2013-2014 Seaweed farm year in a cold Long Island Sound-An update from Connecticut

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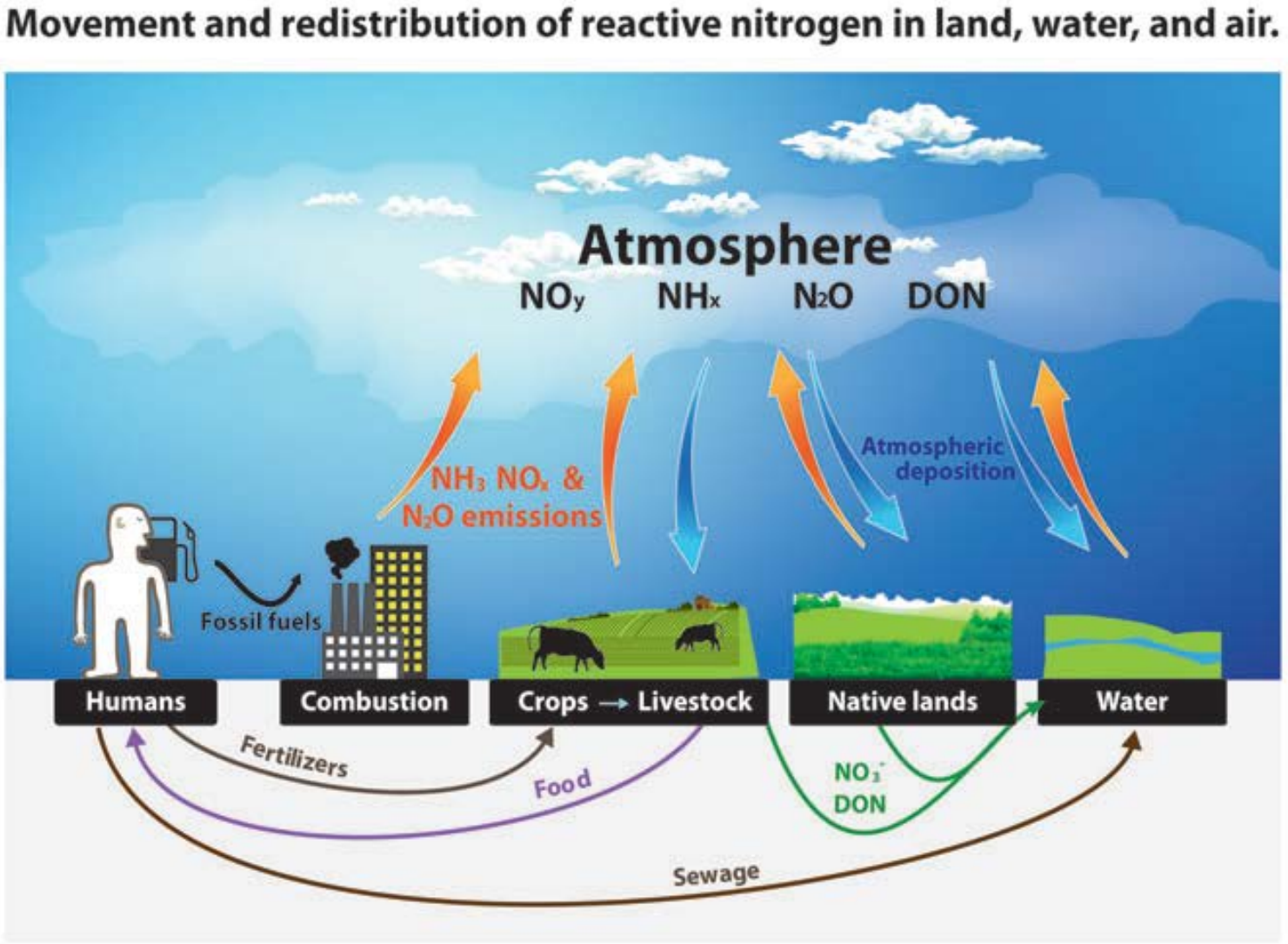
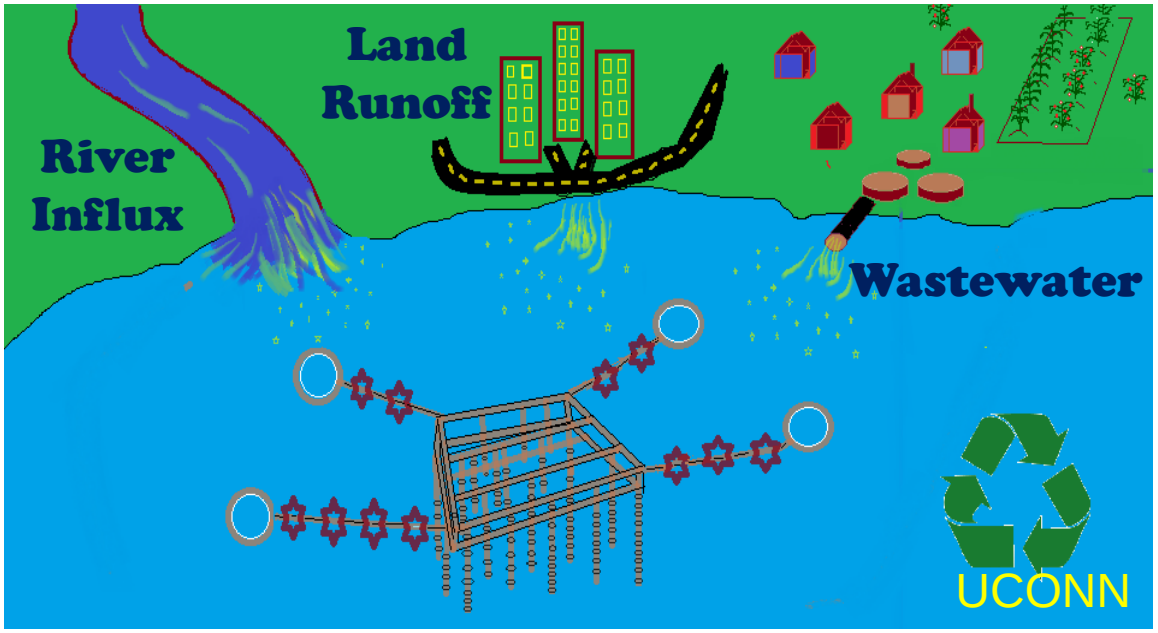
Humans have altered global nitrogen cycle



