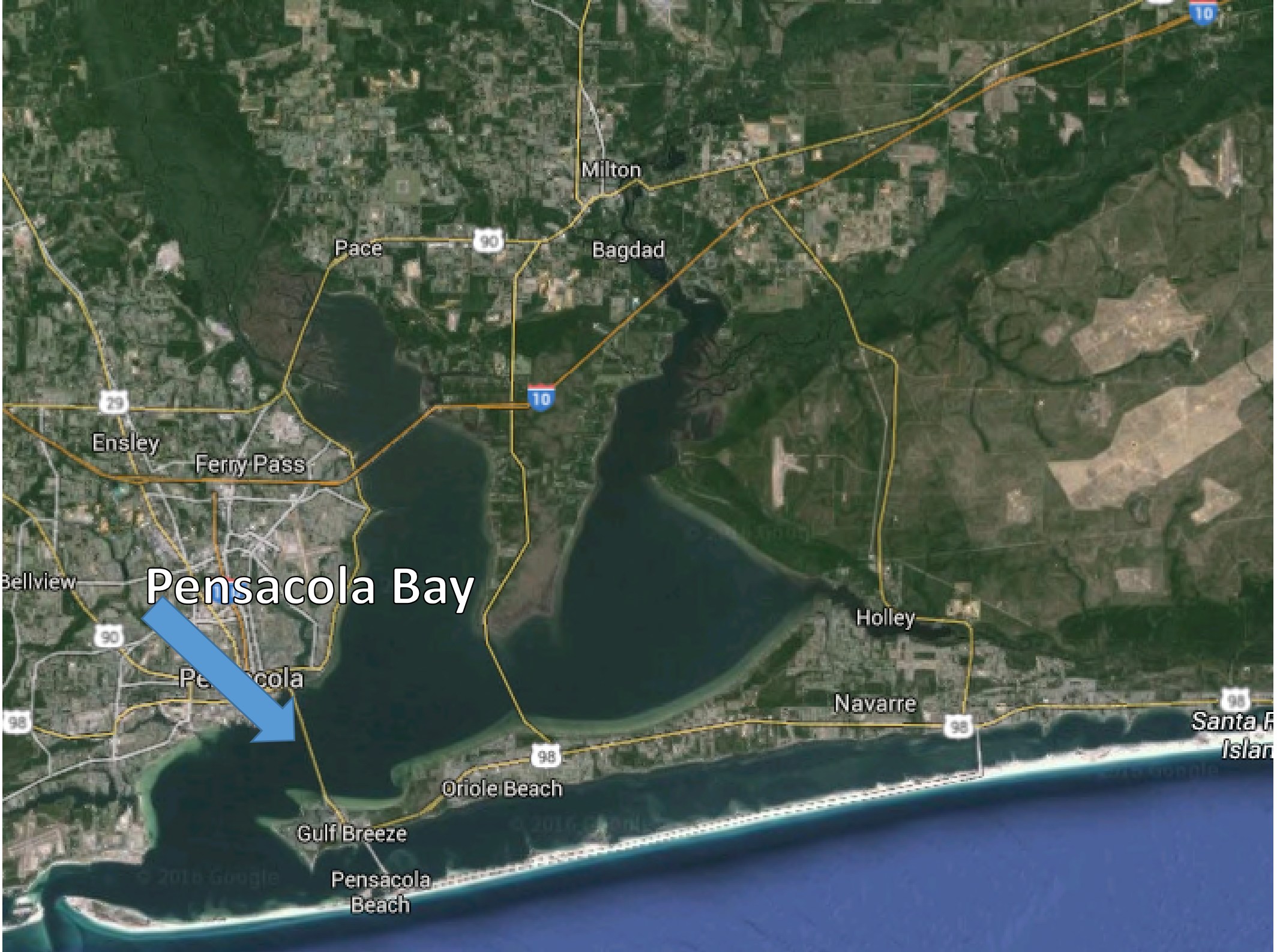
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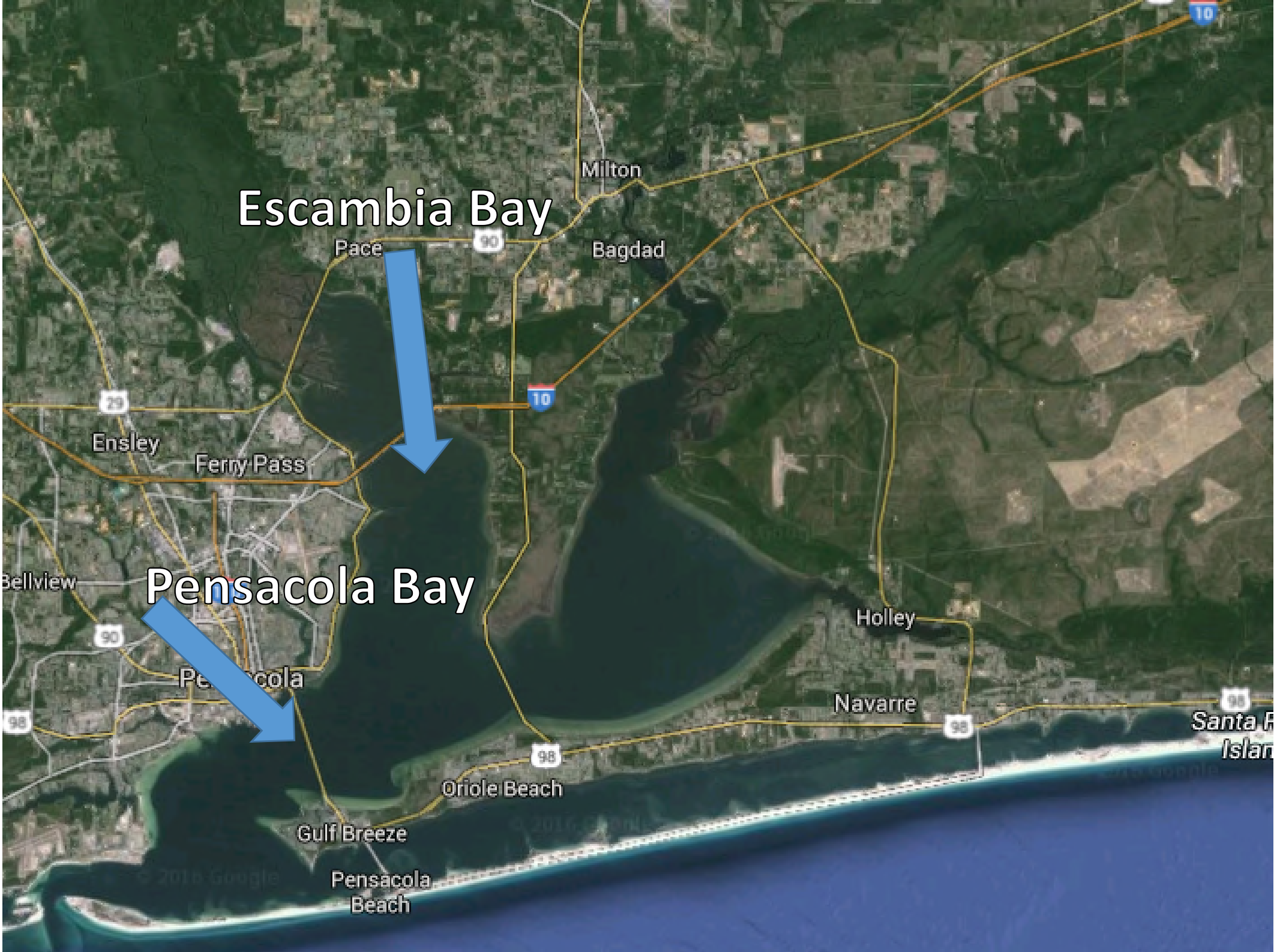
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Escambia Bay
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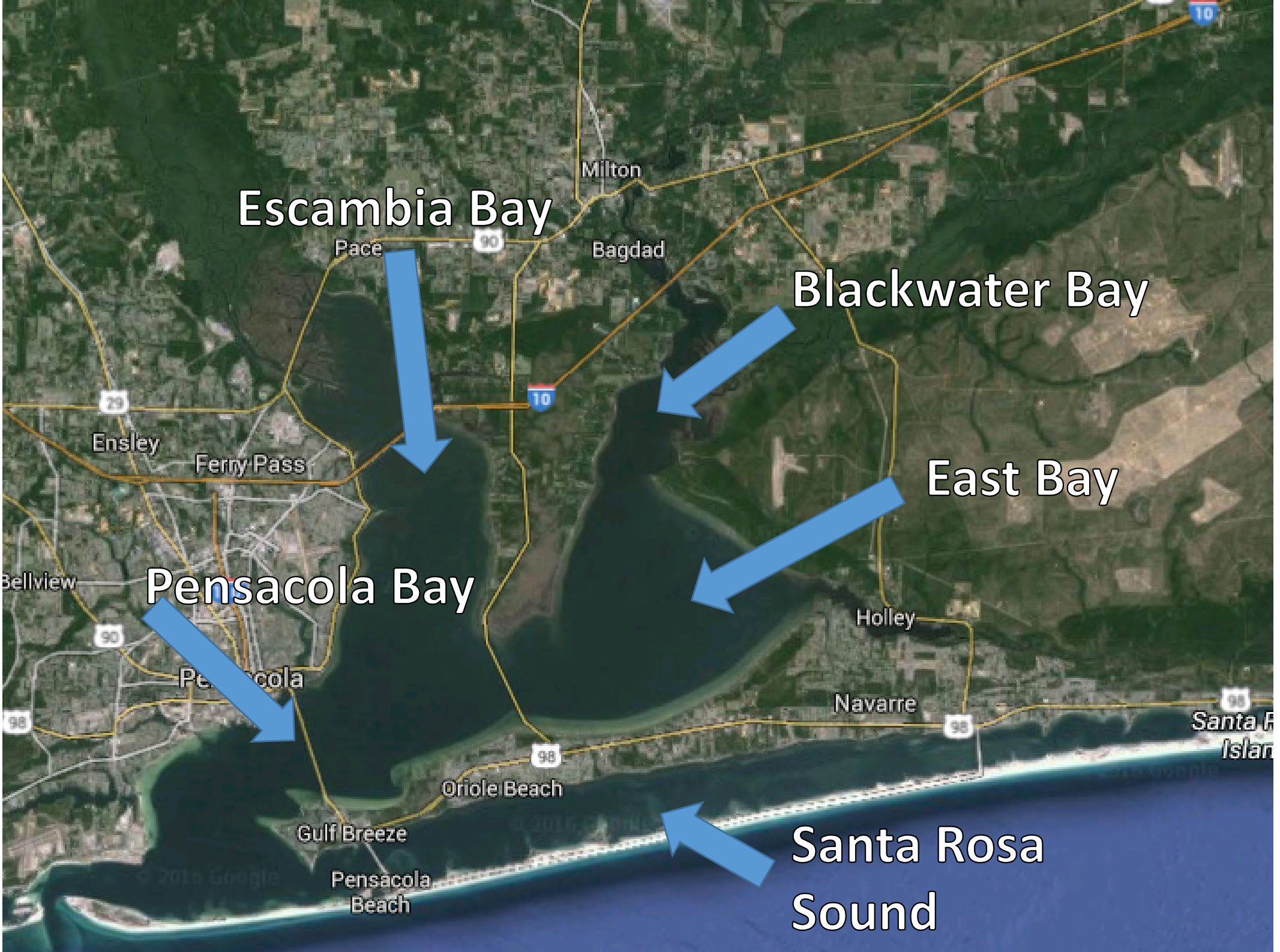
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Pensacola Bay
Santa Rosa Sound
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Bagdad
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Ferry Pass
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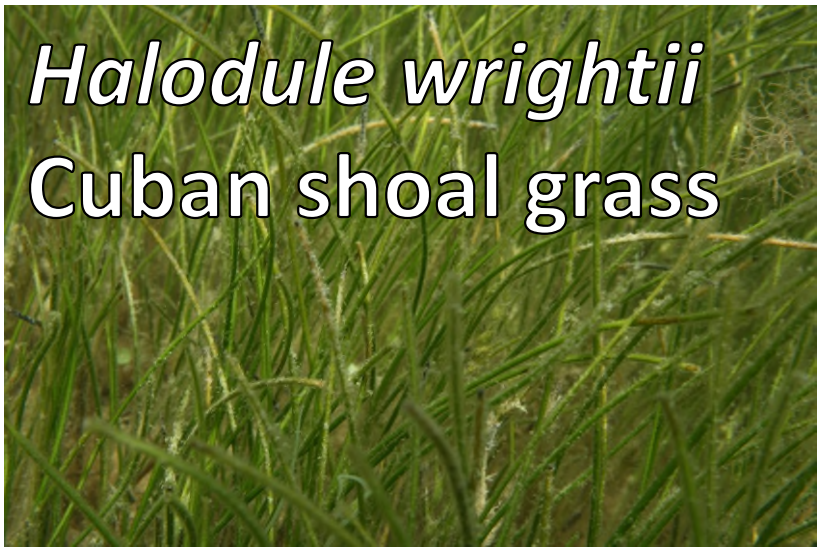
Gulf Breeze
Pensacola Beach

