

Long Island Sound Eelgrass Management and Restoration Strategy: Project Updates

Long Island Sound Eelgrass Collaborative
June 12, 2024

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EPA Long Island Sound Office



**Long Island
Sound Study**

A Partnership to Restore
and Protect the Sound



1. Strategy Overview

2. FY2023 Implementation*

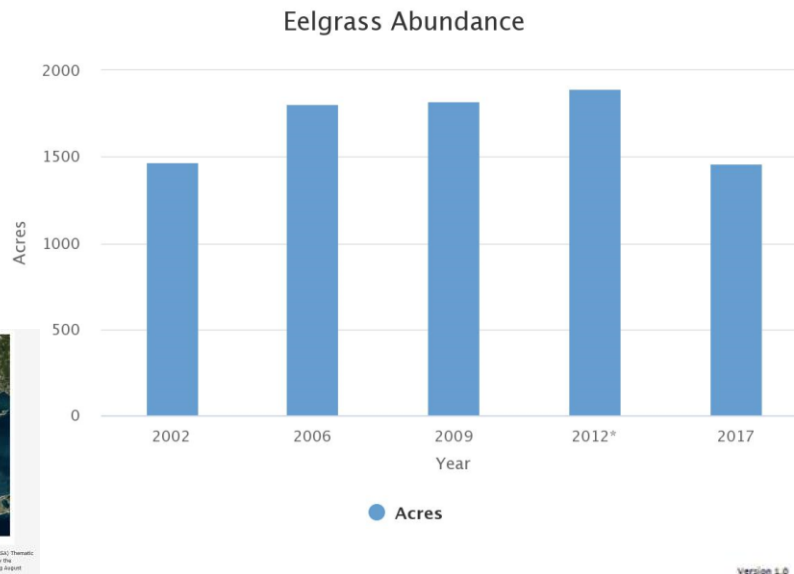
3. FY2024 Implementation*

* Only LISS-funded projects

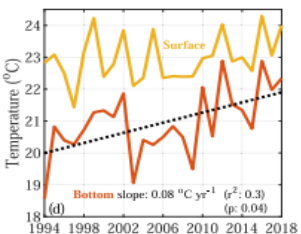
Outline:

- Eelgrass
 - Seagrass Background
 - Eelgrass in Long Island Sound
 - History
 - Threats
 - Gaps Hindering Progress
- Framework
 - Year 1-2
 - Year 2-3
 - Year 3-5+
- Implementation
 - Funding
- Conclusion

- **Ecosystem Target: Restore and maintain an additional 2,000 acres of eelgrass by 2035 from a 2012 baseline of 1,893.**



Version 1.0



Source: Whitney and Vlahos 2021.

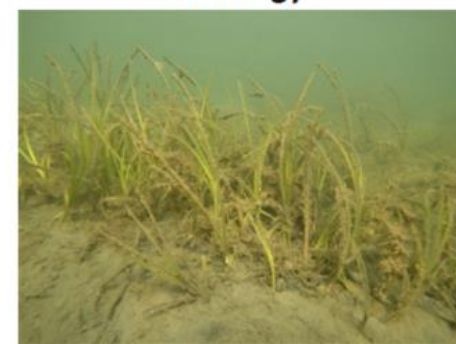


Figure 3. True color image taken by the National Aeronautics and Space Administration (NASA). Thematic images on the Larchmont Channel. Image shows areas of suspended sediment discharged by the Connecticut River into Long Island Sound after Hurricane Irene impacted New England during August 2011. Open water areas approximate location of study area.

- **Strategy Objective: Targeted strategy to meet the Eelgrass Extent Ecosystem Target.**

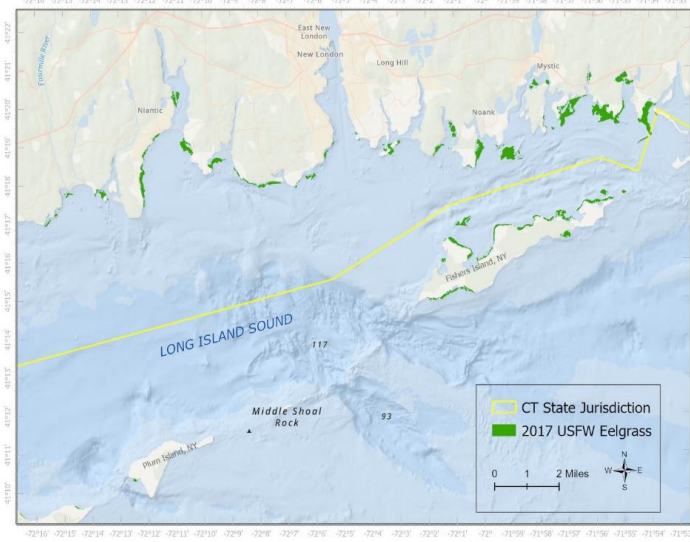
- Extension of the Long Island Sound Habitat Restoration Initiative (2003 – Present)
- Emphasis on climate change related threats
- Highlights current gaps and actions to implement starting in FY23
- Living document

