2019 Long Island Sound Research Conference

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Danford's Hotel and Marina, Port Jefferson, NY

Sea Grant New York

Long Island Sound Study
A Partnership to Restore and Protect the Sound

Sea Grant Connecticut

Acknowledgments

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AGENDA

8:00 am	**Registration** **(**Danford's Lobby) **Poster presentation and table set-up and light continental breakfast** **(**Brookhaven Room)	
9:00 am	**Welcome** (Diplomatic Ballroom) *Kathy Bunting-Howarth*, New York Sea Grant *Sylvain DeGuise,* Connecticut Sea Grant *Mark Tedsco*, Long Island Sound Study *Lane Smith,* New York Sea Grant	
9:15 am	**<u>Concurrent Session 1</u>**	
	Nutrients/Chemistry (Diplomatic Ballroom) Moderator: *Darcy Lonsdale* Stony Brook University	**Microbes/Water Quality** (Bayles Room) Moderator: *Jim Ammerman* Long Island Sound Study
9:15 am	**Assessing the Distributions of Carbon and Nitrogen Between the East River Tidal Strait and Western Long Island Sound** *Allison Byrd* University of Connecticut	**Microbial Source Tracking (MST) – Local Health Departments in Connecticut Cooperate to Evaluate Three Watersheds of Long Island Sound for Bacteria Sources** *Lauren Brooks[1], Mark Cooper [1], Adalgisa Caccone[2]* *<u>David Knauf</u> [1]* Michael Pascucilla[1] [1]Town of Darien, CT [2]Yale University
9:30 am	**Nitrogen Budgets of the Long Island Sound Estuary** *Penny Vlahos* University of Connecticut	**Solar-Electric Pump-out Boat Technology: Impacts on the Marine Environment, Public Health and Climate Change** *Michael Pascucilla* East Shore District Health Department
9:45 am	**Linking Nitrogen Sources to Western Long Island Sound Water Quality** *Michael M. Whitney* University of Connecticut	
10:00 am	**Break**	

10:15 am	**Concurrent Session 2**	
	Fisheries (Diplomatic Ballroom) Moderator: *Syma Ebbin* Connecticut Sea Grant	**Management/Sustainability** (Bayles Room) Moderator: *Katherine Bunting-Howarth* New York Sea Grant
10:15 am	**Can Harvest Slot Limits Rebuild Overfished Stocks?** *Jacob Kasper[1], Jeffrey Brust[2], Amanda Caskenette[3], Jason McNamee[4], Jason Vokoun[1], Eric T. Schultz[1]* [1]University of Connecticut [2]State of New Jersey Department Environmental Protection [3]Fisheries and Oceans Canada [4] Rhode Island Department of Environmental Management	**Stratford Point Living Shoreline: Adaptive Management Strategies Required!** *Jennifer H. Mattei* Sacred Heart University
10:30 am	**Habitat Restoration in New Haven Harbor Utilizing Lab Cultured Oyster Sets and Reef Balls™** *Peter Solomon, Samuel Greenvall, Louis Laudano, Kelly Roper, Stuart Mattison, John Roy* The Sound School	**Do 'Living Shorelines' Provide Habitat for Local Fauna in Long Island Sound?** *Mary Dushay, Jo-Marie Kasinak, Jennifer Mattei* Sacred Heart University
10:45 am	**Obligate v. Opportunist: The Ecology of the Hard Clam Pathogen, Quahog Parasite Unknown (QPX)** *Sabrina Geraci-Yee, Jackie Collier, Bassem Allam* Stony Brook University	**Enhancing the Long Island Sound Comprehensive Conservation and Management Plan: Enter the Blue Plan and Just Sustainabilities** *Michaela Garland* Southern Connecticut State University
11:00 am	**Endocrine Disrupting Effects of Alkylphenol Pollutants on the Development of Horseshoe Crab *Limulus polyphemus* Larvae and Embryos** *Hans Laufer[1], Daniel Gibson[2], James Stuart[1], Anthony Provatas[1], Marat Vasilenko[1]* [1]University of Connecticut [2]Marine Biological Laboratory	**Ecosystem-based Management (EBM) - The Alternative Solution to our Long Island Sound Nitrogen Fixation** *Paul E. Stacey* Footprints In The Water, LLC

11:15 am	**Spatial Distribution and Temporal Variability of the Blue Crab, *Callinectes sapidus*, in Eastern Long Island Sound** *Howard "Mickey" Weiss and Jim Downs* Project Oceanology	**LIS Blue Plan Special Areas: A New Understanding of Significant Human Uses and Ecological Areas** *Christian Fox[1] and Emily Hall[2]* [1]The Nature Conservancy [2]CT Department of Energy and Environmental Protection
11:30	**Boom-Bust Dynamics of a Western Long Island Sound Population of the Non-Native Asian Shore Crab *Hemigrapsus sanguineus*** *George P. Kraemer* Purchase College	**Blue Communities: Coastal Resilience and Sustainability in Long Island Sound and the Next Steps for Public Engagement** *Stephen Axon* Southern Connecticut State University
11:45 am	**Introducing the New LISS Research Projects** (3 min each, 3 minutes for questions) *Moderator: Lane Smith* Diplomatic Ballroom http://longislandsoundstudy.net/research-monitoring/lis-research-grant-program/2019-research-project-descriptions	
12:00	**Lunch and Networking** – Brookhaven Room	
12:30 pm	**Invited Plenary:** Realistic Ocean Modeling for Applied Science Problems in the Pacific Northwest *Dr. Parker MacCready* University of Washington, School of Oceanography Diplomatic Ballroom	
1:00 pm	**Panel Discussion - Sediment-Water Column Connections** Panelists: *Wally Fulweiler[1], Craig Tobias[2], Penny Vlahos[2], Kamazima Lwiza[3]* Moderator: *Jim Ammerman* Diplomatic Ballroom [1]Boston University [2]University of Connecticut [3]Stony Brook University	
2:00 pm	**<u>Concurrent Session 3</u>**	
	Around the Sound (Diplomatic Ballroom) Moderator: *Anna Weshner-Dunning* New York Sea Grant	**Physical/Geological Processes** (Bayles Room) Moderator: *Kathleen Fallon* New York Sea Grant

2:00 pm	**Potential Denitrification Rates Vary With Dominant Vegetation Zones In Southern New England Coastal Salt Marshes** *Sean Khan Ooi, Aidan Barry, Beth Lawrence, Chris Elphick, Ashley Helton* University of Connecticut	**Spatial Patterns Associated with Interannual Variability and Long Term Trends in SST in Long Island Sound** *Robert Wilson, Sultan Hameed* Stony Brook University
2:15 pm	**Rising Tides: Increased Flooding & Its Effect on Carbon Cycling of Coastal Wetlands** *Aidan Barry* University of Connecticut	**Issues of Erosion on the South Shore of Long Island Sound** *Henry Bokuniewicz* Stony Brook University
2:30 pm	**Rapid, But Limited Adaptation of a Marine Copepod to a Greenhouse World** *Hans Dam* University of Connecticut	**Sedimentary Environments of Central and Eastern Long Island Sound: New Data Derived From the Long Island Sound Seafloor Mapping Project** *Cecilia McHugh[1], Frank Nitsche[2], Timothy Kenna[2], Michael Delligatti[1], Celeste Pallone[2]* [1]Queens College CUNY [2]Columbia University, Lamont-Doherty Earth Observatory
2:45 pm	**Adaptation To A Greenhouse World Comes With A Cost For The Copepod, *Acartia tonsa*** *James A. deMayo* University of Connecticut	**Submarine Groundwater Discharge to Long Island Sound** *Joseph Tamborski[1], J. Kirk Cochran[2], Henry Bokuniewicz[2], Christina Heilbrun[2], Jordi Garcia-Orellana[3], Valentí Rodellas[3]* [1]Woods Hole Oceanographic Institution [2]Stony Brook University [3]Universitat Autonoma de Barcelona
3:00 pm	**For Everything There is a Season: Strong Seasonal Variation in Thermal Performance of Long Island Sound Copepods** *Matthew Sasaki* University of Connecticut	
3:15 pm	**Poster lightning talks** (Diplomatic Ballroom) *Lane Smith*, New York Sea Grant	
3:45 pm	**Poster session** (Brookhaven Room)	
5:00 pm	**Closing Remarks and Adjourn** (Diplomatic Ballroom)	

