Reviewed: 7/27/2021

Effects of Freshwater Inflow and Tides on Water Quality of the Brazos River Estuary

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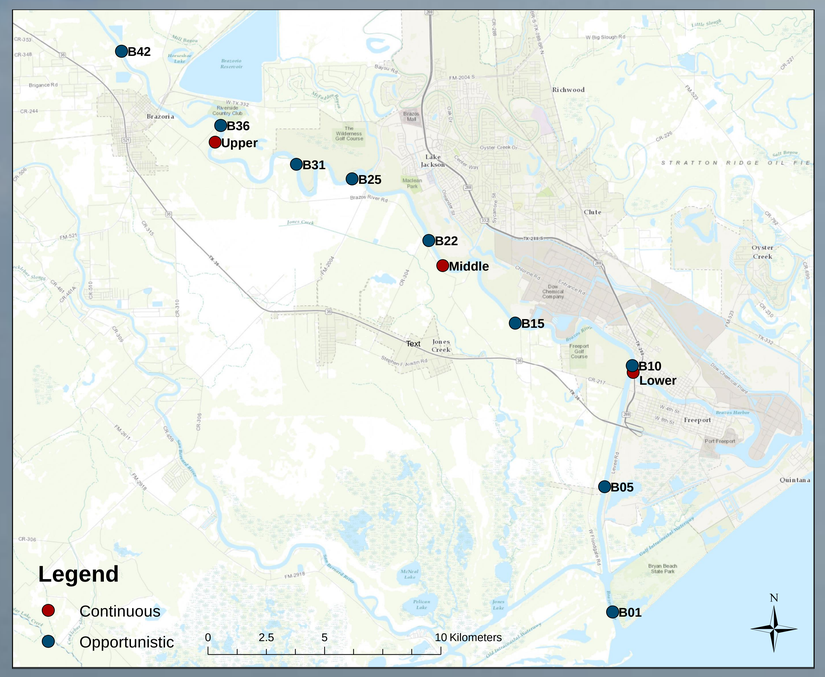
Introduction

- 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.
- Within a riverine system such as the Brazos, 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 salinity gradients in the lower Brazos River.

