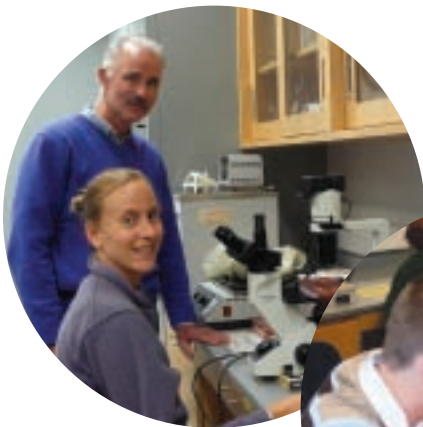




Connecticut Sea Grant

Making a Difference

**Program Highlights,
Accomplishments,
and Impacts, 2001-2006**



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This report was compiled and designed by the Connecticut Sea Grant Communications Office.

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***Research
Outreach
Education***



Connecticut Sea Grant

Making a Difference

Program Highlights, Accomplishments, and Impacts, 2001-2006

The University of Connecticut (UConn) is the formally designated Sea Grant College for the State of Connecticut, serving as the “flagship” university for the Connecticut Sea Grant College Program (CTSG). While a small marine extension program began in 1974 in conjunction with the Cooperative Extension System, the program did not receive formal designation as a Sea Grant College until 1988, marking its maturation as a full-fledged, comprehensive Sea Grant program. The program is located within the new, state-of-the-art marine sciences center on the UConn Avery Point campus, in the southeastern coastal town of Groton.

CTSG is one of 31 Sea Grant programs, which are federal-university partnerships located in coastal and Great Lakes states. In comparison to older Sea Grant programs established in the 1960s and 1970s, CTSG is generally characterized as a small program, with an annual base budget of just under \$1M, and a current staff of 11 people. Located in a state bordering Long Island Sound, “the Urban Sea”, along the highly populated Northeast corridor between New York City and Boston, the relevant opportunities for Sea Grant involvement are far greater than the staff and resources available to address them. As such, CTSG clearly recognizes that both its long-term impact and legacy depend critically on the program’s ability to develop and foster long-term partnerships and leverage funds and resources to achieve its planned outcomes.

CTSG’s broad vision is to foster sustainable use and conservation of coastal and marine resources for the benefit of the environment and both current and future generations of Connecticut citizens. CTSG works statewide and beyond to achieve healthy coastal ecosystems and consequent public benefits by supporting integrated locally and nationally relevant research, outreach, and education activities, in partnership with stakeholders. The primary program themes of the “Blueprint for a Coastal Legacy: Connecticut Sea Grant Strategic Plan 2007-2011” (available at www.seagrant.uconn.edu/blueprnt.pdf) are: (1) Marine aquaculture and biotechnology, (2) Use and conservation of marine resources, ecosystems, and habitats, and (3) Marine and aquatic science literacy.

The principles of partnership and leveraging have been integral to the successful and efficient achievement of CTSG’s goals, through synergistic sharing of personnel and resources and creative collaborations. This report highlights some of the primary accomplishments of CTSG over the past five years, emphasizing measurable impacts on society, the economy, and the environment. While the list is not exhaustive, it gives an idea of the breadth and depth of CTSG’s involvement in addressing “real-life” problems for a broad range of stakeholders. For further information, please contact the Director, Sylvain De Guise (860-405-9138) or Associate Director, Robert Johnston (860-405-9278), or visit our web site (www.seagrant.uconn.edu).

To order additional copies of this publication, contact the CTSG Office via e-mail to Irene Schalla <irene.schalla@uconn.edu> or send your request to the address on the front inside cover.



Connecticut Sea Grant

Making a Difference



Contributions to Science and Technology: Environmental Quality of Long Island Sound

Problems/Needs

The Long Island Sound estuary (LIS) is a highly-valued but stressed “urban sea” that forms the southern boundary of Connecticut and the northern boundary of Long Island, New York. A significant environmental, economic, cultural and recreational resource for both Connecticut and New York, and the southern New England region as a whole, it was one of the first “estuaries of national significance” designated by the EPA. The Sound’s estimated value to the regional economy is more than \$5.5 billion per year.

- More than 8 million people live in the LIS watershed and more than 20 million live within 50 miles of the coast. The pressures on the Sound from this highly-populated area are enormous, and include point source pollution, nonpoint source pollution, and the residual impacts of industrialization.
- Competing human uses (recreation, recreational fishing and boating, commercial fishing, coastal aquaculture, energy transport, marine trades, and shipping/transportation) also compete with the critical role the Sound plays in providing critical habitat and resources for fish, shellfish, birds, wildlife and plants.
- Improved understanding of the biological, chemical, and physical attributes of the Sound is essential to the successful protection and restoration of the estuary and its resources.

CTSG researchers from universities across the State have addressed issues related to the health and condition of Long Island Sound and its surrounding habitats, and beyond. These projects are part of the ongoing CTSG research program to address critical science and policy challenges facing this valued resource.



Investments

- 2002-2004: Sediment dynamics in Connecticut Estuaries: ^7Be , ^{210}Pb , ^{137}Cs , trace metals and modeling to investigate delivery, erosion and accumulation (PI Gaboury Benoit, Yale University). Investment including matching funds: \$217,327.
- 2002-2004: The Connecticut ‘hatting’ industry as a Mercury source for Long Island Sound (PI Johan Varekamp, Wesleyan University). Investment including matching funds: \$98,935.
- 2002-2004: Responses of Eelgrass Habitats to Land-use and Nitrogen (PI James Kremer, University of Connecticut). Investment including matching funds: \$98,849.
- 2004-2006: Determining the Causes of Area-Sensitivity: A Prerequisite for Saltmarsh Bird Conservation and Restoration (PI Christopher Elphick, University of Connecticut). Investment including matching funds: \$219,385
- 2000-2002: Sustainable Integrated Finfish/Nori Aquaculture for Bioremediation and Production of Food and Biochemicals (PI Charles Yarish, University of Connecticut). Total Investment including matching funds: \$243,705

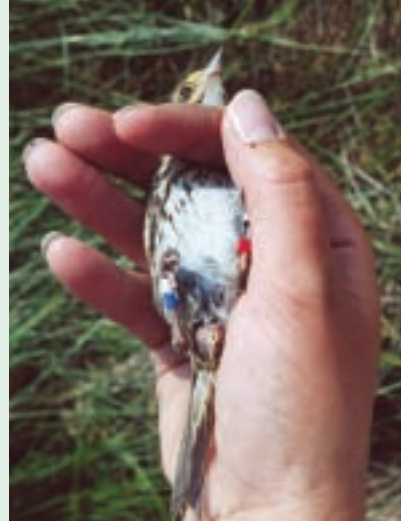
Outcomes

- More than 100 publications and presentations of research results by project scientists.



Impacts

- Long Island Sound Habitat Quality: Enhanced knowledge of the area-sensitivity (large marsh vs. smaller marshes) of critical salt marsh avian species contributes to informed state/regional marsh management decisions, and better management of salt marsh bird populations. Several Connecticut salt marshes have been designated Globally Important Bird Areas, identifying them as key sites for conservation.
- Land Use and Nitrogen: Community groups (Friends of Oswegachie Hills and Save the River, Save the Hills) concerned with proposed developments in the Niantic River watershed used the sampling data and nitrogen load estimates to question the impact of proposed zoning changes on water quality.
- Land Use and Nitrogen: The role of colored dissolved organic matter in reducing water clarity in shallow estuarine systems is being quantified. An empirical statistical model to predict light attenuation based on easily measured water column parameters is in development. The ability to accurately determine underwater light availability will remove a major obstacle to modeling efforts for shallow water estuarine systems.
- Land Use and Nitrogen: A second model, predicting the importance of colored dissolved organic matter's relative influence on light attenuation in a given estuary based on its watershed characteristics, will serve as an important tool for those interested in studying estuarine water quality as well as modeling light attenuation or factors dependent on it (e.g., eelgrass habitat).
- Long Island Sound Mercury Contamination: The City of Danbury, Connecticut contracted with UConn for a follow-up risk assessment of the mercury levels in Danbury. Data has been shared with CT DEP. Public lectures, flyers, news articles, and signs are used to alert local residents about behaviors associated with higher risk of mercury exposure (e.g., consumption of fish caught in local waters).
- Long Island Sound Mercury Contamination: Remote sensing of contaminated areas is being used experimentally to outline areas where plant reflectance spectra indicate the underlying soil is contaminated by mercury.



Impacts *continued*

- Long Island Sound Mercury Contamination: With EPA-funded scientists, CTSG researchers are using genetically-modified cottonwood plants for phytoremediation (pollution extraction) of soils that have high mercury concentrations.
- Sediment Dynamics and Long Island Sound Contaminants: The fate of contaminants added to small Connecticut estuarine systems is better understood; knowledge of critical factors (sediment quality, processes controlling sediment accumulation and re-suspension) that influence the health and function of estuaries can be applied by managers working to protect and restore ecosystem resources.
- Aquaculture Bioremediation: Researchers demonstrated that integrated recirculating systems of black sea bass, cod, and three species of the macroalgae, *Porphyra*, could successfully be run on a continuous basis with optimal growth rates for both fish and seaweed. (The Great Bay Aquaculture operation ran continuously for a year and is ongoing.) Resultant water quality in the system was better than that of local coastal waters. Further research to develop means for providing continuous supply of macroalgae sporelings is necessary. Seaweed grown in the integrated system can be used as a supplement in fishmeal.



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Connecticut Sea Grant

Making a Difference



Partnering to Respond to a Marine Resource Disaster: The Long Island Sound Lobster Research Initiative

Problems/Needs

During the fall of 1999, the Long Island Sound bi-state lobster fishery, valued at \$18-40M/year ex-vessel and \$100M overall, and supporting about 1,200 lobstermen, suffered a massive mortality event. Commercial harvests declined to 64% - 91% of the previous year's landings. The commercial lobster fishery was declared a marine resource disaster by the Secretary of Commerce in January, 2000.

Inputs/Investments

- \$13.9M in federal disaster relief funds appropriated to research the cause of the die-off and provide economic relief to the lobstermen. \$6.4M in non-federal funds supported the effort.
- A national research initiative investigating the potential cause(s) of the lobster mortalities was undertaken by the Steering Committee for Lobster Disease Research, a sub-committee of the Atlantic States Marine Fisheries Commission's Lobster Management Board, established in 2000. Eleven representatives of state and federal regulatory agencies, Sea Grant, and the lobster industry comprised the Steering Committee.
- Twenty-one projects involving 65 scientists at 30 institutions nationwide investigated the effects of environmental stressors and disease on American lobsters over three years.
- CTSG managed 6 major grants and 4 smaller grants supported with lobster development funds (\$1.31M plus \$550K match)
- A \$350K regional lobster outreach program was implemented by the CT and NY Sea Grant Extension and Communications programs. CTSG staff invested at least 4 months / year over four years (\$165K and \$84.5K match)
- Laufer, H. and R. Smolowitz. 2004-2006. Lobster defenses to shell disease: endocrine control of molting and wound healing. (\$140K plus \$59K match).

