Integrated Biscayne Bay Ecological Assessment and Monitoring (IBBEAM): 6 Years of Everglades Restoration Monitoring on the Nearshore Ecosystem

Presented by: Nicole Besemer[1]

Principal Investigators: Diego Lirman[1], Erik Stabenau[2], Joan A. Browder[3], Joseph E. Serafy[1,3],
Research Staff: Herve Jobert[1,5], Ian C. Zink[4,3], Evan D'Alessandro[1], Martine D'Alessandro[1]

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RECOVER assessment science integration evaluation

NATIONAL PARK SERVICE

NOAA NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION U.S. DEPARTMENT OF COMMERCE

UNIVERSITY OF MIAMI ROSENSTIEL SCHOOL of MARINE & ATMOSPHERIC SCIENCE

CIMAS

SOUTH FLORIDA WATER MANAGEMENT DISTRICT

IBBEAM & Relationship to CERP

CERP

Comprehensive Everglades Restoration Plan

RECOVER

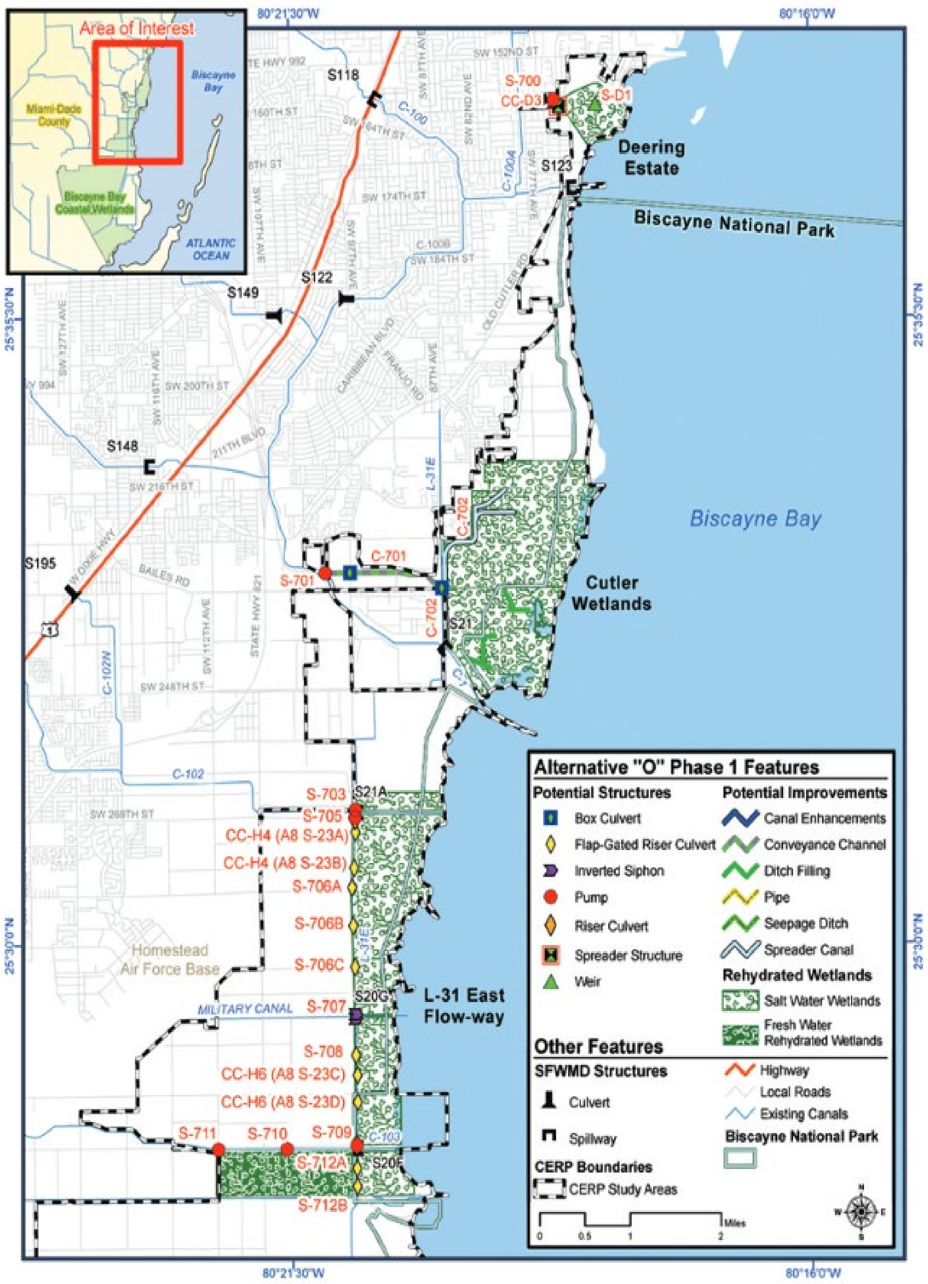
Restoration Coordination Verification

MAP

Monitoring and Assessment Plan

Southern Coastal Systems Module

IBBEAM



Biscayne Bay Coastal Wetlands ←

IBBEAM & Relationship to CERP

Four components of IBBEAM:

Salinity Monitoring

SAV Community

Epifauna Community

Mangrove Fish Community

Salinity Monitoring Network

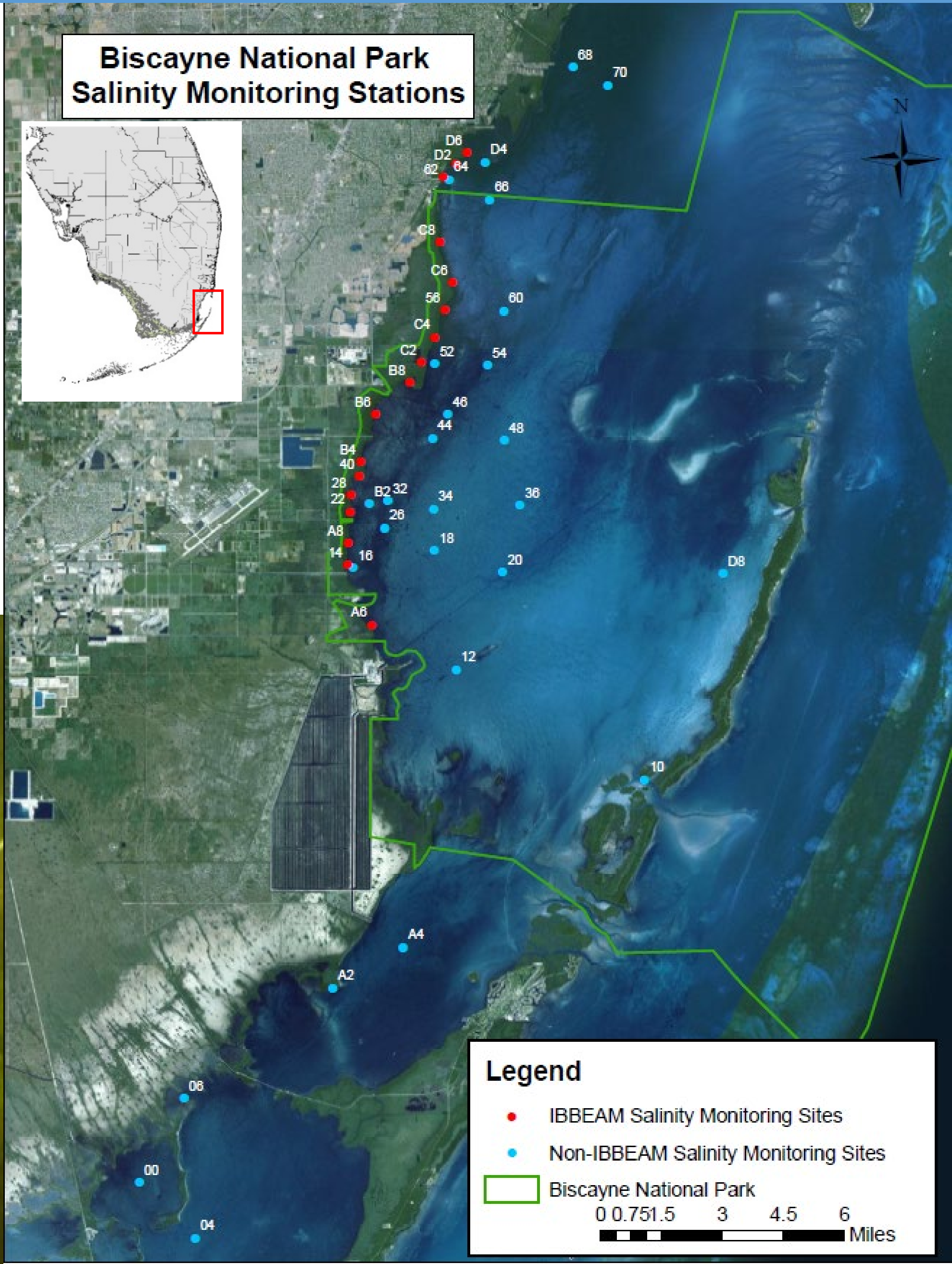
Designed to meet monitoring and modeling data needs as close as possible to the shoreline at specific features

