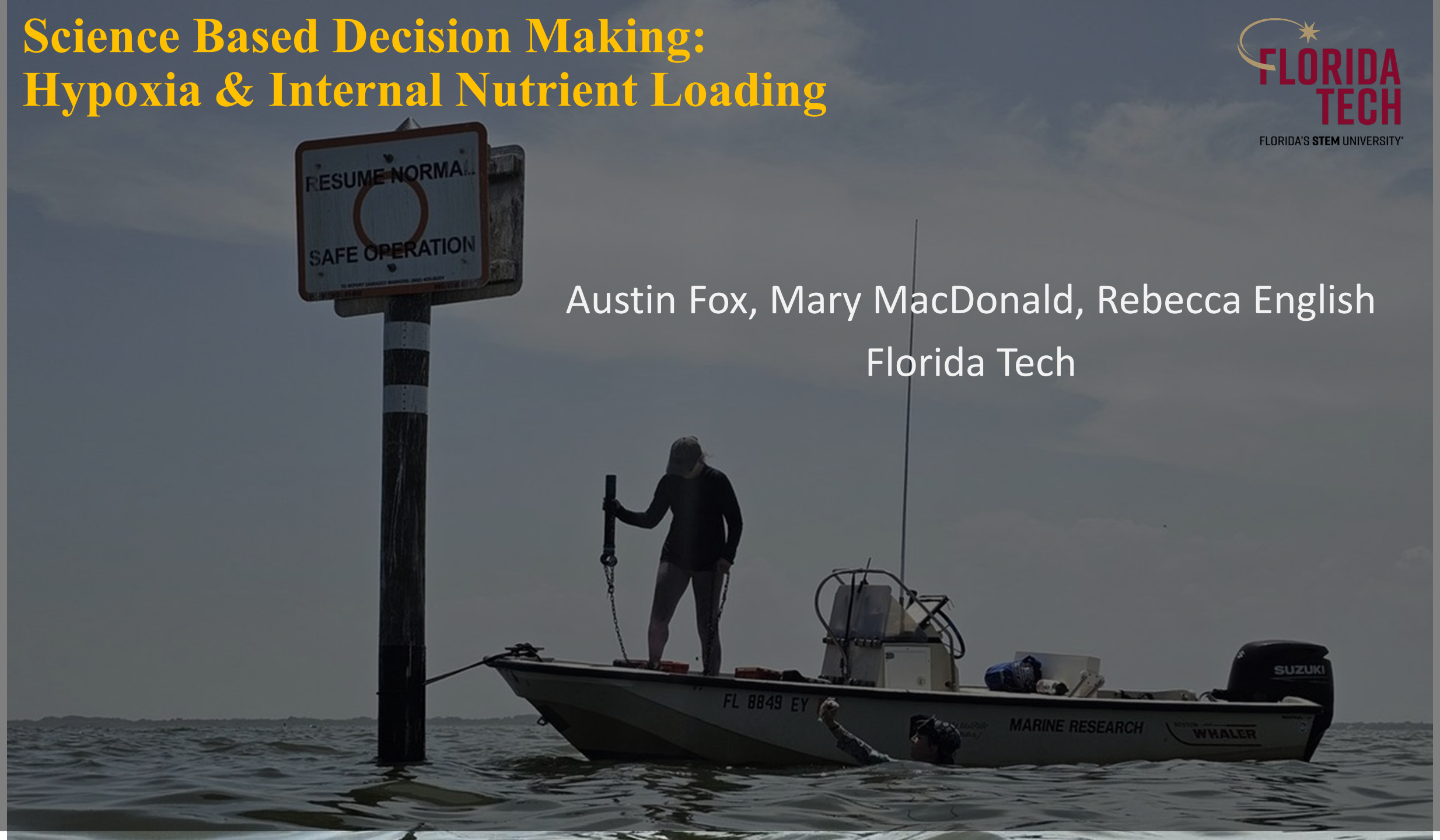
Science Based Decision Making: Hypoxia & Internal Nutrient Loading



