

Long Island Sound Eelgrass Management and Restoration Strategy

Long Island Sound Eelgrass Collaborative Meeting
October 12, 2023



**Long Island
Sound Study**

A Partnership to Restore
and Protect the Sound

1. Strategy Overview

2. FY2023 Implementation

3. FY2024 Potential Implementation

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

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

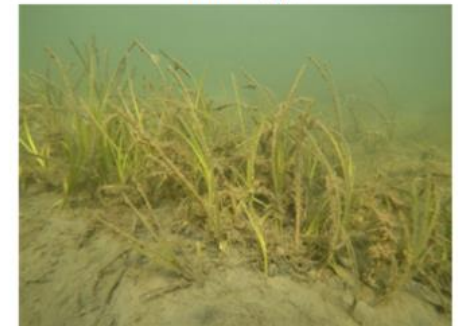
- This document provides guidance for short and long-term actions that should be taken to manage and restore eelgrass meadows in the Long Island Sound and act as a resource for other estuaries in the region facing similar issues.
- This is a living document meaning that as new research, resources, and information becomes available, the gaps and required actions may change.
- Finalized December 2022

Development Process: A series of meetings to gather feedback from local experts and outline recommendations and specific actions to implement (FY23 being the goal):

- Meeting 1 (July 25) - identified current issues/threats, resources, gaps, priorities (short and long-term)
- Meeting 2 (September 19) – identified a prioritization system for management areas and actions/next steps
- Meeting 3 (November 15) – finalized the strategy

Version 1.0

Long Island Sound Eelgrass Management and Restoration Strategy



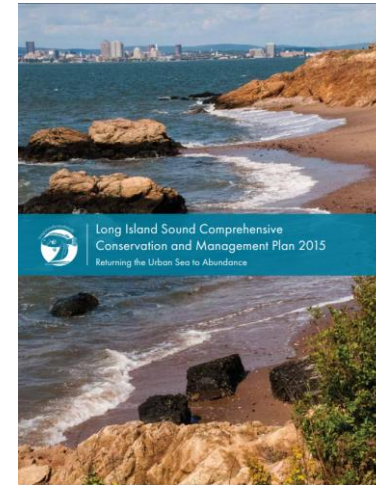
December 2022

Comprehensive Conservation and Management Plan



Long Island Sound Study
A Partnership to Restore and Protect the Sound

- **Four major themes:**
 - Clean Waters and Healthy Watersheds
 - Thriving Habitats and Abundant Wildlife
 - Sustainable and Resilient Communities
 - Sound Science and Inclusive Management
- **To achieve the goals of each theme**
 - 20 Ecosystem Targets and Supporting Indicators
 - Set measurable targets of restoration by 2035
 - 136 Implementation Actions
 - Action plan to be updated every five years



2020–2024
Long Island Sound
Comprehensive Conservation
and Management Plan Update

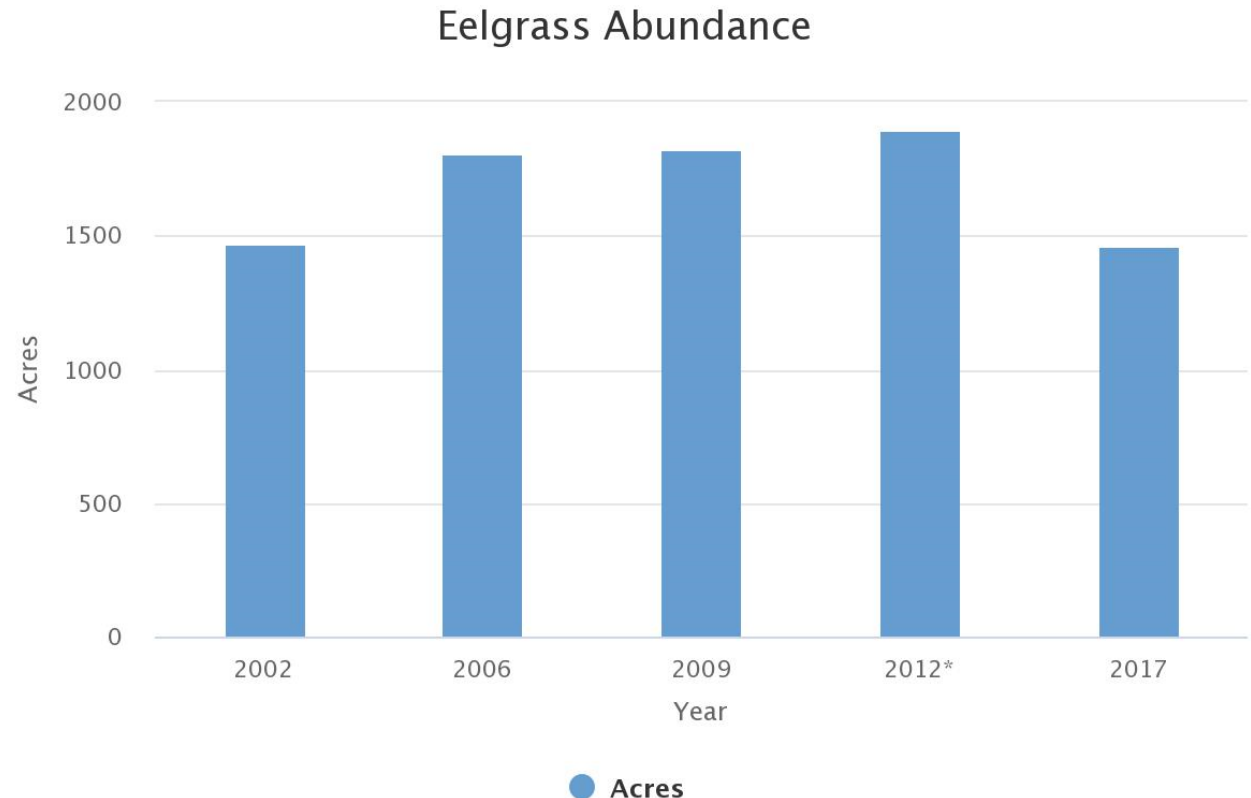
This update contains new and revised Implementation Actions (IAs) for the 2020-2024 planning cycle. The full CCMP with the original IAs is at: longislandsoundstudy.net/2015/09/2015-comprehensive-conservation-and-management-plan