Instruments:

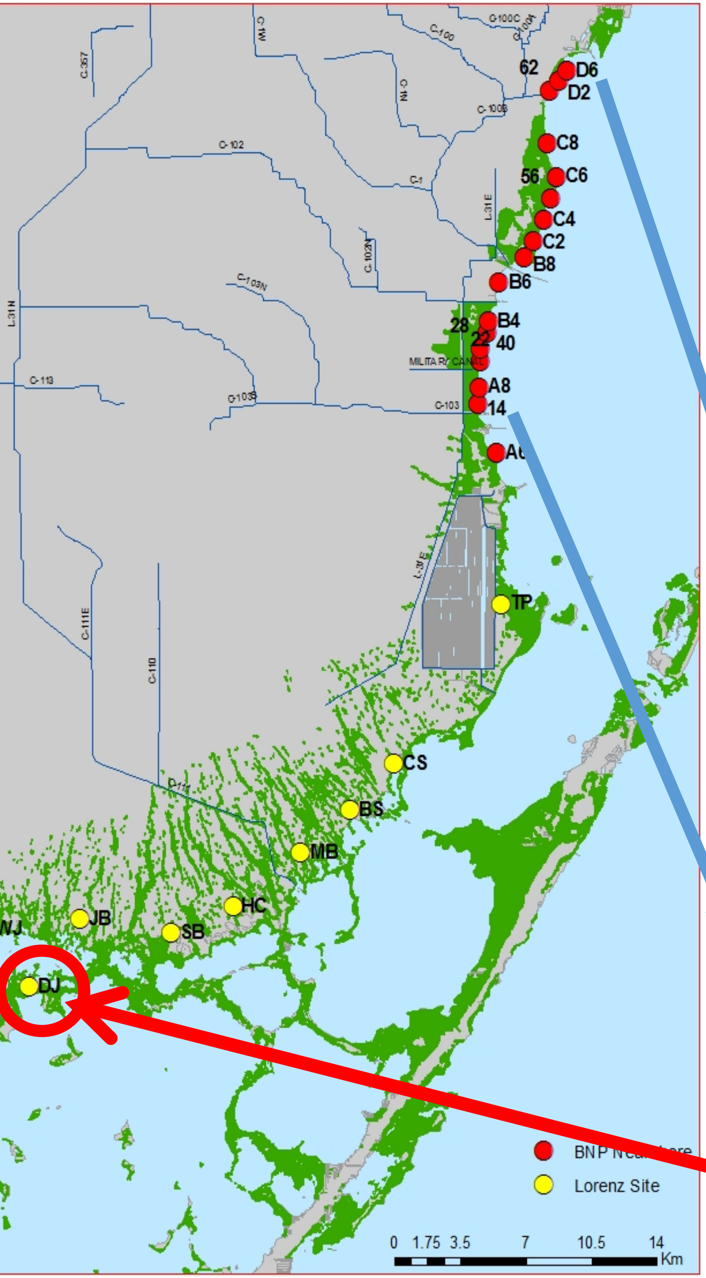
- **YSI 6600: paired 15 min recording 24 hr/365 d**

Parameters:

- **Water Depth**
- **Temperature**
- **Salinity**



Salinity Monitoring Network



Mesohaline Index = proportion of salinity obs. Are between ≥ 5 and < 18 psu

Hyperhaline Index = proportion of salinity obs. >40

Salinity Variability Index = proportion of salinity obs. Where daily range is >5

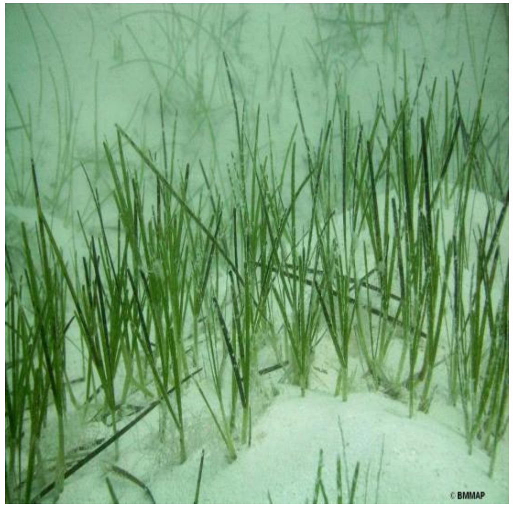
Salinity Regime Suitability Index = composite of previous 3 mentioned

WYR	2010		2011		2012		2013		2014		2015		2016		2017		2018		2019	Mean	
CYR	2009	2010	2010	2011	2011	2012	2012	2013	2013	2014	2014	2015	2015	2016	2016	2017	2017	2018	2018		
Month	May-Oct	Nov-Apr	May-Oct	Nov-Apr	May-Oct	Nov-Apr	May-Oct	Nov-Apr	May-Oct	Nov-Apr	May-Oct	Nov-Apr	May-Oct	Nov-Apr	May-Oct	Nov-Apr	May-Oct	Nov-Apr	May-Oct	May-Oct	Nov-Apr
Season	Wet	Dry	Wet	Dry	Wet	Dry	Wet	Dry	Wet	Dry	Wet	Dry	Wet	Dry	Wet	Dry	Wet	Dry	Wet	Wet	Dry
D6			0.00	0.00	0.01	0.00	0.08	0.00	0.07	0.00	0.00	0.00	0.00	0.06	0.01	0.00	0.07	0.00	0.06	0.04	0.01
D2			0.00	0.00	0.01	0.01	0.07	0.00	0.07	0.00	0.00	0.00	0.00	0.07	0.01	0.00	0.08	0.00	0.09	0.04	0.01
62	0.01	0.00	0.10	0.00	0.02	0.02	0.25	0.00	0.22	0.00	0.00	0.00	0.01	0.15	0.06	0.00	0.20	0.01	0.12	0.11	0.02
C8			0.11	0.00	0.02	0.03	0.34	0.00	0.22	0.01	0.00	0.00	0.01	0.27	0.08	0.00	0.18	0.01	0.14	0.12	0.04
C6			0.11	0.00	0.03	0.04	0.58	0.00	0.38	0.00	0.00	0.00	0.00	0.31	0.21	0.00	0.23	0.01	0.25	0.21	0.05
56	0.05	0.01	0.14	0.00	0.07	0.04	0.65	0.00	0.45	0.01	0.01	0.00	0.00	0.38	0.31	0.00	0.38	0.03	0.36	0.28	0.06
C4			0.22	0.00	0.09	0.05	0.65	0.00	0.50	0.01	0.07	0.00	0.00	0.51	0.43	0.00	0.51	0.06	0.42	0.33	0.08
C2			0.34	0.04	0.19	0.09	0.69	0.01	0.42	0.11	0.08	0.00	0.02	0.60	0.50	0.00	0.56	0.11	0.54	0.37	0.12
B8			0.29	0.05	0.06	0.14	0.78	0.01	0.72	0.17	0.05	0.08	0.00	0.66	0.49	0.00	0.43	0.12	0.49	0.38	0.15
B6			0.65	0.14	0.37	0.40	0.67	0.44	0.53	0.43	0.33	0.13	0.16	0.74	0.67	0.14	0.54	0.46	0.54	0.48	0.36
B4			0.46	0.14	0.28	0.54	0.74	0.19	0.56	0.42	0.19	0.34	0.14	0.87	0.61	0.26	0.52	0.63	0.56	0.45	0.42
40	0.29	0.22	0.49	0.14	0.37	0.53	0.83	0.17	0.73	0.40	0.14	0.12	0.10	0.91	0.61	0.22	0.56	0.55	0.56	0.49	0.38
28	0.16	0.17	0.52	0.11	0.23	0.43	0.78	0.11	0.59	0.33	0.11	0.13	0.07	0.88	0.46	0.15	0.46	0.55	0.49	0.40	0.34
22	0.24	0.16	0.60	0.12	0.25	0.45	0.72	0.11	0.60	0.29	0.11	0.07	0.05	0.84	0.46	0.16	0.42	0.51	0.47	0.38	0.32
A8			0.44	0.12	0.19	0.42	0.60	0.14	0.51	0.24	0.09	0.14	0.07	0.70	0.42	0.18	0.42	0.43	0.49	0.35	0.30
14	0.24	0.23	0.44	0.13	0.21	0.57	0.57	0.22	0.53	0.13	0.11	0.18	0.09	0.68	0.46	0.25	0.48	0.44	0.51	0.37	0.32
A6			0.09	0.04	0.06	0.18	0.22	0.01	0.09	0.03	0.02	0.01	0.04	0.30	0.06	0.03	0.16	0.16	0.08	0.09	0.09
DJ		0.82	0.30	0.56	0.22															0.26	0.69

