EVOLUTION OF SEAWEED CULTIVATION IN NORTH AMERICA AND BEYOND

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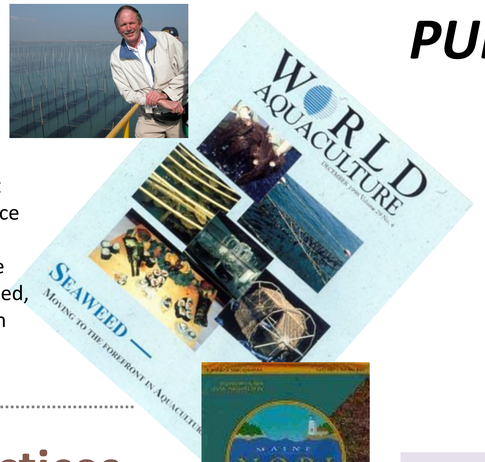
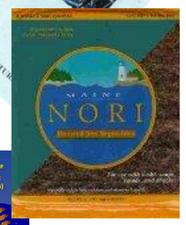
Seaweed Aquaculture

- Seaweeds have been used for human and animal consumption, sources of phycocolloids, cosmaceuticals, nutraceuticals, fertilizers and most recently, feed-stock for biofuels.
- Large-scale open water cultivation of some species has been carried out principally in Asian countries but more recently expansion has taken place in Southeast Asia , South America, northern Europe and East Africa.
- In the United States, social resistance has been major factor limiting the growth of aquaculture. The near-shore waters of the U.S. are heavily used, for both recreational (boating, fishing, etc.) and aesthetic values (ocean and bay views from waterfront homes).

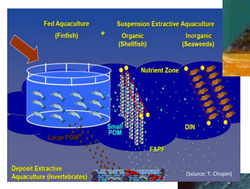




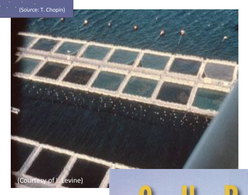
Appropriate Seaweed Aquaculture Practices in North America

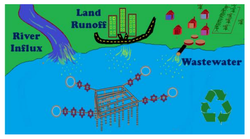
Integrated Multi-Trophic Aquaculture (IMTA)

- Balance Ecosystem Approach



- IMTA combines fed aquaculture of finfish or shrimp with extractive organic aquaculture of shellfish and extractive inorganic aquaculture of seaweed.
- In 1996, Yarish *et al*. and colleagues cultivated the red seaweed *Porphyra* (nori) adjacent to an Atlantic salmon (*Salmo salar*) farm, at Deep Cove, Eastport, ME. This first open water IMTA trial in North America was successful; nori grown with Atlantic salmon grew faster and had higher tissue nitrogen and pigment content than the nori grown at a site without salmon.


(Courtesy of Levine)



Nutrient Bioextraction

- **NUTRIENT BIOEXTRACTION** is an environmental management strategy by which nutrients are removed from an aquatic ecosystem through the harvest of enhanced biological production, including the aquaculture of marine algae and/or suspension-feeding shellfish.
- Long Island Sound (LIS) has a long history of acting as a giant receptacle for human pollution. Its waters are consistently high in nutrients from waste water treatment plants (point source) and land runoff / aerial deposition (nonpoint sources).
- Yarish and his colleagues have cultivated native seaweeds (the red seaweed, *Gracilaria tikvahiae* & the brown sugar kelp, *Saccharina latissima*) at open water seaweed farms in LIS, and at the mouth of the Bronx River estuary).
- Their ongoing studies have showed that seaweed aquaculture can be a useful technique for nutrient bioremediation and managing eutrophication in the urbanized coastal waters of the US.
- In collaboration with Prof. T. Dowding & colleagues (UCONN School of Business and School of Engineering), an optimization model is being developed to determine the value of both nutrient bioextraction and the commodities (including biofuels, animals feeds, etc.) derived from the harvested seaweed as a method to maximize potential multiple revenue streams while reducing any residual biomass waste to zero.

University of Connecticut School of Business

Grown in Connecticut

Leveraging UConn's faculty, students and resources to help grow businesses and create jobs in Connecticut.

The University of Connecticut on behalf of the School of Business' International Business Accelerator (IBA) and the Connecticut Center for Economic Analysis (CCEA) would like to invite you to a very unique invitation-only event showcasing our partnerships with businesses and organizations to leverage technology and expertise to help grow the state's economy and create jobs. Please join us for team presentations, a tour of our sea-water laboratory, and a sampling of Connecticut seafood and aquaculture dishes prepared by our celebrity chef.

Tuesday, August 21
UConn Stamford Campus
Stamford Learning Accelerator - 3rd Floor

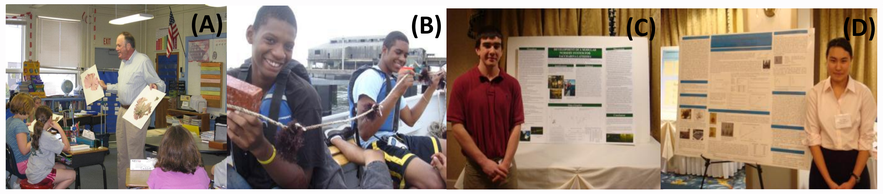
PUBLIC ENGAGEMENT

Science to Business

Yarish helped Ocean Approved, LLC, to cultivate kelp at their open water farms in Portland, ME. OA's aquacultured kelp products are sold throughout New England to foodservice and health food stores such as Whole Food Markets.

Yarish introduced *Gracilaria* farming to RI.

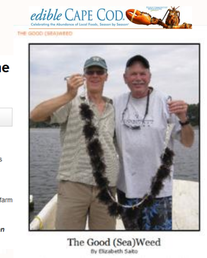
Engagement with Students

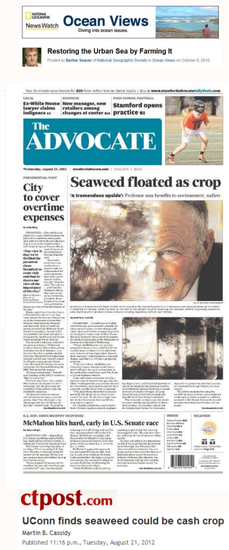


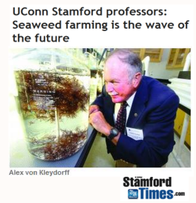
Yarish showing students seaweed herbarium sheets (A), Rocking the Boat students helping the deployment of *Gracilaria* at the Bronx River Estuary farm in Aug. 2011 (B), Yarish and his research team have worked with high school students for their science research projects: Bridgeport Regional Aquaculture Science and Technology Education Center student, Kevin Kollar, and Greenwich High School student, Mary Cirino, presenting their findings at Milford Aquaculture Seminar in March, 2012 (C and D).

Charles Yarish, professor of ecology and evolutionary biology who specializes in research on seaweed, introduces Aqua Kids to his favorite topic. He collaborates with Bridgeport Regional Aquaculture Science and Technology Education Center in a project to culture seaweeds.
Photos by George Stover, Adventure Productions

Engagement via Media and ENGOs







University of Connecticut Sea Grant
Long Island Sound Study — A Partnership to Restore and Protect the Sound
National Fish and Wildlife Foundation
NOAA