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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
• Soil samples collected in June and November 2014
• Analysis completed using a Hach DR/890 colorimeter
• Statistical analyses are ongoing, including evaluation of additional water quality parameters and influence of possible contributing factors.

Results

• Created salt marshes had significantly higher water levels of NO₃ (H=6.57, DF=2, p<0.0001) compared to natural marshes & NO₂ (H=6.02, DF=2, p=0.049) compared to natural and freshwater marshes (Figure 1).
• Freshwater marshes showed significantly higher water TN (H=21.79, DF=2, p<0.0001), NH₃ (H=19.28, 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).
• Differences in water quality between constructed and natural wetlands may be due to increased total suspended solids, large amounts of decaying detritus, and excess organic waste from nesting birds.

Soil Nutrients

Figure 2. Comparison of median water nitrate (NO₃), nitrite (NO₂), total nitrogen (TN), ammonia (NH₃), and total phosphorus (TP) values between marsh type. Letters indicate a significant difference.

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Conclusions and Continued Analyses

• Significant differences in water NO₃ and NO₂ 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 attributed to more aerobic conditions that significantly increase 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.