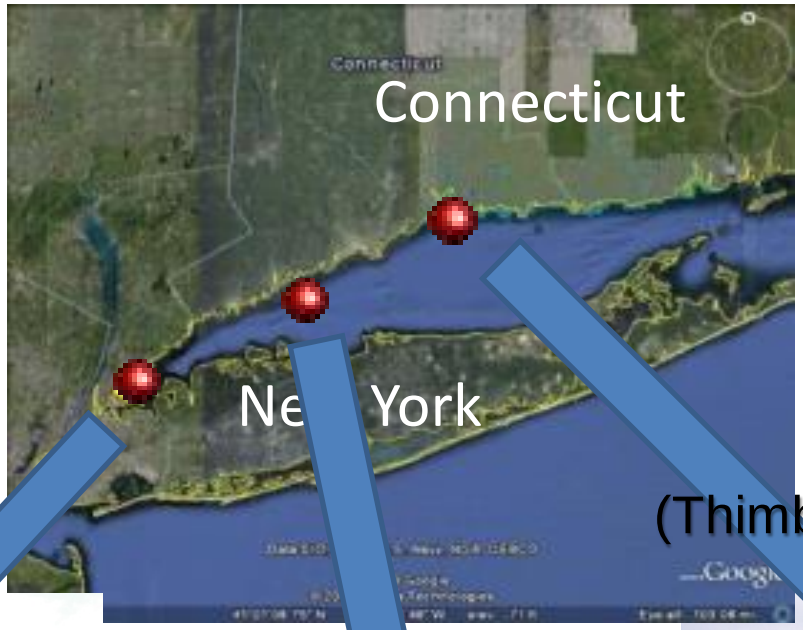
Issues in Ecology #15, Ecological Society of America, www.esa.org/issues

What is nutrient bioextraction?

- The removal of nutrients from an aquatic ecosystem through the harvest of enhanced biological production (aquaculture of seaweed and/or shellfish)



Open water seaweed farms



Bronx, NY

Fairfield, CT

Branford, CT
(Thimble Island Oyster Co.
DJ King)

Saccharina (sugar kelp, brown seaweed, a winter crop)

- Growing season: Nov. – May (< 15 °C or < 60 °F)
- Kelp is the most widely cultivated species in the world
- Significant potential for the cultured sea vegetable industry in Long Island Sound and the Northeast America
- Human food (rich in calcium, folic acid, iodine, vitamins A,B,D,E, & K; regulates metabolism and aids in weight loss) and source of alginates (colloid & biomedical)
- *Nutrient bioextraction (ecosystem services)
- Biofuels

Saccharina nursery and open water cultivation

Productivity (sugar kelp, 2012-2013)

