Understanding Ecology of Atlantic Rangia

Toward Better Management of Freshwater Inflows

Mahmoud E. Omar[1,2], Jenny W. Oakley[1], and George J. Guillen[1,2]

[1]Environmental Institute of Houston, Houston, TX,

[2]College of Science and Engineering, University of Houston-Clear Lake, Houston, TX

*Please direct question/comments to: Omar@uhcl.edu

Introduction

- Atlantic Rangia, *Rangia cuneata*, is an oligohaline clam that is native to the northern Gulf of Mexico.
- Atlantic Rangia is one of the primary indicator species for establishing freshwater inflow regimes in multiple Texas estuaries (Johns, 2012).
- Galveston Bay historically has been the leading fishery resource in Texas contributing to approximately one third of the state's commercial fishing income (Lester et al., 2002).
- The main objective of this study was to **examine the potential influences of salinity and freshwater inflow on Atlantic Rangia abundance and health.**
- Results of this study will help resource managers better estimate and establish freshwater inflow regimes in the Trinity River Estuary.

Study Area

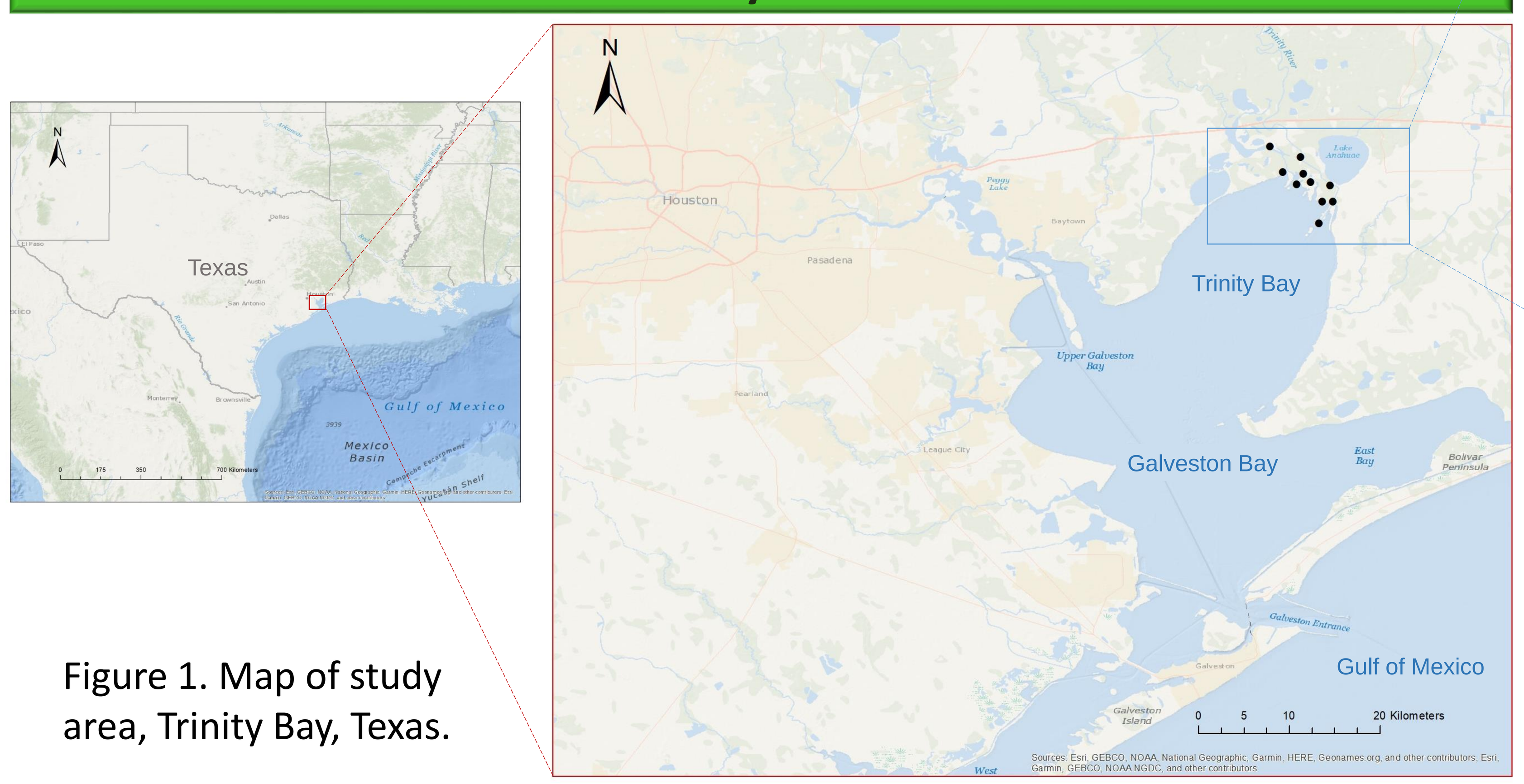

Figure 1. Map of study area, Trinity Bay, Texas.

