

Saving Estuaries through Software Development





NATIONAL ESTUARINE RESEARCH RESERVE SYSTEM



National Estuarine Research Reserve System

Vision – Healthy estuaries and coastal watersheds where coastal communities and ecosystems thrive.

Mission – To practice and promote coastal and estuarine stewardship through innovative research and education, using a system of protected areas.





Research and Monitoring



*Provide observations, data and tools to understand
the past, present and future of our coastal areas*





Stewardship



Promoting stewardship of our estuarine and coastal resources





Education and Outreach



*Advancing environmental literacy through
education and outreach*



Coastal Training Program



*Supporting decision makers who need accurate,
timely information about their changing
environment*



This project...

Title: Undergraduates Develop Job Skills by Creating Interactive Software for Reserve Visitors

This project will support the development of new, innovative visitor displays at three national estuarine research reserves. The visitor's centers at the Guana Tolomato Matanzas, Mission-Aransas, and Delaware National Estuarine Research Reserves currently have hands-off exhibits with limited interactive components. The reserves will partner with students at the University of Delaware to produce gesture controlled, educational computer games that promote interactive, learning opportunities. The experiential games will be designed for use on interactive screens that will be available for public use in each reserve's exhibit hall. Participants will be able to freely navigate through different experiences, providing them with a better understanding that an estuary is a dynamic place upon which plants, animals, and people depend, and that everyone plays a part in shaping the past and protecting the future. This project will provide communities with relevant, accessible science while offering civic-minded solutions and resources that encourage participants to take conservation-based action promoting ecosystem resilience.



Mission-Aransas NERR

Name of grant: Freshwater Inflows: Determining Flow Regimes in the Face of Land Use Change, Climate Change, and Other Unknowns.

Problem Addressed:

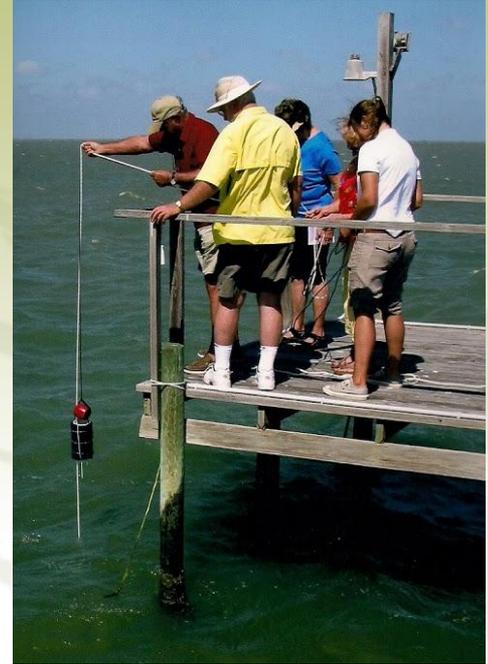
- The mixing of fresh and salt water creates a gradient of salinity that is vital to the survival of estuary-dependent species such as fishes, shrimps, oysters, and crabs.
- Increasing amounts of freshwater are being drawn from rivers and streams to meet the growing needs of industry, agriculture, and municipalities in Texas.
- As human populations grow and demand for freshwater increases, the amount of freshwater that reaches estuaries is projected to further decrease.



Mission-Aransas NERR

What We Did:

- Used planning software to examine various scenarios of future land use, population growth, and precipitation levels and their potential impact on freshwater use and runoff regimes.
- Collected data on water exchange between adjacent bay systems to improve future predictions of salinity changes resulting from freshwater inflow into adjoining bays.
- Conducted experiments with blue crab larvae to explore the relationship between their movement into the estuary and salinity levels.
- Constructed a computer model to simulate population dynamics of blue crabs in response to different freshwater inflow and salinity regimes.



Volunteers collecting blue crab larvae in the Estuary.