Austin Fox, Mary MacDonald, Rebecca English

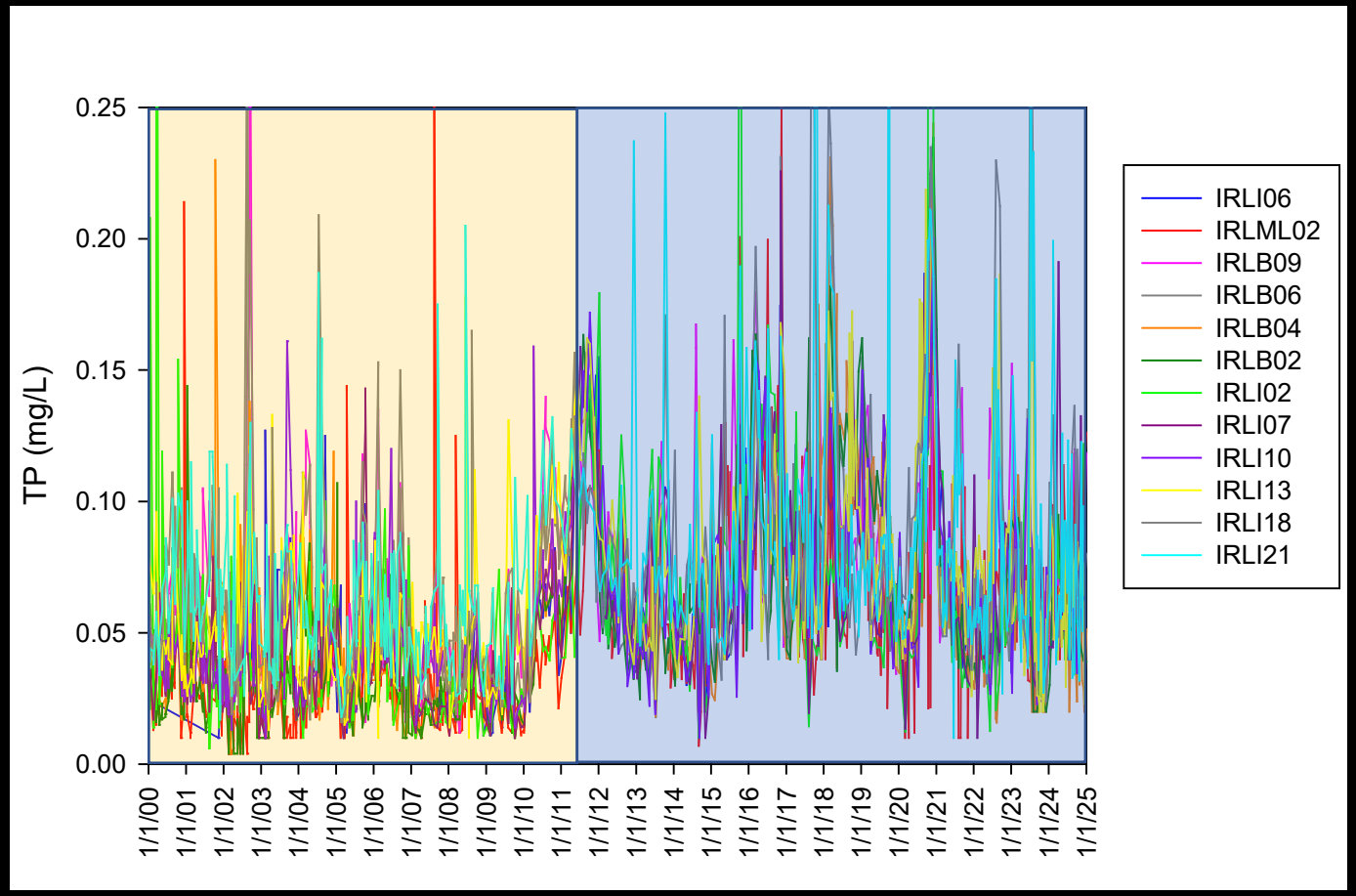
Florida Tech

Motivation: Phosphorus concentrations over time

- H_1: Phosphorus source is anaerobic sediment

1997-2010

Average: 0.051 mg/L



2011-2020

Average: 0.085 mg/L
(70% increase)

N:P ratio decreased at the same time

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Hypoxia Induced Changes to Phosphorus Sorption

Aerobic

Anaerobic

$$FeS + H_2S \rightarrow FeS_2 + H_2$$

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Phosphorus Sorption of Sediments

Equilibrium Phosphorus Concentration:

Water concentration at which there is a net zero flux of phosphorus into or out of the sediments

EPC (mg/L)	Aerobic	Anaerobic
2001	**0.05** ± 0.06	>0.3
2023-5	**0.12** ± 0.17	>0.3

