Assessing Fish Movement Through Time in Everglades National Park Using Drift Fences

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Introduction

- The eastern boundary of Everglades National Park (ENP) and the headwaters of Taylor Slough are an important focus of management and planning
- Implementation of the Interim Operating Plan (IOP) in 2000 impacted hydrology of this area
- In 2003, we began monitoring fishes and macroinvertebrates along the eastern ENP boundary to track impacts of changing water deliveries by establishing a baseline dataset for S332 B and D areas
- In 2012, new operations and water deliveries were implemented under the Everglades Restoration Transition Plan (ERTP)
- Past result include documenting that the timing and flow of water from the L-31W canal influences marsh fish species distribution and movement in the study area. Density of all aquatic organisms sampled increase closer to canals[2]

Central question: How does water delivery affect exchange of fishes between the L31W, Aerojet, and C-111 canals and the adjacent marshes?

- **Hypothesis 1:** There will be no change in the community structure in samples taken before IOP/ERTP implementation to after.
- **Hypothesis 2:** There will be no difference in the community structure between the Control and Impact regions

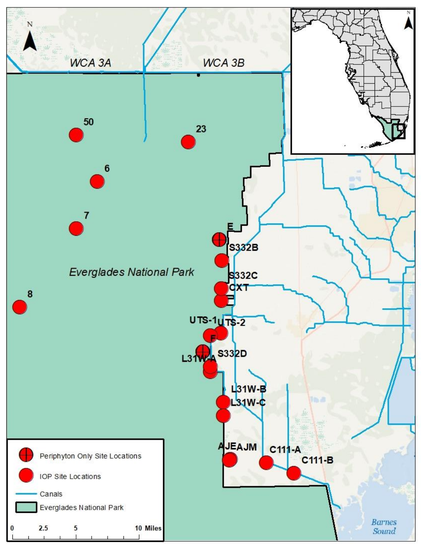

Figure 1: Map of current study sites

Methods

Sampling Method

- Drift Fence
  - X-shaped formation, 90° angles (Fig. 2a, 3, 4)
  - 4 minnow traps per fence set (Fig. 2b)
  - 12 hydroperiod sites (Fig. 1)
  - 5 sets of samples annually

Figure 2: Diagram of drift fence setup with minnow trap[1]

Figure 3: Drift fence set up in sawgrass area

Figure 4: Drift fence in open water

Analysis

- PERMANOVA used for Before-After Control-Impact (BACI) analysis (2012 to present)
- Morista-Horn similarity index to evaluate patterns of community structure unaffected by CPUE (density invariance)
- Control Sites: Aerojet, C-111, SRS
- Impact Sites: L31-W, S332, UTS, Context Road

Key Findings

- Hydroperiod was longer after 2012 than before in both control (3% longer) and impact (30% longer) regions
- Water depth consistently greater in impact region than the control region; depth also greater after 2012 than before
- Fish CPUE was lower after 2012 than before (47% decrease at control sites, 58.4% at impact sites), but decreased less in impact than control sites
- Relative abundance of African Jewelfish had a higher increase in collections at impact than in control sites

Future Work

- 2018-2019: Continue assessing changes to the water delivery in the Upper Taylor Slough region
- Link to throw trapping data in Taylor Slough and Panhandle
- Evaluate if new operations impacts food-web function through changes in phosphorous delivery and food quality

Results

- Depth and Days Since Last Dry (DSD): Both main effects and interactions were significantly different from the null hypothesis of no difference (Depth p<0.01, DSD p=0.026; Fig. 6a,b)
- Total fish: main effects interactions significantly different from the null hypothesis (p=0.0244; Fig. 6c)