Methods

- Ten study sites throughout the delta (Fig 1).
- Study duration: Feb. 2018 – Aug. 2019.
- Installed on-site gear continuously (every 15 min) monitors salinity, temperature, conductivity, water depth and atmospheric pressure. Gear maintained and data retrieved monthly (Fig 2a).
- Atlantic Rangia and sediment sampled quarterly (total of six events).
  - Hand sampling: 1 m^2 Quadrat (3 replicates) (Fig 2b).
  - Clam rake 30 second pull (3 replicates) (Fig 2c).
  - Sediment samples for percent fines analysis (Fig 2d & 2e).
- Lab Analysis
  - 20 Rangia from each site measured (length, width, and height) (Fig 2f).
  - 10 Rangia from each site weighed for health assessment (meat index).

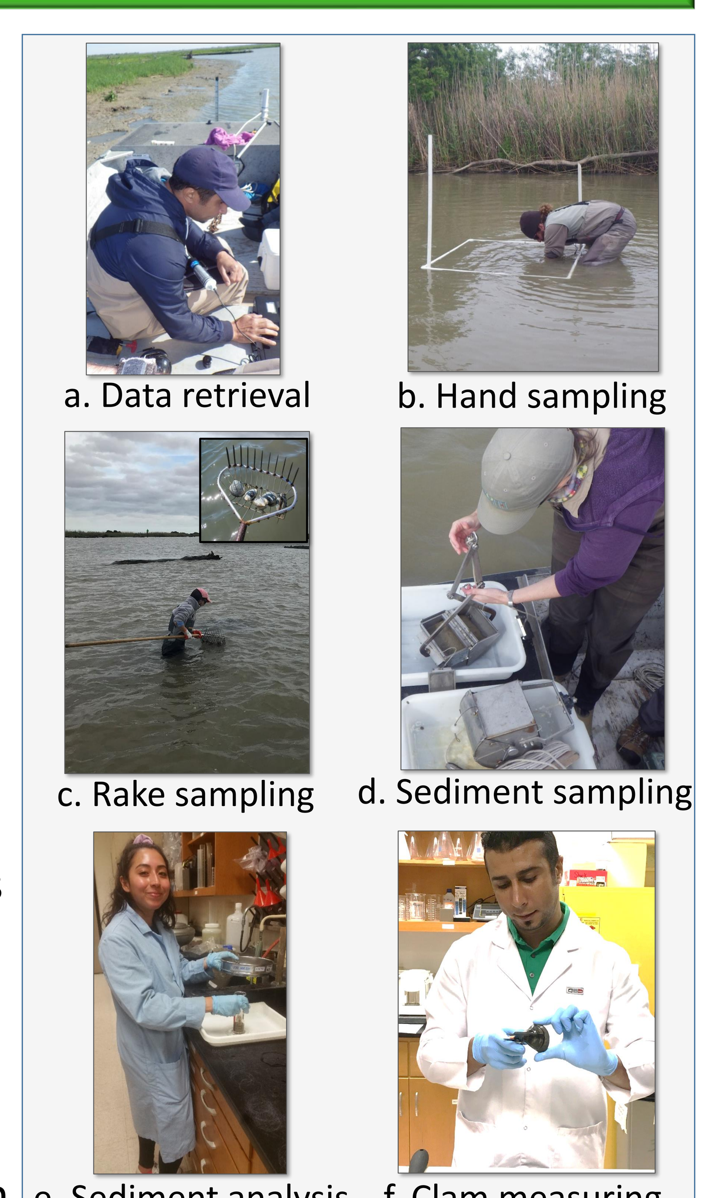

Figure 2. EIH staff and students conducting field and lab work.

