LINKING EVERGLADES RESTORATION EFFECTS TO FISHERIES HABITAT: INFLUENCE OF SAV SEASCAPE STRUCTURE AND FISH PREDATION RISK IN BISCAYNE BAY

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Submerged Aquatic Vegetation (SAV) Habitats

Key ecosystem services
- High biomass seagrass meadows trap sediments and nutrients.
- Seagrass meadows provide a nursery for finfish and shellfish.
- Seagrasses and associated algae have high primary production.
- Seagrasses promote trophic transfers and cross-habitat utilization.

Tropical seagrass loss
- Coastal salinity changes because of altered water flow for irrigation.
- Pulsed turbidity exacerbated by erosion due to poor land management.
- Large urchin grazing events.
- Eutrophication resulting in phytoplankton blooms, reducing light.
- Dredging and boating effects.

Orth et al. 2006
SAV Habitats and Freshwater Management

Historic Flow

Most of the Rainfall is in the West of the Coastal Ridge

Pre-Drainage - Lower East Coast of Florida Circa 1900

Current Flow

Most of the Rainfall is in the West of the Coastal Ridge

Present Day - Lower East Coast of Florida
SAV Habitats and Freshwater Management

- CERP designed to:
  - Restore,
  - Protect, and
  - Preserve water resources of central and south Florida

- Biscayne Bay Coastal Wetland Project plans to affect the sources, amount of FW inputs
Quantifying freshwater-induced fragmentation of submerged aquatic vegetation communities using a multi-scale landscape ecology approach

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SAV Seascape Structures

SAV Seascape Fragmentation

SAV Habitat Cover
Seascape approach to understand community responses
Objective

- Important to look at possible mechanisms behind population and community responses to seascape spatial structures
  - Predation effects

- Use the predation model to understand:
  - How predation effects vary across different types of SAV seascapes
  - Assess how the nektonic community structure, diversity and probability of occurrence respond to such effects
Methods

- **Study Site**
  - Biscayne Bay, Miami, FL
  - Fragmented & Continuous SAV Seascapes

- **Sampling**
  - Baited Remote Underwater Video Sampling (BRUVS)
  - Tethering Predation Experiment

- Night sampling
Methods

- BRUVS
- Diversity
- Predation Risk
  - Abundance (MaxN)
  - Habitat Usability (TiV)
  - Vigilance (Prate)

BRUVS station

X Tethering experiment station

Seagrass Continuous Seascape

Seagrass Fragmented Seascape

Mangrove-Seagrass Edge

Seagrass Meadow (core habitat)

Seagrass Meadow Edge

BRUVS station

Tethering experiment station
Methods

- Tethering Predation Exp.
  - Pink shrimp
  - Probability of predation
    - Seascape
    - Distance from shore

BRUVS station
X Tethering experiment station
Results: BRUVS
Results: BRUVS

- **Abundance (MaxN)**
  - ✓ No seascape effects
  - ✓ MS edge < SG core < SG edge

- **Habitat Usability (TiV)**
  - ✓ Continuous > Fragmented
  - ✓ MS edge < SG core < SG edge

- **Vigilance (Prate)**
  - ✓ Continuous < Fragmented
  - ✓ MS edge < SG core < SG edge

The bar charts show the mean values for different categories such as Buffer and Seascape, with significance levels indicated by p-values.
Results: BRUVS

- **Mesopredator**
  - Higher prevalence in MS edge

- **Invertivore/Piscivores**
  - Across seascapes

- **Invertivore of small prey**
  - MS edge < SG core < SG edge

**Seascape**
- Continuous
- Fragmented

**MesoP** – Mesopredator

**IvPi** – Medium invertivore/piscivores

**IvSm** – Invertivores of small prey
Results: Shrimp Predation

- Shrimp predation
  - Continuous < Fragmented
  - MS edge < SG core < SG edge

Mangrove-Seagrass Edge
Seagrass Meadow
Seagrass Meadow Edge
Summary

• Higher abundance and habitat usability closer to the seagrass meadow edge and continuous SAV seascapes

• Higher vigilance within fragmented seascapes

• Higher probability of predation within fragmented seascapes and towards the seagrass meadow edge
Conclusion

 ✓ Evidence of predation risk effects shaping the abundance and habitat suitability of fish/invertebrate species
 ✓ Trophic cascades influenced by SAV seascape spatial properties

 ✓ BRUVS proved to be an efficient and non-destructive sampling method to assess how ecological dynamics of fish/invertebrate species respond to anthropogenic induced habitat changes
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