POSTER PRESENTATIONS

(Brookhaven Room)

1. Macroalgae as Bioindicators for Mercury Contamination in Long Island Sound - **Cassandra Bhageloo, Vincent Breslin, and Sean Grace**, *Southern Connecticut State University*

2. The M.A.P.- Monitoring Acidification Project - **Katie O'Brien-Clayton[1], Parker Gassett[2], Joel Corso[1]**, *[1]CT Dept. of Energy and Environmental Protection, [2]University of Maine*

3. Distributions of Alkalinity in Long Island Sound - **Allison Staniec**, **Penny Vlahos, Michael M. Whitney,** *University of Connecticut*

4. Management Impacts on Nitrogen and Hypoxia in Western Long Island Sound - **Christina Menniti**, **Michael Whitney, Penny Vlahos, John R Mullaney, Jonathan Morrison,** *University of Connecticut*

5. Sources of Nutrients Discharged Seasonally From the Pawcatuck River Evidenced by Nitrate N and O Isotope Ratios - **Veronica Rollinson[1], Julie Granger[1], Sydney Clark[2], Craig Tobias[1], Mackenzie Blanusa[1], Reide Jacksin[1], Claudia Koerting[1] , Jamie Vaudrey[1], and Meredith Hastings[2],** *[1]University of Connecticut, [2]Brown University*

6. Sources of Atmospheric Deposition in the Long Island Sound Watershed - **Carmen Lamancusa, Michael Crowl, Kristina Wagstrom**, *University of Connecticut*

7. Hypoxia in NYC Embayments: Is High-BOD Water Exported to Western LIS? - **Timothy T. Eaton**, **Gregory D. O'Mullan and Angel Montero,** *Queens College CUNY*

8. Temporal Variability of Dissolved Oxygen in the Western Long Island Sound - **Juan Sebastian Mafla**, *College of Staten Island*

9. Restoration of Coastal Meadows at Stratford Point, CT: Is Native Plant Seeding the Best Method? - **Adeline DeStasio**, *Sacred Heart University*

10. Mapping and Characterization of Long Island Sound Coastal Wetlands Using Synthetic Aperture Radar and Optical/IR Satellite Imagery - **Brian Thomas Lamb**, **Maria Tzortziou, Kyle McDonald,** *City College of New York & CUNY Graduate Center*

11. Microbial Degradation and Bioavailability of Marsh-Exported Colored Dissolved Organic Matter in the Long Island Sound - **John Supino**, **Liz Corbett, Brice Grunert, Maria Tzortziou,** *CUNY, The City College of New York*

12. Analysis of Bacterial Community Dynamics Related to Water Quality Along Environmental Gradients Within the Lower Hudson River Estuary - **Roman Reichert**, *Queens College City University of New York*

13. Comparing Urban Stormwater vs Combined Sewage as Sources of Microbial Pollution to Flushing Bay - **Gregory O'Mullan**, **Angel D. Montero, and Roman Reichert,** *Queens College City University of New York*

14. The Urban Street Surface As a Source of Fecal Bacteria to Coastal Waterways - **Angel D. Montero and Gregory O'Mullan,** *Queens College City University of New York*

15. Optical Characterization of Water Quality in the Long Island Sound - **Alana Menendez**, **Brice Grunert, Maria Tzortziou,** *CUNY The City College of New York*

16. Pigment Concentrations and CDOM Absorption Coefficients Estimation From in Situ and Satellite Ocean Color Measurements for Coastal Waters - **Guoqing Wang**, *CCNY, Columbia University*

17. Satellite Ocean Color Observations from NASA's PACE Mission: Addressing Environmental Challenges and Enhancing Environmental Management Decisions - **Maria Tzortziou[1], Ali Omar[2], Woody Turner[3]**, [1]*NASA Goddard Space Flight Center, and City College of New York,* [2]*NASA Langley Research Center,* [3]*NASA Headquarters Applied Sciences Program*

18. Satellite Tracking of Juvenile Green, Loggerhead, and Kemp's Ridley Turtles From Rehabilitation Centers in southern New England and Long Island, USA - **Nathan J. Robinson[1], Kayla Deguzman[2], Lisa Bonacci-Sullivan[3], Robert DiGiovanni[4, 5], Theodora Pinou[2]**, [1]*Cape Eleuthera Institute,* [2]*Western Connecticut State University,* [3]*New York State Department of Environmental Conservation,* [4]*Atlantic Marine Conservation Society,* [5] *The Riverhead Foundation for Marine Research and Preservation*

19. An Interactive Application for Tracking the Movement of the *Limulus polyphemus* throughout Long Island Sound (LIS) - **Ismael Youssef**, *Valhalla High School & Sacred Heart University*

20. Living Shorelines: the Good, the Bad and the Ugly - **Benjamin Miller**, *Sacred Heart University*

21. Lagrangian Circulation and Connectivity in Long Island Sound - **Han Sun**, *Stony Brook University*

22. Is Desiccation an Ecologically Important Threat to *Hemigrapsus sanguineus* (Asian shore crab)? - **Lara Pratt, George Kraemer,** *Purchase College*

Contributed Oral Presentation Abstracts

(In alphabetical order by lead author)

Blue Communities: Coastal Resilience and Sustainability in Long Island Sound and the Next Steps for Public Engagement.
Stephen Axon
Southern Connecticut State University

On the surface, it may appear that public awareness, knowledge and engagement with sustainable practices in coastal communities in Long Island Sound has increased in the last 10 years. Surveys conducted in 2016 and 2017 by The Nature Conservancy suggest that almost every resident would be willing to engage in one of eight suggested pro-environmental activities and there are an increasing number of citizens participating in volunteerism. Despite these improvements, there are more ways in which the public can participate in efforts to enhance environmental stewardship through various interventions and activities. This paper indicates how current research in sustainability science could be applied to support next steps for public engagement for sustainable and resilient communities in Long Island Sound.

Rising Tides: Increased Flooding & Its Effect on Carbon Cycling of Coastal Wetlands. **Aidan Barry**
University of Connecticut

To determine how sea level rise (SLR) may impact carbon cycling rates among dominant Long Island Sound salt marsh vegetation zones, we manipulated marsh elevation and vegetation composition during a 2018 field experiment. We quantified CO_2 fluxes and carbon mineralization rates responses to three SLR-scenarios (present day, ~10 year SLR (+7.5cm), ~20 year SLR (+15cm)) and five vegetation treatments (*Spartina alterniflora*, *S. patens*, *Phragmites australis*, and two un-vegetated controls). We observed strong differences among vegetation, but not SLR-scenarios. Our data suggest that as marshes flood more often as sea levels rise, vegetation composition within marshes will shift towards more flood-tolerant species such as *S. alterniflora*, which may lead to increased carbon turnover rates.

Issues of Erosion on the South Shore of Long Island Sound. **Henry Bokuniewicz**
Stony Brook University

The critical eroding, south shore of Long Island Sound threatens both coastal communities and marine habitats. Shoreline compartments are backed by sandy bluffs. Under the attack of wind-driven waves and storm tides, erosion supplies sand to the beach while also threatening community property. A recent regional workshop focused on the competing goals of maintaining coastal ecosystems while protecting property. Problems have often tended to be addressed in isolation, in part, due to a dearth of information on the distribution of source areas of beach sand and the rate of supply needed to feed the beaches. A fully integrated approach to local community planning and development is needed based on a quantitative assessment of the regional sediment budget.

Assessing the Distributions of Carbon and Nitrogen Between the East River Tidal Strait and Western Long Island Sound.
Allison Byrd
University of Connecticut

Hypoxia is reoccurring in the summer months in western Long Island Sound (WLIS), however the drivers of this have not been well established. Despite successful efforts to reduce nitrogen loading from waste water treatment plants and rivers to LIS, the extents of hypoxic events remain unpredictable. The exchange of nitrogen between the East River Tidal Strait and WLIS is likely important for forecasting hypoxic events. To better assess this exchange, carbon, nitrogen and phosphorous constituents were repeatedly sampled on transects crossing the WLIS boundary during spring, summer and winter to resolve seasonal and tidal variability. Findings show high nutrient concentrations at the ERTS that are quickly attenuated before reaching the WLIS boundary.