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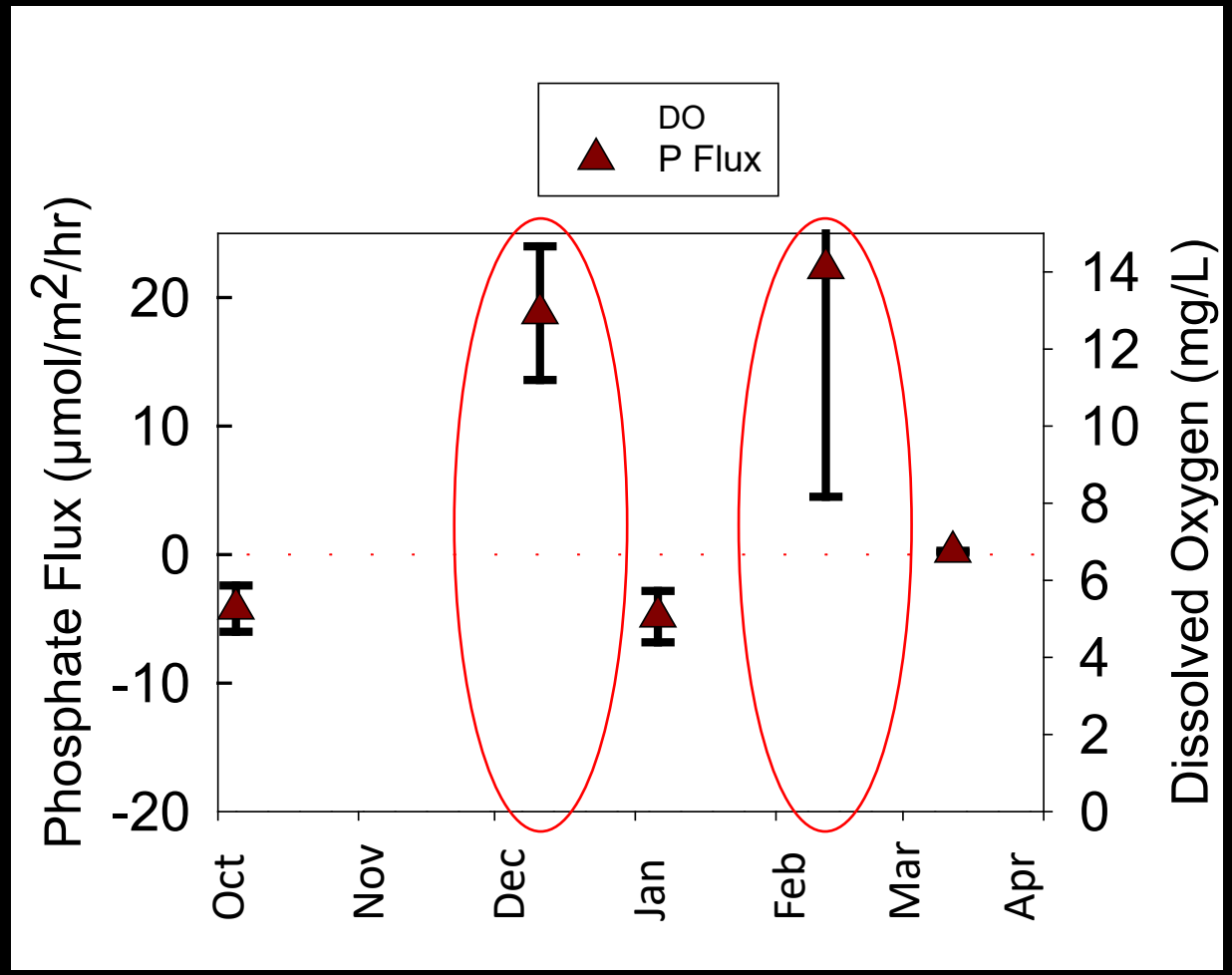
