Metrics Through April 2016

Format 1

Funding Strategy: Habitat Restoration
Activity / Outcome: Sandy - Wetland restoration - Acres restored
Description: Enter the number of acres restored
Required: Recommended
Acres restored - Current: 0.00
Acres restored - Grant Completion: 1607.00
Restoration Status through 2015:

Treated and presumed (will be mapped in 2016) restored 275 acres of native marsh vegetation through the removal of two dominant non-native invasive plants: Common Reed (Phragmites australis) and Perennial Pepperweed, (Lepidium latifolium) allowing native marsh vegetation to recolonize managed areas. Removal was accomplished through uprooting, mowing, and chemical treatment. Obtained 90% of local permits and property permissions, mapped salinity via Electromagnetic Induction and GPS equipment, and employed SOP to monitor and evaluate native plant revegetation to ensure a greater than 80 percent conversion rate from invasive plants to native marsh plants.

One-and-one half acres of submerged aquatic vegetation was restored.

1280 acres of tidal flats was restored through the implementation of a green crab depletion program at eelgrass restoration sites and across marsh habitat.

Format 2

Marsh Restoration & Revegetation

The marsh restoration team has obtained over 90% of land owner permissions for properties to be managed in Ipswich, Newbury, Rowley, Newburyport, and Salisbury for Phragmites management, while land owner permissions for pepperweed management have been obtained in Salisbury, Newburyport, and Newbury. Town permits have been obtained. Seventy-five acres of invasive Phragmites australis and 200 acres of perennial pepperweed were treated in 2015.

One-and-one half acres of submerged aquatic vegetation (SAV) was restored in 2015.

The marsh restoration team completed five episodes of green crab trapping/monitoring in Plum Island Sound and Essex Bay covering 1280 acres of potential SAV restoration and marsh area.

The work boat and associated equipment rental contracts have been signed for the two year contract period. Three Student Conservation Association researchers were hired and utilized for all implementation projects in 2015, and field season housing was secured for them as well for the months of April 2015 to December 2015. Three new Student Conservation Association researchers have been hired for implementation projects in 2016. Housing has been secured for all but six weeks for these 2016 researchers (still in process).

Great Marsh Interim Progress Report

Name of Project Component: SCA students
Dates of performance: *October 15, 2015 to March 15, 2016*
Name of Partner: *Boston University*

1. **Summary of Accomplishments:** *In two to three sentences, provide a brief summary of the project's key accomplishments and outcomes that have been observed or measured to date.*

   Three Student Conservation Association (SCA) interns were hired to work on various components of the Sandy Project between October 15, 2015 and March 15, 2016.

2. **Project Activities and Outcomes:**

Activities
Thoroughly describe and quantify the primary activities conducted under this project.

None

Outcomes
Thoroughly describe and quantify progress towards achieving the project outcomes. Please reference progress made to date on specific project metrics.

Interns will begin in May.

Provide any further information (such as unexpected outcomes) important for understanding project activities and outcome results.

None- all activities will continue.

Great Marsh Interim Progress Report
Narrative Template

Name of Project Component: Sandy - Research
Dates of performance: October 16th, 2015 to March 15th, 2016
Name of Partner: Woods Hole Group

1. **Summary of Accomplishments:** *In two to three sentences, provide a brief summary of the project's key accomplishments and outcomes that have been observed or measured to date.*

Focus since October was on continued incorporation of existing data, testing of different modeling platforms, and development of alternative hydrodynamic modeling grids. Partners at BU provided supplemental bathymetric data in December, which supports development of a highly refined grid within the marsh system. Consideration currently underway for application of an alternative model so the grid can be further refined with reasonable computational run times. Recently received tide data time series in February from partner at BU, which allows for preliminary model simulations and subsequent model calibration to proceed.

2. **Project Activities and Outcomes:**

Activities
Thoroughly describe and quantify the primary activities conducted under this project.