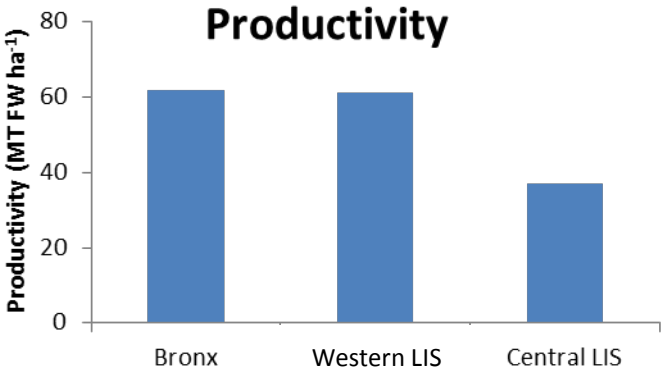
~ 1,752 kg per 100 m longline
(Dec. – May growing season)

Productivity (sugar kelp, 2012-2013)

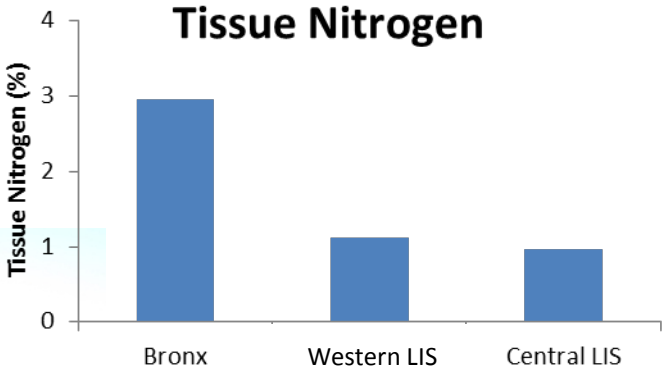
*29.2 – 116.7 MT FW ha^{-1}
(Dec. – May growing season)

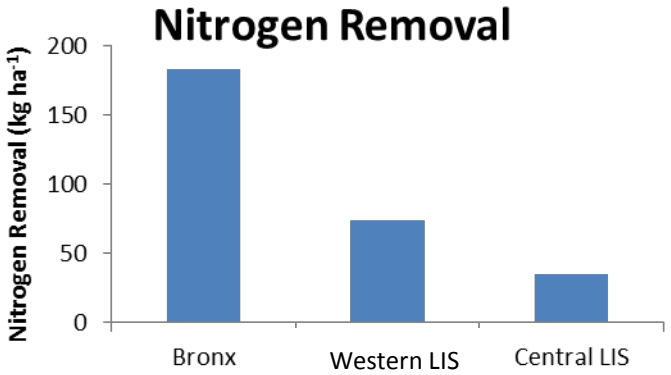
* Assumption: 1.5 or 6.0 m spacing between longlines (UCONN)