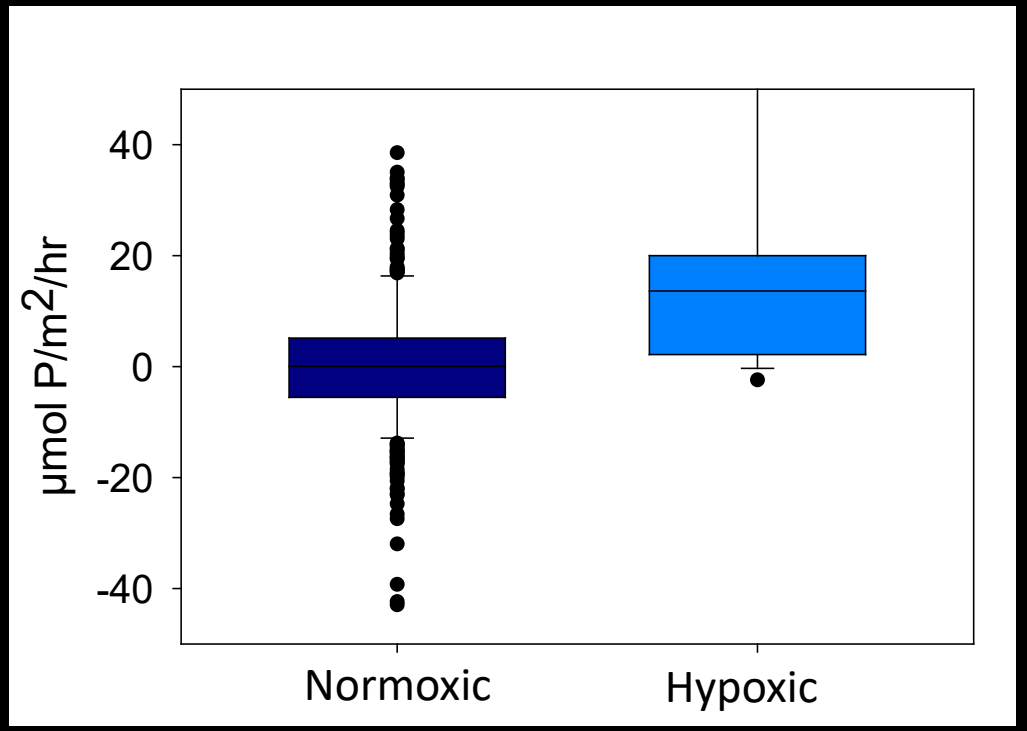
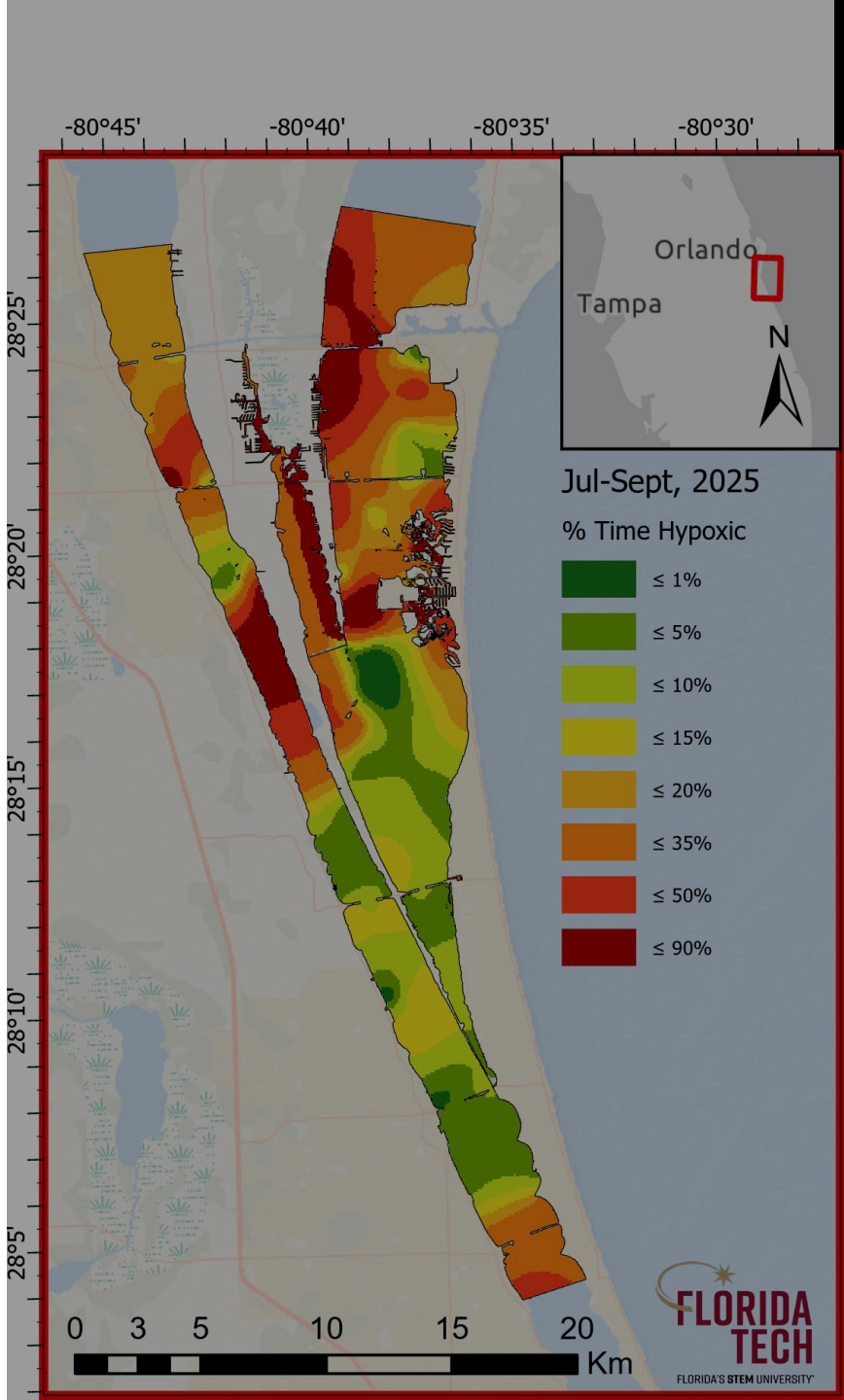
Hypoxia drives enhanced benthic fluxes in BRL/IRL