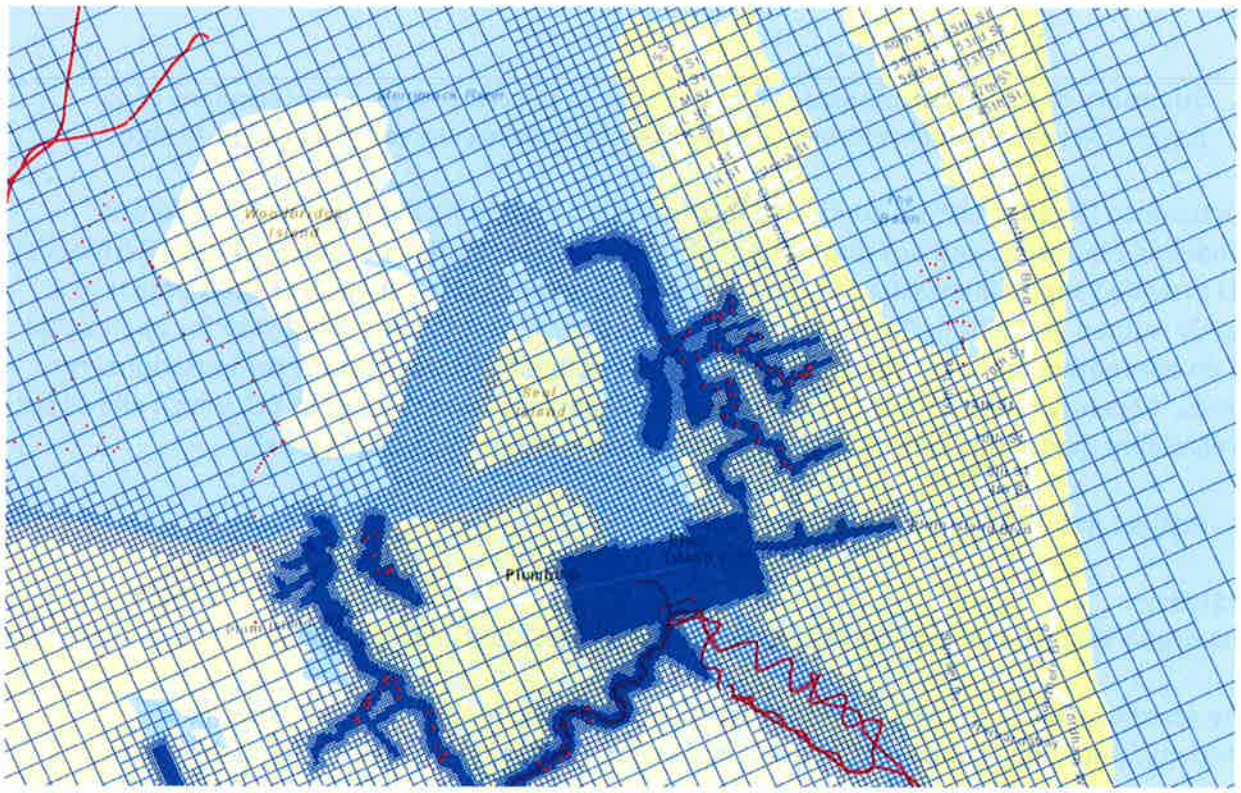
The specific activity advanced through the hydrodynamic modeling is described as "Activity/Outcome: Sandy – Research - # research studies completed." The hydrodynamic modeling is intended to provide a detailed understanding of the existing circulation and salinity regime in the Great Marsh system with a focus on the Plum Island Turnpike bridge crossing. Woods Hole Group is responsible for the hydrodynamic modeling, in cooperation with data to be provided by a Boston University team. USGS also is providing water level and salinity data at the Plum Island Turnpike Bridge, and Woods Hole Group have coordinated with USGS personnel. Once calibrated, the model will be used to better understand existing conditions in the system to identify potential restoration opportunities with a focus on the Plum Island Turnpike crossing. The model and data also will provide tools for future evaluation of restoration alternatives in other areas of the system.

Through February, primary modeling accomplishments have been focused on model selection and refinement, and grid development. Now that bathymetry and tide data are available, model simulations can proceed including stability simulations and model calibration against field data. Next steps will include:

- Final selection of the model (EFDC or CMS)
- QAPP refinement
- Finalization of hydrodynamic modeling grid

- Calibration/validation
- Plum Island wave/sediment transport modeling
- Team progress meeting in late spring/early summer to review results and identify potential alternatives at the Plum Island Bridge crossing

A sample of a preliminary model grid for a specific area is shown below:



Sample preliminary model grid illustrating telescoping refinements that are possible, depending upon the model selected.