Rapid, But Limited Adaptation of a Marine Copepod to a Greenhouse World. **Hans G. Dam**
University of Connecticut

Forecasting the response of the biota to climate change is hampered by a lack of transgenerational studies that can assess the potential for evolutionary adaptation. We used the ubiquitous copepod *Acartia tonsa*, a key prey for coastal forage fish, to understand the consequences of a dire greenhouse world on copepod fitness. We characterized life-history traits for 25 generations under ambient (18°C, 400 ppm pCO_2), elevated temperature (22°C, 400 ppm pCO_2), elevated CO_2 (2000 ppm pCO_2, 18°C) conditions, and greenhouse (22° and 4000 ppm pCO_2) conditions. Rapid adaptation (as demonstrated by improved egg production rate and hatching success) became evident after a few generations under elevated temperature and full greenhouse conditions, but performance never reached the control levels. Thus, for this species there appears to be sufficient extant genetic variation to cope with the direst projections for climate change, albeit at some cost. Genetic analysis indeed shows selection, but not a decrease in genetic diversity. This suggests adaptation proceeded through soft sweeps of common genetic variation.

Adaptation to a Greenhouse World Comes with a Cost for the Copepod, Acartia tonsa. **James deMayo**
University of Connecticut

Fitness consequences of climate change (warming and acidification) for copepods, the most abundant oceanic metazoans and the basis of pelagic fisheries, are poorly documented and understood. We have shown evidence of adaptation (exhibited as increased egg production and hatching frequency) in the estuarine copepod *Acartia tonsa* raised for over 20 generations under elevated temperature and CO_2 (factorial temperature X CO2 treatments) relative to present-day ambient conditions. Yet, it is unclear if adaptation to future climate conditions incurs direct fitness costs (a drop in fitness relative to extant conditions), or indirect fitness trade-offs (a drop in fitness relative to newly adapted conditions) to other stressors such as food limitation or prey toxins. Here, we tested for costs of adaptation by comparing survival, egg production, and hatching frequency of animals raised under present-day and future climate conditions (greenhouse conditions). For animals adapted to greenhouse conditions, we observed lowered egg production when they were returned to ambient conditions, and increased susceptibility to food limitation. Animals adapted to warmer conditions displayed increased susceptibility to prey neurotoxin. These costs need to be considered in forecasting the response of the biota to climate change.

Do 'Living Shorelines' Provide Habitat for Local Fauna in Long Island Sound? **Mary Dushay, Jo-Marie Kasinak, and Jennifer Mattei**
Sacred Heart University

Anthropic coastal habitat degradation results in flat and barren shorelines, for example Stratford Point, Connecticut. A ~280m 'living shoreline' was installed to decrease erosive forces and restore estuarine habitats (2014-2018). We tested if this living shoreline allows the easy passage and recolonization of the area by local fauna. Over the past seven years, spawning horseshoe crabs (*Limulus polyphemus*) and Eastern oysters (*Crassostrea virginica*) were surveyed to determine if the living shoreline installation had an effect on their activity. During the years of construction, spawning horseshoe crab counts were low but have now increased. Oyster counts have oscillated and a small population is becoming established at the base of the artificial reef.

LIS Blue Plan Special Areas: A New Understanding of Significant Human Uses and Ecological Areas. **Christian Fox [1], Emily Hall [2]**
[1]The Nature Conservancy, [2]CT Department of Energy and Environmental Protection

The Blue Plan is a new paradigm in Connecticut's management of Long Island Sound that, in part, addresses the CCMP goals. Working in close collaboration with hundreds of stakeholders and scientists the Plan Development Team has identified and mapped Significant Human Use Areas and Ecologically Significant Areas for the first time. There areas represent the "most important" places of each use or ecological feature type and will be protected from the impacts of

future development in Connecticut State policy. Many were extracted from existing public datasets, but in some cases new data for LIS needed to be collected through Participatory Mapping and modeling. The Blue Plan identifies 25 types of Significant Human Use Area and 14 types of Ecologically Significant Area.

Enhancing the Long Island Sound Comprehensive Conservation and Management Plan: Enter the Blue Plan and Just Sustainabilities. **Michaela Garland**
Southern Connecticut State University

Blue Economy policy initiatives that aim to promote both economic and environmental sustainable development of the ocean and its resources have recently begun to emerge rapidly. Connecticut, expanding upon the ideas of the Long Island Sound Comprehensive Conservation and Management Plan, has begun the process to adopt their own Blue Economy policy initiatives in the new development of the Long Island Sound Blue Plan. Using a 'just sustainabilites' framework for analysis, this paper aims to discuss the expansion of the Long Island Sound Comprehensive Conservation and Management Plan's framework into the Blue Plan while also highlighting the potential gaps in a successful and proper sustainable transition taking place in the coastal zone of Long Island Sound.

Obligate v. Opportunist: The Ecology of the Hard Clam Pathogen, Quahog Parasite Unknown (QPX). **Sabrina Geraci-Yee, Jackie Collier, and Bassem Allam**
Stony Brook University

A critical question in the management of QPX disease is whether QPX is an obligate or opportunistic pathogen. Currently, it is managed based on the assumption that QPX is an obligate pathogen, resulting in significant economic losses. In order to better understand QPX, we performed a two year survey throughout the marine district of New York and quantified QPX abundance in clams and the environment using newly developed molecular assays. QPX was prevalent in clam tissue and pallial fluid, and regularly detected in environmental samples, but its distribution was not strongly related to the prevalence of QPX in hard clams. This study supports that QPX is an opportunistic pathogen, highlighting the need for improving current management approaches.

Can Harvest Slot Limits Rebuild Overfished Stocks? **Jacob Kasper[1], Jeffrey Brust[2], Amanda Caskenette[3], Jason McNamee[4], Jason Vokoun[1], Eric T. Schultz[1]**
[1]University of Connecticut, [2]State of New Jersey Department Environmental Protection, [3]Fisheries and Oceans Canada, [4] Rhode Island Department of Environmental Management

Changing fishing regulations from minimum size limits (MSLs) to harvest slot limits (HSLs) should reduce the harvest of older individuals; this could facilitate sustainability because older fish disproportionately contribute to recruitment. Here we model HSLs for Tautog (*Tautoga onitis*) in Long Island Sound, an overfished stock that is also experiencing overfishing. Using long-term projections, we analyzed stock recovery and equilibrium abundance. For some HSLs, older fish abundance rapidly increased to 23 times status quo levels within 11 years. After stocks reached equilibrium, HSLs maintained more older fish than MSLs. Results indicate that HSLs are likely to rebuild truncated age structures in other long-lived slow growing species.

Microbial Source Tracking (MST) – Local Health Departments in Connecticut Cooperate to Evaluate Three Watersheds of Long Island Sound for Bacteria Sources. **Lauren Brooks[1], Mark Cooper[1], Adalgisa Caccone[2] David Knauf[1] Michael Pascucilla[1]**
[1]Town of Darien, CT, [2]Yale University

Current US EPA protocols for water testing as a means for determining whether bathing areas and/or shellfishing areas should be open or closed utilize a process that involves a 24-hour delay between collecting water samples, obtaining the results and making decisions. Furthermore, those decisions are being made based on the presence or absence of indicator organisms, as actual pathogens are not being tested for and sources of bacteria are unknown. The purpose of this study was to examine bacterial DNA to identify the actual sources of bacteria in order to scientifically evaluate the true risk to public health.

Boom-Bust Dynamics of a Western Long Island Sound Population of the Non-Native Asian Shore Crab Hemigrapsus sanguineus. **George P. Kraemer**
Purchase College

Many invasive species exhibit boom-bust population dynamics. From 1998-2018, the June population density of the invasive Asian shore crab (*Hemigrapsus sanguineus*) was estimated from quadrat sampling of the intertidal zone at a western Long Island Sound site. After initial 8-fold population growth, average intertidal densities declined by ca. 4% yr^{-1} from 2001-2018. However, the variability of density estimates required long term (15 year) monitoring to be able to conclusively (i.e., statistically) identify trends. The size (carapace width; CW) of *H. sanguineus* declined by almost 25% from 2005-2018, as larger crabs disappeared (both male and female). Reproductive output scales with cube of CW; loss of largest females is predicted to have reduced population reproductive output in 2018 to ca. 50% of production in 2005. Additionally, the smallest, reproductively mature were found increasingly likely brood eggs (3% ovigerous for 2005-2007, 16% for 2013-2018).

