Long Island Nitrogen Action Plan (LINAP) Newsletter

Nutrient Bioextraction Initiative Update

In this edition of our newsletter, we are excited to introduce Kimarie Yap, the new Coordinator for the Nutrient Bioextraction Initiative. We delve into her background, current projects, and future programs that aim to make a lasting impact on Long Island and beyond.

Nutrient bioextraction combines growing and harvesting shellfish and seaweed for the purpose of removing nitrogen and other nutrients from coastal waters. Nutrient bioextraction can reduce nutrients as the shellfish and seaweed take up nitrogen and phosphorus from the water, and use these nutrients to grow and develop, in the same way land plants do. In addition to removing excess nutrients, shellfish and seaweed provide other benefits, such as creating habitats for fish and other marine life, making nutrient bioextraction a valuable strategy in helping to improve water quality.

In 2018, the Long Island Nitrogen Action Plan (LINAP) took a significant step forward by launching the Nutrient Bioextraction Initiative, in collaboration with NEIWPCC with funding from the Long Island Sound Study. This Initiative aims to enhance the water quality of New York and Connecticut's coastal and marine waters in the Long Island Sound (LIS) through the sustainable cultivation and harvest of shellfish and seaweed. By effectively removing excess nitrogen absorbed by these species, the Nutrient Bioextraction Initiative seeks to establish a lasting nutrient management strategy that not only improves water quality but also supports local economies reliant on healthy marine ecosystems.

Kimarie's path to becoming the Nutrient Bioextraction Coordinator is rooted in a strong academic foundation and hands-on experience in water quality management. Through her graduate studies at Fordham University, she gained extensive experience in water quality sampling, experimental design, laboratory water analyses, and knowledge of water quality issues caused by nutrient pollution. Upon graduation, she transitioned to the role of Long Island Sound (LIS) Coordinator at the Interstate Environmental Commission (IEC) where she managed and coordinated the Western LIS Water Quality Monitoring Program and IEC's participation in Save the Sound's Unified Water Study embayment monitoring program. Her firsthand observations of the severe impacts of nitrogen pollution deepened her commitment to finding solutions. "I saw many widespread fish die-offs due to depletion of oxygen in the water that marine life needs to breath, harmful algal blooms including brown tide events, and nuisance seaweed blooms," said Kimarie.

Now, as the Nutrient Bioextraction Coordinator, she is applying her expertise to implement bioextraction practices that focus on reducing nitrogen pollution in LIS waters. “Seeing the consequences of nitrogen pollution in Long Island Sound was disheartening, especially knowing that it affects the livelihoods of those who rely on the waters around Long Island for their jobs, sustenance, or recreational use. I was really excited by the opportunity to help make a difference and mitigate these issues as the Nutrient Bioextraction Coordinator,” said Kimarie.

The Nutrient Bioextraction Initiative supports LINAP’s overarching goal of reducing nitrogen levels in Long Island’s surface water and groundwater through scientific and technical studies and by tackling regulatory and policy challenges to establish a large-scale bioextraction industry. In addition, both the Nassau and Suffolk Counties watershed Nine Element plans reference nutrient bioextraction as part of their watershed management plans.

New York has made substantial investments to upgrade municipal wastewater treatment plants and septic systems to lower nitrogen discharges into LIS. However, managing non-point sources remains challenging, and large amounts of nitrogen have already accumulated in LIS, perpetuating water quality issues. “This is where bioextraction’s strength comes into play. It is a management strategy currently available that can remove existing nitrogen after it has entered Long Island’s embayments. Nitrogen reduction is especially needed in embayments where excessive nitrogen pollution accumulates due to high population density, extensive coastal development, and inefficient tidal flushing,” Kimarie explains.

Current Projects

Ribbed Mussel Research

There are two ribbed mussel projects currently underway. The first is a pilot project evaluating ribbed mussels for nutrient reduction in uncertified waters that are unsuitable for shellfish harvesting due to fecal contamination. “I’m excited about this project because it is being extended for a third growing season and will monitor their size ranges. This information is understudied and would help us better understand this species if they’re to be used for more bioextraction projects in the future,” said Kimarie. This project will also analyze the harvested ribbed mussels to assess if they are suitable as animal feed.

The second project is an aquaculture refinement project aiming to test and refine the best ribbed mussel conditioning, spawning, and grow-out techniques. “Currently, there hasn’t been a reliable way to culture ribbed mussels in a hatchery setting or a way to source them sustainably, so projects that utilize ribbed mussels have had to continuously harvest them from salt marshes in the wild. This is a really exciting project that can lead to the development of a ribbed mussel hatchery, so they can be easily sourced for future bioextraction projects,” explained Kimarie.

Ribbed mussel sample collection, September 2022, in Huntington Harbor. Photo Credit: Kristin Kraseski.

Sugar Kelp Studies

A pilot project currently underway by Cornell Cooperative Extension of Suffolk County tests locally grown Long Island Sound sugar kelp processed as a fertilizer amendment. It has been tested on tomatoes, lettuces, and basil. Lab analysis revealed that the crops did not absorb heavy metals from the seaweed fertilizer. This is important because one of the main concerns about using seaweed as fertilizer is the potential for it to contain harmful heavy metals, which could then be taken up by plants and pose risks to human health and the environment.