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28°20'
28°15'
28°10'
28°5'
Orlando
Tampa
N
Jul-Sept, 2025
% Time Hypoxic
≤ 1%
≤ 5%
≤ 10%
≤ 15%
≤ 20%
≤ 35%
≤ 50%
≤ 90%
0 3 5 10 15 20
Km
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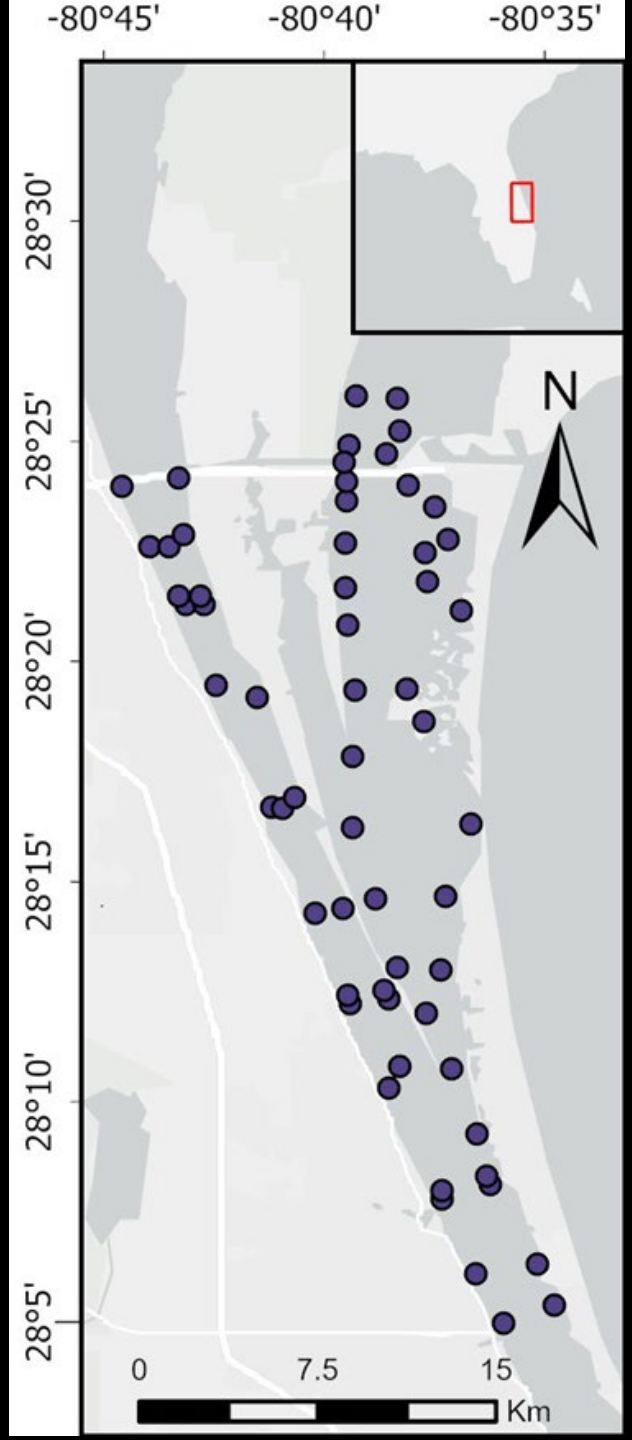
FLORIDA'S STEM UNIVERSITY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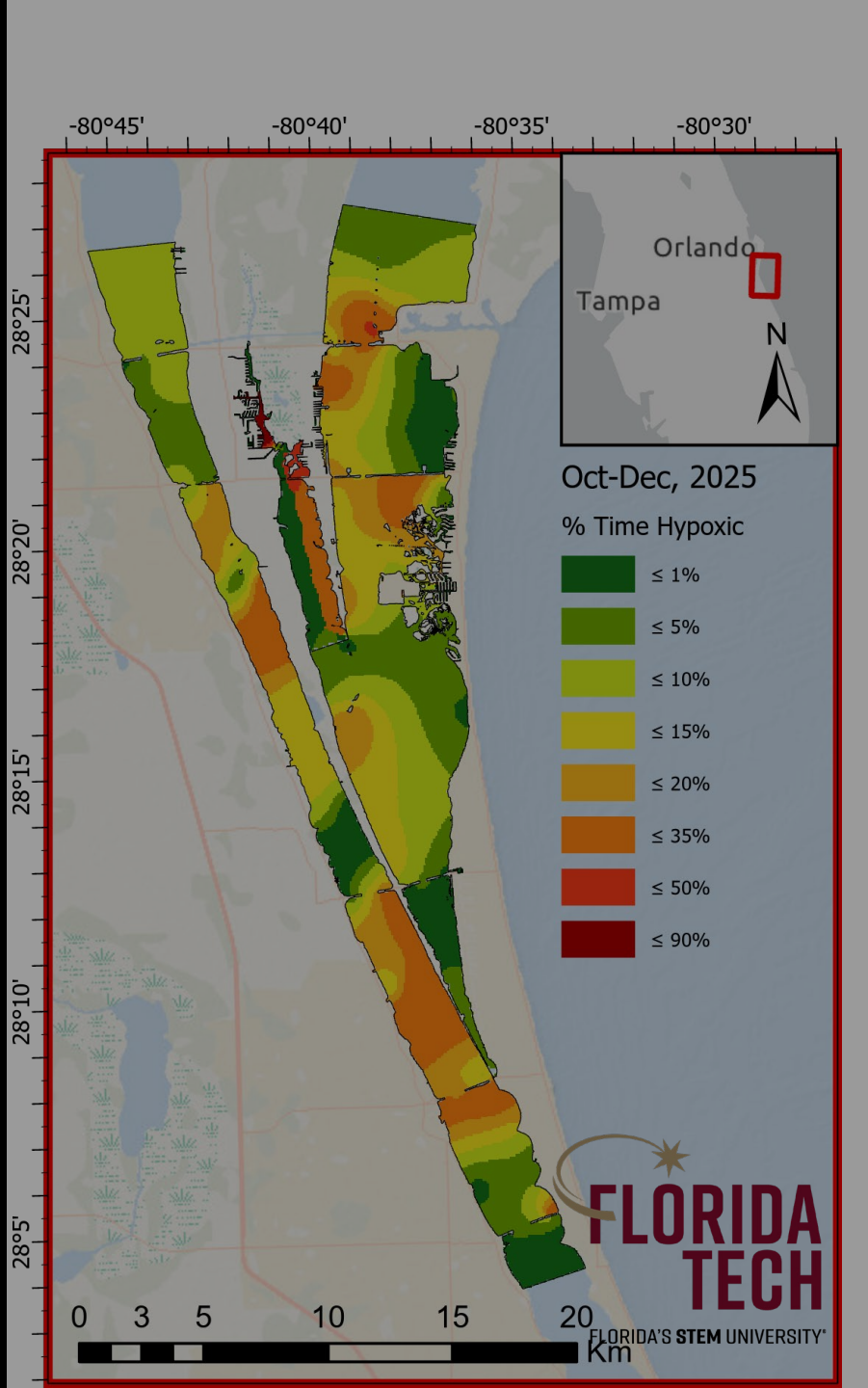