Endocrine Disrupting Effects of Alkylphenol Pollutants on the Development of Horseshoe Crab Limulus polyphemus Larvae and Embryos. **Hans Laufer[1], Daniel Gibson[2], James Stuart[1], Anthony Provatas[1], and Marat Vasilenko[1]**
[1]University of Connecticut, [2]Marine Biological Laboratory

We studied development of *Limulus polyphemus* because of their importance in medical diagnosis, declining populations, and their presence in organismal food chains. Alkylphenols were found in eggs, embryos, and juveniles from Cape Cod. We treated eggs through hatching and metamorphosis with 5 and 10 nanograms bisphenol A, 2,4-bis-dimethylbenzylphenol, or nonylphenol. Control embryos hatched between days 7 and 27 to larvae and metamorphosed into juveniles by days 31 and 37. Nonylphenol treated larvae survived as larvae. More treated embryos and larvae were less well developed and more died. The experiments show that alkylphenols which are known to have juvenile hormone (JH) activity interfered with horseshoe crab metamorphosis. Reduced JH induces metamorphosis, contrary to some literature. Our results indicate that alkylphenols in marine environments, produced from breakdown of plastics, detergents, and other sources including liners of cans, need to be reduced to maintain wild life populations.

Stratford Point Living Shoreline: Adaptive Management Strategies Required! **Jennifer H. Mattei**
Sacred Heart University

In Connecticut, we discovered that wave attenuation necessarily comes first for successful living shoreline installation and improved resiliency. Reef, low marsh, high marsh, dunes, meadow and forest/shrub habitats were installed sequentially. Dune vegetation was lost when installed first (in 2012). *Spartina alterniflora* has increased in height and stem density over three years behind the protective offset lines of reef balls along ~280m of shoreline. The newly installed high marsh has been damaged by numerous fall/winter storm events (2018/2019) but installing and anchoring large woody debris has allowed for sediment retention. In the shadow of climate change, successful coastal restoration will require adaptive management strategies and extended time for plants to mature and give back the ecosystem services we need.

Sedimentary Environments of Central and Eastern Long Island Sound: New Data Derived From the Long Island Sound Seafloor Mapping Project. **Cecilia McHugh[1], Frank Nitsche[2], Timothy Kenna[2], Michael Delligatti[1], and Celeste Pallone[2]**
[1]Queens College CUNY, [2]Columbia University, Lamont-Doherty Earth Observatory

As part of the "Long Island Sound Seafloor Mapping Project" we have been surveying the Central and Eastern parts of Long Island Sound (LIS). High-resolution subbottom profiling, multibeam bathymetry and sediment sampling (~75 cores, 500 grabs) were collected between 2013-2018. Based on acoustic images, grain size, core photos, lithology, physical properties and heavy metals we have characterized the seafloor into distinct depositional environments: 1) low energy, 2) high-energy, 3) depositional and erosional. The initial results in Eastern LIS reveal

a seafloor that contains deep troughs (70m) and terraces likely relics of glacial times. The sediments are mainly composed of reworked sand and gravel with fine sediments concentrated near river mouths and bays, revealing a dynamic system influenced by strong currents.

Potential Denitrification Rates Vary With Dominant Vegetation Zones In Southern New England Coastal Salt Marshes.
Sean Khan Ooi, Aidan Barry, Beth Lawrence, Chris Elphick, and Ashley Helton
University of Connecticut

The goal of our study was to determine how potential denitrification rates vary among dominant vegetation zones in Connecticut salt marshes. We conducted a field survey across 20 salt marshes and quantified potential denitrification rates using denitrification enzyme activity assays (DEA) on sediment collected from zones dominated by *Spartina alterniflora*, *Spartina patens*, and *Phragmites australis*. Our results showed significant differences in potential denitrification rates among vegetation zones, suggesting that dominant vegetation is a good indicator of denitrification. Further analysis of plant and soil chemistry parameters will examine the mechanisms driving potential denitrification in each zone. These results suggest that incorporating shifting vegetation under scenarios of sea-level rise is critical for predicting the future role of coastal wetlands in nitrogen cycling.

Solar-Electric Pump-out Boat Technology: Impacts on the Marine Environment, Public Health and Climate Change.
Michael Pascucilla
East Shore District Health Department

The East Shore District Health Department (ESDHD) of Branford, Connecticut is pioneering the implementation of the nation's largest solar-electric pump-out boat to replace an older gasoline-powered model. This study, conducted with ESDHD, sought to assess the environmental and health effects of solar-electric pump-out boat technology. We conducted national surveys of pump-out program managers and boat operators to gauge pump-out boating costs, cultures, and best practices. We also conducted life-cycle analyses of gasoline-powered and solar-electric pump-out boats to compare their production of environmental pollutants. Our work constitutes the most comprehensive study into pump-out boating in the United States to date, and identifies challenges and opportunities that remain for the widespread adoption of solar-electric pump-out boat technology.

For Everything There Is a Season: Strong Seasonal Variation in Thermal Performance of Long Island Sound Copepods. **Matthew Sasaki**
University of Connecticut

Temperature has a universal effect on biological processes. Organisms in Long Island Sound experience an annual temperature range of almost 30oC in shallow coastal areas, similar to that observed across the global ocean. This may pose a severe physiological challenge to the inhabitants of Long Island Sound. Organisms can cope with this seasonal variation using either a "fixed generalist" or "variable specialist" strategy. By assaying thermal performance throughout the annual temperature cycle, we find strong evidence for variable thermal performance curves in two common copepod species (*Acartia tonsa* and *Acartia hudsonica*). Understanding the strategies organisms use to maintain performance under fluctuating conditions is crucial for predicting organismal responses to climate change and for the sustainable management of fisheries and biodiversity.

Habitat Restoration in New Haven Harbor Utilizing Lab Cultured Oyster Sets and Reef Balls™. **Peter Solomon, Samuel Greenvall, Louis Laudano, Kelly Roper, Stuart Mattison, John Roy**
The Sound School

Oyster reefs have been documented to provide valuable habitat structure and ecosystem services as well as socioeconomic benefits. Native reefs once dominated many estuaries ecologically and economically. Studies have shown depletion and degradation of oyster reefs worldwide. Successful restoration efforts have further demonstrated the value of oyster reefs to coastal ecosystems and communities.

Reef Ball™ Modules (RBM's) are designed to mimic natural bottom structure and are being used to address a variety of environmental concerns. Initial investigations suggest that these artificial forms may have far reaching effects in habitat and species restoration efforts including; designing and growing artificial reefs, coral propagation and planting systems, estuary restoration, mangrove plantings, erosion control, and oyster reef restoration.

Students and faculty at the Sound School built five Mini-Bay RBM's (width: 0.76m, height: 0.53m, weight: 91kg) using oyster shell as a cement additive. In May of 2018 the aquaculture laboratory at the school successfully spawned oysters. After the spawn three RBM's were placed in a set-tank with 200µm spat. The RBM's soaked for ten days. In June 2018 the RBM's, three with set and two unseeded, were deployed in nearshore waters by the school campus. To date the three modules with oyster set have demonstrated successful oyster growth and survival over their entire surface. A variety of crab and fish species were observed using the seeded RBM's. Students are building ten additional RBMs to expand the reef this spring. Oyster growth and species interactions continue to be monitored.

Ecosystem-based Management (EBM) -The Alternative Solution to our Long Island Sound Nitrogen Fixation.
Paul E. Stacey
Footprints In The Water, LLC

EBM holistically addresses collective habitat and water quality impacts in a social-ecological context, a goal of the 2015 revision of the LISS CCMP for connecting Healthy Watersheds with a Healthy Long Island Sound. Yet, the 2015 LISS Nitrogen Reduction Strategy takes a traditional, regulatory tack – single-pollutant criteria and targeted point and non-point load reductions – with scant attention to EBM principles. We may be missing an opportunity to connect watershed health with Sound health to guide both pollution targets and sustainable ecosystem integrity outcomes engendered in EBM. This analysis of 160 Connecticut coastal watersheds tests natural recovery potential for attaining collective ecosystem goals for stream ecosystems and Long Island Sound estuaries.

