longislandsoundstudy

Long Island Sound Study (LISS)
Science & Technical Advisory Committee (STAC) 2/23/2018

In Attendance:

STAC Members: James Ammerman, Ebru Unal (for Paul Anderson), Chester Arnold, Vincent Breslin, Sarah Crosby, Hans Dam, Stuart Findlay, Senjie Lin, David Lipsky, Darcy Lonsdale (NY Co-chair), John Mullaney, Suzanne Paton, James O'Donnell (CT Co-chair), Danielle Alexander (for Evelyn Powers), Julie Rose, Kelly Streich, Mark Tedesco, Craig Tobias, Jamie Vaudrey, Penny Vlahos

Others: Mark Altabet (U Mass.), Mike Bradley (URI Environmental Data Center), Holly Drinkuth (CAC Co-chair, TNC), Syma Ebbin (CT Sea Grant), Wally Fulweiler (Boston University), Peter Linderoth (Save the Sound), Matt Lyman (CT DEEP), Kevin O'Brien (CT DEEP), Katie O'Brien-Clayton (CT DEEP),Tom Shyka (NERACOOS), Paul Stacey (Footprints in the Water, LLC), Mike Whitney (U. Conn.)

On the webinar: Cassie Bauer, Anthony Dvarskas, Kristin Kraseski, Anne McElroy, Robin Landeck Miller

Darcy Lonsdale (NY) Co-Chair, opened the meeting at 9:15 AM: She conducted an election for STAC CT Co-chair in which Jim O'Donnell was reelected.

Wally Fulweiler, Boston University: *"Quantifying benthic-pelagic coupling in Long Island Sound".* Wally described preliminary results of the benthic-pelagic coupling and the flux measurements she made at the five LISCOS buoy locations, including sediment oxygen demand, denitrification (N_2 and N_2O), and dissolved inorganic nutrients and related measurements. Sediment oxygen demand decreased from west to east, and net sediment N_2 flux could account for about 10% of total inputs. Nitrous oxide flux was maximal at the ARTG location where nitrogen fixation was also measured. N_2 flux measurements were also made before and during hypoxia in 2017. While the pre-hypoxia N_2 fluxes removed 22% of total N (nitrogen) inputs, hypoxia shut this flux down. Wally concluded by discussing oligotrophication, the decrease in estuarine and coastal nutrients as a result of management actions and/or climate change. She used the examples Narragansett and Waquoit Bays, where it may be occurring, and posed the question as to whether it is happening in Long Island Sound because of the N reductions.

Craig Tobias, U. Connecticut: *"Biogeochemical Nitrogen Loss vs. Recycling in Long Island Sound: Connecting Sediments to Overlying Water".* Craig's project assessed LIS sediment N inventories and turnover processes with the goal of establishing geochemical proxies applicable to larger space and time scales and able to parameterize models. He focused on the in-situ N removal rates, denitrification and annamox, as well as the retention processes, DNRA (dissimilatory nitrate reduction to ammonium), mineralization, nitrification, and DIN (dissolved inorganic nitrogen) sediment-water fluxes. He took sediment cores at the sites of the LISICOS buoys and incubated them with tracers or measured fluxes. Sediment pore waters had high ammonia inventories, approximately 5 to 10 million kg N compared to the annual loading of 40 million kg, with higher concentrations closer to the surface in the western sound. In general net nitrate fluxes from the sediment were greater than denitrification, which was much greater than DNRA. Annamox was also much smaller than denitrification, and its importance requires further assessment. Total denitrification was estimated at 6 million kg per year, was higher at higher water temperatures, and was largely coupled with nitrification. No samples were collected at DO concentrations less than 3 mg/l (hypoxia), where denitrification would be expected to decline. If 5 million kg of N is exported, and 10-18 million kg buried, then a quarter to half of the annual N loading to the Sound is still unaccounted for.

Mark Altabet, U. Massachusetts: *"Nitrogen loading and oxygen dynamics in LIS using stable isotope geochemistry".* Mark discussed his work on variations in natural abundance stable nitrogen and oxygen isotopes in Long Island Sound. It is motivated by the decrease in N loading from wastewater treatment plants in LIS as well as the historical record of $\delta^{15}N$ in LIS sediment cores. CT DEEP data shows a progressive increase in nitrate concentrations following fall overturn in LIS, with a strong gradient increasing from east to west. $\delta^{15}N$-nitrate was highest in the central Sound, with decreasing values to the west due to high ammonia concentrations and decreasing values to the east due to exchange with the ocean. Sinking particulate organic matter also had high $\delta^{15}N$ and was the source signature for the sediments. Exploratory studies were also conducted on dissolved organic nitrogen concentrations in LIS and their $\delta^{15}N$ signatures. Additionally, oxygen concentration and the dynamics of oxygen isotope $\delta^{18}O_2$ were examined in LIS. There was a divergence in $\delta^{18}O_2$ isotope values between surface and bottom waters.

