Update #3 | April 2023

Periodic project updates like this one keep Great Bay communities and organizations informed about the Eelgrass Resilience project. You can find past project update newsletters on our project webpage. Sign up to receive future updates by email.

~ Project Updates ~

The Eelgrass Resilience Project Advisory Committee will be meeting in April 2023 to preview initial results from the first field season. As our first in-person meeting, this will be a great chance to build personal connections while we make sense of the messy field data.

Because this is a complex research project, this winter we carefully reviewed the original goals and plans laid out in our proposal to identify gaps and priorities for the coming year. We're offering a quick re-cap of our research plans here.

Research question 1: *How does water quality affect eelgrass?* To answer this question, the team is leveraging on-going eelgrass monitoring (known as "Tier 2") and analyzing water quality at 16 of the long-term eelgrass monitoring sites in Great Bay. We are using this data to look for patterns in eelgrass growth across the estuary.

Research question 2: *How does eelgrass affect water quality?* We selected three areas of Great Bay for intensive sampling using novel methods. Our amazing field team followed water flow paths from paddle boards, sampling water quality at multiple points along the flow path. We wanted to know: how is the water changing as it flows through an eelgrass meadow - is the water getting clearer?

See: photos of the research team and the Tier 2 monitoring team in action

~ So What ~

Tracking the status of eelgrass in Great Bay

by Sierra Kehoe, Piscataqua Region Estuaries Partnership

In 2021, the Piscataqua Region Estuaries Partnership in collaboration with municipalities and partners launched an expanded monitoring program - the Eelgrass and Seaweed "Tier 2" Monitoring Program - to track long trends for this important habitat. Although this program began before the Eelgrass Resilience project was funded, the monitoring data is a critical part of the project.

Why do we care about this aquatic grass?
Eelgrass provides numerous water quality and resilience functions like stabilizing sediments, storing carbon, reducing wave energy, and providing habitat for numerous species including fish, crabs and lobsters! In a nutshell, the happier and healthier the eelgrass, the happier and healthier the estuary. Unfortunately, eelgrass abundance has declined significantly worldwide, and here in the Piscataquq Region, we have lost over half of our eelgrass acreage over the last few decades as a result of stressors including poor water quality and light conditions (Burdick et al. 2020).

How do we track trends?
The "Tier 2" monitoring program visits 25 sites within the Great Bay Estuary. By visiting a spatially diverse set of sites, researchers are able to get an estuary-wide snapshot of eelgrass health each year. Divers collect eelgrass samples for analysis

and take measurements such as biomass and density. Over 600 eelgrass shoots were collected for analysis in the first two field seasons!

In addition to collecting eelgrass for analysis, seaweed, sediment, and water samples are also collected from the sites. These water samples are the ones analyzed in the Eelgrass Resilience Project. Since the water quality samples are taken at the same location of the eelgrass that is analyzed, we can start to see how these two indicators are related.

Back in the lab, scientists analyze these samples to calculate biomass and measure epiphytes (the stuff that grows or lives on the leaves of eelgrass). These metrics are all important indicators that give insight into the health of the eelgrass, and therefore, the health of the estuary!

The presence of some seaweeds can harm eelgrass growth, as they can be in competition with each other. Many seaweeds can prevent eelgrass plants from getting the light they need to thrive.

What patterns do we see across the estuary?
Initial results reveal that eelgrass meadows look pretty different in different parts of the Great Bay Estuary. The biomass of eelgrass is higher at the coast by Portsmouth Harbor (180 g/m^2) than it is by Dover Point (60.2 g/m^2) and in Great Bay Proper (by Adams Point and the Great Bay Discovery Center, 28.7 g/m^2) based on 2021 data

In order to tell a more complete story, the Tier 2 program measures a number of different attributes about an eelgrass meadow, including the height of the canopy, the density of the shoots, percent cover, and the overall biomass of the plants. For example, while there is a large difference in biomass between Great Bay Proper and Dover Point (28.7 g/m^2 vs. 60.2 g/m^2), the percent coverage (44% vs. 38%) and bed density (77 plants/m^2 vs. 73 plants/m^2) are relatively similar. The factor that makes the biggest difference between sites is the canopy height; the plants in Great Bay Proper average at 66cm while the plants by Dover Point average at 98cm, almost a meter high! The taller stature may be due to the deeper water in the Piscataqua and the need for the plant to grow higher to reach light.