Long Island Sound Eelgrass Management and Restoration Strategy



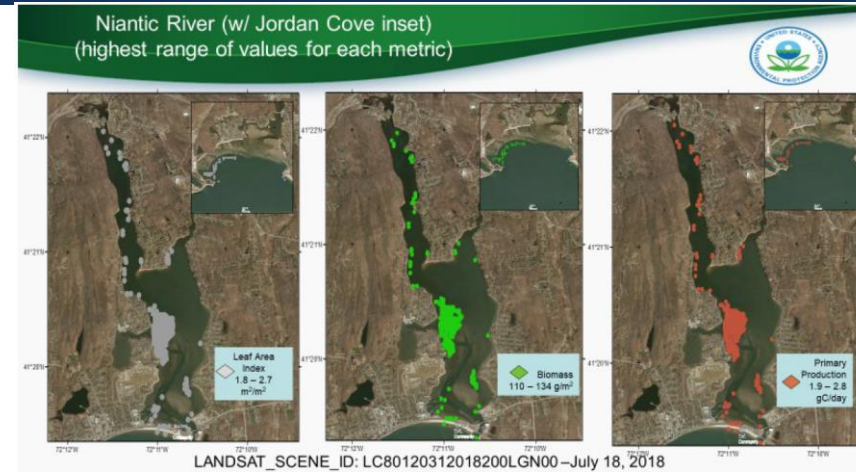
December 2022

• Aerial Surveys



Source: Bradley, 2017

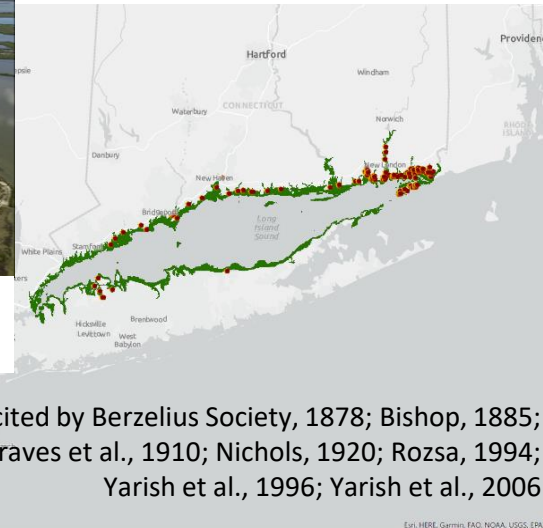
- Frequency of aerial surveys
 - Recommendation: Annual
- Restrictions/Limitations:
 - Weather
 - Funding
 - Methodology to accurately and consistently determine percent cover



Source: Colarusso, Keith, and Rego, 2019



Source: University of Florida, <https://geog.ufl.edu/2019/10/09/geography-colloquium-drone-mapping-for-coastal-seagrass-monitoring-and-citizen-science/>



as cited by Berzelius Society, 1878; Bishop, 1885; Graves et al., 1910; Nichols, 1920; Rozsa, 1994; Yarish et al., 1996; Yarish et al., 2006

