Water Quality Monitoring Work Group
TEAMS Online Meeting
January 17, 2023 – Meeting Summary

Attendance

Jim Ammerman (Chair)—Long Island Sound Study (LISS)/NEIWPCC
Mary Arnold—New York State Dept. of Environmental Conservation (NYSDEC)
Lauren Barrett—University of Connecticut (UConn)
Chris Bellucci—Connecticut Dept. of Energy and Environmental Protection (CT DEEP)
Jordan Bishop—NEIWPCC
Melissa Duvall—EPA
Richard Friesner—NEIWPCC
Kaitlin Willig Giglio—Stony Brook University (SBU)
Dianne Greenfield—City University of New York (CUNY)
Gina Groseclose—United States Geological Survey (USGS)
Biswarup Guha—New Jersey Dept. of Environmental Protection (NJDEP)
Elizabeth Hornstein—NY Sea Grant
Gavin Jackson—CT DEEP
Kate Knight—CT DEEP
Ben Lawton—EPA ORISE
Peter Linderoth—Save The Sound (STS)
Bill Lucey—STS
Katie Lund—UConn
Kamazima Lwiza—SBU
Emily Marquis—CT DEEP
Michelle Lapinel McAllister-- Coalition to Save Hempstead Harbor
Jon Morrison—USGS
Esther Nelson—EPA
Katie O'Brien-Clayton—CT DEEP
Jim O'Donnell—UConn
Casey Personius—NYSDEC
Nancy Pierson—Suffolk County
Evelyn Powers—Interstate Environmental Commission (IEC)
Beau Ranheim—NY City Dept. of Environmental Protection (NYCDEP)
Joshua Rosen—USGS
Samarra Scantlebury –NYSDEC
Paul Stacey—Footprints in the Water
Kelly Streich—CT DEEP
Cayla Sullivan-- EPA, LIS Office
Mark Tedesco—EPA
Maria Tzortziou—CUNY
Samantha Wilder--IEC

Jim Ammerman started the meeting with a few announcements.

Recent pH Trends in the Sound and Coupling with Dissolved Oxygen Trends: Ben Lawton, EPA ORISE

Ben said that this project started with a data collection but evolved into an investigation of the coupling between pH and oxygen in the Sound. The pH data set was collected by CT DEEP at 46 stations going back to August 2010, a 12-year data set through August of 2022. Ben thanked those at CT DEEP who made the meta data available in addition to what was found on the Water Quality Portal. While not a long enough time series to see climate change effects, the 17 year-round stations are amenable to seasonal analysis and comparison with trends in dissolved oxygen at the same stations. These trends and the relationships between them were then compared to trends within other estuaries in published research. His talk outline listed the following: 1. Overview of Data Coverage and Limitations, 2. Overview of pH data for the last 12 years, 3. Seasonal Analysis Methodology – LOESS, 4. Seasonal Analysis Results, and 5. Coupling with Dissolved Oxygen and Carbonate Chemistry.

Initial focus was on pH data from the Water Quality Portal, which included data from CT DEEP from 46 different stations, including 17 year-round stations, with many samples from closely spaced depth intervals. There was additional pH data from 33 IEC stations in the western Sound, though none were year-round, and USGS monitoring stations in rivers which empty into the Sound. In the actual analysis, for consistency, only CT DEEP data was used. He showed a map of the station locations and noted that the number of samples per station was relatively consistent for most of the data generators. He showed Save the Sound's Report Card map and numbered the basins from 1 to 5 starting with the Western Narrows and going eastward.

Before discussing the results, Ben summarized his data processing method and thanked Katie O'Brien-Clayton and Matt Lyman of CT DEEP for cruise logs. Each data point was matched with its cruise log and apparent pH sensor malfunctions and data outliers, which often coincided, were discarded. A conservative de-spiking algorithm was also applied to remove obvious outliers but not data of interest. The pH values at stations within a particular basin were consistent with clear seasonal patterns, with minimal values usually late in the summer (August). Even with de-spiking there were anomalous very low pH values which appeared to result from sensor malfunction at or very near the surface. Additional data processing to examine one-meter intervals at different depths showed similar seasonal patterns with less noise.