Seagrass Species Present in PBS



Benefits of Seagrass Beds

Ecological Services

- Nursery grounds
- Foraging grounds
- Biodiversity
- Sediment stabilization
- Carbon sequestration
- Biogeochemical cycling

Human Services

- Storm buffering
- Prevent erosion
- Decreased turbidity
- Commercial fisheries
- Recreational fisheries

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Benefits of Seagrass Beds

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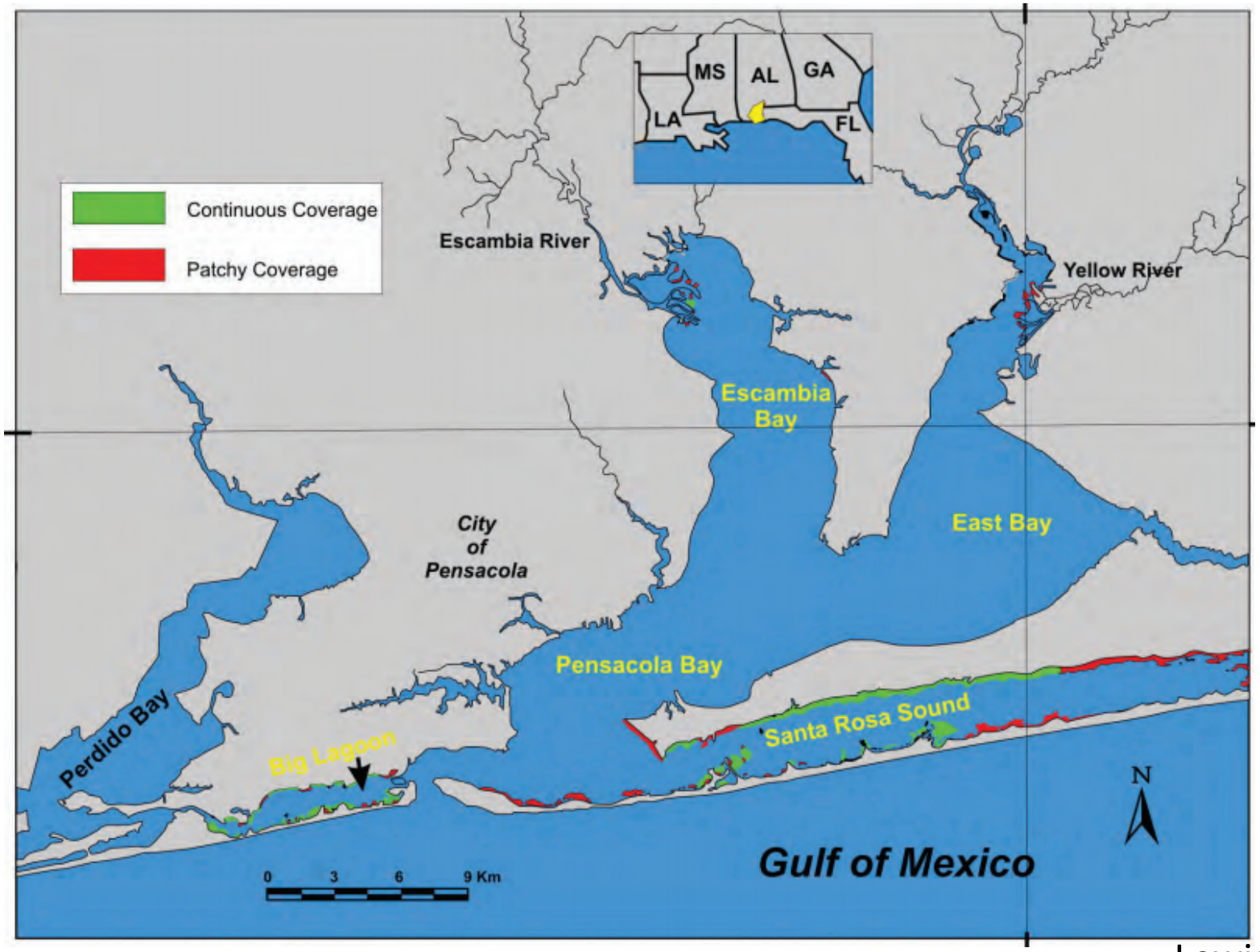
Human Services

- Storm buffering
- Prevent erosion
- Decreased turbidity
- Recreational fisheries
- Commercial fisheries
- Recreational activities

95% loss of seagrasses 1950-1980



Lewis et al. 2008

Factors that affect seagrass health

- Light attenuation
  - Water depth
  - Turbidity
  - Plankton productivity
  - Epiphyte
  - Macroalgae
- Temperature
- Salinity
- Grazing
- Disease
- Sulfide toxicity
  - 300µM affects growth
  - 2,000µM kills
- Nutrients
  - Water column: nitrate, ammonium, and phosphate
  - Porewater: ammonium and phosphate

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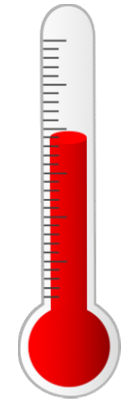
Study Site

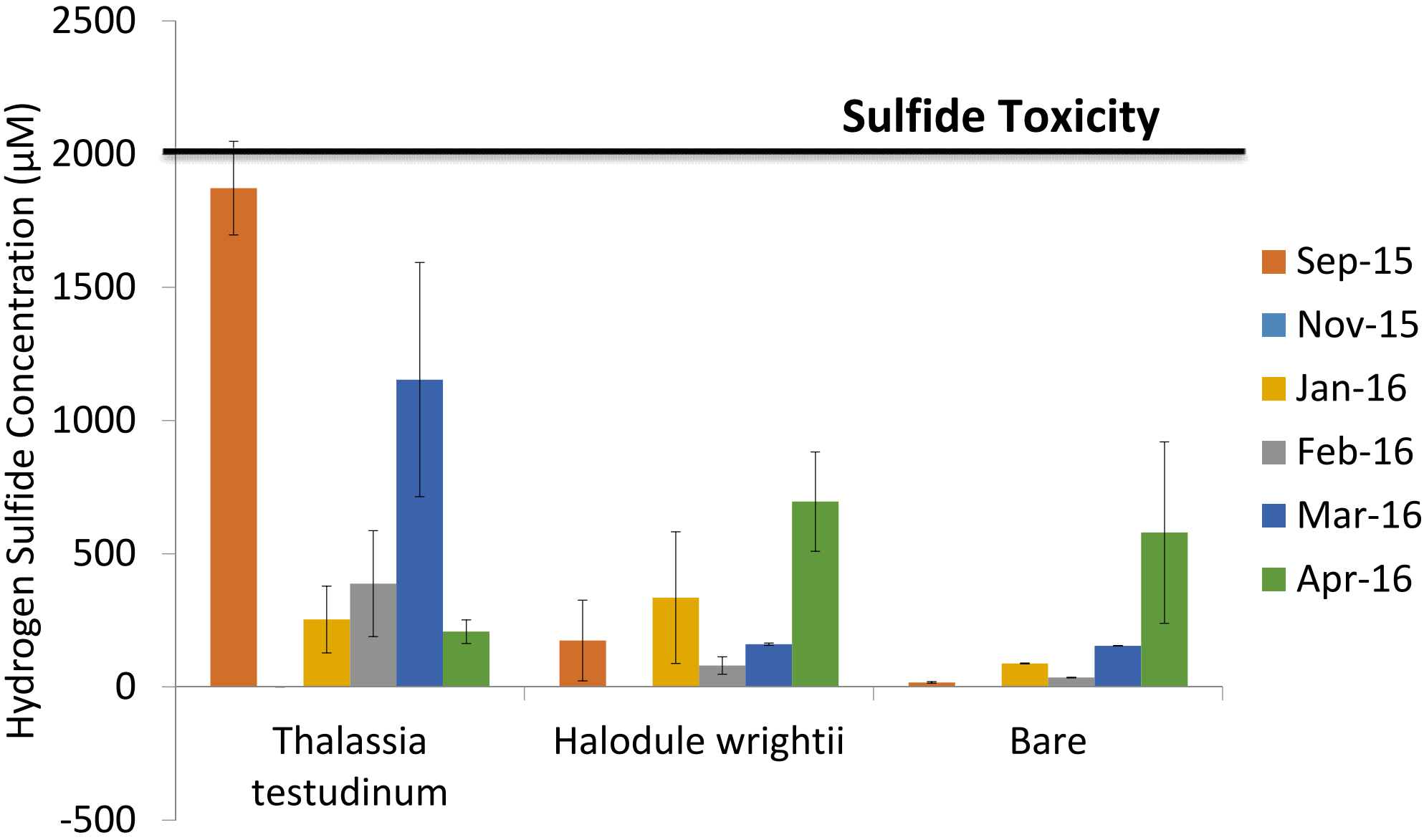
- Little anthropogenic pressure
- Dominated by *T.testudinum* and *H. wrightii*