Addressing the Gap

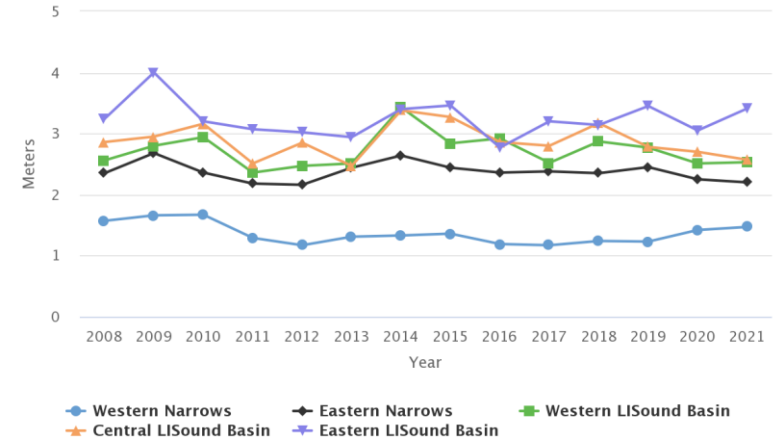


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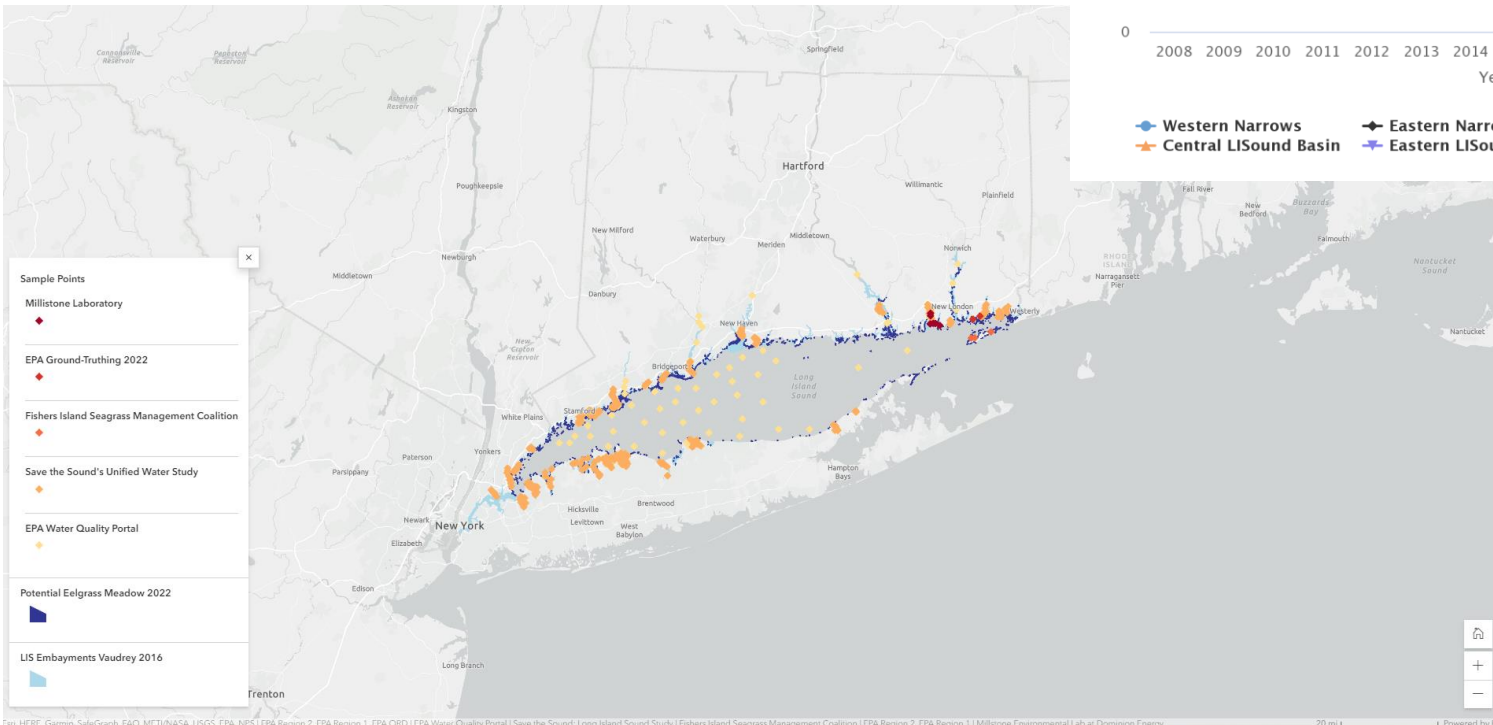
Title	Lead Organization	Point of Contact	Partner Organizations	Objectives	Timeline
Eelgrass Aerial Survey 2024 & 2025	New York State Department of Environmental Conservation (2024), US Geologic Survey (2025)	Della Campbell (NYSDEC), Jon Morrison (USGS)	NEIWPCC	The objectives is to conduct an eelgrass aerial survey to map eelgrass extent in 2024 and 2025. The survey data will be used for the Eelgrass Mapping Intercomparison Study (see below).	June/July 2024 and 2025
Eelgrass Mapping Intercomparison Study	University of Rhode Island	Mike Bradley (URI), Suzanne Paton (USFWS)	US Fish and Wildlife Service, Connecticut Department of Energy and Environmental Protection, US Environmental Protection Agency	The objective is to conduct an intercomparison study between remote-sensing technologies to determine the utility of each technology in mapping eelgrass extent and density.	June 2024 – September 2026
Eelgrass Leaf Area Index Mapping Using Satellite Imagery	US Environmental Protection Agency	Nate Merrill, Phil Colarusso, Darryl Keith, Cayla Sullivan, Melissa Duvall	University of Connecticut	The objective is to develop and refine an algorithm to train computers how to estimate eelgrass distribution and productivity (in the form of leaf area index) by using satellite imagery (Landsat-8; Sentinel-2).	Summer 2022 – Present

