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Influence of Instream Flow and Tides on Water Quality of the Brazos River Estuary, Texas



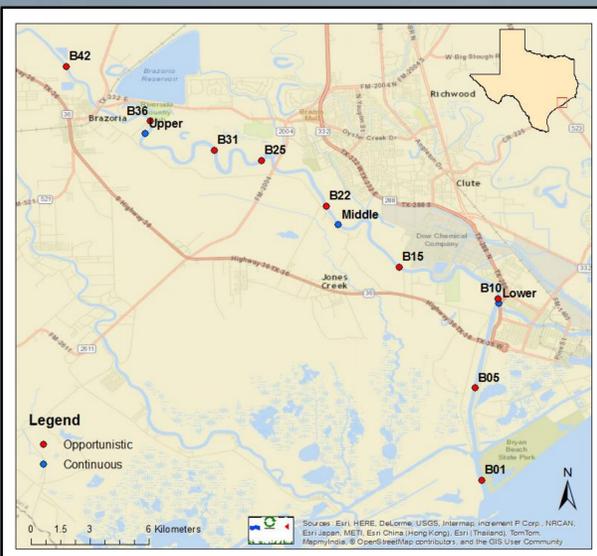
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Introduction

- The State of Texas is currently in the process of validating environmental flow recommendations in an effort to maintain sound ecological environments in rivers and estuaries.
- It is assumed that the primary mechanism regulating production in estuaries is the discharge of freshwater which creates an optimal salinity gradient.
- This salinity gradient operates on a dynamic linear scale influenced by freshwater inflow and tidal forces.
- Objectives of this study were to:
 1. Characterize the flow regime and
 2. Assess the influence of freshwater inflow and tidal movement on water quality gradients in the lower Brazos River.

Study Area

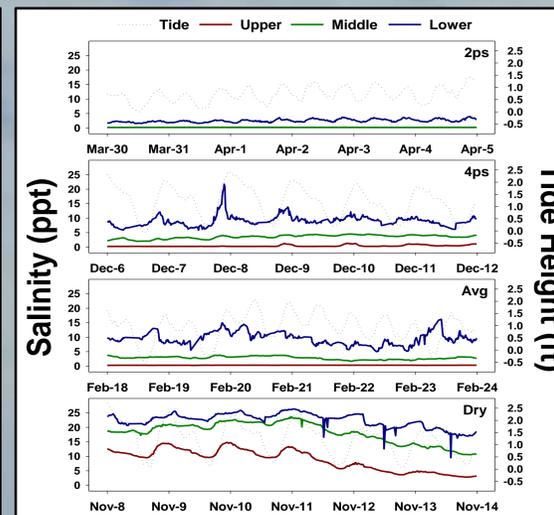
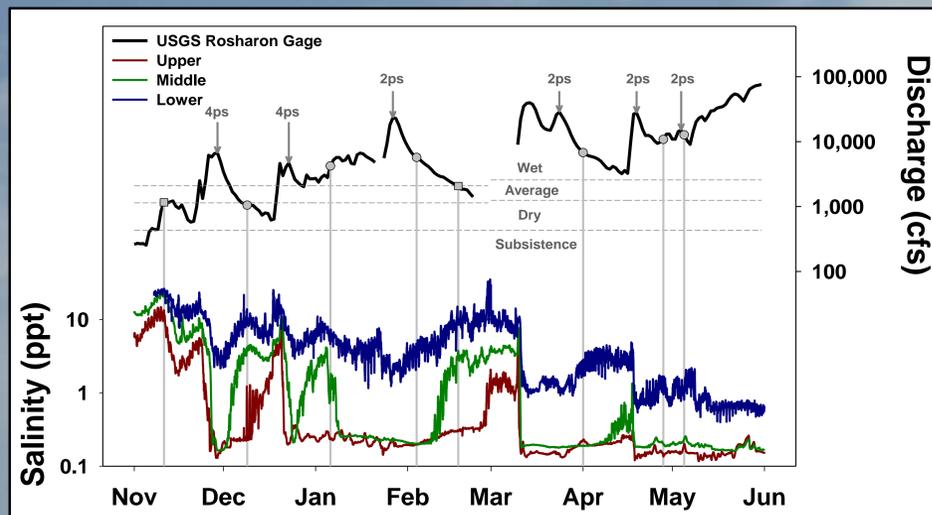


