Science & Technical Advisory Committee
TEAMS Online Meeting
December 2, 2022 – Meeting Summary

In Attendance:
STAC Members: Jim Ammerman, Sylvain De Guise, Kristin DeRosia-Banick, Dianne Greenfield, David Lipsky, Darcy Lonsdale, Kamazima Lwiza (New York Co-chair), Robin Miller, Jim O'Donnell, Julie Rose, Paul Stacey, Kelly Streich, Mark Tedesco, Craig Tobias, Maria Tzortziou, Jamie Vaudrey, Penny Vlahos (Connecticut Co-chair), Nils Volkenborn, Laura Wehrmann, Mike Whitney, Chester Zarnoch

CAC Liaisons to STAC: Sarah Crosby (The Maritime Aquarium), Mickey Weiss (Project Oceanology)

Others: Mary Arnold (NYSDEC), Zosia Baumann (U Conn), Jordan Bishop (NEIWPCC), Michael Burgess (UCONN), Finnian Cashel (EPA), Cynthia Corsair (USFWS), Mel Cote (EPA), Melissa Duvall (EPA), Syma Ebbin (CTSG), Shawn Fisher (USGS), Lillit Genovesi (NYSG), Michele Golden (NYSDEC), Elizabeth Hornstein (NYSG), Shannon Jordan (UCONN), Sharon Kahara (U New Haven), Katherine King (UCONN), Kristin Kraseski (NYSDEC/NEIWPCC), Ben Lawton (EPA/ORISE), Qian Lei-Parent (UCONN), Leonel, Bill Lucey (STS), Mary McGuinness (UCONN), Jon Morrison (USGS), Esther Nelson (EPA), Victoria O'Neill (NYSDEC/NEIWPCC), Jimena Beatriz Perez-Viscasillas (NYSG), Matthew Pruden (Cornell), Sarah Schaefer-Brown (NYSG), Eric Schultz (UCONN), Nancy Seligson (CAC Co-chair), Lane Smith (NYSG), Alexa Sterling (EPA), Cayla Sullivan (EPA), Gregory Wilkerson (NYCDEP), Emily Wilson (UCONN CLEAR), Kimarie Yap (IEC)

Introductions, Updates: The meeting began with a discussion of the role of the STAC liaisons to the CAC, Jamie Vaudrey suggested that her role as the CT CAC liaison was to act as a resource to the CAC about the STAC and to bring back information from the STAC that is relevant to the CAC. Jim Ammerman said that anyway interested in being the NY CAC liaison should talk to Penny Vlahos about it. (Maria Tzortziou later volunteered to be the NY CAC liaison.)

Jim asked Cayla Sullivan to briefly describe the hypoxia prediction project. This project is working with Jim Hagy and Katherine Canfield, a social scientist, at the EPA Office of Research and Development (ORD) to predict the annual area of hypoxia in Long Island Sound analogous to the annual predictions for the Gulf of Mexico and Chesapeake Bay. It will predict the area in both the open Sound and embayments using existing data and open science tools and serve as a useful communications tool. One or more community workshops will be held to maximize the utility of the tool. In response to a question, Cayla said that the prediction would probably be released annually for the Memorial Day weekend and then the success of the prediction would be evaluated during the summer for communications purposes along with a story map. Other comments were made about improving the information on watershed nutrient reductions and crowd-sourcing fish kill information as part of this project and Mark Tedesco noted the scientific

challenges of such hypoxia predictions. Jim O'Donnell said that due to the significant reductions in the area of hypoxia over the last 20 years, such predictions would be unlikely to work or serve as a significant communications tool because they would be dealing with differences between small numbers. The overall reductions and consequent improvements in the Sound are what should be emphasized. Jamie Vaudrey agreed but noted that the "shock value" or the forecast or a report card, like the one from Save the Sound, was important to impart the information to the public even if the scientific details were not completely described. Paul Stacey concluded that discussions of the success of the TMDL were looking backwards, and we are obligated to protect and restore the Sound under the Clean Water Act and have done little to further reduce nitrogen since the last treatment plant nitrogen reductions came online.