January 2021

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

Since 2002, eelgrass meadows have been intermittently monitored through US Fish and Wildlife Service aerial surveys. The most recent aerial survey (2017) showed a decline in eelgrass extent (1,465 acres).



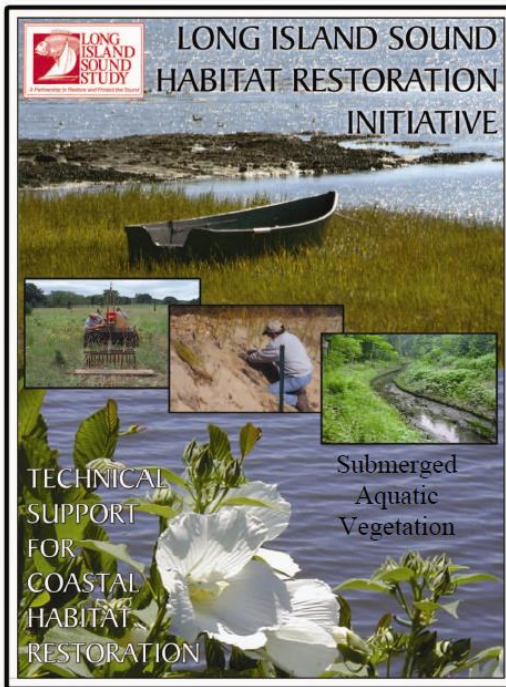
Highcharts.com

HW-25: Continue Long Island Sound eelgrass abundance surveys and promote eelgrass management

Eelgrass in Long Island Sound

History

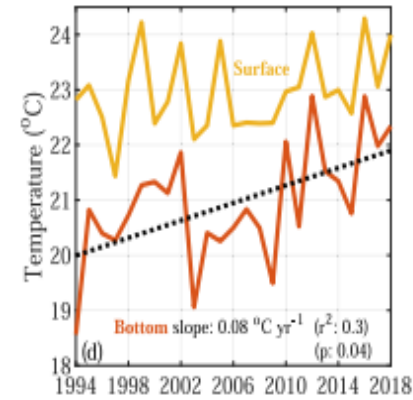
- Pre-1931
- 1931-1995
- 1995-2003
- **2003-Present**



Eelgrass in Long Island Sound – History and Threats

A. Threats

- Impaired Water Quality
- Fishing and Vessel Related Activity
- Waterfowl and Storm-Related Damage
- Shoreline Erosion Control Structures
- Shading of Beds
- Dredge Activities & Fill
- **Temperature**
- **Sea Level Rise**
- **Storm Disturbance**



Source: Whitney and Vlahos 2021.

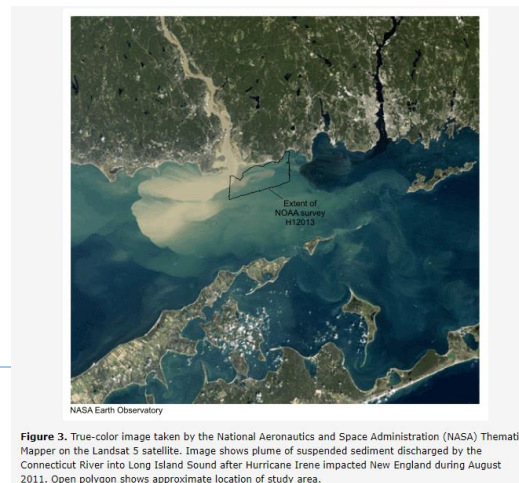
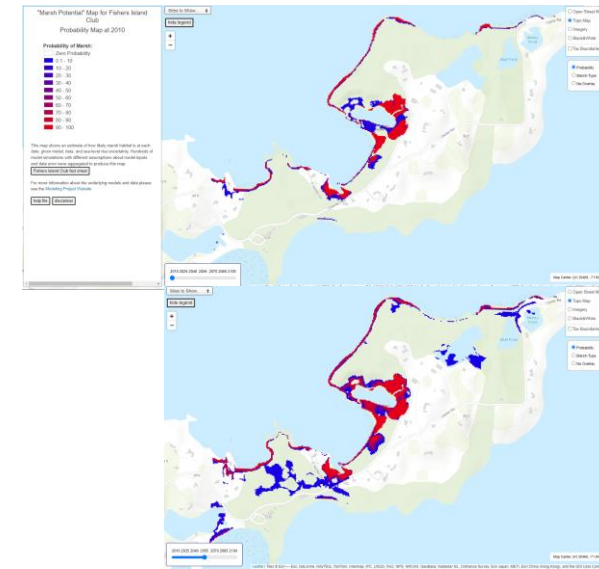
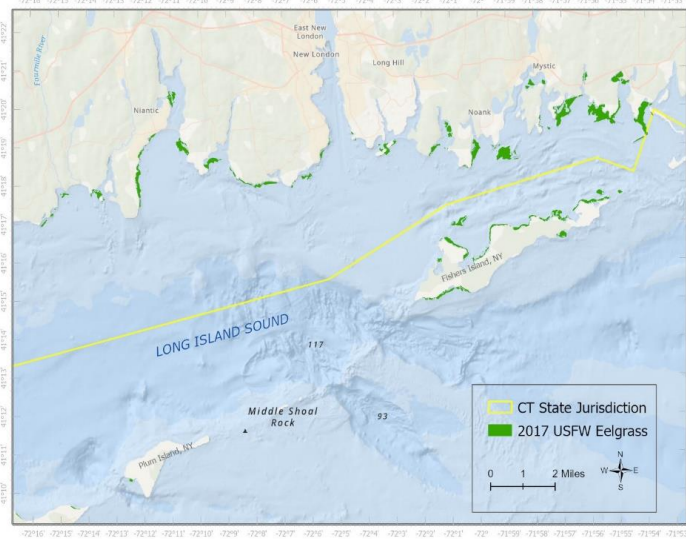


