N.H. Sea Grant Research Project Progress Report
For time period 2/1/14 – 1/31/15

Today's date: 3/24/2015

Project number: R/HCE-1

Project title: What happens to the nutrients that have accumulated in the sediments of the Great Bay? Quantifying nutrient release and removal due to diffusion and sediment resuspension

Project initiation date: 2/1/2014

Project completion date:

Principal investigator: Linda Kalnejais

Affiliation: UNH

Associate investigator(s) and affiliation(s):
Diane Foster, UNH
Thomas Lippmann, Center for Coastal and Ocean Mapping, Joint Hydrographic Center

Technician(s) and affiliation(s):

Partner(s) and affiliation(s) (List any collaborators, sponsors, industry partners, municipalities, etc., associated with this project):

NOTE: For each partner, include SCALE (local, state, regional, national, international) and TYPE (gov’t, NGO, industry/business, academic institution, other)

Brief project overview/Abstract:
The goal of this project is to quantify the release of nutrients from the sediments of the Great Bay due to diffusive processes and sediment resuspension. A combination of field and laboratory experiments will be used to examine the relationship between large-scale fluid shear stresses and geochemical fluxes at the fluid-sediment interface. We will upscale small-scale sediment geochemical measurements with spatially extensive observations of the estuarine flow field to give a load estimate that is representative of the whole Bay. Nutrient release will be measured with core incubations, porewater profiles and erosion chamber experiments at sites along an estuary-wide transect. Fluid shear stresses will be observed with a suite of fixed acoustic Doppler profilers (ADCP) that will measure in detail the bottom boundary layer ranging a few cm right at the seabed to the full water column, and with an ADCP mounted on a highly maneuverable personal watercraft that will measure the three-dimensional flow field along cross-bay transects. The flow field data will quantify the spatial and temporal variability of the current boundary layer and shear stress distribution needed to scale up the erosion chamber results. High spatial and temporal resolution measurements of boundary layer dynamics at three sites will be used to verify both the erosion chamber data and the shear stresses observed from the personal...
watercraft. The boundary layer observations will also be used to improve the accuracy of diffusive flux estimates by directly measuring the thickness of the benthic boundary layer. This study will provide regional and local resource managers with concrete information on the magnitude and mechanisms of the nutrient release (or removal) from sediments.

Objectives:

1) To quantify the diffusive flux of nutrients to/from sediments over various sediment types present in Great Bay.
2) Determine the critical thresholds for hydraulically rough hydrodynamic conditions and resuspension over the various sediment types in the Great Bay.
3) Determine the magnitude of particle and nutrient release as the shear stress and erosion intensity increases.
4) Develop the use of large-scale mobile platform velocity observations to estimate the bed shear stress and the nutrient uptake or release from sediments.

Research findings/progress during 2/1/14 – 1/31/15:
PI Kalnejais recruited graduate student Riccardo Vera to work on the geochemistry component of the project. Mr Vera started at UNH at the end of August 2014 and has been learning nutrient analysis techniques and setting up systems for core incubations. The bulk of our fieldwork is planned for summer of 2015 so all work has been focused on preparing for the 2015 summer field season.

PI Lippmann has been working with research technician Jon Hunt on mobile platform observations of the velocity structure of the Great Bay. This data will ultimately be coupled to the geochemistry data to provide accurate nutrient flux estimations. PI Foster unfortunately was not successful in recruiting a qualified graduate student for the 2014/2015 academic year and is currently reviewing graduate student applications. Foster aims to have a student in place for the summer field season.

Accomplishments during 2/1/14 – 1/31/15:
This project was delayed by graduate student recruitment but has made good progress towards preparation for the 2015 summer field season.

Impacts during 2/1/14 – 1/31/15 (Impacts are significant economic, societal and/or environmental benefits of research.):

NOTE: Include quantitative data to validate the impact, if possible.

None yet.

Economic benefits realized during 2/1/14 – 1/31/15 (businesses retained or created, jobs retained or created, market and non-market economic benefits):

NOTE: Please quantify and provide supporting data if possible.

None yet.
Tools, technologies or information services resulting from this project that were developed or used during 2/1/14 – 1/31/15 to improve ecosystem-based management:

We expect this project to generate innovative tools for up-scaling local geochemical observations. This is however, work that is ongoing.

**Patents:**
None expected

**Technology transfer** (Has a private company utilized this research successfully?):
Not applicable.

**Related grants and contracts** (Other grants and contracts that funded this research or that were obtained as a result of this research.):
None yet.

**Leveraged funding**
Not applicable.

**Problems encountered:**
Recruiting of qualified graduate students has delayed this project, but we expect a strong summer field season.

**Publications to date** (please cite and attach PDF or send a hardcopy, or provide possible title, authors, etc. and status if not yet published)

**Peer reviewed publications:**
None yet.

**Theses/Dissertations:**
None yet.

**Other communications products (non peer-reviewed pubs, manuals, tech reports, videos, etc.):**
Presentation to the NH Sea Grant Annual Symposium January 30 2015.

**Presentations to date, with published abstract citation if applicable:**

NOTE: For presentations to civic groups, etc. (i.e., to the public rather than a scientific conference), please include number of attendees.


**Awards:** None
### Students Supported  *All fields are required*

<table>
<thead>
<tr>
<th>Student Name</th>
<th>Institution</th>
<th>Cont’d or New for 2014?</th>
<th>Where is he/she now?</th>
<th>Dates of support</th>
<th>Type of degree: Undergrad Master’s PhD</th>
<th>Year degree awarded</th>
<th>Title of thesis (if supported by N.H. Sea Grant)</th>
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</thead>
<tbody>
<tr>
<td>Riccardo Vera</td>
<td>UNH</td>
<td>New</td>
<td>UNH</td>
<td>8/14-7/16</td>
<td>Masters</td>
<td>Expected 2016</td>
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