Light, Temperature, and Salinity

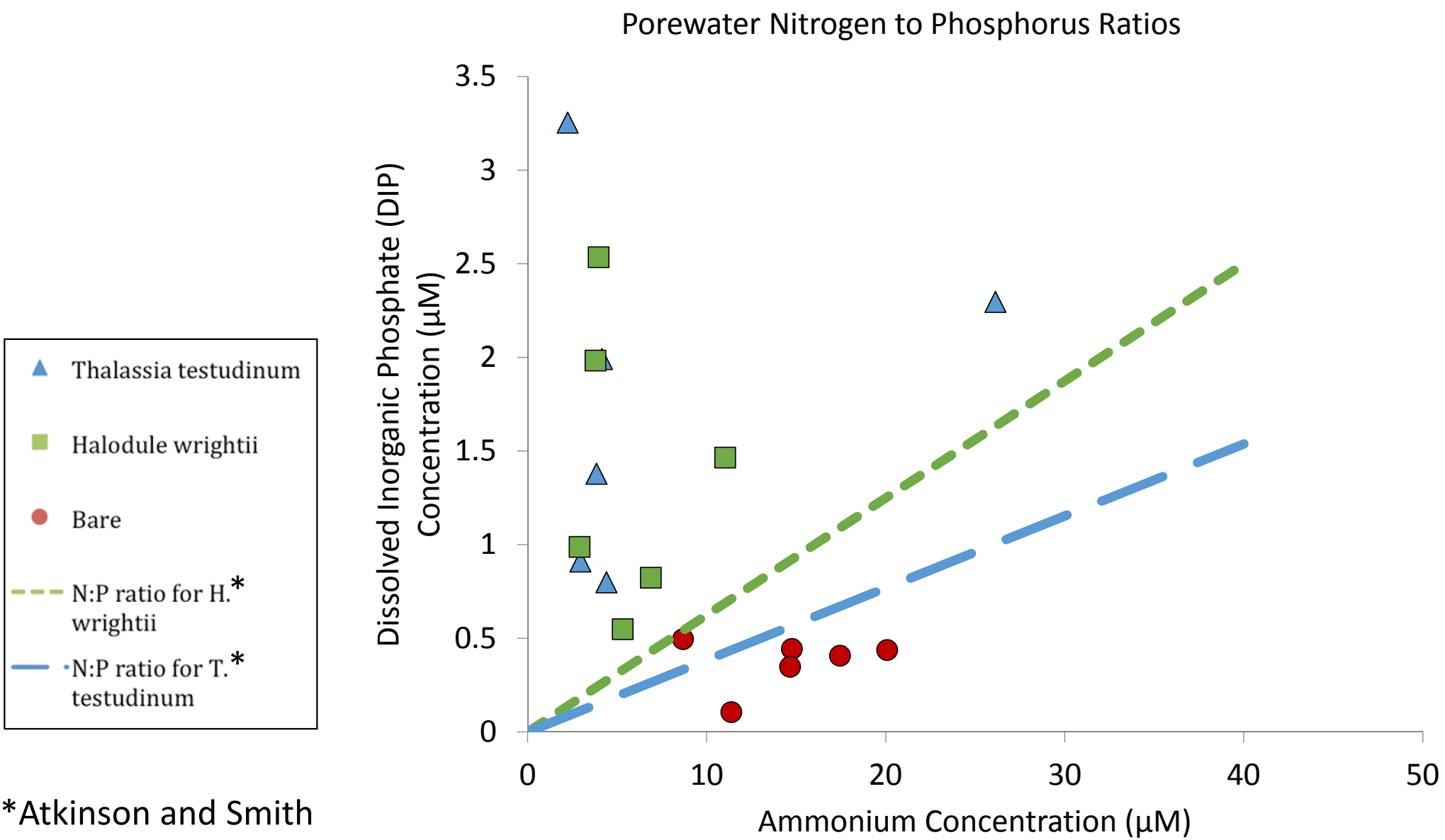


- 58.7 – 72.6 % SI
- 10.0 – 26.9°C
- 12.4 – 28.9 PSU

Sulfide Toxicity

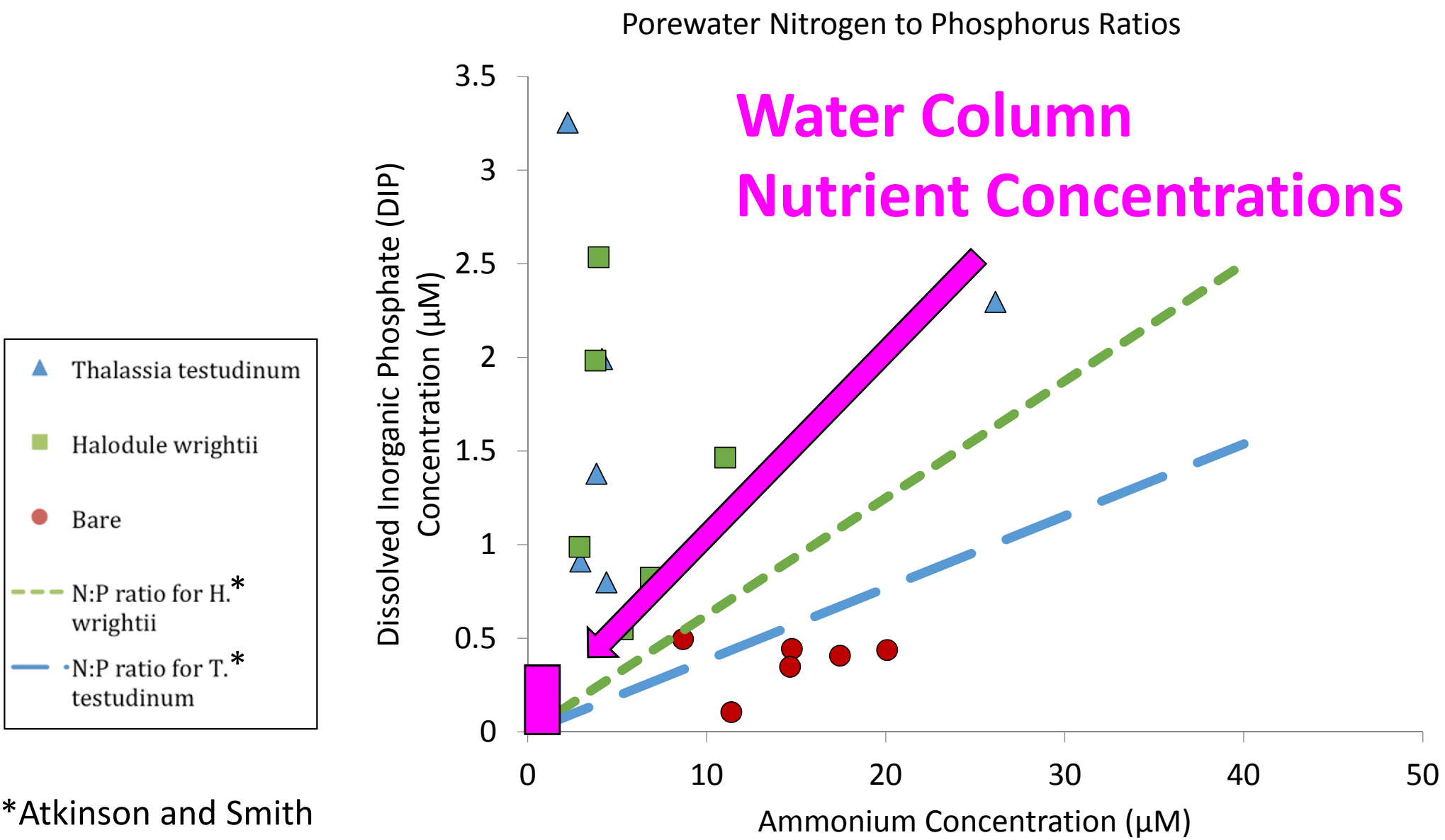


Nutrients



*Atkinson and Smith 1983

Nutrients



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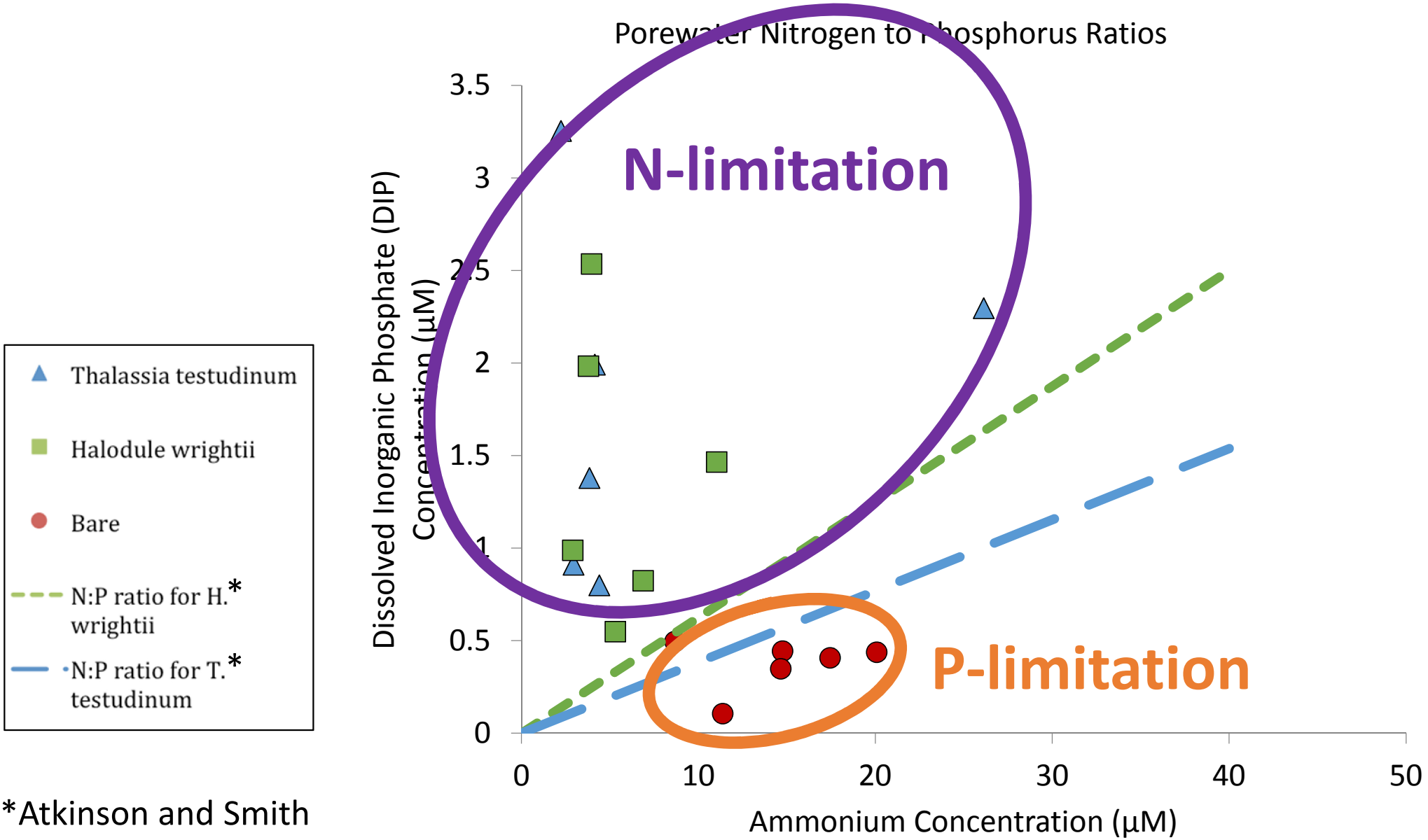