Figure 3. True-color image taken by the National Aeronautics and Space Administration (NASA) Thematic Mapper on the Landsat 5 satellite. Image shows plume of suspended sediment discharged by the Connecticut River into Long Island Sound after Hurricane Irene impacted New England during August 2011. Open polygon shows approximate location of study area.



Gaps Hindering Progress

Aerial Surveys

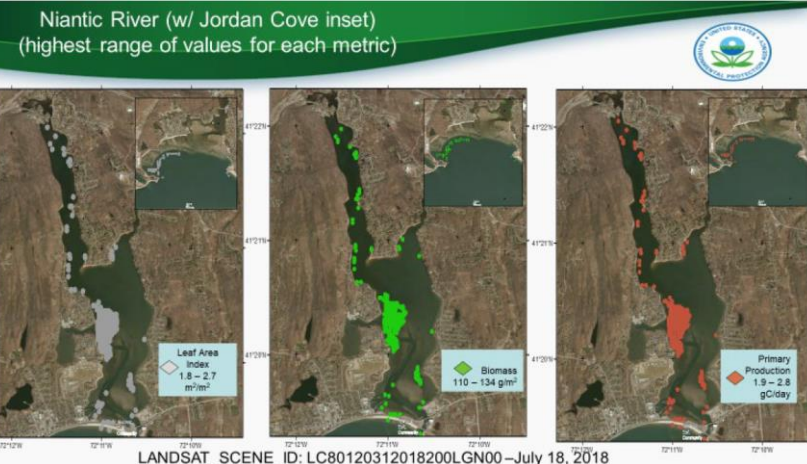


Source: Bradley, 2017

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

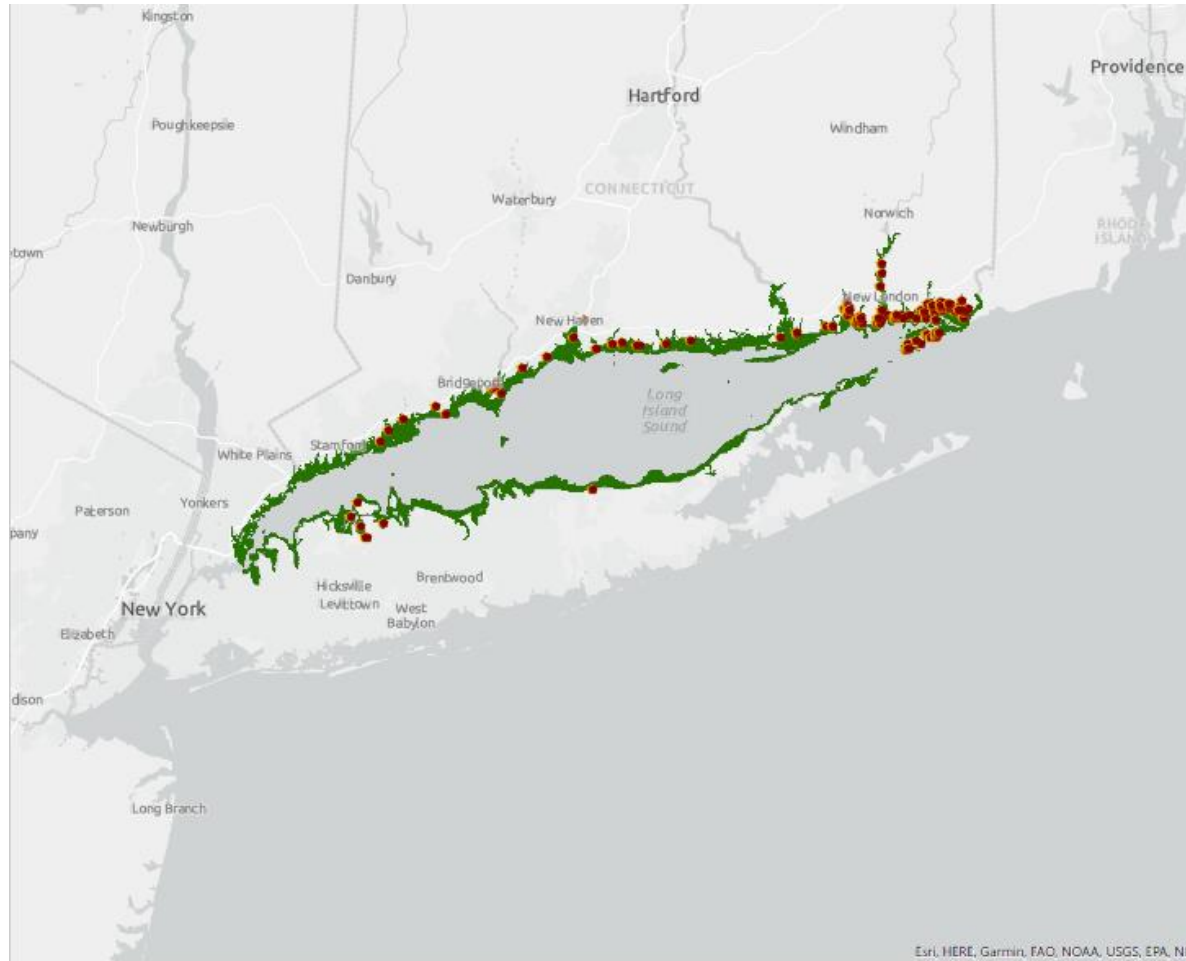