Outputs

Training

- Joint meeting of state lobster biologists (MA, RI, CT, NY) to standardize the method for monitoring/recording incidences of shell disease during sea sampling

Educational Resources

- <http://www.seagrantsunysb.edu/LILobsters> (joint NYSG-CTSG web site documenting progress of research and outreach efforts)
- Four public Lobster Health Symposia (2000, 2001, 2003, 2004)
- Two internal working meetings of the lobster research community
- Extensive media relations (print, TV, radio)

Outputs *continued*

Outreach Publications

- Balcom, N. and A. Clemetson. 2006. Lobster resource failure in LIS, Fisheries Extension, and Litigation: A Perspective. *Fisheries* 31(6):276-284.
- Balcom, N. and P. Howell. 2006. *Responding to a resource disaster: American lobsters in Long Island Sound*. CTSG-06-02. 24 pp.
- Balcom, N. 2004. At the intersection of extension and litigation: what to do when lawyers call. *J. Extension* 42(2). www.joe.org/joe/2004april/tt4.shtml
- Balcom, N. 2003. Lobster resource showing no signs of recovery as research progresses. *Wrack Lines* 3(1):8-9, 13-14. Connecticut Sea Grant College Program.
- Balcom, N. (ed.) 2003. *Third Long Island Sound Lobster Health Symposium Program and Abstracts; Summary of Presentations*. CT-SG-03-02 (72pp.); CTSG-03-06 (14pp.)
- Calabrese, A., N. Balcom, and A. Clemetson (guest eds.) 2005. Contributions to the Long Island Sound Lobster Research Initiative, 2001-2004. Special issue of *J. Shellfish Res.* 24(3):687-875 (24 manuscripts)
- Clemetson, A., N. Balcom, and P. Van Patten (eds.) 2003. *Long Island Sound Lobster Health News*, Issues 1(1) and 1(2). NY Sea Grant and CT Sea Grant.
- Clemetson, A. and N. Balcom 2002. Identifying the factors that affect lobster health in Long Island Sound. *Coastlines*, 12.4:12-13. Urban Harbors Institute and US Environmental Protection Agency.
- Van Patten, P. and N. Balcom 2003. Crisis in the Connecticut lobster fishery. *The SandBar* 1(4):8-9. Legal Reporter for the National Sea Grant College Program.
- Van Patten, P. and N. Balcom 2003. Long Island Sound lobster fishery disaster leads to litigation and a research initiative. *Waterman's Gazette* 30:8.
- Van Patten, M. 2004. A Decapod crustacean 'Who-Dun-It?' *Wrack Lines* 4(2):3-4, 10. Connecticut Sea Grant College Program.
- Van Patten, M. 2004. Spreading shell rot disease 'eating' New England lobsters. *Wrack Lines* 4(2):5, 14-16. Connecticut Sea Grant College Program.
- Van Patten, M. (ed.) 2004. *Wrack Lines* 4(2). Connecticut Sea Grant College Program. (Issue dedicated to lobster resource disaster)



Outputs *continued*

Outreach Presentations

- Balcom, N. 2005. *Piecing Together the Lobster Mortality Puzzle*. Northeastern Mosquito Control Association. November 28-30. Northampton MA.
- Balcom, N. 2005. *Long Island Sound lobster health initiative: piecing together the mortality puzzle*. Coastal Perspectives Lecture, 29 March, Groton CT.
- Balcom, N. and A. Clemetson. 2004. *When Extension Meets Partners and Litigants: the Case of the Long Island Sound Lobster Mortality*. 134th Annual meeting of the American Fisheries Society. 21-24 August. Madison, WI.
- Balcom, N. 2003. *Lobsters, Litigation and Extension*. "Handling Controversy" panel discussion, National Sea Grant Week, 28 April, Galveston TX.
- Balcom, N. 2003. Briefing on status of lobster research to Lobster Management Board of Atlantic States Marine Fisheries Commission, 10 June, Alexandria VA.
- Balcom, N. 2001. *Responding to a Lobster Fishery Failure in Long Island Sound*. SETAC North Atlantic Chapter 7th Annual meeting, 26-28 April, Plymouth MA.
- Pearce J. and N. Balcom. 2004. *Identifying the driving forces behind the 1999 lobster mortality event – fitting together the pieces of the puzzle*. Fourth Long Island Sound Lobster Health Symposium. 4 October. Stony Brook NY.
- Van Patten, M. and N. Balcom. 2001. *Holistic Response to a Lobster Fishery Failure and Ecosystem Mystery in Long Island Sound*. USGS 26th Annual Eastern Fish Health Workshop, 23-26 April. Sheperdstown WV.
- Van Patten, M., N. Balcom, R. French, P. Focazio, and C. LoBue. 2000. *Responding to a Lobster Fishery Disaster and Ecosystem Enigma in Long Island Sound*. Fifth Long Island Sound Research Conference, Nov. 17-18, Stamford, CT.
- Van Patten, M., N. Balcom, R. French, E. Beckwith, and B. Young. 2000. *The Plan of Action for the Long Island Sound Lobster Fishery Failure*. Sixth International Conference and Workshop on Lobster Biology and Management, 10-15 September, Key West FL. (Poster)



Impacts

- Lobster industry members participated in all key decisions through their formal representatives on the Steering Committee.
- 21 research projects were integrated topically and presented by five individuals at the 3rd and 4th public symposia (a practice which challenged researchers to collaborate on the interpretation and integration of disparate results for the public, to address the overall question, “What happened to the lobsters in 1999?”).
- Researchers cited the internal working meetings as extremely beneficial and suggested that they serve as the standard for future multi-disciplinary efforts.
- The LIS Lobster Health Research Initiative collectively produced results that determined the impacts of natural and human environmental stressors on the health of the American lobster stock in the Sound, and provided lobster biologists and resource managers with extensive new information to help guide management decisions.
- State and local review and revision of mosquito control pesticide usage was undertaken. The use of malathion has been reduced or eliminated altogether, coupled with a stronger push for the use of BT.
- Civil lawsuits filed by commercial lobstermen against three manufacturers of pesticides used for mosquito control were settled for ~\$16M.
- Commercial lobstermen and state resource managers are initiating a v-notching program for female lobsters in LIS as a resource conservation measure, with support from the State of Connecticut.
- Extensive press coverage (print, TV, radio), generated through press releases, briefings, and interviews arranged with researchers, Sea Grant staff, and commercial lobstermen, kept the issue in the public eye.
- The CT-NY Sea Grant lobster outreach team was awarded the Northeast Sea Grant Extension Network’s Outstanding Outreach Program Group Award in 2004 (Balcom and Van Patten, CT).
- Balcom was recognized with a Special Achievement Award by the University of Connecticut in 2001, upon recommendation of the Steering Committee Chairman.



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Connecticut Sea Grant

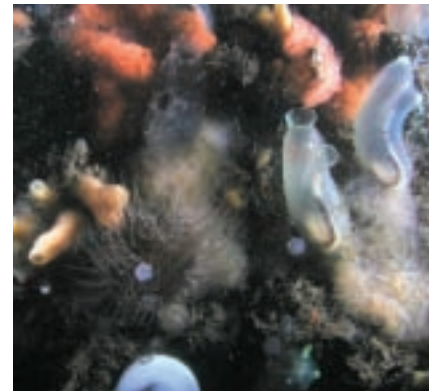
Making a Difference



Partnering to Address Aquatic Nuisance Species

Problems/Needs:

The introduction and spread of aquatic nuisance species (ANS) in the marine and freshwater environments pose a serious threat to the ecology and biodiversity of native ecosystems and to the economic interests of the people of the State of Connecticut. Aquatic invasions pose difficult challenges to natural resource managers. Once established, populations of ANS are self-sustaining. Effective ANS management requires on-going efforts devoted to the prevention of new introductions and the eradication and/or control of existing populations, in concert with rigorous scientific research to learn more about the aquatic invaders and their impact on local ecosystems, and educational programs to raise awareness of the issue among stakeholders.



Inputs/Investments:

- 2-4 outreach and education staff, part-time, ~ 2.5 months / year
Outreach grants (\$237K plus \$98K match)
- Balcom, N. and K. Heinonen. 2006-2007. ANS in Long Island Sound: Fostering a Cooperative and Comprehensive Approach to Management, Research, and Education. New England Interstate Water Pollution Control Commission. (\$54K plus \$7k match)
- Balcom, N. and R. Johnston. 2005-2006. CT Long Island Sound Fellows Program. US Environmental Protection Agency. (ANS Risk Analyses) (\$304K plus \$7K match)
- Chrysostromidis, C., J. Pederson, N. Balcom, C. O'Neill, T. Crago, M. Schwartz, R. Gough, M. Wiley, and T. N. Hart. 2005-2007. Interrupting the Flow: A Northeast Regional Sea Grant Education and Outreach Collaborative Addressing Vectors of Marine Invasive Species Introductions in the Northeast Region. NOAA NSGO NSI (\$29K of \$298K plus \$15K match)
- Goettel, R., B. Miller, H. Domske, D. Lindstedt, J. Luke, N. Balcom, and D. Payne. 2005-2007. Nab the Aquatic Invader! —A Nationwide Online Educational Program to Direct Attention to AIS Issues and Inspire Action. NOAA NSGO NSI. (\$27K of \$300K plus \$14K match)
- Balcom, N., W. Hyatt, and N. Murray. 2003-2004. Assessing the Status of Marine and Freshwater ANS in CT: Laying the Groundwork for Comprehensive and Coordinated Management and Outreach. NOAA NSGO NSI. (\$51K + \$29K match)
- Balcom, N. and T. Getchis. 2003-2004. Exotic Species in LIS: Raising Awareness through Education. US EPA LIS Study Office. (\$9K)
- Crawford, H. and N. Balcom. 2000-2002. Research and Outreach to Prevent and Control Aquatic Nuisance Species Invasions: A National Invasive Aquatic Plant Outreach/ Research Initiative. (\$33K plus \$17K match)

Investments *continued*

Research Grants (\$1.105M plus \$520K match)

- Whitlatch, R., S. Shumway, R. Osman, N. Balcom, C.M. Adams, & T. S. Getchis. 2005-2007. Control and Economics of Aquatic Invasive Species in Marine Aquaculture. NOAA National Sea Grant Program National Strategic Initiative. (\$448K plus \$149K match)
- Whitlatch, R., R. Osman, and N. Balcom. 2003-2005. Evaluation of the importance of ship hull fouling by privately-owned vessels as a vector for the transport of invasive species along the Eastern seaboard. NOAA NSGO NSI. (\$284K plus \$170K match)
- Yarish, C., R. Whitlatch, G. Kraemer, S. Lin. 2006-2008. Impacts and spread of non-indigenous Rhodophycean alga, *Grateloupia turuturu*, on Long Island Sound. (\$154K plus \$77K match)
- Yarish C., S. Lin, G. Kraemer, and R. Whitlatch. 2006-2007. Multi-component evaluation to minimize the spread of aquatic invasive seaweeds, harmful algal bloom microalgae, and invertebrates via the live bait vector in Long Island Sound. (\$110K plus match; funded by EPA LISS in partnership with CTSG funding of \$8K).
- Whitlatch, R. and R. Osman. 2000-2002. Species and community attributes affecting invasion success by exotic species. (\$163K plus \$124K match)

Outputs

Publications

- Balcom, N., W. Hyatt, N. Murray, and P. Bresnahan. 2005. State of Connecticut Aquatic Nuisance Species Management Plan. CT ANS Working Group. 118 pp.
- Balcom, N. 2004. What are introduced or invasive species? Invasive Species Fact Sheet. CTSG-04-14 URL: <http://www.seagrant.uconn.edu/INVSF1.PDF>; 4 pp.
- Balcom, N. 2002. Aquatic nuisance species harm Northeast. Northeast ANS Panel. 2pp.
- Balcom, N.C. & T. S. Getchis. 2004. Identification guide to selected marine invasive species of Long Island Sound. Connecticut Sea Grant College Program. CTSG-04-08.
- Benson, J. 2006. "Investigating an Algal Invasion" (*Grateloupia*). *The Day*. p. B1 and B8.
- Balcom, Nancy. 2006. Hull fouling's a drag on boats and local ecosystems. *Wrack Lines* 5(1):14-17.
- Bullard, S. and R.B. Whitlatch. 2004. *Guide to Larval and Juvenile States of Long Island Sound Ascidians and Bryozoans*. CT DEP/CT Sea Grant. Illustrated. 39 pp. CTSG-04-07
- Bullard, S., R. Whitlatch, S. Shumway and R. Osman. 2006. Scientists crying "foul" – sea squirts are invading Long Island Sound! *Wrack Lines* 5(1): 2-7. Winter 2005-2006
- Crawford, H. M., *et al.* 2001. Sea Grant and Invasive Aquatic Plants: A National Outreach Initiative. *Journal of Aquatic Plant Management*, 39:8-11.
- Funkhouser, D. 2006. "Long Island Sound: A New Threat: The Sinister Sea Squirt." *The Hartford Courant*, July 2, 2006. P. 1-2.
- Getchis, T. and N. Balcom. 2004. Invasive Species of Long Island Sound. URL: <http://www.seagrant.uconn.edu/LISINV.htm>
- Getchis, T. S. & N. C. Balcom. 2004. Identification guide to selected marine invasive species of Long Island Sound (field cards). Connecticut Sea Grant College Program. CTSG-04-08.
- Dobroski, N. 2005. Anatomy of an invader: aspects of the feeding ecology, physiology, and habitat breadth of the Asian shore crab, *Hemigrapsus sanguineus*. Thesis. Univ. of Rhode Island.
- Lohrer, A. M. and R. B. Whitlatch. 2002. Alien crabs in Long Island Sound: relative impacts of two exotic brachyuran species. *Marine Ecology Progress Series*, 227: 135-144.
- Lohrer, A.M. and R. B. Whitlatch. 2002. Interactions among aliens: apparent replacement of one exotic species by another. *Ecology* 83: 719-733.

