Connecticut Sea Grant, University of Connecticut (UConn)
2010 – 2014 Program Summary - Introduction

From 2/1/ 2010 to 1/31/2014, Connecticut Sea Grant (CTSG) directed its efforts in the areas of research, outreach (extension and communications) and education to support its vision to "*foster sustainable use and conservation of coastal and marine resources for the benefit of the environment and current and future generations of residents of Connecticut and the Region*" (outlined in its 2006-2013 strategic plan). Major accomplishments, impacts, and progress towards achieving identified performance measures and metrics are summarized in the individual program summary reports and the PRP reports. Severe storms in 2011 (Hurricane Irene) and 2012 (Superstorm Sandy) caused significant economic and environmental harm to Connecticut municipalities, businesses and residences. As a result, the program redirected some of its effort under *Sustainable Coastal Development* to begin to address hazard resiliency in coastal communities. *Hazard Resilient Coastal Communities* was adopted as a focus area in the 2014-2017 strategic plan. Other key program approaches are highlighted below.

Growing our Research Portfolio: NSGO data released in 2012 show that CTSG was tied with IL-IN Sea Grant for the third lowest level of base funding among Sea Grant programs. Within that environment, CTSG continues to make a concerted effort to increase its support for research. Key steps taken to free more federal funds for research included (1) sharing support staff with other UConn programs as appropriate; (2) requiring extension and education staff to raise 25% of their full-time salaries from grants and contracts other than core federal or match dollars; (3) jointly funding research through the Northeast Sea Grant Consortium; (4) allocating most of the additional funds received through the NSGO portfolio realignment of 2014 to research; and (5) jointly with New York Sea Grant, continuing to administer the EPA Long Island Sound Study research program. Enhancing our research portfolio advances scientific and technological discoveries that can be applied to solving problems and informing decisions for society's benefit.

Partnership and Leveraging: As a "small program", CTSG long ago identified partnerships and leveraging to be among its most important core values and strategic principles in support of the achievement of its goals. About half of the CTSG total program budget typically comes from grants and contracts leveraged by CTSG staff members from state, federal, non-governmental organizations, and private sources. The additional monies leveraged during this time frame permitted full funding of the program's activities in research, extension, education, communications, and administration.

Managing the Program for Success: Despite its size, CTSG strives to undertake activities that will "make a difference" while creating a "legacy" for the program. Therefore, its actions are goal-oriented. We attempted to highlight this through the different sections of this summary report by presenting overall goals and a series of related activities, accomplishment, and impacts that together demonstrate significant progress and contributions toward the achievement of those goals, in collaboration with our partners.

Connecticut Sea Grant, University of Connecticut (UConn)
2010-2014 Program Summary - Safe and Sustainable Seafood Supply (SSSS)

Program Goal: *To contribute to the expansion of environmentally- and economically-sustainable marine aquaculture industries in Connecticut and the Northeast.*

Background

Shellfish aquaculture is Connecticut's most prominent seafood sector. Oysters and clams are raised on 70,000 commercial acres in Long Island Sound (LIS) leased from the state and coastal towns. Ongoing differences between industry and resource managers are similar to those in other states. As a trusted independent third party, Connecticut Sea Grant (CTSG) brings together key parties to discuss issues, improve management practices and maximize economic benefits.

CTSG is also at the forefront of discoveries with potential applications in different fields, e.g. seaweed-based products, integrated aquaculture systems, bioremediation and biofuels. Long-time research support leading to a new seaweed aquaculture industry (described below) is garnering attention at local, regional, national and international scales.

Ecological landscapes and the services they provide (e.g., habitat for fish to support commercial fisheries) are changing, requiring adaptation. This is especially true in LIS, which borders two distinct eco-regions. Shifts in fish and shellfish species have been noted; warm-adapted species are increasing and cold-adapted species (e.g., lobster, winter flounder) are declining. CTSG continued an important role in helping industry transition following the lobster resource collapse. Finally, CTSG has leveraged key investments for impact at the national and international scales.

Shellfish Aquaculture

CTSG has long worked with both industry and management/regulatory agencies to streamline processes, improve management and increase economic benefits. Given the local context, CTSG research, outreach and education efforts, mostly focused on shellfish aquaculture, target the entire industry from permitting to product commercialization to seafood safety.

CTSG works with diverse regulatory agencies to streamline the permitting process and reduce time from application to approval (#14661). Industry members report a 50% reduction in time from submission to approval as a result of CTSG efforts.

Recreational shellfisheries managers were initially trained by CTSG and partners to use Geographic Information Systems (GIS) to develop maps to inform their decisions (#15132). A user-friendly tool, Shellfisheries Mapping Atlas, was later developed that does not require GIS expertise. It is an interactive, online GIS-based decision-making tool used for site selection for shellfisheries and aquaculture management. Users have free, open access to resource datasets and can create and print maps to inform aquaculture siting decisions (#15114). CT resource managers encourage its use in permit application preparation and utilize it during permit reviews.