Results

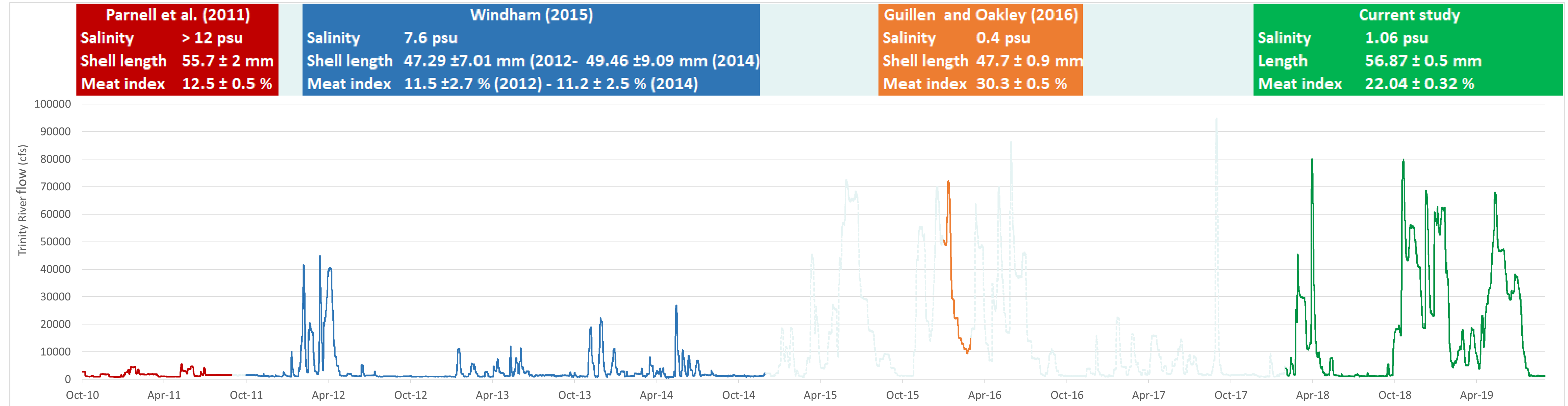

Figure 3. Historic freshwater inflow from Trinity River (USGS gage at Romayor # 08066500) and summary of Atlantic Rangia results from past and current studies. Inflow chart shows general trend of increasing flows and studies show concomitant increase in meat index (MI) through time.