Panel Discussion with Previous Speakers (Fulweiler, Tobias, and Altabet): There was a general discussion after these three talks relating to the major issues of nitrogen, sediments, and hypoxia in the Sound. Results showed that two different denitrification methods gave similar results, which is encouraging, but it appears that denitrification can remove only 10-15% of the N loading. There was evidence of N fixation in some sediments, even in the presence of high sediment ammonium concentrations, but this needs to be confirmed by other methods. Many of the measurements discussed are time-consuming and therefore limited to few samples. There is a need for simpler methods and proxies which can be more widely applied on survey cruises. Sediment oxygen demand (SOD) is currently one of the best signals and should be more widely compared to N fluxes. In addition, most of these measurements have been made at deeper depths, there is a need for more measurements at shallower near-shore locations. N loading, chlorophyll *a*, primary production, and hypoxia in LIS all show at least some evidence of declining, however, there is a lot of legacy N in the system and climate factors can also confuse the picture. In order to decrease the large amount of sediment N, it has to be either buried or denitrified, though as mentioned above, denitrification rates are relatively low. Declining N loading is probably decreasing dissolved inorganic nitrogen (DIN) and hypoxia but dissolved organic nitrogen (DON) may be increasing. LIS has early spring blooms, how important are they to hypoxia compared to the summer phytoplankton production? Also, what is the role of the small phytoplankton, are they part of the food chain or do they just settle out? After the investigators further compare their data, what will these three studies tell us about the current state of LIS, and what are the next steps?

Tom Shyka, NERACOOS: *"NERACOOS nutrient observatory".* Tom described the NERACOOS Nutrient Observatory recently installed in the Northeast and the Gulf of Maine. His presentation was focused on ways to increase stakeholder awareness and facilitating data usage in the Long Island Sound region. The instruments deployed include SeaBird Nitrate, Phosphate, and Ammonium sensors, though the Ammonium sensor is currently not supported by the manufacturer. One of the instrument locations is the Western Long Island Sound buoy. Tom described some of the challenges of maintaining instrument operations, including integrating with the mooring systems and interpretation of the data, as well as instrument fouling and future funding.

Mike Bradley, University of Rhode Island; Suzanne Paton, US Fish and Wildlife Service: *"Tier 1 2017 Mapping of Zostera marina in Long Island Sound and Change Analysis".* Mike discussed the 2017 LIS eelgrass survey and data analysis. This was a Tier 1 reconnaissance survey which followed previous surveys in 2002, 2006, 2009, and 2012. The aerial photography was obtained under optimal conditions on June 28th, 2017, with a 1-ft pixel resolution. The goals included a comprehensive survey, quantification of acreage, and a change analysis compared to earlier surveys. Field surveys and eelgrass delineations were conducted from June of 2017 through the end of the year and preliminary results were reported. In 2017, eelgrass in LIS was estimated to cover 1581 acres, a likely 12% loss from 2012 with an additional 11% of the 2012 area uncertain due to a lack of data (the total 2012 LIS eelgrass coverage was 2061 acres). A similar decline was seen in Rhode Island. More detailed Tier 2 mapping showed that the greatest losses (54%) were in Little Narragansett Bay and Niantic Bay, attributed to a die-off in 2012 due to high temperatures.

Kevin O'Brien, CT DEEP: *"Connecticut National Estuarine Research Reserve (NERR) Selection Process: 2018 LISS STAC Status Update".* Kevin discussed the site selection process for the planned Connecticut National Estuarine Research Reserve (NERR), a NOAA program. This reserve would be part of the national network of 29 reserves in nearly every coastal state. The drivers of NERR sites are people, science, and protected places; and the goals include system-wide monitoring and research, coastal training, and K-12 estuarine education. NERR sites are Federal-State partnerships which involve a multi-year site selection and approval process. Kevin has organized this process for CT DEEP with the collaboration of a steering committee and a site selection group representing a cross-section of Connecticut organizations. Four multi-site coastal complexes including locations in Western LIS, Central LIS, the lower Connecticut River, and Eastern LIS were evaluated in detail. The Eastern LIS site received the top rating of the four sites and is currently being further vetted by CT DEEP. Upon final selection, an Environmental Impact Statement and Management Plan will need to be developed before reserve operations can begin.

Jamie Vaudrey, University of Connecticut; Peter Linderoth, Save the Sound*: "LIS Report Card Update, revisiting nutrient criteria".* Jamie noted that the purpose of the Save the Sound report card is to reach the general public, not scientists or managers. It is a quick snapshot report of the water quality and ecosystem health of LIS. It does not address human health issues or details of monitoring or data needs. If desired, those interested can find a lot more information online at various partner websites. STS is reevaluating the indicators used in its Long Island Sound Report Card, which in 2015 included nitrogen, phosphorus, dissolved oxygen, chlorophyll *a*, and water clarity. In the 2016 Report Card, nitrogen and phosphorus were combined into a “nutrients” parameter, due to concerns that low ratings for phosphorus were exaggerating concerns about it when nitrogen is the real problem. The next Report Card will be released this summer and a series of potential indicators have been evaluated. An important new indicator that will be used in the Report Card is the annual average Dissolved Organic Carbon (DOC). DOC shows a clear relation with eutrophication in a variety of coastal environments and decreases from west to east in Long Island Sound. DOC scores have also been stable or improved (DOC concentrations decreasing) in most Long Island Sound basins between 2008 and 2016. Jamie agreed with the need to further examine the standard deviation for the average DOC concentrations within each region. Remaining tasks before issuing the Report Card include finalizing the indicator grading, addressing data gaps, and conducting quality assurance. Press events will be held in CT and NY. This year’s Report Card design will also address water quality trends over time in addition to the snapshot of past Report Cards.

Meeting was adjourned at 2:30 PM