Diseases cause significant economic losses to the aquaculture industry. CTSG Extension led a collaboration of extension agents, researchers, aquatic animal health professionals and industry to develop a comprehensive publication identifying strategies to address aquaculture production hazards. Science-based information covers major production hazards (e.g., predators, diseases, pests), organisms causing aquatic animal illness and human illness, biofouling and invasive species, and other operational and environmental hazards (#18398).

Connecticut's oyster production levels fluctuate due to disease epizootics caused by the protozoan parasite MSX and long periods of poor natural sets. A 1997 MSX-outbreak causing a $17M loss was followed by years of low production due to the lack of natural sets. CTSG researchers collaborated with industry to condition and spawn the MSX-resistant 'Clinton' oyster and developed BMPs for enhancing natural oyster beds in Connecticut (CT) (#18265). Shellfish growers can use the BMPs to buffer adverse impacts of future outbreaks and poor natural sets.

Over a ten-year period, CTSG worked with diverse partners (USDA Farm Service Agency, CT Farm Bureau Association, CT Department of Agriculture, Bureau of Aquaculture, East Coast Shellfish Growers Association, members of Connecticut's congressional delegation) to educate and convince USDA to broaden its recognition of aquaculture commodities to include farmed shellfish, regardless of cultivation method, under its Noninsured Crop Disaster Assistance Program (NAP). Ninety-nine percent (99%) of the shellfish grown in Connecticut was ineligible for coverage under the USDA NAP because it was grown on leased beds rather than in bags or cages. Crops grown on ropes, such as seaweed or mussels, were also ineligible for coverage. Relatively minor changes to NAP effective December 15, 2014 means that 45 shellfish and sea vegetable companies in Connecticut and aquaculture operations across the country now have the opportunity to sign up for coverage starting in 2015. U.S. Senators Richard Blumenthal and Chris Murphy, and U.S. Representative Joe Courtney chose to hold a joint press conference at UConn Avery Point to announce the change in order to highlight the contribution of CTSG.

Shellfish farmers are continually to increase revenue by adopting new strategies, including targeting consumers directly. CTSG worked with its regulatory and industry partners to assist local shellfishermen in adopting new market strategies by producing a guidance document that adopts direct marketing models to Connecticut-specific regulations (#20694).

No aquaculture industry would be profitable without assuring that its products are safe. Unlike many states, CT licenses all shellfish harvesters as seafood dealers, subjecting them to FDA regulations related to the safe processing of seafood. With RI Sea Grant, CTSG jointly offers basic Seafood Hazard Analysis and Critical Control Point (HACCP) Alliance training courses to industry members 4-5 times per year. Since 1997, more than 1500 processors and regulators have completed the required training. Upon request, seafood HACCP courses have been given onsite for larger companies such as Blount Fine Foods (Fall River, MA) and Bozzutos, Inc. (Cheshire, CT). Onsite courses enable large companies to train more employees at one time. The HACCP course is offered annually to senior high school aquaculture students at vocational high schools

in Bridgeport, New Haven and Groton to promote workforce development. Bridgeport teachers established Angie's Seafood Market at the school, where both students and teachers directly apply the HACCP principles from the training to parts of the operation (#17943). A number of students have been able to apply HACCP training to jobs during and after high school.

CTSG also partnered with the CT Seafood Council and the Bureau of Aquaculture to purchase insulated bags printed with messages that promote keeping seafood cold and safe. Bags are made available to seafood industry members to give away or sell to retail customers, particularly those purchasing seafood at Farmers' Markets, to keep it safely chilled until back home (#16984).

While most of the above efforts focused on aquaculture, it came to CTSG's attention that the aquaculture industry, the recreational shellfishing sector managed by town commissions, and the restoration sector rarely talk and do not necessarily share points of view in everything shellfish. CTSG is now leading a visioning exercise for all shellfish sectors to build a long-term, cohesive plan to address common issues and concerns in a broad, inclusive manner.

Overall, CTSG partners to address needs and reduce barriers to a successful, environmentally friendly aquaculture industry through research, outreach and education.

Seaweed Aquaculture

CTSG's most significant contribution to the advancement in science and technology in the seafood sector is without a doubt its support of research on the physiology, genetics and culture of different seaweed species over the last 30 years. Leveraging contributions from other agencies, the research focused on improving understanding of biology, physiology, uptake kinetics and integrated aquaculture cultivation systems for seaweed. Key discoveries, with significant potential for application in different fields such as product development and bioremediation have received interest from the local to international scales. They include advances in culturing techniques, research to commercial application, and technology transfer.

CTSG research on kelp culture techniques, support for product testing (to protect public health by assuring product safety for human consumption), and extension assistance in the area of permitting, resulted in the first permitted commercial kelp farm and harvest in LIS, with direct sales to restaurants in New York City (#17392). The CT Bureau of Aquaculture is collaborating with CTSG Extension and industry members to investigate additional processing options and potential processing hazards for a dried sea vegetable product. UConn researchers are working with industry to expand this new aquaculture opportunity by setting up several kelp nurseries.