Source: University of Florida,
<https://geog.ufl.edu/2019/10/09/geography-colloquium-drone-mapping-for-coastal-seagrass-monitoring-and-citizen-science/>



Source: Colarusso, Keith, and Rego, 2019

Aerial Surveys - History



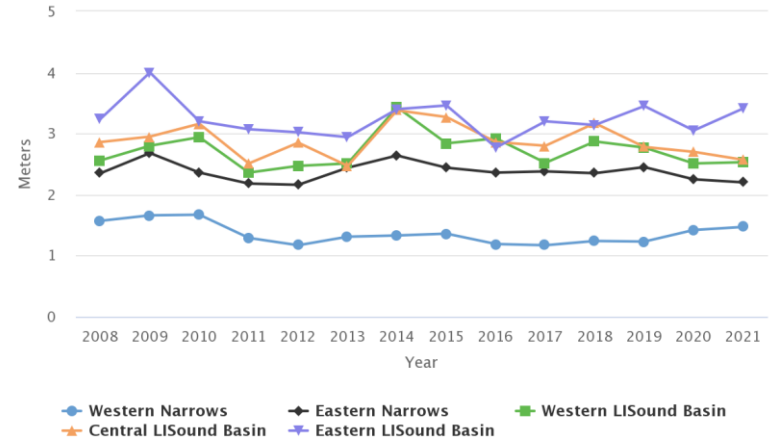
as cited by Berzelius Society, 1878; Bishop, 1885; Graves et al., 1910; Nichols, 1920; Rozsa, 1994; Yarish et al., 1996; Yarish et al., 2006

Gaps Hindering Progress

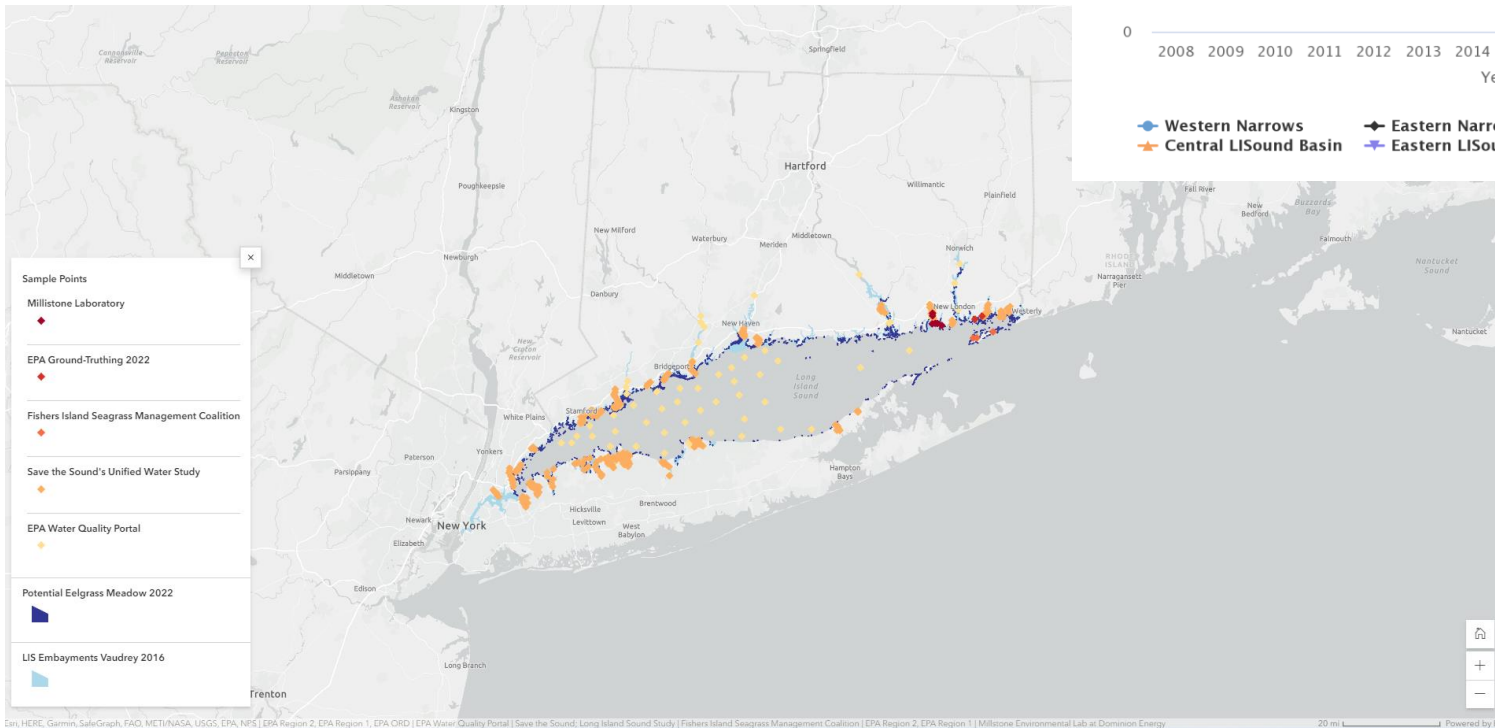
Monitoring

- 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)