To focus more on seasonal variations rather than long-term trends, Ben then homed in on the year-round sampling stations. Additionally, he compared seasonal data at different depth ranges and then in different basins. He used a method called STL (Seasonal Trend Decomposition using LOESS) which decomposed the data into three components: 1. A repetitive, cyclical component, 2. Non-cyclical trends, and 3. Residuals from the previous two series. The first is the annual cycle, the second is not likely to be meaningful because of the short time-series, and the third should just be random noise. The STL method relies on a LOESS smoother which is frequently applied to environmental time-series data and is an iterative algorithm which allows for changes in seasonal trends over time. Seasonal patterns were evident in the plots but also showed variations among different years.

Ben then addressed the relationship between pH and dissolved oxygen (DO), noting that aerobic respiration typically lowers both pH and DO. However, the relationship can be more complex in late summer when elevated buffering processes, such as increased calcium carbonate dissolution, also increase pH despite continued low DO. The decoupling of DO and pH can be seen in the annual means of the whole Sound, however, it is better shown at individual stations. Such stations show an increase in the seasonal decoupling of DO and pH the further east one goes in the Sound. (Ben also clarified some methods and sampling issues raised by Jim O'Donnell.) These are preliminary analyses intend to show the potential of this pH data. Further studies will benefit from more statistical tests among basins, more detailed analyses of depth profiles, and longer time series as well as additional water quality data. These should provide additional information as to the pH buffering mechanisms involved. Ben concluded by listing some recent related publications focused on the Chesapeake Bay, where the pH and DO decoupling was also noted.

Questions:

1. IEC mentioned that they now do year-round monitoring.
2. Katie O'Brien-Clayton had concerns about all the stations being listed in basin 2 and wondered if the LISICOS buoy data had been used. Ben replied that the station listing issue was simply a mistake in the figure legend and said that the LISICOS data was not accessible.
3. Biswarup Guha asked about seasonal probability plots and Ben responded that he was interested in more detailed analyses but that there was limited data from the eastern Sound.
4. Kamazima Lwiza suggested using a clustering method like Principal Components or related analysis might be a more objective grouping related to what Jim O'Donnell asked about earlier. Ben agreed that a clustering method based on trends in the data would be interesting.
5. Jim O'Donnell suggested synthesizing pseudo data with known noise and signals that are characteristic of what you are looking for and repeat with different phase lags to see if you can detect it and increase your confidence. This also addresses the variable sampling issues raised earlier.

Long Island Sound Eelgrass Management and Restoration Strategy: Continuous Monitoring: Cayla Sullivan, EPA

The LISS has an Ecosystem Target, *Eelgrass Extent*, to restore an additional 2,000 acres of eelgrass by 2035. The last local survey reported almost 1500 acres 2017, a loss of about 400 acres from 2012. To focus our efforts, a targeted strategy has been developed to address this ecosystem target, following several months of meetings and consultations with local experts. Water Quality monitoring, in addition to eelgrass monitoring, is one of gaps seen as hindering progress in this effort to increase eelgrass acreage.

The Water Quality Monitoring Work Group has previously advocated for more continuous monitoring related to eelgrass and the related Ecosystem Target of water clarity. Monitoring enhancements are targeted for established eelgrass meadows, struggling meadows, and embayments with high eelgrass suitability as predicted by the Eelgrass Habitat Suitability Index but no current eelgrass. Minimum monitoring enhancements include continuous temperature monitoring of water and air, and ideally also secondary parameters of turbidity and chlorophyll *a*.

Cayla asked Peter Linderoth of Save the Sound to describe the status of submitted FY23 proposals to address the monitoring gap. Peter said that Save the Sound is currently proposing to add Unified Water Study Tier 1 monitoring, by Project Oceanology, at Mumford Cove and the Poquonnock River in FY2023 and at two embayments with eelgrass near Fishers Island in FY2024. To further address the monitoring gap, Peter proposed to the work group to add surface HOBO loggers for temperature (and light) at three Tier 2 sites with eelgrass (Mystic Harbor, Niantic River Outer, and Stonington Harbor) as there are already bottom temperature sensors. Adding light, turbidity, and chlorophyll *a* sensors would be more difficult and requires discussion. Cayla added that the EPA Region 1 lab in Chelmsford, Massachusetts, might be able to fill in some of the gaps and that the establishment of EPA SeagrassNet sites, which would use standard monitoring protocols, was being considered for Beebe and Mumford Coves. She concluded by showing a map of the eastern Sound with eelgrass locations and areas of current monitoring and needed monitoring. She noted that the eelgrass locations shown are from the 2017 survey and that there will be a new survey this year in 2023. She also mentioned that there was satellite data currently being processed which will provide additional information and asked anyone else with information to come forward.