Nutrients



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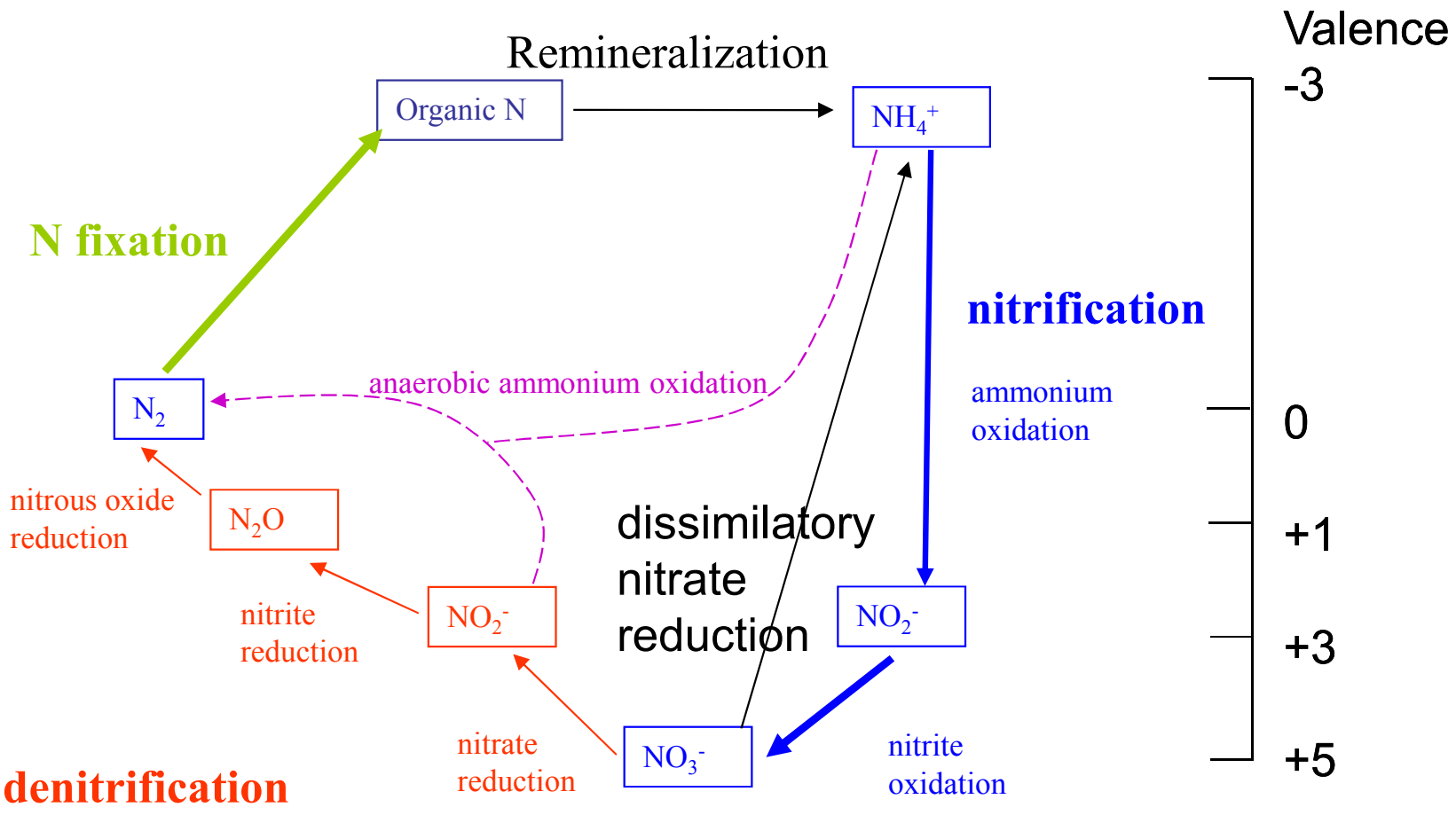
The Nitrogen Cycle



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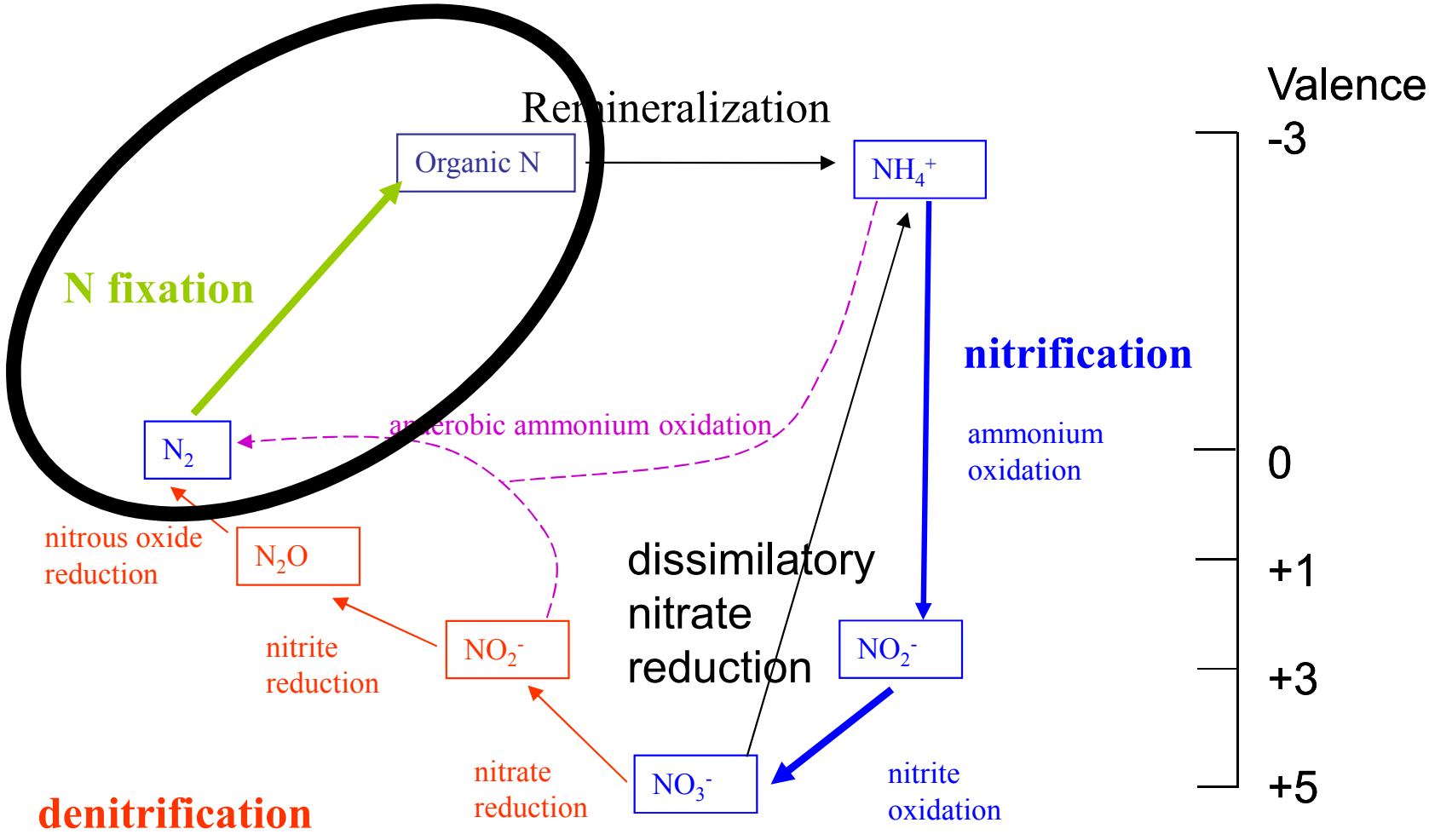
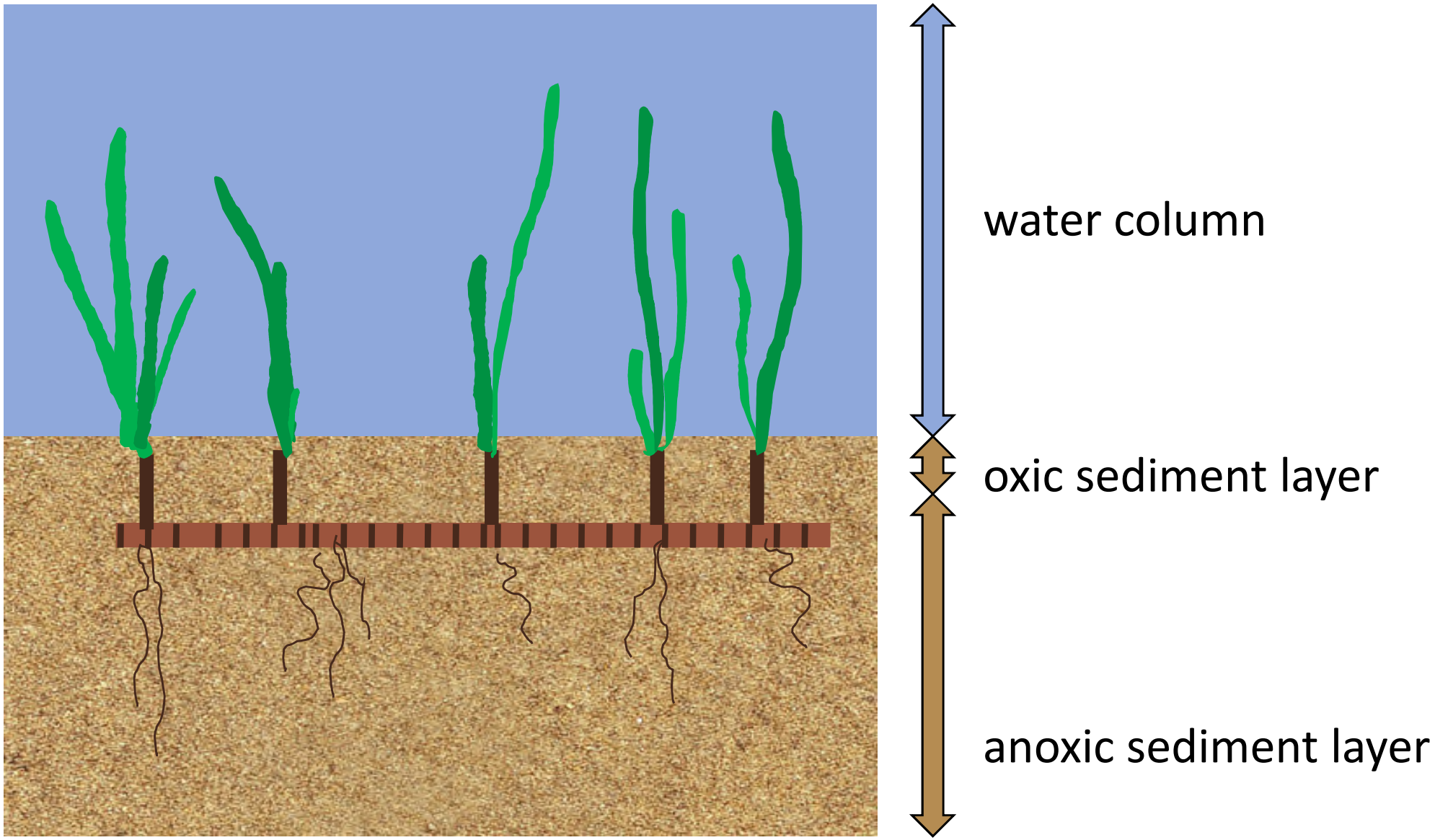