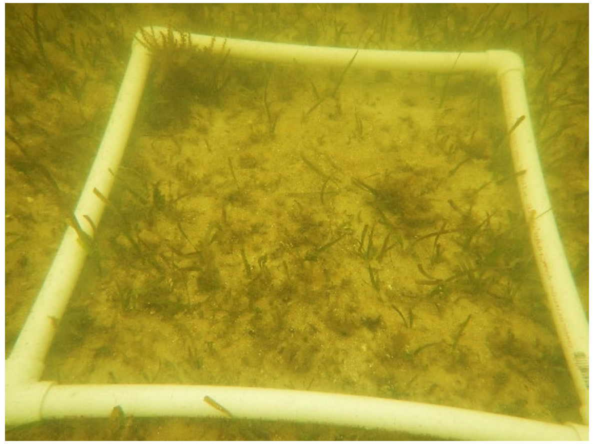
No color	insufficient data

Florida Bay Reference Site: DJ (Downstream Joe Bay)

SAV Community



Halodule wrightii ↑



↑ Benthic SAV habitat

↑ SAV survey

Survey Methods

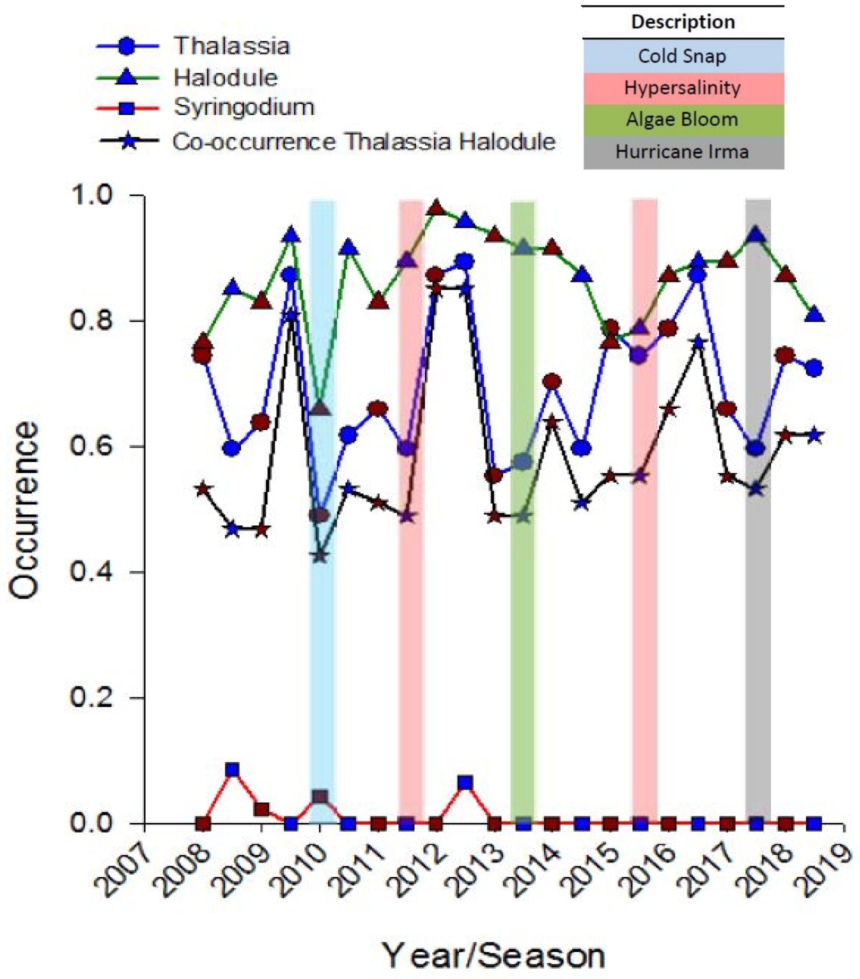
Designed to access submerged aquatic vegetation communities in nearshore habitats and quantify relationship with Salinity

- Every Wet Season
- 100-120 randomly sampled sites
- Water quality parameters measured at each site

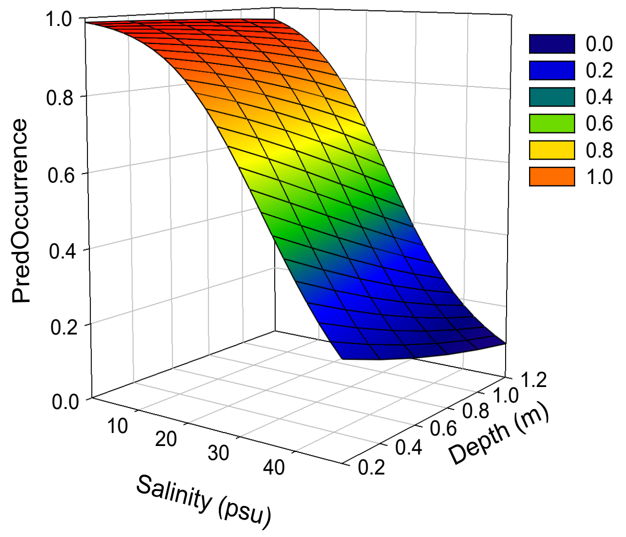
- Data from 10 quadrates per site including percent cover of:
    - Seagrass species
    - Algae
    - Sediment Depth
    - Canopy Height