CTSG researchers developed a 122-page online technical manual and training videos on culturing four species of seaweed for human consumption, covering biology, system requirements, and cultivation techniques, providing broad-based user-friendly technology transfer (#17394). The document is now being used in Chile and other countries.

Seaweed naturally removes nutrients like nitrogen from water to fuel growth and reproduction, in a process called bioextraction, benefitting waters suffering from nutrient enrichment. CTSG-supported research quantified the bioextractive properties of seaweed in LIS, and showed promise of both improved water quality and economic benefits for seaweed farmers from nitrogen (N) trading credit programs. The economic value of N removal, if incorporated into the Connecticut N trading program, could be as high as $1,600/hectare for *Gracilaria* and $2,020/hectare for sugar kelp, giving farmers other options for enhancing income (#18686).

Seaweed is also used for non-food products. Two UConn undergraduates working with School of Business faculty collaborated on a business plan and formula for organic liquid seaweed-based lawn fertilizer, leading to the creation of a start-up company (#18675).

Overall, CTSG-supported research on seaweed physiology and cultivation techniques has resulted in not only significant scientific breakthroughs, but also commercial applications supporting a nascent new industry with economic and ecological added benefits.

Lobster Fisheries

Many adjustments followed the LIS lobster resource collapse in 1999. CTSG helped some lobstermen redirect their livelihoods through the Trade Adjustment Assistance (TAA) Program, a federal program for sectors adversely affected by foreign trade. Sea Grant extension from Maine to Connecticut worked with lobstermen to gain eligibility for the TAA program, and then created a workshop series to train them in new skills. CTSG developed a popular online course, Alternative Enterprises. Training opportunities, financial support and access to business consultants helped affected lobstermen re-tool their businesses. Of the 4000 eligible lobstermen (70 from CT), 84% completed the required training and developed new business plans (#18533). One established a new shellfish operation in the Town of Stonington CT (#14652).

National and International Activities

CTSG made judicious investments to develop specific national or international opportunities. A CTSG development project led to a cultured coral wholesale business and establishment of a coral conservation consortium in Saint-Martin. Technological developments reduce aquarium trade pressure on natural coral resources, and create potential for ecologically relevant restoration efforts (#19238). CTSG extension, with US AID funding, is helping build local jobs, production and markets in Cambodia and Vietnam through aquaculture and small scale fisheries management (#6300). With external support, CTSG extension is serving as technical lead for the US Coral Triangle Initiative, applying an ecosystem approach to fisheries management to improve governance of regional and national fisheries in the region. Effective flexible approaches to foreign fisheries management serve as alternative models for US fisheries.

Overall, CTSG works with different sectors of the seafood industry to facilitate the expansion of environmentally- and economically-sustainable endeavors in Connecticut and beyond.

PIER PRP Program Focus Area Report

Connecticut Sea Grant

Safe and Sustainable Seafood Supply

Program Focus Area: Marine Aquaculture

Program Goals

1. To contribute to the expansion of environmentally- and economically-sustainable marine aquaculture industries in Connecticut and the Northeast.
2. To contribute to the expansion of environmentally- and economically-sustainable marine aquaculture industries in Connecticut and the Northeast.

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Full Text of Impacts
Program Performance Measures
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   - 18686 - Connecticut Sea Grant nutrient bioextraction research creates potential new market source for nitrogen trading credits
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2. **Program Goal: To contribute to the expansion of environmentally- and economically-sustainable marine aquaculture industries in Connecticut and the Northeast.**

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Full Text of Impacts and Accomplishments

20694 - Connecticut Sea Grant and local partners develop direct marketing guidance for shellfishermen

RELEVANCE: In Connecticut, shellfishing generates $30 Million plus in farm-gate sales annually. Forty-four (44) licensed harvesters work the 70,000 acres of shellfish grounds under cultivation in Connecticut's coastal waters. Farming predominantly Eastern oysters and northern quahog clams, price competition can be stiff both regionally and nationally. Shellfish farmers are continually looking for

ways to increase revenue by adopting new strategies, including targeting consumers directly.
RESPONSE: Connecticut Sea Grant, along with its regulatory partners (the Connecticut Departments of Agriculture, Bureau of Aquaculture and Public Health), industry partners (Noank Aquaculture Cooperative), and UConn Extension are in the process of completing a guidance document focused on the regulations involved in directly marketing shellfish to the final consumer. Pulling from existing sources on direct marketing of seafood products nationwide, direct marketing models have been examined and adopted to regulations specific to Connecticut. The audience for the guide will be shellfish producers who are interested in direct marketing their shellfish, as well as other commodity groups who wish to incorporate shellfish into their product offerings, such as those operating community-supported agriculture or aquaculture projects, specialty retail shops, farmers markets or roadside stands.
RESULTS: Distribution of the guide will begin in 2015.