Productivity, Tissue Nitrogen and Nitrogen Removal



- ***Saccharina latissima***
- 2012-2013 growing season
- 1.5 m spacing of lines





Courtesy of J. Savicky, J. Kim and C. Yarish

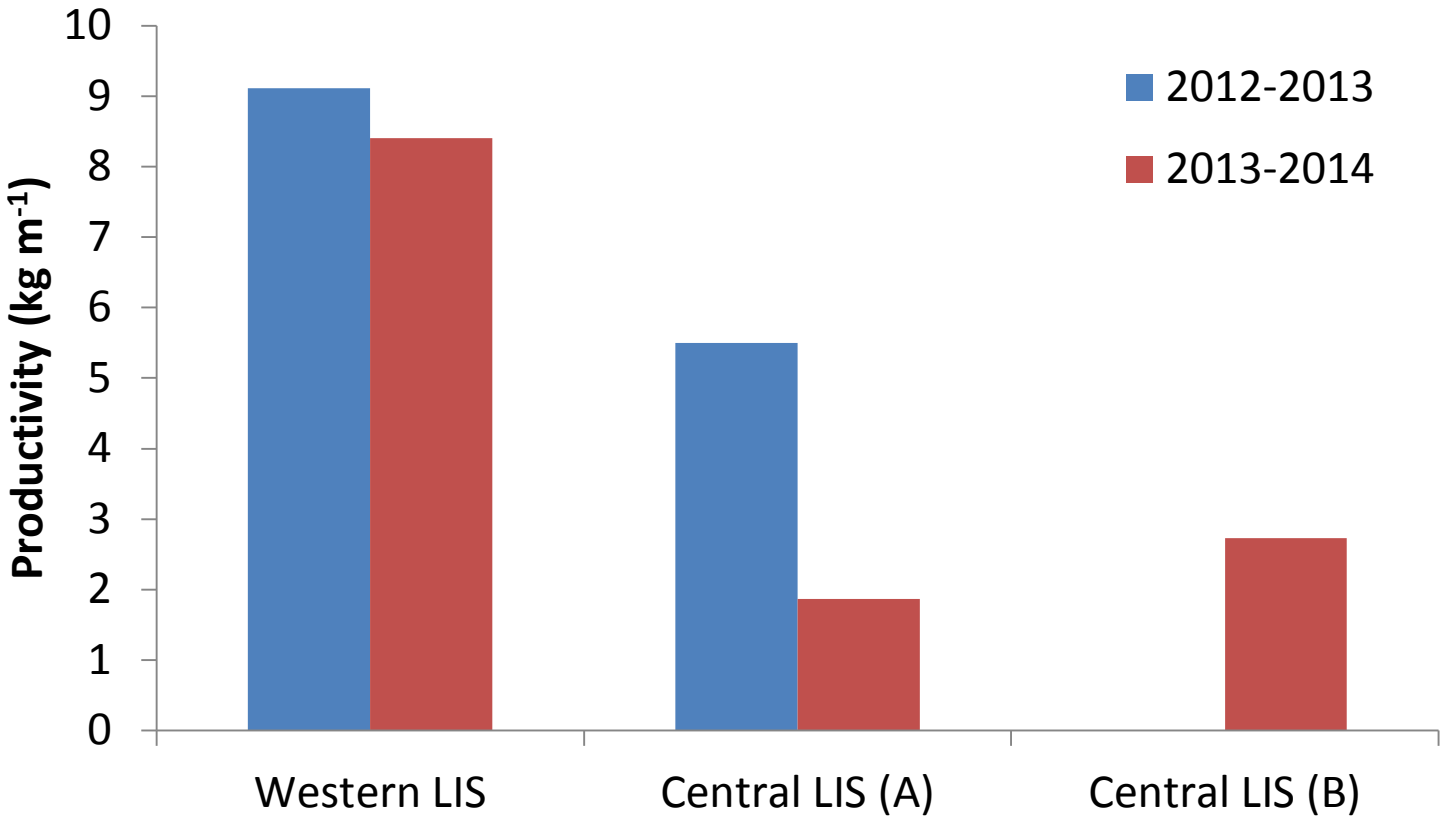
March 29, 2014

June 4, 2014

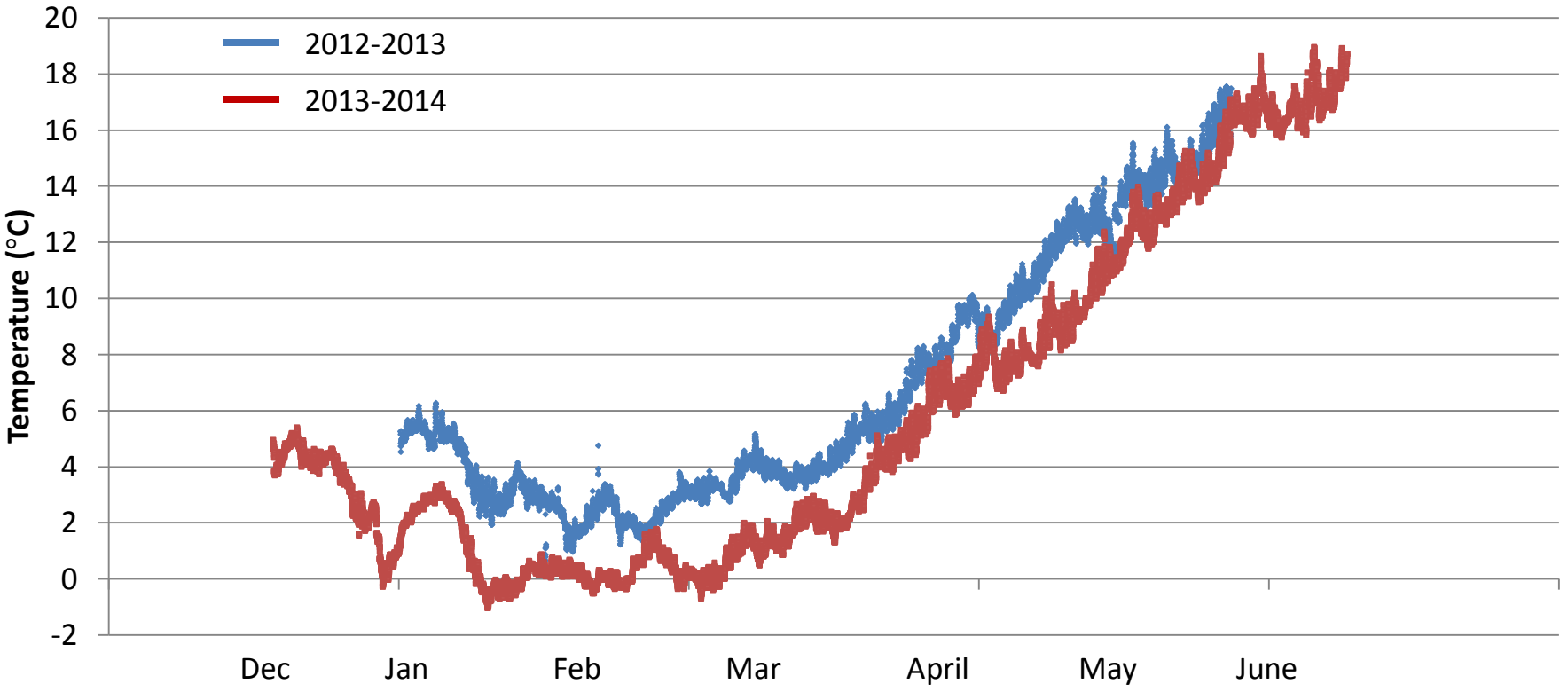
Feb 13, 2013

May 21, 2013

Productivity (2012-2013 vs. 2013-2014 growing seasons)



Temperature Profile (2012-2013 vs. 2013-2014 growing season)



