Inter-annual variation in hydroperiod affects periphyton standing crop and the associated macroinvertebrate community in the Everglades

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Introduction

Aquatic macroinvertebrate community composition and periphyton standing crop are measures that indicate how the basal portion of the food web in the Everglades ecosystem responds to inter-annual variation in hydroperiod (Liston and Trexler 2005). We monitored periphyton standing crop and the associated macroinvertebrate (infaunal) community during the 2004 – 2008 water years at short-hydroperiod sites in the eastern Everglades, which are influenced by the S332 B and D impoundments, and long-hydroperiod sites in Shark River Slough (SRS).

Objective

Assess how inter-annual variation in hydroperiod affected the difference between the macroinvertebrate community at short and long hydroperiod sites in Everglades National Park.

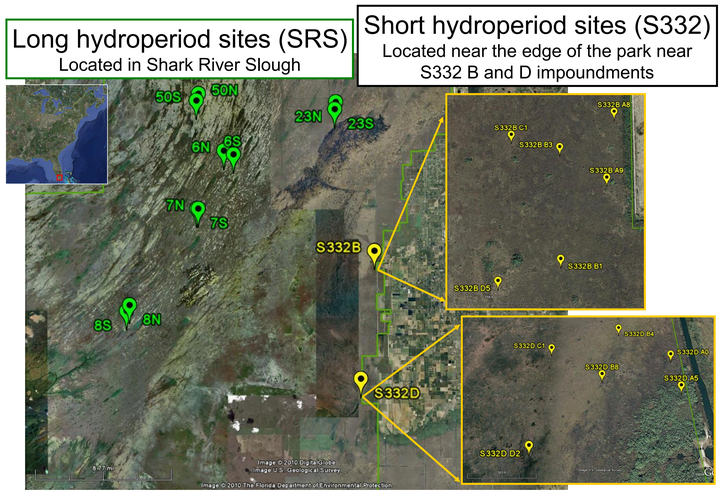

Figure 1. Sampling locations in Everglades National Park (ENP)

Methods

- Periphyton cores collected twice while sites were inundated (Liston and Trexler 2005) and preserved with 70% EtOH.
- Replicate samples collected within 10 m of permanent sampling location in SRS
- Samples collected ~0 m, 250 m, 500 m from park boundary at S332 sites
- Water depths measured at each site on each sampling date, used to calibrate EDEN depth estimates.
- Infaunal macroinvertebrates identified and counted in lab
- Periphyton ash-free dry mass (AFDM) quantified in lab

Hydrology

Water depths in ENP were interpolated with the Everglades Depth Estimation Network (EDEN, http://sofia.usgs.gov/eden/) (Telis et al. 2006) and corrected with field observations using site-specific linear models. The interpolated time series (Fig 3) shows inter-annual variation in hydroperiod, and that SRS was inundated longer than S332 each water year.

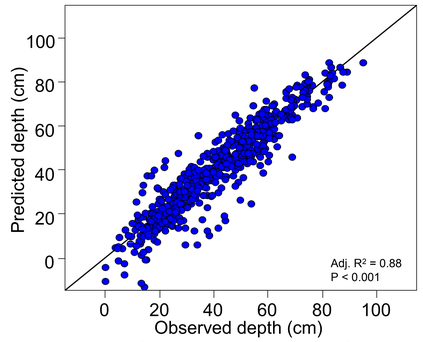

Figure 2. Interpolated water depths (y-axis) and field observations (x-axis)

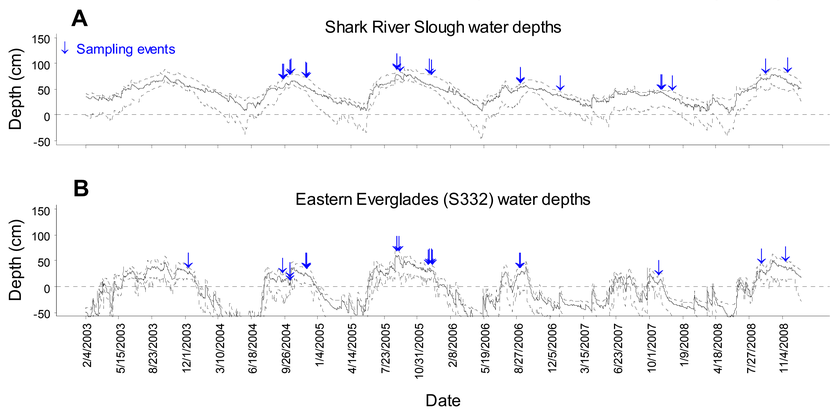

Figure 3. Daily water depths (median ± 95% CI) from 2003 – 2008 at SRS (A) and S332 (B) sampling locations. Depths interpolated with EDEN and linear models. Sampling dates indicated by arrows.