Nitrogen Fixation in Seagrass Beds



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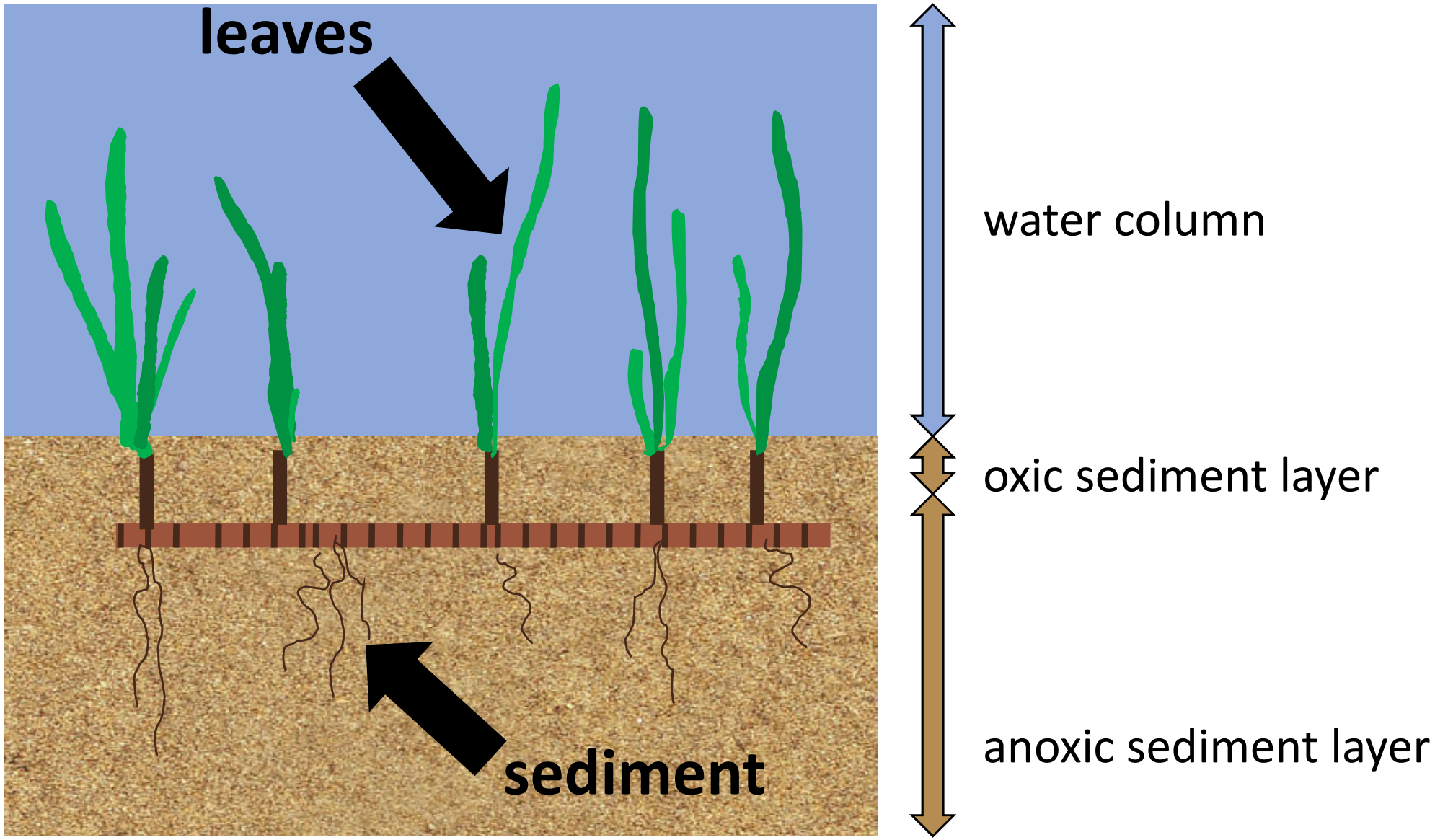
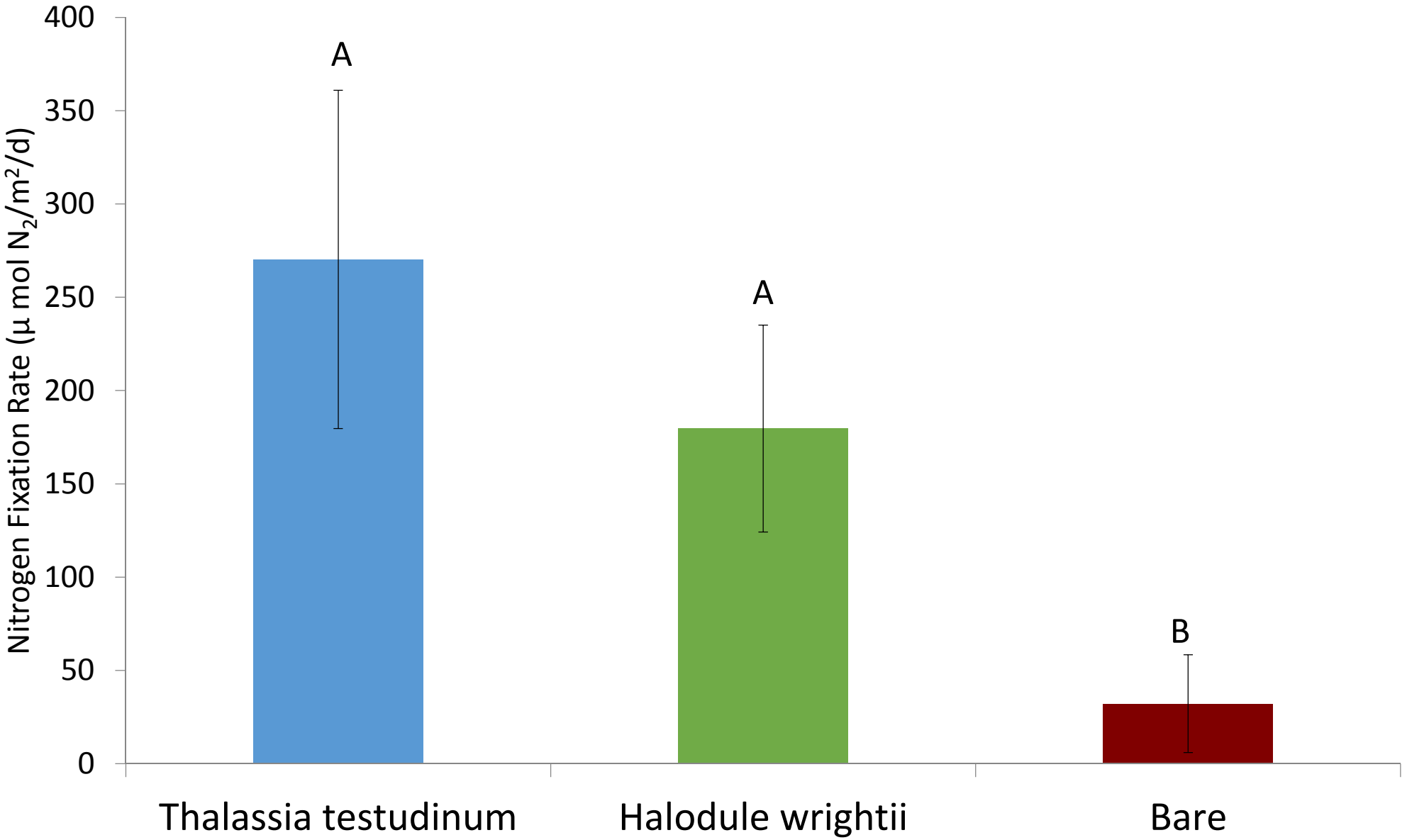