Nutrient Bioextraction by Seaweed and Bivalves

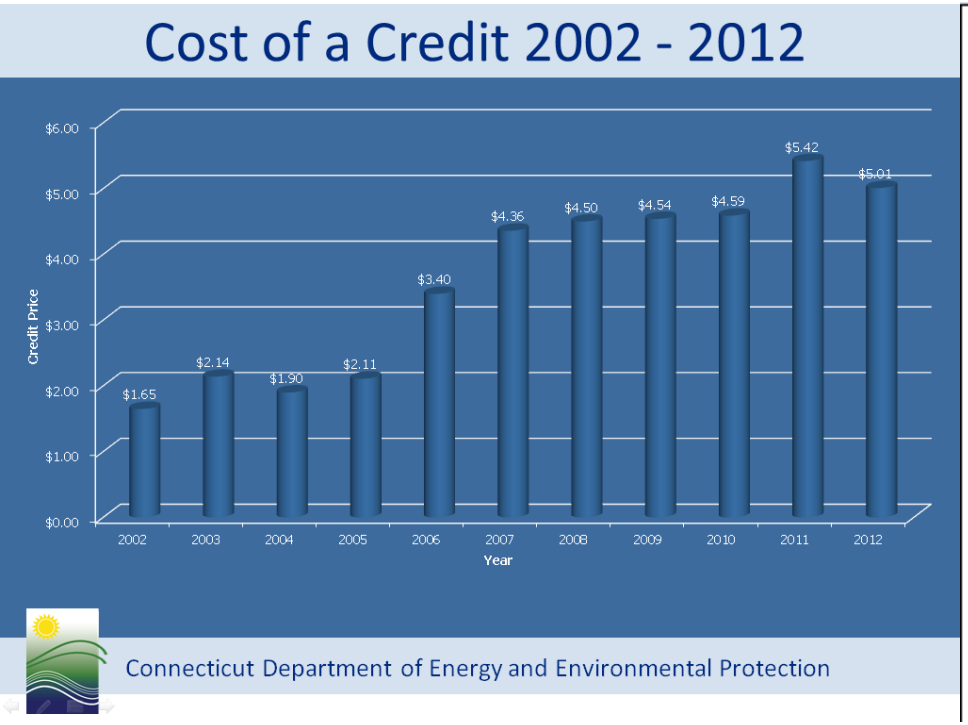
- Mussels (*Ischadium recurvum*): 217 kg N ha^{-1} yr^{-1} (Kellogg et al., 2013) in Chesapeake Bay.
- Oysters (*Crassostrea virginica*): 331 – 556 kg N ha^{-1} per up to two years (Higgins et al., 2011) in Chesapeake Bay (Kellogg et al., 2013).
- Oysters (*Crassostrea virginica*): 77 kg N ha^{-1} yr^{-1} from Waquoit Bay (MA; Kite-Powell et al., 2006).