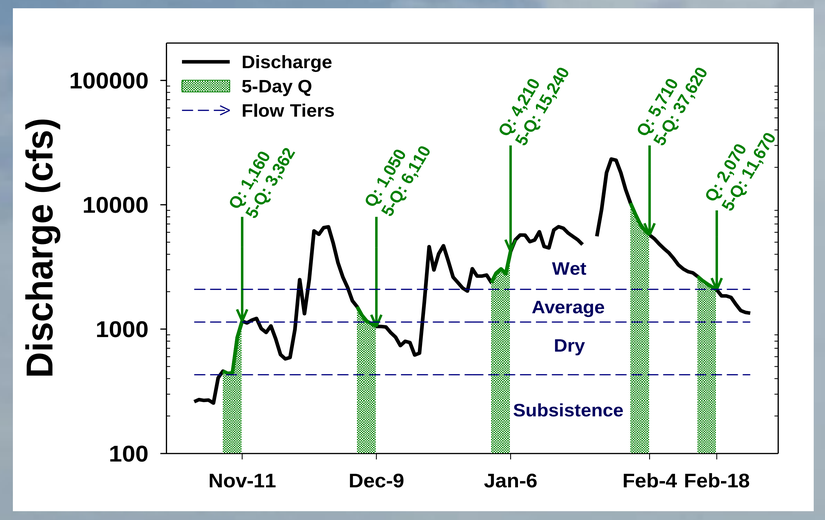
Study Area

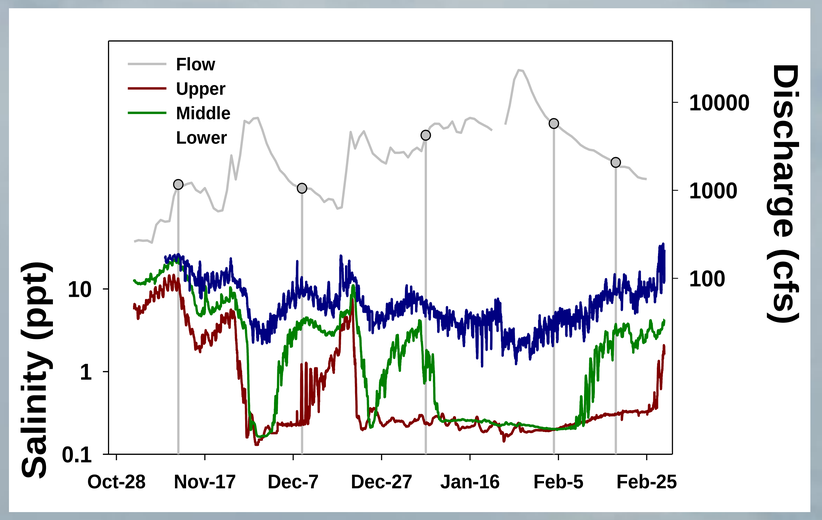


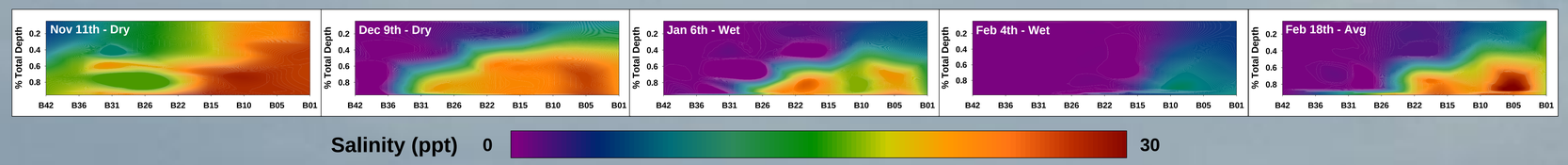
Methods

- Brazos River sampled from Nov 2014 – Feb 2015
- Discharge & Tides
  1. Freshwater Inflow
     - Data collected from USGS Rosharon Gauge (08116650)
     - Base flow tiers from Brazos River BBEST
  2. Tidal Patterns
     - Data collected from NOAA
     - USCG station in Freeport, TX (8772447)
- Water Quality – Salinity
  1. Opportunistic Samples
     - 5 sampling events at 9 sites (B01 – B42)
     - Depth profiles (surface, 25%, 50%, 75% & bottom)
  2. Continuous Monitoring
     - Surface readings using conductivity HOBOs
     - 3 sites: Upper (B35), Middle (B21) and Lower (B10)

Results



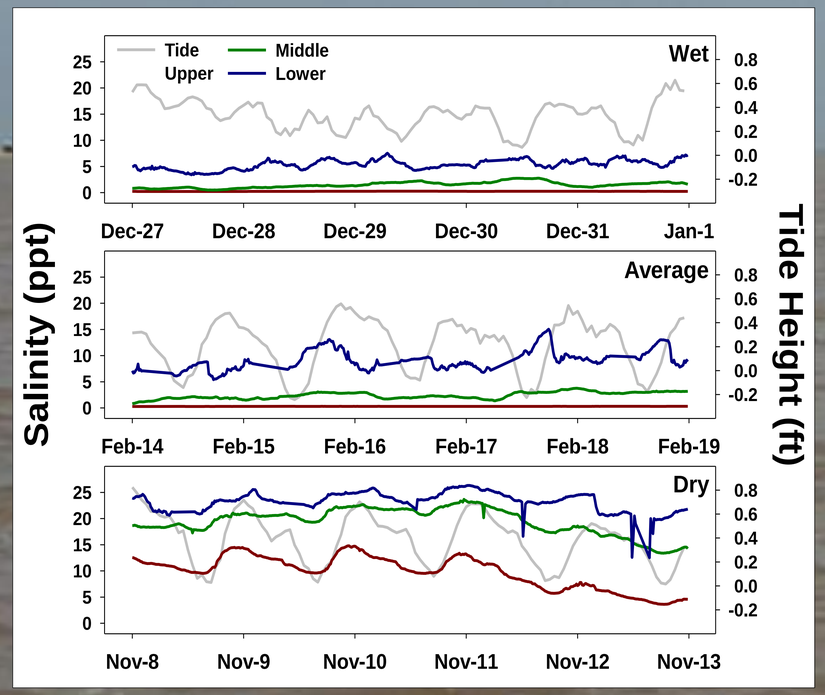




Freshwater Inflow

- Opportunistic Samples
  - Dry base flow: salinity wedge located 31-42 rkm upstream of the mouth
  - Average and wet base flow: salinity wedge located 0-26 rkm upstream of the mouth
  - High flow pulse events: salinity wedge located 0-10 rkm upstream of the mouth
- Continuous Monitoring
  - Salinity values were lowest upstream and highest downstream at the mouth of the Brazos
  - Prior and during high flow pulse, salinity decreased upstream to downstream
  - After high flow pulse, salinity increased downstream to upstream

Tidal Patterns



- Wet base flow: tidal influence along lower reach ~2 ppt per tidal cycle (± 0.2 ft); middle reach minimal; upper reach none
- Average base flow: tidal influence along lower reach ~6 ppt per tidal cycle (± 0.6 ft); middle reach minimal; upper reach none
- Dry base flow: tidal influence along lower reach ~4 ppt per tidal cycle (± 0.6 ft); middle reach ~3 ppt; upper reach ~5 ppt

Conclusions & Future Work

- Broad-scale patterns in salinity gradients depended upon the timing, magnitude and duration of freshwater inflow events
- Location of salinity wedge along sampling reach relative to size of inflow event and timing within the hydrograph
- Salinity levels responded predictably to high flow pulse events along the sampling reach
- Tidal influence most evident on the tapered end of the salinity wedge and dependent upon period within the hydrograph
- 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

Acknowledgments

- Field Assistance: Kristi Fazioli, Bryan Alleman, Michael Lane, Natasha Zarnstorff, Sherah Loe, Rachel Byrne, James Yokely, Josi Robertson & Nicole Morris
- Funding: Texas Water Development Board

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