Characterization of ambient water quality in natural and created wetlands of the Texas coast

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Background

The US EPA has expressed interest in creating water quality criteria and standards specific to coastal and inland wetlands. Environmental agencies and professionals have long recognized the fundamental difference in ambient water quality between wetlands and open water systems. Saltwater wetlands provide a variety of ecosystem services, but little research has been published on water quality of these wetlands. To date, no studies comparing water quality among created, natural, and freshwater marshes have been conducted. Here, we present preliminary results on the range of water quality conditions among created, natural, and freshwater wetlands compared to ambient open water quality.

Methods

- Surface water quality of 3 marsh types within Galveston Bay (Figure 1)
  - 2 created saltmarshes (created)
  - 2 natural saltmarshes (natural)
  - 1 freshwater marsh (freshwater)
- 6 sampling events from Nov. 2013 to Oct. 2014 w/ handheld YSI
  - Collected in-situ samples
  - NO_3, NO_2, TN, NH_4, & TP
  - Analysis completed using a Hach DR/890 colorimeter
- Statistical analysis – One-way ANOVA ($\alpha = 0.05$)
  - Open-water vs. marsh type
  - Created vs. natural saltmarsh

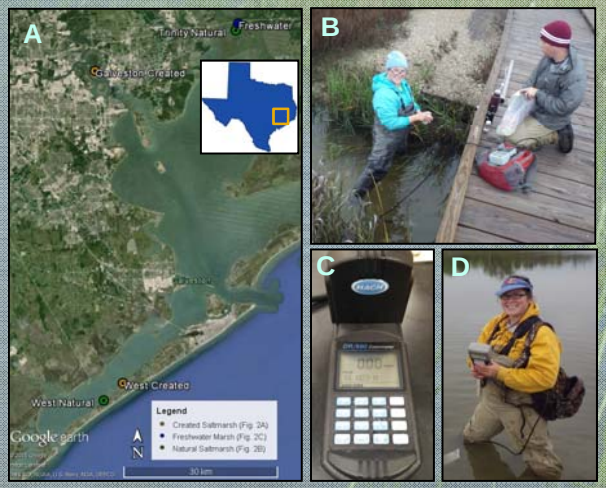

Figure 1. (A) Map of Galveston Bay displaying site locations and marsh type; (B) Collecting water samples at a created saltmarsh; (C) Hach DR/890 Colorimeter; (D) Using YSI handheld monitoring device.

Nutrient levels between open water and marsh

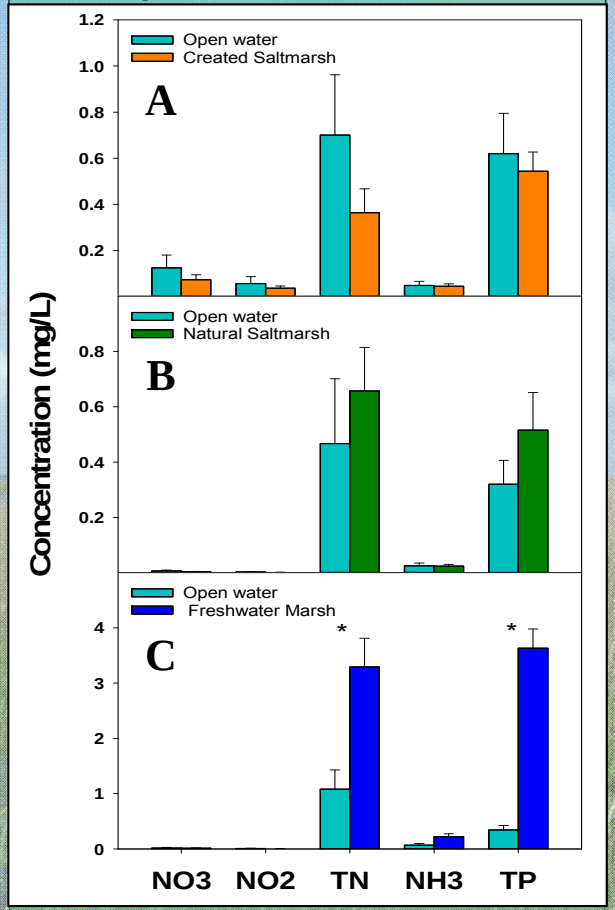

Figure 2. Comparison of open water mean (± SE) nitrate (NO_3), nitrite (NO_2), total nitrogen (TN), ammonia (NH_3), and total phosphorus (TP) values in mg/L to created saltmarshes (A), natural saltmarshes (B), and freshwater marsh (C).
* Indicates significant difference

Contact Information

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Results

- No significant differences between created marshes or natural marshes compared to open water sites
- Freshwater marshes showed significantly higher TN ($F_{5,17} = 5.69$, $p = 0.026$) and TP ($F_{5,17} = 28.71$, $p < 0.001$) (Figure 2)
- Created salt marshes had significantly higher levels of NO_3 ($F_{35,34} = 10.10$, $p = 0.002$) and NO_2 ($F_{35,34} = 10.93$, $p = 0.002$) compared to natural marshes (Figure 3)

Nutrient levels between created and natural saltmarsh

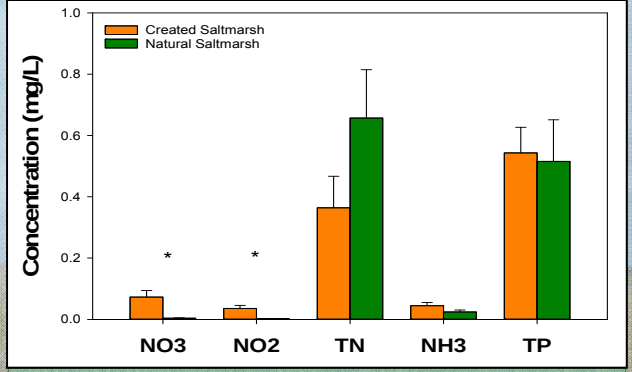

Figure 3. Comparison of mean (± SE) nitrate (NO_3), nitrite (NO_2), total nitrogen (TN), ammonia (NH_3), and total phosphorus (TP) values between created and natural saltmarshes. * Indicates significant difference

Conclusions and Continued Analyses

- Preliminary results suggest that open water and saltmarsh nutrient levels are equivalent.
- Significantly higher TN and TP values in freshwater marshes may be due to increased total suspended solids, large amounts of decaying detritus, and excess organic waste from organisms.
- Significant differences in NO_3 and NO_2 between created and natural saltmarshes may be attributed to delayed break down of nitrogenous compounds or increased concentrations of dredge material in base soils, though this requires further analysis
- Statistical analyses are ongoing, including evaluation of additional water quality parameters and influence of possible contributing factors.

Acknowledgments

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