Another discovery was that there were comparable results between this sugar kelp fertilizer amendment and commercially available kelp fertilizer from other states that currently dominate this market. “If seaweed, such as sugar kelp, could be grown locally and used as fertilizer to impart the nutrients naturally taken up by the seaweed onto lawns and gardens, this could potentially help close that nutrient loop and would be a better, more sustainable option for both marine and agricultural industries compared to importing kelp fertilizer, and thus excess nutrients, from other states,” said Kimarie.

Locally grown help being harvested. Photo Credit: Kristin Kraseski.

Economic Feasibility Study

Economics have been a vital component of the Nutrient Bioextraction Initiative from the start. To better understand the capacity of bioextraction as an industry, a Bioextraction Economic Feasibility/Market Study is being conducted to determine the feasibility of commercial operations using seaweed and/or shellfish in the Long Island Sound for the purpose of bioextraction. The study addresses which seaweed and shellfish species would be best suited for bioextraction, including which would be most feasible and profitable in the short, medium, and long-term, and the logistical and legal barriers to establishing a bioextraction industry in New York and Connecticut.

“It will be helpful to gain more insight on the barriers we need to tackle in order to reach commercial scaling of seaweed and shellfish production in uncertified waters to support an industry, as well as the most promising product market sectors so this strategy of nitrogen management can be profitable and thus sustainable long-term,” said Kimarie.

The Bioextraction Economic Feasibility/Market Study is going to lay the foundation for many future bioextraction projects. In addressing insights from some of the preliminary results of the study Kimarie states, “One surprising finding was that *Ulva* (sea lettuce) ranked higher than sugar kelp for nitrogen uptake, challenging preconceived notions about seaweed farming in LIS.” Kimarie sees potential for both species to complement each other, with sugar kelp thriving in winter and *Ulva* in the summer.

The full results of the study are expected to be available to the public by early next year and will be part of the effort to encourage a strong bioextraction industry on Long Island.

Upcoming Projects

Next year marks an exciting new chapter for the Nutrient Bioextraction Initiative, with three projects set to launch in partnership with SUNY Stony Brook's School of Marine and Atmospheric Sciences.

The first is a "wild harvest" bioextraction project. Naturally occurring nuisance seaweed overgrowth can take up a lot of nitrogen pollution. The targeted removal of these seaweeds can be another important component to complement bioextraction work that typically cultivates seaweed to remove excess nitrogen instead. The wild harvested seaweed will be dried and processed as a fertilizer meal to be tested in future fertilizer amendment studies.

A second project will investigate if long-term storage of sugar kelp spores can result in successful cultivation of kelp. If it works, this would allow for the possibility to keep a reliable supply of spores ready for use, instead of having to wait for specific times of the year when temperatures are right to produce them. "Like conventional farmers who grow vegetable crops, we need a seed stock to supply kelp spores whenever needed, so that is what this study hopes to achieve. Like the wild harvest project, this study will also determine if this cultivated kelp and other seaweeds would be suitable as a fertilizer amendment for turfgrass," said Kimarie.

The third project is an on-going long-term bioextraction monitoring project. "They're quantifying the amount of nitrogen and carbon taken up by different seaweed species and oysters across various LIS nearshore and open waters over a 5-year period". This project will look at factors like chlorophyll-a concentrations, which is an indicator of algal blooms, and coastal acidification. They already have promising preliminary results from their first year and will continue into the second year of their study," said Kimarie.

Challenges

While the Nutrient Bioextraction Initiative holds significant promise, Kimarie acknowledges some challenges. One key issue is access to capital; new entrepreneurs and farmers need financial resources and technical assistance to successfully enter the bioextraction industry. Additionally, the lack of local processing facilities poses a hurdle, as it limits how much bioextracted harvest could be dried and processed to create saleable products. "Currently, groups have had to send their harvested biomass to Maine, which has over 20 processing facilities for this, but it is costly and so they ultimately were not able to make a profit," Kimarie explains. Despite these challenges, Kimarie remains optimistic about the future, believing that with the right support and innovation, the Nutrient Bioextraction Initiative can overcome these hurdles and pave the way for a thriving, sustainable industry that benefits both the environment and local communities

Ribbed mussels in the Long Island Sound. Photo Credit: NOAA Milford/Mark Dixon.

As the Nutrient Bioextraction Initiative progresses, it is positioned to make significant advances in addressing nitrogen pollution in the Long Island Sound. By integrating rigorous research with collaboration among local communities, researchers, and environmental organizations, the Initiative seeks to develop effective bioextraction strategies that provide lasting benefits.

For more information on the Nutrient Bioextraction Initiative and to stay updated on ongoing projects, visit the Nutrient Bioextraction Initiative website.

This Interactive Map shows locations where the Long Island Sound Study has funded nutrient bioextraction projects.

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