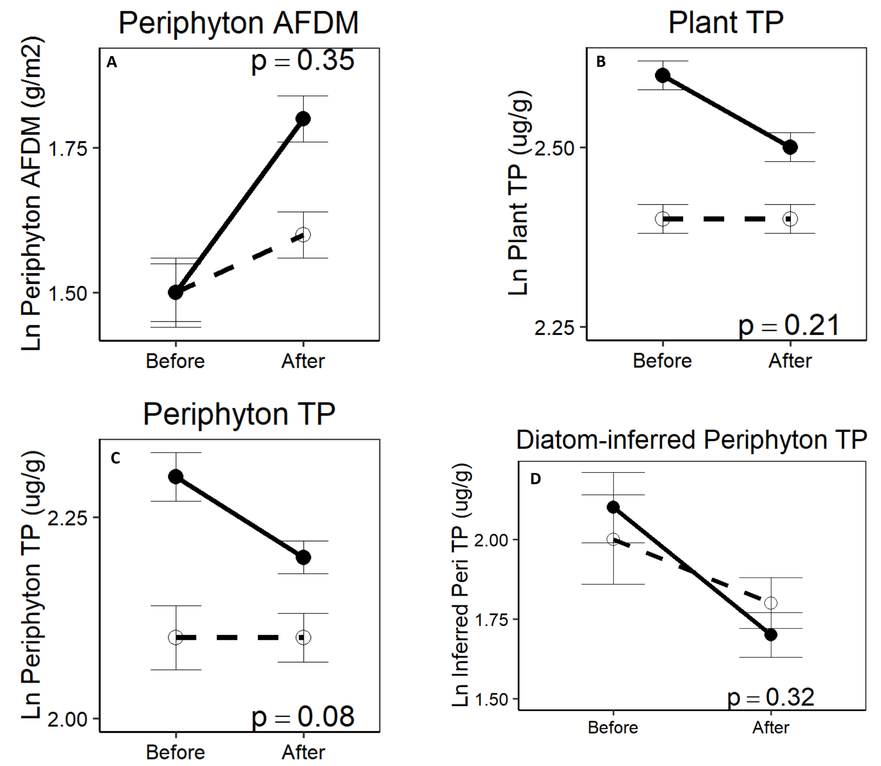

Figure 5: Means and standard errors a) Periphyton Ash-free Dry Mass (AFDM), b) Plant Total Phosphorous (TP), c) Periphyton TP, and d) Diatom-inferred Periphyton TP for Control (solid points and lines) and Impacted (open circles and dashed lines) transects before and after 2012. P-value for interaction reported.

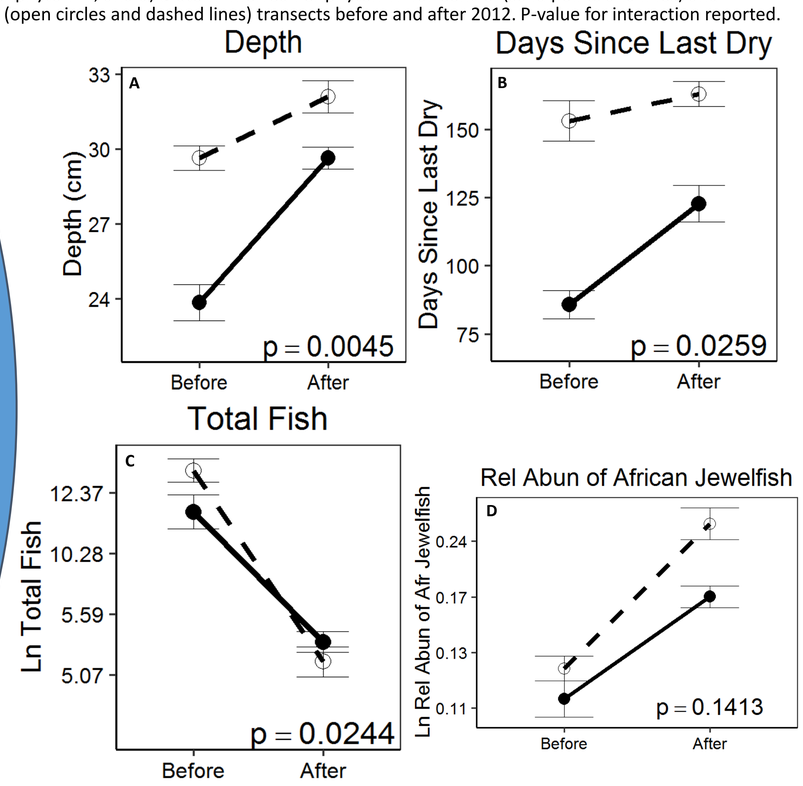

Figure 6: Means and standard errors of a) Total Fish b) Relative Abundance of African Jewelfish c) Depth d) Days Since Last Dry Down for Control (solid points and lines) and Impacted (open circles and dashed lines) transects before and after 2012. P-value for interaction reported.

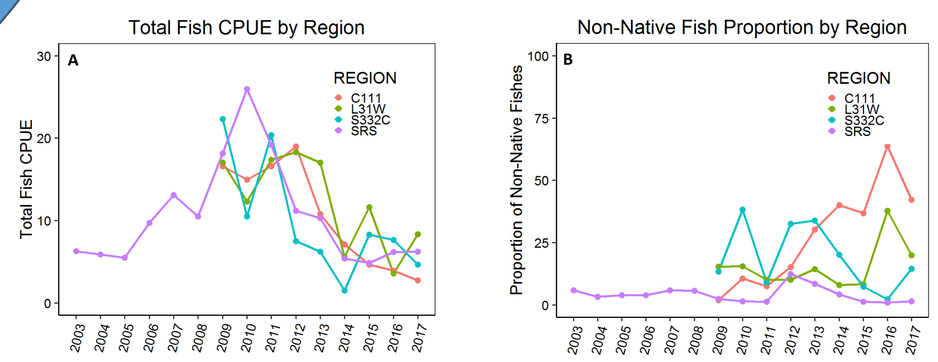

Figure 7: a)Total catch per unit effort (CPUE) by region b) proportion of non-native fishes to total catch by region

Conclusions

- DSD increased at the impact sites relative to the controls (significant BACI interactions; Fig. 6a,b,c), suggesting that the intervention had desired effects. Periphyton TP may have decreased (p=0.08).
- CPUE data indicate more fish movement between canal and marsh habitats at impact sites after 2012 than before compared to control sites.
- Important contributors to community responses in the BACI hypothesis tests: Sailfin Mollies, Bluefin Killifish, Flagfish, African Jewelfish
- 2010 cold event, loss of non-native species (Fig. 7a,b)

Citations

[1] Obaza, A., D. L. DeAngelis, and J. C. Trexler. 2011. Using data from an encounter sampler to model fish dispersal. Journal of Fish Biology 78:495–513

[2] Rehage, J. S., and J. C. Trexler. 2006. Assessing the net effect of anthropogenic disturbance on aquatic communities in wetlands: community structure relative to distance from canals. Hydrobiologia 569:359–373.

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