Overview of 2022 2-Day Management Committee Meeting and 2023 Budget Plans: Mark Tedesco, EPA LISS

Mark reviewed the committed structure of the and the recent budget trends with anticipated funds of ~$30 million in regular funds and ~$20 million in BIL funds. (Congress later added another $10 million to the regular LISS funds for 2023). He then reviewed the new and increased investments in several areas since 2019, including monitoring, research, and modeling. He also listed major investments using the BIL (infrastructure) funding including environment justice, infrastructure improvements (including in upper watershed states), and climate resilience and sustainability. Going forward the LISS is developing 2023 budget priorities, improving Management Conference structure and function, and reviewing priority and cross-cutting topics like communications and outreach, environmental justice, and data access and management.

Summary and Synthesis of Environmental Justice Breakout Sessions from June STAC Meeting: Penny Vlahos, U Conn; Kamazima Lwiza, SBU

Penny noted that there were many useful comments in the June breakout sessions, with common themes among the groups and some objectives relatively easy to pursue. Started her discussion by thanking the facilitators who worked with each of the breakout groups and summarized their discussions.

Penny first list the six questions that were considered by the breakout groups:

1. How can we encourage the consideration and prioritization of environmental justice in research proposals supported by the Long Island Sound Study?
2. How can we encourage more research projects/proposals from academic institutions located in areas with environmental justice concerns? (Team 1)
3. What kind of backgrounds, disciplines, institutions, and perspectives are missing in the current STAC membership? What steps could be taken to help expand and diversify STAC membership? (Team 2)
4. Are there existing or future environmental justice research questions and/or science needs that the Long Island Sound Study should be supporting?
5. How can we ensure that Long Island Sound Study research and implementation projects are benefiting disadvantaged communities? Who benefits from environmental

improvement projects (e.g., how far downstream do benefits go) in trying to reach disadvantaged communities? Do these questions constitute a research project?

6. If the STAC developed a 5-year plan, what environmental justice goals, considerations, and actions should be included in the plan?

The first opportunity she discussed was partnering with universities and community colleges in Environmental Justice (EJ) communities. While there are number of apparent barriers, Penny mentioned some potential action items useful in addressing the following concerns:

1. Engaging Universities and Community Colleges in a partnership with the existing LISS Academic institutions to facilitate co-created projects with community perspectives engaged earlier in the process.
   Action items:
   a. Invite new investigators across LIS Universities and Community Colleges to present to the STAC at quarterly meetings (at least two per meeting).
   b. Extend invitations (to interested investigators) to join the STAC.
2. Establishing a means to maintain that relationship:
   Action items:
   a. Mentoring students (student summer research awards?)
   b. Encourage education focused awards through the LISS Futures Fund? (Make clear that such awards are available to a wide array of groups.)
   c. Providing a platform for sharing and co-creating the research questions
   d. Reserving a seat on the STAC for organizations intended to represent DEIJ scientists/researchers
3. If the above items were implemented then it would diversify the STAC and provide a broader range of voice at the table which could then lead to:
   Actions items:
   a. Developing an inclusive 5-year plan for the STAC over the next two years
   b. Requiring a post-award summary for investigators' research projects that is aimed at the broader public for posting on the LISS website and other communications efforts, and providing to the CAC for use in their visits to Washington (much like the National Science Foundation which requires a public summary as well as a scientific abstract)
   c. Syma Ebbin suggested a potential student communications fellowship which could help with the above efforts
   d. Nancy Seligson confirmed that scientific summaries understandable to the public were important to the CAC, as well as long stories. She also asked for STAC members to join the CAC in their visits to Washington. Penny asked when this years' visit would occur and Nancy said it was dependent on Congressional schedules but she could provide a ball park estimate at the February STAC meeting.
   e. Penny also proposed a potential annual STAC newsletter which could be developed by the communications fellows and provide online and to the CAC.

f. She concluded by asking for comments on the major items above.

Discussion:

-Chester Zarnoch said that he liked the above ideas but suggested a "bold" proposal for consideration to include the Harlem River, northern Manhattan, and the western Bronx within the Long Island Sound Study western boundary. This would incorporate several important communities and also makes sense when you consider the sewer shed map. These areas contribute to the Wards Island treatment plant which already near the existing boundary.

-Paul Stacey said that he had significant experience in bringing communities into the environmental process. These are good ideas and will engage those involved in but it will be difficult to expand beyond those. We need to focus on local benefits for EJ communities which is difficult.