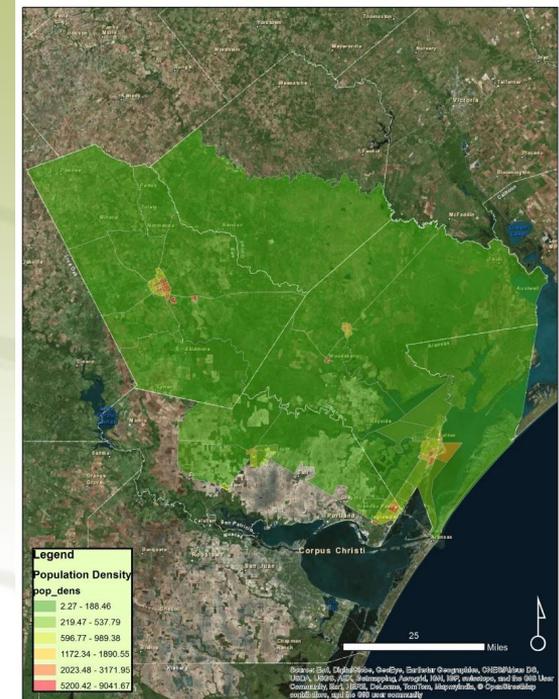


Mission-Aransas NERR

What We Found:

Future Growth and Land Use Computer Modeling

- Population increases will result in higher residential water use, fewer acres of cultivated cropland, and less water used for irrigation. The extent of these changes will depend on future precipitation levels and water conservation efforts.
- Future freshwater runoff patterns will be more affected by precipitation amounts and patterns than by land use changes.



Human population density within the Reserve boundary.

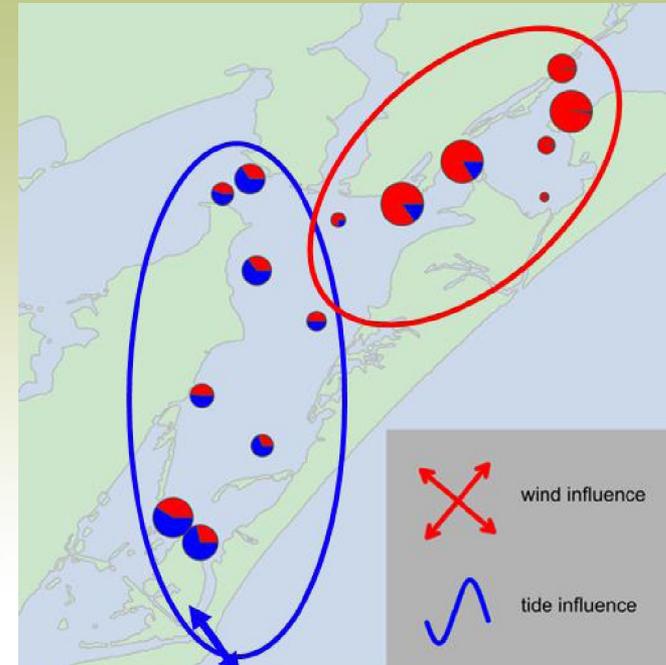


Mission-Aransas NERR

What We Found:

Water Circulation Monitoring

- Water exchange between the estuary and neighboring systems is strongly influenced by wind direction.
- Field measurements correspond well with the current pattern predicted by a circulation model used by the State for approximating salinity patterns in the estuary.



Pie charts indicating the influence of tides (blue) and wind (red) on current speed and direction at monitoring stations.



Mission-Aransas NERR

What We Found:

Blue Crab Larvae Experiments

- Blue crab larvae from Texas are able to detect smaller tidal changes in salinity than larvae from the Atlantic Coast, which could help them better find their way into the estuary based on salinity cues.

Blue Crab Computer Modeling

- The computer model interface allows the settings to be adjusted so that countless different factors and scenarios can be explored to better understand the effect of future salinity patterns on blue crab population dynamics.



Larval blue crab from study.



Guana Tolomato Matanzas NERR

Name of Grant: Re-Engineering living shorelines to halt erosion and restore coastal habitat functioning in high-energy environments.