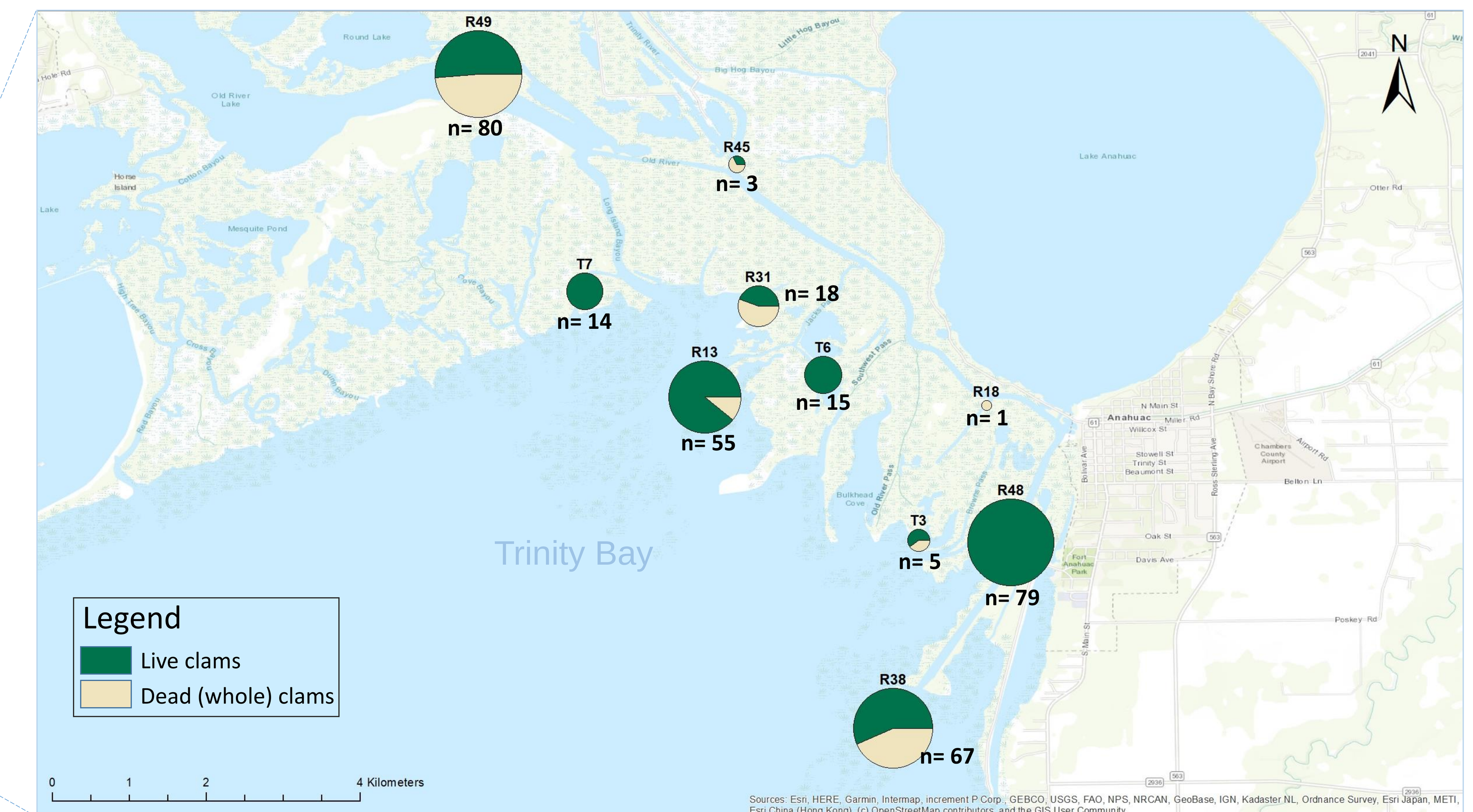

Figure 4. Atlantic Rangia abundance shown by graduated symbols where n is the total number of clams per site throughout the study. Green area on the pie chart represent live clams while gray area represent dead, but whole, clams.

