CHARACTERIZATION OF AMBIENT WATER QUALITY, SOIL NUTRIENTS, AND BIOLOGICAL COMMUNITIES IN NATURAL & CREATED WETLANDS OF THE TEXAS COAST

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Background

Environmental agencies, limnologists and oceanographers have long recognized the fundamental difference in ambient water quality between open water systems and wetlands and the need to develop specific protective water quality standards for each type of system. Saltwater wetlands provide a variety of ecosystem services, but little research has been published on water quality of these marshes. In addition to the lack of information that exists on saltmarsh water quality, there have been no critical studies looking at the differences in water quality between created and natural coastal marshes. Here we present preliminary results on water quality, soil nutrients, and fish community trends for created, natural and freshwater wetlands. Further analyses will compare water quality trends to environmental factors to determine correlations.

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 water sampling events from Nov. 2013 to Oct. 2014 w/ handheld YSI
  - Samples collected in-situ
  - NO_3, NO_2, TN, NH_4, & TP
  - Analysis completed using a Hach DR/890 colorimeter
- Nekton collected via straight seine in June and October 2014
- Soil samples collected in June and November 2014
  - Analyzed by Texas A&M Soil Water Forage Lab using ICP and Nitric Acid Digestion
- Statistical analysis – Kurskal –Wallis (α = 0.05)
- NMDS of fish species assemblages and ANOSIM

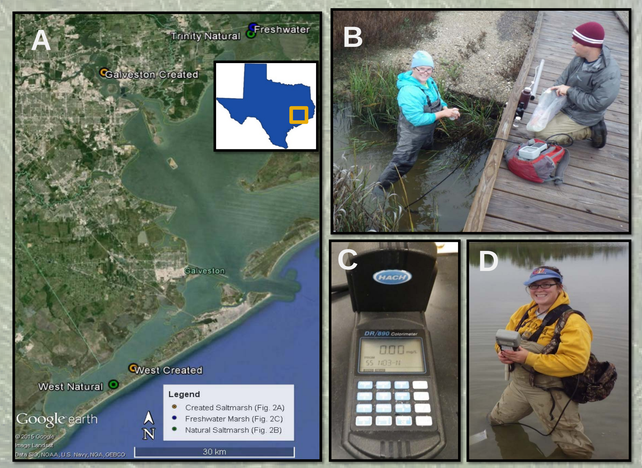

Figure 1. (A) Map of Galveston Bay displaying site locations and marsh type; (B) Collecting water samples at a created saltmarsh; (C) Hach DR/890 Colorimeter; (D) Using YSI handheld monitoring device.

Water Quality

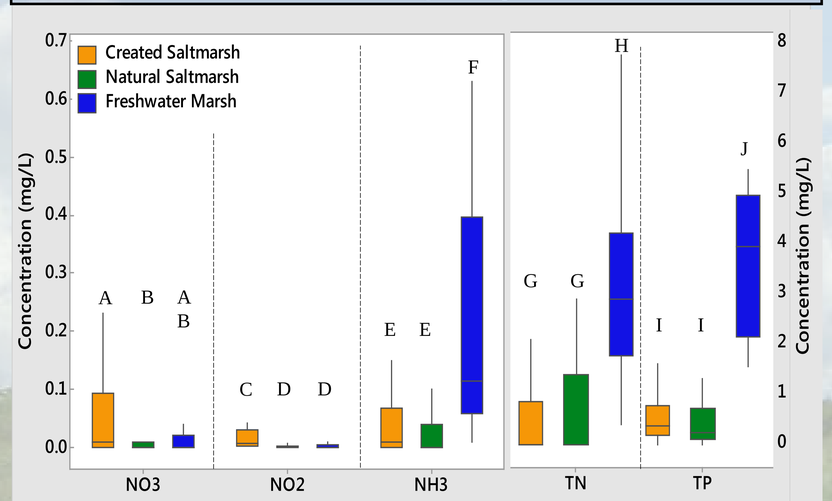

Figure 2. Comparison of median water nitrate (NO_3), nitrite (NO_2), total nitrogen (TN), ammonia (NH_3), and total phosphorus (TP) values between marsh type. Letters indicate a significant difference.

