CONNECTICUT SEA GRANT PROJECT REPORT

Please complete this progress or final report form and return by the date indicated in the emailed progress report request from the Connecticut Sea Grant College Program. Fill in the requested information using your word processor (i.e., Microsoft Word), and e-mail the completed form to Syma Ebbin (syma.ebbin@uconn.edu), Research Coordinator, Connecticut Sea Grant College Program. Do NOT mail or fax hard copies. Please try to address the specific sections below. If applicable, you can attach files of electronic publications when you return the form. If you have questions, please call Syma Ebbin at (860) 405-9278.

Please fill out all of the following that apply to your specific research or development project. Pay particular attention to goals, accomplishments, benefits, impacts and publications, where applicable.

Name of Submitter: Michael M. Whitney

Date of Report submission: 1/14/19

Project #: R/CMC-14-CTNY Check one: [X] Progress Report [ ] Final report

Duration (dates) of entire project, including extensions: From [3/1/17] to [2/28/19].

Project Title or Topic: Nutrient and Carbon Fluxes through Long Island Sound, Linking River Sources to Impacted Areas

Principal Investigator(s) and Affiliation(s):

1. Michael M. Whitney (UCONN, Department of Marine Sciences)

2. Penny Vlahos (UCONN, Department of Marine Sciences)

A. <u>COLLABORATORS AND PARTNERS</u>: *(List any additional organizations or partners involved in the project.)*

John Mullaney, CT USGS

B. PROJECT GOALS AND OBJECTIVES:

Objectives:

1. Quantify the nitrogen, phosphorus, and carbon fluxes through across-estuary sections bounding the eastern, central, and western Long Island Sound (LIS) basins by combining data from the CT-DEEP LIS Water Quality Monitoring Program, new observations, and an existing hydrodynamic model.

2. Link inter-basin nutrient fluxes to individual major-tributary, coastal-river, and major-WWTP sources using calculated fluxes, observed loads, and model-based river-water tracers.
3. Determine if and to what extent each basin is net heterotrophic, indicating eutrophication, using net organic carbon fluxes and relating these conditions to nutrient fluxes and sources.

The scientific methods are designed to complete the project objectives and test the following hypotheses: **H1)** The Housatonic, Southwest coastal rivers, and incoming Hudson and WWTP waters through the East River transport the highest nutrient concentrations (and stratification) into western LIS. **H2)** Much of the Connecticut River nutrient load is mixed with incoming shelf water and transported into central LIS and only a small fraction reaches western LIS within a month of entering the estuary. **H3)** The western LIS shifts from net autotrophic to heterotrophic (representing a net carbon sink) during summer due to organic carbon inputs from the central LIS and East River. **H4)** The eastern and central LIS remain net autotrophic (carbon exporters) throughout the spring and summer. Education and outreach efforts include: 1) a new UCONN course and companion open-source web videos designed around the book *Long Island Sound: Prospects for an Urban Sea*, 2) A Coastal Perspectives Lecture featuring a panel discussion on LIS nutrient and carbon issues, and 3) a workshop with scientists and managers to discuss results in the context of LIS management.

C. <u>PROGRESS</u>: (*Summarize progress relative to project goals and objectives. Highlight outstanding accomplishments, outreach and education efforts; describe problems encountered and explain any delays.)*

We have conducted three field surveys in Western Long Island Sound (October 2017, June 2018, and August 2018) and one field survey in Central Long Island Sound (August 2018). Samples for carbon and nutrients along with shipboard measurements of currents and physical water properties were collected. The bounding sections were across the sound near Execution Rocks and near the Throgs Neck Bridge. The currents and physical water properties have been processed and quality controlled. The carbon and nutrient analysis of water samples has been completed and quality controlled. These data have been combined with the water currents to compute fluxes through the western Long Island Sound and estimate the carbon and nitrogen budgets.

Working with John Mullaney (USGS) we calculated a time series of nitrogen loading to Long Island Sound. The methods involved extending the approach Mullaney used previously for Connecticut watersheds and including results of recent LISS work by Jamie Vaudrey. The loading time series now spans 1994 to 2016. Direct atmospheric loading has been calculated using wet and dry deposition of nitrogen based on data from the National Atmospheric Deposition Program.

The hydrodynamic model has been run for the 1994 to 2016 period and been compared to and then calibrated to CT-DEEP hydrographic observations and NOAA tidal observations. Nitrogen budgets using this loading, hydrodynamic model results, and CT-DEEP Long Island Sound Monitoring station data have been completed for years 1994 to 2016.

Project results and the overall project goals were included with related CTSG project results in an oral and poster presentations at the AGU Fall Meeting 2017, LISS PI meeting, Ocean Sciences 2018, Physics of Estuaries and Coastal Seas 2018 Meeting, and the AGU Fall Meeting 2018.

One major finding is nitrogen concentrations in Long Island Sound have decreased as loading from the East River (predominantly from NYC wastewater treatment plants) has decreased through nitrogen management. As East River has decreased, other nitrogen sources (chiefly local rivers and direct atmospheric inputs) have become relatively more important to the total nitrogen budget. Our observations show nutrients from the East River are quickly attenuated as they enter Western Long Island Sound and confirm nitrogen limitation in this area. A major finding for the entire Long Island Sound nitrogen budget is about a third of the loading is exported to the shelf and the rest is consumed, buried, or denitrified.

Our major issue is we unable to conduct all of the field surveys because of weather issues and ship availability. We also need to complete analysis and write-up of our project results We are requesting a no-cost-extension to complete a field survey of Central and Western Long Island Sound in May 2019 and complete analysis and write-up of results.