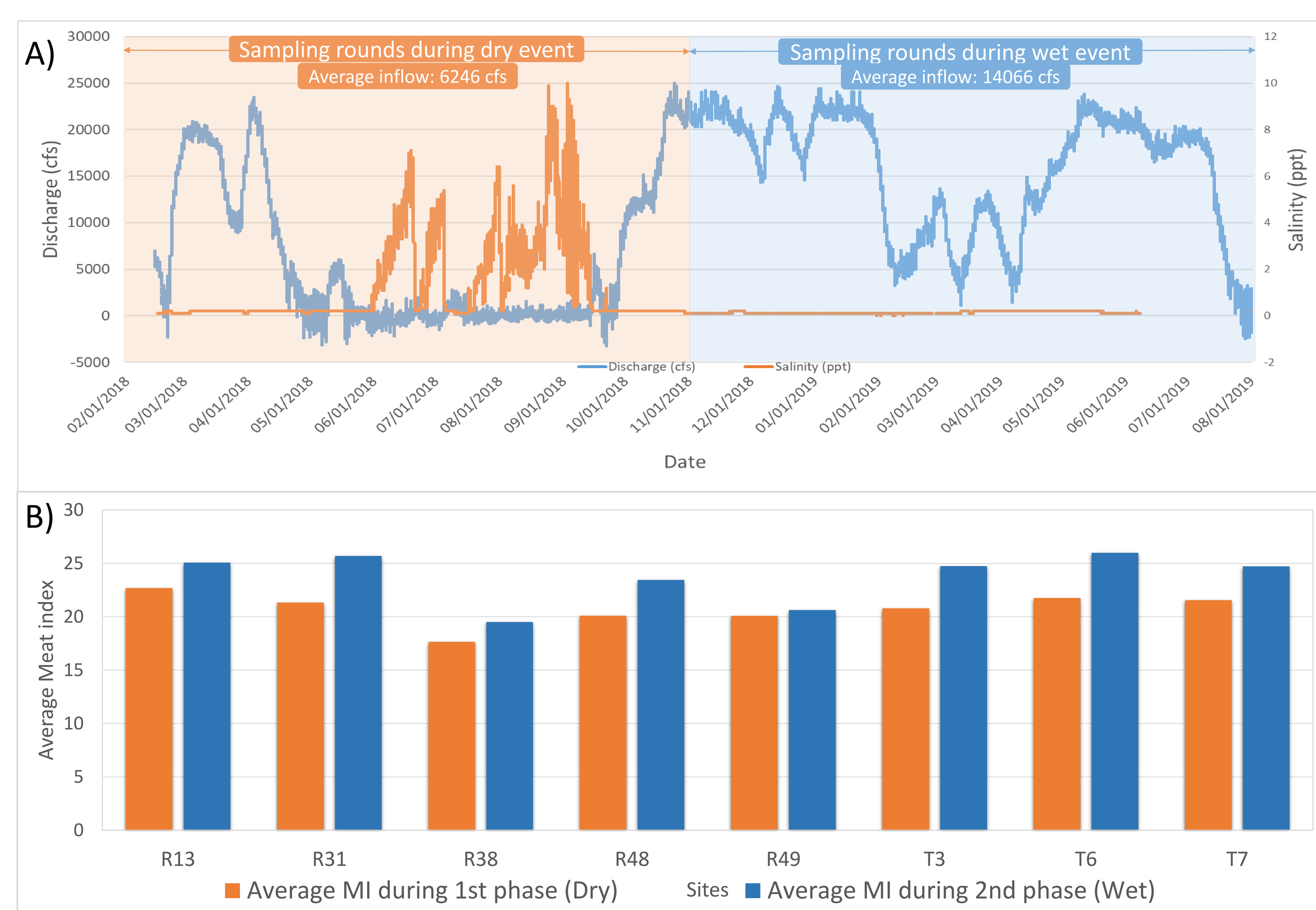

Figure 5. A) Freshwater discharge and salinity at the upstream gage (USGS gage at Wallisville # 8067252) during current study shows two distinct periods in terms of inflows amount and salinity (dry period with tan panel and wet period in light blue panel). B) The average meat index (MI) by site and period.

Conclusion

- In general, throughout the Trinity River Delta, Atlantic Rangia health (as measured by meat index) increases as freshwater inflow increases.
- Preliminary analysis suggests that abundance and proportion of live Atlantic Rangia didn't appear to vary directly with salinity or percent fines.
- Abundance and proportion of live Atlantic Rangia is likely a result of a combination of many factors including (but not limited to) salinity, sediment type, localized water velocity, sedimentation, and water depth (Parnell et al., 2011).

Ongoing and Future Work

- Shell-sectioning of individual clams from each site and trip to visualize:
  1) Annual growth increments to estimate age-length relationship by site and year (Fig 6).
  2) Daily growth increments (thin-sectioning) to observe the effect of salinity, temperature and other conditions on daily growth (von Leesen, 2014).
- Hydrodynamic modeling in the Trinity River Delta using publicly available (freshwater inflows, tide regime) and acquired data (salinity, barometric pressure and water surface elevation) (Fig 7).

Figure 6. Low-speed diamond wheel saw used for shell sectioning.

Figure 7. EIH staff measuring water surface elevation using DGPS.

Acknowledgment

- Field and lab assistance: Dr. Marc Mokrech, Cory Scanes, Kaylei Chau, Natasha Zarnstorff, Sherah Loe, Justin Hansen, Mackenzie Farrell and Angelika Ortiz.
- Funding: Galveston Estuary Bay Program, Texas Commission of Environmental Quality (TCEQ).

Literature Cited

Guillen, G., & Oakley, J. J. C. (2016). Trinity River Delta and Upper Trinity Bay Rangia Population Assessment. 1511, 014.

Johns, N. D. (2012). Examining bay salinity patterns and limits to *Rangia cuneata* populations in Texas estuaries: National Wildlife Federation.

Lester, J., Gonzalez, L. A., Sage, T., & Gallaway, A. (2002). The state of the bay: a characterization of the Galveston Bay ecosystem.

Parnell, A., R. A. Windham, S. Ray, A. Schulze, and A. Quigg. 2011. Distribution of Rangia clams in response to freshwater inflows in Galveston Bay, Texas. Texas A&M at Galveston, Galveston, TX.

Windham, R. A. 2015. Rangia as potential indicators of bay health. Texas A&M University, Galveston, Texas.

von Leesen, G. (2014). Thin-sections of marine bivalve shells: a window to environmental reconstructions on daily scale? (Doctoral dissertation).

If you'd like to learn more about EIH, visit us at: **www.eih.uhcl.edu**

Presented at: CERF, Mobile AL, 11/6/2019