Publications continued

Lohrer, A. M. and R. B. Whitlatch. 2002. Modeling life-stage based recovery dynamics of marine invertebrates in soft-sediment habitats: implications for habitat conservation. Pp. 191-213. In: M. Ruth and J. Lindholm (eds.), *Dynamic Modeling for Marine Conservation*. Springer-Verlag NY.

Prisloe, S. 2006. "Phrag" is a drag: a bird's eye view of a pesky invasive plant. *Wrack Lines* 5(1):11-13. Winter 2005-2006.

Stachowicz, J. J., J. R. Terwin, R. B. Whitlatch, and R. W. Osman. 2002.

Linking climate change and biological invasions: ocean warming facilitates nonindigenous species. *Proc. National Academy of Sciences* 99(24) 15497-15500.

Stachowicz, J. J., H. Fried, R.W. Osman and R.B. Whitlatch. 2002. Reconciling pattern and process in marine bioinvasion: how important is diversity in determining community invisibility. *Ecology* 83:2575-2590.

Van Patten, Peg, ed. 2006. *Wrack Lines* 5(1): 2-7. Winter 2005-2006. (theme issue: invasive species)

Whitlatch, R. B., A. M. Lohrer and S. F. Thrush. 2002. Scale-dependent recovery of the benthos: effects of larval and post-larval life stages. In: J.Y. Aller and S.A. Woods (eds.), *Organism-Sediment Relationships*. Univ. of South Carolina Press, Columbia, SC.



Extension Presentations

Balcom, N. 2006. Nab the Aquatic Invader workshops (3). Marine Sciences Day, Groton CT.

Balcom, N. and D. Payne. 2006. Nab the Aquatic Invader teacher workshop. Long Island Sound Educators Conference, Norwalk CT.

Balcom, N. 2005. Nab the Aquatic Invader workshops (3). Marine Sciences Day, Groton CT.

Balcom, N. 2004. Briefing, Invasive Plant Council, 11 March, Hartford CT.

Balcom, N. 2004. Alien Invaders in the Sea. Univ. of RI coastal lecture series. 21 July, Narragansett RI

Balcom, N. 2004. One if by Land, Two if by Ballast Water: Aquatic Nuisance Species in LIS & Its Watershed, 24 May, Long Island Sound Councils, New Haven CT.

Balcom, N. 2002. Member, panel discussion on water chestnut, Northeast Regional Panel on Aquatic Nuisance Species, semi-annual meeting, 16-17 December, Hadley MA.

Balcom, N. 2002. One if by Land, Two if by Ballast Water. University of Connecticut –Johns Hopkins University Center for Talented Youth Workshop, Explorations in Ocean and Marine Science, 2 November, Groton CT.

Balcom, N. 2002. Protecting the Homefront: Connecticut's Approach to Invasive Species issues. 16th Annual States Organization of Boating Access Conference, 23 September, Mystic CT.

Impacts

- The Connecticut ANS Management Plan provides a comprehensive and coordinated approach to address early detection and monitoring, rapid-response, control and eradication, spread prevention, and policy/legislative needs with respect to aquatic nuisance species in a timely manner. Coupled with targeted research and educational programs to improve awareness of the issue, available resources and expertise will be utilized more efficiently to address priority ANS problems in Connecticut.
- Following completion of the draft of the Connecticut ANS state management plan, the EPA Long Island Sound Study awarded an additional grant to CTSG to coordinate CT and NY interests in developing an interstate ANS management plan for Long Island Sound.
- For the first time in a marine environment, experimental research has demonstrated that invasion potential is related to biodiversity.
- Hull fouling on private boats has been documented as being a potentially significant vector of marine invasions.
- The results of ongoing studies focused on new invaders (*Grateloupia* and *Didemnum*) will provide resource managers with critical information on the ecological impacts of these species, as well as shed light on possible economic impacts to commercial fishery and aquaculture operations.
- Pressing concerns about the presence of the colonial tunicate, *Didemnum*, in Long Island Sound resulted in a CTSG-NURC-UConn Department of Marine Sciences collaboration to pool resources and expertise to survey the newly discovered mats several times in 2006 with a remotely-operated vehicle.



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Connecticut Sea Grant

Making a Difference



Aquaculture and the Environment

Problems/Needs

The impact of aquaculture on essential habitats, especially in view of the coast-wide decline of eelgrass beds, is an emerging concern. Eelgrass beds provide critical ecological functions; however, there are many sources of impact which have caused cumulative damage to the resource. In many areas, bivalve aquaculture coexists with eelgrass, and the gear provides essential habitat and refuge for estuarine fish and invertebrates. Cultured bivalves also have the potential to alleviate eutrophication by converting phytoplankton blooms into biomass, which is then removed and marketed. However, there is also potential for local negative gear impacts, from uprooting, scouring, shading and increased organic deposition. Due to the increasing loss of eelgrass, significant attention has been focused on investigating potential impacts to the resource, and determining methods to minimize these impacts without affecting economic growth.



Another habitat concern is that shellfish and finfish aquaculture can release inorganic nutrients that are dissolved in the wastewater effluent, causing eutrophication. An integrated recirculating aquaculture system was designed and built to couple economically important seaweed with animals to take up the excess nutrients and turn them into a valuable crop. Two demonstration facilities, one in Bridgeport and one in Great Bay, NH have been in operation to assess the effectiveness of these systems.

Investments

- Cheney, D., J. Davis, M. Luckenbach, C. Newell, D. Angel, J. Richardson, V. Panchang, P. Nelson, B. Dumbauld, T. S. Getchis, & R. Downey. 2006-2008. Alternative shellfish production methods: environmental interactions and regulatory compliance. DOC, NOAA, NSGO National Marine Aquaculture Initiative. (\$285,583)
- Cheney, D., R. Elston, J. Davis, R. Downey, C. Newell, J. Richardson, T. S. Getchis, & D. Angel. 2004-2006. Environmental and technical assessment of alternative shellfish production methods. DOC, NOAA, NSGO National Marine Aquaculture Initiative. (\$225,817)
- Yarish, C. 2000-2002. Sustainable Integrated Finfish/Nori Aquaculture for Bioremediation and Production of Food and Biochemicals: Culture and Mesocosm Studies. DOC, NOAA, NSGO, Connecticut Sea Grant College Program. (\$243,705)
- Yarish, C. 2003-2004. Development of Integrated Recirculating Aquaculture System for use in Urban Aquaculture. DOC, NOAA, NSGO, Connecticut Sea Grant College Program. (\$156,447)
- CTSG outreach staff time dedicated: 1.5 months per year
- Match time provided by Industry Partners: 1.0 month per year (salary) plus boat time

Publications

- Vaudrey, J., T. S. Getchis, R. Britton, & J. Kremer. 2006. Assessing impacts of shellfish aquaculture on eelgrass populations in eastern Long Island Sound. *J. Shellfish Res.* 25(2):674
- Getchis, T. and J. Vaudrey. 2006. Year One Progress Report. Submitted to Pacific Shellfish Institute. 2pp.
- Pereira, R., C. Yarish, and I. Sousa-Pinto. 2006. The influence of stocking density, light, and temperature on the growth, production and nutrient removal capacity of *Porphyra diocia* (Bangiales, Rhodophyta). *Aquaculture* 252:66-78.
- Carmona, R., G. P. Kraemer, and C. Yarish. 2006. Exploring Northeast American and Asian species of *Porphyra* for use in an integrated fin-fish-algal aquaculture system. *Aquaculture* 252: 54-65.
- Neori, A., T. Chopin, M. Troell, A. Buschmann, G. Kraemer, C. Halling, M. Shpigel, and C. Yarish. 2004. Integrated aquaculture: rationale, evolution and state of the art emphasizing seaweed biofiltration in modern mariculture. *Aquaculture* 231:361-391.
- Troell, M., C. Halling, A. Neori, A. H. Buschmann, T. Chopin, C. Yarish, & N. Kautsky. 2003. Integrated mariculture: asking the right questions. *Aquaculture* 226:69-90.
- Rawson Jr., M.V., C. Chen, R. Ji, M. Zhu, D. Wang, L. Wang, C. Yarish, J. B. Sullivan, T. Chopin, & R. Carmona. 2002. Understanding the interaction of extractive and fed aquaculture using ecosystem modeling. pp. 263-296 In: *Responsible Aquaculture*. Stickney R.R. and McVey J.P. (Eds.). CABI Publishing, Oxon, 391 pp.
- McVey, J. P., R. Stickney, C. Yarish, & T. Chopin. 2002. Aquatic polyculture and balanced ecosystem management: new paradigms for seafood production: pp. 91-104. In: *Responsible Aquaculture*. Stickney R.R. and McVey J.P. (Eds.). CABI Publishing, Oxon, 391 pp.
- Chopin, T., C. Yarish, & G. Sharp, 2002. Beyond the monospecific approach to animal aquaculture ... the light of integrated aquaculture. In: *Ecological and genetic implications of aquaculture activities*. T. Bert (ed.). Kluwer Academic Publishers, Dordrecht.
- Chopin, T., A. H. Buschmann, C. Halling, M. Troell, N. Kautsky, A. Neori, G.P. Kraemer, J.A. Zertuche-Gonzalez, C. Yarish, C. and C. Neefus, 2001. Integrating seaweeds into marine aquaculture systems: a key towards sustainability. *J. Phycol.* 37: 975-986.



Outputs *continued*

Presentations

Cheney, D., R. Elston, J. Davis, R. Downey, C. Newell, J. Richardson, T. S. Getchis, D. Angel, M. Luckenbach, R. Rheault, & M. Pierson, M. 2006. Assessing environmental impacts of marine shellfish aquaculture in the USA. Annual meeting of the World Aquaculture Society. Florence, Italy.

Richardson, J., C. Newell, D. Angel, T. S. Getchis, A. Suhrbier, J. Davis & D. Cheney 2006. CFD analysis of shellfish aquaculture gear used in intertidal and subtidal locations. Annual meeting of the National Shellfisheries Association. Monterey, CA.

Vaudrey, J., T. S. Getchis, R. Britton, & J. Kremer. 2006. Assessing impacts of shellfish aquaculture on eelgrass populations in eastern Long Island Sound. Annual meeting of the National Shellfisheries Association. Monterey, CA.

Vaudrey, J., T. S. Getchis, R. Britton, & J. Kremer. 2006. Assessing impacts of shellfish aquaculture on eelgrass populations in eastern Long Island Sound. Milford Aquaculture Seminar. Meriden, CT.

Getchis, T. S. & E. C. Monahan. 2003. Sea Grant's role: sharing with the community the goal of fostering ecologically-sound, and economically viable, aquaculture. Aquaculture Ecology and Economics, Puerto Varas, Chile, and International Workshop on Extension and Aquaculture, Ensenada, Mexico (both December).

