Created coastal marshes have equivalent diversity to natural coastal marshes: A case study from Louisiana

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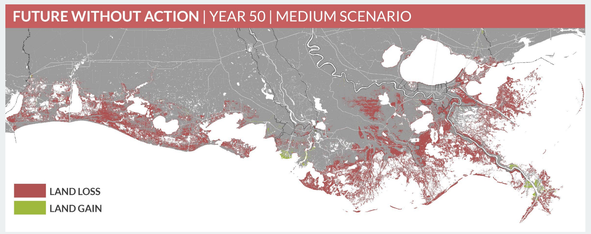
Background

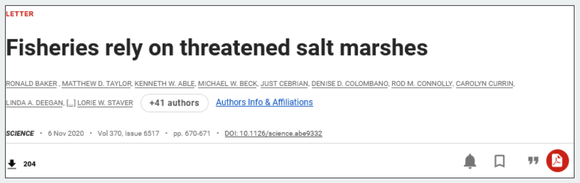
Alarming disappearance of coastal wetlands



In Louisiana…

- 4800 km² have been lost since the 1930s with rates as high as 100 km² per year
- 4,500 km² is projected to be lost in the next 50 years

Saltmarshes support Biodiversity


LETTER

Fisheries rely on threatened salt marshes

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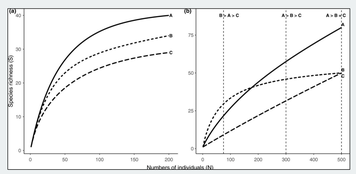
Methods

Documenting changing biodiversity: How do we appropriately measure it?

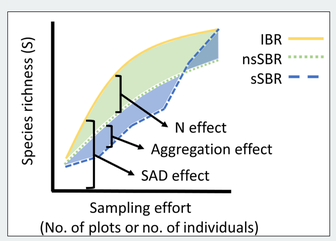
Biodiversity is complex and scale-dependent



- Beyond species #s. Multivariate
- Conclusions can vary on sampling scale

Multi-scale Analysis

- Multiple rarefactions: individual, spatial, & sample-based
- Separate aggregation, density, & evenness effects



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* Preliminary results, subject to revision and not for citation

Study site

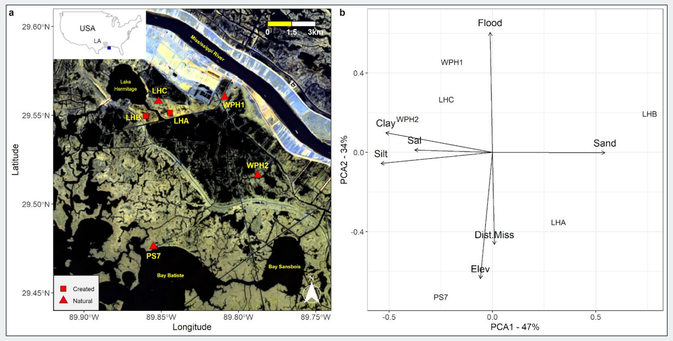


Figure 1. Study site map and Principal Components Analysis of environmental variables across marshes.

Table 1. Outline of sampling strategy and replicates for the cross-taxonomic analysis of marsh biodiversity

Sampling

Taxa	Taxonomic resolution	Sampling method	Replicates per marsh
Fish & Macroinvertebrates	Species	Minnow trap	27
	Species	Trawling	8
Plants	Species	Quadrats	15
Spiders	Morpho type	Sweeps	1
Microbes	Order	Core (surface)	4
	Order	Core (8-10 cm depth)	4
Macroinfauna	Species/Genus	Core	10

All sampling conducted in 2018.

Created marshes

Reference marshes

Figure 2. Aerial views of marsh sites.