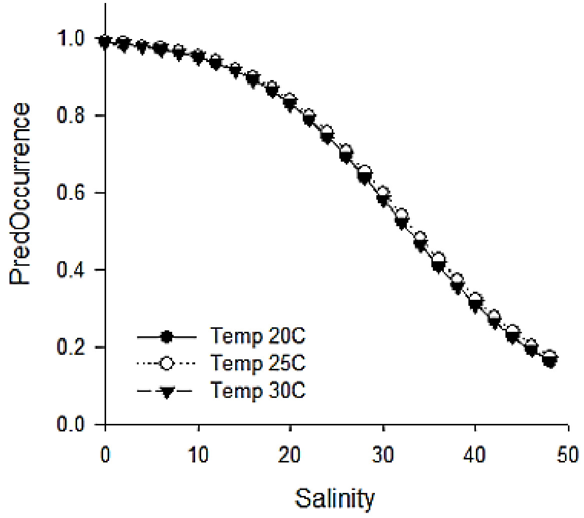
SAV Community

Temporal Trajectory



Bio-Physical Relationships



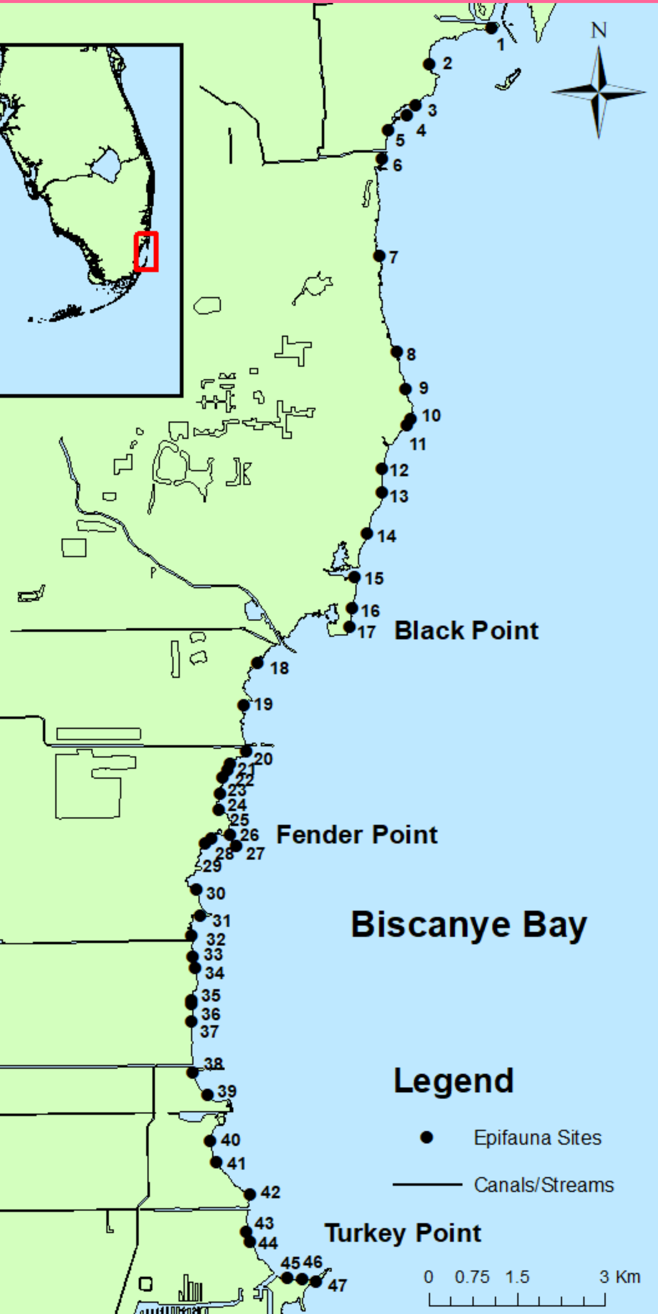


Multiple Regression Approach:

H. wrightii Occurrence = **Sal** + Depth + Temp + **Sal²** + Depth² + Temp²

p ≤ 0.05

Epifaunal Community



↑ Throw trap sampling ↓

Survey Methods

Compare past and present SAV associated epifauna to determine status and trends for before/after CERP comparison

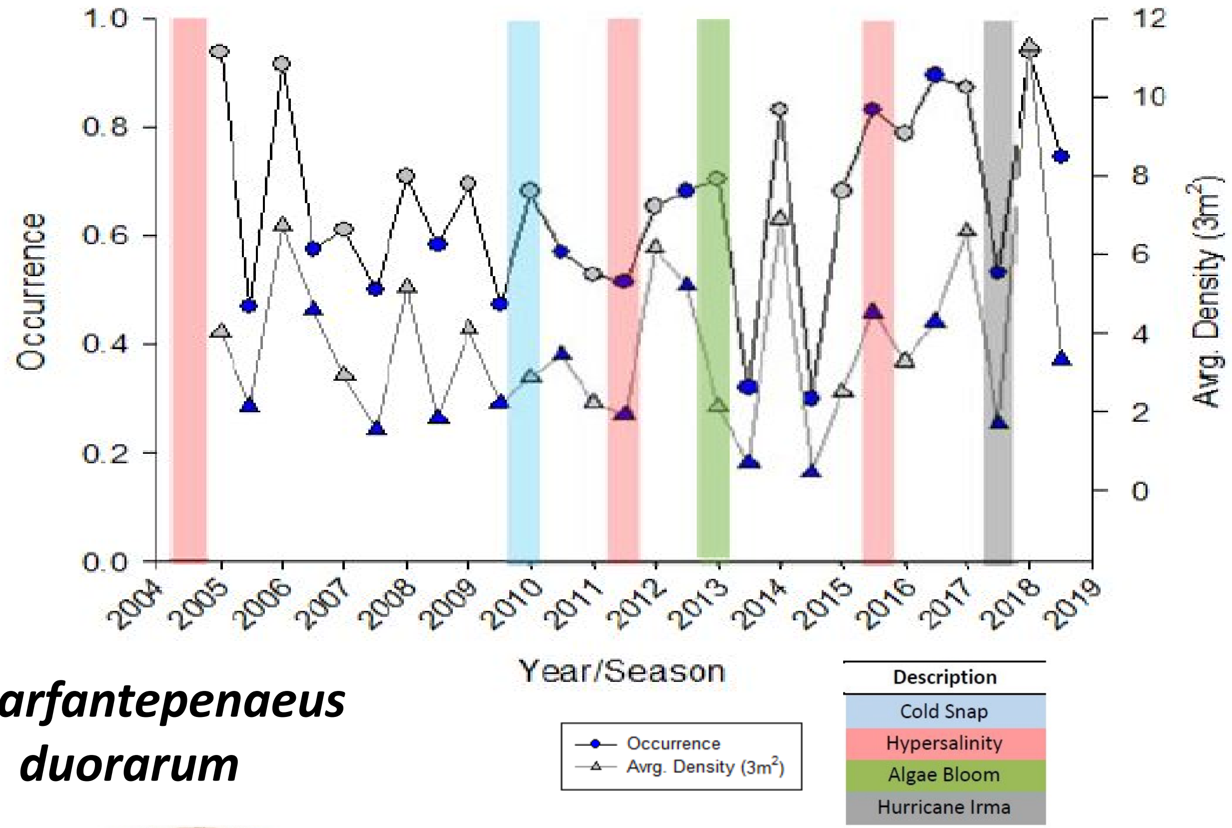
Methods

- Every wet and dry season (generally October and March)
- 47 sites

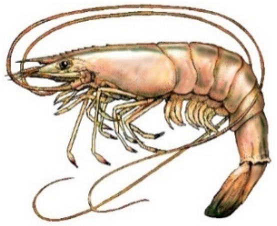
- Water quality parameters measured at each site
- 1-m^2 throw trap thrown 3 times
- Organisms identified, weighed, measured