RECAP: Connecticut Sea Grant and its regulatory and industry partners are assisting local shellfishermen in adopting new market strategies by producing a guidance document that adopts direct marketing models to Connecticut-specific regulations. Back to Goals

19238 - Connecticut Sea Grant support is springboard for cultured coral wholesale business and coral conservation consortium
RELEVANCE: Globally, coral reefs are facing destruction and depletion from a number of factors. Among these factors is the harvest of corals, fish and invertebrates for the live aquarium trade. The successful culture of coral species for sale to aquarium hobbyists will help reduce the pressure on coral reef systems.
RESPONSE: In 2007, Connecticut Sea Grant supported a development project looking at the feasibility of coral aquaculture in Long Island Sound water, which led to immediate and positive local outcomes.
RESULTS: Years later, the positive outcomes continue to accrue and Sea Grant support continues to be recognized as being an important step to the ongoing success of the funded individual. System design ideas and techniques first explored and refined as part of the Sea Grant project continue to be utilized. In 2012, the former PI and partner co-founded the wholesale company, ReefGen. Based at the Long Island Aquarium in Riverhead, NY, this company produces aquacultured corals, invertebrates, fish and sharks for the marine aquarium trade. The pair are also partnering with Hofstra to establish the Caribbean Coral Conservation Consortium, a coral research and education center. Eighty acres of land and a 60-acre pond on St. Martin have been donated for the center; the group is currently fundraising. One goal of the Consortium is to pursue the former PI's dream of restoring coral reefs in the Caribbean by propagating 50+ species of coral and seeding them at depths and densities necessary to reproduce a Caribbean coral reef ecosystem. The organization has developed a sophisticated, large-scale, state-of-the-art system for culturing coral from the larva/juvenile stage to coral colonies large enough to significantly improve their survival when transplanted. This size element advances reef restoration because survivability is a function of size; naturally, corals only grow millimeters each year. In the laboratory, geometric-scale growth is achievable, making it possible to produce colonies of some species 6 cm across (rather than miniscule dots) in a year. If applied, these capabilities have the potential to greatly hasten recovery of impoverished reefs on a scale of years rather than centuries.

RECAP: Connecticut Sea Grant small development project leads to cultured coral wholesale business and coral conservation consortium Back to Goals

18686 - Connecticut Sea Grant nutrient bioextraction research creates potential new market source for nitrogen trading credits
RELEVANCE: Seaweed aquaculture removes nutrients from seawater that could otherwise fuel the growth of potentially harmful plankton blooms. Bloom prevention through bioextraction can help reduce bottom water hypoxia. Seaweed aquaculture can serve as one management tool used to remove nutrients from urbanized coastal waters, while providing new business opportunities for US seaweed farmers.
RESPONSE: Recent studies in Long Island Sound (LIS) and Bronx River, supported by Connecticut Sea Grant, EPA, National Fish and Wildlife Foundation, and Bronx River Watershed Initiative, investigated the culture of two seaweed species for human consumption and for bioextractive properties. Gracilaria tikvahiae is a red seaweed that grows well in LIS during the summer. Optimally, it may grow more than 16% / day, and accumulate up to 6% nitrogen (N)/gm of dry tissue. Sugar kelp (Saccharina latissima) is a brown seaweed that grows well during the winter/spring, yielding over 18 kg fresh weight/meter of line. Sugar kelp can accumulate up to 3% N/gm of dry tissue. Potential crop yields for Gracilaria and sugar kelp could reach 21 and 62 metric tons fresh weight/hectare (10,000 square meters), respectively.
RESULTS: The economic value of N removal, if incorporated into a N trading program, could be as high as $1,600/hectare for Gracilaria and $2,020/hectare for sugar kelp, providing farmers with additional income. Currently only sewage treatment plant N reductions qualify as credits for purchase in the Connecticut N trading program. Projections for LIS show potential for up to 10,500 tons (dry weight) of annual Gracilaria production, with a 5% N capture rate. Using the 2011 Connecticut Nitrogen Credit Trading Board's price of $5.42/pound of N, the potential market value for N removed is $5.7M annually. By comparison, the total Connecticut nitrogen credit pool in 2011 was $6.8M.

RECAP: Connecticut Sea Grant-supported research into bioextractive properties of seaweed shows promise of both improved water quality and economic benefits for seaweed farmers from nitrogen trading credit programs. Back to Goals

18675 - Connecticut Sea Grant seaweed culture/nutrient bioextraction research spawns two new seaweed fertilizer-based interests

RELEVANCE: Cultured seaweeds have many potential uses in addition to human food, providing seaweed farmers with a number of ancillary revenue sources. Seaweed naturally removes nutrients like nitrogen from the water to fuel growth and reproduction, in a process called bioextraction. When the seaweed is harvested, the nutrients taken up in the plants are removed from the water and can be used as fertilizer components. This removal benefits waters where too many nutrients cause pollution and water quality problems.