Outcomes

Thoroughly describe and quantify progress towards achieving the project outcomes. Please reference progress made to date on specific project metrics.

The primary expected outcome that will result from this activity is completion of the hydrodynamic modeling study. The hydrodynamic model will be applied to evaluate three (3) alternatives for the Plum Island Turnpike bridge crossing, and a recommended alternative(s) will be recommended. If possible, the recommended alternative will contribute to the future health and resiliency of the Great Marsh system. The model also will provide a tool that can used on behalf of the local stakeholders and communities to evaluate and design various future improvements within the system related to wetland restoration, shore protection, sea level rise planning, marsh migration, and storm water management. The Plum Island side work will produce a greater understanding of wave action and sediment transport processes as related to

beach erosion. This information will contribute to future consideration of shore protection alternatives.

Provide any further information (such as unexpected outcomes) important for understanding project activities and outcome results.

Nothing at this time.

Great Marsh Interim Progress Report

Name of Project Component: Habitat Restoration, Wetlands Plant Restoration, Invasive Vegetation Management
Dates of performance: October 16th, 2015 to March 15th, 2016
Name of Partner: Merrimack Valley Planning Commission

1. **Summary of Accomplishments:** *In two to three sentences, provide a brief summary of the project's key accomplishments and outcomes that have been observed or measured to date.*

Equipment and chemicals were inventoried and stored for the season. Contractors were paid for work performed during 2015. Maps of treated sites were scrutinized for completeness of treatment areas and for developing treatment schedules for next year. A preliminary strategy has been developed but will be dependent on regenerative growth in the upcoming spring season.

2. **Project Activities and Outcomes:**

Activities
Thoroughly describe and quantify the primary activities conducted under this project.

- Review of invasive vegetation treatment work performed in 2015
- Begin identifying the 2016 treatment locations
- Identify potential contractors for enlisting in 2016 invasive vegetation treatments
- Preparation of equipment and chemicals for use in 2016
- Hire SCA researcher with applicators license
- Oversee Phragmites monitoring volunteers
- Continue outreach to landowners for phragmites permissions.
- Draft report on pepperweed and plan for 2016 treatment season.
- Provide pepperweed control management and oversight
- Continue acquiring Pepperweed permissions.
- Advertise for summer staff.

Outcomes

Thoroughly describe and quantify progress towards achieving the project outcomes. Please reference progress made to date on specific project metrics.

Planned and prepared for treatment of 50 acres of Phragmites in Newbury, Ipswich, Rowley, Newburyport and Salisbury in late summer 2016. Treated 75 acres of invasive Phragmites in 2015.

Gained 40 responses for permission to treat pepperweed from local landowners.

Oversaw 559 volunteers for a total of 1559 hours of monitoring Phragmites and Salinity.

Oversaw the treatment of pepperweed on an estimated 1489 acres of land in the Great Marsh Region.

Provide any further information (such as unexpected outcomes) important for understanding project activities and outcome results.

None at this time.

Great Marsh Interim Progress Report

Name of Project Component: Eelgrass Transplanting and Green Crab monitoring/management
Dates of performance: *October 15, 2015 to March 15, 2016*
Name of Partner: *Boston University*

1. **Summary of Accomplishments:** *In two to three sentences, provide a brief summary of the project's key accomplishments and outcomes that have been observed or measured to date.*

   10 km of marsh habitat was monitored/managed for green crabs in the Great Marsh between October 15, 2015 and March 15, 2016.

2. **Project Activities and Outcomes:**

Activities
Thoroughly describe and quantify the primary activities conducted under this project.

EELGRASS

GREEN CRAB MONITORING/MANAGEMENT

Twenty-four sites in the Great Marsh were monitored and managed for green crab. To harvest crabs, we used Russell traps baited with haddock wrack. Traps were deployed for a 24 hr. period. To assess population structure, crabs caught were counted and examined for sex, size (carapace width at widest point), and reproductive condition.

Outcomes
Thoroughly describe and quantify progress towards achieving the project outcomes. Please reference progress made to date on specific project metrics.

Monitored/managed the invasive green crab along 10 km of coastline between October 15, 2015 and March 15, 2016. Our efforts also included initiating a comprehensive outreach and education program to engage the coastal communities, state, and other interested partners in all components of our eelgrass restoration efforts.