Nitrogen Fixation Rates



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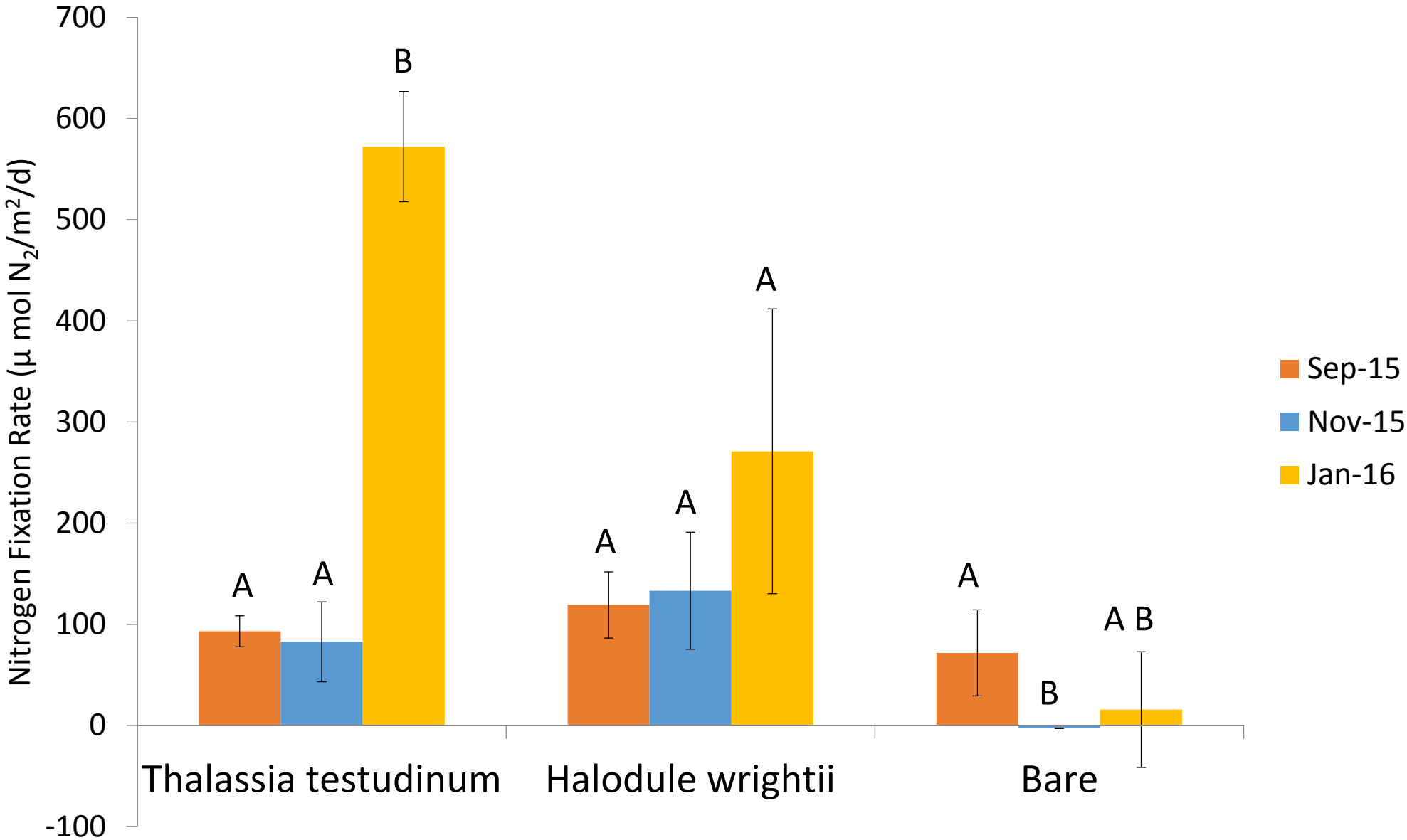
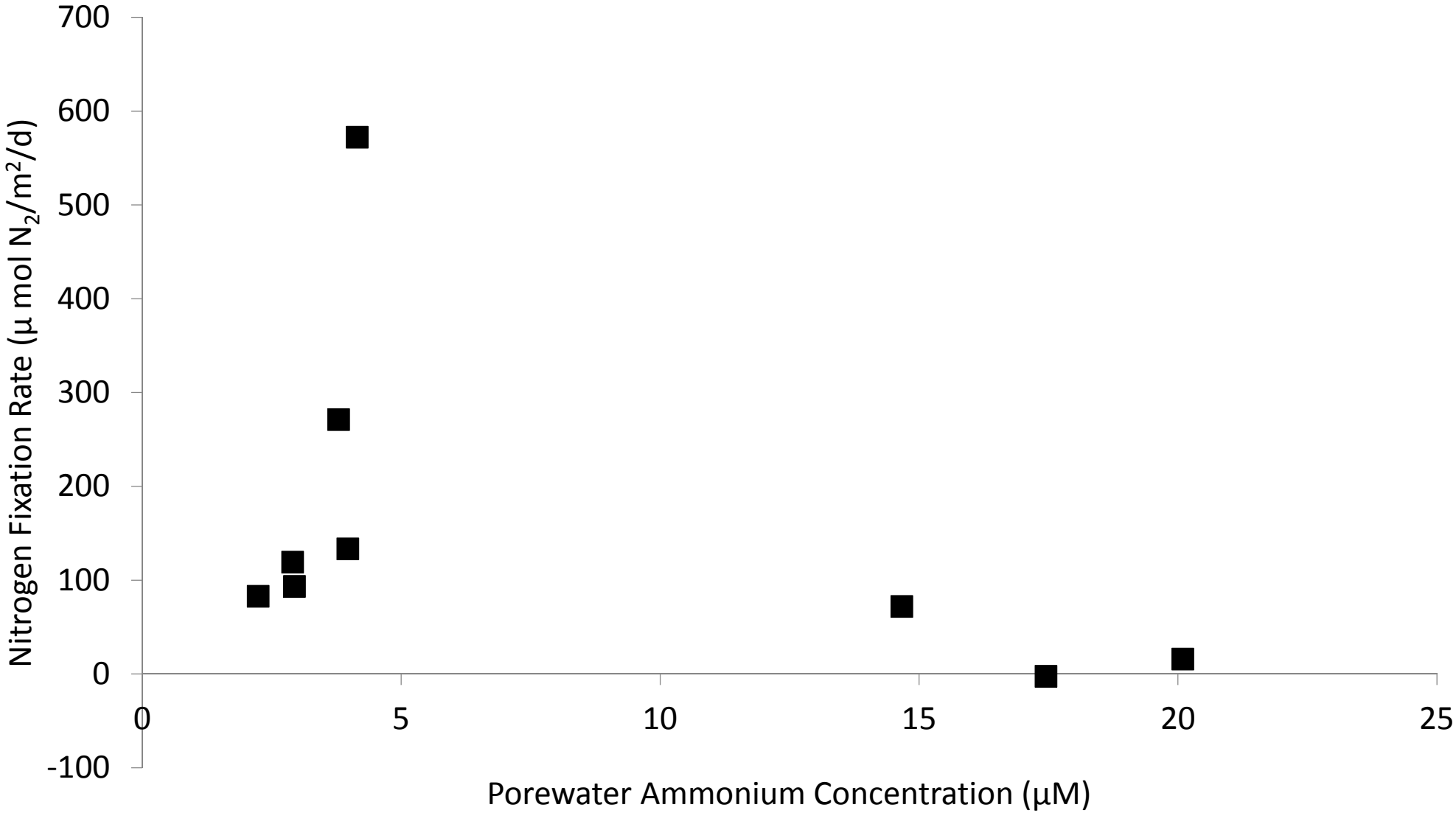


