Climate Change & Sentinel Monitoring Work Group
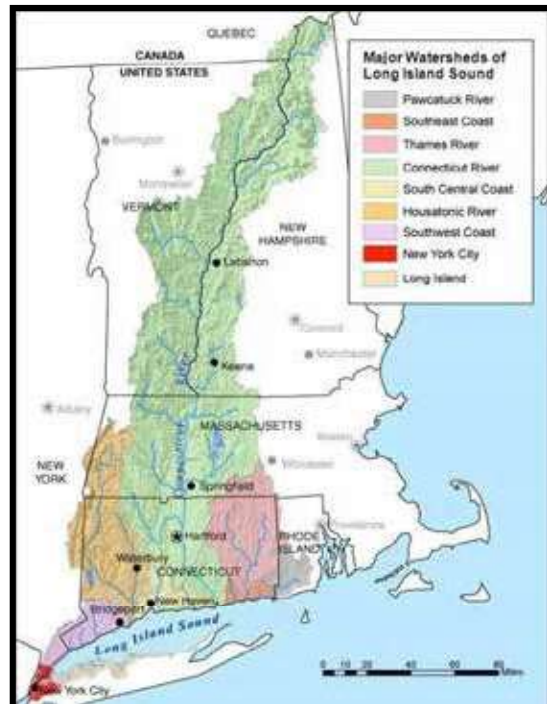
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FY2023 Work Plan October 1, 2022

Members:
Kathleen Knight, CTDEEP (Co-Chair)
Samarra Scantlebury, NYSDEC (Co-Chair)
James Ammerman, NEIWPCC
Juliana Barrett, CTSG
Robert Burg, NEIWPCC
Jordan Bishop, NEIWPCC
Sarah Crosby, Maritime Aquarium
Greg Dietl, Cornell University
Richard Friesner, NEIWPCC
Shannon Meseck, NOAA
James O'Donnell PhD., UCONN, CIRCA
Leah O'Neill, EPA R1
Victoria O'Neill, NYDEC
Matthew Pruden, Cornell University
Ron Rozsa, CTDEEP (Ret.)
Cayla Sullivan, EPA R2
Mark Tedesco, EPA R2 Nicole
Tachiki, EPA R2
Maria Tzortziou, PhD, CCNY, CUNY
Penny Vlahos, PhD, UCONN
Harry Yamalis, CT DEEP

I.   Mission Statement:

To assist the Long Island Sound Study (LISS) Management Conference in developing, maintaining, and enhancing a dynamic climate change monitoring program for the Long Island Sound Study's watershed and its coastal ecoregions[1]; and to oversee implementation of a broader dynamic monitoring program to evaluate and make recommendations regarding the scope and magnitude of current and potential climate change impacts to Long Island Sound (LIS); and develop adaptive management strategies to address the impacts.

II.   Background:

The Sentinel Monitoring Strategy, last updated in 2018 (the 2018 Strategy), defines the

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[1] Ecoregions are areas where ecosystems (and the type, quality, and quantity of environmental resources) are generally similar (EPA, 2021)

intent, direction and goals of the Climate Change and Sentinel Monitoring Workgroup. Per the 2018 Strategy, the Climate Change and Sentinel Monitoring Work Group (CCSM) oversees the implementation of a broader dynamic Climate Change and Sentinel Monitoring Program is a multidisciplinary scientific approach to provide early warning of climate change impacts to Long Island Sound watershed and its coastal ecoregions (including Fishers Island Sound), species, and processes to facilitate appropriate and timely management decisions and adaptation responses.

