**NASA DEVELOP National Program**

**Alabama - Mobile**

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*Project Summary – Fall 2017*

**Coastal Alabama Water Resources II**

*Using NASA Earth Observations to Obtain Water Quality Trends in the Mobile Bay and Mississippi Sound to Enhance Future Oyster Habitat Suitability and Fisheries Management*

**VPS Title:** Coming Out of Our Shells: Monitoring Water Quality in the Mobile Bay and Mississippi Sound

**Project Team**

***Project Team*:**

Dionne Blanks (Project Lead), dblanks93@gmail.com

Chad Austin

Gregory Leenig

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***Advisors & Mentors*:**

Dr. Bernard Eichold, M.D., Mobile County Health Department

Joe Spruce, Science Systems & Applications, Inc

Dr. Kenton Ross, NASA Langley Research Center

***Past or Other Contributors:***

Mercedes Bartkovich

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Leah Parker

Amy Schwarber

**Project Overview**

***Project Synopsis*:**

Water quality parameters such as turbidity, sea surface temperature (SST) and salinity influence marine life in the northern Gulf of Mexico. The coastal environment in the Mobile Bay and Mississippi Sound area are vital to the local economy due in part to the seafood and tourism industries contribution to the influx of money into the region. In recent years, the area has suffered loss of marine and coastal habitat as the result of urban development, oil spills, and hurricanes. This project applied NASA Earth observation products along with end products from the Summer 2017 project to generate spatio-temporal water quality regression trends needed for future marine habitat suitability products.

***Abstract*:**

The Mobile Bay and Mississippi Sound region comprise the majority of the coastal estuaries along the Alabama and Mississippi Gulf Coast. These bodies of water provide the salinity conditions needed to sustain diverse wildlife species and coastal habitats. Changes in water quality parameters directly impact native species, specifically the Eastern oyster (*Crassostrea virginia*). The project observed water quality by creating a time series analysis of turbidity, salinity, and sea surface temperature in the Mobile Bay and Mississippi Sound from September 2003 to May 2007. The Aqua Moderate Resolution Imaging Spectroradiometer (MODIS) Ocean Color and Sea Surface Temperature (SST) products were used to measure salinity and SST values. Landsat 5 Thematic Mapper (TM) Surface Reflectance data were used to retrieve turbidity. The end results along with the end products from the Summer 2017 project were used to create a qualitative water quality approximation. This will provide project partners with additional resources for use in fisheries management and enhance marine habitat suitability restoration throughout the region.

**Keywords:**

Aqua MODIS, Landsat 5 TM, water quality parameters, coastal habitat

***National Application Area Addressed:*** Water Resources

***Study Location:*** Mobile Bay, AL, and Mississippi Sound, MS

***Study Period:*** September 2003 – May 2007

***Community Concern:***

* Salinity, sea surface temperature, and turbidity are important to the health of coastal habitat and marine ecosystems in the area, as they are vulnerable to environmental change.
* Community leaders, researchers, and commercial fisheries in the region need spatio-temporal GIS data to enhance water quality assessments and future fisheries management.
* Suitable coastal water quality in the region is important for maintaining a healthy environment for the fishing and shellfish industries.
* Coastal water quality is a factor in identifying locations for coastal zone managers to nurture living shorelines and conduct habitat restoration.

***Project Objectives:***

* Derive and assess additional coastal salinity products, comparing with local buoy data
* Compute and assess additional sea surface temperature time series data
* Compute and assess turbidity time series analysis to further establish baseline conditions that are needed to develop habitat suitability maps for Eastern oyster

***Previous Term:*** 2017 Summer (Alabama – Mobile and Alabama – Marshall) – Coastal Alabama Oceans

**Partner Overview**

***Partner Organizations:***

|  |  |  |  |
| --- | --- | --- | --- |
| **Organization** | **POC (Name, Position/Title)** | **Partner Type** | **Boundary Org?** |
| Alabama Coastal Foundation | Mark Berte, Executive Director | End User | Yes |
| The Nature Conservancy, Alabama Chapter | Dina Knight, Conservation Information Manager | End User | No |
| Mississippi-Alabama Sea Grant Consortium | Russell Grice, Oyster Aquaculture Business Specialist  | End User | Yes |
| Dauphin Island Sea Lab, Manatee Sighting Network  | Dr. Ruth Carmichael, Senior Marine Scientist II | Collaborator | No |