Provide any further information (such as unexpected outcomes) important for understanding project activities and outcome results.

None- all activities will continue.

Great Marsh Interim Progress Report
Narrative Template

Name of Project Component: *Hydrodynamic and Sediment Transport Modeling Leading to Restoration, Better Management, and Improved Sustainability of Great Marsh:* Data Collection

Dates of performance: December 2015 to March 2016

Name of Partner: Boston University/VIMS/UNO

1. **Summary of Accomplishments:** *In two to three sentences, provide a brief summary of the project's key accomplishments and outcomes that have been observed or measured to date.*

Most of our effort during this time period has centered on completing the QA/QC and post-processing of the data and conveying these data sets to WHG for calibrating and validating the hydrodynamic modeling of the Plum Island Sound/Merrimack River Estuarine system. In addition, we have begun interpreting the bottom sample, hydrographic, and bedform data for bedload sediment transport determinations. Dating (using Pb-210, Cs-137) of the sediment cores for the marsh vertical accretion are proceeding and have yielded two accretion rates.

2. **Project Activities and Outcomes:**

Activities
Thoroughly describe and quantify the primary activities conducted under this project.

- Current meter/ Water levels output and post processed to NADV
- Water levels QA/QC
- Water level data conveyed to **WHG**
- Synoptic ADCP data synthesized and passed to **WHG.**
- Conductivity output has been post-processed to salinity (see below).
- Flow velocity data has been post-processed/QA/QC (in progress)
- Continued collection and analysis of metrics of creek morphology and dynamics
- Additional RTK data have been collected and QA/QC and processed for:
  a) Accretion cores (elevation)
  b) Instruments (correct water levels)
  c) Marsh surface and shallow creeks (bathymetry)

- Water samples filtered for suspended sediment, 50% completed
- Impoundment cores split, sampled, logged, and stratigraphic section completed
- Lab work has consisted of filtrations, core descriptions, sediment analyses, RTK processing, hydrodynamic data processing
- Analyses have involved processing RTK data, plotting site locations, producing metrics of creek morphology and creek dynamics, initial correlations among grain size trends (see below) current measurements and bedform orientations have been made.

<u>Vertical Accretion Study:</u>

- All Great Marsh accretion-rates cores have been fully pre-processed for gamma counting (method used for 210-Pb/137-Cs dating).
- LOI and wet/dry bulk density have been calculated for all 300 samples from 15 cores (20 samples down-core for each core).

- Gamma counting is under way, with *ca.* 1/3 of samples completed.
- One core (PIS-16) is complete and preliminary accretion rates calculated. Gamma counting on 9 additional cores is in progress, with several nearing completion. Samples from the remaining 5 cores are pre-processed but counting has not yet begun.
- Gamma counting takes 24-48 hours per sample, depending on the sample size. Of three detectors available at VIMS, one is currently offline for repair (a $10k+ cost), after running continuously for two months. Another detector is temporarily (1-2 more weeks) reserved for another project. Additional upcoming demands for detector time will continue to slow sample processing. Target completion date for completion of all gamma counting for the full set of 300 samples remains late 2016 / early 2017. Approximately 2-3 days of data reduction and analysis is required for each core to convert gamma count data to core accretion rates; it is expected these will be calculated concurrently with the completion of sample analysis for given cores.

Outcomes

Thoroughly describe and quantify progress towards achieving the project outcomes. Please reference progress made to date on specific project metrics.

- We have collected all the bathymetric data required for the modeling effort
- We have collected all of the current meter data for the modeling effort. We may consider acquiring additional ADCP profiles across the Merrimack R. Est. (see below).
- We have collected all the water samples for the suspended sediment analyses
- Fifteen sediment cores have been collected for the vertical accretion rate determinations
- All of the bottom sediment samples have been collected (we may collect additional samples this summer if we deem it necessary for our bedload transport study.
- Most of the data have been QA/QC and more than 75% of the data have been post-process
- Two of the fifteen sediment cores have been fully processed (see results below)

Provide any further information (such as unexpected outcomes) important for understanding project activities and outcome results.

No unexpected results at this time.