Chopin, T., C. Yarish, G. Sharp, C. Neefus, G. Kraemer, J. Zertuche-Gonzalez, E. Belyea, R. Carmona, G. Saunders, & C. Bates. 2001. Development of integrated aquaculture systems for responsible coastal zone management. In: Aquaculture and its Role in Integrated Coastal Zone Management. Proceedings of the European Aquaculture Society International Workshop, Oostende, Belgium: 77-80. European Aquaculture Society, vi + 145 p.

Chopin, T., C. Yarish, C. Neefus, G. Kraemer, J. Zertuche-Gonzalez, E. Belyea & R. Carmona. 2001. The role of seaweeds in integrated aquaculture and their contribution to nutrient bioremediation of coastal waters. In: Chopin, T. and P.G. Wells (Eds.). Opportunities and Challenges for Protecting, Restoring and Enhancing Coastal Habitats in the Bay of Fundy. Proc. 4th Intl. Conference on Coastal Zone Canada. Sept. 17-22, 2000. Environment Canada, Atlantic Region Occasional Report No. 17, Environment Canada, Dartmouth, Nova Scotia, p. 41.

Kraemer, G.P., R. Carmona, T. Chopin, & C. Yarish. 2002. Use of photosynthesis measurements in the choice of algal species for bioremediation. Pp. 113-117 In: *Proceedings of the Fifth Biennial Long Island Sound Research Conference 2000*, Stamford, CT. Van Patten P. (ed.). Connecticut Sea Grant College Program, Groton, CT. USA, 152 pp.





Impacts

- The results of the habitat study will enable researchers, extension specialists, and resource managers to place the potential impacts from aquaculture in perspective with other anthropogenic impacts, providing critical information that can be used in the development of an eelgrass management plan for Connecticut.
- The results will assist managers in balancing the needs of economic development with sustainable use of existing resources.
- USDA Natural Resources Conservation Service has partnered with Sea Grant to develop best management practices for the industry and is developing an incentive plan to help conserve threatened marine resources.



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Connecticut Sea Grant

Making a Difference



Partnering to Streamline the Marine Aquaculture Permitting Process

Problem/Needs

In October 2001, the Connecticut Department of Agriculture, Bureau of Aquaculture introduced a new permitting system to the marine aquaculture industry. Because no two aquaculture projects are alike in Connecticut, applications have been reviewed on a case-by-case basis which has led to uncertainty on the part of the grower about application requirements, process time, and permit conditions, liability, etc. In 2002, the Sea Grant Extension Program was asked to chair a state aquaculture permitting workgroup. CTSG convened workshops for state and federal agencies involved in aquaculture permitting decisions to review the current policies and application process, and develop a more streamlined, straightforward permit application process



Investments

- Getchis, T. S. 2005. Industry Assessment Guide. Ocean Technology Foundation Small Grants Competition. \$1,000.
- Getchis, T. S., P. Hoagland, & J. Duff. 2003. Northeast Regional Aquaculture White Paper – Policy and Regulations. USDA CSREES Northeast Regional Aquaculture Center. \$10,000.
- Getchis, T. S. 2003 Industry Assessment Conference Support. DOC, NOAA, NSGO, Connecticut Sea Grant College Program Development Fund. \$750
- CTSG Outreach Staff time dedicated: 1 month per year
- Match time provided by State/Federal Partners: 3 months per year

Outcomes

Publications

- Getchis, T. S., C. M. Rose, D. Carey, K. Bellantuono, M. Ludwig, & S. Kelly. *in prep.* *A Guide to Marine Aquaculture Permitting in Connecticut.* (final draft undergoing review at state/federal level).
- Getchis, T. S. 2005. *An assessment of Connecticut's shellfish aquaculture industry.* Connecticut Sea Grant College Program. Fisheries & Aquaculture Fact Sheet Series. CTSG-05-02. 12pp.
- Getchis, T. S. 2004. A report on the 2003 Shellfish Industry Summit. *J. Shellfish Res.* 23(2):636.
- Getchis, T. S. and R. J. Johnston. 2004. Connecticut Commercial Aquaculture. Chapter 5 in: *Connecticut Agriculture and Resources: 21st Century Issues and Challenges.* Department of Agricultural and Resource Economics, University of Connecticut and the University of Connecticut Cooperative Extension System.
- Duff, J., T. S. Getchis, & P. Hoagland. 2003. *A Review of Legal and Policy Constraints to Aquaculture in the US Northeast.* NRAC Publication No. 03-005. NRAC Project No. WP03-9. 28pp.
- Getchis, T. S., C. Rose, J. Volk, P. Francis, R. Bray, M. Johnson & R.M. Payton. 2003. Aquaculture policy in Connecticut - constructing a permitting roadmap for stakeholders. *J. Shellfish Res.* 22(1):293.
- Rose, C., P. Francis, R. Bray, & T. S. Getchis. 2003. Evaluation factors for aquaculture gear applications. *J. Shellfish Res.* 22(1):299.



Outputs *continued*

Presentations

Getchis, T. S. Marine Aquaculture Permitting and Needs Assessment Workshops:

- 2006, Aug. State/federal resource managers
- 2006, Jul. State/federal resource managers
- 2006, Apr. State/federal resource managers
- 2006, Apr. Municipal resource managers
- 2006, Feb. Industry
- 2003, May State/federal resource managers & industry
- 2003, Jan. State/federal resource managers & industry
- 2002, Nov. State/Federal resource managers

Getchis, T. S. 2004, March. Law & Policy Session Organizer, Meeting of the World Aquaculture Society, Honolulu, HI.

Getchis, T. S. 2004, March. Balancing Existing Water-based Uses With Aquaculture: Is it Possible? Meeting of the World Aquaculture Society, Honolulu, HI.

Hoagland, P., T. S. Getchis, & J. Duff. 2004, February. A Review of Legal and Policy Constraints to Aquaculture in the US Northeast. Milford Aquaculture Seminar, New Haven, CT.

Getchis, T. S. 2003, November. A Summary of the 2003 Connecticut Shellfish Industry Summit. Milford Aquaculture Seminar, New Haven, CT.

Getchis, T. S. 2003, September. Aquaculture Policies and Regulations in the Northeast. USDA CSREES Northeast Regional Aquaculture Center Industry Summit, Seekonk, MA.

Getchis, T. S. 2003, April. Connecticut Aquaculture Policy and Permitting. National Aquaculture Extension Conference. Tucson, AZ.



Impacts

- As a result of a series of workshops held to review the current policies and application process, the agencies have a better and more efficient working relationship and more importantly, individuals and businesses applying for new aquaculture permits have developed improved lines of communication with the resource managers.
- A guide to marine aquaculture permitting in Connecticut is being drafted. This 8-page publication will contain information including: factors to consider when developing an application (i.e. environmental, structural engineering, business management, navigation, safety and security, public etiquette, etc.), detailed instructions on the permitting process, a sample application, a checklist for applications and contact information for permitting authorities.
- A comprehensive guide to aquaculture in Connecticut is being drafted (expected publication in spring 2007). This document will be distributed to a wider audience and will contain information such as: an overview of Connecticut's commercial industry, an introduction to CT's shellfish and trout management programs, aquaculture enhancement and restoration programs, recreational shellfishing, tools for getting started in aquaculture, detailed permitting guidance, as well as numerous appendices containing contact information for stakeholders, reference and historical information on Connecticut's aquaculture operations.
- The immediate impact of this outreach effort was a significant reduction in the time it takes for aquaculture applications to be permitted. The longer-term goal is to achieve cost savings for aquaculture operations, as well as for resource managers. These results will be realized as resource managers begin to take a proactive rather than reactive approach to reviewing aquaculture operations.



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Connecticut Sea Grant

Making a Difference



Enhancing Aquaculture Production

Problems/Needs

The Connecticut aquaculture industry has expressed a clear need to diversify the types of products it produces and markets, to offset potential economic losses due to disease and depressed market price caused by regional and imported product supplies exceeding demand. One of the bottlenecks in hatchery-based aquaculture operations is the availability of appropriate feeds for larval fish and invertebrates in their early life stages. Additional food sources that are high in nutritional quality, easy to culture, and cost-effective are needed to help advance the industry. Although producers possess the knowledge and skill to carry out these types of applied research projects, they are often limited by time, manpower, and money. Scientists, Extension specialists and resource managers must partner with industry to see through the development of new species and technology from pilot-stage to permitting to marketing.

Investments

- Rhodes, E., R. Garrison, T. S. Getchis, S. Macfarlane, & D. Morse. 2004. Business feasibility study related to the culture of shellfish products in the Northeast United States. CSREES USDA Northeastern Regional Aquaculture Center. (\$15,000)
- Flimlin, G., R. Pomeroy, and D. Schoor. 2004. Business feasibility for ornamental aquatic plant culture in the Northeast United States. CSREES, USDA, Northeastern Regional Aquaculture Center. (\$15,000)
- McManus, G. 2004-2006. Development of an oligotrich ciliate as a food organism for marine aquaculture. DOC, NOAA, NSGO, Connecticut Sea Grant. (\$135,979)
- Wadsworth, J., T. S. Getchis, & N.C. Balcom. 2003-2005. Razor Clam Aquaculture. USDA CSREES Northeast Regional Aquaculture Center. (\$2,500)
- Chen, T.T. 2002-2004. Characterization of the biological function of somatolactin-identification of the receptor and determination of the somatolactin target tissues. DOC, NOAA, NSGO, Connecticut Sea Grant. (\$127,570)
- Williams, L. and T. S. Getchis. 2001-2003. Blue Mussel Aquaculture in Long Island Sound. DOC, NOAA, NSGO, Connecticut Sea Grant. (\$10,000)
- Chen, T. 2000-2002. An Innovative Approach to Growth Enhancement in Two Economically Important Euryhaline Teleosts, the Rainbow Trout & Tilapia. DOC, NOAA, NSGO, Connecticut Sea Grant. (\$150,750)
- CTSG outreach staff time dedicated: 1.0 month per year.

Outputs

Publications

- Rhodes, E., R. Garrison, T. S. Getchis, S. Macfarlane, & D. Morse. 2005. Business feasibility study related to the culture of shellfish products in the Northeast United States. CSREES USDA Northeastern Regional Aquaculture Center.
- Flimlin, G., R. Pomeroy and D. Schoor. 2005. Business feasibility for ornamental aquatic plant culture in the Northeast United States. CSREES USDA Northeast Regional Aquaculture Center.
- Sunila, I., L. Williams, S. Russo, & T. S. Getchis. 2004. Reproduction and Pathology of Blue Mussels, *Mytilus edulis* (L.) in an Experimental Longline in Long Island Sound, Connecticut. *J. Shellfish Res.* 23(3):731-740.
- Lin, C. – M., C. Yarish, and T. Chen. 2004. Development of a novel gene transfer method. *Bull. Fish. Res. Agen. Supplement* 1:155
- Getchis, T. S. 2003. Razor Clams: The Cutting Edge of Aquaculture. *Wrack Lines*, 2(1). Connecticut Sea Grant College Program.
- Williams, L, T. S. Getchis, & I. Sunila. 2003. An update on blue mussel aquaculture in Long Island Sound. *J. Shellfish Res.* 22(1): 304.
- Wadsworth, J., T. S. Getchis, & N. Balcom. 2003. Razor clam growth rates in the Niantic River, Connecticut. *J. Shellfish Res.* 22(1): 302.
- Simlick, T. 2002. Mouthwatering Mussels. Connecticut Sea Grant College Program. *Wrack Lines.* 1(1):18-19.
- Williams, L. and T. Simlick. 2002. Blue mussel aquaculture in Long Island Sound. *J. Shellfish Res.* 21(1): 356.
- Wadsworth, J., T. Simlick, & N. Balcom. (2002). A new clam for Connecticut: razor clam aquaculture. *J. Shellfish Res.* 21(1): 353-354.