How is eelgrass changing over time?
While we know eelgrass populations in Great Bay are much lower than they were 20 years ago, this monitoring program will allow us to more carefully track trends over time.

Although not all the data from 2022 have been analyzed yet, we are seeing some differences between the last two years. For example, we saw a 14% *decrease* in cover, a 44% *decrease* in canopy height and a 15% *increase* in the density of eelgrass shoots when looking across the eelgrass meadows sampled (including Great Bay, Dover Point, and Portsmouth Harbor). Although it's hard to conclusively explain observed changes, we know there was record historic rainfall in July 2021, after that year's Tier 2 sampling. Heavy rainfall can negatively impact eelgrass by delivering excess nutrients and sediments to the bay. It looks like the eelgrass meadows are still recovering in 2022, with many new shoots, increasing plant density relative to 2021, but the plants are smaller overall.

What's next
The Eelgrass Resilience Project will be looking for relationships between environmental data and eelgrass populations to try to better understand what's driving the differences we see across sites and time.

Exploring recent patterns in Great Bay's eelgrass meadows highlights the importance of having robust data - including a number of different measurements collected year after year, along with other environmental data - so we can carefully track what's happening in this important habitat. Stay tuned for more updates!

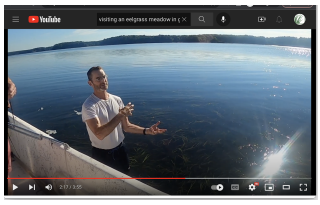
~ Get to Know Our Team and Advisors ~

Estuarine Ecologist: David Burdick, UNH
As one of the lead scientists on this project, David is responsible for designing the seaweed growth experiment and providing guidance on field work to measure the productivity and uptake of carbon and nitrogen by plants, analysis of the biological data, and the Tier 2 monitoring program. David is an associate research professor at UNH and director of the Jackson Estuarine Lab. He is a broadly-trained ecologist who works to assess and improve restoration techniques in seagrass habitats as well as dunes and salt marshes (learn more). In his free time, David is an avid longboard surfer (since the 60s) who may be seen on smaller waves along the Rye beaches. For this project, David is most excited about understanding how eelgrass filters sediments and nitrogen from tidal waters.

Project Advisor: Stacy Villanueva, Brown and Caldwell
As a member of the Project Advisory Committee, Stacy is representing the communities that have hired her firm, Brown and Caldwell, to provide technical assistance on the Municipal Alliance for Adaptive Management. The Alliance is a way for communities to collaborate as they comply with the Great Bay Total Nitrogen General Permit. Stacy brings a unique perspective to this role. She is trained as a marine ecologist and has worked on estuarine systems all along the east and Gulf coasts. She currently lives in Florida where the seagrass species are different, but the threats and issues are similar. In her free time, Stacy likes to kayak, snorkel, hike, and travel. For this project, Stacy is excited about connecting the communities surrounding Great Bay to the research being done to understand the ecosystem's health and function.

~ Stay Engaged ~

- There is lots of great work happening around the Bay. The City of Rochester and UNH secured funding to pilot a novel approach for sub-tidal habitat restoration this summer - planting eelgrass shoots with individual adult oysters intermixed to improve survival and maximize benefits.
- Visit the Great Bay Discovery Center in May and see our new eelgrass exhibit.
- This year's Teacher on the Estuary program, August 10 - 11, will focus on eelgrass ecology. Encourage your teacher friends to sign up!
- Save the Date for PREP's State of our Estuaries Conference, June 2, 2023.



For more information about this 3-year collaborative research project, visit our project web page, watch this video of a visit to a Great Bay eelgrass meadow, or reach out to a member of our Advisory Committee (see: List), which includes representatives from the municipalities and agencies that help protect Great Bay's waters.

Lynn Vaccaro and Cory Riley, Great Bay National Estuarine Research Reserve
Co-collaborative leads for the Eelgrass Resilience Project. Contact Lynn at Lynn.E.Vaccaro@wildlife.nh.gov