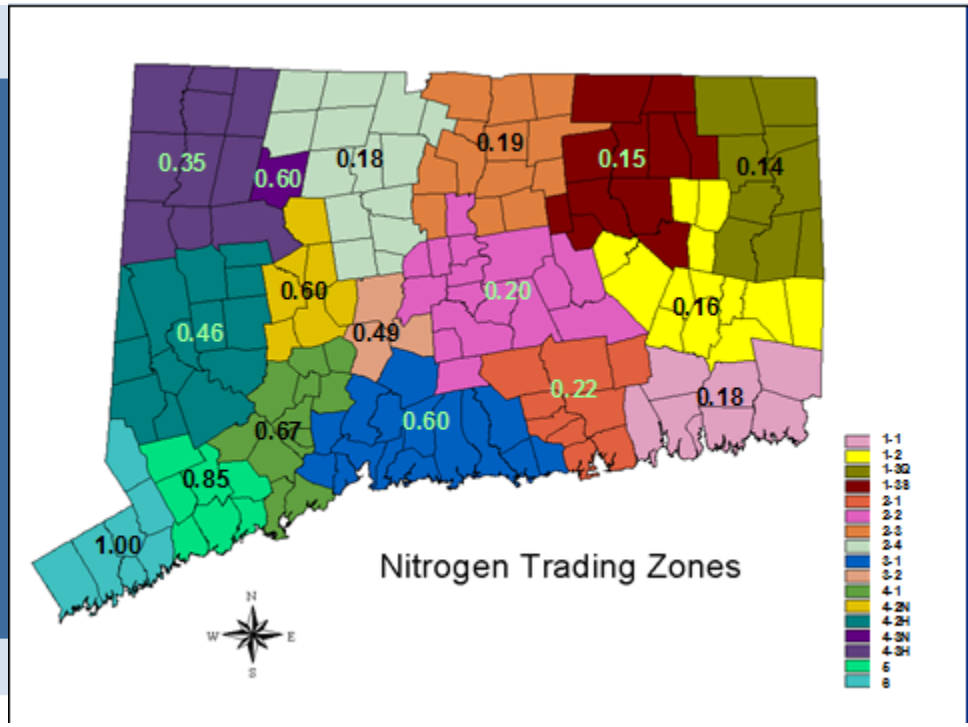
***Gracilaria*: ~140 kg N ha^{-1} (July – Oct.)**

(See Kim et al. 2014. Aquaculture 433:148-156)

Sugar kelp: ~180 kg N ha^{-1} (Nov. – May)

Nitrogen Trading Program in CT





Nutrient bioextraction

Species	Site	N Removal (kg per hectare)
*Gracilaria**	Bronx, NY *(July)*	66 kg/month
	Fairfield, CT *(Oct)*	12 kg/month
Saccharina	Fairfield, CT *(Dec-May)*	280 kg

See *Kim et al. 2014. Aquaculture 433:148-156;
Kraemer, G.P., J.K. Kim and C. Yarish. 2014. Association of Massachusetts Wetland Scientists Newsletter. April 2014 No. 89, 16-17.

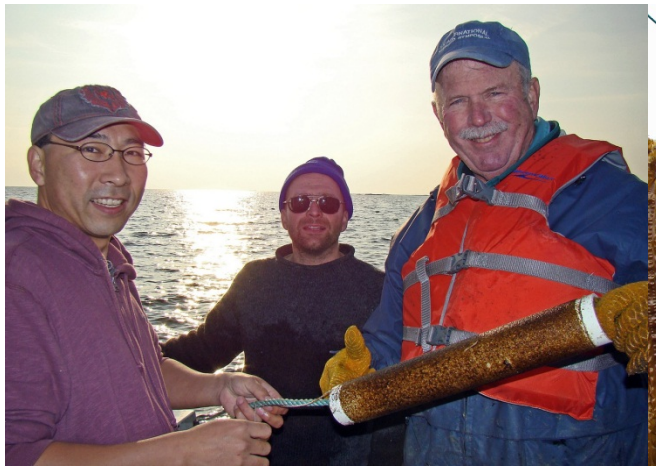
Nutrient bioextraction potential value in CT Nitrogen Trading Program

Species	Site	N Removal ($ per hectare)	C Removal ($ per hectare)
Gracilaria	Bronx *(July-Oct)*	$2,040	$19
	Fairfield *(July-Oct)*	$235	$4
	Bronx (Dec-May)	$2,020	$34
Saccharina	Fairfield (*Dec-May)*	$650	$32
	Branford (Dec-May)	$235	$21

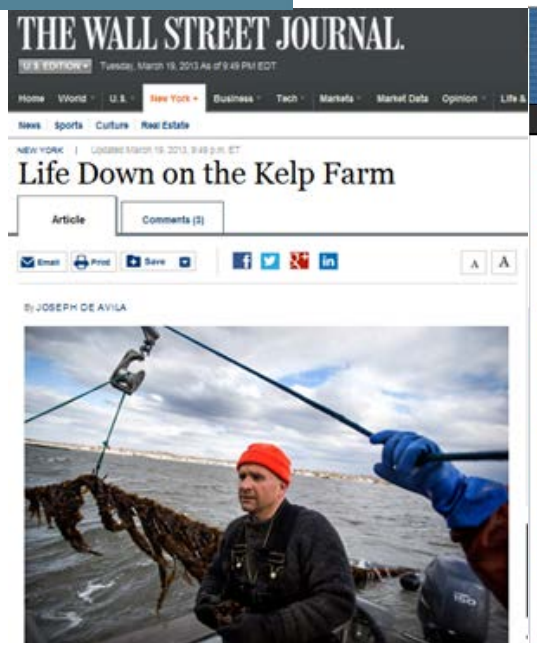
- **Nitrogen Credit Exchange (NCE): $5.01 per pound N**
- **2012: 33 facilities purchased N (ca. $1.5 million)**