-Mike Whitney agreed with Paul and noted that there were fewer environmental groups in EJ communities. Community colleges will be important and short web vignettes from undergraduate researchers would be useful.

-Nancy Seligson said that the CAC is working closely with the EJ and SRC work groups to locate communities of interest. She suggested that the Futures Fund could be a good opportunity for EJ communities, including for green infrastructure which could help them address issue like heat exposure, flooding, and others. We need to determine the specific needs of these communities and actions that will benefit both them and LIS.

-Jim O'Donnell mentioned that CIRCA was reviewing grant proposals recently received from EJ communities. The initial focus of these efforts should be on community groups which are already known. As a science organization the STAC should ensure that its membership is diverse, and we should also determine how current efforts are working. Invited new members, as Penny proposed, is a good idea. Jim suggested that increasing public access to LIS is an important policy issue for the LISS, a low income communities have historically been barred from access. Those with access to the Sound are more likely to value it and help protect it and yet many people are unaware of the recent improvements in the Sound.

-Dave Lipsky suggested that the ecosystem focus of the LISS was important, but low income residents are probably more interested in public health issues like bacteria and beach contamination as well as information about places where they can fish. He noted that Save the Sound was releasing its new Water Quality Report Card but that had nothing about public beaches (though they have a separate Beach Report Card).

-Lane Smith suggest participation in local festivals, many of which are environmentally-oriented as well as displays and talks in local libraries and schools. Also, small local publications could help to reach local communities.

-Sylvain De Guise followed up on that thought that in recruiting a new CT outreach coordinator for the LISS, a presence at local events like festivals and others was high on the list. Also working with "bridge organizations" who already have contacts in EJ communities is more effective than starting from scratch.

-Penny concluded the discussion by thanking everyone for all the input and support and noting that there were lots of synergistic activities underway and that we just needed to keep track of them.

New LIS USGS Data Clearinghouse: Shawn Fisher, USGS
USGS is developing a data clearinghouse and mapper for the all the data being collected in the LIS watershed. The project just started in October and includes several USGS colleagues. This fills a current void. The project will determine what is being measured, where, and by whom; with an emphasis on water quality data, though others will be included as well. Data repositories, like EPA's Water Quality Portal (WQP), include only a small percentage of LIS data. This is not a new database but would bring together information about where the data is located.

The three main objectives include:

1. Create a publicly accessible clearinghouse and web-based mapper for displaying all monitoring, research, and modeling data within the LIS watershed.
2. Provide direct links and/or contact information for retrieving data.
3. Increase stakeholder engagement.

Shawn provided examples of several relevant current mappers from EPA, STS, U Conn., and NOAA, and listed major LISS stakeholders and data collectors who will need to be engaged with the project. USGS has developed a one-page document describing the project and the basic information about the data to be included. A questionnaire will also go out to all data collectors asking for information about their data. Initial data will either be point data or polygons, point data for water quality, physical, biological, and meteorological data; as well as polygons for spatial data such as land use, topography, bathymetry, aquifers, etc. The mapper will link to dynamic data sets which can be automatically update through APIs, as well static data sets, which require manual updates. He then showed a schematic diagram of the mapper and its various links from data generator to user. For each entry, the mapper will provide the following attributes: 1. Program and spatiotemporal information, 2. Data category, 3. Data availability, and 4. Quality assurance.

This project will leverage two existing USGS mappers and those involved in creating them. These are the South Shore Estuary Reserve (SSER) on the South Shore of Long Island which is run by the New York Department of State, and the New York State Department of Environmental Conservation (NYSDEC) Long Island Water Quality Integrated Data System (LIQWIDS) which goes a step further and displays the data from dynamic databases allowing basic analysis. This project will provide a broad overview of LISS data which can potentially be useful for: 1. Risk assessment, 2. Identification of data gaps, 3. Monitoring cost reductions, 4. Future opportunities data download, visualization, and analysis, and 5. Increased public engagement by providing simple communication tools. Shawn finished with a timeline showing collection of information and stakeholder meetings through the spring of 2023, followed by development of the mapper for dissemination on the web by September of 2024.