RESPONSE: Two UConn-Stamford undergraduates working with a School of Business faculty member collaborated on a new business plan and a formula for organic liquid seaweed-based lawn fertilizer. The formula was developed with input from UConn Departments of Marine Sciences, Chemical Engineering, and Plant Sciences faculty. At the same time, the first Connecticut company permitted to grow and harvest seaweed for human consumption diversified by selling some kelp to Yale University to turn into fertilizer for its farm. The farm supports Yale's sustainable food program, and the bioextractive qualities of the seaweed returns potassium and nitrogen to the fields.

RESULTS: The students submitted their business plan to The Entrepreneurship Foundation's Spring 2013 competition under the Venture Business category, winning first place. They have since formed Sea Green Organics, a LLC start-up based in Shelton, CT to commercially produce and distribute liquid fertilizer made from their proprietary blend of seaweeds targeted to optimize turf and lawn growth.

RECAP: Connecticut Sea Grant research on seaweed culture for human food leads to spin-off enterprises for seaweed-based fertilizer. Back to Goals

18533 - CT Sea Grant among Northeast Sea Grant extension staff recognized for trade adjustment assistance program for lobstermen

The Trade Adjustment Assistance (TAA) Program is a federal program that helps US workers whose livelihoods have been adversely affected by foreign trade. The TAA program provides affected workers with opportunities to obtain the skills, resources, and support needed to diversify their businesses and become re-employed. From 2010 to 2013, Sea Grant fisheries extension specialists from Maine to Connecticut worked with New England lobstermen seeking eligibility for the TAA program because domestic lobster prices had been adversely affected by the price of foreign lobster products. Once lobster became an approved TAA program commodity, the extension staff developed and offered introductory workshops to ensure that lobstermen were aware of the program, and provided assistance as the lobstermen worked their way through the phases of the program. A series of workshops were developed and offered online and in-person to train lobstermen in new skills. Connecticut Sea Grant developed an online course called Alternative Enterprises, one of the two most popular courses of this effort. This workshop was also offered in person in Connecticut, Massachusetts, and Maine. In addition to the training opportunities, financial support and access to business consultants helped affected lobstermen re-tool their businesses. Of the 4000 eligible New England lobstermen, more than 84% (including ~ 70 from Connecticut) completed the required hours of online or in-person training and met with a business consultant to develop business plans. In 2013, the extension specialists were awarded an Outstanding Outreach Award for the lobster TAA program by their Northeast Sea Grant Consortium peers.

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18398 - Connecticut Sea Grant leads development of Northeast US Aquaculture Management Guide for aquaculture production hazards

Each year, the aquaculture industry experiences significant economic losses as a result of pathogens that cause disease, pests that render product unmarketable, operational mishaps, adverse weather events, and closures of harvest areas due to the presence of organisms with the potential to cause human illness. Aquaculture production hazards present considerable operational risk. Loss of farmed product and human illness caused from ingestion of unknowingly contaminated product adversely impact profitability, trade, and public perception. The ability of professionals to assist farmers is often limited by a lack of farm-level monitoring, record keeping, and farmer knowledge of hazards and hazard management strategies. Frequently, the causes of mortality events remain unknown or are identified too late to prevent, control, correct or mitigate. Often, information to help extension and aquatic health professionals identify and correct hazards is missing, thereby limiting response. Connecticut Sea Grant Extension led a multi-year collaboration of the Northeast Aquaculture Extension Network, researchers, aquatic animal health professionals and industry members to develop a comprehensive publication that identifies strategies to address aquaculture production hazards. The 285-page manual includes science-based information about major production hazards, including: predators, diseases, and pests of aquaculture species, organisms that have the potential to cause aquatic animal illness and human illness, biofouling and spread of invasive species, as well as other operational and environmental hazards. The manual includes guidelines for environmental monitoring, evaluating and sampling of stocks, record-keeping procedures, and state-specific contact. The Guide incorporates best management practices and biosecurity measures developed through other research and outreach efforts funded by the USDA Northeastern Regional Aquaculture Center. The manual is available in print and electronically in 2014.

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18265 - Connecticut Sea Grant research on restocking natural oyster beds with disease-resistant remote sets yields BMPs

Connecticut's oyster production levels have fluctuated due to disease epizootics caused by the protozoan parasite MSX (Haplosporidium nelsoni) and long periods without successful natural sets. In 1997, an MSX-outbreak caused a $17M loss followed by continued low production ($1-2M per year) for a number of years due to the lack of natural sets. Connecticut Sea Grant researchers collaborated with industry partners to condition and spawn MSX-resistant 'Clinton' oyster broodstock, which was then set on cultch, grown out for six weeks and deployed to pre-dredged commercial grounds, both in biodegradable netting and without nets. The disease-resistant 'Clinton' strain grew quickly; the three-inch market size was reached 15 months after deployment (compared to the three to four year production cycle of naturally-set oysters). The remotely-set oysters appeared to enhance natural oyster sets as well. After leaving the remotely-set oysters on the beds for two years, the oyster survival rate was only 2%. Siltation accounted for 70% of the mortality while predation-associated mortality was minor. Industry Best Management Practices for enhancing natural oyster beds in Connecticut include deploying remote-set on shell oysters without netting on natural beds, then transplanting the oysters away from the natural beds (located near the mouths of rivers) to hard-bottom leases during or following the first growing season to minimize mortality due to siltation. By employing these best Management Practices, Connecticut's oyster industry can be buffered from the economic impacts of future MSX outbreaks and poor natural sets.

