**Long Island Sound Study (LISS) Science & Technical Advisory Committee (STAC)**
**6/16/2017**

**In Attendance:**

**STAC Members:** James Ammerman, John Connolly, Hans Dam, Charles DeQuillfeldt, Stuart Findlay, Jason Grear, David Lipsky, Darcy Lonsdale (NY Co-chair), Kamazima Lwiza, Robin Miller, James O'Donnell (CT Co-chair), Suzanne Paton, Kelly Streich, Mark Tedesco, Johan Varekamp, Jamie Vaudrey, Penny Vlahos, Howard Weiss, Robert Wilson

**Others:** Cassie Bauer (NYSDEC/LISS), Nancy Balcom (CTSG), Heidi Dierssen (U. Conn.), Syma Ebbin (CTSG), Peter Linderoth (Save the Sound), Chris Mecozzi (EPA), Alison Staniec (U Conn.), Craig Tobias (U Conn.), Mike Whitney (U Conn.)

**On the Webinar:** Carmela Cuomo, Evelyn Powers, Charles Yarish

**Jim O'Donnell (CT) Co-Chair, opened the meeting at 9:15 AM**: Jim Ammerman went over meeting logistics and noted that the meeting was also available by webinar.

**Heidi Dierssen (U. Conn.): "***Remote sensing of chlorophyll and SST in Long Island Sound".* Heidi Dierssen described results from a recent remote sensing project supported by EPA's Climate Ready Estuaries program. The goal was to acquire and process satellite imagery for Long Island Sound, especially for chlorophyll (chl) and sea surface temperature (SST). Particle backscattering was also examined, particularly to determined what drives changes in it. Ultimately these parameters (and others) could be examined going back in time to look for evidence of climate change and responses to nitrogen management. She noted that LIS is optically complex, and that most open ocean remote sensing algorithms fail in such systems, particular due to interference from colored dissolved organic matter or CDOM. Therefore, new algorithm development is needed. Fernanda Henderikx Freitas, a postdoctoral researcher from the University of California, Santa Barbara, carried out much of this project under the supervisions of Dr. Dierssen. The data sources for this project included the AERONET (AErosol RObotic NETwork) station off Northport, Long Island, which provides ground-based remote sensing aerosol information; CT DEEP monitoring information for both chl and SST; chl from MODIS (AQUA) and MERIS satellites; and SST from TERRA and AVHRR satellites. To avoid CDOM absorption, remote sensing reflectance from in situ AERONET data was matched with satellite data at red wavelengths. Using both MODIS and MERIS satellite information, the spring and summer/fall chl maxima found in the CT DEEP monitoring data could be replicated by estimating the height of the reflectance peak using the MERIS 709 nm channel from November through May, and the height of the fluorescence peak at 678 nm (MODIS) or 681 nm (MERIS) between June and October. Satellite SST closely matched CT DEEP data, with warmer waters in the western Sound, and there was tendency for warmer winters to exhibit smaller spring blooms. Chl over the Sound declined about 3% per year, but variability was large. Changes in particle backscattering were largely determined by surface wind waves and not river discharge. Overall results were encouraging and suggest further investigations, including using data from new satellites. Discussion included caution in interpreting trends in chl during the period evaluated, but encouragement to segment trend evaluations among the WLIS, CLIS, and ELIS basins. There also was a suggestion to review the suspended sediment signals in 2011 for signs of Tropical Storm Irene, which delivered a huge sediment pulse to LIS.

**Suzanne Paton (USFWS):** Suzanne was asked to give a brief update on the plans for eelgrass survey overflights in eastern LIS supported by the LISS, the first since 2012. She outlined the survey requirements for flying in the morning at low tide with light wind and no rain in the last three days. The survey will include five transects and the pixel resolution is 0.3 m. The next flight window is June 28 and other dates ongoing. Images and raw data will be posted and there will be satellite data as well.