The program was developed to quantify local changes in the environment brought about by climate change in which specific goals include to 1) collect and synthesize data to identify climate related changes and 2) provide scientists and managers with the information necessary to prioritize climate change impacts in mitigation efforts and determine appropriate adaption strategies to address these impacts. The CCSM had developed a data citation clearing house (the Sentinel Monitoring Database) to support this work.[2]

The 2018 Strategy provided recommendations based on the available information regarding what parameters should be measured and assessed to provide early-warning (sentinel) detection of climate change impacts to the Sound and associated habitats, biota, and processes. Specifically, the 2018 Strategy update recommended the following steps:

- Hold workshops: Organize LISS sentinel monitoring workshops to help identify additional data, centralize all the available data, and develop a monitoring network.
- Promote sustained observations, including citizen science (e.g., use citizen science to help collect sentinel data, such as trends in flora, and fauna in coastal ecosystems) and analyses of trends at decadal intervals.
- Identify existing data sources to be added to the database and prioritize data rescue efforts on data gaps
- Keep the LIS sentinel monitoring website on the LISICOS[2] website with a link to the regional NERACOOS sentinel monitoring database and update the sentinel monitoring webpage on the LISS website
- In order to promote the use of the database, request that a link to the database be included in future LISS research RFPs.
- Develop and maintain a sentinel monitoring network and associated database

Using FY2020 LISS funding, NEIWPCC hosted a Sentinel Monitoring Network virtual workshop on June 2nd and 3rd, 2022. The ultimate objective of this workshop was to develop and maintain a sentinel monitoring network. The full list of the detailed desired outcomes of the workshop included:

A.   Identify all existing data sources (including associated metadata – methodology, measurements) and gaps
B.   Determine parameters to be analyzed for each identified sentinel
C.   Identify sites for the Sentinel Monitoring Network
D.   Determine next steps to compile the actual data into a centralized location
E.   Develop a LISS Supplemental Package Proposal for FY2022/23 to advance the Sentinel Monitoring Network.

[2] Monitoring Inventory – Integrated Sentinel Monitoring Network

At this workshop, the participants identified the following needs to be addressed by the CCSM:

- Data need goals:
  - Need to further narrow the focus and update outdated information. To include this effort in the process of review and update of the 2018 Strategy.
  - Identified top three priority sentinels for the two categories of focus for the workshop, "Water Quality and Quantity" and "Coastal Habitat of Long Island Sound & Associated Species & Systems". See Table 1 below.
- Identified needs of the Sentinel Monitoring Database:
  - Identified a need to encourage data entry and data accessibility. To ensure this is done in concert with other efforts and provide the potential to be less burdensome for principal investigators, data entry needs to be coordinated with other on-going database efforts.
  - Participants noted that data quality in the Sentinel monitoring database remains an issue and further quality assurance is needed, including but not limited to a crosswalk to each sentinel.
  - Participants noted that the sentinel monitoring database currently has no defined plan for continued hosting, maintenance, and other update support, these must be further scoped, and a direction defined.
  - Participants identified historical data as an aspect of the Sentinel Monitoring database that is high value. As such, a recommendation to focus on filling the gaps to ensure the historical set is complete was noted.

The workshop's final report was still being compiled during the creation of this workplan and additional learnings maybe available when the full report is available.

III.   Desired Outcomes:

During Fiscal Year 23 (FY23) the workgroup intends to review and update the 2018 Strategy. This update shall address the outcomes of the workshop held in 2022; incorporate the perspectives and expertise from the broader LISS, evaluate the knowledge gained from previously supported and completed pilot projects and literature[3], define a plan for the sentinel monitoring database, and explore opportunities for better coordination and collaboration within LISS and externally with organizations such as Northeast Regional Association of Ocean Observing Systems (NERACOOS).

As noted above during 2022, a two-day workshop was held that outlined priorities for the Sentinel Monitoring database and for two of the four categories[4] of sentinels. In summary, during FY23 the CCSM intends to build upon the results of the workshop by:

A.   Completing the review and update the 2018 Strategy to better define and focus the sentinel monitoring objectives and thereby prioritize data compilation needs.

B.   Continue to compile and analyze historic and ongoing data related to subsets of each of the sentinels but with enhanced coordination and collaboration with other data compilation efforts. Specifically, during the FY23 the CCSM will collaborate with the Coastal Acidification Monitoring partners, to support the analysis of the historical pH data and support other data interpretation needs.