Soil Nutrients

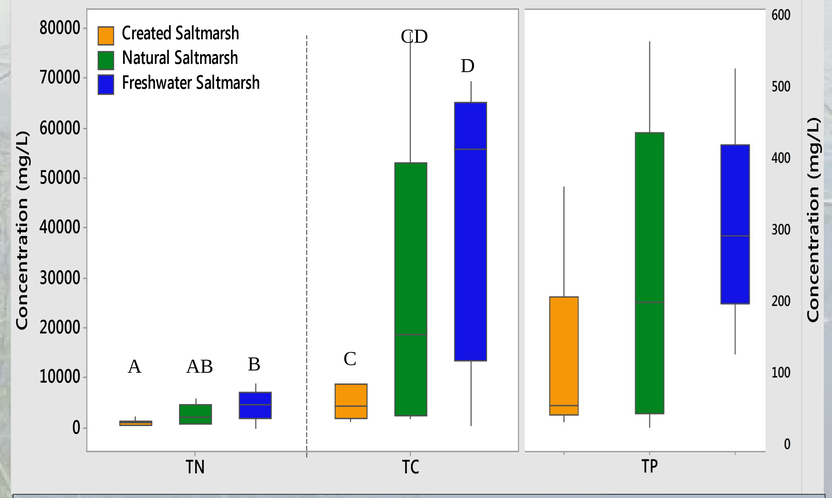

Figure 3. Comparison of median soil total nitrogen (TN), total carbon (TC), and total phosphorus (TP) values between marsh type. Letters indicate a significant difference

Acknowledgments

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Results

- Created salt marshes had significantly higher water levels of NO_3 (H=6.57, DF=2, p = 0.037) compared to natural marshes & NO_2 (H=19.28, DF=2, p <0.0001) compared to natural and freshwater marshes (Figure 1).
- Freshwater marshes showed significantly higher water TN (H=30.95, DF=2, p <0.0001), NH_3 (H=21.79, DF=2, p<0.0001) and TP (H=41.37, DF=2, p < 0.0001) (Figure 1)
- Freshwater marshes had significantly higher soil TN (H=6.75, DF=2, P=0.0354) & TC (H=6.02, DF=2, p=0.049) (Figure 3)
- Created saltmarsh, natural saltmarsh, and freshwater marsh all had significantly different fish assemblages (Global R=0.635, P<0.001, Stress=0.07) (Figure 4)

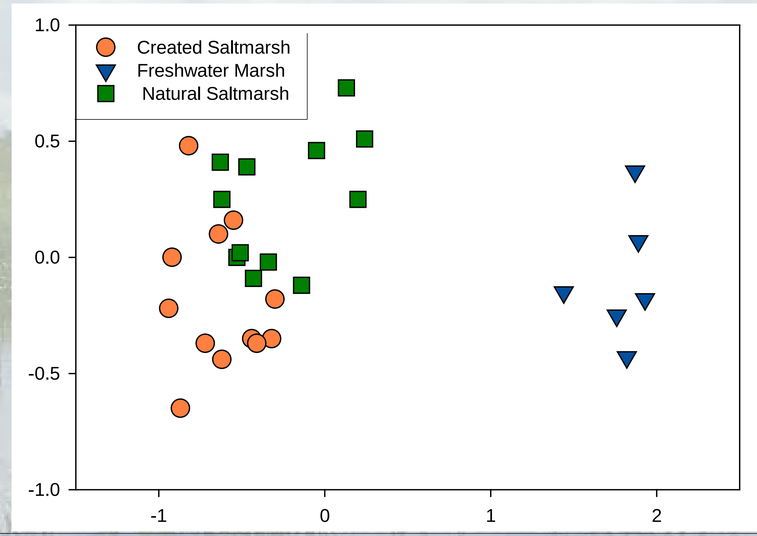

Figure 4. NMDS of fish assemblage between marsh type. Global R=0.635, P< 0.001, Stress=0.07.

Conclusions and Continued Analyses

- Significant differences in water NO_3 and NO_2 between created and natural saltmarshes may be attributed to more aerobic conditions that facilitate efficient processing of nitrogen by microorganisms.
- Significantly higher water 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 nesting birds.
- Significantly higher soil nutrients at the freshwater sites may be due to a higher percent of organic material found at these sites in comparison to saltwater marshes, though more analysis is needed.
- Significant differences in fish assemblages between marsh types follows expectations based on previous studies and salinities.
- Differences in water quality between constructed and natural wetlands should be considered in future restoration projects
- Statistical analyses are ongoing, including evaluation of additional water quality parameters and influence of possible contributing factors.

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