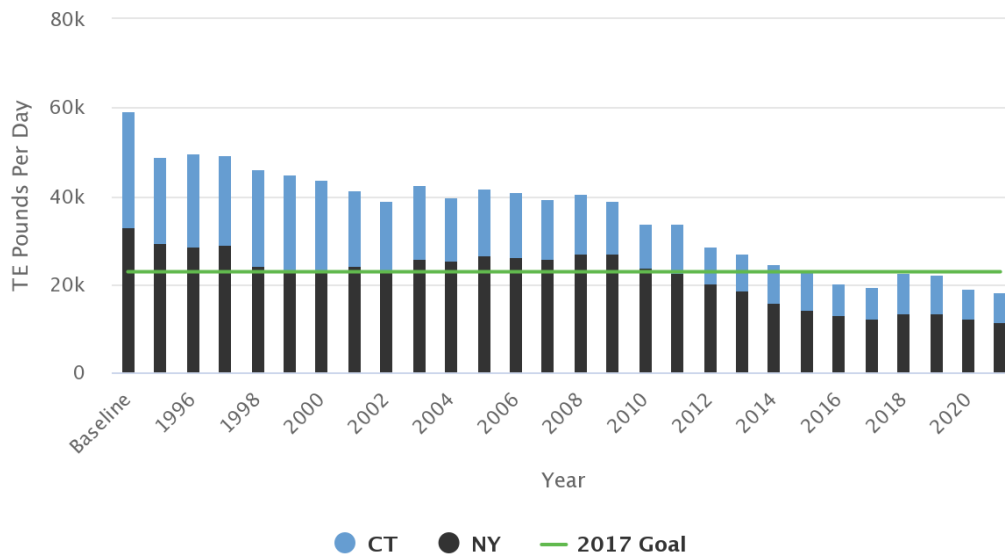
Highcharts.com



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)

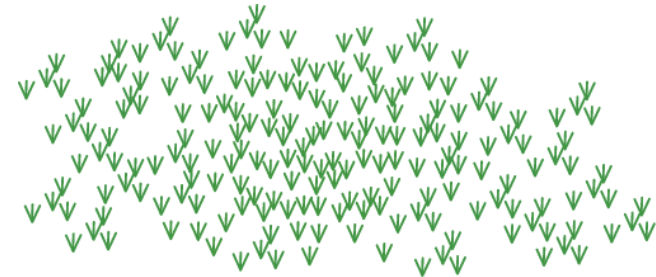
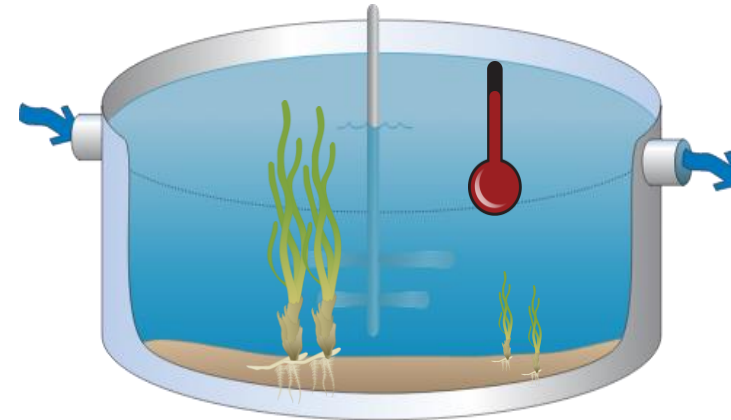
Wastewater Treatment Plant Point Sources–Nitrogen Trade Equalized (TE) Loads, 1995–2021



Highcharts.com

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 - Steering Committee, including representatives from Stony Brook University, Ocean Sewage Alliance, US EPA, The Nature Conservancy, Smithsonian Institute, and Northeastern University, held a series of workshops designed to discuss emerging techniques to address declining eelgrass populations which face pressures from warming waters along our coastline
- Next Steps: Common Garden Implementation
 - A common garden is an approach to bring in a wide array of plants (from many locations with differing environments) in a strategically selected location, determine which phenotypes survive and are productive, and then investigate if there are particular genotypes that were self-selected by the garden (Rellstab et al., 2021)



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.