Submarine Groundwater Discharge to Long Island Sound. **Joseph Tamborski[1], J. Kirk Cochran[2], Henry Bokuniewicz[2], Christina Heilbrun[2], Jordi Garcia-Orellana[3], and Valentí Rodellas[3]**
[1]Woods Hole Oceanographic Institution, [2]Stony Brook University, [3]Universitat Autonoma de Barcelona

Submarine groundwater discharge (SGD) to Long Island Sound (LIS) represents a well-known but poorly quantified vector for water, nutrients and contaminants. SGD includes the discharge of fresh, meteorically derived water and seawater that has circulated through the permeable sediments of a reactive subterranean estuary. Freshwater SGD has been estimated to deliver 3.5 $*10^{11}$ L y^{-1} to LIS. The marine component has been more elusive, but concentrations of long-lived Ra isotopes constrain the volume of total SGD (meteoric + marine) into LIS between 1 and 12 $*10^{13}$ L y^{-1}. N isotope measurements reveal that both fresh and marine SGD flow paths carry distinct inorganic nitrogen loads that rival inputs from riverine and wastewater treatment plants.

Nitrogen Budgets of the Long Island Sound Estuary. **Penny Vlahos, Michael M Whitney, John R Mullaney, Jonathan Morrison, and Christina Menniti**
University of Connecticut

Nitrogen inputs to Long Island Sound (LIS) have a direct influence on water column productivity and ecosystem health. Quantifying the nitrogen sources and sinks in LIS is critical to understanding how LIS responds to changes in both natural and anthropogenic inputs. Here total LIS nitrogen budgets are evaluated from 1995-2016 to evaluate regional differences and to ascertain inter-annual trends for the system as a whole. The study focuses on differences in nitrogen inputs and the resulting changes in both nitrogen export to the adjacent continental shelf versus losses within LIS through nitrogen burial and denitrification. The results are compared to organic carbon budgets to approach better predictability of LIS hypoxia.

Spatial Distribution and Temporal Variability of the Blue Crab, Callinectes sapidus, In Eastern Long Island Sound.
Howard M. Weiss and James Downs
Project Oceanology

Blue crabs were sampled for 7 years with an otter trawl in Long Island Sound (LIS) and with traps in the estuarine portion of 3 rivers in eastern Connecticut. In the rivers, blue crabs were most abundant in the upper, less saline, sections and 89% were males or immature females. None were egg bearing. In LIS, 93% were mature females and one third were gravid. These results are consistent with the blue crab life cycle described for other regions. Crab catches per unit effort (CPUE) varied significantly from year to year. Summer CPUEs in the rivers correlated strongly with prior winter water temperatures suggesting that inter-annual fluctuations in LIS crab abundance are due to over-winter survival rates.

Linking Nitrogen Sources to Western Long Island Sound Water Quality. **Michael M. Whitney**
University of Connecticut

A mosaic of nitrogen sources from local and remote rivers, wastewater treatment plants (WWTPs), the coastal ocean, and the atmosphere deliver nitrogen to the western Long Island Sound (WLIS). Management actions have decreased nitrogen loading from most of these sources and observations indicate WLIS nitrogen concentrations and hypoxic extent have decreased in recent years. A hydrodynamic model with passive tracers is applied to quantify contributions of river waters and New York City (NYC) WWTP effluent to WLIS waters. Waters from the Connecticut River make up much of the freshwater in WLIS, but they are delivered at lower concentrations than waters from the Housatonic, Hudson, NYC WWTPs, and local WLIS rivers. Implications for WLIS nitrogen levels are discussed in terms of nitrogen budgets and new observations.

Spatial Patterns Associated with Interannual Variability and Long Term Trends in SST in Long Island Sound.
Robert Wilson and Sultan Hameed
Stony Brook University

Analyses based on daily Level 4 AVHRR_OI gridded SST data available for 1985-2016 show that long term warming rates and the magnitude of interannual fluctuations are spatially and seasonally variable. Warming trends in June are maximum in the western Sound (~0.12 ^{o}C/yr) and decrease significantly towards the east. The trends are nonlinear. The magnitude of interannual fluctuations is maximum in winter months and minimum in summer, with amplitude decreasing towards the east. The longitudinal structure in both warming rates and magnitude of interannual fluctuations is consistent with a response to local and nonlocal forcing. The relationships to trends and interannual fluctuations in local air temperature and wind speed is considered in connection with possible sensible and radiative forcing.

Contributed Poster Abstracts

(In presentation order)

Macroalgae as Bioindicators for Mercury Contamination in Long Island Sound - **Cassandra Bhageloo, Vincent Breslin, and Sean Grace**, *Southern Connecticut State University*

This study examined the suitability of macroalgae as bioindicators for mercury contamination in Long Island Sound. The mercury content was determined in seven species of macroalgae including green (*Ulva lactuca, Codium fragile*), brown (*Fucus vesiculosus, Fucus distichus*) and red (*Chondrus crispus*, *Grateloupia turutura, Gracilaria tikvahiae*) algae sampled from seven locations along the Connecticut shoreline (Stamford to Westbrook) in fall 2017. Freeze-dried algae tissue samples were analyzed directly for mercury using a Milestone DMA-80 direct mercury analyzer. Results showed that macroalgal tissue mercury concentrations varied by species but no significant west to east trends in algal tissue mercury were observed. Mercury concentrations were typically lowest in green algae species, intermediate in red algae species and highest in brown algae species.

The M.A.P.- Monitoring Acidification Project - **Katie O'Brien-Clayton[1], Parker Gassett[2], Joel Corso[1]**, *[1]CT Dept. of Energy and Environmental Protection, [2]University of Maine*

Nearshore environments and the communities that rely on them are uniquely vulnerable to ocean and coastal acidification, yet we lack comprehensive monitoring at spatial and temporal scales requisite to providing actionable information. While there are a small number of existing long-term, decadal and climate-scale coastal acidification monitoring sites, crowdsourcing monitoring through broad collaborations of water quality stakeholders offers an opportunity to vastly expand monitoring of nearshore conditions of acidification. Existing networks of volunteer and citizen science water quality monitors in the Northeast United States are well positioned to expand monitoring from their traditional focus on marine habitat protection, nutrient pollution and watershed management to include carbonate chemistry parameters. To help meet this goal, M.A.P. provides an online GIS Story Map showing the first ever Northeast US archive of monitoring sites that measure ocean acidification parameters. Distinct water monitoring groups can more easily connect and collaborate by seeing the comprehensive coverage and gaps in monitoring through info-rich GIS layers showing the location of monitoring sites, which parameters are being measured for each location, and links for organizations' websites and contact information. Since sharing data is easier than collecting data, it makes sense that collaborating with partner organizations can offer novel insights into local patterns for water quality and ocean acidification. Additionally, developing organizational relationships among water quality monitoring groups can better serve individual organizations' missions by facilitating broader impacts, securing team grants, and improving existing monitoring coverage. M.A.P. is important for our organizations because we strive to support solutions and management for ocean acidification which will require connectivity and participation from water quality stakeholders and local decision-makers throughout the Northeast and potentially expanding to the entire East Coast.

Distributions of Alkalinity in Long Island Sound - **Allison Staniec**, **Penny Vlahos, Michael M. Whitney,** *University of Connecticut*

Alkalinity represents the buffering capacity of a system and is particularly important in urbanized estuaries such as Long Island Sound (LIS) which encounter both natural and anthropogenic inputs from many sources. In this study, alkalinity is measured in three major transects across the eastern, central, and western LIS. Measurements are compared across the LIS regions and over tidal cycles. CO2SYS, a parameterization of the carbonate system, is often used as an effective estimation of alkalinity in the open ocean but the complexity of coastal systems may affect the accuracy of such parameterizations. Transect alkalinity measurements will be compared to CO2SYS and any resulting discrepancies will be examined in light of DIC concentrations and isotopic variations (^{13}C).