Periphyton biomass and infaunal crowding

Infaunal crowding (macroinvertebrate density standardized to periphyton biomass) was greater at long hydroperiod (SRS) sites, and periphyton standing crop was greater at short hydroperiod sites (S332) excluding the 2005 water year.

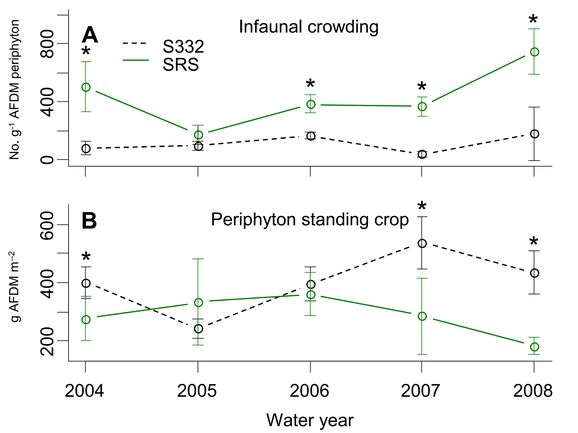

Figure 4. Infaunal crowding (A) and periphyton standing crop (B) at short (S332) and long (SRS) hydroperiod sites. Points are a regional (SRS or S332) mean (± 95% CI) for a given water year (x-axis). * indicates significant difference (P < 0.05) between S332 and SRS during a water year.

Infaunal community composition

Infaunal macroinvertebrate community composition was summarized with a nonmetric multi-dimensional scaling (NMDS) ordination (Fig 5A). Infaunal community composition was less variable among long hydroperiod (SRS) sites than short hydroperiod (S332) sites during the study period (Fig 5B). S332 and SRS communities were similar in the 2005 water year (Fig 6)

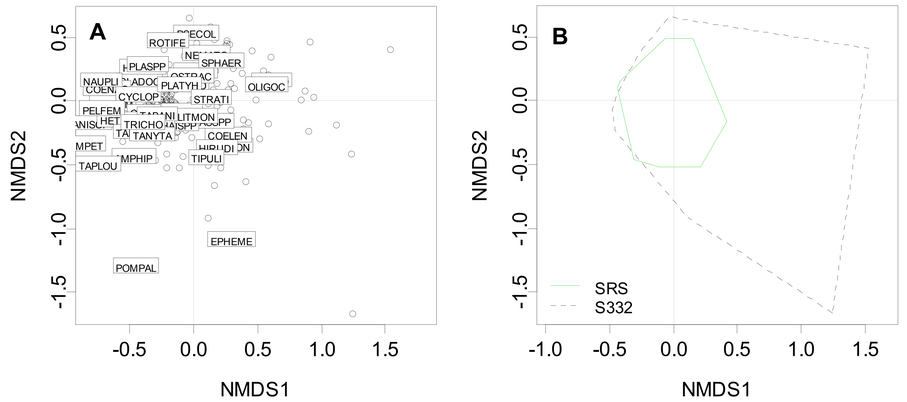

Figure 5. Axes of a NMDS ordination (stress = 17.6) provide two composite variables to describe among-site variation in community composition (A). Convex hulls indicate the range of taxonomic composition observed for short hydroperiod (S332) and long hydroperiod (SRS) sites (B).

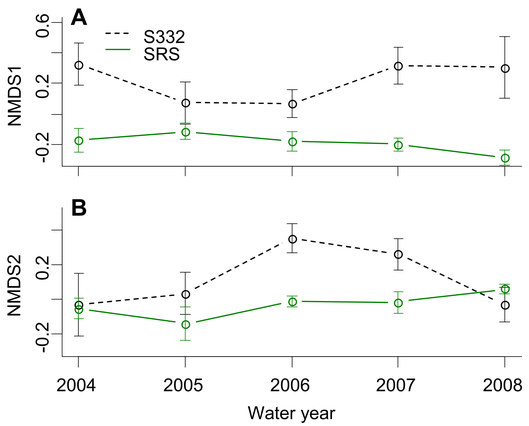

Figure 6. NMDS1 (A) shows S332 and SRS sites are different in all years excluding 2005. Community composition with respect to NMDS2 differ among long and short hydroperiod sites during the drier water years (2006 and 2007) (B).

Conclusions

Generally, Infaunal macroinvertabrate communities were more densely packed at long hydroperiod sites (SRS) than short hydroperiod sites, and periphyton standing crop was greater at short hydroperiod sites. During the 2005 water year, when sites were inundated longer, SRS and S332 sites had similar periphyton standing crops and community composition.

Implications

The observed response of the macroinvertebrate community to yearly changes in hydroperiod suggest planned management strategies to increase the hydroperiod in the Rocky Glades region (SE region of ENP near C-111 canal) may have an immediate, restorative impact on the macroinvertebrate community.

References

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Acknowledgments

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