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17943 - Connecticut Sea Grant provides seafood HACCP training to aquaculture high school students; school opens seafood market

Connecticut Sea Grant offers the basic Seafood HACCP Alliance industry training course annually to senior high school aquaculture students at vocational high schools in Bridgeport, New Haven and Groton, Connecticut. In 2012, 21 high school students were trained, bringing the total to 188. Historically, about 5% of these students are known to have applied their knowledge of HACCP directly in jobs with seafood businesses and shellfish operations. A direct employment link can be found in the Bridgeport Regional Aquaculture Science and Technology Education Center (BRASTEC). With the students, aquaculture science teachers also completed the seafood HACCP training course in partial preparation for the opening and operation of a seafood market based at the high school. The operation of Angie's Seafood Market directly correlates to the BRASTEC Seafood Science scope and sequence of instruction over the four years, during which they are taught a nationally standardized curriculum called "ServSafe" on the requirements/protocols for safely handling food in addition to HACCP. The market features fish and shellfish cultured by the students as well as other locally-grown seafood products. Following in BRASTEC's path, aquaculture science teachers from Bloomfield and Groton CT have also completed HACCP training with an eye to the future sale of their cultured fish products. A bill passed the Connecticut General Assembly in 2012 that enables these schools to raise finfish for sale to Connecticut foodservice facilities, once they are licensed and inspected, and operate under a HACCP program.

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17394 - Connecticut and New Hampshire Sea Grant research produces cultivation manual and video for four species of seaweed

Connecticut and New Hampshire Sea Grant researchers developed a written technical manual and accompanying training video for the culture of four species of seaweed for human consumption. The work on Saccharina latissima and Graciliaria tikvahiae was conducted in Connecticut and the work on Chondrus crispus and Porphyra was conducted in New Hampshire. The technology transfer materials have been peer-reviewed by extension educators and outside peer reviewers and are under final product development by Connecticut Sea Grant communications. The 122-page manual and accompanying video cover topics such as general culture system requirements, and the biology, culture and cultivation system for each species. As interest continues to grow in New England for the cultivation of seaweed for human consumption, these materials will provide critical information to prospective growers on the actual culture requirements and techniques.

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17392 - Connecticut Sea Grant research and extension efforts lead to first permitted kelp farm in Long Island Sound

RELEVANCE: Worldwide, seaweed production eclipses the production of shellfish, finfish and other marine organisms, but U.S. production contributes only about 1%. Sugar kelp (Saccharina latissima) is a native cold temperate brown seaweed. Its southernmost limit of distribution in the U.S. is Long Island Sound. While similar kelp species have been cultivated for decades in Asian countries, the U.S. depends on wild harvests for this resource.

RESPONSE: Connecticut Sea Grant (CTSG) researchers adapted techniques developed in China and Japan for this kelp species, and built upon them utilizing results from several Sea Grant projects to develop scalable technology for the mass culture of kelp. The researchers established a kelp culture to serve as a seed bank for aquaculturists. CTSG extension educators worked with the Thimble Island Oyster Farm and the Connecticut Department of Agriculture, Bureau of Aquaculture on the permit application for kelp culture, which was approved in 2012 as a winter crop. The Bureau also worked with the kelp farmer on HACCP protocols for the sale of fresh wet seaweed, as well as blanched frozen product. Students from the Bridgeport (CT) Regional Aquaculture Science and Technology Education Center (BRASTEC) were trained in how to process the seaweed under a HACCP program. CTSG also provided development funds to enable the Connecticut Agricultural Experiment Station and the Department of Health to run tests to determine the safety of the kelp product as a food product, before a permit to harvest and sell the product was issued (PD-13-05).

RESULTS: In May 2013, The Thimble Islands Oyster Farm harvested their first crop of kelp. Over 120 pounds was sold as fresh, wet product to five restaurants in New York City. The farmer is integrating his shellfish and seaweed crops, plans to grow 12 tons of kelp in 2014, and is also considering another species of seaweed, Graciliaria, as a future summer crop.

RECAP: Connecticut Sea Grant research on kelp culture techniques, support for product testing, and extension assistance in the area of permitting, results in first permitted kelp farm and harvest in Long Island Sound.