Discussion:
-Nancy Seligson suggested coordinating with the CAC as interest stakeholder group who would be potentially interested in using the publicly available tools to be developed. Shawn said that any interested groups would be welcome.
-Emily Wilson note that Connecticut has lots of spatial data on the CT ECO website, including Blue Plan information. The state also just opened a state GIS office and launched a data portal. Shawn noted that decision would need to be made on which data layers to be displayed and which to just link to.
-Mel Cote mentioned the Northeast Ocean Data Portal and possible linkages to that.
-Paul Stacey said he wanted to reinforce what Emily said and encourage a strong link between LIS data and the land cover database. Shawn agreed and specifically mentioned green infrastructure and best management practices.

Recent Glider Deployments in LIS: Jim O'Donnell, UConn
In the past Jim has combined continuous buoy data at a few locations to determine the errors in the spatial structures of the ship surveys which occur only every two weeks but cover a much larger area. He recently deployed gliders to assess whether the above error assumptions were reasonable. The gliders used were Slocum Gliders made by Teledyne Webb with sensors for conductivity, temperature, depth, dissolved oxygen (DO), fluorescence, and backscatter, as well as acoustic modems for communication. Jim showed the internal structure of the glider and discussed how it could change its buoyancy to go up and down in the water column. The speed is only about 50 cm/sec, but it the western Sound it can make headway against the tidal current.

Past deployments have explored winter cooling in the eastern Sound, these were his first summer deployments in the western Sound when there is a lot of ship traffic. One glider was quickly picked up by a boat which damaged it, but the second glider deployment was successful. The glider comes to the surface and transmits some of the data about every hour and a half by email and can also receive new directions. They sustained the deployment for 18 days and he showed a 7-day track where the glider went back and forth from one side of the Sound to the other between the Execution Rocks and ARTG buoys in the western Sound. IOOS has a website (gliders.ioos.us) where you can see glider deployments all around US coasts.

He showed a series of DO profiles from just east of Execution Rocks and another series near ARTG with a thicker surface layer of high DO, though both had low bottom layer DO values of about 3 mg/l. Jim plans to use these glider profiles like additional ship surveys, averaging in small horizontal bins, and comparing with previous estimates of errors in hypoxic volumes. Such glider deployments in LIS are clearly practical but further evaluation of their contribution to current ship survey and buoy data is required.

Discussion:
-Kamazima Lwiza said that he was impressed but wondered how the gliders avoided ships, especially in the summer. He also wondered if the wide range of DO values indicated water movement or instrument problems. Jim suggested that the DO sensors were stable and the

variation in DO reflect both horizontal and vertical variability and perhaps internal waves. They minimized time at the surface to prevent boat collisions but allowed enough time to establish position and telemeter data.
-Nancy Seligson said it was really cool and should be presented to the CAC and wondered when the glider was near Execution Rocks, Jim replied that it was near the peak of hypoxia, about August 26th. Another glider was launched for two weeks to follow the decline of hypoxia, also unlike ships, gliders can continue sampling during storms. The downside is the huge amount of data, more profiles were acquired in a glider deployment than in the 30 years of CT DEEP ship profiles.
-Mark Tedesco said he was amazed that the glider survived the deployment. He also wondered if in addition to refining hypoxic area and volume estimates from the year of glider deployment, whether it could be used to refine estimates from prior years without glider deployments. Jim replied that once the area and volume error estimates were assessed using the glider data, those error estimates would be applicable to all 30 years of ship survey data.
-Jon Morrison asked about the DO measurements and the rate of sampling, are values oversampled and combined, and how does the sampling rate compare with the speed of the instrument? Jim responded that the raw data DO measurements shown were made every two seconds, but the time constant for DO was somewhat longer leading to smoothing of the data. Coming up, the glider is moving only 10 cm/sec so the DO measurements should be reliable (independent of hysteresis effects) at least every meter. Jon said it would be interesting to assess the serial correlation between the points going up vs. going down.
-Craig Tobias asked if the glider could be parked on the bottom and Jim responded that it could but if too close the CTD pump would entrain mud. Jim added that bottom encounters had happened and were not fatal, and some of the military applications of gliders included sitting on the bottom.