**Craig Tobias (U. Conn.): "**Sediment-water nitrogen fluxes in Long Island Sound". Craig described information from both a past study on Niantic Bay as well as a current related Sound-wide study. Both were funded by the LISS through CT and NY Sea Grants and his current project was informed by the previous one. His studies addressed LIS sediment inventories and turnover, measured season sediment-water exchange of key N, C, and $O_2$ parameters, determined seasonal sediment N removal and recycling rates, and evaluated geochemical proxies to predict sediment N retention. The overall goal is to determine the importance N supply from the sediments to the water column, with secondary goals of identifying processes important to models as well as developing mass balance and rate constraints and also proxies useful for models. Some of the major N removal and recycling processes studied include denitrification, anammox (anaerobic ammonium oxidation), and DNRA (dissimilatory nitrate reduction to ammonium), as well as nitrification and sediment-water N fluxes. Measurements were made at the locations of the LISICOS buoys, and there was generally a gradient from west to east. Craig found high ammonium in the porewater, especially in the Western Sound, where it was also closer to the surface. Dissolved inorganic nitrogen turned over quickly, comparable to sediment oxygen demand (SOD) rates of 150 – 300 umoles $O_2$ $m^{-2}$ $hr^{-1}$. The highest denitrification rate was at the ARTG buoy site in the Western Sound, which may have been increased by active bioturbation. Denitrification was also closely coupled to nitrification throughout the Sound, from almost 70% in the west to nearly 100% in the east. Overall, the net nitrate flux was larger than denitrification, but denitrification exceeded DNRA by several times, increasing to the east.

**Jim O'Donnell (U. Conn.): "**Update on new LISICOS acidification and nutrient sensors". Jim O'Donnell provided a brief update on the new sensors on the WLIS buoy. These new sensors include nutrients (nitrate, ammonium, and phosphate) at the surface and $pCO_2$ and pH at the bottom. The nitrate, $pCO_2$ and pH sensors are working well, as the data showed. However, the phosphate sensor has a problem with its filter, automated nutrient measurements in estuaries generally are challenging due to low concentrations, turbidity, and biofouling.

**Penny Vlahos and Mike Whitney (U. Conn.): "**Nutrient and carbon fluxes through Long Island Sound". Penny and Mike did tag-team talks to describe the results of a current project supported by CT Sea Grant which is focused on Eastern LIS. They also mentioned a new related project in Central and Western LIS which is just beginning and is supported by LISS. A major question addressed by their work is whether LIS is autotrophic or heterotrophic, does it import or export organic carbon? They used carbon and nitrogen monitoring data from CT DEEP, and paired it with physical observation and ROMS modeling to determine fluxes. They found that the CT DEEP data for carbon and nutrients was generally very good, with the exception of the dissolved organic carbon (DOC) data prior to 2008 which was too high. Since the method was changed the problem has disappeared. Carbon and nitrogen exhibit clear gradients decreasing from west to east in LIS. There is also both interannual and tidal variability in these parameters but they are nonetheless able to detect major interannual changes. Penny and Mike segmented LIS into the Eastern, Central, and Western Sound and determined the biogeochemical mass balances of the different segments. Whether or not LIS was autotrophic or heterotrophic depended very much on the river flow rate. In low-flow years the Sound was heterotrophic and imported organic carbon from the shelf (15% of the time), in high-flow years the Sound was autotrophic and exported organic carbon (35%), and in mid-flow years the Sound was heterotrophic but exported organic carbon (50%). Much of this study will be described in an article in a special issue of *Limnology and Oceanography* in 2017 which covers the aquatic continuum from headwaters to oceans.