See *Kim et al. 2014. Aquaculture 433:148-156;
Kraemer, G.P., J.K. Kim and C. Yarish. 2014. Association of Massachusetts Wetland Scientists Newsletter. April 2014 No. 89, 16-17.

SEA GREENS
THIMBLE ISLAND
KELP NOODLES



(Photo credits: R. Gautreau)


THE WALL STREET JOURNAL.

Life Down on the Kelp Farm

Article | Comments (3)

By JOSEPH DE AVILA


YOUR PUBLIC MEDIA

News Arts

Seaweed And The Sound

ONE FISHERMAN EMBARKING ON NEW ENTERPRISE.

By WNPR Staff
Published: May 21, 2013

Slideshow

<< Previous 1 of 4 Images Next >>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Long Island Sound delicacy on NYC menus, and it isn't fish, it's seaweed

By Judy Benson

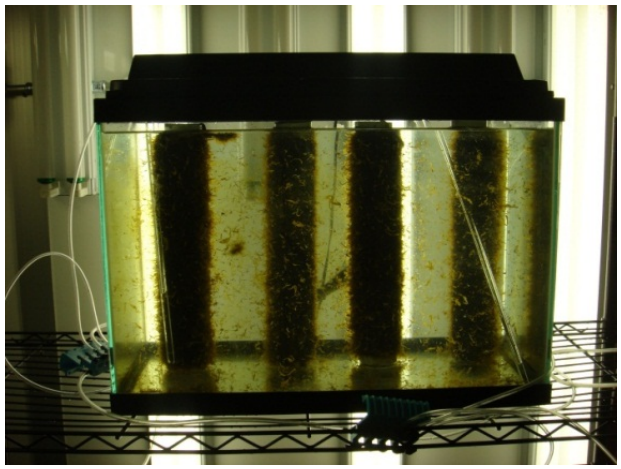
Publication: The Day

Published 05/27/2013 12:00 AM Updated 05/27/2013 08:13 PM

Scientific American! http://blogs.scientificamerican.com/food-matters/2014/07/11/move-over-kale-the-new-super-vegetable-comes-from-the-sea-video/

Saccharina (sugar kelp) Farmers 2014-2015

- Thimble Island Oyster Co., Branford, CT (Brendan Smith)
- King Lobsters and Montowese Bay Oysters, Branford, CT (DJ King)
- **New Growers + Scott Lindell (MBL, Woods Hole, MA)**
- Charles Island Oysters, Milford, CT (Charles Viens)
- Clean & Green Farms, Old Greenwich, CT (Jeff Bella)
- Noank Aquaculture Cooperative
  - Noank, CT and Southold, NY (Karen Rivara)
- Menemsha Fish House, MA
- Saltwater Farms, Narragansett, RI (Bill Silkes)





What's Next in Coastal Management? Bioextraction technologies that move towards a balanced ecosystem approach

In nutrient rich coastal waters (LIS) we can use extractive organic aquaculture of shellfish and extractive inorganic aquaculture of seaweed to provide invaluable ecosystem services and generate new economic activity, which will create jobs and deliver revenue!