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16984 - Connecticut Sea Grant partners to promote seafood safety with insulated bags

Connecticut Sea Grant partnered with the Connecticut Seafood Council and the Connecticut Department of Agriculture, Bureau of Aquaculture to purchase insulated bags printed with messages that promote keeping seafood cold to keep it safe. The bags are made available to seafood industry members at a reduced price so that they can give or sell the bags to retail customers, particularly those purchasing seafood at Farmers' Markets, to help keep the product cold until the customer returns home. In 2012, the East Shore District Health Department purchased the bags and gel packs for their July Clam Dig in Branford CT, so that participants had the means to chill their newly-dug shellfish. More than 20 industry members have used the bags to date. Given the success of the effort, the partners hope to find a source of funds or new partner that will facilitate the purchase of a greater number of bags, to reduce the overall per-bag price.

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15132 - Local shellfish commission uses Connecticut Sea Grant GIS training to develop map and data layers to inform decisions

In 2008, CTSG received a state Agriculture Viability Grant to train members of municipal shellfish commissions in use of a Geographic Information System (GIS). Each commission was expected to undertake a GIS-related project as a hands-on follow-up to the training. The Town of Groton (CT) Shellfish Commission created a map to help inform local decisions that result in the protection of their estuaries. The Commission used the town's GIS system to create a map of the estuaries within Town waters and the watersheds that have an impact on them. Commission members are now refining that map by adding a water quality data layer. They have also initiated a small water sampling program, using a lab located within the Noank Aquaculture facility in Groton.

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15114 - Connecticut Sea Grant develops web-based Shellfisheries Mapping Atlas to aid resource managers and industry

Relevance: The Connecticut Department of Agriculture competitively leases more than 70,000 shellfish grounds in Long Island Sound. Of these, approximately 12,000 acres are leased by local shellfish commissions. Recreational shellfishing is available in 11 towns, managed by local shellfish commissions. One of the major barriers to aquaculture development is the identification of suitable and appropriate sites. Connecticut Sea Grant has provided hands-on training in the use of GIS, however the skills are often not retained through lack of continuous use or turnover of commission members.
Response: In 2011, Connecticut Sea Grant launched a web-based site selection tool for shellfisheries and aquaculture management. The Shellfisheries Mapping Atlas Version 3.0 (http://seagrant.uconn.edu/whatwedo/aquaculture/shellmap.php) is an interactive, online GIS-based decision-making tool. The Atlas provides users free and open access to marine and coastal resources data sets, and contains tools including Google and Bing imagery for selected sites. Users can view and overlay GIS data, and create, print, and share maps to inform aquaculture siting decisions.
Results: The Atlas has proven to be a valuable tool for Connecticut resource managers who use it to evaluate applications for aquaculture; they encourage its use by industry to identify suitable sites as they develop permit applications. According to Dave Carey, Director of the CT Department of Agriculture, Bureau of Aquaculture, this tool has contributed to "improved efficiency of and dialogue about the decision-making process", and has provided "a mechanism to visually represent to the public aquaculture within the context of the broader ecosystem." Extension educator Tessa Getchis and partners are seeking the means to address requests from other states and regions to develop a similar tool. They are working with NOAA Fisheries to add greater functionality to the Atlas and share it with stakeholders nationally.
RECAP: The Shellfisheries Mapping Atlas, a Connecticut Sea Grant web-based tool to aid local shellfishermen and resource managers, is being adapted for broader national use and functionality.

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14661 - Connecticut Sea Grant continues ongoing efforts with state and federal agencies to improve aquaculture permit process

For many years, Connecticut Sea Grant Extension has served as the catalyst for regularly scheduled joint meetings between the Connecticut Department of Agriculture, Bureau of Aquaculture (DA/BA), Connecticut Department of Energy and Environmental Protection (DEEP), the U.S. Army Corps of Engineers (USACE) and Sea Grant to work on streamlining the permit application process for aquaculture in Connecticut. The goal is to reduce the time from aquaculture application to permit approval from an average of six to an average of three months for those eligible for a General Permit. The DEEP General Permit is currently under development and has been established to coincide with the USACE updated 2011 Programmatic General Permit for Aquaculture. It is anticipated that these two permitting processes will further streamline the process and increase grower flexibility.

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6300 - Connecticut Sea Grant partners to find alternative feeds and species for freshwater aquaculture in Cambodia and Vietnam
RELEVANCE: In the lower Mekong River basin region, many capture fisheries resources have been largely overexploited and development of aquaculture has been encouraged to provide protein, income, employment and export earnings in Cambodia and Vietnam. One primary source of aquaculture feed is small size/low value/trash fish harvested from the river system. There is increasing competition and conflict between the use of small size fish for aquaculture feed and for human consumption in the lower Mekong River basin region of Cambodia and Vietnam.
RESPONSE: CT Sea Grant staff working with partners at Cantho University in Vietnam and the Inland Fisheries Research and Development Institute in Cambodia are implementing a USAID-funded project with the vision for sustainable freshwater snakehead (Channa micropeltes and C. striata) aquaculture development and the management of small size fisheries resources in the lower Mekong River system.
RESULTS: To date the project has developed and disseminated a pelleted snakehead feed, made recommendations for improved management strategies for small size fish in the Lower Mekong river, developed best processing practices for fermented fish paste, and identified five new domestic and six international markets for small size fish and snakehead. Eight feed mills in the lower Mekong Delta are producing the pelleted feed, and 54 farmers in the Dong Thap and An Giang provinces are using the feed to raise snakehead fish for the domestic and international markets.