Presentations

- Leavitt, D., J. Gardner, T. Getchis, D. Grunden, D. Murphy, D. O'Connell, M. Patricio, A. Surier, J. Wadsworth, & W. Burt. 2005, April. *A Preliminary Investigation of the Razor Clam (Ensis directus) as a candidate for commercial farming.* Annual Meeting of the National Shellfisheries Association. Philadelphia, PA.
- Rhodes, E., R. Garrison, T. Getchis, S. Macfarlane, & D. Morse. 2005, March. *Expanding Shellfish Culture in the NRAC Region - Constraints to Existing Industry Expansion and an Analysis of the Economic Feasibility of New, Small-scale Oyster Culture Businesses.* Milford Aquaculture Seminar. N. Haven, CT.
- Rhodes, E., R. Garrison, T. Getchis, S. Macfarlane, & D. Morse. 2005, January. *Expanding Shellfish Culture in the NRAC Region - Constraints to Existing Industry Expansion and an Analysis of the Economic Feasibility of New, Small-scale Oyster Culture Businesses.* Maryland Waterman's Meeting, Baltimore, MD.
- Rhodes, E., R. Garrison, T. Getchis, S. Macfarlane, & D. Morse. 2004, December. *Expanding Shellfish Culture in the NRAC Region - Constraints to Existing Industry Expansion and an Analysis of the Economic Feasibility of New, Small-scale Oyster Culture Businesses.* Northeast Aquaculture Conference & Expo, Manchester, NH.
- Getchis, T. S. 2004, November. *An Assessment of the Needs of Connecticut's Shellfish Aquaculture Industry.* Long Island Sound Biennial Research Conference. Stony Brook, NY.
- Wadsworth, J., T. S. Getchis, & N. Balcom. 2003, February. *Razor Clam Growth Rates in the Niantic River, Connecticut.* 24th Annual Milford Aquaculture Seminar, New Haven, CT.



Outputs continued

- Getchis, T. S. 2004, November. *An Assessment of the Needs of Connecticut's Shellfish Aquaculture Industry*. Long Island Sound Biennial Research Conference. Stony Brook, NY
- Wadsworth, J., T. S. Getchis, & N. Balcom. 2003, February. *Razor Clam Growth Rates in the Niantic River, Connecticut*. 24th Annual Milford Aquaculture Seminar, New Haven, CT.
- Williams, L. and T. S. Getchis. 2003, February. *An Update on Blue Mussel Culture in Long Island Sound*. 24th Annual Milford Aquaculture Seminar, New Haven, CT.
- Williams, L. and T. S. Getchis. 2002, November. *Blue Mussel Aquaculture in Long Island Sound: An Industry-Extension Partnered Research Project*. Northeast Aquaculture Conference & Expo 2002, Warwick, RI.
- Simlick, T. L. 2002, April. *Growing Up in Long Island Sound: Aquaculture Opportunities of Under-represented Species*. Coastal Perspectives Lecture Series. University of Connecticut, Groton, CT.
- Wadsworth, J., T. Simlick, & N. Balcom. 2002, February. *A New Clam for Connecticut: Razor Clam Aquaculture*. 23rd Annual Milford Aquaculture Seminar, New Haven, CT.
- Williams, L. and T. Simlick. 2002, February. *Blue Mussel Aquaculture in Long Island Sound*. 23rd Annual Milford Aquaculture Seminar, New Haven, CT.
- Williams, L. and T. Simlick. 2001, November. *Blue Mussel Aquaculture in Long Island Sound*. 2nd Annual Southern New England Aquaculture Conference, Newport, RI.

Impacts

- CTSG extension initiated a successful cooperative research program with aquaculture producers for the development of new species and practices/applications to diversify the products cultivated in Connecticut. CTSG extension involvement provides resources and expertise in (1) business planning and decision-making, (2) field research coordination, (3) commercial implementation, and (4) technology transfer. Coupled with the potential economic benefit of new industries, alternative species culture may alleviate harvest pressure on traditional species. This program provides new skills to producers, and promotes an ability to earn additional profits with a minimal amount of investment and risk. It is the only program of its type available to CT aquaculture producers.
- The feasibility of blue mussel (*Mytilus edulis*) culture on longlines in LIS was investigated, combining a new species with new technology for LIS. The project was a technical success with mussels cultured to market size (55mm) in less than 12 months. The product was harvested and packaged, and market acceptability proved with a local seafood buyer. The industry partner is now investigating the permitting process for longline culture at potential shellfish lease sites in LIS.
- CTSG participated in a Northeast regional effort to determine suitable grow-out methods for the razor clam (*Ensis directus*). Several grow-out methods were proven successful with clams reaching market size (~100mm) without incidence of disease or significant predation. Currently, industry partners are working to address a bottleneck in seed production which has prevented further grow-out studies.
- CTSG researchers consider the ciliate, *Strombidium stylifer*, to be a promising alternative food for first-feeding stages of cultured larval fish and invertebrates. This planktonic ciliate is widely distributed in coastal ecosystems. Ease of mass culturing, culturing method, and determination of nutritional quality is ongoing. Small-scale culturing provides evidence that maximum growth rates can be achieved quickly with minimal food, suggesting these ciliates would be economical to grow. If efforts to cultivate the ciliate economically on a larger-scale are successful, this could be the first ciliate routinely used in marine aquaculture operations.



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Connecticut Sea Grant

Making a Difference



Partnering to Market Connecticut Seafood

Problems/Needs

Created by Connecticut's General Assembly, the Connecticut Seafood Council (CSC) was proposed by the Seafood Task Force in 1997. The Task Force proposed a council to "promote Connecticut seafood products and to examine other market opportunities." The Task Force also recommended that the council develop private and public partnerships to promote seafood and assist the Connecticut seafood industry. Four *ex officio* agency members were appointed by the General Assembly to the Council. Among them is the Connecticut Sea Grant College Program.

Investments

- CTSG outreach staff time dedicated: 1 month per year
- Balcom, N. *Ex officio* member (1997-present). CT Seafood Council
- Getchis, T. Advisory member (2000-present). CT Seafood Council.



Outputs

Publications

- Balcom, N. 2006. *Seasonal buying guide for Connecticut grown/harvested fish and seafood*. Prepared for the Connecticut Seafood Council. Connecticut Sea Grant Extension. CTSG-06-05. 2pp.
- Balcom, N. 2006. Fact Sheet: *Luscious Lobster*. Connecticut Seafood Council 1p.
- Gambardella, M. and T. Getchis. 2006. Fact Sheet: *Conch*. Connecticut Seafood Council. 1p.
- Getchis, T. 2006. Fact Sheet: *Sea Scallop*. Connecticut Seafood Council. 1p.
- Getchis, T. 2006. Fact Sheet: *Eastern Oyster*. Connecticut Seafood Council. 1p.
- Getchis, T. 2006. Fact Sheet: *Hard Clam*. Connecticut Seafood Council. 1p.
- Getchis, T. 2004. *The shellfish state*. The Newsletter of the Connecticut Farm Bureau.
<http://www.cfba.org>
- Balcom, N. ed. 1999-2003 *Seafood News: The Newsletter of the Connecticut Seafood Council*. (8 issues; 4-8 pp.)
- Getchis, T. 2003. Shad's in as State Fish. *Seafood News: The Newsletter of the Connecticut Seafood Council*. 5(1):1.
- Getchis, T. 2003. The Big E 2003. *Seafood News: The Newsletter of the Connecticut Seafood Council*. 5(1):4
- Getchis, T. 2003. Connecticut Seafood Buyers Meeting Huge Success. *Seafood News: The Newsletter of the Connecticut Seafood Council*. 5(1):5.

Outputs *continued*

Balcom, N. and B. Gordon. 2001. *Annual Report of the Connecticut Seafood Council*. Connecticut Seafood Council. 16 pp.



Presentations

- Getchis, T. S. 2006. Interview in "Working the Land". CD. SimonPure Communications, broadcast on CPTV.
- Balcom, N. and T. Getchis. 2006. Connecticut Seafood, Connecticut Chef's Event.
- Balcom, N. and T. Getchis. 2005. Interview, "Our own seafood". *The Hartford Courant*, Flavor section, Nov 3, 2005. pp. G1+3.
- Balcom, N. 2001, July. Interview, A Deep-Water Discovery, Stonington Reds Catch On. *The New York Times* (Sunday), Connecticut section, pp. 1& 9
- Getchis, T. and N. Balcom. 2001-2006. Participants, Connecticut Seafood Council booth at Agriculture Day at the Capitol.
- Getchis, T. and N. Balcom. 2003-2006. Participants, Connecticut Seafood Council booth at Eastern States Exposition (Big E), Connecticut Day.
- Balcom, N. and T. Getchis. 2003-2006. Participants, Legislative receptions at the Capitol, Connecticut Seafood Council booth.
- Getchis, T. 2003-2006. Participants at Milford Oyster Festival, Connecticut Seafood Council booth.

Impacts

CTSG extension staff contributes to the success of the Connecticut Seafood Council by:

- Developing and producing written materials such as newsletters, fact sheets, and brochures that enable the Council to spread its message to broader audiences in Connecticut.
- Providing manpower to help promote the Council's activities on behalf of the different sectors of the seafood and aquaculture industries in Connecticut.
- Assisting in development and implementation of marketing plans and activities for the Council.
- Providing an objective viewpoint.



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Connecticut Sea Grant

Making a Difference



Partnering to Promote Seafood Safety through Industry Training

Problems/Needs

A 1997 FDA regulation requires all seafood processors to meet a Hazard Analysis at Critical Control Points (HACCP) training requirement. The requirement can be met by taking a standardized course developed by academics, regulators, and industry members in the methods for processing fish and fishery products safely according to HACCP principles of risk identification, evaluation, monitoring, and control. The impetus for the regulation was concern about the increasing number of outbreaks of foodborne illness related to seafood, and the need to protect consumers by assuring that all domestic and imported fish and fishery products are processed and handled in the safest manner possible.

Response

Recognizing that the seafood industry's continual employee/business turnover would drive the demand for this training, a regional training partnership between Connecticut and Rhode Island Sea Grant Extension / Cooperative Extension was established to:

- ensure that industry members in southern New England have regular access to the required training;
- engage instructors from both the university and regulatory environments in the training to broaden the perspective and expertise available to course participants;
- provide pertinent, timely HACCP and food safety-related information post-training through print and electronic newsletters; and
- share responsibility for organizing and teaching the training courses.

Inputs/Investments

- Training opportunities offered a minimum of four times annually to industry members in partnership with RISG, the FDA, CT and RI regulatory agencies, and the Association of Food and Drug Officials
- Annual "School to Career" training offered to senior high school students at the Sound School Aquaculture Center in New Haven and Grasso Technical High School in Groton to enhance employability
- Two primary instructors certified as supervisory instructors for two HACCP courses and one sanitation course.
- ~1 month FTE of CTSG staff time (extension and secretarial) annually;
- Fee-based courses recover cost of AFDO fee for certificates, manuals, resource materials, supplies, & refreshments (all except for salary); cost to print and mail newsletters (~\$700/year) covered in part by course fees; balance of cost covered by CTSG.

Outputs

Training

- Through 39 courses offered in CT, RI, and MA since 1997, more than 600 seafood processors, importers, and dealers received the required training in the application of HACCP principles to seafood processing (349 since 2001), enabling them to remain in business (including 127 CT firms with gross annual income ranging from less than \$100K to more than \$10M).



Educational Resources

- Enhancements to the standard Seafood HACCP Alliance curriculum provide trainees with stronger understanding of sanitation requirements and other prerequisite programs.
- Periodic newsletter helps HACCP-trainees to stay current with changes to seafood hazards and/or controls, changes in inspection or enforcement policies, or pending rules and regulations that are pertinent. The only HACCP instructors to offer this continuing education service, our newsletters are used by several instructors and FDA/state inspectors outside CT and RI.

Presentations

Balcom, N. Radio Interview on Red Tide on “Simply Food with Prudence Sloane” 11 June 2005.

WDRC-AM 1360, WMMW-AM 1470,
WWCO-AM 1240, WSNG-AM 610.

Balcom, N. 2005. Safe Seafood, Healthy Seafood.
Storrs Women’s Club, Storrs, CT.

Balcom, N. and T. Getchis. 2005. Sea Grant seafood
display/ activity for CANR Cornucopia festival.