Participants: ***Boston University***

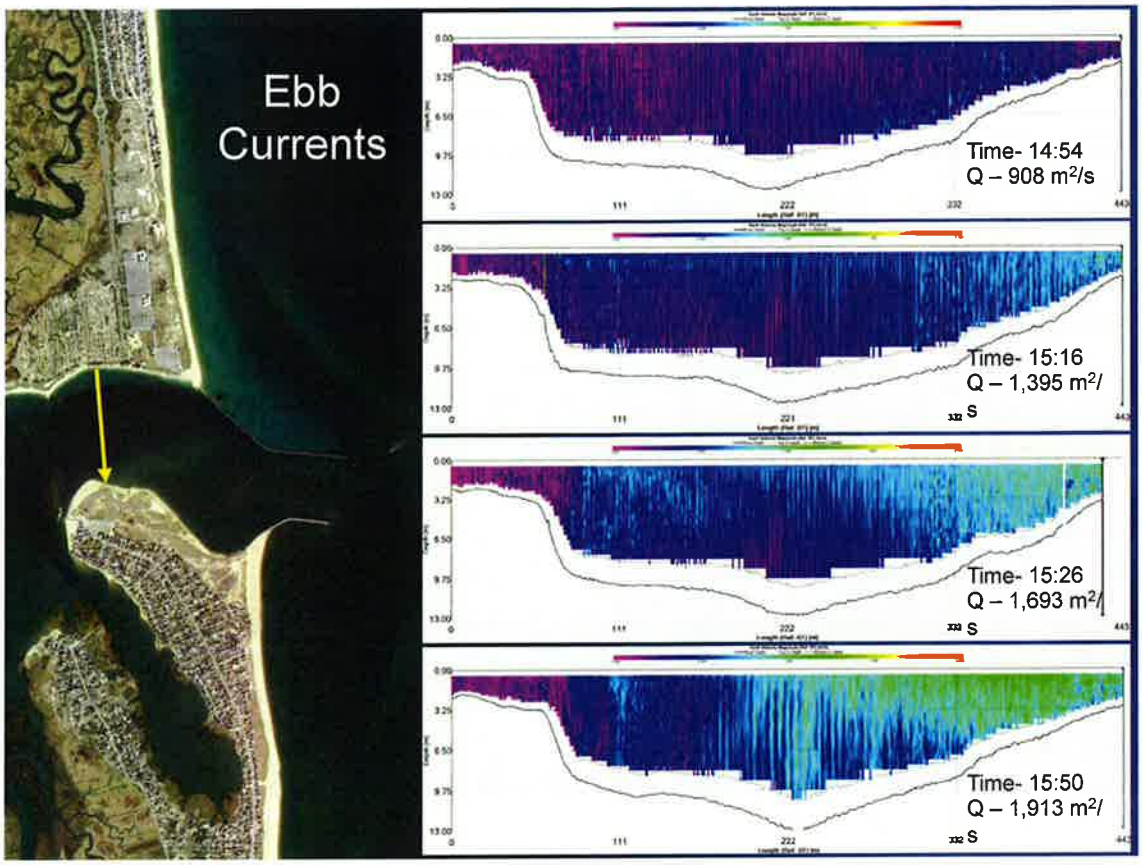
Duncan FitzGerald, PhD
Zoe Hughes, PhD
Alyssa Novak, PhD
Sarah Farron, PhD Student
Thomas Malgieri, PhD Student
Conner Levy, Undergraduate Field Assistant
Philip Purvis, Undergraduate Field Assistant
Amanda Coelho, Visiting Student from Brazil