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[3] Including but not limited to the work of Juliana Barrett of Connecticut Sea Grant, https://longislandsoundstudy.net/wp-content/uploads/2019/09/LISS-VA-Final-Report-Appendices-A-C-and-E.pdf
[4] The four categories include: "Water Quality and Quantity", "Coastal Habitat of Long Island Sound & Associated Species & Systems", "Pelagic/Benthic Systems and Associated Species", and "Fish Communities of Long Island Sound and Associated River Systems"

C.   Utilize open-science tools to communicate the results of long-term climate change trends (i.e., sea level rise, temperature) in Long Island Sound and enhance coordination with the LISS Communications team utilizing the new Communications Education and Outreach (COE) Plan. CCSM supports the additional staffing needs identified in the COE and would greatly benefit from enhanced collaboration with these staff members to improve transparency and visibility of the Climate Change and Sentinel Monitoring work of the LISS. During FY23 it is the CCSMs objective to review and update the content of the workgroup's webpages on the LISS site and identify opportunities to enhance communications with a broader audience and enhance transparency of the Sentinel Monitoring Program.

D.   The CCSM will scope and define the specific tasks and data needs for each sentinel defined as a priority during the workshop, see Table 1. Specifically, during FY23 the CCSM will:

- Enhance coordination with other LISS working groups (as applicable) and field experts to evaluate the available resources and gaps for sentinels identified as the top three under the Water Quality and Water Quantity category: Acidification, HABs, and Hypoxia.
- Enhance coordination with other LISS working groups (as applicable) and field experts to evaluate the available resources and gaps for sentinels identified as the top three under the Coastal Habitat of Long Island Sound & Associated Species & Systems category: Tidal Wetlands, Freshwater Wetlands and Changes in distribution, composition, and marine transgression of marshes. Particularly:
  - During the workshop information shared indicated that the data collected under the Salt Marsh Habitat and Avian Research Program (SHARP) has a well-established baseline and data to support trend analysis. It is CCSM's intent to coordinate with the principal investigators of the relevant SHARP research, other complimentary research, the Indicators Review Team, and the Habitat Restoration and Stewardship Workgroup to evaluate and possibly establish this as a sentinel monitor and/or a climate indicator.
  - Freshwater Wetlands were noted to have no monitoring data, during FY23, CCSM will define opportunities of existing data to analyze and scope the network that is needed to address this sentinel. To appropriately address this, the CCSM will further define "Freshwater Wetlands" to bring clarity to the objective. An opportunity to address this gap was noted to be through the USGS network of monitors and the work compiled by the Indicators Review team. Two of the metrics have data available and the CCSM will commence that analysis for workgroup review. This review will include coordination with other interested LISS workgroups.
  - The third priority identified in the workshop is not currently listed in the 2018 Strategy, therefore the focus of FY23 will include a discussion and vetting of these potential sentinels for the update of the 2018 Strategy.

E.   Effectively communicate with principal investigators to understand the status of their research and its relation to the identified sentinels. Including reviewing the final reports and subsequent research around the six pilot studies funded through the LISS Sentinel Monitoring Program, see below for the specific list of pilot studies.

F.   Support projects through the Long Island Sound Research Program that focus on the identified priority sentinels, including provide principal investigators of related research the platform to share information gained during the project period within the LISS and throughout the broader LISS community.

G.   Develop and define the future direction (i.e., platform) for the Sentinel Monitoring Data Citation Clearinghouse. This shall include:

- Initiate coordination with on-going Long Island Sound Study partner data collection/databasing efforts to streamline efforts, reduce redundancy and begin to scope a formalized data template to initiate more automated coordination and data entry. Specifically, the CCSM intends to coordinate with USGS FY22 Data Clearing house project, NY's LIQWIDs and Save the Sounds Quick Drops project.

- Additionally, CCSM will initiate conversations with owners of research databases of non-LISS programs that include climate and coastal research to ensure we incorporate best practices and enable further relationship building with climate experts (including but not limited to the [NOAA research & Development Database](#) and the [Statewide Ecosystem Assessment of Coastal and Aquatic Resources](#) under development by the Florida DEP).