D. <u>PROJECT PUBLICATIONS, PRODUCTS, PRESENTATIONS AND PATENTS</u>: *(Include published materials with complete references, as well as those which have been submitted but not yet published and those in press. Please attach electronic versions of any journal articles, reports, and abstracts not previously provided.)*

Journal Articles (List URLs): None

Conference Papers: None

Proceedings or book chapters: None

Web sites, Software, etc.: https://cprime.uconn.edu/nitrogen

Technical Reports/Other Publications: None

Other Products (including popular articles):

Benson, J. Chemistry in Motion, *Wracklines*, CTSG, 17 (2), 7-9. https://seagrant.uconn.edu/wp-content/uploads/sites/1985/2017/12/wracklines-Fall2017-web.pdf

Publications planned / in progress: Vlahos, Whitney, Mullaney, Menniti, Nitrogen Loading and Transport in Long Island Sound, L*imnology and Oceanography*, in prep.

Menniti, Whitney, and Vlahos, Linking nitrogen management to decreases in nitrogen and hypoxia in western Long Island Sound, *Environmental Management*, in prep.

Byrd, Vlahos, Whitney, Warren, High-Resolution Observations of Organic Carbon Exchange through the Eastern Long Island Sound Shelf Boundary, Estuaries, in prep.

Byrd, Vlahos, Whitney, Warren, High-Resolution Observations of Nitrogen and Phosphorus Exchange through the Eastern Long Island Sound Shelf Boundary, Estuaries, in prep.

Patents: None

Presentations and Posters:

Vlahos and Whitney, Variations in organic carbon fluxes from Long Island Sound to the Continental Shelf, AGU Fall Meeting 2017, Oral Presentation.

Byrd, Vlahos, Whitney, Warren, Carbon, Nitrogen, and Phosphorus Exports from Long Island Sound to the Mid-Atlantic Bight, Oral Presentation.

Byrd, Warren, Vlahos, Whitney, Constraining the Exchange of Carbon and Nitrogen in Eastern Long Island Sound, AGU Fall Meeting 2017, Oral Presentation.

Vlahos, Whitney, Mullaney, Morrison, Menniti, Nitrogen Budgets in the Long Island Sound Estuary, Ocean Sciences 2018, Poster Presentation.

Whitney, Vlahos, Menniti, Byrd, River influences on Nitrogen and Organic Carbon Fluxes in Long Island Sound, Physics of Estuaries and Coastal Seas 2018, Oral Presentation.

Vlahos, Whitney, Mullaney, Morrison, Menniti, Resolving Shifting Nitrogen Budgets of the Long Island Sound Estuary, AGU Fall Meeting 2018, Poster Presentation.

Byrd, Vlahos, Whitney, Nutrient Exchange in Western Long Island Sound through the Highly Urbanized East River Tidal Strait, AGU Fall Meeting 2018, Oral Presentation.

E. <u>FUNDS LEVERAGED</u>: *(If this Sea Grant funding facilitated the leveraging of additional funding for this or a related project, note the amount and source below.)*

None

F. <u>STUDENTS</u>: ***(****Document the number and type of students supported by this project.)*
*Note: **"Supported"** means supported by Sea Grant through financial or other means, such as Sea Grant federal, match, state and other leveraged funds. "**<u>New"</u>** students are those who **have <u>not</u>** worked on this project previously. "**<u>Continuing"</u>** students are those who **have** worked on this project previously. If a student volunteered time on this project, please use section G, below.*

Total number of **new*** K-12 students who worked with you: 0
Total number of **new** undergraduates who worked with you: 0
Total number of **new** Masters degree candidates who worked with you: 0
Total number of **new** Ph.D. candidates who worked with you: 0

Total number of **continuing**** K-12 students who worked with you: 0
Total number of **continuing** undergraduates who worked with you: 1
Total number of **continuing** Masters degree candidates who worked with you: 0
Total number of **continuing** Ph.D. candidates who worked with you: 2

Total number of volunteer hours: 0

*(Note: ***New** students are those who have not worked on this project previously. ****Continuing** students are those who have worked on this project previously.)*

In the case of graduate students, please list student names, degree pursued, and thesis or dissertation titles related to this project.

Student Name: Allison Byrd
Degree Sought: PhD Oceanography
Thesis or Dissertation Title: TBD
Date of thesis completion: 5/15/22
Expected date of graduation: 5/15/22

Student Name: Allison Staniec
Degree Sought: PhD Oceanography
Thesis or Dissertation Title: TBD
Date of thesis completion: 5/15/20
Expected date of graduation: 5/15/20

G. VOLUNTEER HOURS:

(List the number of hours provided to the project by volunteers, i.e., individuals who were not compensated in any way or for whom involvement is not part of their paid occupation. This could be students or citizens. What was their contribution?)

None

H. PICTORIAL: Please provide high resolution images/photos of personnel at work, in the field or laboratory, equipment being used, field sites, organism(s) of study. Attach images as separate files (do not embed). Include links to websites associated with the research project. Please include proper photo credits and a caption with date, location, names of people, and activity. These images are useful to document your project in future CTSG publications, websites and presentations.

https://cprime.uconn.edu/nitrogen

https://seagrant.uconn.edu/wp-content/uploads/sites/1985/2017/12/wracklines-Fall2017-web.pdf

I. HONORS AND AWARDS: *(List any honors or awards received during the reporting period, for anyone working on the project. This can be for best paper or poster, university awards, etc.*) Specify:

a) Name of person or group receiving recognition: N/A
b) Name of award or honor: N/A
c) Group or individual bestowing the award or honor: N/A
d) What it was for: N/A
e) Date: N/A