Proposed Solutions

- Partnered with University of Florida to copy what nature does best and install multiple living shorelines
- Reduce wave energy caused by boat wake from reaching the shore
- Slow down the shoreline from wearing away
- Restore oyster reefs using recycled oyster shell
- Repair natural processes that could have been lost

What we're doing

- Develop profiles of wave/wake energy
- Develop and place gabions positioned behind wave breaks
- Final year will fine tune the gabions to optimize ability to stabilize salt marshes and restore reefs at different energy levels



Problem

Bulkheads and Concrete Seawalls

↑ Increase coastal erosion

↓ Decrease the shoreline's ability to do what it does best

↓ Decrease habitat for estuarine species

Oyster Gabions



Copy nature, restore functioning

Delaware NERR

Name of Grant: Expanding the Use and Value of System-Wide Monitoring Program Data by Prioritizing Questions, Targeting Products, and Building Capacity within the National Estuarine Research Reserve System

What we're doing:

- Conduct a NERRS-wide, SWMP-related needs assessment
- Create a purposeful, collaborative approach to engage all sectors of the NERRS in the development of useful and accessible SWMP-based data products, that in turn reflect the diverse needs of the external audiences with whom the NERRS interacts.



Proposed linkages....

- Water dynamics influence the biological diversity found in a location but also the physical characteristics of a habitat.
- By adapting and mitigating our estuaries to incorporate development we are creating a resilient estuary that can serve our communities.
- The tool used to determine whether we're doing what we need to be doing is SWMP.



Client Expectations

- Complete the Teacher's on the Estuary online module called "Where River Meets the Sea". Make sure to save your exam certificate at the end for evidence of completing the module. <https://goo.gl/ytJmDY>
- Students will need to dedicate time to...
 - Research Estuary Adventure Game
 - Go through the following slides and understand what the client is asking for. If you are unclear of anything it is your responsibility to email as soon as possible.
- Create a video of your game - YouTube
- Storyboard - Google Drawing



Client Guidelines

- Must be 3 mini games
- Each game should be able to be played within 2 minutes
- Improve upon Estuary Adventure's mini games 1 and 3
- Themes for each mini game are as follows:
 - Mini Game One - We Are Places
 - Mini Game Two - We Are People
 - Mini Game Three - We Are Connected



Mini Game One

- We like the concept of the blue crab navigating the maze based on salinity levels. We'd like this to tell a short story and have the "salinity", the "blue crab", and the "reasoning of the maze" to be variables that can be adjusted based on the location the game is being played at. We would ideally like you to use our [SWMP \(swamp\) visualization](#) to guide your "parameter gauge".
- This larval blue crab hatched in the ocean (where there is more salt in the water). It must make its way into the estuary (where there is still salt in the water, but not as much because the estuary usually has freshwater input from rivers) so that it can grow big and strong.
 - Added obstructions...
 - There might be a drought which reduced freshwater inflow and might provide confusion to the Blue Crab's navigation.
 - Might be freshwater removed for a new city being built, which reduces freshwater input into the estuary which might confuse the blue crab's navigation.
- [Click here for additional stories](#)



Mini Game Two

- We like the concept for Mini Game Two to be the 3rd game of Fall 2016's Estuary Adventure (crab building sea walls and oyster gabions). We'd like there to be improvements on the types of boats producing different types of wakes. There wasn't much evidence demonstrating the difference between sea walls and gabions. We'd like to add the component of replanting habitats with smooth cordgrass as an additional support.
 - Things to keep in mind...
 - If you plant the smooth cordgrass further in the water (than where you put the sea wall) the grass will not be able to expand.
 - If you plant it too deep, it will die.
 - If you plant it too dry, it will die.
 - There are rules to not making one long line of barriers because aquatic animals could get trapped and die if they aren't able to escape (ie., manatees, sea turtles, horseshoe crabs).
- The Story line... The shoreline is eroding due to increased human use around the estuary. More specifically, more boat traffic along these shores.



Mini Game Three

- We'd like this game be an estuary version of <https://www.storycubes.com/>.
- Essentially, you'd ask the participant to frame their story about...
 - What's the issue?
 - What do they think are things they can do to help?
- They would push or do a motion that would shake the die. The die would layout in no particular order. The participant would be asked to drag the die into a particular order and as they were doing so would tell a story. Their imagination is what guides the story. Hopefully, they've played the previous games so that might guide their stories a little, but ultimately this game could potentially stand on it's own (as could the others).



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