Improving Eelgrass Restoration Success by Manipulating the Sediment Iron Cycle: Shannon Jordan, Craig Tobias, Jamie Vaudrey; UConn
Eelgrass is declining in LIS (to perhaps 15% of its historical area) and globally and the LISS has specific restoration goals. Though LIS water quality has improved, eelgrass acreage often has not increased because high organic carbon and sulfide concentrations, resulting from sulfate reduction, remain in the sediment. This project aims to facilitate survival of young eelgrass plants by decreasing sulfide concentrations by the addition of iron (Fe). Addition of iron can reduce sulfide in two ways, by complexation and competition. Complexation with Fe (2+) binds sulfide and sequesters it, iron reduction with Fe (3+) competes with sulfate reduction, reducing the rate of sulfide production. Reduction of Fe (3+) also produces Fe (2+), increasing the sulfide complexation.

The objective of this project is to characterize the practicality of sediment iron addition as a strategy to reduce sediment sulfide concentrations and the ultimate goal is to expand the acreage of viable eelgrass restoration sites and improve transplant success. Sediments were sampled in the Niantic River Estuary in locations that used to host eelgrass, and a sulfide gradient was demonstrated. Isolated centrifuge tube experiments were conducted to

determine which form of iron should be added, siderite (Fe +2) or magnetite (Fe +2, +3), and how much. Mesocosms were then used to determine how long the optimal iron dose would last under simulated transplant conditions. Transplants were just conducted and will be monitored going forward.

Historical eelgrass distributions in the Niantic River Estuary provide by the Millstone Environmental Lab coupled with sulfide mapping from 2015 and field verification provided the best sites for transplanting. A dose response relationship was established for iron amendments by adding increasing amounts of four different iron minerals and grain sizes to high sulfide sediments in centrifuge tubes, incubating for a week, and measuring the loss of sulfide. These experiments were then followed by months-long incubations in mesocosms. Transects of site characterization revealed sulfide concentrations from 0-3000 uM, and sites were binned as low sulfide (<100 uM), medium (100-500 uM), and high sulfide (>500 uM).

In the centrifuge tube experiments, porewater pH values were not significantly changed by a wide range of iron additions. However, sulfide concentrations were greatly reduced by any type or amount of iron addition, with optimal scavenging medium-coarse or smaller grain sizes. The mesocosm time-course showed that while either iron mineral was initially effective at lowering sulfide, the magnetite treatment (Fe3+) was more effective in maintaining low sulfide, suggesting that the competition approach was the most useful. Field eelgrass transplants along a natural sulfide gradient with a range of magnetite additions were completed in October by divers. Follow up monitoring will include geochemical parameters including sulfide and nutrients, as well as plant density and related plant parameters to be measured in the summer and fall of 2023. In summary, small additions of magnetite can scavenge sediment sulfide for at least two months and the success of the transplant experiments will be known by next summer.

Discussion:
-Paul Stacey asked if iron-rich stormwater could facilitate eelgrass growth in areas nearby. Craig Tobias suggested it might and that there was potential natural analog on Long Island called Iodine Beach which has iron rich groundwater and apparently a lush growth of eelgrass.
-Lane Smith asked if current or other scour could remove the iron from transplant experiments and Craig replied that scour was not a problem in Niantic Bay and most sulfidic environments with high sediment carbon. The divers also mixed the iron into the sediment under the disk with the transplants.

Can They Get Out? Loss of Connectivity for Juvenile Alewives Out-Migrating to Long Island Sound: Michael Burgess, Katherine King, Eric Schultz; UConn
Michael started by focusing on Objective 3 of the project's 5 objectives: To characterize the timing of juvenile outmigration and its dependence on stream discharge. In other words, when do the fish leave their spawning grounds, what to they look like when the leave, and how does this timing vary at different sites along the Connecticut coast? River Herring (Alewives and Blue Back Herring) are ecologically important anadromous fish which live in the sea but spawn in

freshwater and are important in both marine and freshwater food chains. They are listed as a species of concern largely due to human impacts. While there are many projects facilitating migration of adults upstream, there has been less attention paid to whether juvenile herring can get out, especially under drought conditions.

There were drought conditions in the summer of 2022 in Connecticut and the most important lake out flow (Bride Lake) has been dry since early July, most of the normal June to mid-fall out migration period. Bride Lake also had only half the number of adults in 2022 as in previous years. Of six sites examined, all but one experienced at least a month of a dry stream outflow in the summer of 2022. Most of the sites are relatively close to the Connecticut coast.