Publications

Balcom, N. and L. Pivarnik. 1999–2006. *Safety Savvy: A HACCP Update*. Connecticut Sea Grant and URI Cooperative Extension and RI Sea Grant (12 issues)

Goal: Safe Seafood ... from boat to purchase

Connecticut differs from many other states in that it licenses all shellfish harvesters as dealers. This designation means that all Connecticut shellfish businesses operate under a HACCP program that covers boat and harvest operations right through to distribution to wholesale or retail companies, or restaurants, adding an additional layer of food safety protection to the product.



Impacts

- The result of the training program is a local seafood workforce trained in the concepts of safely processing fish and fishery products according to HACCP principles.
- Availability of local training courses and modest registration fees reduce costs associated with meeting training requirement, allowing southern New England businesses to train 2+ employees, easing HACCP program implementation, improving company efficiency and profitability, and ensuring greater safety for seafood consumers.
- “School to Career” training in seafood HACCP for vocational agriculture / technical high school seniors enhances employability. Four of 61 HACCP-trained students are currently utilizing their training as employees of CT seafood wholesaler operations and shellfish farmers.
- FDA inspection data comparing results of all domestic HACCP inspections vs. New England-based inspections indicate percent compliance in key areas by NE firms is equal to or better than the national percent compliance. The percent of NE-based seafood processors complying with key sanitation areas is significantly higher.
- Ongoing Sea Grant communication enables HACCP-trained individuals to keep their training current, and provides easy means for notifying them of important changes.



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Connecticut Sea Grant

Making a Difference



Fisheries Extension Program

Problems/Needs

Commercial and recreational fisheries are key components of the maritime cluster in Connecticut, a state with a highly urbanized coastline, and multiple and sometimes conflicting users of Long Island Sound and its coastal resources. Commercial fisheries and fishers are in a period of transition as new government fisheries regulations are being put into place, as operating costs increase, lack of crew, and reduced catches. New fisheries management measures will need to be considered in order to respond to these emerging issues. The lives of people associated with Connecticut's seafood industry will need to be safeguarded and ideally improved, as a result of the transitions underway. As fish are an international commodity in a globalized economic marketplace, linkages with and understanding of other types of fisheries around the world must be established in order to ensure food security and resource conservation both at home in Connecticut and the United States, as well as internationally.

Investments

- 25% AY - Pomeroy (CTSG Extension)
- Alternative Fisheries Management Strategies for New England Fisheries. Surdna Foundation. 2005-2006 (\$15,000)
- Rehabilitating Livelihoods in Tsunami-Affected Coastal Communities in Asia. WorldFish Center. 2005 (\$45,000)
- Policy Brief on Live Food Fish Capture and Trade: Focus on Calamianes Islands and Palawan Province, Philippines, with Implications for National Policy. Fisheries Improved for Sustainable Harvest Project (FISH). U.S. Agency for International Development/Tetra Tech. 2004-2005 (\$20,000)
- Reforming Governance: Coastal Resources Co-management in Central America and the Caribbean. Oak Foundation. 2003-2004 (\$250,000)
- Socioeconomic Monitoring Guidelines for Coastal Managers in Southeast Asia and the Caribbean. NOAA. 2002-2004 (\$100,000)
- A Process for Community-centered Coastal Resources Co-management. International Development Research Centre (Canada). 2003-2004 (\$75,000)
- Building Capacity for Integrated Coastal Management in Quang Ninh Province, Vietnam: Socioeconomic Assessment. NOAA/IUCN. 2002-2003 (\$150,000)
- Developing Guidelines for Successful Co-management in the Caribbean. UK Department for International Development. 2002-2003 (\$100,000)
- Marine Protected Areas Management Effectiveness Indicators. IUCN/WWF/NOAA. 2001-2004 (\$250,000)

Outputs

Publications

- Pomeroy, R., B. Ratner, S. Hall, J. Pimoljinda & V. Vivekanandan. 2006. Coping with disaster: rehabilitating coastal livelihoods and communities. *Marine Policy*.
- Pomeroy, R. S., L. M. Watson, J. E. Parks & G. A. Cid. 2005. How is your MPA Doing? A Methodology for Evaluating the Management Effectiveness of Marine Protected Areas. *Ocean and Coastal Management*
- Pomeroy, R. S., P. McConney & R. Mahon. 2004. Comparative Analysis of Coastal Resource Co-management in the Caribbean. *Ocean and Coastal Management* 47:429-447.
- Pomeroy, R. S. 2006. Integrating Cooperative Research and Management. pp. 207-215 In A.N. Read and T.W. Hartley (eds.). *Partnerships for a Common Purpose: Cooperative Fisheries Research and Management*. American Fisheries Society, Symposium 52, Bethesda, Maryland.
- Pomeroy, R. S. and R. Rivera-Guieb. 2006. *Fisheries co-management: a practical handbook*. CAB International, Rome and International Development Research Centre, Ottawa, Canada.
- Bunce, L. and R. S. Pomeroy. 2003. Socioeconomic Monitoring Guidelines for Coastal Managers in the Caribbean (SOCMON-Caribbean). World Commission on Protected Areas and Global Coral Reef Monitoring Network/Australian Institute of Marine Science, Townsville, Australia.
- Bunce, L. and R. S. Pomeroy. 2003. Socioeconomic Monitoring Guidelines for Coastal Managers in Southeast Asia (SOCMON-SEA). World Commission on Protected Areas and Global Coral Reef Monitoring Network/Australian Institute of Marine Science, Townsville, Australia.
- Pomeroy, R. S., J. E. Parks & L. M. Watson. 2003. *How is Your MPA Doing? A Guidebook: Biophysical, socioeconomic and governance indicators for the evaluation of management effectiveness of marine protected areas*. IUCN World Commission on Protected Areas-Marine, World Wide Fund for Nature, and National Oceanographic and Atmospheric Administration. Gland, Switzerland and Silver Spring, Maryland.
- Pomeroy, R. S. 2003. The Government as a Partner in Co-management. In D.G. Wilson, J. Raakjaer-Nielsen and P. Degnbol (eds.) *The Fisheries Co-management Experience: Accomplishments, Challenges and Prospects*. Dordrecht, The Netherlands: Kluwer Academic Publishers.
- Pomeroy, R. S. and K. Viswanathan. 2003. Fisheries Co-management Developments in Southeast Asia and Bangladesh. In D.G. Wilson, J. Raakjaer-Nielsen and P. Degnbol (eds.) *The Fisheries Co-management Experience: Accomplishments, Challenges and Prospects*. Dordrecht, The Netherlands: Kluwer Academic Publishers.



Outputs *continued*

Pomeroy, R. S., B. M. Katon & I. Harkes. 2003. Fisheries Co-management: Key Conditions and Principles Drawn from Asian Experiences. Chapter 13 in G.A. Persoon, D.M.E. van Est and P. Sajise. *Co-management of Natural Resources in Asia: A Comparative Analysis*. NIAS Man and Nature in Asia, No. 7. NIAS Press, Copenhagen, Denmark.

Pomeroy, R. S. 2001. Devolution and Fisheries Co-management. In R. Meinzen-Dick, A. Knox and M. Di Gregorio (eds.) *Collective Action, Property Rights and Devolution of Natural Resource Management – Exchange of Knowledge and Implications for Policy*. Zentralstelle für Ernährung und Landwirtschaft, Feldafing, Germany.



Berkes, F., R. Mahon, P. McConney, R. Pollnac & R. Pomeroy. 2001. *Managing Small-Scale Fisheries: Alternative Directions and Methods*. International Development Research Center, Ottawa, Ontario, Canada. (translated into Portuguese and Spanish)

Bunce, L., P. Townsley, R. Pomeroy & R. Pollnac. 2000. *Socioeconomic Manual for Coral Reef Management*. Australian Institute of Marine Sciences, Townsville, Australia.

Pomeroy, R., B. Ratner, S. Hall, J. Pimoljinda & V. Vivekanandan. 2006. *Rehabilitating livelihoods in tsunami-affected coastal communities in Asia*. World Fish Center, Penang, Malaysia.

R. S. Pomeroy, M.D. Pido, J. F. A. Pontillas, B.S. Francisco, A.T. White & G.T. Silvestre. 2005. *Evaluation of Policy Options for the Live Reef Food Fish Trade: Focus on Calamianes Islands and Palawan Province, Philippines, with Implications for National Policy*. Palawan Council for Sustainable Development, Fisheries Improved for Sustainable Harvest Project, and Provincial Government of Palawan. Philippines.

Pomeroy, R., B. Ratner, S. Hall, J. Pimoljinda & V. Vivekanandan. 2005. *Rebuilding livelihoods in tsunami-affected coastal communities in Asia*. CONSRN Policy Brief No. 2. CONSRN and WorldFish Center, Penang, Malaysia.

Presentations

"Why Rights-Based Management Is Being Considered" Rights-Based Management Approaches Workshops. June 2003.

"Marine Protected Areas: A General Overview" Marine Protected Areas Workshops. February/March 2003.

"Harvesting Agreements" Harvesting Cooperatives Workshop. December 2004.



Impacts

- Five regional education workshops on fisheries management in 2003-2004, reaching 312 fishermen, managers, environmental groups, researchers in CT, ME, NH and RI, and the New England Fisheries Management Council (NEFMC), causing alternative fisheries arrangements through harvest cooperatives in MA.
- Four training sessions on fisheries co-management in 2004-2005 reached 64 fishermen and practitioners in ME, Nova Scotia and Newfoundland and caused the establishment of two new co-management systems in ME and Nova Scotia.
- NEFMC, implemented rules that govern sector allocations of Total Allowable Catch (TAC), such as those authorized under Amendment 13, to allow for the development of harvest cooperatives such as the Georges Bank Fixed Gear sector in MA.



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Connecticut Sea Grant

Making a Difference



Nonpoint Education for Municipal Officials (NEMO)

Problems/Needs

The impacts of poorly planned land use on the natural resources, economic vitality, and local character of our nation's coastal communities are well documented. Connecticut has no regional (county) government, and land use is decided by appointed and elected volunteer officials that serve at the municipal (town) level. There is no statewide training program, mandatory or otherwise, for these critical decision makers. Local land use decision makers in Connecticut's coastal municipalities need information and tools to assist them in planning the growth of their communities while protecting natural resources, particularly coastal and water resources.

Response

The NEMO Program was developed in 1991-92 as a partnership of CTSG and the Department of Extension, and continues to this day. NEMO focuses on the target audience of local land use decision makers, and makes use of remote sensing-based land cover information and other geospatial technologies to help connect the concepts of land use and natural resource protection. NEMO is a statewide program of the UConn Center for Land Use Education and Research (CLEAR); CTSG support of NEMO helps to enhance and ensure NEMO programming in coastal communities across the state.



Investments

- Two full-time and one part-time faculty members are dedicated to this program: NEMO Director (Extension Educator John Rozum), Stormwater Specialist (Extension Educator Michael Dietz) and GIS/RS Specialist (Extension Educator Emily Wilson). These staff members are all on soft money.
- NEMO efforts are also supported by the University in the form of salary support for Jim Gibbons and Chet Arnold of the Department of Extension, both tenured faculty who also work on Connecticut NEMO.

Investments *continued*

- External funds come from a yearly grant from the Connecticut Department of Environmental Protection Nonpoint Source Control Branch, typically in the \$75,000 - \$100,000 range.
- Connecticut Sea Grant College Program Coastal Community Development Program invests \$50,000 per year in NEMO.
- Additional grants on a project basis total from \$30,000 - \$100,000 per year.
- A fourth CT NEMO/CTSG faculty position, Coastal Habitat Educator, has just been added in October 2006, funded by a grant from NASA.
- NEMO leverages a wide variety of other resources via the research and technology training portions of the CLEAR, its parent organization in the College of Agriculture and Natural Resources.