**Mark Tedesco (EPA), Director of the Long Island Sound Office:** “Long Island Sound Study program updates, budgets, and plans”. The total anticipated LISS budget for FY17 is $8.6 million, a significant increase over last year. The FY18 LISS budget which starts October 1, 2017 is still under consideration by Congress. The projects approved for funding in FY17 are listed below:

| Activity | Amount | Notes |
|---|---|---|
| Submitted Base Proposals | $4,261,985 | |
| Submitted non-base proposals | $747,673 | Except the NPS tracking tool |
| LIS Futures Fund | Increase by $1 million | |
| Forward Fund Staff | ~ $600,00 | |
| Blue Plan proposal | $200,000 | |
| Stewardship acquisitions | $685,000 | NYDEC Conscience Bay property |
| Eutrophication modeling | $1.0 million | Fund through NYC or NY/CT Sea Grants (potentially add another $400,000 to this from research request in base budget) |
| SLAMM analysis | Likely <$100,000 | Support phase 1 of CTDEEP SLAMM analysis to identify future acquisitions |

There will be significant funding ($1.0-$1.4M from the LISS) for an enhanced LIS eutrophication model and data calibration, probably in partnership with New York City Department of Environmental Protection (NYCDEP). Discussions are currently ongoing to write a proposal to support development of the scope of work by a contractor with the assistance of a technical advisory committee. The solicitation phase for actual modeling proposals would begin by January 2018, an RFP would be released by July 1st, 2018, and the award phase could take 18 months (the award would be issued in January 2020). This effort would be broken up into 4 tasks – water quality (20%), hydrodynamic model (30%), graphical user interface (10%), and calibration of the model (40%). The total cost is estimated at $6-10 million and it would take 2-3 years to complete. If the NYC award process takes too long, there is also an option to fund this effort through a different mechanism, such as NY/CT Sea Grants. The regular LISS contribution to research that is funded through NY/CT Sea Grants is likely to be delayed for a year.

**STAC Panel Discussion (Jim O'Donnell, Craig Tobias, Penny Vlahos, and attendees):**
Themes:

Respiration, Water Column vs sediments

1. Water column respiration is dominant 4-10x, should we worry about sediment respiration?, water column should probably be the focus
2. Only sediments do N removal by denitrification (why no WC denitrification?)
3. Constrain respiration with surface $CO_2$ sensors
4. Past respiration rates were 10x production measurements, are the latter reliable?
5. In situ respiration measurements (with temperature and salinity?)---
   End of summer/early fall, organic matter respiration high in sediment when oxygen available, but sediment ammonium is high and flux low (fall plankton bloom, high anaerobic breakdown with DO of 7, production of ammonium and sulfide) see details in Synthesis Book
6. Boston Harbor example suggests sediment N reservoirs will burn out in a few years, large inventory in LIS, but rates are relatively low in initial measurements (more to come)
7. O2 isotope fractionation by water column DO utilization, what are major impacts and source of error?
8. DO-production-respiration, horizontal transport and benthic exchange are secondary
9. Constrain respiration in important locations and address drivers
10. Respiration rates are OK and coherent with others, but factors by which they are multiplied are poorly understood

N and carbon, refractory vs. labile

1. What is carbon source for hypoxia?
2. Refractory vs. labile carbon, different impacts on oxygen
3. Allochthonous carbon more refractory
4. Sediment traps problematic in LIS, use carbon burial rates instead

5. C and N residence times in sediments?

Modeling and measurements

1. Link N discharges to hypoxia
2. Need early discussion and clear coordination between modelers and experimentalists, should drive each other; will need to prioritize order of additional measurements to support modeling
3. Respiration rates from bottle measurements are possibly 2-4x SWEM
4. SWEM has a detailed sediment nutrient flux model, similar to the Chesapeake Bay model. Most other eutrophication modeling codes/frameworks available do not.
5. EFDC and other available eutrophication model codes/frameworks are similar to SWEM in the water column, differing in the number of algal assemblages and zooplankton grazing.
6. Kamazima Lwiza's bacterial model, delay mechanism related to carbon lability, important for DO
7. Measure twice, model once, 6X?
8. Do models and data agree, good data needed
9. Chlorophyll a to carbon, discriminate between good and bad models, biology and boundary conditions

Phytoplankton, Zooplankton, and Bacteria

1. Bacterial activity-can bacterial dynamics explain variation in respiration?
2. Phytoplankton production and flux to bottom
3. Time series measurements of phytoplankton and zooplankton

**Meeting was adjourned at 2:30 PM**