***Decision Making Practices & Policies***:

The Alabama Coastal Foundation (ACF), The Nature Conservancy, Alabama Chapter (TNC), and the Mississippi-Alabama Sea Grant Consortium (MASGC) currently rely on field measurements and buoy data to evaluate salinity, temperature, and turbidity for managing the aquatic wildlife in the region. Additionally, the ACF began the Oyster Shell Recycling Program in fall of 2016 and has collected over 3.5 million shells to place back into the water to promote oyster population growth. The program started with 6 restaurants and has now expanded to over 30. The ACF will begin the process of placing recycled oyster shells in the Mobile Bay by the fall of 2017. To aid in shoreline restoration, the TNC has committed to creating 2,250 m of breakwater reefs by bagging oyster shells as well as building reef balls and Reefblksm cages. The MASGC works directly with oyster farmers and uses the on-line Shellfish Aquaculture Siting Tool to evaluate shellfish habitat conditions in the region.

***Project Benefit to End User***:

The products will allow the end users to identify areas suitable for placement of oyster shells and living shorelines. Currently, the ACF does not have the means to conduct GIS or remote sensing analysis, yet they look to outside organizations to support initiatives where these data analyses are needed. The TNC and MASGC currently have a limited number of employees in their local offices with GIS experience. Additionally, the TNC has limited access to high performance computer mapping equipment needed to process large raster datasets. The products, methodologies, and tutorials created from this project will assist the TNC and MASGC in creating future products and continuing further analyses.

**Earth Observations & End Products Overview**

***Earth Observations:***

|  |  |  |
| --- | --- | --- |
| **Platform & Sensor** | **Parameters** | **Use** |
| **Aqua MODIS**  | Sea Surface Temperature, Ocean color | Aqua MODIS data were used in an algorithm to calculate sea surface temperature levels throughout the Mobile Bay area. Aqua MODIS ocean color products were used to calculate salinity levels in the Mobile Bay and Mississippi Sound |
| **Landsat 5 TM** | Surface reflectance | Bands from Landsat 5 were used to detect and quantify turbidity in the Mobile Bay and Mississippi Sound. |

***Ancillary Datasets:***

Mobile Bay National Estuary Program Buoy Data – water quality measurements throughout the Gulf Coast

Universities Space Research Association contracted to support NASA – buoy data, salinity mapping for the study area

***Software & Scripting:***

ERDAS Imagine – Landsat data processing, analysis and visualization

ESRI ArcGIS Pro – Raster processing and manipulation, vector data processing, map creation of Aqua MODIS and Landsat 5 TM

SeaDAS – Raster processing manipulation of GSFC’s Ocean Color data

ACOLITE - Landsat 5 data processing to analyze turbidity

***End Products:***

|  |  |  |  |
| --- | --- | --- | --- |
| **End Products** | **Earth Observations Used**  | **Partner Benefit & Use** | **Software Release Category** |
| Sea Surface Temperature Time Series Analysis | Aqua MODIS | This end product will provide the end users with measurements of sea surface temperature for the area and assist in establishing baseline conditions. | N/A |
| Turbidity Time Series Analysis | Landsat 5 TM | This end product will provide the end users with measurements of turbidity for the area and assist in establishing baseline conditions. | N/A |
| Salinity Time Series Analysis | Aqua MODIS | This end product will provide the end users with measurements of salinity for the area and assist in establishing baseline conditions. | N/A |
| Spatio-temporal Water Quality Regression Trends | Aqua MODIS and Landsat 5 TM | This end product will benefit the end users by providing them with approximated turbidity, SST, and salinity data. This will provide end-users with a better understanding of which parameters are predicted to change over time. | N/A |

**Project Handoff Package**

**Transition Plan:**

At the end of the term, the team will present the project results to the Executive Director of the ACF, Mark Berte, the Conservation Information Manager of TNC, Dina Knight, and the Business Specialist at the MASGC, Russell Grice. Additionally, the handoff package will be provided electronically to the partners.

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**Handoff Package:**

* All deliverables
* Link to VPS
* Text file explaining data
* Time series analyses for (1) salinity, (2) turbidity, and (3) temperature
* All shapefiles and ArcMap documents