- **Monitoring**
- Lack of water quality and sediment data
 - Especially water temperature and water clarity
- Lack of eelgrass phenology and growth characteristics

Water Clarity by Avg. Secchi Depth (Meters)

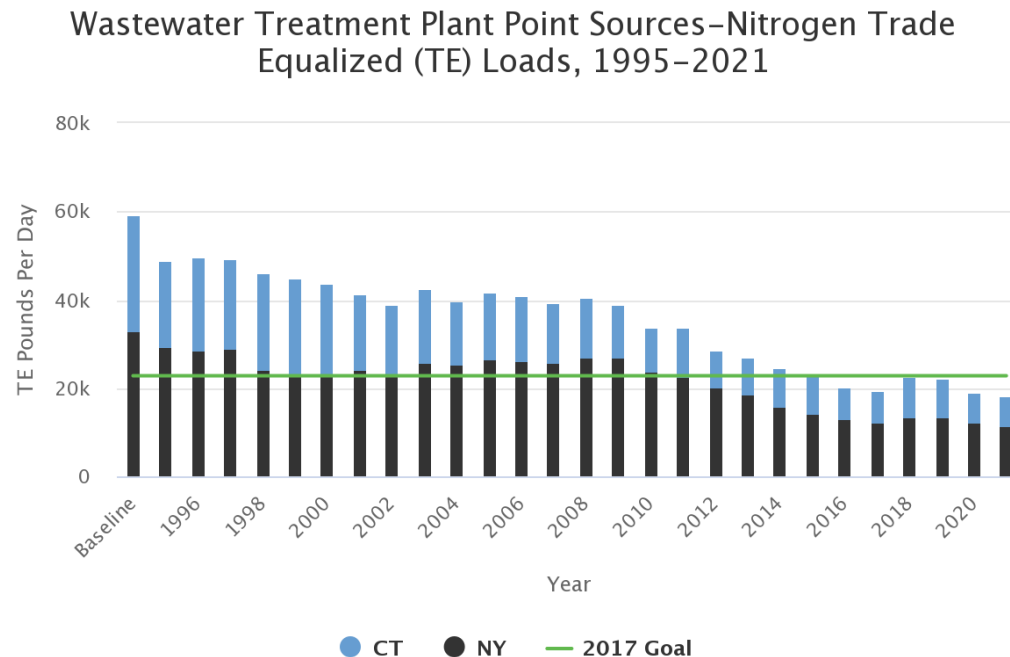


Highcharts.com



- **Water Quality Management**

- Nitrogen Loading Ecosystem Target has shown LISS has made great progress in reducing nitrogen from wastewater treatment plants
- Natural habitat restoration: Mumford Cove (Vaudrey et al., 2010)



Modeling Updates



Figure 11: Exclusive Band. The Exclusive Band was generated from a combination of water depth, mean tidal amplitude, and % Light Reaching the Bottom. The resulting area is theoretically suitable for eelgrass if all other parameters are optimal.