Management Impacts on Nitrogen and Hypoxia in Western Long Island Sound - **Christina Menniti**, **Michael Whitney, Penny Vlahos, John R Mullaney, Jonathan Morrison,** *University of Connecticut*

Western Long Island Sound (WLIS) experiences seasonal hypoxia related to nitrogen loading. Management plans have been enacted to reduce hypoxia by upgrading wastewater treatment plants to decrease point source nitrogen loading. These upgrades appear to have coincided with decreasing river loading into WLIS. Separate national management initiatives have resulted in decreasing direct atmospheric deposition onto the surface of WLIS. The combined effect is a decrease in the total loading into WLIS, and as a result surface nitrogen concentrations appear to be trending downward over time. The decrease in nitrogen has been accompanied by a general downward trend in hypoxic area, indicating a positive impact of management efforts.

Sources of Nutrients Discharged Seasonally From the Pawcatuck River Evidenced by Nitrate N and O Isotope Ratios - **Veronica Rollinson[1], Julie Granger[1], Sydney Clark[2], Craig Tobias[1], Mackenzie Blanusa[1], Reide Jacksin[1], Claudia Koerting[1]**, **Jamie Vaudrey[1], and Meredith Hastings[2],** [1]*University of Connecticut,* [2]*Brown University*

The Pawcatuck River discharges elevated nutrient concentrations into Little Narragansett Bay, promoting the growth of nuisance macroalgal mats of the genus *Cladophera*. The river watershed comprises non-point and point nutrient sources. Weekly sampling at a bridge slightly upstream of salt water intrusion reveals an inverse relationship between nitrate and phosphate concentrations and river discharge, with the highest concentrations occurring in winter, suggesting that rain and overland water dilutes river nutrients largely sourced from groundwater and point-source discharge. The nitrate 15N/14N ratios, in turn, decrease proportionally to water discharge, whereas nitrate 18O/16O ratios increase with discharge, suggesting that atmospheric nitrate is added by rain. The elevated nitrate 15N/14N in winter is consistent with partially denitrified ground-water sources.

Sources of Atmospheric Deposition in the Long Island Sound Watershed - **Carmen Lamancusa, Michael Crowl, Kristina Wagstrom**, *University of Connecticut*

Anthropogenic emissions of nitrogen released into the atmosphere can contribute to water eutrophication. In this study, we estimate the seasonal dry and wet deposition of major nitrogen-containing species into the major watersheds that impact Long Island Sound. We make these estimates using a regional air quality model. In addition, we estimate the amount of deposited nitrogen resulting from emissions outside the individual watersheds and nitrogen transported from areas far removed from Long Island Sound (often called long-range transport). We identify regions that contribute disproportionately to nitrogen deposition and regions that are disproportionately impacted by long-range transport of nitrogen emissions.

Hypoxia in NYC Embayments: Is High-BOD Water Exported to Western LIS? - **Timothy T. Eaton**, **Gregory D. O'Mullan and Angel Montero,** *Queens College CUNY*

Like Long Island Sound, limited-circulation embayments in the NY-NJ Harbor Estuary suffer from periodic hypoxia, linked to tidal cycles and CSO discharges, as shown by preliminary continuous DO data in Flushing Bay. Environmental impacts of these hypoxic episodes (<<4 mg/L) are largely unrecognized by the NYC Department of Environmental Protection, due to their monthly or weekly sampling for Long Term Control Plans. First-order analysis of circulation and tidal cycling in Flushing Bay using specific conductance and temperature sensors, as well as additional continuous DO measurement is planned to evaluate the dynamics of dissolved oxygen in this embayment. We hope to link these analyses with results from NYHOPS circulation modeling to evaluate the fate of high-BOD water and potential management implications.

Temporal Variability of Dissolved Oxygen in the Western Long Island Sound - **Juan Sebastian Mafla**, *College of Staten Island*

High mortality across aquatic populations is associated with hypoxia, which typically occurs when dissolved oxygen (DO) falls below 3 mg L-1. Despite advances, hypoxia remains a concern in the Long Island Sound (LIS).

This project sheds light on DO dynamics in the Western LIS during summers from 2003 to 2015. Data was collected by the Interstate Environmental Commission. Temporal analysis shows DO concentration mirror temperature trends of the summer season. Time series analysis shows mean DO increased in the observed time period. Notably, 2004 mean DO was lowest at 3.9 mg L-1, while 2014 mean DO was highest at 6.2 mg L-1 ($\bar{X}$ = 5 ± 0.6 mg L-1). This suggests an improvement in environmental conditions in the Western LIS.

Restoration of Coastal Meadows at Stratford Point, CT: Is Native Plant Seeding the Best Method? - **Adeline DeStasio**, *Sacred Heart University*

Coastal grasslands/meadows are important for the maintenance of our native pollinators. Restoration ecologists often use commercial seed mixes to restore or enhance flowering plant biodiversity. The focus of our study is to measure the success of seed mixes to establish native plant diversity three years after seeding a ~1000 sq. meter plot on Stratford Point, CT. It was hypothesized that both the diversity of native plant species and pollinators would increase at the site. The flowering plants attracted 32 Hymenoptera and 43 Lepidoptera species. Of the 42 species used to seed the area, only 14 remained in the meadow by the third year after seeding. Annual maintenance is imperative to control non-natives and to increase the survival of native flowering plants.

Mapping and Characterization of Long Island Sound Coastal Wetlands Using Synthetic Aperture Radar and Optical/IR Satellite Imagery - **Brian Thomas Lamb**, **Maria Tzortziou, Kyle McDonald,** *City College of New York & CUNY Graduate Center*

Situated at the terrestrial-estuarine interface, tidal wetlands influence and are influenced by numerous geophysical and biological processes in adjacent regions, both terrestrial and aquatic. Tidal wetlands have profound impacts on carbon and nutrient cycling, hydrology, and geomorphology in coastal regions. Accurate characterization of ecosystem parameters in these tidal wetland systems is key for understanding how tidal wetlands are influenced by the upstream watershed and how they interact with connected estuaries. In this research effort, we use synthetic aperture radar (SAR) and optical satellite imagery to map the extent of tidal wetlands in the coastal northeastern United States with a particular focus on the Long Island Sound. In addition to mapping wetland extent, we present findings on the use of satellite imagery to characterize wetland vegetation communities and inundation dynamics. We note key differences between different forms of satellite imagery and how these different, yet complementary, forms of imagery can be fused to produce operational products for monitoring tidal wetlands of the Long Island Sound and the greater coastal northeastern United States.

Microbial Degradation and Bioavailability of Marsh-Exported Colored Dissolved Organic Matter in the Long Island Sound - **John Supino**, **Liz Corbett, Brice Grunert, Maria Tzortziou,** *City College of New York*

The Long Island Sound is one of the world's most urbanized estuaries, polluted from excess nutrients, which impact the quality of water through increased biological productivity. Dissolved organic mater is a sensitive indicator of anthropogenic pollution and nutrient enrichment in coastal waters. Bacteria produce and consume DOM, however spatial and temporal dynamics in the microbial availability of DOM derived from different sources in estuarine systems are not well characterized. We completed 25-day incubations of water collected from upriver, marsh, and estuarine sites in different seasons to assess variability in DOM bioavailability across the Long Island Sound. Preliminary results show the refractory nature of wetland exported humic-rich and highly aromatic DOM, and preferential microbial consumption of protein-like DOM across seasons.

Analysis of Bacterial Community Dynamics Related to Water Quality Along Environmental Gradients Within the Lower Hudson River Estuary - **Roman Reichert**, *Queens College City University of New York*

The 153 mile stretch of the Hudson River Estuary from river mouth near the New York City Battery to the lock at Waterford, north of Albany, represents a diverse and variable environment. Conditions range from highly saline to

freshwater and has mixtures of land use from highly urban to rural. DNA was extracted from water samples taken along the river in 2014-2017 during both wet and dry weather. DNA sequences have been analyzed to understand how the Hudson's bacterial microbiome changes structure according to environmental factors including salinity, runoff and sewage influence. Multi-ordinate analyses are used to help identify combinations of environmental variables that can be used to understand the dynamic bacterial community of the Hudson River Estuary.