Epifaunal Community

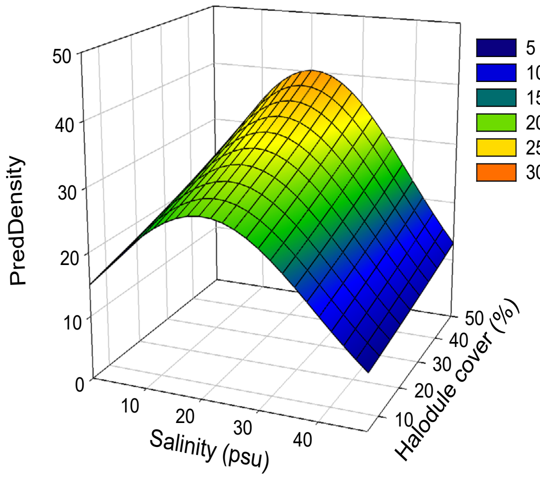
Temporal Trajectory

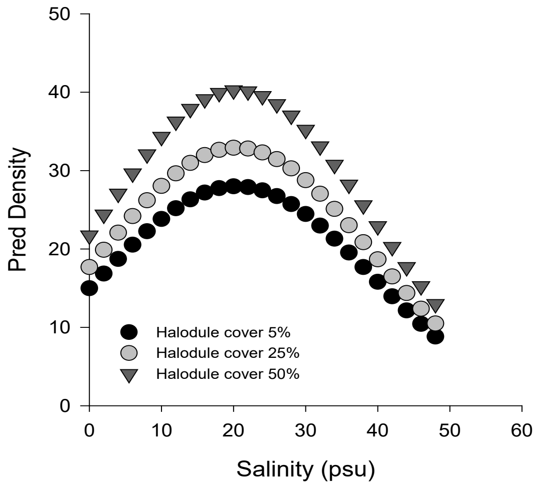


↓***Farfantepenaeus duorarum***



Bio-Physical Relationships





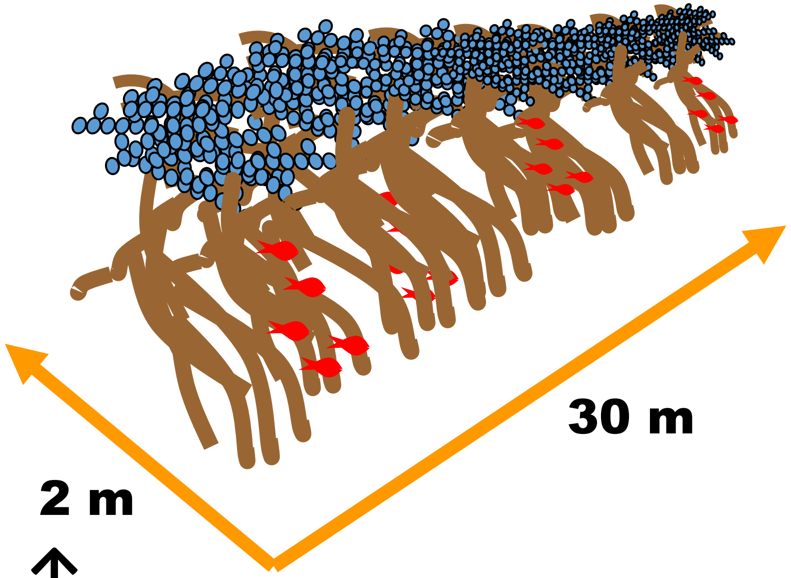
Multiple Regression Approach:

F. duorarum Density = **Sal** + Temp + TH + HA + $\mathbf{Sal^2}$ + HA^2

$p \leq 0.05$

Mangrove Fish Community

← Mangrove fish surveys →



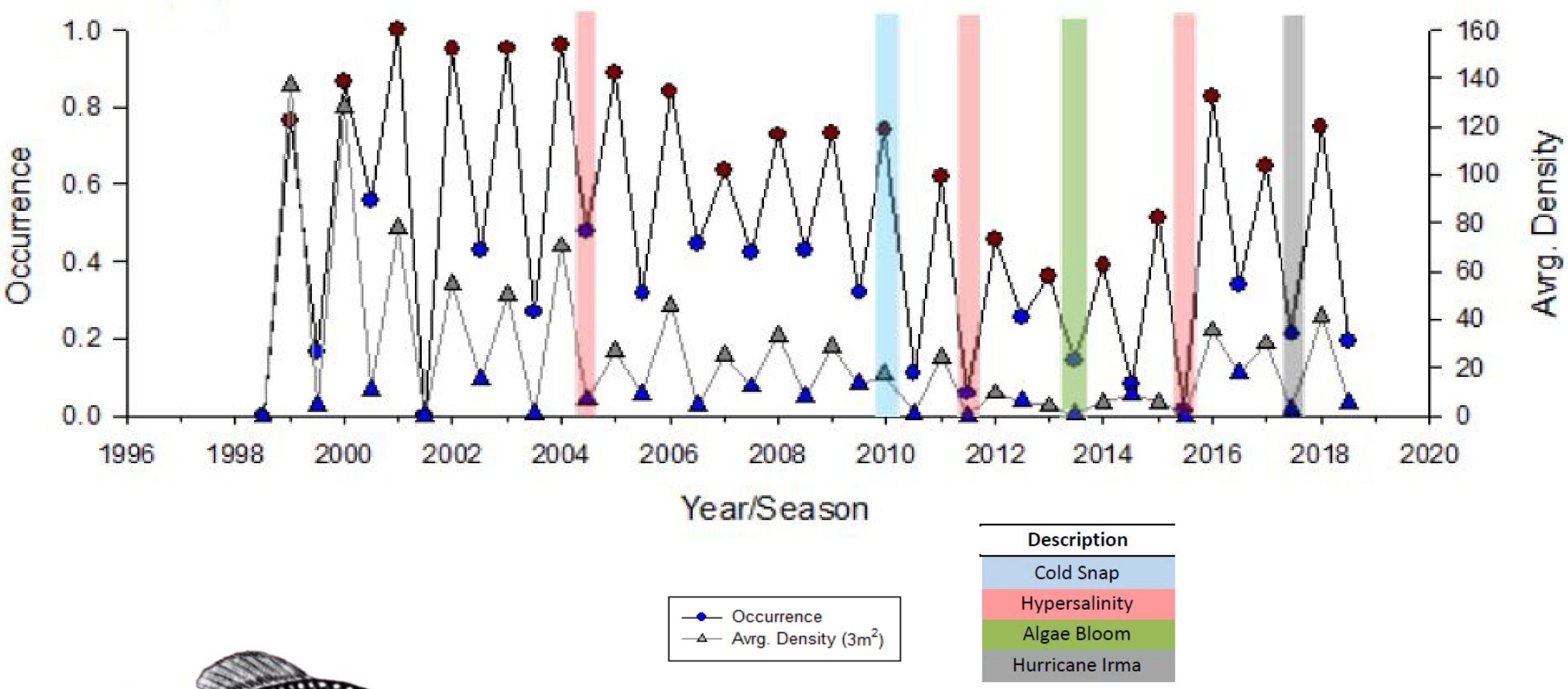
Survey Methods

Compare and contrast mangrove associated fish for status and trends before/after CERP

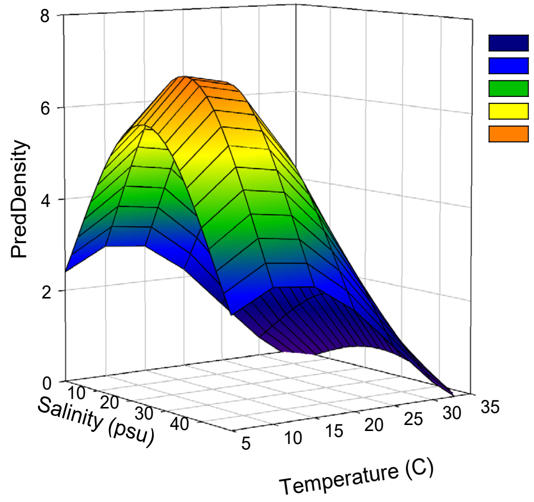
- 30 m long belt-transect survey
- Data collected includes:
  - Water quality parameters at each site
  - Taxonomic identification
  - Number
  - Size structure (min, max avg. length)
  - Depth