Nitrogen Fixation & Ammonium



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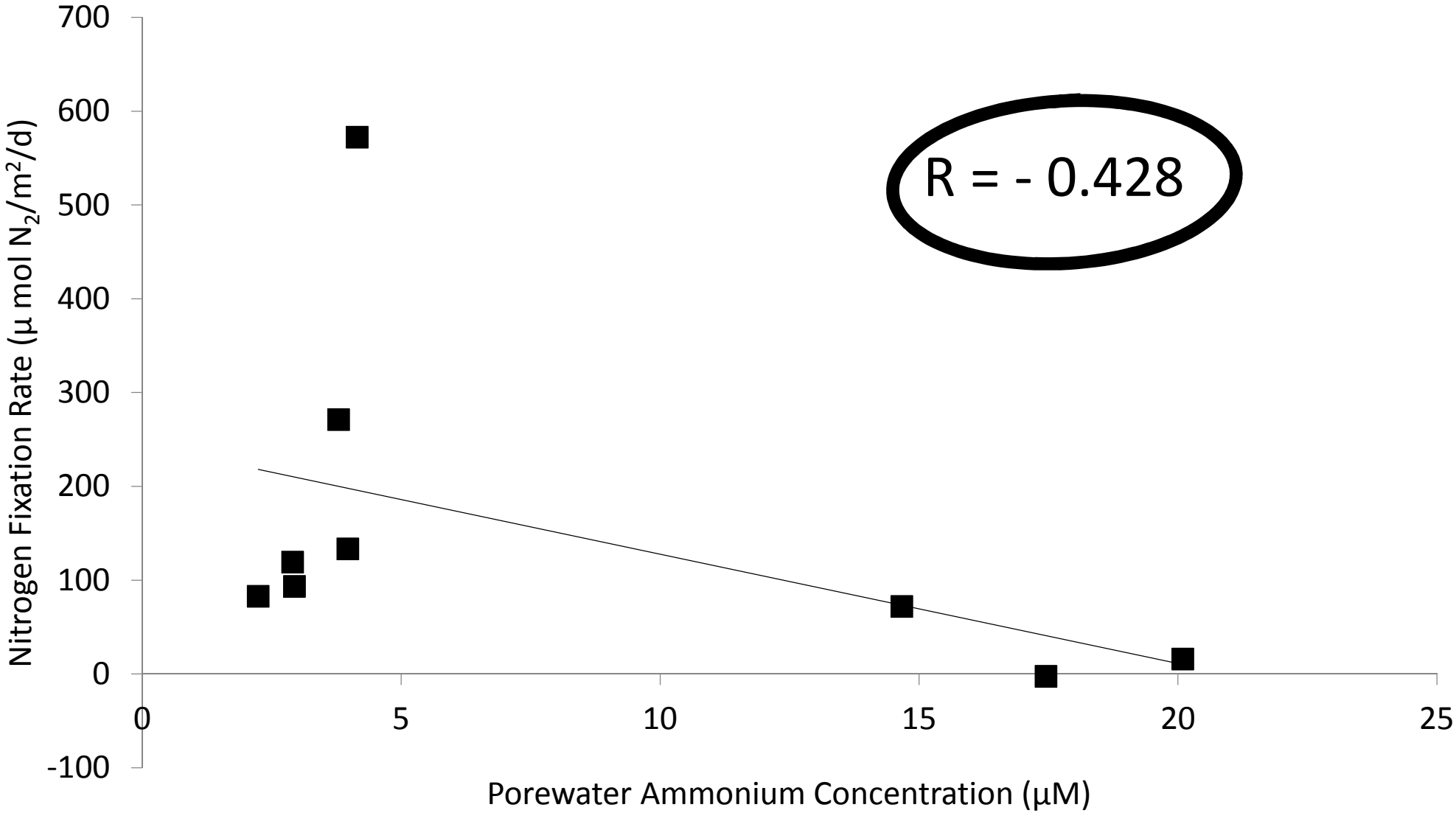
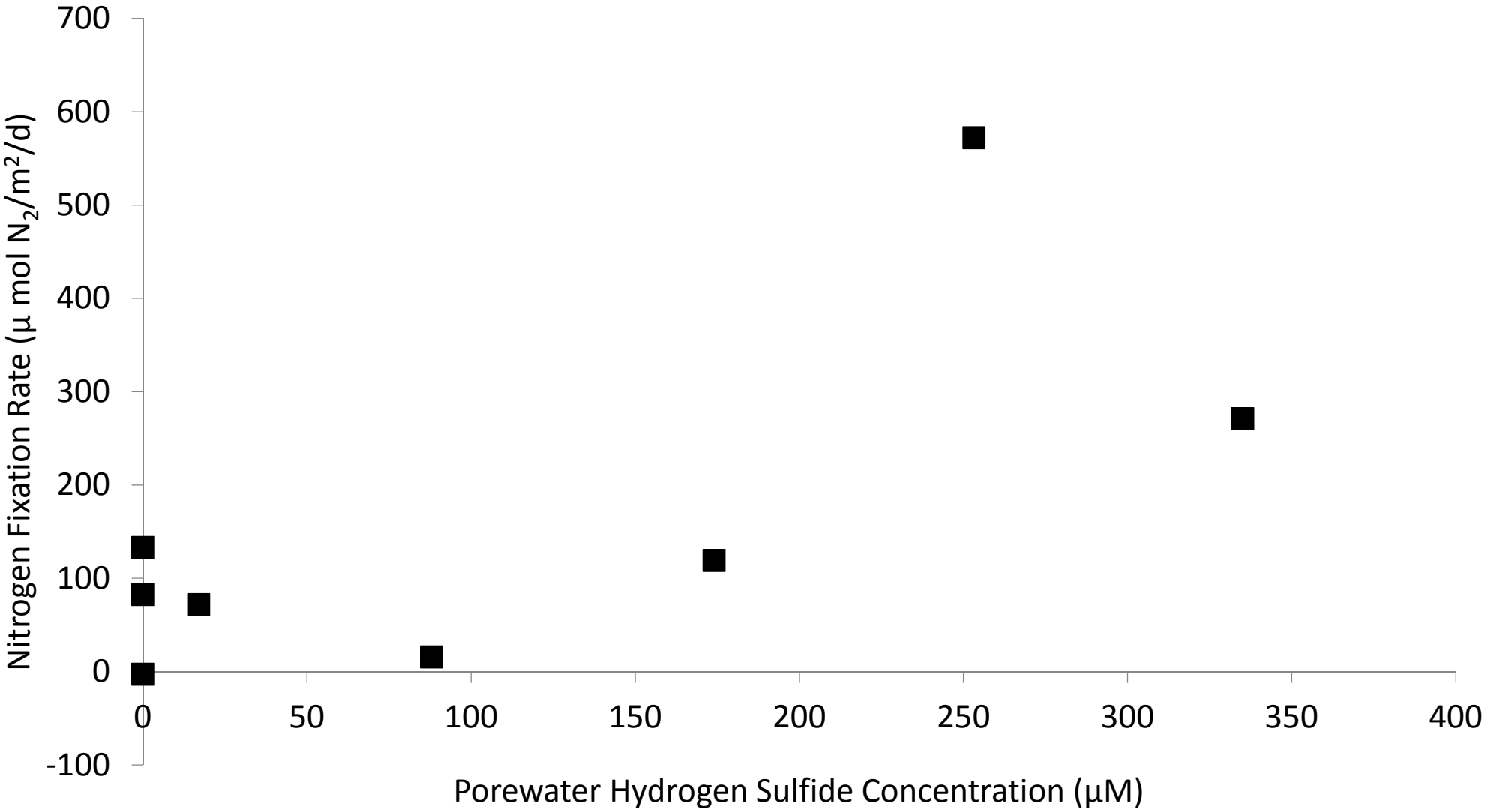


Nitrogen Fixation & Sulfide Conc.