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Orlando
Tampa
N
Oct-Dec, 2025
% Time Hypoxic
≤ 1%
≤ 5%
≤ 10%
≤ 15%
≤ 20%
≤ 35%
≤ 50%
≤ 90%
0 3 5 10 15 20
Km
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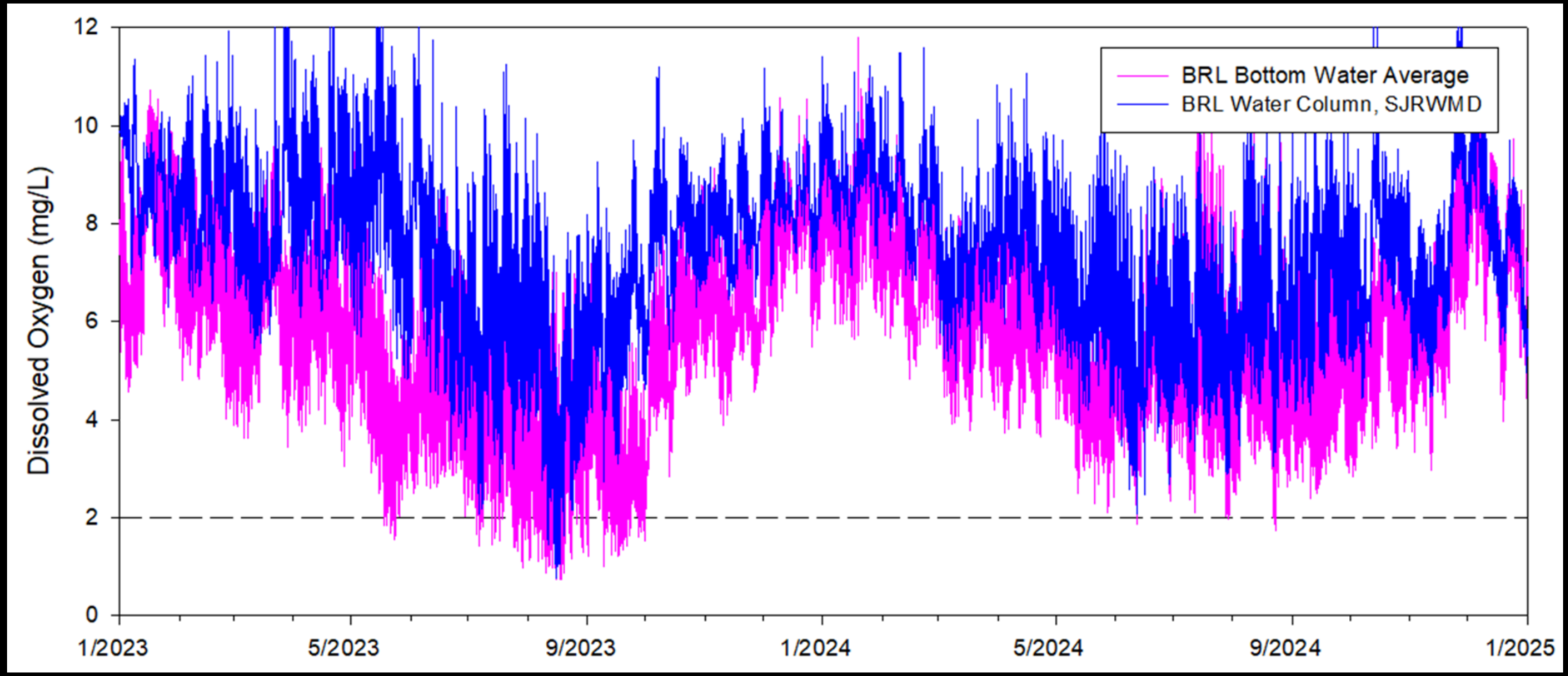
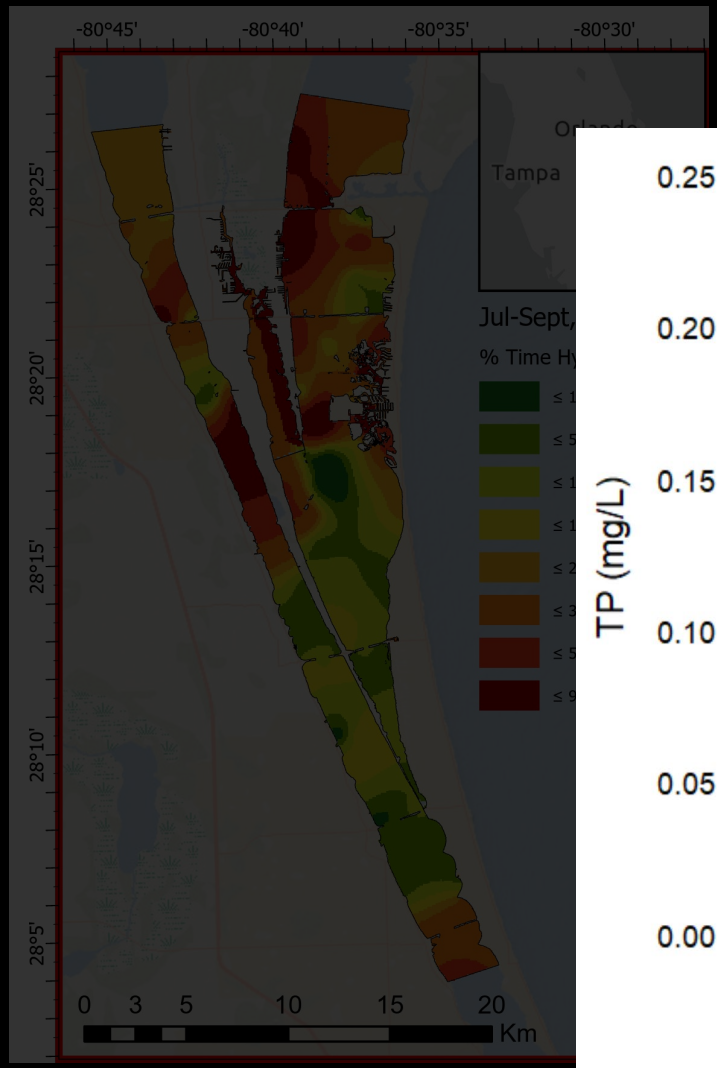
Bottom Water DO