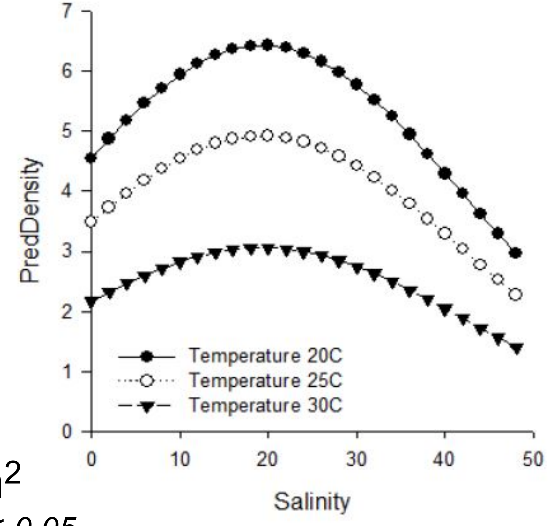
Mangrove Fish Community

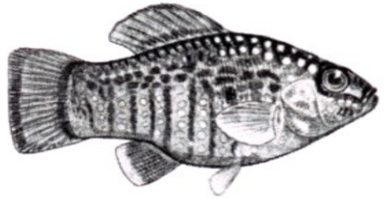
Temporal Trajectory



Bio-Physical Relationships







↑***Flordichthys carpio***

Multiple Regression Approach:

F. carpio Density = **Sal** + Depth + Temp + **Sal²** + Depth²

$p \leq 0.05$

Salinity Network: Research

FastTrack publication

Bull Mar Sci. 91(4):000–000. 2015
http://dx.doi.org/10.5343/bms.2015.1017

research paper

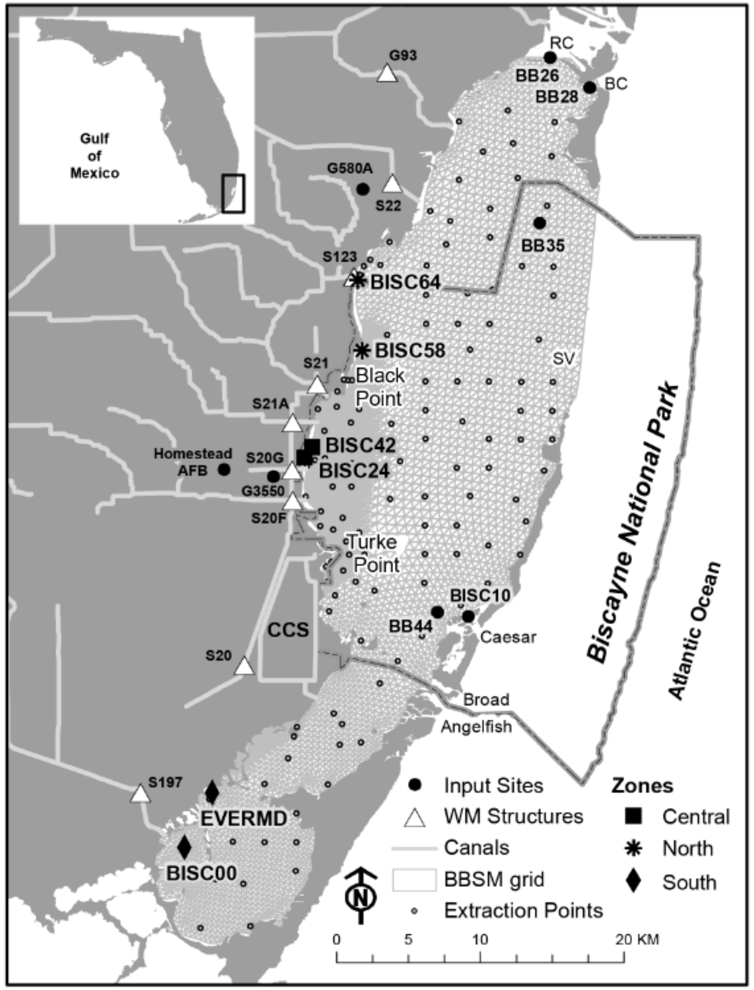
Improved coastal hydrodynamic model offers insight into surface and groundwater flow and restoration objectives in Biscayne Bay, Florida, USA

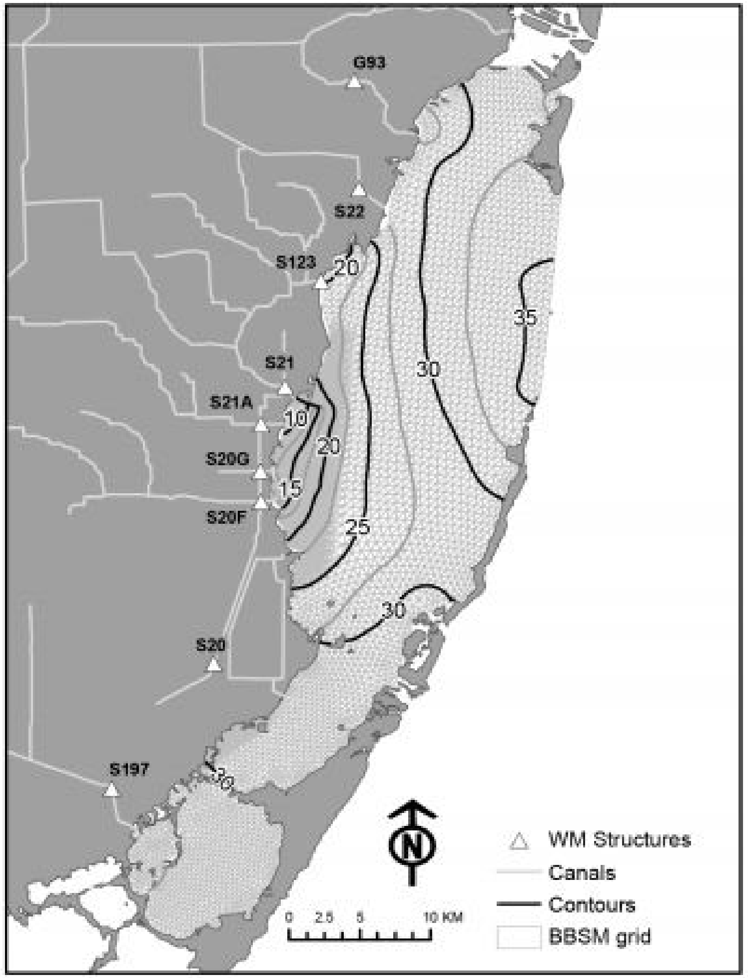
Erik Stabenau [1]*
Amy Renshaw [1]
Jiangang Luo [2]
Edward Kearns [3]
John D Wang [2]

[1] South Florida Natural Resources Center, National Park Service, Homestead, Florida 33145.

[2] Rosenstiel School of Marine & Atmospheric Science, University of Miami, Miami, Florida 33149.

[3] National Climate Data Center, National Oceanic and Atmospheric Administration, Asheville, North Carolina 28801.





Other Publications:

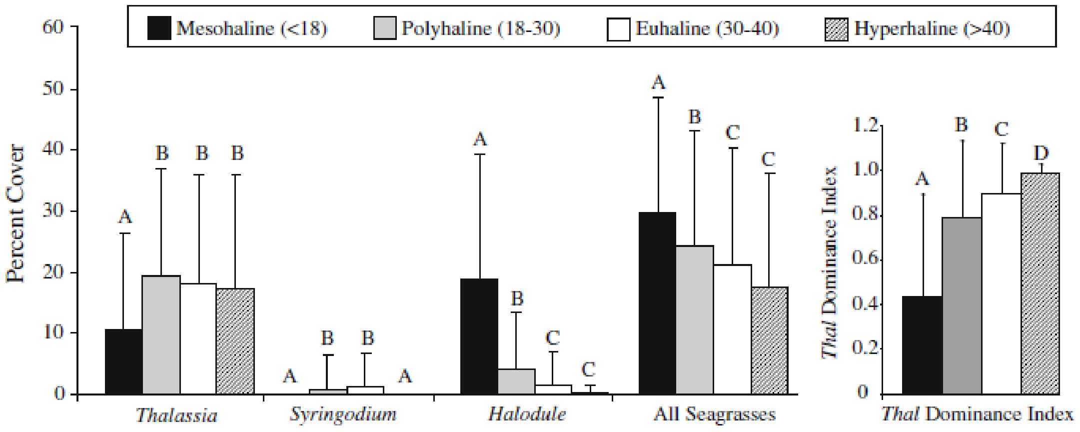
Lirman et al. 2008, Zink et al. In Prep, Serafy et al. In Prep, Besemer et al. In Prep