Two methods were used to characterize outmigration, time lapse photography to determine when they are migrating and biological sampling to measure the size and age of the migrating fish. Photography is done with GoPro cameras, with photos taken every minute 24/7, with full stream views from late May/early June, and with maintenance three times per week. Time lapse photography has major advantages over vide in terms of post-processing time and allowing easy deployment with battery powered cameras. Experiments showed >90% detection of any fish present within an hour by the time lapse photography. So far about a third of the 2 million photos taken have been examined, fish have been seen at Bride but not at other locations which is currently unexplained.

While the largest number of fish seem to migrate early in the season, June and July, biological samples were taken throughout the year to determine the peak of biomass migration, since later in the season the fish were larger. Fish were also aged by examining their otoliths. Michael is continuing to collect photos at sites where fish have been seen to assess timing of migration throughout the season, as well as biological samples to assess changes in biomass and body condition. They are also working with stakeholders like CT DEEP and lake associations and land trusts to explain their study, help with restoration efforts, and will connect with other stakeholders in the future.

Katherine discussed development of the other four project objectives: 1. Geospatial characteristics of herring runs, 2. A Hydrological model of the herring runs, 3. A tool that quantifies risk of connectivity loss of herring runs, and 4. Further outreach to stakeholders on herring vulnerability. The overall goal is to use the connection between stream flow and migration success to develop a management tool to predict migration loss based on low flows. She showed a screen shot of a preliminary example of the tool for the Bride Lake Watershed.

The tool is developed from the continuous stream flow measurements coupled with stochastic weather generation, a calibrated Soil and Water Assessment Tool (SWAT) model, synthetic streamflow realizations, and a random forest model which uses weather and synthetic stream flow data to predict when migration is lost based on weather variables. The migration threshold was defined as the flow level below which migration is not possible and migration loss occurs when there is a two-week average flow below the migration threshold.

Four selected watersheds were modeled, and the measured and modeled parameters were shown for the Bride Watershed. The fit of the model to the observed data was satisfactory for all four watersheds and was used to calibrate and further train the model. Results showed the model performance was best the month of or before the prediction and the reservoir depth was the most important model parameter the month of the prediction. Early and late season drought in the same year were positively correlated suggesting significant management implications. Remaining tasks include completing model training and performance analysis for all sites, finalizing the web-based tool, and additional outreach efforts.

Alkalinity of Long Island Sound Rivers: Mary McGuinness, Penny Vlahos; UConn
Mary said they were interesting in alkalinity because of increasing acidification in the Sound and rivers in particular because of their proximity to shellfish hatcheries. Alkalinity is a measure of buffering capacity and is usually closely correlated with salinity but that deviates at lower salinities. The project objectives were to collect Total Alkalinity (TA) and Dissolved Inorganic Carbon (DIC) data in LIS rivers as well as supporting parameters. Also, to examine trends and patterns for the TA system in LIS and to develop an attributive model to gain insight into the TA system. She showed a map of surface sample locations in the Housatonic, Quinnipiac, Connecticut, and Thames Rivers as well as estuarine sites along the coast sampled from 2020-2022.

The Housatonic and Quinnipiac Rivers had much higher TA and DIC concentrations than the Connecticut and Thames. Comparisons with earlier USGS data from further north showed similar trends. The higher TA probably results from the carbonate rich bedrock in the sediment of the Housatonic River and urban runoff, particularly in New Haven, into the Quinnipiac River. They also investigated the aragonite saturation state, values above 1 result in calcium carbonate production, and below 1 dissolution. Even at high salinities, there were some values below 1, and there was also a spatial gradient in aragonite saturation even at equivalent pH values of 7.9. The DIC/TA ratio is also greater than 1 in some of these rivers and coastal locations suggesting that they are susceptible to acidification. Mary compared their data with other models and found that there was good agreement in the eastern Sound but not the western Sound. They developed their own multiple linear regression (MLR) model which in the eastern Sound included only salinity, much like it was a shelf model. In the western Sound, however, biological and temperature parameters were also included with salinity to improve the correlation. This is an important first step in developing a predictive model, but further work is needed.

Jim Ammerman adjourned the meeting about noon.