Comparing Urban Stormwater vs Combined Sewage as Sources of Microbial Pollution to Flushing Bay - **Gregory O'Mullan**, **Angel D. Montero, and Roman Reichert,** *Queens College City University of New York*

Many of New York City's waterways are influenced by both sanitary sewage from combined sewage overflow (CSO) and urban stormwater. While water quality management efforts have primarily focused on CSO pollution (e.g. large scale CSO Long Term Control Plans), municipal separated stormwater sewer systems (MS4) have recently been permitted in New York City, making direct stormwater release increasingly a target for management intervention. Fecal indicator bacteria, commonly used in water quality monitoring programs, are found to be highly elevated in both CSO and urban stormwater. In this study, the microbial composition of both stormwater and CSO sources into Flushing Bay were characterized using high throughput 16S rRNA gene sequencing and the influence of these two sources on the water quality of the Flushing Bay is examined following wet weather periods. Our data support the importance of controlling both sources of microbial contamination to this impaired waterway, but also suggest that commonly used cultivation based fecal indicators may be decoupled from the broader fecal microbe community they are used to represent.

The Urban Street Surface as a Source of Fecal Bacteria to Coastal Waterways - **Angel D. Montero and Gregory O'Mullan,** *Queens College City University of New York*

New York City waterways are significantly impacted by Combined Sewer Overflows and stormwater runoff. As plans to reduce CSO discharges are implemented and take effect, the contribution from stormwater discharge become more significant. In our study, stormwater samples and dry-weather swabs were enumerated for fecal indicator bacteria and their microbial community characterized via Illumina sequencing. Fecal indicator bacteria were detected in urban streets, and in all stormwater, samples exceeded concentrations >100X governmental thresholds, indicating that the urban surface acts as a reservoir for FIB that can be mobilized by precipitation. Also, a novel anti-microbial column was tested which reduced FIB in stormwater and urban embayment water by >100x while allowing rapid (>5L/min) flow rates through the column. These findings have relevance to the management of urban water quality and the development of MS4 permits.

Optical Characterization of Water Quality in the Long Island Sound - **Alana Menendez**, **Brice Grunert, Maria Tzortziou,** *City College of New York*

Human populations are disproportionately located in coastal zones, resulting in water quality issues including harmful algal blooms and hypoxia that are exacerbated by climate change. Throughout the U.S., management programs have been enacted to decrease nutrient inputs into coastal waters in an effort to combat these impacts. However, tracking the effectiveness of these management endeavors across space and time is difficult and costly, particularly in urban estuaries, where changing demographics, industrial activities, and waste management combine with natural fluctuations in delivery of nutrients and organic matter fueling eutrophic conditions. Satellites provide a means for tracking changing conditions, provided regionally-tuned algorithms accurately retrieve relevant water quality parameters. Beginning in the fall of 2017, optical and chemical water samples have been collected and analyzed across the Long Island Sound and along its major river-to-estuary transects. These datasets provide the foundation for the development of new algorithms for this system that are capable of mapping chlorophyll-a and carbon cycling, allowing us to capture seasonal and inter-annual variability. Results show promise for retrieving these parameters across a variety of satellite platforms, which will allow us to better characterize Long Island Sound water quality and its anthropogenic perturbations.

Pigment Concentrations and CDOM Absorption Coefficients Estimation From in Situ and Satellite Ocean Color Measurements for Coastal Waters - **Guoqing Wang**, *CCNY, Columbia University*

Phytoplankton pigments and the colored dissolved organic matter (CDOM) are key indicators of the biogeochemical state and the water quality of coastal waters. Yet, the accurate simultaneous estimation of them from satellite ocean color measurements have been scarce for coastal waters. Here, a semi-analytical algorithm was used to obtain the pigment concentrations and CDOM absorption coefficients from in situ and satellite ocean color measurements. The algorithm performance was validated with the IOCCG synthesized dataset and matched field data for pigment concentrations, CDOM spectra and remote sensing reflectance at MERIS bands. The mean unbiased absolute percentage difference (MUAPD) for CDOM is 29%, and pigment concentrations of 39%, 44%, 63%, 57% and 61% for chlorophyll a, b, c ([Chla], [Chlb], [Chlc]), photoprotective and photosynthetic carotenoids (PPC, PSC). The accuracy of CDOM and pigment concentrations are comparable to those previously reported for satellite and in situ retrievals in less optically complex offshore waters. Application of this semi-analytical algorithm to the seasonal MERIS imagery over the Long Island Sound allowed, for the first time, to capture the spatial gradients, seasonal variability, and year-to-year changes in phytoplankton group composition and water quality associated with riverine inputs, marsh export, and extreme precipitation events.

Satellite Ocean Color Observations from NASA's PACE Mission: Addressing Environmental Challenges and Enhancing Environmental Management Decisions - **Maria Tzortziou[1]**, Ali Omar[2], Woody Turner[3], [1]*NASA Goddard Space Flight Center, and City College of New York,* [2]*NASA Langley Research Center,* [3]*NASA Headquarters Applied Sciences Program*

With advanced global remote sensing capabilities that include global hyper-spectral imaging, extended spectral coverage to the UV and SWIR, and improved spatial coverage, NASA's PACE (Plankton, Aerosol, Could, ocean Ecosystem) satellite mission is expected to provide high quality observations that, over the long-term, will contribute to an extended time series of records on inland, coastal, and ocean ecosystems—all of which have substantial value beyond basic science and research. Here we discuss the combination of climate-quality, global atmospheric and oceanic observations provided by the PACE mission and their application towards addressing environmental challenges and enhancing environmental management decisions in inland, coastal and marine ecosystems.

Satellite Tracking of Juvenile Green, Loggerhead, and Kemp's Ridley Turtles From Rehabilitation Centers in southern New England and Long Island, USA - **Nathan J. Robinson[1], Kayla Deguzman[2], Lisa Bonacci-Sullivan[3], Robert DiGiovanni[4, 5], Theodora Pinou[2]**, [1]*Cape Eleuthera Institute,* [2]*Western Connecticut State University,* [3]*New York State Department of Environmental Conservation,* [4]*Atlantic Marine Conservation Society,* [5]*The Riverhead Foundation for Marine Research and Preservation*

The northeast coast of the USA hosts important seasonal foraging habitats for several species of sea turtle, including green (*Chelonia mydas*), loggerhead (*Caretta caretta*), and Kemp's ridley (*Lepidochelys kempii*) turtles. However, seasonal declines in water temperatures in the post-summer months means that most turtles must move to warmer waters either further south or off-shore to avoid the risk of becoming cold-stunned. This is especially important for small juveniles that are more sensitive to temperature changes than their larger counterparts. Several organizations dedicate substantial resources to rehabilitating these cold-stunned turtles, yet the real conservation impact of these efforts depends on whether these rehabilitated animals can resume typical foraging and seasonal migratory behavior.

To assess whether cold-stunned sea turtles are able to resume typical behavior after rehabilitation, we deployed satellite transmitters onto 12 green (curved carapace length: 25 – 59 cm), 7 loggerhead (curved carapace length: 18 – 70 cm), and 12 Kemp's ridley (curved carapace length: 25 – 39 cm) onto turtles that were initially found cold-stunned in the water's of Long Island Sound and then released the subsequent summer from a nearby

location. To remove spurious locations from the 4791 daily locations generated by the 31 tracked sea turtles (averaging at 154 tracking days per turtle), we used speed filter than removed all locations that required a movement speed exceeding 100 km d-1 to all tracks. We then used a Hierarchical Bayesian State Space model to further smooth the tracks and provide daily position estimates. Binned dive depth and duration summaries were also provided by 15 of the 31 satellite transmitters.

The movement patterns of all three different species were roughly comparable, with individuals initially moving south local water temperature begin to decline between September – October. While moving south these animals would remain within 200 km of the USA coastline until reaching the Gulf Stream around North Carolina. Although some individuals of each species continue to follow the coastline south and into habitats in Florida, others following the prevailing Gulf Stream into the open ocean. These individuals following the Gulf Stream exhibited meandering movements that were clearly associated with the presence of large mesoscale eddies.

Considering the similarity between the movements of these animals and wild-caught, non-rehabilitated turtles in these habitats, we conclude that cold-stunned animals appear to be able to resume typical behavior after being released. Moreover, if rehabilitated turtles show similar movement patterns as non-rehabilitated animals, satellite tracking of cold-stunned turtles could be a logistically straightforward alternative for studying the movements of wild-caught turtles.