University of New Orleans

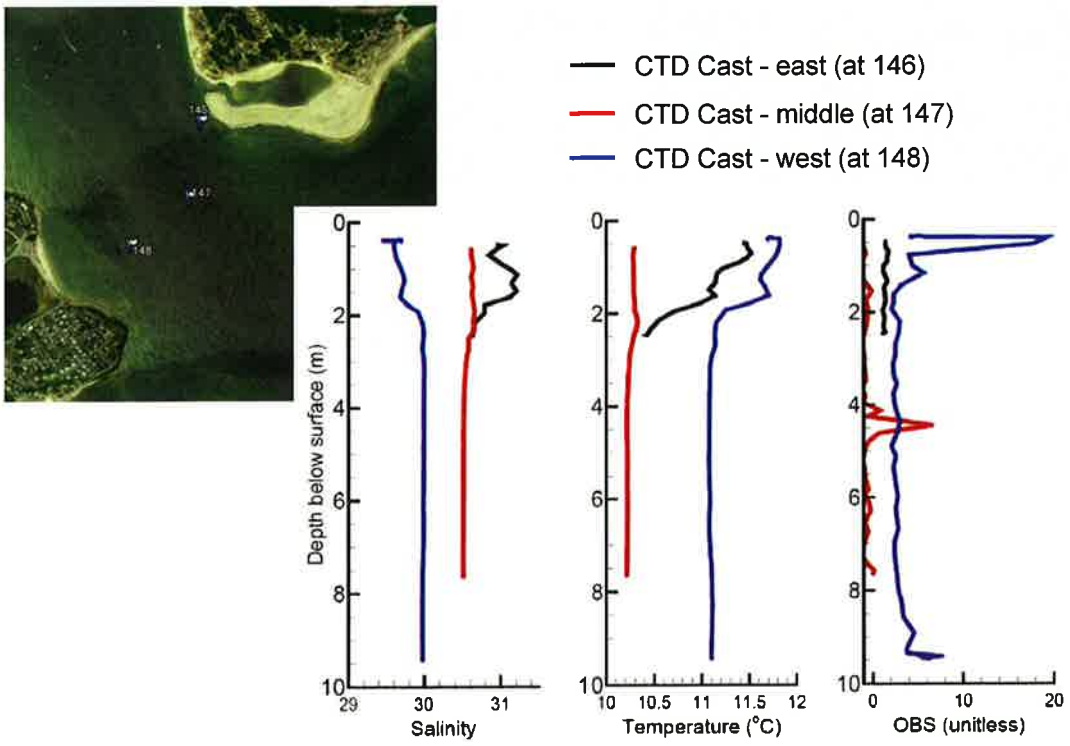
Ioannis Georgiou, PhD
Tara Yokum, Masters Student
Mike Brown, Field Technician

Virginia Institute of Marine Science

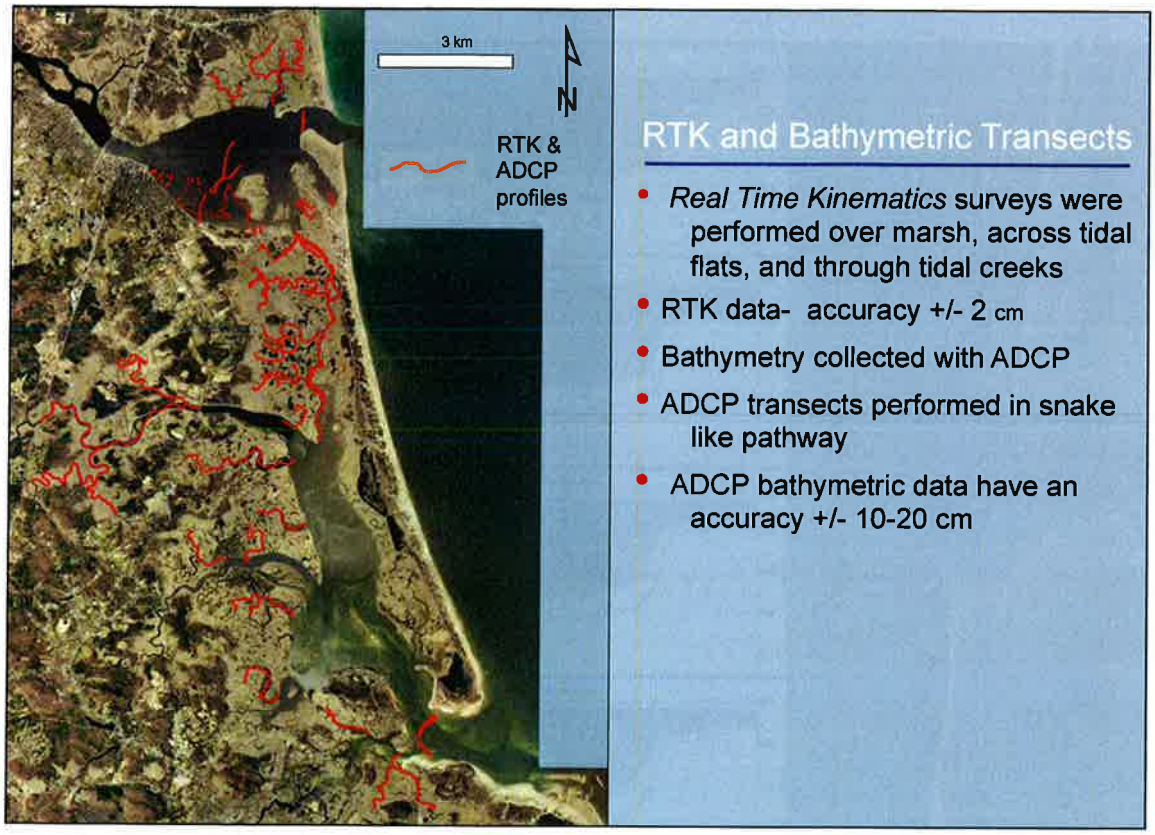
Chris Hein, PhD
Claudia Shuman, PhD Student
Luiza Caminada, Undergrad. Field Assist.