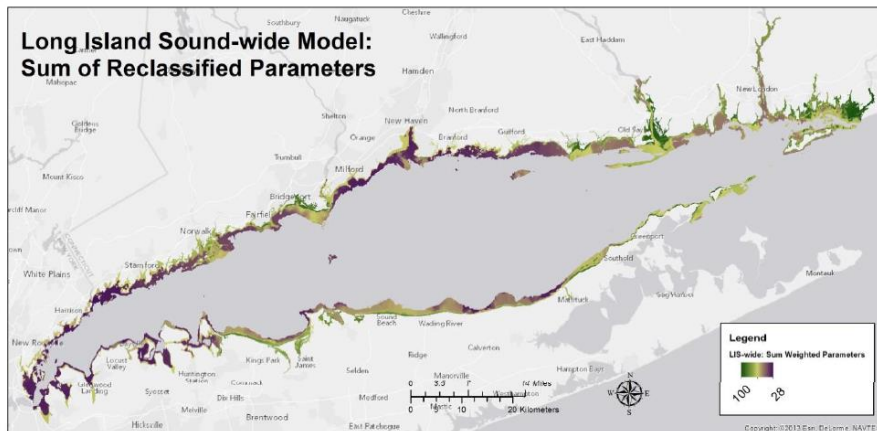


Figure 22: Sum of Ranked Parameters within the Exclusive Band.
The ranking results of the five selected parameters which were weighted and then summed to a maximum score of 100. A score of 100 is considered most ideal for eelgrass and 0 is least ideal. The lowest score within the exclusive band is 28.

Table 6: Ranking Analysis Selected Parameters.

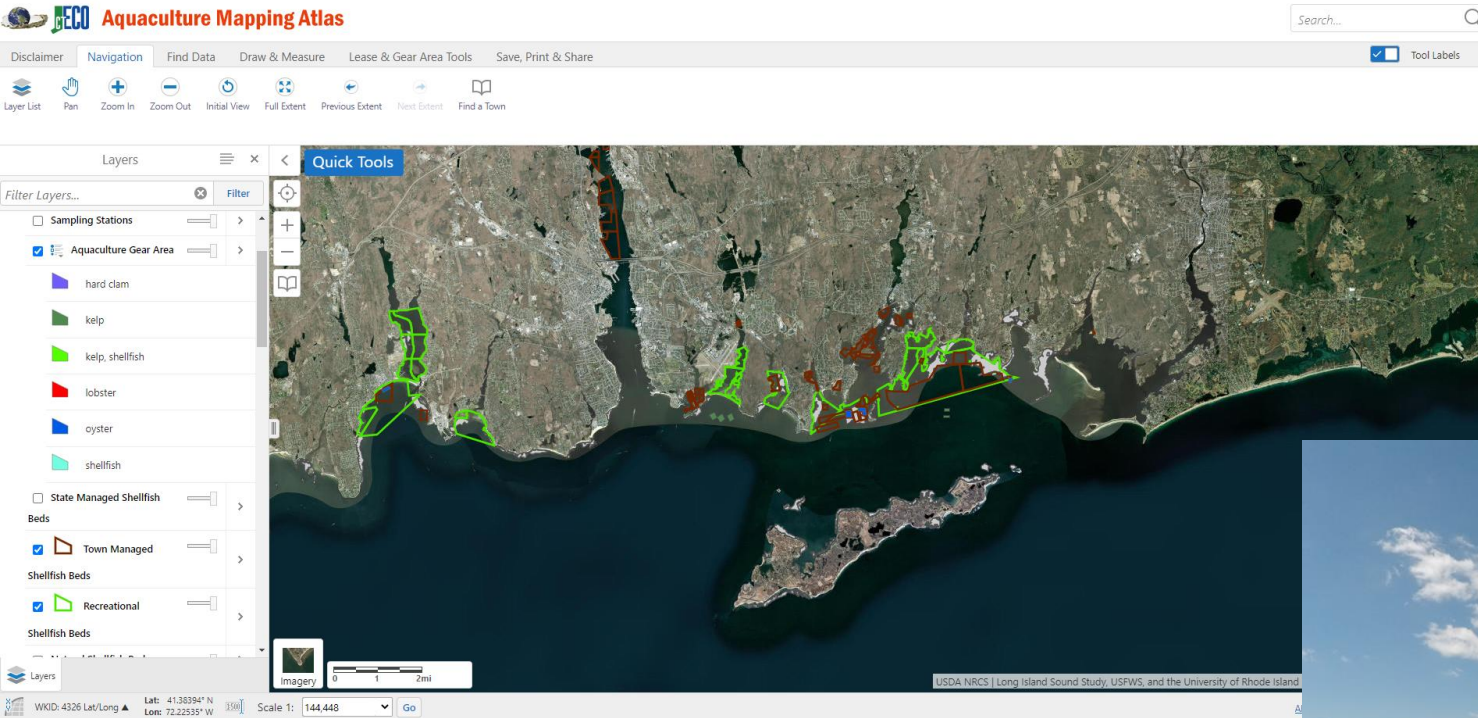
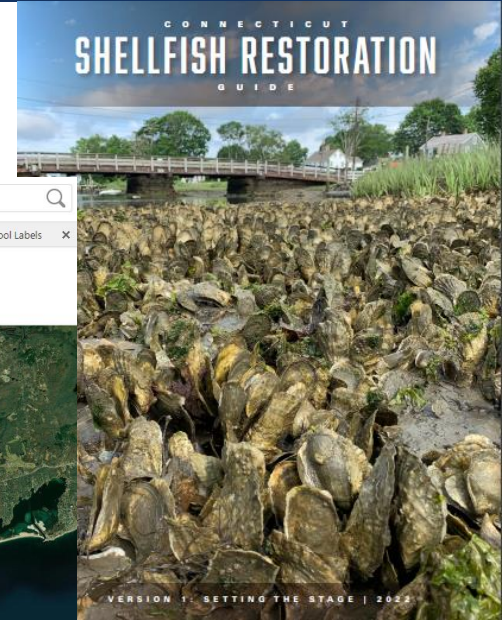
These five parameters were applied to the ranking analysis within the exclusive band.