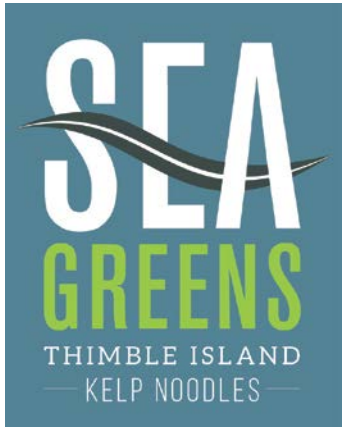
UCONN

Potential applications & uses of seaweeds

Ecosystem services
-Habitat Improvement
-Nitrogen credit

Hydrocolloids and Cosmeceuticals

Sea vegetables



Biofuel

Project Partners

University of Connecticut

Bridgeport Regional Aquaculture Science & Technology Education Center

Purchase College State University of New York

Rocking the Boat

Project Sponsors

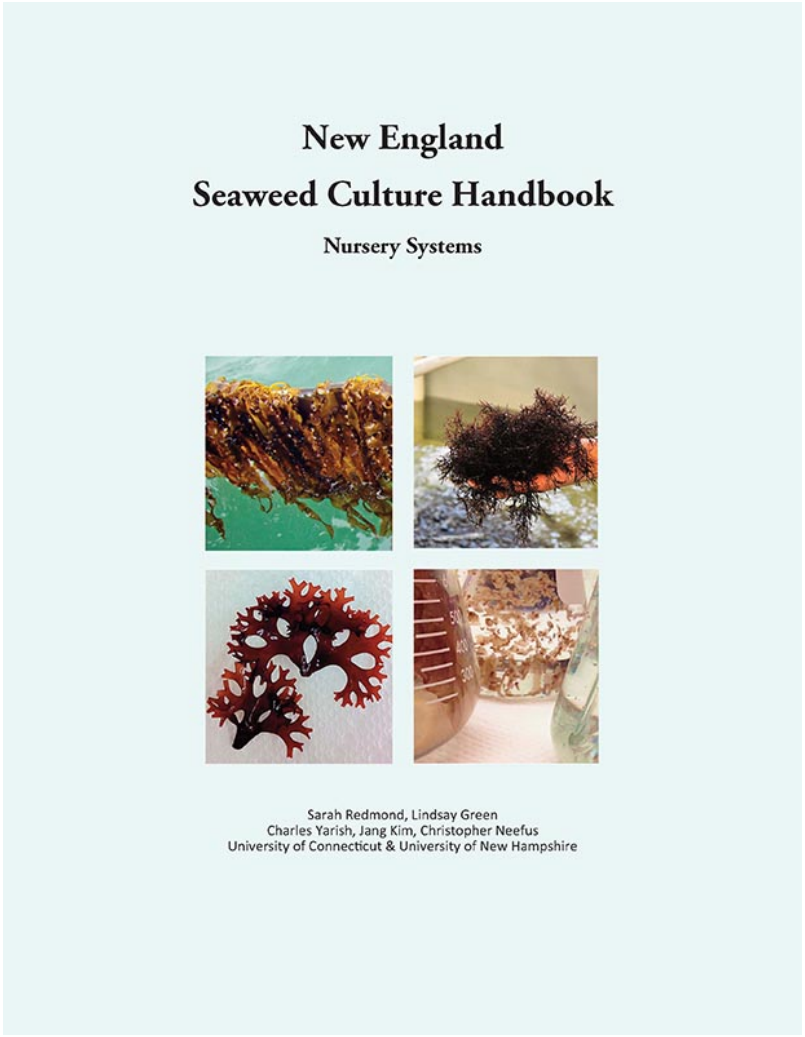
National Fish and Wildlife Foundation

Sea Grant Connecticut

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

National Oceanic and Atmospheric Administration — NOAA — U.S. Department of Commerce

New England Seaweed Culture Handbook



http://s.uconn.edu/handbook

http://s.uconn.edu/seaweedplaylist

Part One, Introduction:
http://youtu.be/zQr-ZoYu1SE

Part 2: Laboratory
http://youtu.be/7Ay0NFSIOlg

Part 3: Kelp
http://youtu.be/y-k3eseEJFs

WRACK LINES
Volume 13, Number 2, Fall/Winter 2013-14

Video Series Shows How to Start Growing Seaweed

Ever wonder what it would be like to grow seaweed? Connecticut Sea Grant has posted a six-part educational video playlist series on YouTube, to show people how to culture and grow four different species of economically important seaweeds. Part One, the introduction to the "Handbook for Seaweed Culture in New England" offers a broad overview of seaweeds and uses in New England. Other chapters describe how to set up a laboratory to culture seaweed, and seaweed nursery culture for native New England species of Kelp, *Gracilaria*, *Chondrus*, and *Porphyra*. The videos are close captioned for accessibility.

This project was funded through NOAA's Sea Grant programs in Connecticut and New Hampshire. Research was conducted at the UConn Marine Biotechnology Laboratory in Stamford (Charles Yarish) and at the University of New Hampshire, Durham (Chris Neefus).

Link for the entire Seaweed Handbook playlist: http://s.uconn.edu/seaweedplaylist

Links to Individual Chapters:

Part 1 Introduction http://youtu.be/zQr-ZoYu1SE
Part 2 Laboratory http://youtu.be/7Ay0NFS1Olg
Part 3 Kelp http://youtu.be/y-k3eseEJFs
Part 4 *Gracilaria* http://youtu.be/cd5jDPbx63g
Part 5 *Chondrus crispus* http://youtu.be/AKEk6MQ9fHs
Part 6 *Porphyra* http://youtu.be/RGUrPJs_Vj8