Questions:

1. Katie O'Brien-Clayton had a question about the light measurements with the HOBO loggers. Peter Linderoth replied that Jamie Vaudrey had recommended that the light measurements be used for only the first three days after instrument cleaning due to biofouling, and that was the procedure that they intended to follow.
2. Paul Stacey noted that Cayla has mentioned the Ecosystem Target to increase eelgrass acreage by 2000 acres and asked if there was specific nitrogen reduction target connected with that. Cayla responded that there were other stressors like temperature also involved and that they did not currently have the embayment-specific information needed to address nitrogen loading, though she noted that Tetra Tech has developed a related Shiny App. Both the Water Quality Monitoring and Habitat Work Groups have suggested updating the Eelgrass Habitat Suitability Index model, which is in the works. The model does include a nitrogen-loading component. Paul also wondered about monitoring of watershed nitrogen loading

and suggested that it should be monitored at the same frequency as current embayment monitoring.

3. Mark Tedesco responded that CT DEEP was addressing some of Paul's concerns about loading through their embayment and subwatershed monitoring and modeling. One of the endpoint targets is water quality suitable for eelgrass which could lead to nitrogen reductions to meet that target.
4. Jim Ammerman asked about how the new Fishers Island monitoring under the Unified Water Study (UWS) would fit with the current monitoring that they already conduct in collaboration with the University of Rhode Island (URI). Peter Linderoth replied that that they would become a part of the UWS and probably conduct a year of Tier 1 monitoring before moving on to Tier 2 continuous monitoring. He did not know whether their URI-connected monitoring would continue. In response to a question from Kelly Streich about the units of light, Peter responded that they would be measuring the light attenuation coefficient (Kd), which measures how light dissipates with depth in the water and can readily be converted into Secchi Depth or NTU or Nephelometric Turbidity Unit, a measure of turbidity. Cayla concurred with the Kd measurements and added that chlorophyll *a* and turbidity were also potential important light-related measurements. Both agreed that temperature measurements were also critical and would be done at both the surface and bottom.
5. Bill Lucey mentioned that Brad Peterson currently had many eelgrass-related sensors deployed in LIS and asked if the methods used were the same. Cayla replied that she was not aware of his deployments on the north shore of Long Island but would check with him on the details.
6. Jon Morrison said that Kd sensors on the bottom required information on the depth to calculate Kd and Peter Linderoth said Jamie Vaudrey recommended that they be deployed at the surface. Peter added that they could also deploy them at the bottom and had water level loggers to determine depth.
7. Melissa Duvall asked about members of the UWS collecting sediment samples while out in the field sampling as the data could be useful in updating the habitat suitability index. Peter replied that sediment collection would be a significant extra effort but could be added if important to the eelgrass effort. Melissa also wondered if there were light sensors which could provide more than three days of continuous data without fouling to be more comparable to the continuous temperature data already collected. Jim Ammerman referred Melissa to related comments in the chat about EPA coastal assessment data and NRCS subaqueous sampling.

Jim Ammerman concluded by thanking Ben, Cayla, and Peter for speaking and noted that there were thirty-seven people on the call at one point, likely a record for this work group. He suggested that those interested contact the speakers for more information. Bill Lucey noted that there is a bill in the Connecticut legislature to form an eelgrass restoration working group, it was defeated last year but is likely to pass this year. Jim Ammerman added that New York State DEC was planning to fill their vacant eelgrass coordinator position. Cayla said that a LIS Eelgrass

Collaborative Network would be formed this year to provide a platform for the exchange of ideas regionally and perhaps wider without being redundant.