As the 2022 Workshop only addressed two of the four Sentinel Categories it is also the intent of the CCSM by using the existing Sentinel Monitoring Database, careful coordination with other working group priorities and the expertise of the CCSM membership, to identify and scope the data needs of the remaining two categories. Specifically, it is the CCSMs intent to begin to outline an additional workshop series that provide individual focus to each of the sentinels under the remaining categories: Pelagic/Benthic Systems and Associated Species, and Fish Communities of Long Island Sound and Associated River Systems.

As noted above, to support the strategy, the LISS has funded several research and pilot projects (linked below). During FY23 the CCSM will coordinate with these project leads to fully incorporate lessons learned and identify any necessary next steps and share resources[5]

- [Sentinels of Climate Change: Coastal Indicators of Wildlife and Ecosystem Change in Long Island Sound](#)
- [Detecting Climate Change Impacts in Long Island Sound](#)
- [Sentinels of Change – Are Salt Marshes in Long Island Sound Keeping Pace with Sea Level Rise?](#)
- [Application of SLAMM to Coastal Connecticut](#)
- [SLAMM in NYS](#)
- [LISS Vulnerability Assessment (2019)](#)

Additionally, LISS has funded related work to support the needs of other workgroups that are very relevant to the data/informational needs of the CCSM. It is the CCSM's intent to begin to collaborate with those working groups and project teams. Some of those opportunities identified include:

- USGS Compound Flood Risk Model, coordinated by the Sustainable and Resilient Communities Workgroup.
- LIDAR and Mulitspectral Imaging for Saltmarsh baseline, coordinated by CT DEEP

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[5] .[https://longislandsoundstudy.net/research-monitoring/sentinel-monitoring/sentinel-monitoring-for-climate-change-research-projects/.](https://longislandsoundstudy.net/research-monitoring/sentinel-monitoring/sentinel-monitoring-for-climate-change-research-projects/)

Beyond these funded projects, there is a multitude of research projects previously and currently being conducted measuring parameters related to sentinels. It is imperative for LISS CCSM to coordinate and collaborate with other monitoring data compilation efforts. Effective coordination will enable a maintained focused study and continual awareness regarding climate change and sentinel long-term trends, and thereby a more seamless integration into LISS program and policy.

Furthermore, CCSM supports the mission and the workplan developed by the LISS Environmental Justice Workgroup and commits during FY23 to engage in the cross-workgroup collaborations initiated in FY22.

IV.   Implementation Actions:

Priority IAs for the work group include the following. Note that blue bolded implementation actions below were identified as priorities in the 2020-2024 CCMP.

Status	IA	Description
Work Group Priority In Progress	**WW-32 *CCMP Priority**	**Improve the monitoring needed to assess the risk of climate change impacts including acidification on water quality.**
Work Group Priority	WW-33	Implement the 2018 Sentinel Monitoring Strategy
Work Group Priority	**WW-34**	**Conduct periodic (five year, or earlier) review and revision of Sentinel Monitoring Strategy document.** ***However, there should be more emphasis on review rather than the revision.**
Work Group Priority	**WW-40**	**Continue to support, improve, and utilize the Sentinel Monitoring Data Citation Clearinghouse and other data synthesis, storage, and sharing efforts.**
Work Group Priority Further consideration by the HRSWG	**HW-5**	**Use remote sensing, mapping tools, modeling, and field verification to determine sites that are likely to be impacted by sea level rise, and which sites are ideal for habitat migration.**
Work Group Priority Further consideration by the HRSWG	HW-23	Collect and analyze data on LISS 12 targeted coastal habitat types in order to improve habitat assessment and adaptive management.
Work Group Priority Further consideration by the HRSWG	HW-27	Assess causes and extent of tidal marsh change through research and monitoring and use this information to create a model to prioritize sites for restoration and conservation.
Work Group Priority Further consideration by the WEWG & HRSWG	SM-26	Incorporate climate change-driven factors such as temperature, acidification, and sea level rise in model applications to assess factors that can influence future attainment of water quality standards and habitat protection and restoration goals.
Work Group Priority	SM-27	Determine how climate change will impact attainment of CCMP Ecosystem Targets, goals and objectives using LISS vulnerability assessment and other resources.

