

RESTORE LAGOON INFLOW RESEARCH



Can enhanced ocean inflow help restore the natural processes that regulate nutrient loads and HAB outbreaks?

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IRL phase I and II reports

50 Years of Declining Water Quality and Ecosystem Health

- Frequent harmful algal bloom (HAB) outbreaks are the “new normal”¹
- 89% seagrass loss over 30 years²
- Reoccurring fish kills, reduced juvenile recruitment, and increasing marine mammal mortalities^{3,4,5}
- “Lagoon at risk of ecosystem collapse”⁶

Critical Questions

Can enhanced ocean inflow help to ...

- Reduce nutrient loads by promoting natural nutrient sequestration and removal?
- Reduce frequency and duration of HAB outbreaks?
- Promote recovery of seagrasses and other impacted aquatic life?

Multidisciplinary Approach

- Coupled 3D hydrodynamic and eutrophication modeling, including HAB simulations and nutrient export projections (G. Zarillo)
- Lab and field-based determination of nutrient turnover, flux, and flux thresholds (A. Fox)
- Predictive fish abundance modeling and validation (J. Blanchard, R. Turingan)
- Improved physical and biological trends and baselines (R. Weaver, A. Fox, J. Eble, K. Johnson)
- Small-scale, demonstration project engineering design (R. Weaver)

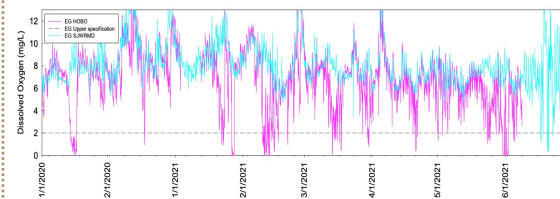
Special thanks to ...

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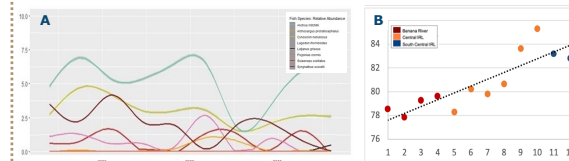
Key Preliminary Findings

- Lagoon sediments frequently experience low oxygen conditions that are unable to sustain life.
- When oxygen levels are low, lagoon sediments release rather than absorb excess nutrients.
- Stabilizing dissolved oxygen and reducing water temperature can improve natural nutrient removal.
- Net nutrient decreases are predicted with enhanced inflow with no detectable increase in nutrient export.

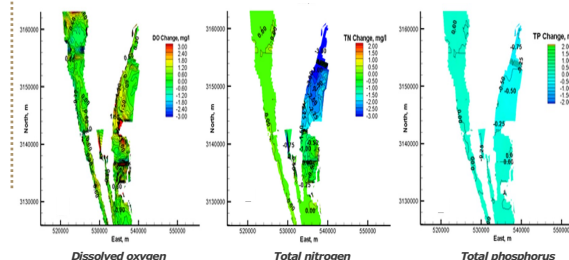
IRL bottom water (pink) and mid-depth (cyan) dissolved oxygen



HAB impacts on IRL fish based on FWC FIM catch data (A) and eDNA-based estimates of taxonomic diversity (B)



Predicted change in water quality after 2 years of 10 m³/sec inflow



Next Steps

Initiate permitted small-scale, temporary demonstration system

- Provide scalable inferences to inform permanent inflow feasibility
- Calibrate nutrient response and nutrient removal thresholds
- Validate physical and biological predictive models
- Directly assess inflow impacts to essential species and biological communities

Proposed Temporary, Demonstration Inflow System



- One year demonstration project
- Low flow rate (0.5 m³/s)
- Continuous water quality monitoring
- Remote emergency shutdown

References

- 1 Indian River Lagoon National Estuary Program. Comprehensive Conservation and Management Plan. 2020
- 2 Morris, L. et. al. 2021. Diversity and distribution of seagrasses as related to salinity, temperature, and availability of light in the Indian River Lagoon, Florida. *Florida Scientist*, 84, pp.119-137.
- 3 Fish and Wildlife Research Institute, “Health monitoring of Florida’s sportfish”. 2014
- 4 Walters, L.J et al. 2021. A negative association between recruitment of the eastern oyster *Crassostrea virginica* and the brown tide *Aureoumbra lagunensis* in Mosquito Lagoon, Florida. *Florida Scientist*, 84, pp.81-91.
- 5 FWC. 2021. 2021 Preliminary Manatee Mortality Table with 5-Year Summary From: 01/01/2021 To: 08/27/2021. Marine Mammal Pathobiology Laboratory.
- 6 Paperno R, et. al. 2019. Florida Lagoon at Risk of Ecosystem Collapse. Science, v365