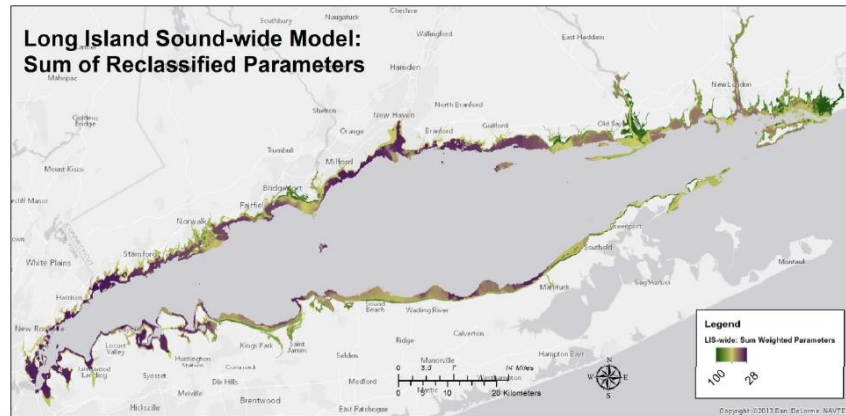


Figure 22: Sum of Ranked Parameters within the Exclusive Band. The ranking results of the five selected parameters which were weighted and then summed to a maximum score of 100. A score of 100 is considered most ideal for eelgrass and 0 is least ideal. The lowest score within the exclusive band is 28.

Table 6: Ranking Analysis Selected Parameters. These five parameters were applied to the ranking analysis within the exclusive band.

Parameter	Summary	Source
Percent Light Reaching the Bottom (%)	Kd measures light in the water column, the % Light Reaching the Bottom is a measure to the benthic eelgrass. Kd value calculation: $\% \text{ Light} = e^{-(Kd * \text{Depth})}$ Where 'e' is the base of natural logarithm	CT DEEP, June through September for 2009-2011
Temperature (°C)	Temperatures in the water column may exceed the thermal tolerance for eelgrass and result in reduction of photosynthesis and growth rates or lead to death.	CT DEEP, July and August for 2009-2011
Dissolved Oxygen (mg/L)	Eelgrass requires sufficient oxygen in the water column. Sufficient oxygen reduces the levels of reduced compounds which can be toxic to eelgrass plants (e.g. hydrogen sulfide, ammonium). The lowest values are during July and August.	CT DEEP, July and August for 2009-2011
Sediment Grain Size (% silt and clay)	The type of sediment can impact the survival of benthic flora and influence the success of a species that attempts to root in this sediment	Woods Hole Oceanographic Institute, 1964-2010
Sediment Total Organic Carbon (%)	Existing eelgrass beds have relatively organic rich sediment due to settling and trapping of particles. Restoration of eelgrass indicates much lower organic content is preferred by beds in the process of establishment.	Long Island Sound Resource Center, 1974-1997

Source: Vaudrey et al., 2013

Addressing the Gaps

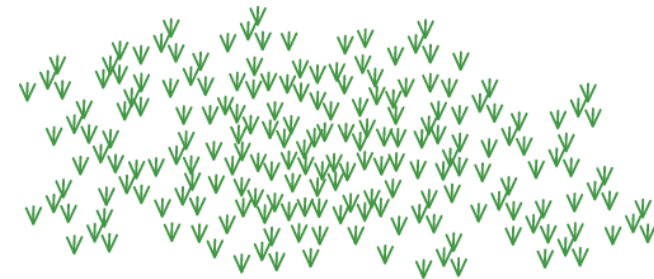
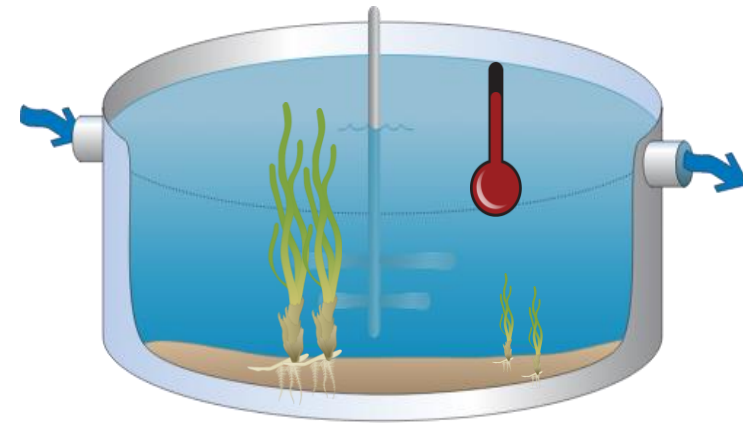