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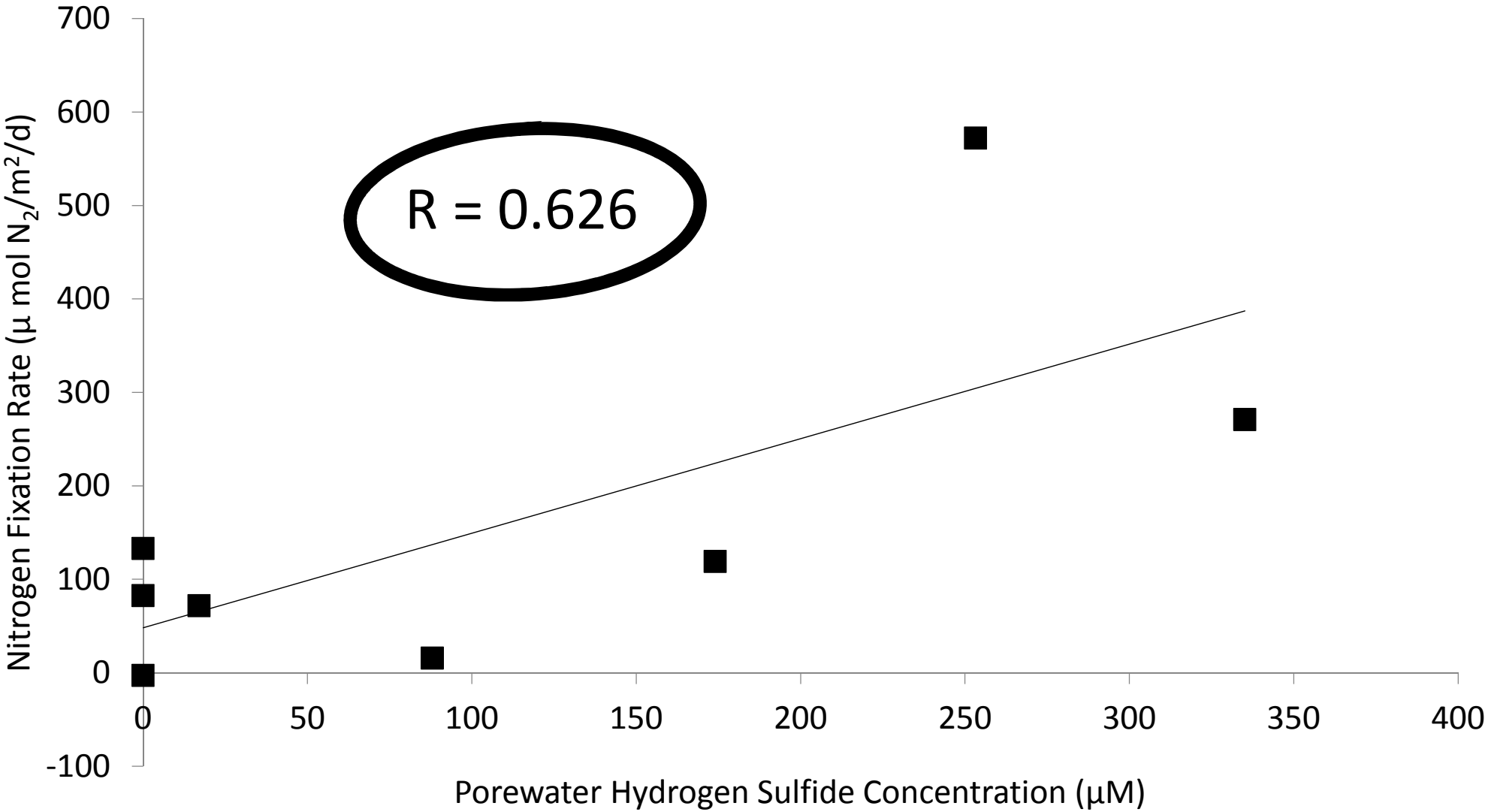
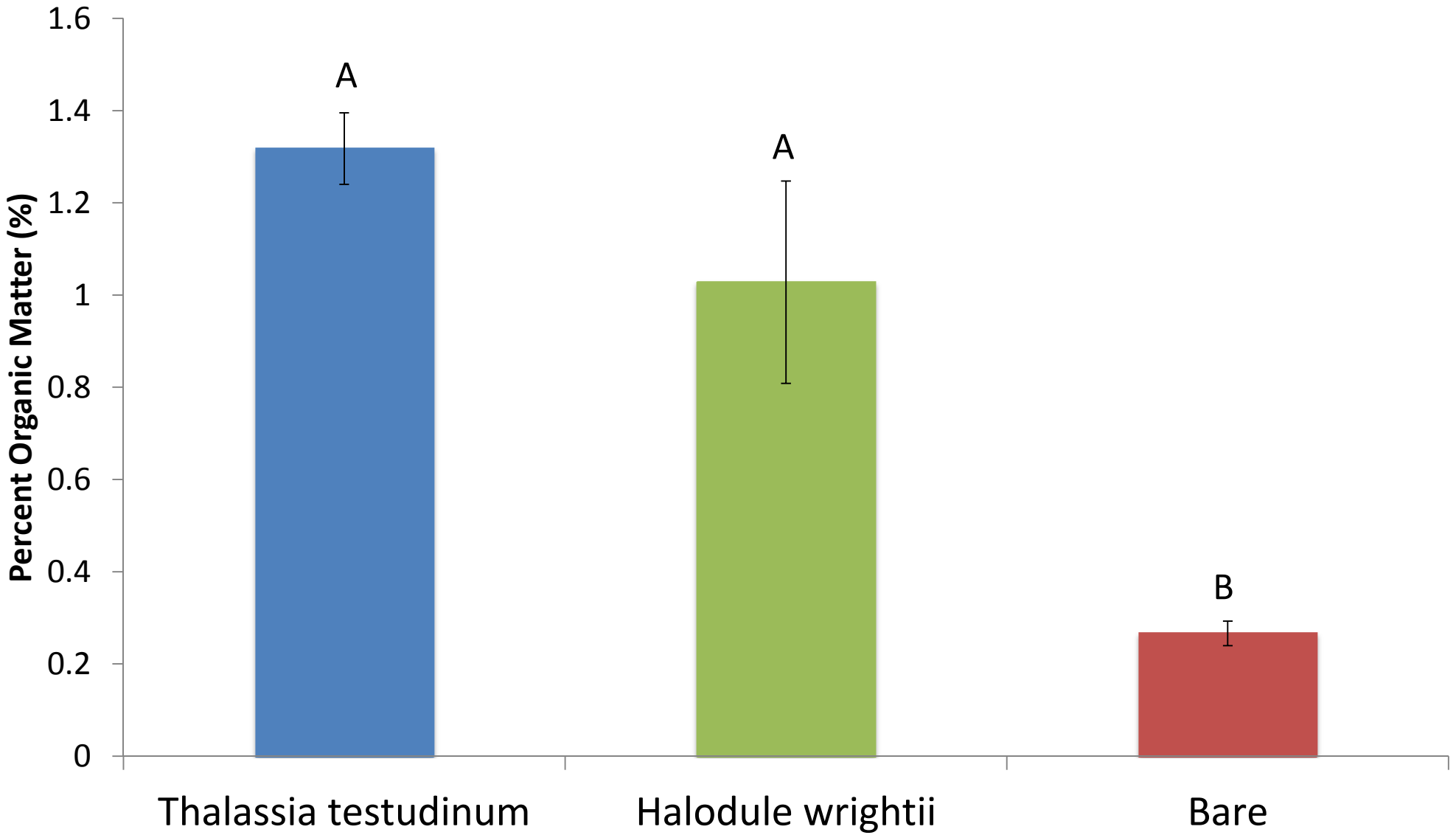
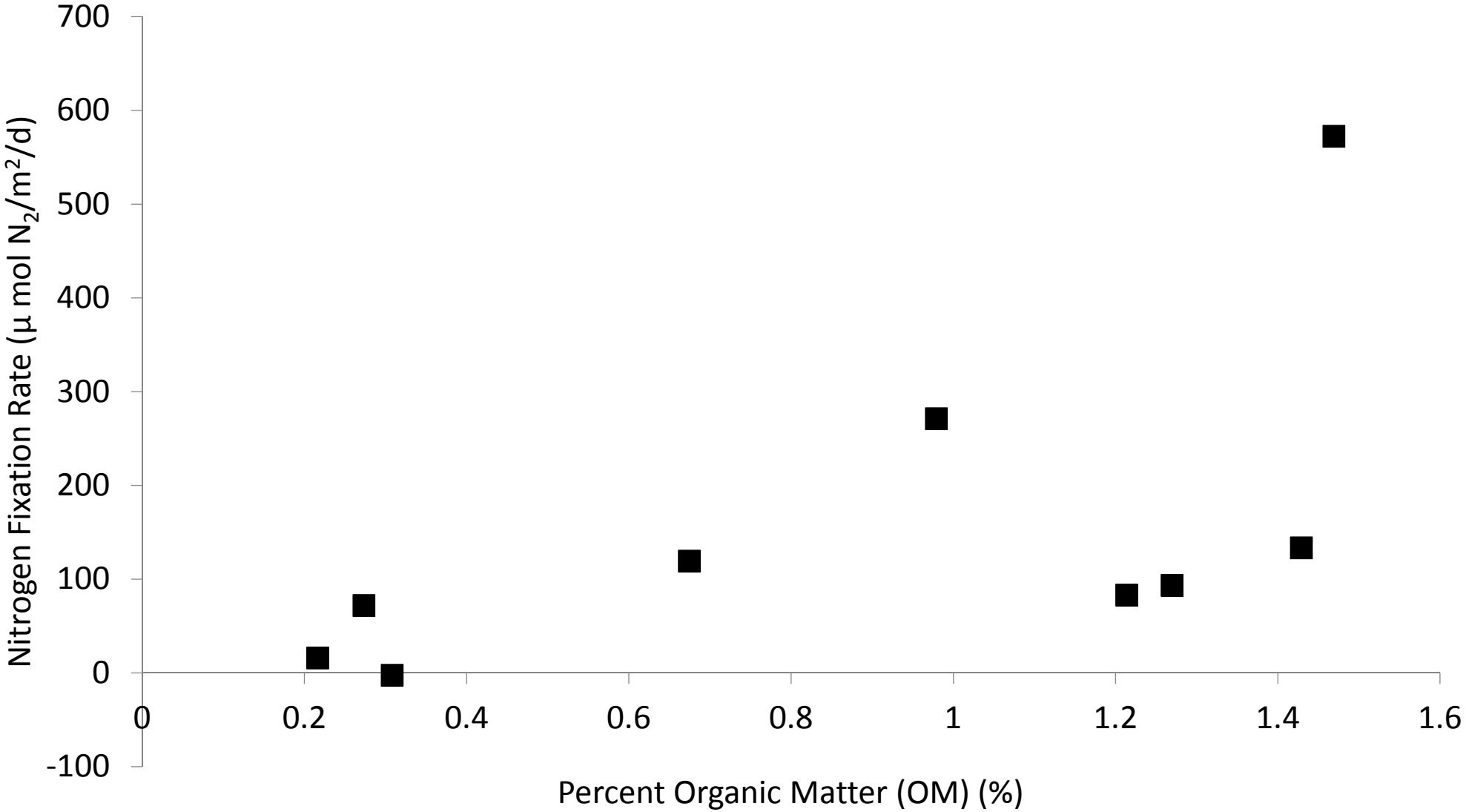


Sediment Organic Matter Content



Nitrogen Fixation & OM



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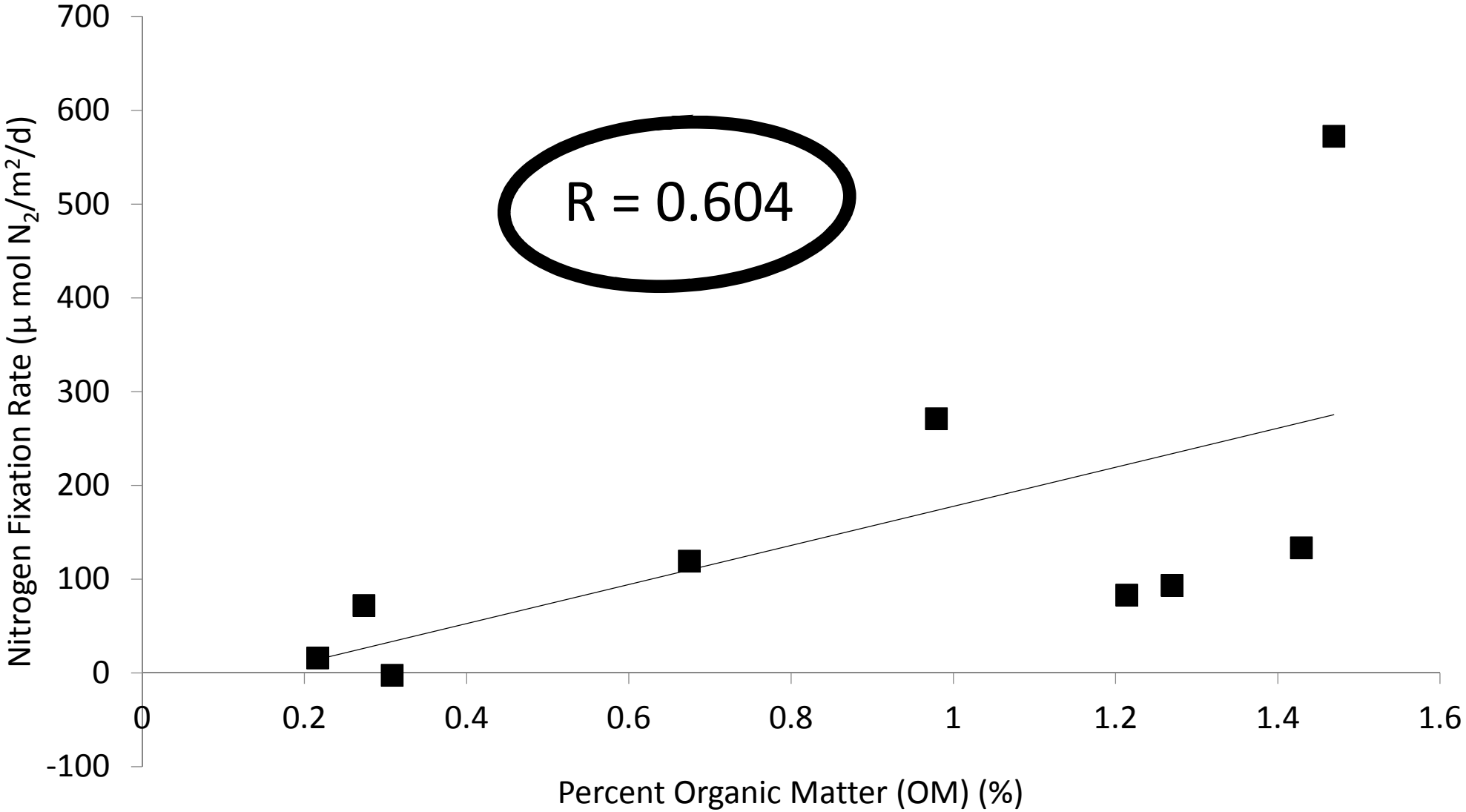

Conclusions

- H_2S concentrations are relatively low
- N-limitation in seagrass
- Higher nitrogen fixation rates in sediments colonized by seagrasses
- Nitrogen fixation rates vary temporally in some
- Weak inhibition by ammonium
- Sulfate-reducing bacteria possibly responsible for the majority of nitrogen fixation
- Activity of diazotrophic bacteria may be driven by sedimentary organic matter content

Future Work

- Water column NO_3^- concentrations
- qPCR on *nifH* gene
- Sampling continuing until August 2016

Acknowledgments

Mentors and Thesis Committee Members

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- Dr. Phil Darby
- Dr. Joe Lepo
- Joe Moss

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- UWF Department of Biology
- UWF SCAC
- UWF GRSA

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- Josh Presley
- Jenna Sleek
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- Hillary Skowronski
- Gary Baine
- Katelyn Knight
- Chelsea Barfield
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- Ethan Morris
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