Outputs

Training

- More than 80 educational workshops for local officials were conducted by request during the past biennium, on a variety of topics.
- The “Municipal Initiative” allows NEMO to focus more intensive educational efforts of 2-5 towns per year, and the goal is for at least one of these towns each year to be coastal. “Muni” towns collaborate with NEMO on a two-year education program specifically targeted to their local concerns. Coastal municipal towns during the biennium include Stonington, East Haddam, North Stonington, and Killingworth.
- NEMO in collaboration with CT DEP, developed and organized statewide training workshops on a new DEP publication, the *2004 Stormwater Quality Manual*. NEMO team members had worked with DEP and a steering committee of state agency representatives and private professionals, in the development of the manual. The manual provides guidance to both land use decision makers and development professionals on stormwater practices to protect water quality. NEMO team members conducted 20 workshops, statewide.
- NEMO was a partner in the Niantic River Watershed Project, which is developing a management plan for this coastal watershed. NEMO conducted a “buildout” analysis of the watershed, and also organized the state’s first Low Impact Development workshop for developers and contractors, which was held on the Avery Point campus. About 25 people directly involved with the construction and development industry attended.

Educational Resources

- The project created three new educational workshops: (1) Managing Stormwater in Urban Areas; (2) Low Impact Design for Contractors and Builders, and; (3) Build-out Analyses: a tool for Community Planning
- The project web site was entirely redesigned and includes a number of new resources, including a section focusing on research on impervious surfaces, and a “Low Impact Development” searchable database that is being emulated at University of Rhode Island and University of Vermont.

Outputs *continued*

- The team is completing a state-of-the-art “Online Community Resource Inventory” web site for Connecticut communities, providing access to key natural resource and other information for non-technical citizens.

Publications

Arnold, C.L., and E. Wilson. 2004. Local Decisions, National Consequences: Meaningful Remote Sensing Tools, Education are Keys to Effective Decision Making. *Earth Imaging Journal*. Volume 1(6):12.17

Dietz, M. and K. Filchak. 2006. Rain Gardens in Connecticut. Publication of the University of Connecticut Cooperative Extension Service. 12 pp.

Dietz, M.E., and J.C. Clausen. 2004. A field-based evaluation of rain garden flow and pollutant capture. *Proceedings of Low Impact Development: Putting the LID on Stormwater Management*, College Park, MD.

Rozum, J., E. H. Wilson and C. Arnold. 2005. Strengthening Integration of Land Use Research and Outreach Through Innovative Web Technology. *Journal of Extension* 43(5): <http://www.joe.org/joe/2005october/iw1.shtml>

Rozum, J. and C. Arnold. 2004. Putting Communities in Charge. Publication 041215.1 of the University of Connecticut Center for Land Use Education and Research. 35 pp.

Wilson, E., J. Rozum and C. Arnold. 2004. Connecticut NEMO: Multifaceted Geospatial Support for Local Land Use Decision Makers. In: *Proceedings of the ASPRS Specialty Conference*, Kansas City, MO. 9 pp.

The *Connecticut NEMO Update* newsletter is published twice during the year and distributed statewide to all municipalities and partner organizations.



Impacts

- The NEMO Report *Putting Communities in Charge* won the 2006 Outstanding Achievement Award from the Renewable Natural Resources Foundation, a national nonprofit organization.
- The NEMO Team won the 2006 University of Connecticut Outreach and Engagement Award (the first ever bestowed).
- The CT NEMO program is the inspiration for, and leader of, the National NEMO Network, currently comprised of 32 programs in 31 states. A majority of Network programs are in coastal states, and led or co-led by Sea Grant staff.
- Impacts in terms of changes to local land use plans, regulations, practices and initiatives catalyzed by NEMO educational programming are described in the *Putting Communities in Charge* report, and are also posted on the “Successes” portion of the program website at: <http://nemo.uconn.edu/successes.htm>. Some examples from coastal communities are excerpted below.
- The Town of Killingly included the information from the NEMO workshop series into their town’s Plan of Conservation and Development. The town has modified their subdivision regulations to allow for environmentally responsible design and to modify road design to lessen their impacts on water quality. The town is in the process of updating the zoning regulations.
- The Town of Killingworth is completing a community resource inventory. This inventory will be used as a basis of a town plan update, due to begin this summer. The town has also formed an Open Space Planning Subcommittee that will use the resource inventory to prioritize lands for preservation. The Planning and Zoning Commission is also working to make changes to their zoning and subdivision regulations based upon the NEMO workshops.
- The Eightmile River Watershed recently has been designated by Congress to be a Wild and Scenic River. Interest in the Eightmile was stimulated by a watershed project conducted by NEMO staff in the mid-1990s, in concert with The Nature Conservancy.
- The Town of Stonington has made changes to their comprehensive plan to help better manage stormwater, protect open space, and ensure that the landscape is compatible with proposed development.
- The Town of Stonington got a grant from CT DEP to study the feasibility of creating the state’s first stormwater utility, to help underwrite the cost of improved stormwater management in response to the Stormwater Phase II regulatory program.
- The Town of East Haddam made changes to their subdivision regulations, road standards, and wetland regulations to better protect their water and other natural resources.
- Nearly 1000 engineers, town staff, land use commissioners, state agency representatives were educated on the CT Stormwater Quality Manual. The result of these workshops is that many towns are incorporating the practices outlined in the manual into their regulations. The professionals in the development field have also begun to use the manual as a standard reference text. The upshot of both the publication and the subsequent training workshops is that both the decision makers and the development community have a single source on which to design and evaluate development proposals.



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Connecticut Sea Grant

Making a Difference



The Long Island Sound Mentor Teacher Program

Problems/Needs

In 2004, the Connecticut State Department of Education issued new Science Frameworks for grades K-10. The new Science Frameworks lack a focus on environmental quality, biodiversity, and Long Island Sound and its watershed, leaving teachers to creatively weave water and Long Island Sound related materials into their curricula. The previous version of the Connecticut Science Frameworks contained an entire strand, through all K-12 grade levels, dedicated to water. The lack of focus on water issues in the Connecticut Science Frameworks will have an impact on K-12 students. Many students in Connecticut's most diverse cities and towns have never been to the shore, and are not aware of how their actions can impact coastal environments. Several Long Island Sound coastal communities, including New Haven, New London, and Bridgeport, and river towns, including Hartford and Norwich, are among Connecticut's poorest and most diverse.



Investments

- N. Balcom, D. Payne, P. Van Patten. 2005. LIS Mentor Teachers Program: Promoting Long Island Sound as a Teaching Tool for K-12 Formal and Informal Educators.
- N. Balcom, D. Payne, S. McNamara, P. Van Patten. 2004. Supporting K-12 Education and Outreach in the Long Island Sound Watershed (Co-PI: Balcom, Payne, McNamara, Van Patten).
- N. Balcom, E. C. Monahan, P. Van Patten, D. Payne, S. McNamara. 2003: Outreach/publications activities in support of the Long Island Sound Study: Facilitating K-12 Teachers Use of Existing LIS Outreach Materials.
- N. Balcom, D. Payne, P. Van Patten. 2002. Activities in support of the Long Island Sound Study: Facilitating K-12 Teachers Use of Existing Long Island Sound Outreach Materials and the LISS Scholar Program.
- CTSG investment from LISS EPA funds for Years 1-3 = \$23,854

Outcomes

Publications

- Payne, D.L. 2003. Bringing Long Island Sound watershed materials and resources to your classroom. *Nautilus*, 14(3).

Presentations

- *The Long Island Sound Mentor Teacher Program*. Southeastern New England Marine Educators Association conference, Groton, CT, October 18, 2003.
- *Exploring the Ocean Without Getting Wet*. Southeastern New England Marine Educators Association conference, Groton, CT, October 18, 2003.

Impacts

- Since its inception in 2002 with funding from the US EPA LISS, the 17 LISMT has held nine professional development workshops, reaching 111 educators and through them, more than 5,445 students.
- The program has reached teachers and students in 33 Connecticut towns, including some of Connecticut's poorest and most underserved. The state of Connecticut has two means of identifying school districts: the Economic Reference Groups (ERGs) and the Priority School District Program. ERGs were developed to "compare groups of districts that have similar characteristics" and are "used in (Connecticut Department of Education) reports to place district resources and district-level student achievement into perspective" (<http://www.csde.state.ct.us/public/cedar/edfacts/ergs.htm>). The ERGs reached through CTSG educational programs include East Hartford, Norwich, Middletown, Stamford, Hartford and New London. Priority district program reserves state funds for the "school districts with the greatest academic need" (http://www.csde.state.ct.us/public/der/psd/priority/psd_info.htm). The priority district programs reached through CTSG efforts include East Hartford, Hartford, New London and Stamford.



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Connecticut Sea Grant

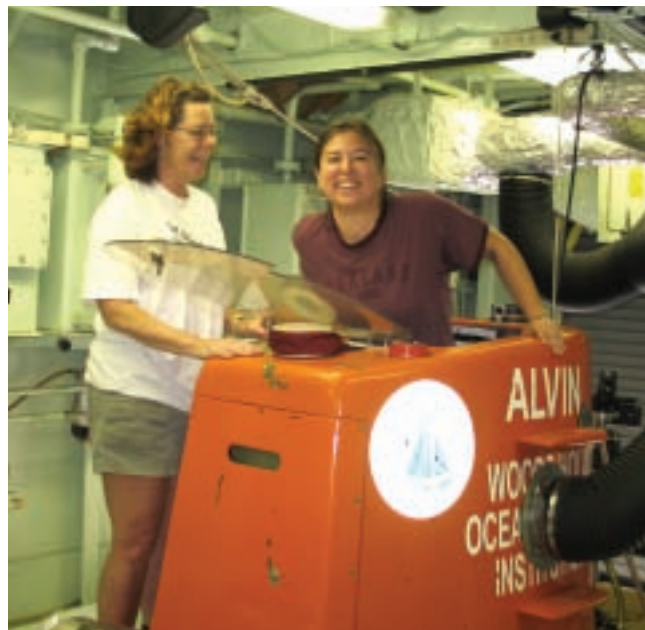
Making a Difference



Teacher Research Experiences

Problems/Needs

Professional development standards for science teachers encourage opportunities for intellectual professional growth, *including* participation in scientific research (NRC, 1996). Additionally, educational research notes that strategies for the professional learning of teachers of mathematics and science include partnerships with scientists and immersion into the world of scientists and mathematicians (Loucks-Horsley, Love, Stiles, Mundry, & Hewson, 2003). A Teacher Research Experience (TRE) can offer a sustained relationship with scientists over a prolonged period of time, with scientists serving as role models and “coaches” for teachers – a practice that has been shown to dramatically increase the transfer of knowledge, skill, and application to the classroom (Joyce & Showers, 2002).



Presently, the educational research is limited regarding the impact of a TRE, and much of the data is anecdotal. The CTSG Education Coordinator, as a part of her dissertation research at The University of Connecticut’s Neag School of Education, is investigating the effects of TRE on teachers and their students.

References Cited

- Joyce, B., & B. Showers. 2002. *Student Achievement Through Staff Development* (Third ed.). Alexandria, VA: Association for Curriculum Development.
- Loucks-Horsley, S., N. Love, K. E. Stiles, S. Mundry, & P. W. Hewson. 2003. *Designing Professional Development for Teachers of Science and Mathematics* (Second ed.). Thousand Oaks, CA: Corwin Press.
- National Research Council (1996). *National Science Education Standards*. Washington, DC: National Academy Press.