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Title	Lead Organization	Point of Contact	Partner Organizations	Objectives	Status
<p>Adding a New Group Monitoring Two Embayments with Eelgrass Present to the Unified Water Study, 2024 Season</p>	<p>Save the Sound</p>	<p>Peter Linderoth</p>	<p>Project Oceanology</p>	<p>The objective is to add Unified Waters Study monitoring groups in embayments with eelgrass to characterize water quality conditions in these waters. Mumford Cove was added in 2023 in response to this interest and this supplemental proposal will bring two Fisher Island embayments into the UWS in 2024.</p>	<p>2023/2024 – Present (annual)</p>
<p>Update and Enhancement of the GIS-based Long Island Sound Eelgrass Habitat Suitability Index</p>	<p>TBD</p>	<p>TBD</p>	<p>NEIWPCC</p>	<p>The objectives are to expand the evaluation of sites being considered for eelgrass restoration efforts in the Long Island Sound area and to identify areas where environmental or climate factors reduce or eliminate the potential for natural eelgrass colonization.</p>	<p>October 2023 – September 2026</p>
<p>SeagrassNet: Fishers Island Site</p>	<p>Fishers Island Seagrass Management Coalition</p>	<p>Hannah Vagts</p>	<p>US Environmental Protection Agency</p>	<p>The objective is to develop a SeagrassNet monitoring site in Long Island Sound where the eelgrass meadows will be monitored to assess the health annually.</p>	<p>July 2023 – Present (annual)</p>

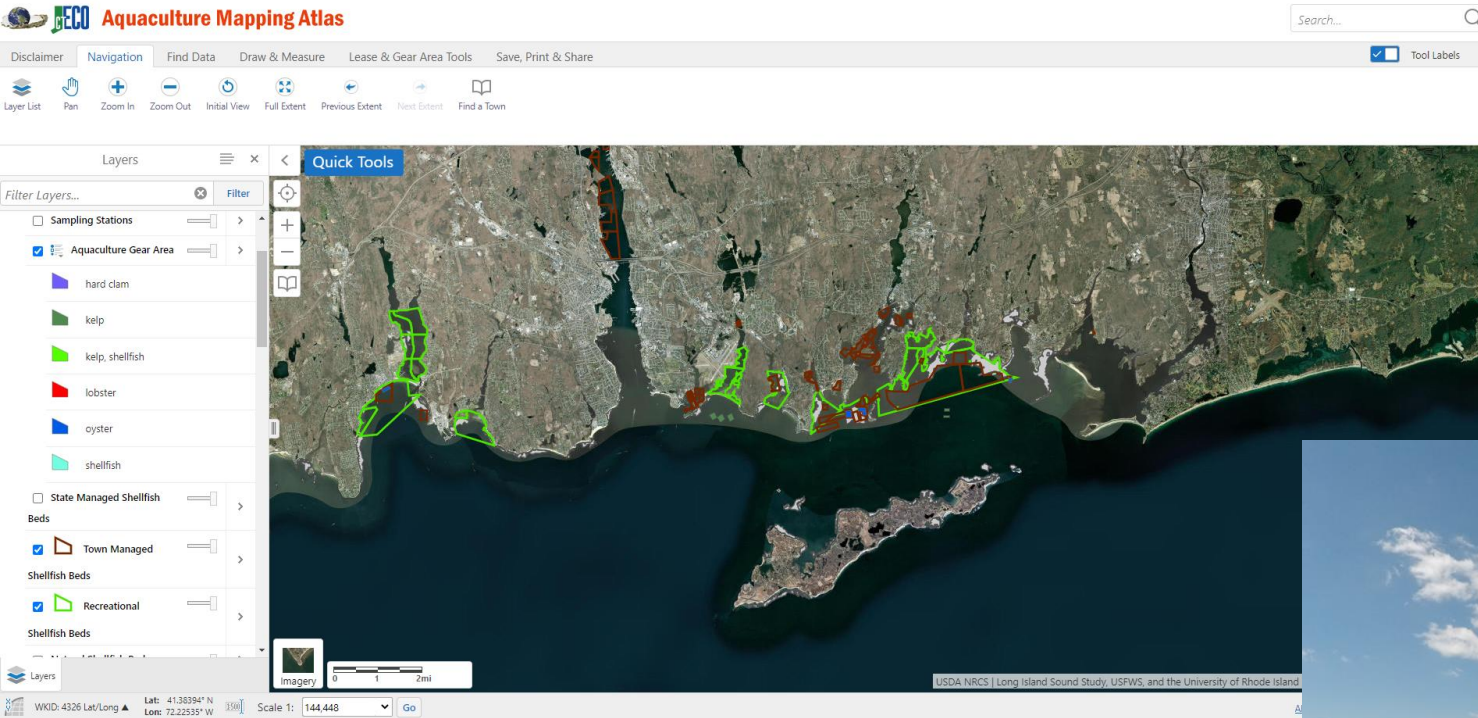
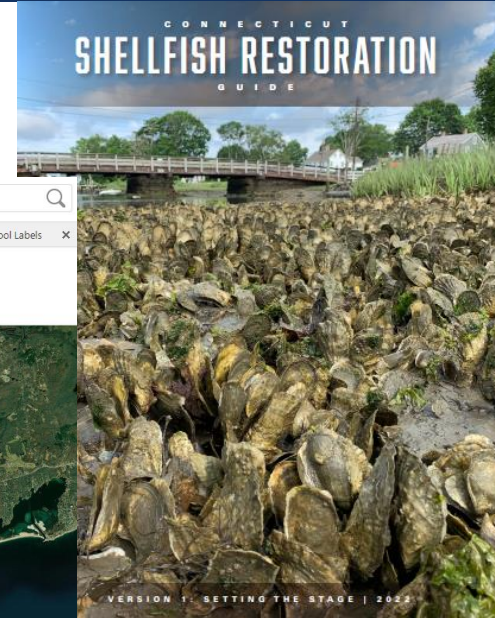
• Changing Climate