An Interactive Application for Tracking the Movement of the *Limulus polyphemus* throughout Long Island Sound (LIS) - **Ismael Youssef**, *Valhalla High School & Sacred Heart University*

The American Horseshoe Crab, *Limulus polyphemus* is an economically and ecologically important species in LIS. However, the population is not managed collaboratively by NY and CT. Hundreds of citizen scientist volunteers, organized through Project Limulus, tagged and reported re-sightings of horseshoe crabs on both sides of the Sound since 1998. Coding language R was used to map the movements of ~14,000 horseshoe crabs. LIS was divided into five regions to help analyze the data to understand how often the horseshoe crabs left the area in which they were originally tagged. An interactive application was made to allow researchers/managers to change the parameters of these maps to better understand movement patterns and help produce a comprehensive management plan for the species.

Living Shorelines: the Good, the Bad and the Ugly - **Benjamin Miller**, *Sacred Heart University*

Living shorelines may be composed of both live plants and hardened structures like rocks or cement to act as wave attenuation structures. At Stratford Point, Connecticut we have learned that wave attenuation is important for marsh restoration success in areas of high wave energy due to wind and storm events. A living shoreline model was used in designing: 1) low marsh (reef balls and *Spartina alterniflora*), and 2) high marsh (loose oyster and slipper shells, large anchored woody debris, and S. patens) areas. Preliminary results, using Cera-Diver pressure sensors, revealed 30-40% wave height reduction by reef balls. Loose shell proved less effective. Assessments of the effectiveness of these different methods are crucial to evaluate and produce a cost-effective management plan.

Lagrangian Circulation and Connectivity in Long Island Sound - **Han Sun**, *Stony Brook University*

This study relates to the effects of hydrodynamic exchange on the connectivity of perimeter habitats; it was motivated by the need for a description of connectivity between coastal embayments, within LIS, some of which exhibit periodic blooms of toxic *Alexandrium fundyense*. It elucidates the influence of the complex tidal residual Eulerian current field in LIS, consisting of estuarine gravitational circulation interacting with tidal residual eddies associated with topography and coastal morphology, on long term water parcel movements. The methodology involves use of the hydrodynamic model (ROMS) and a particle tracking model which can represent the effects of vertical mixing (LTRANS) to compute particle trajectories.

Is Desiccation an Ecologically Important Threat to *Hemigrapsus sanguineus* (Asian shore crab)? - **Lara Pratt, George Kraemer,** *Purchase College*

The Asian shore crab, *Hemigrapsus sanguineus*, successfully invaded rocky intertidal communities in Long Island Sound. Success required tolerance of desiccation stress. Measurements of water loss of field-collected crabs were conducted during June-August. Laboratory experiments described the rate of water loss, and water loss at which death occurred. Further, *H. sanguineus* were desiccated (0%, 7.5%, 12%, 18.9% and 23.4% water loss), and the time to escape a stressful surface temperature (50 °C) was recorded. Field-collected crabs had lost 2-14% of their body water, while death occurred at 22-24% loss of body water. The time to escape dangerous heat stress decreased as a water loss increased to 16%, an adaptive functional response to moderate water loss. Overall, *H. sanguineus* avoids desiccation stress.

Panel discussion - Sediment-Water Column Connections
Panelists: **Wally Fulweiler, Craig Tobias, Penny Vlahos, Kamazima Lwiza**
Moderator: Jim Ammerman
Diplomatic Ballroom

The three Long Island Sound Study research projects funded through Connecticut and New York Sea Grants in 2015 all focused on related aspects of sediment-water column connections. The three Principal Investigators (PIs) were Dr. Mark Altabet of the University of Massachusetts, Dartmouth, Dr. Wally Fulweiler of Boston University, and Dr. Craig Tobias of the University of Connecticut. Dr. Altabet is currently out of the country but his project will be summarized by Dr. Tobias. Drs. Kamazima Lwiza of Stony Brook University and Dr. Penny Vlahos of the University of the University of Connecticut, who have conducted related research in Long Island Sound, will also join the panel. The projects measured nitrogen fluxes, sediment oxygen demand, and stable isotopes, along with other parameters. Sea Grant also made significant efforts to help the PIs coordinate their projects. The panel will briefly summarize their projects, answer questions from the moderator and each other, and then take questions from the audience.

Invited Plenary - Realistic Ocean Modeling for Applied Science Problems in the Pacific Northwest
Dr. Parker MacCready
University of Washington, School of Oceanography

The Pacific Northwest is part of a coastal upwelling region where nutrients from the ocean fuel high primary production, resulting in valuable fin- and shellfish fisheries. Estuaries, especially the large fjordal system of the Salish Sea where Puget Sound is located, are an essential part of this ecosystem. However, the upwelled water is also naturally low in oxygen and relatively acidified, leading to serious problems for shellfish. These problems are made worse by human contributions in some bays near cities, and more generally though increased atmospheric CO2. In addition there are Harmful Algal Blooms and invasive species. In this talk I will share some experiences using realistic numerical ocean models to help understand and respond to these problems.

The LIS Respire Program

Investigators: Penny Vlahos, Jamie Vaudrey, and Michael Whitney, University of Connecticut

Gaining a better understanding of how oxygen is being used in the water column of Long Island Sound will inform decisions that seek to avoid hypoxia and manage the estuary sustainably amidst coastal population growth and shifting climate. The research team will sample 10 sites across the Sound. The Connecticut Department of Energy and Environmental Protection's monitoring vessel *John Dempsey* will provide access for the project. Components of the respiration process that will be quantified include: organic matter degradation rates, nutrients, oxygen, carbon dioxide and controlling variables including pH, alkalinity and temperature. The field sampling will occur in different seasons and at various locations, allowing the timing and location of respiration rates to be predicted.
This project builds on analyses of carbon balances in the Sound being conducted by the investigators and will help develop a more detailed biogeochemical understanding to enhance Long Island Sound management.

Water Column O2 Respiration – Rates, Distribution, Drivers and Elemental Stoichiometry

Investigator: Craig R. Tobias, University of Connecticut

Western Long Island Sound is the area of the Sound most vulnerable to low oxygen (hypoxic) conditions. The investigator will deploy automated respiration chambers at locations throughout the western Long Island Sound, including in the Bronx at Throgs Neck where the East River enters the Sound, and along the gradient of the Connecticut River plume, the largest source of non-urban freshwater and nutrients to the Sound. These devices will measure respiration and net ecosystem production at the above locations chosen for their differences in organic matter sources and composition, a major driver of these processes. The researcher will incubate parallel samples on board the research vessel to compare with measurements from the automated respiration chambers and provide additional information. The results will address hypoxia by increasing our understanding and the predictability of how respiration responds to management actions.

Eliciting and Modeling Residential Lawn and Landscape Practices: Systematic Information to Assess Knowledge, Explicate Behavior and Inform Management across the LIS Watershed

Investigators: Robert J. Johnston, Clark University; Peter Groffman, City University of New York; and Colin Polsky, Florida Atlantic University

The ecological impact of residential lawns exporting nutrients from fertilizer into Long Island Sound (by runoff into storm drains and rivers or by infiltrating into the groundwater) is significant. Currently, there is no clear understanding of the most effective means to reduce harmful lawn care practices across the Long Island Sound watershed. The research team will study and explain how different homeowner behaviors influence nitrogen export and stormwater runoff, and will evaluate the effectiveness of programs and policies designed to encourage less polluting lawn care and landscaping practices. The team will develop a model of lawn care practices around the watershed, and survey over a thousand households across New York and Connecticut portions of the watershed. Using this survey data and direct observation of lawns in the watershed, the team will forecast behavioral changes from management interventions in differing scales at a variety of locations.
At the conclusion of the study, the researchers will engage with stakeholders to explore implications for policy and program development to reduce the environmental impacts of lawn care in the Sound.

Refined Integration of Remote Sensing with Biological parameters for improved management of Long Island Sound Water Quality

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The research team will address the challenge of gathering data from satellite images of Long Island Sound. Like many similar highly populated estuaries in the world, the Long Island Sound suffers from water quality problems, including high loadings of nutrients, hypoxia, and recurrent harmful algal blooms. Satellite observations give environmental monitors and water resource managers the ability to observe changes in water conditions across large areas not feasible with field-based monitoring alone. However, determining water composition and identifying which bloom-forming phytoplankton species are in the Sound from space has been a challenge. This study proposes to develop new remote sensing products to improve our knowledge of the Long Island Sound ecosystem parameters that are critical for management.