Results

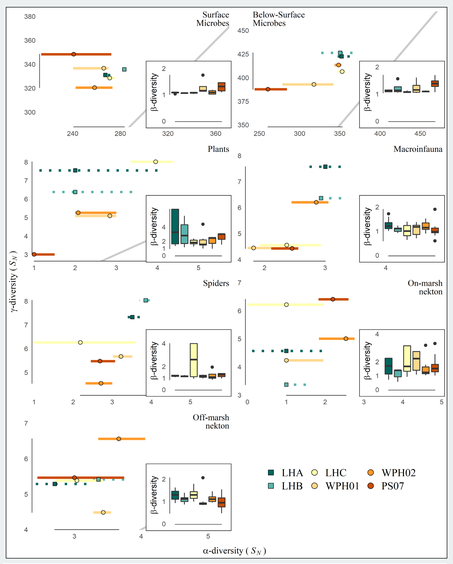


Figure 3. Among-site rarefied diversities for individual plots/samples (α; x-axis) among-samples (β; insets), and total site (γ; y-axis) for all taxonomic groups.

Question: Do created and reference marshes harbor the same abundance and diversity of organisms?

Takeaways

- Created Marshes contained similar diversity as references
- Many terrestrial groups show higher diversity
- Abundances were similar, trend of lower in LHA in some groups

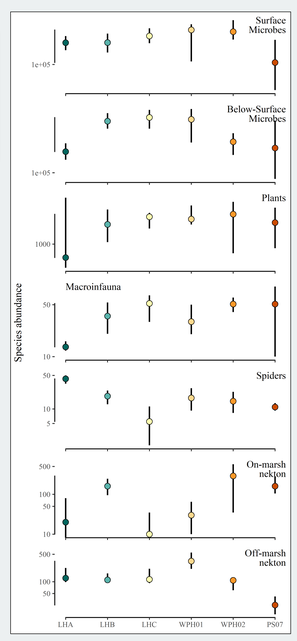
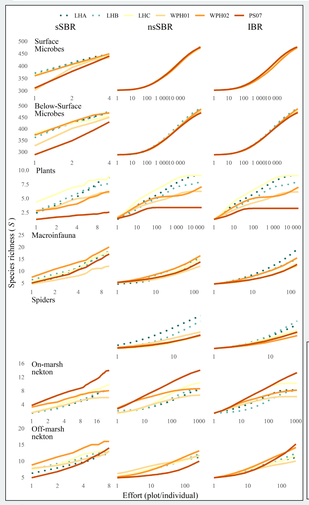


Figure 4. Abundance (mean ± 1SD) among created (LHA & LHB; green symbols) and reference marshes (LHC, WPH01, WPH02, & PS07) for all taxonomic groups. ---------->

Question: How does species richness change across scales amongst groups?



Takeaways

- Crossed streams: Scale-dependence in all taxonomic groups

Figure 5. Sample-based rarefactions (left column) maintaining spatial configuration and (middle column) breaking spatial relationships. (right column) Individual-based rarefactions based on sampling individuals randomly.

Question: Do the effects of aggregation, density, and SAD differ among marshes?

Takeaways

- Aggregation, density, and SAD vary among taxonomic groups
- But mostly similar effects in created and reference marshes

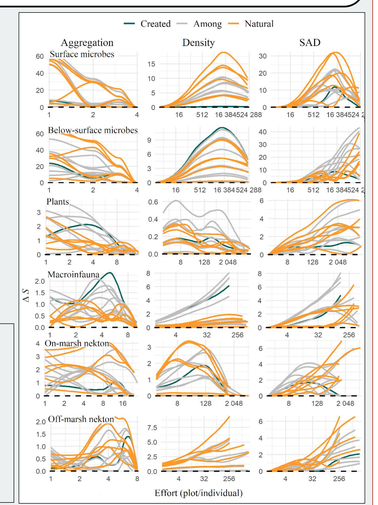


Figure 6. Absolute difference between marshes in the contribution of aggregation, density, and species abundance distribution (SAD) to richness patterns. Colors highlight the pairwise comparison between created and reference marshes.

Conclusions

- Created marshes were not notably different than reference marshes
- Created marshes harbor similar levels of biodiversity as reference marshes: Important tools for the maintenance and restoration of coastal biodiversity
- Artificial marshes are not equivalent. Different building plans may lead to different biodiversity patterns