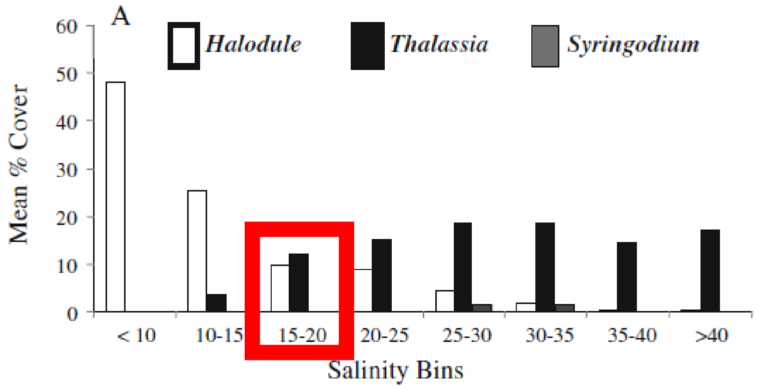
SAV Community: Research

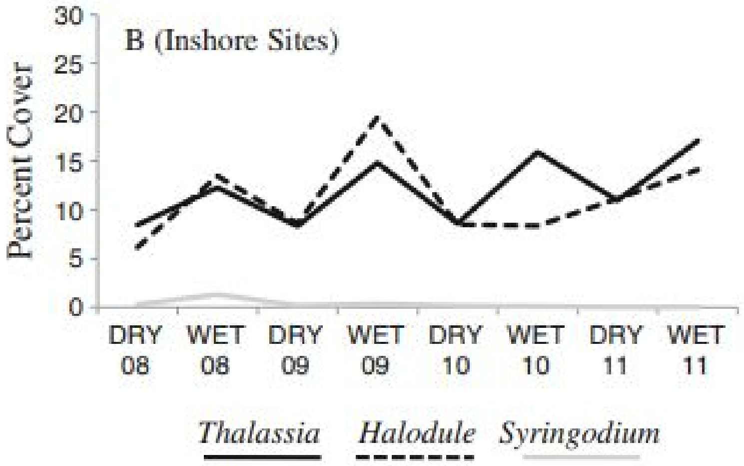
Estuaries and Coasts (2014) 37:1243–1255
DOI 10.1007/s12237-014-9769-6

SAV Communities of Western Biscayne Bay, Miami, Florida, USA: Human and Natural Drivers of Seagrass and Macroalgae Abundance and Distribution Along a Continuous Shoreline

D. Lirman · T. Thyberg · R. Santos · S. Schopmeyer ·
C. Drury · L. Collado-Vides · S. Bellmund · J. Serafy







Other Publications:

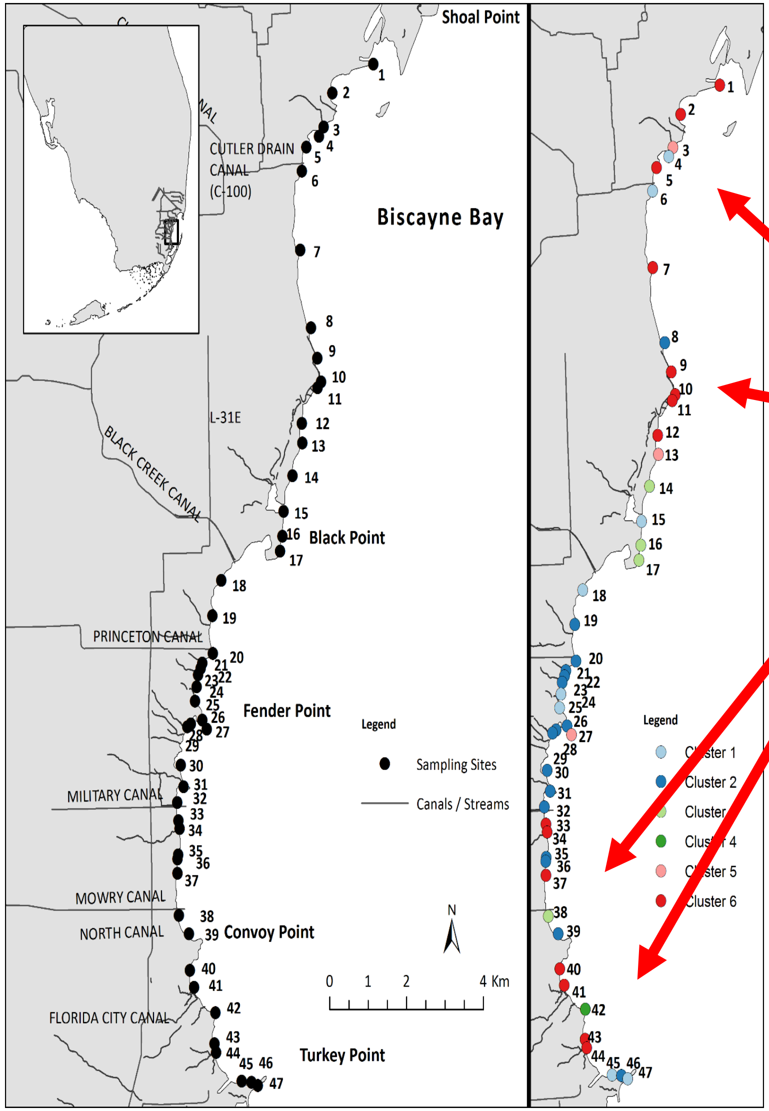
Santos and Lirman 2012; Lirman et al. 2011; Santos et al. 2011; Collado-Vides et al. 2011; Lirman et al. 2008a, b

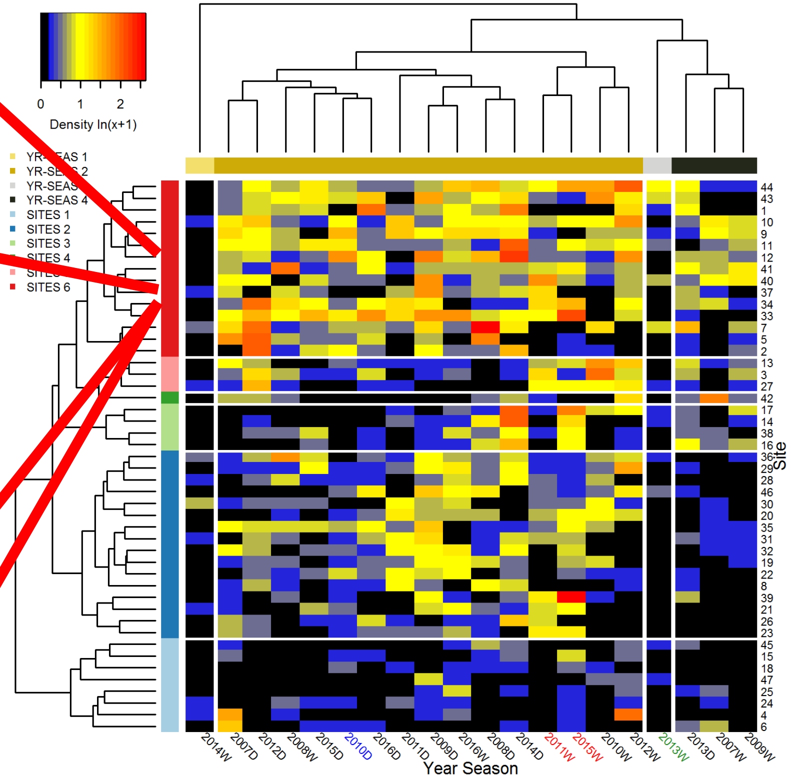
Epifauna Community: Research

RESEARCH ARTICLE

Pink shrimp *Farfantepenaeus duorarum* spatiotemporal abundance trends along an urban, subtropical shoreline slated for restoration