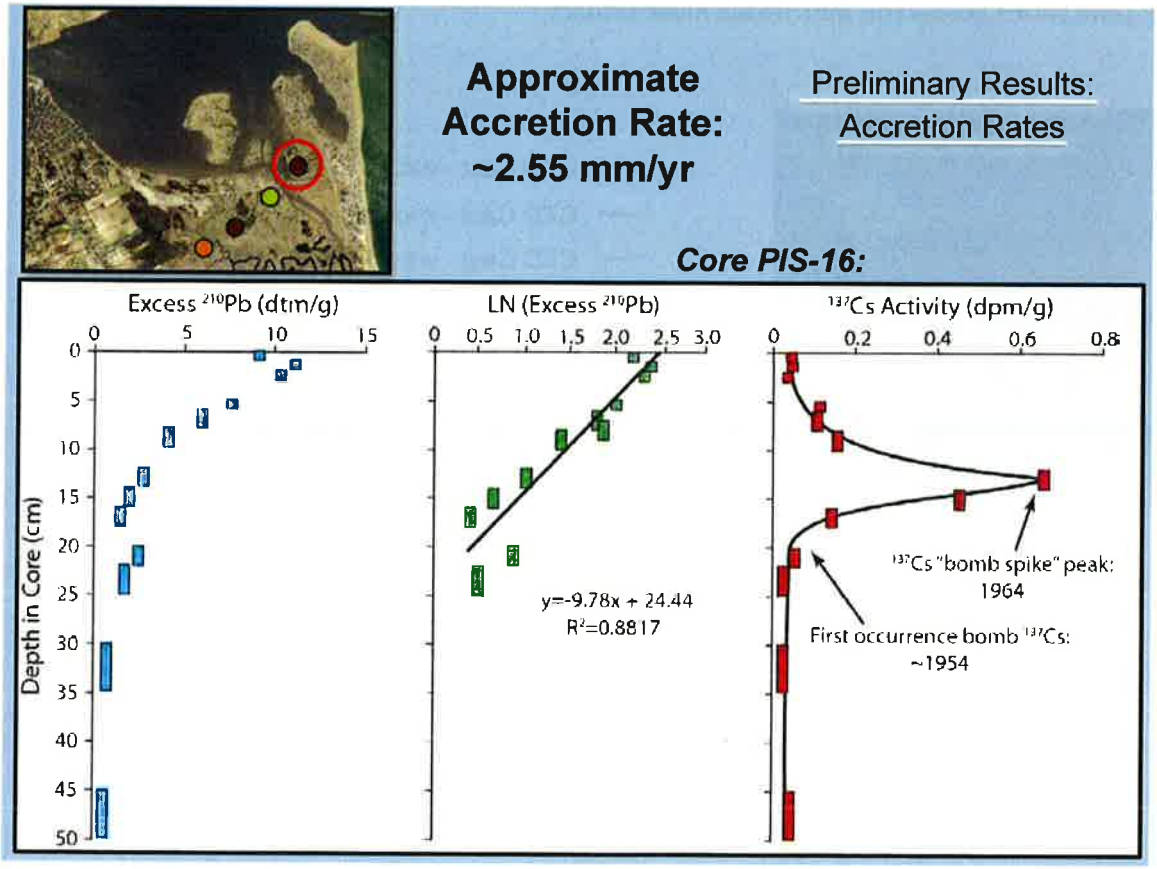
ADCP time series across the Merrimack River Estuary