Methods

- Sampled from Nov 2014 – May 2015
- Discharge & Tides
 1. Freshwater Inflow
 - o Data collected from USGS Rosharon Gage (08116650)
 - o Base flow tiers from Brazos River BBEST
 2. Tidal Patterns
 - o Data collected from NOAA
 - o USCG station in Freeport, TX (8772447)
- Water Quality
 1. Continuous Monitoring
 - o Surface readings using conductivity HOBOS
 - o 3 sites: Upper (B35), Middle (B21) & Lower (B10)
 2. Opportunistic Samples
 - o 8 sampling events at 9 sites (B01 – B42)
 - o Depth profiles (surface, 25%, 50%, 75% & bottom) of salinity and dissolved oxygen
 - o RFU Chlorophyll-a, Total Suspended Solids & Nutrients (Nitrate-Nitrite, TKN & Total P)



Results



Continuous Monitoring

Instream Flow

- Salinity values were lowest upstream and highest downstream at the mouth of the Brazos near the Gulf of Mexico
- Prior to and during high-flow pulse events, salinity decreased upstream to downstream
- After high-flow pulse events, salinity increased downstream to upstream

Tides

- 2 per season high flow pulse events: tidal influence along lower reach ~1.5 ppt per tidal cycle (± 0.3 ft); middle and upper reach 0 ppt
- 4 per season high flow pulse events: tidal influence along lower reach ~8.0 ppt per tidal cycle (± 0.8 ft); middle reach ~0.6 ppt; upper reach ~0.5 ppt
- Average base flow: tidal influence along lower reach ~3.8 ppt per tidal cycle (± 0.6 ft); middle reach ~0.6 ppt; upper reach 0 ppt
- Dry base flow: tidal influence along lower reach ~4.2 ppt per tidal cycle (± 0.9 ft); middle reach ~3.3 ppt; upper reach ~5.8 ppt

Opportunistic Sampling

Salinity

- 2 per season high flow pulse events: salinity wedge located 0-5 rkm upstream of the mouth
- 4 per season high flow pulse events: salinity wedge located 26-31 rkm upstream of the mouth
- Average base flow: salinity wedge located 22-26 rkm upstream of the mouth
- Dry base flow: salinity wedge located 36-42 rkm upstream of the mouth

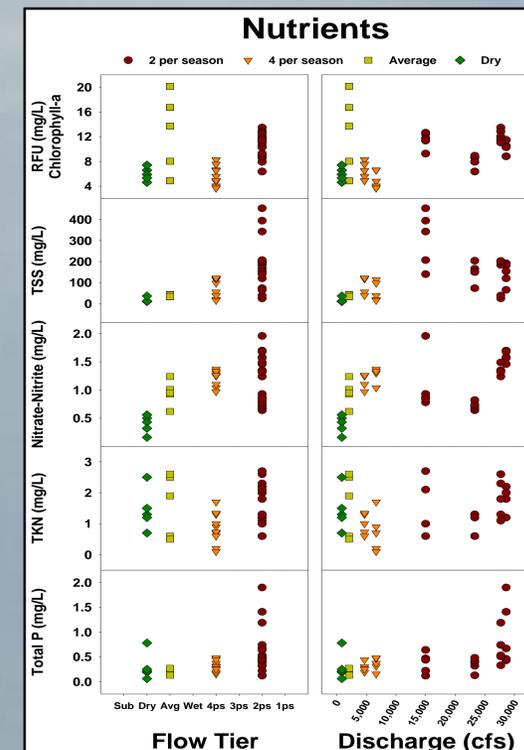
Dissolved Oxygen

- 2 per season high flow pulse events: DO mixed throughout the entire estuary and water column
- 4 per season and average: DO fairly homogenous across all sites at the surface and stratified at the bottom
- Dry base flow: DO values lowest in upper estuary and stratified across most sites

Nutrients

- Total suspended solids (TSS) generally increased across flow tier and discharge and were highest during 2ps events
- Nitrate-nitrite generally increased across flow tier and discharge and were lowest during dry base flow
- Chlorophyll-a, Total Kjeldahl Nitrogen and Total Phosphorus did not exhibit flow tier or discharge relationships

Results



Conclusions & Future Work

- Broad-scale patterns in water quality depended upon timing, magnitude and duration of freshwater inflow events
- Salinity levels responded predictably to high flow pulse events along the sampling reach; tidal influence most evident on tapered end of the salinity wedge
- Location of the salinity wedge relative to size of inflow event and timing within the hydrograph; depressed DO conditions usually occurred on the bottom near the leading edge of the salinity wedge
- Total suspended solids and nitrate-nitrite values generally increased with flow tier and discharge
- Continued monitoring of flow and water quality along with integration of biological data will help resource managers better understand the influence of freshwater inflow on biota and plan for the freshwater needs of the Brazos River Estuary



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