Ian C. Zink[1,2]*, Joan A. Browder[2], Diego Lirman[3], Joseph E. Serafy[2,3]





↑ **Spatial Clustering of pink shrimp**

Other Publications:

Browder and Zink Submitted;

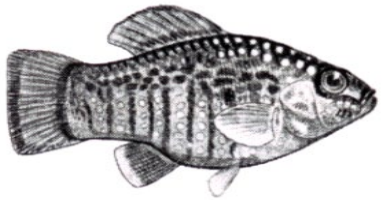
Besemer et al. In Prep

Mangrove Fish: Research

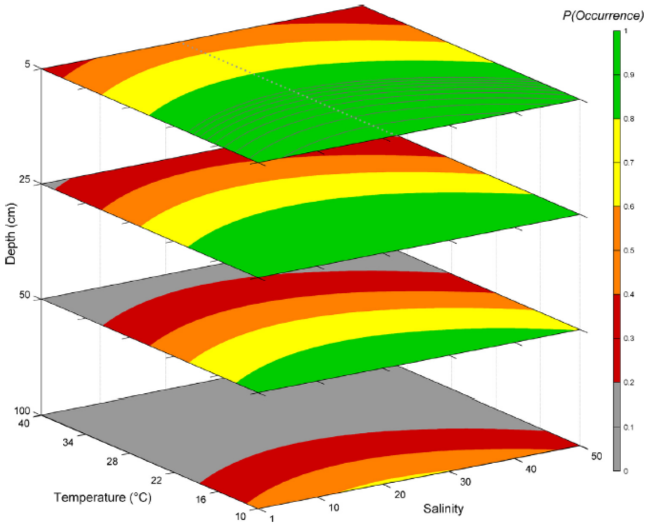
Killifish habitat suitability as a measure of coastal restoration performance: Integrating field data, behavioral trials and simulatior

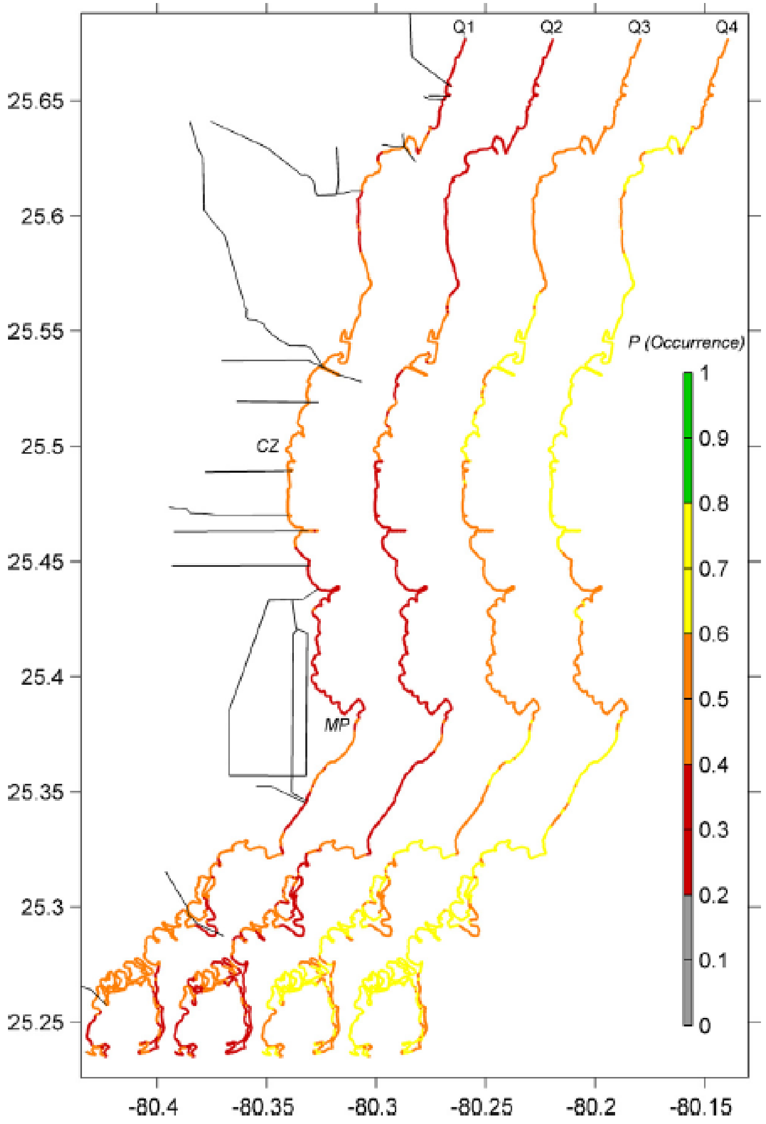
L.C. McManus[a,*], S. Yurek[b], P.B. Teare[a], T.E. Dolan[a], J.E. Serafy[a,c]

[a] University of Miami, Rosenstiel School of Marine and Atmospheric Science, 4600 Rickenbacker Causeway, Miami, FL 33149, United States
[b] Department of Biology, Cox Science Center, University of Miami, 1301 Memorial Drive, Coral Gables, FL 33124-0421, United States
[c] Southeast Fisheries Science Center, National Marine Fisheries Service, 75 Virginia Beach Drive, Miami, FL 33149, United States



↑*Flordichthys carpio*





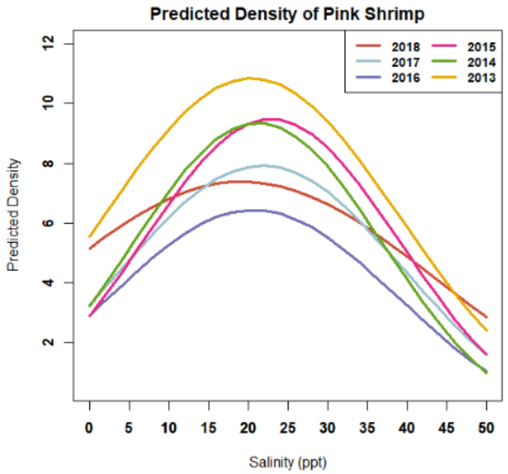
Other Publications:

Faunce and Serafy 2007, 2008; Faunce et al. 2002; Serafy et al. 2007, 2003

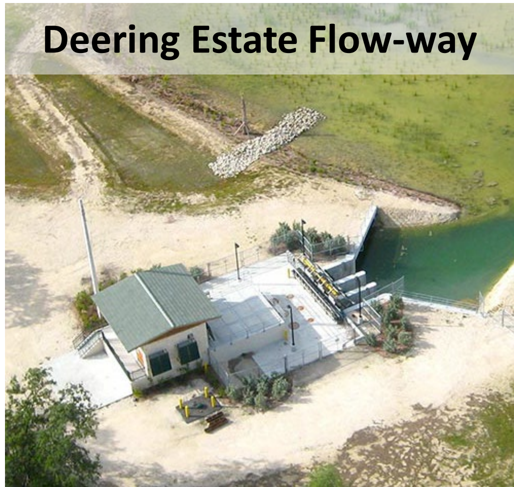
IBBEAM – Lessons Learned

Seagrass target should be refined to consider mixed seagrass beds of *Halodule wrightii* and *Thalassia testudium* instead of only *H. wrightii*

Our baseline data has a variety of non-CERP related disturbances (rainfall/hurricanes, cold snaps, phytoplankton blooms and Sargassum ingressions etc.) that will be useful or analyzing responses post implementation



Epifauna key species relationships with salinity are statistically significant, and predictions (occurrence and density) from them become more consistent from year to year as more years of data are added



Still waiting to see true establishment of some estuarine flora and fauna

Thank you! Questions?

A special thanks is deserved by the many technicians who have supported this project over the years

We would also like to thank USACE for support of this work:

IBBEAM is comprised of elements 3.2.3.3, 3.2.4.7, and 3.2.3.6 of CERP RECOVER MAP Southern Coastal Systems Module