Investments

- CanyBal (PI: Babb; Mullineaux. 2005. Diana Payne served as Education and Outreach Coordinator while collecting data for dissertation. NOAA National Undersea Research Program.
- Funding for dissertation related expenses, including participating teacher substitute fees. 2005. NOAA National Sea Grant Office. \$12,888
- Deep Atlantic Stepping Stones. 2005. (Co-PI: Watling, Babb). Diana Payne served as Education and Outreach Coordinator. NOAA Office of Ocean Exploration.
- Canyons (PI: Watling). 2004. Diana Payne served as Education and Outreach Coordinator. NOAA National Undersea Research Program
- Mountains in the Sea 2004: Exploring the New England Seamount Chain. 2004. (Co-PI: Watling, Babb). Diana Payne served as Education and Outreach Coordinator. NOAA Office of Ocean Exploration.
- Mountains in the Sea: Exploring the New England Seamount Chain. 2003. (Co-PI: Watling, Babb). Diana Payne served as Education and Outreach Coordinator. NOAA Office of Ocean Exploration.
- Deep East 2001: Voyage of Discovery to Deep Sea Frontiers Off the U.S. East Coast. 2001. (PI: Watling). Diana Payne served as Northeast Region Education and Web Coordinator on the first signature OE Exploration. NOAA Office of Ocean Exploration.
- CTSG investments for participation in and coordination of six research experiences are more than \$50,000.



Outputs

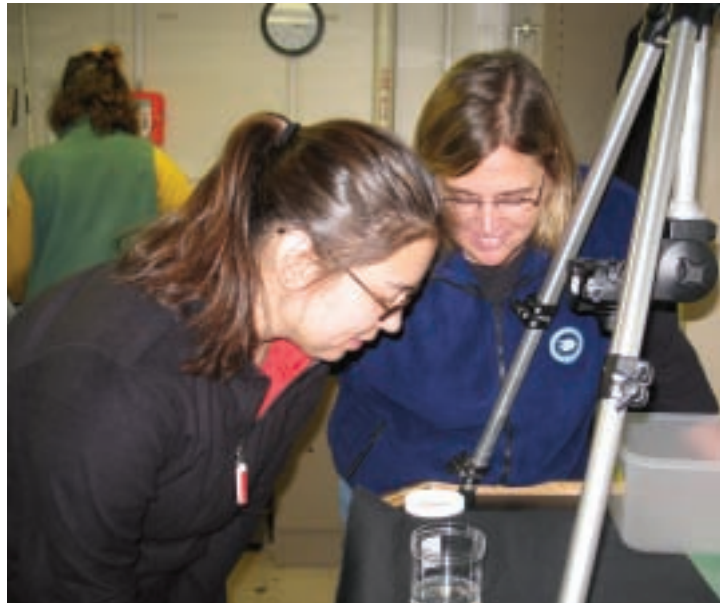
Publications and Products

Payne, D.L. 2007. *Epistemology, Teacher Research Experience and Student Attitudes Toward Science*. Doctoral Dissertation, expected completion Spring 2007.

Ocean Exploration web site
www.oceanexplorer.noaa.gov
Lesson plans and web logs.

Payne, D. L., & G. Scowcroft (eds.)
Teacher Research Experiences.
Issue of NMEA publication
Current: The Journal of Marine Education. Topic accepted by
NMEA Publications committee;
fundraising and article solicitation in progress.

Babb, I. G. & D. L. Payne. 2005. *Mountains in the Sea: Exploring the New England Seamount Chain DVD*. More than 300 have been distributed to date.



Presentations

Payne, D.L., R. E. S. Reed, & I. G. Babb. 2006. *An Analysis of a Teacher Research Experience as Professional Development for In-service Teachers*. Association for Science Teacher Education (ASTE), Portland, OR, January 14, 2006.

Payne, D.L., & J. Carlson, J. 2005. *Explore the Ocean Without Getting Wet: Multimedia Expeditions to the Arctic and to the New England Seamount Chain*. National Marine Educators Association (NMEA), Maui, Hawai'i, July 16, 2005.

Reed, R.E.S., I. G. Babb, & D. L. Payne. 2005. *Teacher Research Experiences—Exploring the New England Seamount Chain*. Poster presentation, Conference on Teacher Research Experiences (funded by NSF), Narragansett, RI, April 26, 2005.

Payne, D.L., R. E. S. Reed, & I. G. Babb. 2005. *Teacher Research Experiences—Exploring the New England Seamount Chain*. Poster presentation, NEAG School of Education Day of Research, Storrs, CT, April 20, 2005.

A total of nine professional development institutes (PDI) were held prior to the research cruises. Diana Payne served as a guest speaker for a follow-up PDI at the American School for the Deaf.

Awards

- Northeast Sea Grant Extension Network Outstanding Outreach Program Group Award. May 2002.

Impacts

- Seventeen educators have participated in a Teacher Research Experience (TRE) since 2001 through CTSG's partnerships with NOAA, NURC, NA&GL, and OE. Many teachers have incorporated their experience directly into the classroom as lesson plans and by sharing their experiences with students and peers through images, video, web-based technology and multimedia.
- Connecticut Sea Grant partnered with NURC and OE to bring Teacher Professional Development Institutes to more than 100 educators in New York (New York Aquarium), Connecticut (The Maritime Aquarium at Norwalk, Mystic Aquarium and Institute for Exploration, American School for the Deaf), Rhode Island (URI Coastal Institute), Massachusetts (WHOI, 2004 Massachusetts Marine Educators conference, New England Aquarium) and Maine (Gulf of Maine Research Institute).
- These unique opportunities have allowed educators throughout the nation to participate in research cruises through Daily Logs and images posted to the OE web site (www.oceanexplorer.noaa.gov) and to utilize expedition-related lesson plans embedded in the ongoing oceanographic research.
- A teacher participant on the 2004 *Mountains in the Sea* cruise submitted a log to the Providence (RI) Journal newspaper for one week. The journal was designated for special promotion in the print edition of the daily morning metropolitan paper and was posted to the newspaper's web site.
- The 2004 *Mountains in the Sea* expedition featured five days of live Web casts from the NOAA ship *Ronald H. Brown*. The Webcasts featured shipboard educators demonstrating lessons aligned in scope and sequence with the research objectives, as well as live voice-overs of scientists describing their real time exploration and discoveries in real-time via satellite transmission of the video from remotely operated vehicles. These lesson plans and other video clips have been compiled on a DVD, "*The Mountains in the Sea – Exploring the New England Seamount Chain*", which has been distributed to more than 300 educators nationally (see Publications and Products, previous page).



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Connecticut Sea Grant

Making a Difference



Connecticut Sea Grant International

Problems/Needs

Sea Grant is a proven, effective paradigm for the engagement of universities and government agencies acting in partnership in promoting research, education and technology transfer related to marine issues. The Sea Grant paradigm is inherently flexible culturally and administratively, thus there is substantial potential for developing cooperative programs with international partners. An international Sea Grant provides a platform that promotes international research, educational activities and technology transfer related to coastal issues, encourages information exchange, and fosters international collaboration in activities that improve understanding of the marine and coastal environment. CTSG has been actively involved with international Sea Grant activities in Ireland, Brazil, Chile, Mexico, Belize, and Nicaragua.



Investments

- Activities with Ireland, CTSG Development Funds. \$22,000.00
- Activities with Chile, CTSG Development Funds. \$5,000.00
- Activities with Mexico, CTSG Development Funds. \$5,000.00
- Coastal Resources Management Project (CORECOMP). Funding to support Diana Payne to provide environmental education workshops in Nicaragua and Belize. University of the West Indies, Barbados. \$5,000.00
- Activities with Brazil re Sustainable Resources Management, U.S. Department of Education. \$50,000.

Outcomes

Publications

Getchis, T. S. and E.C. Monahan. 2003. Sea Grant's Role: Sharing with the Community the Goal of Fostering Ecologically-Sound, and Economically-Viable, Aquaculture. *Proceedings of "Aquaculture Ecology and Economics"* held December 7-10, 2003. Puerto Varas, Chile.

Getchis, T. S. and E. C. Monahan. 2003. Sea Grant's Role in Connecticut Aquaculture. *Proceedings of a Workshop on Extension and Aquaculture*. December 16-18, 2003. Ensenada, Mexico.

Pomeroy, R., B. Bravo-Ureta, D. Solís and R. Johnston. 2006. Bioeconomic modelling and salmon aquaculture: an overview of the literature. *Int. J. Environment and Pollution*.

Johnston, R.J., C. A. Roheim, D. P. Joglekar and R.S. Pomeroy. 2005. Estimating Preferences for Non-Market Attributes of Aquaculture and Sustainable Seafood Production: Methods and Empirical Applications. *International Journal of Environment and Pollution*.



Outputs

Presentations

Getchis, T. S. 2003, December. *Sea Grant's Role: Sharing with the Community the Goal of Fostering Ecologically-Sound, and Economically-Viable, Aquaculture*. University of Los Lagos, Puerto Varas, Chile.

Pomeroy, R., B. Bravo-Ureta, D. Solís and R. Johnston. 2003, December. *Bioeconomic modelling and salmon aquaculture: an overview of the literature*. University of Los Lagos, Puerto Varas, Chile.

Getchis, T. S. 2003, December. *Sea Grant's Role in Aquaculture Extension*. Universidad Autonoma de Baja California, Ensenada, Mexico.

Pomeroy, R. 2003, December. *Sea Grant's Role in Fisheries Extension*. Universidad Autonoma de Baja California, Ensenada, Mexico.

Pomeroy, R. and R. Johnston. 2004, May. *The Economics of Biotechnology in Aquaculture*. 2004 Ir-Am Aqua Marine (Aquaculture) Biotechnology Workshop in Galway, Ireland.

Monahan, E.C. 2004, May. *The US Sea Grant Model: Research and Outreach*. 2004 Ir-Am Aqua Marine (Aquaculture) Biotechnology Workshop in Galway, Ireland.

Payne, D. 2004, March. *Environmental education program in the Pearl Lagoon municipality*, Nicaragua.

Payne, D. 2005, January. Environmental education program for TASTE, Punta Gorda and Friends of Nature, Placencia, Belize.

Pomeroy, R. 2005, July. *The Economics of Aquaculture Biotechnology*. Irish-American Conference on Aquaculture, Galway, Ireland.



Impacts

- Fabiola Lafarga de la Cruz, Coordinator for Fisheries and Aquaculture, State of Baja California, Ensenada. January 25-May 15, 2004. Lafarga was involved in a scientific exchange program with the UABC and UCONN TIES project. She took a fisheries management course with Bob Pomeroy, and “shadowed” Tessa Getchis and Nancy Balcom, to learn about extension programs related to aquaculture and fisheries. Lafarga developed recommendations and strategies for implementing a formal extension program, modeled after Sea Grant extension, in the State of Baja California, Mexico.
- Nicaragua with a local NGO, CAMPLAB, meeting with 8 educators to share resources and assist in the development of an environmental education program for use in school in the remote Pearl Lagoon region. Initiated contact with NMEA’s International Committee Chair, Dr. Vicki Osis to assist CAMPLAB in their environmental education program. Solicited additional relevant resources from other Sea Grant programs.
- Friends of Nature (Belize) conducted environmental education programs with six primary schools and one high school, ranging in size from 150 to 600 students.
- TASTE (Belize) conducted environmental education programs with 425 students from schools in mainly rural districts, 75 students in science clubs, and 110 adults, from 19 villages and towns.
- In collaboration with the National University of Ireland-Galway, CTSG established an Aquaculture, Biotechnology, Economics and Policy program. This on-going collaboration, that began in 1988 through a Memorandum of Understanding between Ireland, Northern Ireland, and the Northeast Sea Grant programs, has resulted in several meetings of scientists and industry from both countries and the sharing of knowledge and information. CTSG co-sponsored and co-organized an Aquaculture Biotechnology Workshop held in Galway, Ireland.
- Through formal courses, supervised field research, and internships, 16 Brazilian and 16 U.S. undergraduate exchange students from UConn, Cal State Fullerton, Universidade Federal du Paraiba, and Universidade Federal Fluminense understand the scientific and socioeconomics of coastal resource management.



Connecticut Sea Grant is one of 31 university-based programs in coastal and Great Lakes states, forming the National Sea Grant network. Connecticut Sea Grant’s mission is to work towards achieving healthy coastal and marine ecosystems and consequent public benefits by supporting integrated locally and nationally relevant research, outreach and education programs in partnership with stakeholders. Funding is provided by the U.S. Department of Commerce, National Oceanic and Atmospheric Administration via NOAA grant #NA16RG2253 and the University of Connecticut, the State’s Sea Grant College.