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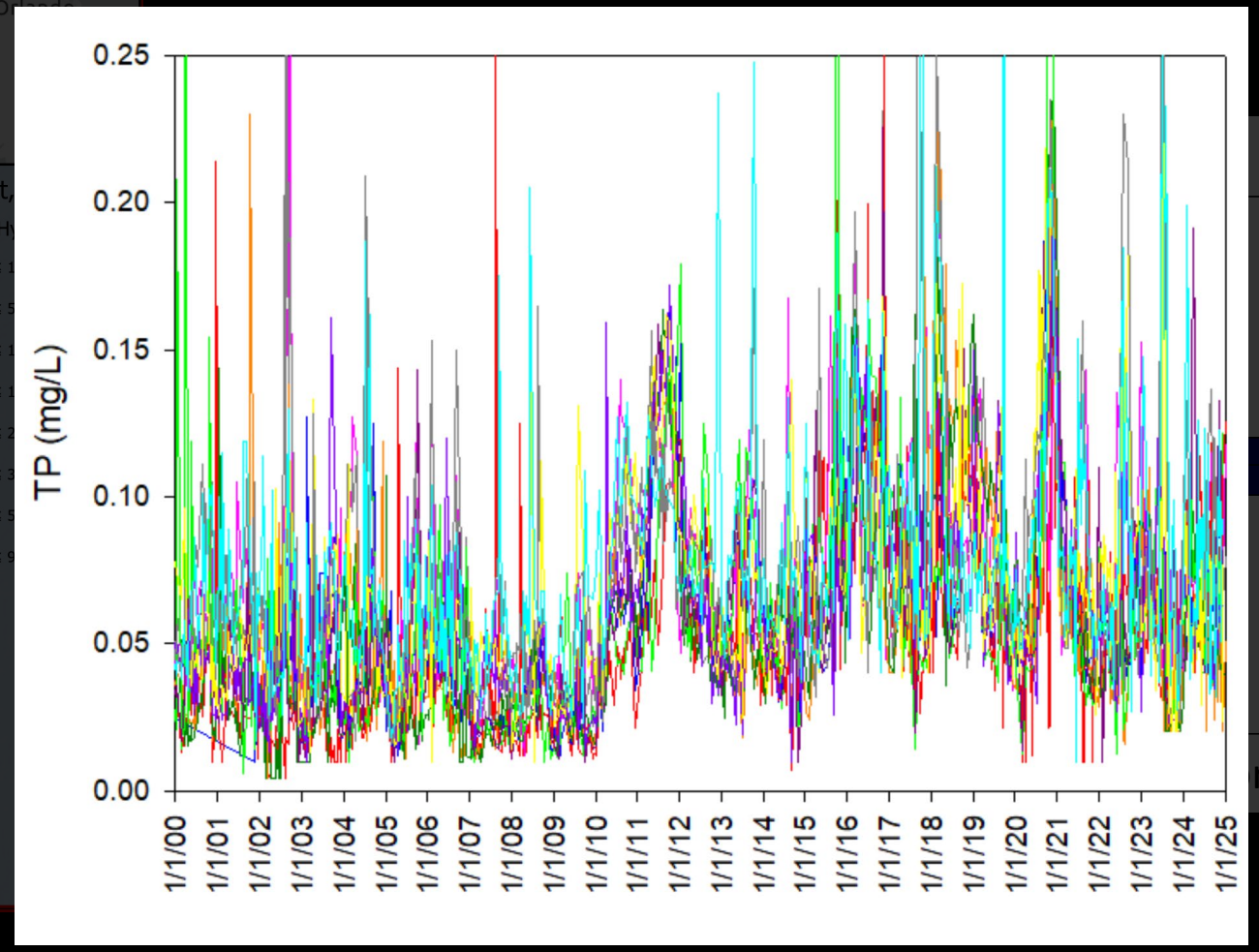
Tampa
Jul-Sept,
% Time Hy
0 3 5 10 15 20
Km