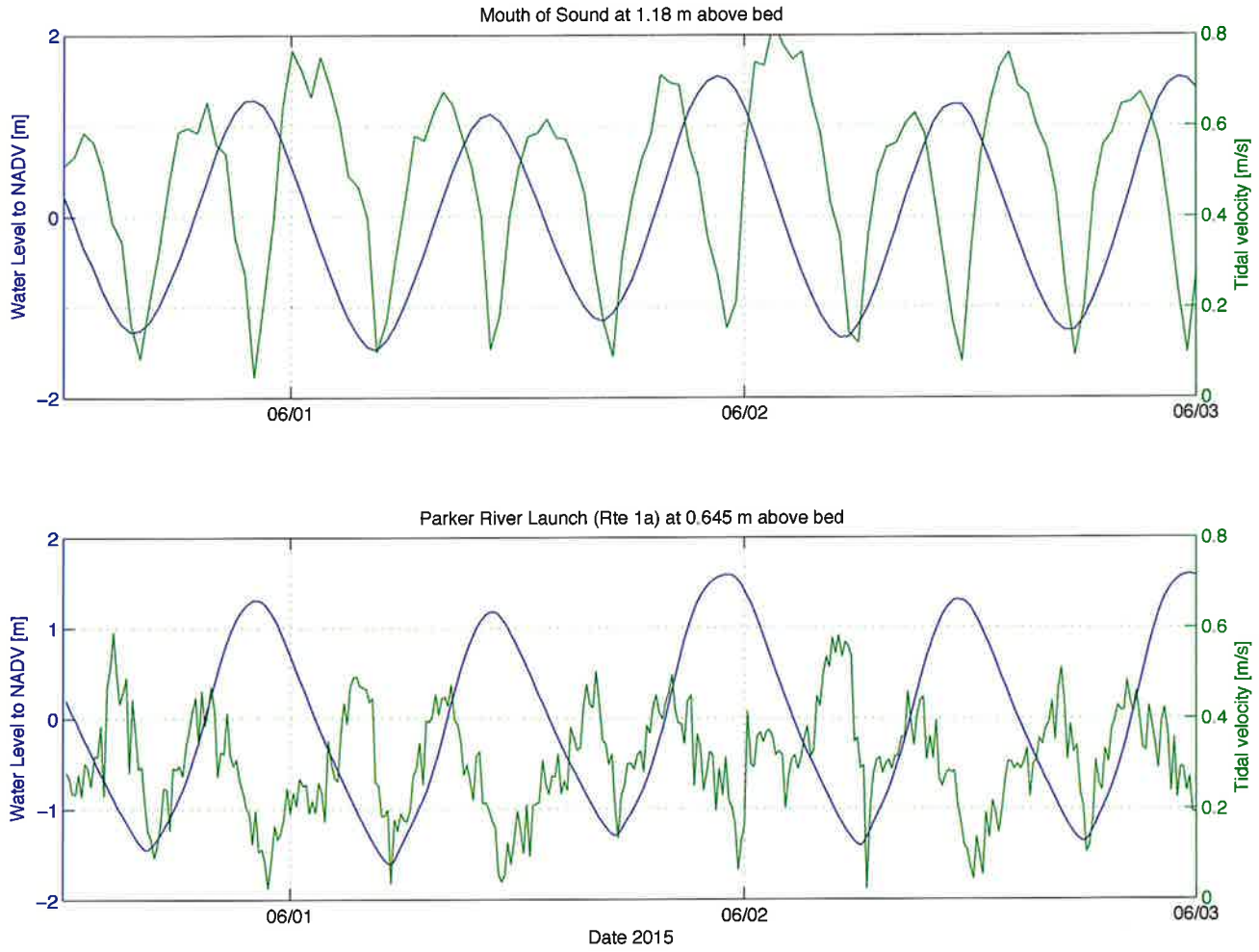
CTD casts were performed at the early onset of Flood currents into Plum Island Sound



RTK and Bathymetric transect data.



Example of dating analysis of sediment core north of the Turnpike.



Water levels and velocity comparisons for the Mouth of the Sound and the Parker River Launch.