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

Gaps Hindering Progress

Eelgrass and Aquaculture Interactions



Source: Cayla Sullivan

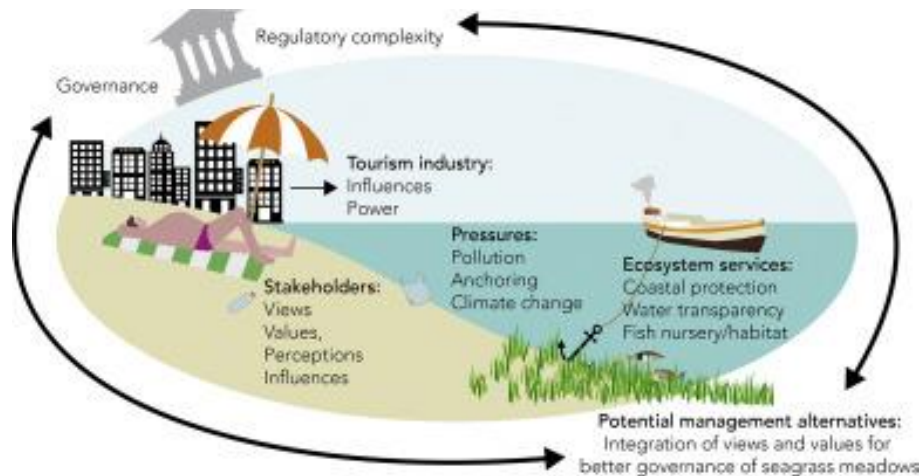
Gaps Hindering Progress

Public Awareness

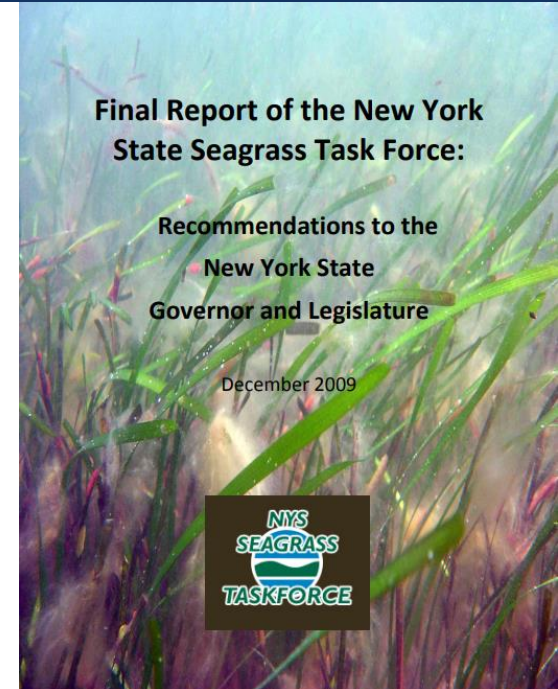
- Recreational and other human activity can cause harm to eelgrass meadows

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.

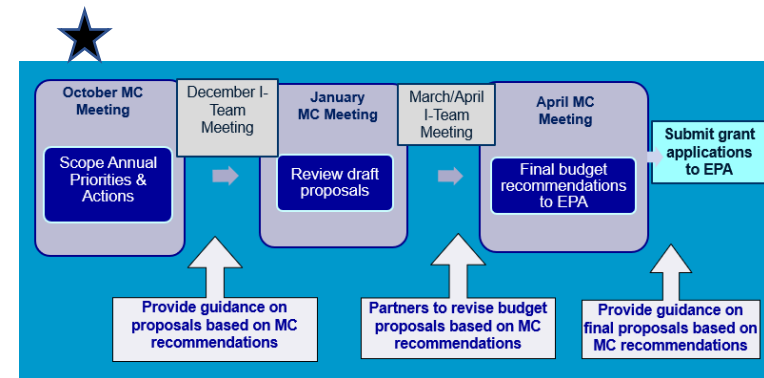
Year 1 (FY23)

- Data Visualization and Analytics Challenge, US EPA
- Long Island Sound Eelgrass Story Map, US EPA
- **Create a Long Island Sound Eelgrass Collaborative Network, CT NERR**
- **Update to the Eelgrass Habitat Suitability Index Model, NEIWPCC**
- **Enhance Continuous Water Quality Monitoring, Save the Sound**
- Initiate Eelgrass Monitoring (SeagrassNet), US EPA, FISMC and CT NERR
- **Continue and Enhance Remote Sensing Surveys, USFWS and USGS**
- Historical Data Analysis, University of Connecticut (Dr. Vaudrey Lab)

Year 2 (FY24) – LISS HRSWG Work Plan

- HW 25: To promote eelgrass management, \$1-3 million in funding is needed for restoration, protection, and monitoring of the resource and an assessment of the existing data. Identify sites for eelgrass restoration based on water quality improvements, including temperature, to the embayment sites.
 - Potential Project (EPA): Restoring Eelgrass in a Changing Climate project. Implement a large scale seed dispersal project in pilot location (location TBD). Partner with local restoration practitioners.
 - Potential Project: Establish a long term funding source for continuous LIS eelgrass monitoring efforts (aerial and drone surveys).
 - Potential Project (EPA): Identifying Resiliency of Eelgrass Genotypes/Phenotypes & Environmental Conditions (partner with researcher).
 - Potential Project (EPA): Expansion of the Eelgrass Flowering and Ground-truthing study, working with partners to identify areas of substantial eelgrass beds and determining flowering abundance for seed collection.