TP (mg/L)
0.25
0.20
0.15
0.10
0.05
0.00
1/1/00
1/1/01
1/1/02
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1/1/04
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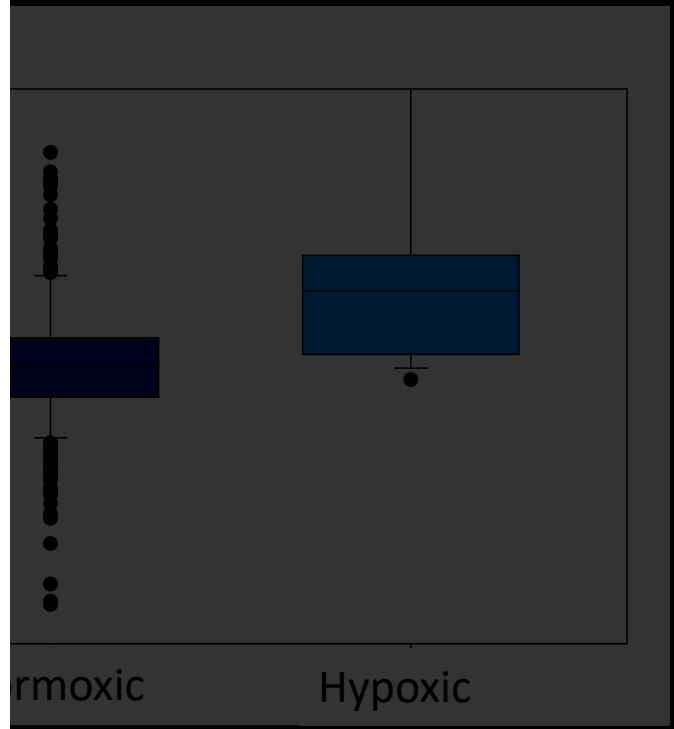
rmoxic
Hypoxic

In Development: Assimilative Internal Flux "As-IF" Model

- ArcGIS tool: hypoxia risk map
  - calculate internal nutrient loading
- Phosphorus fluxes associated with hypoxia may help to explain the increased P concentrations following 2010.
- Refining estimates based on diurnal and chronic diurnal hypoxia
  - Current estimating ~40,000 lb/year from 5% of lagoon bottom

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"Save the Sand"

ONE LAGOON
ONE COMMUNITY · ONE VOICE

brevard COUNTY

St. Johns River
Water Management District

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION

"Save the Worms*"

*polychaetes