- A study performed in 2012 investigated genetic traits of eelgrass meadows in New England and New York. Out of the 39 sites samples, the investigators evaluated the resilience of 10 eelgrass populations and identified three metapopulations in the region that experience gene flow
- Building Eelgrass Resilience Workshop, June 2022
- Next Steps: Genetic Resiliency Analysis & Common Garden Implementation





- Eelgrass and Aquaculture Interactions



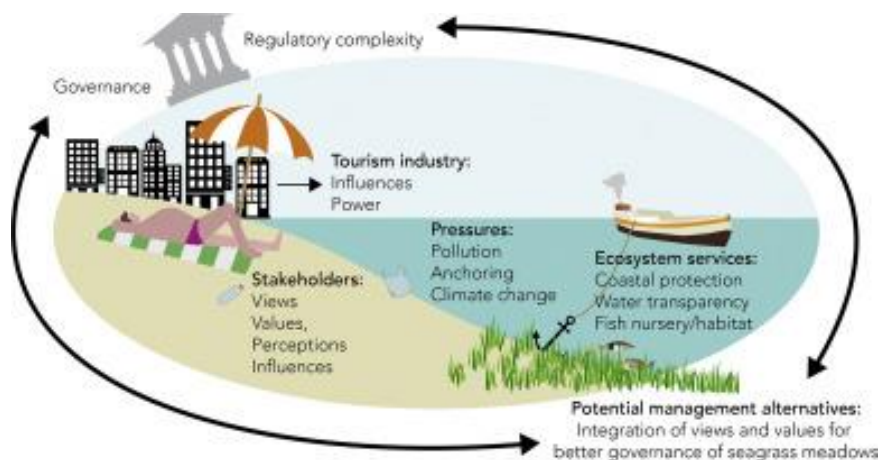
Source: Cayla Sullivan

- **Public Awareness**

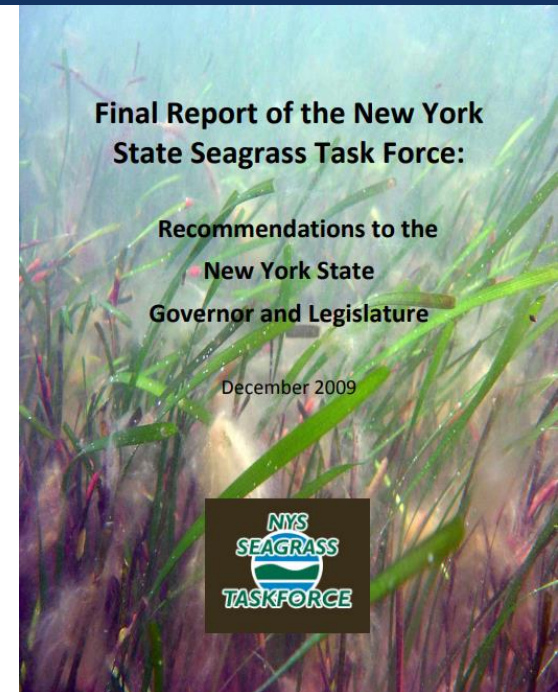
- Recreational and other human activity can cause harm to eelgrass meadows

- **Regulations and Implementation**

- Better coordination between federal, state, and local agencies and organizations to protect eelgrass



Source: Ruiz-Frau et al., 2019



General Assembly
February Session, 2022

Raised Bill No. 242

LCO No. 1827



Referred to Committee on ENVIRONMENT

Introduced by:
(ENV)

AN ACT ESTABLISHING A WORKING GROUP ON THE RESTORATION OF EEL GRASS.

