7 Going **Really** Green: *Sea Farming for Environmental and Economic Benefits*

Brief Description:

The key elements of this best practice are: 1) key partners' recognition of the need for a comprehensive approach that combines traditional water pollution control methods with innovative strategies in a cost-effective and economically sustainable manner; 2) the vision to foresee a different approach that combines science and business in synergistic partnerships to achieve mutual goals—clean water and economic benefits, including new jobs; 3) the willingness and ability to use limited resources to conduct on-the-ground scientific empirical experiments in cooperation with the business community; and 4) moving from practical experimentation to actual implementation and development.

This multi-partner project has shown that sea farming in highly urbanized waters is feasible and practical. Conflicts with recreation can be minimized or avoided. Farming seaweeds and shellfish species improves water quality while developing new consumable and nonconsumable products and markets that enhance the economic value of the waterbody. Sea farming can provide new jobs in a very vulnerable commodity sector, as well as new sources of revenue for local and state governments. Sea farming in urban coastal areas has demonstrated scientifically that seaweed and shellfish production is viable and sustainable, can provide safe and nutritious feedstock for both human and animal consumption, and can produce a stable source of stock for nonconsumable products such as biofuels.

Current Status:

The best practice consists of essentially three parts: Part 1, Seaweed Demonstration, which has been successfully implemented on a pilot-scale; Part 2, Shellfish Demonstration, which also has successfully undergone pilot-scale implementation; Part 3, Economic Analysis Modeling, or

[10] New York State Office of the Attorney General and the New York State Department of Environmental Conservation (NYSDEC), under the Bronx River Watershed Initiative Memorandum of Agreement, executed by and between the New York State Office of the Attorney General, the NYSDEC, and the National Fish & Wildlife Foundation, as of April 20, 2007.

Subobjective:

Long Island Sound

Type:

Nutrient Reduction—Ecological Services

Highlights:

- **What:** This best practice demonstrates the potential for sea farms, shellfish, and seaweeds to improve water quality in coastal areas of the United States. Pilot projects on Long Island Sound are evaluating the feasibility of sea farming in coastal waters, quantifying the potential for nutrient bioextraction, evaluating use conflicts, and researching new markets for products, considering suppliers and consumers. Enhancing sea farming can reduce nutrient pollution, have ancillary ecosystem benefits by creating habitat, support sustainable jobs, and potentially reduce the national seafood trade deficit.
- **Who:** EPA and its Regional Ecological Services (REServ) program; the University of Connecticut (UConn) Department of Ecology and Evolutionary Biology (School of Business and Stamford Learning Accelerator); NOAA's Small Business Innovation Research (SBIR) program (Aquaculture Program, National Marine Fisheries Service Northeast Fisheries Science Center Milford Laboratory, Center for Coastal Monitoring and Assessment, and Aquaculture Program); the Bronx River Watershed Initiative;[10] and the Connecticut Sea Grant College Program.
- **Why:** Nutrient pollution impairs coastal water quality. EPA is focused on reducing nutrient pollution through comprehensive and innovative strategies. This best practice focuses on restoring the assimilative capacity of coastal water bodies to nutrients that have been lost from changes in habitat and living resources, such as a reduction in shellfish populations. Enhancing sea farming of shellfish and seaweeds can complement nutrient control as part of a comprehensive strategy to attain water quality standards.

ecosystem-scale seaweed and shellfish modeling and economic benefits efforts, which are underway and ongoing.

Outcomes:

The annual nutrient-reduction capabilities of shellfish and seaweed aquaculture have been scientifically demonstrated; aquaculture techniques in general are well established, and these approaches are applicable in a wide range of aquatic environments in urban coastal waters throughout the U.S. Coastal Zone and its Exclusive Economic Zone. Economic incentives for aquaculture expansion still need to be develop (e.g., payment to sea farmers for ecosystem services created, sustained inclusion in nitrogen trading programs). For instance, in a nitrogen trading scheme, cultivated seaweeds and shellfish can increase the nitrogen carrying capacity of the waterbody, creating a new market source for trading credits. Currently, in the Connecticut nitrogen trading program, only sewage treatment plant nitrogen reductions qualify as credits for purchase. Projections for Long Island Sound show a potential for as much as 10,500 tons (dry weight) of annual seaweed *(Gracilaria)* production, with a 5% nitrogen capture rate at extraction. Using the Connecticut Nitrogen Credit Trading Board's 2011 price per pound of nitrogen of $5.42, there could be a potential market value in the nitrogen removed to operators of $5,691,000 annually. The total Connecticut nitrogen credit pool in 2011 was $6.8 million by comparison. The additional market and non-market benefits of seaweed and shellfish farming and bioextraction are being reviewed.

Lessons Learned/Recommendations:

Limits to aquaculture expansion come primarily from social sources rather than ecosystem carrying capacity, so informing the public and gaining acceptance and understanding is critical to this enterprise. It is important to engage the local communities in explaining both the physical processes and the environmental and social benefits of these initiatives. It is also important to engage federal, state, and local leaders, regulators, and, potentially, legislators.

Contact Information:

Mark A. Tedesco, Director, EPA Long Island Sound Office, 203-977-1541

http://www.longislandsoundstudy.net

Dr. Charles Yarish (center) with UConn and Bridgeport Center researchers and students collecting farmed kelp.

Shellfish and seaweed suspension raft off the Bronx River, New York Regional Aquaculture Science and Technology Education.