V. FY2023 Priorities/Needs:

- Develop and advance a Sentinel Monitoring Network. Specifically, FY23 will focus on the six sentinels identified as priorities in the June 2022 workshop (see Table 1) and define the scope and process for developing/analyzing networks for the remaining sentinels. To accomplish this the CCSM will work to address the following (WW-33, WW-34, WW-38, HW-5, HW-23, HW-27, SM-26).:
  - Identify a cluster of sites (e.g., rocky intertidal, tidal wetlands, submerged habitats) for each major sub-region (i.e., eastern, central, and western). To do this the CCSM will define the criteria to be evaluated in selecting a sentinel monitoring site.
  - Compile and analyze historic and ongoing raw data related to each of the sentinels. The workgroup has identified several opportunities noted, in the desired outcomes, to coordinate the data assessments of these priority sentinels. Additionally, it is the CCSM's intent to scope a description of the further data analysis needs that may provide a mentorship/internship opportunity.
  - Enhanced workgroup and public coordination to increase early suggestions about potential new sampling sites.
  - Continue to examine recommendations regarding the existing documentation QA/QC monitoring with considerations for distribution of cluster of sites in each major sub-region. To do so the CCSM shall match existing monitoring programs to the list of revised sentinels, consider regional coverage provided and then approve the list as the incipient network. First step will be to create a crosswalk from data listed in the sentinel monitoring database with the sentinels identified in the Sentinel Monitoring Strategy.
  - Collaborate and leverage existing work to ensure the best science, greatest efficiencies and likelihood of longevity are secured. Specifics include:
    - Develop the future direction (i.e., platform) for the Sentinel Monitoring Data Citation Clearinghouse through coordinating with existing database effort such as SECAR, LISICOS/NERACOOS, NOAA and on-going database efforts within LISS and its partners such as LIQWIDS, Quickdrops, and USGS Data Clearinghouse.(WW-40)
    - Coordinate the Tidal Wetland metrics, specifically the relevant data collected through the SHARP program, that may provide an ideal opportunity for collaborating with the Indicators Review Team, and the Habitat Restoration and Stewardship Workgroup.
    - Coordinate with the project leads of the Coastal Acidification Monitoring project to support the continuance of this critical data need.
    - Coordinate with EPA's ORISE fellow to evaluate the historical pH data and further define the duties required for a full historical data analysis of the priority data sentinels.
    - Coordinate with CT National Estuary Research Reserve to identify overlapping research/monitoring needs.
- Outline and define additional workshop needs to better evaluate the remaining sentinel categories. Specifically, the remaining categories are: Pelagic/Benthic Systems and Associated Species; and the Fish Communities of Long Island Sound and Associated River Systems (HW-23)
- Increase engagement, collaboration, and connection with the LISS team through a targeted collaboration with the LISS EJ Workgroup and identification of opportunities to view and act on sentinel monitoring work through this lens.

- Support and increase collaboration with the LISS communications team through the implementation of the COE. CCSM supports the additional staff for additional language support recommended in the COE.
- Through enhanced collaboration with LISS working groups, principal investigators of Sentinel pilot projects and other related research, the CCSM will update the evaluation on how climate change will impact attainment of CCMP Ecosystem Targets, goals and objectives using LISS vulnerability assessment and other resources (SM-27). This shall be instituted during FY23 through the review and update of the 2018 Strategy. (WW-34)

Table 1. Priority Sentinels Identified for 2023 Focus During the June 2022 Workshop[6]

Category	Sentinel
Water Quality and Quantity	Hypoxia
	Acidification
	Harmful Algal Blooms
Coastal Habitat of Long Island Sound & Associated Species & Systems	Tidal Wetlands
	Changes in distribution, composition, and marine transgression of marshes*
	Freshwater Wetlands

Note this was not identified in the 2018 Strategy

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[6] Note the other categories were not addressed during the June 2022 Workshop