Addressing the Gap



Long Island Sound Study
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Title	Lead Organization	Point of Contact	Partner Organizations	Objectives	Status
Expansion of the Eelgrass Flowering Study	US Environmental Protection Agency	Phil Colarusso	Long Island Sound Study	The objective is to identify areas of substantial eelgrass beds and determining flowering abundance for seed collection	June 2023 (Pilot)/ June 2024 (More-Targeted)
Long Island Sound Eelgrass Collaborative	Connecticut National Estuarine Research Reserve	Katie Lund	Long Island Sound Study	The objectives are to identify management and regulatory challenges and recommendations for eelgrass restoration; coordinate with other regional efforts to better understand the interactions between eelgrass and aquaculture; provide input on other LISS funded eelgrass projects; and improve bi-state collaboration by sharing information, identifying research gaps, funding opportunities, and networking	August 2023 – Present
Diving Into Long Island Sound's Seagrass Meadows	US Environmental Protection Agency	Cayla Sullivan	Long Island Sound Study	The objective is to communicate the importance, history, and threats of Long Island Sound's eelgrass meadows, highlights Long Island Sound Study's ongoing efforts to protect and restore these essential ecosystems, and emphasizes the importance of understanding climate change implications on eelgrass distribution and productivity.	Published October 2023 (Plan to Update)

A. Year 1-2 (2023-2024)

- Create a Long Island Sound Eelgrass Collaborative
- Update to the Eelgrass Habitat Suitability Index Model
- Enhance Continuous Water Quality Monitoring and Initiate Human Activity and Eelgrass Monitoring
- Continue and Enhance Remote Sensing Surveys
- Analysis of Historical Data (Vaudrey Lab)

B. Year 2-3 (2024-2025)

- Continue the Collaborative
- Eelgrass Resiliency and Common Garden Implementation
- Continue to conduct and expand aerial surveys
- **NEW: Initiate a long-term and large-scale seed-based restoration program**

C. Year 3-5+ (2025+)

- Organize a workshop to identify trends, progress, and next steps
- Compile, synthesize, and analyze continuous eelgrass and water quality monitoring data to understand interannual variability
- Utilize the EHSI model outputs to make informed decisions
- Continue eelgrass resiliency mesocosm experiments/common garden experiments for potential expansion
- Following 3-4 years of monitoring and piloting small-scale restoration projects with common garden or existing meadow with high genetic resiliency seeds, aim to have a large-scale restoration project installed in the Sound



- **Request for Proposals: Initiate and Develop a Long-Term Targeted and Large-Scale Eelgrass Seed Dispersal Restoration Initiative**
- **Organization: NEIWPCCEPA**
- **Project Period: October 1, 2024-September 30, 2028 (RFP to be released in October 2024)**
- **Project Cost: \$1,500,000 (for 3 years)**
- **Objectives: The objective of this proposal is to develop and release a Request for Proposals (RFP) to initiate a long-term targeted and large-scale eelgrass seed dispersal restoration initiative. The amount requested would support the program's set up as well as 3 years of seed dispersal restoration. The project leads will continue to develop and refine the RFP, but some key components to be highlighted in the RFP are:**
 - Expanding acreage in well-established eelgrass meadows
 - Piloting establishment of eelgrass meadows in areas where there is currently no eelgrass but suitability is high
 - Increasing the gene flow/genetic diversity in eelgrass meadows
 - Piloting innovative approaches to broadcast eelgrass seeds
 - Coupling other restoration techniques with seed broadcasting (i.e., building off Long Island Sound Research Grant Program)
 - Post-dispersal monitoring



- **Address knowledge gaps (FY23 LISS-funded projects)**
- **Inform restoration and management goals**
 - Update the LIS Eelgrass Management and Restoration Strategy
 - Target sites for protection, restoration, monitoring, or water quality improvement projects
- **CCMP Revision – Ecosystem Target: Eelgrass Extent?**
 - New Objective: Coastal Habitat
 - Numeric Goal: Protect and enhance the current extent and health of coastal habitat and restore an additional 1,000 acres.
 - Measurable: Coastal Habitat Extent (includes eelgrass mapping)
 - Sub-Goal: Restore 10 acres of eelgrass.



QUESTIONS?