Today



- **Long Island Sound Study**
 - **Long Island Sound Research Grant Program**
 - Investigate the relationship between eelgrass meadows and coastal acidification; specifically how eelgrass acts as buffer and therefore refugia for other important species (i.e., shellfish)
 - Common garden experiments and genetic/phenotypic plasticity and phenology investigations
 - Climate change impacts on eelgrass distributions
 - Investigate southern eelgrass populations' response in Long Island Sound waters
 - Confirm light deficiency in declining eelgrass habitats using physiological biomarkers in the eelgrass plants
 - **The Long Island Sound Futures Fund**
 - Learn from Fishers Island Seagrass Management Coalition. Educate political leaders about their resource and then educate the public.
 - Community Based Social Marketing at public access sites
 - Seagrass Spotter/community science effort
 - Pilot new restoration techniques:
 - Building off the 2021-2023 LISS Research Grant Program-funded project: Improving Eelgrass Restoration Success by Manipulating the Sediment Iron Cycle (Drs. C. Tobias and J. Vaudrey, University of Connecticut)
 - Interactions between eelgrass and shellfish restoration efforts
 - Conservation moorings to protect eelgrass beds
 - Large-scale restoration with broadcast seeding (regional effort)
 - **Other Potential Funding Opportunities**
 - Offshore wind could act as a source of mitigation funds for restoration projects, especially as transmission lines are likely to traverse eelgrass habitat when closer to shore
 - Explore funding within the Estuary Restoration Act
 - NYS OCA Task Force – called out eelgrass (could be a management funding opportunity)
 - Potential CT Legislation for stakeholder advisory group and/or directed state funding
 - NOAA BIL (Habitat Restoration)
-

QUESTIONS?



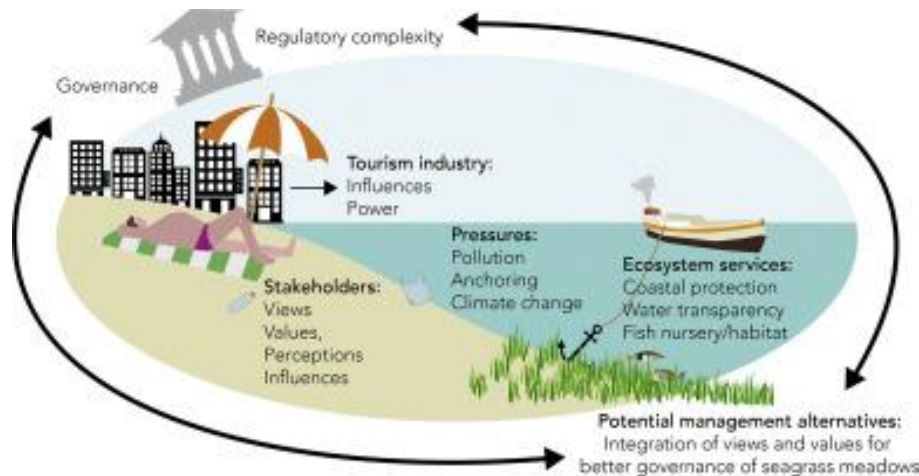
Gaps Hindering Progress

Public Awareness

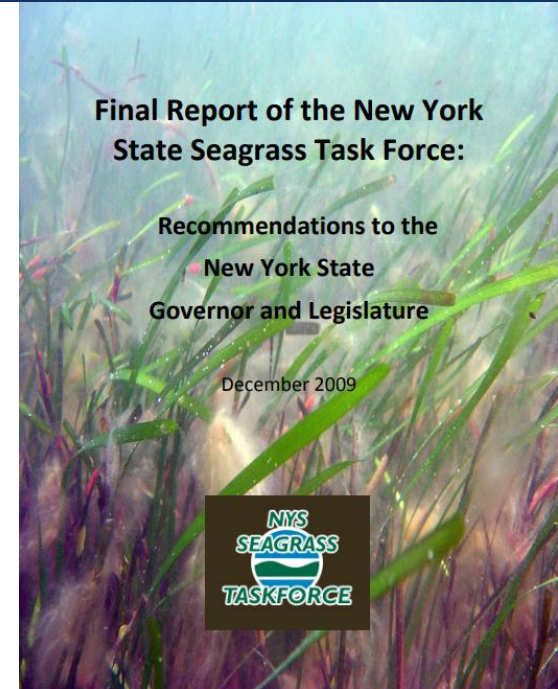
- Recreational and other human activity can cause harm to eelgrass meadows

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.

A. Year 1-2

- Create a Long Island Sound Eelgrass Collaborative Network
- 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

B. Year 2-3

- Continue the Network
- Eelgrass Resiliency and Common Garden Implementation
- Continue to conduct and expand aerial surveys

C. Year 3-5+

- 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



This document provides guidance for short- and long-term actions that should be taken to manage and restore eelgrass meadows in the Long Island Sound and serves as a resource for other estuaries in the region facing similar issues. This is a living document meaning that as new research, resources, and information becomes available, the gaps and required actions may change. This strategy focuses on previously known threats and expands on new threats exacerbated by climate change. **The work group that was convened will continue to meet to progress this strategy through the Long Island Sound Eelgrass Collaborative. The Collaborative will tackle the following priority items: 1) increase coordination, 2) enhance monitoring, 3) update modeling efforts, and 4) investigate unique restoration techniques (i.e., genetic resiliency).**