RECAP: Connecticut Sea Grant contributes to local livelihoods, production and markets in Cambodia and Vietnam through aquaculture development and management of small scale fisheries in lower Mekong River system.

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Program Performance Measures (2010 - 2013)

Program Performance Measure	Program Plan Target (2010-2013)	Reported	Program Comments
Growth in the annual value of the Connecticut shellfish aquaculture production associated at least in part with CTSG programs and activities by 2013, compared to 2007 ($24.7million).	25	25	2010 - Since 2007, harvesters have refused to provide harvest numbers to the State due to a bill (which was not placed into law) that proposed a tax on each bushel of shellfish harvested. The State does not have the staff or funds to collect harvest data from harvesters log books (which is the only way to acquire the data legally). As such, CTSG has taken on the responsibility of surveying the industry as an unbiased group. That survey will be conducted in late 2011. 2011 - Following discussions with CT Dept Agriculture, Bureau of Aquaculture about data collection, the survey was delayed, and began in spring 2012. 2012 - Economic data was collected in 2012 from all but one producer, who has one of the largest companies in Connecticut. Ability to collect the complete set of data from all companies is questionable and data currently undervalues existing industry. In addition, the Bureau of Aquaculture notes that the total value for 2011 and 2012 may not change as harvest numbers go up for oysters as it appears that the increased oyster production by the larger operations has resulted in a price drop so that the dollar value may stay the same. As oyster production increases typically there is a fall in clam production, however harvest numbers have also dropped for several of the larger clam only operations which came into existence after the lobster die-off. After many years of large clam numbers, the harvest numbers appear to be shrinking. So overall the 2011 and 2012 dollar value may not change unless there are many more oysters being sold then is being assumed at this point. The Bureau usually states that farm gate sales are approaching the $30 million mark

			(which would be our target) but that may be overoptimistic. CTSG has made significant contributions in terms of helping prospective growers start new businesses and existing and new growers diversify their products, both of which will continue to add to the revenue stream. 2013 - 2013: Updated economic data on state's Bureau of Aquaculture's website only goes to 2010 due to missing data. According to the website "The largest cultivated acreage producer failed to report harvest statistics from 2008 to 2010. As a result, the overall average harvest growth rate was factored into the last reported figures by the company to obtain an estimate for 2010 harvest numbers. However, no growth rate was factored for 2008 harvest numbers." The value of oyster and hard clam landings data for 2007 and 2010 are both about $25M. What are missing to make the determination whether the target was met or not are the unreported landings data from the shellfish producers, particularly the increased production from largest shellfish producer. Since 2007, there are more shellfish producers plus at least two new seaweed producers. Ongoing industry disputes with the State have resulted in no recent landings data for shellfish lack of at least three seaweed producers has resulted in no reported landings due to privacy considerations.
Number of additional students in seafood/aquaculture-related vocational or technical education programs in southern New England who will complete and apply the FDA-required HACCP training offered by CTSG, by 2012.	60	95	2011 - Sound School and Grasso Tech in 2011 Sound School and BRASTEC in 2012 2012 - 37 in 2010, 17 in 2011, 21 in 2012 (BRASTEC and Sound School)and 20 in 2013 (BRASTEC and Sound School) for a total of 95 since 2010 - target met in 2013. 2013 - 2013: 20 trained for a total of 95 since 2010.
Number of business plans completed for the establishment of a CSA located at the Noank Aquaculture Cooperative facility, Groton, CT by 2012	1	0	2010 - Working with 2 individuals on CSA business plan development also establishing business plan outlines for different CSA models. 2011 - Difficulties with the shellfish hatchery have caused some delays but the development of the business plan for the CSA is ongoing and expected to be completed by fall 2012 2012 - Business plan anticipated to be completed by end of 2013. 2013 - 2013: For reasons beyond Sea Grant's control, the members of the Noank Aquaculture Cooperative involved in the project ultimately did not pursue a shellfish Community Supported Aquaculture (CSA) business model. Instead they did attempt direct marketing and had success within their local community. As they have limited staff, the Cooperative members involved in the project decided to keep their efforts focused on selling product to local retailers and restaurants and through a seafood distributor. Another member of the Cooperative, not involved in the project, decided shortly after the Sea Grant project was announced that he would establish the first CSA in Connecticut, and he has since been operating one. This may have had some bearing on the decision of other Cooperative members not to pursue the CSA. Other factors may be that selling shellfish shares alone may not be sufficient and that other products need to be added to the mix. Teaming

			up with a vineyard or a farm CSA was explored as potential options. While the shellfish CSA was not pursued by the Cooperative, other CT producers gave or are considering direct marketing avenues like CSAs and farmers markets. CTSG, in collaboration with the State Dept. of Agriculture developed a guidance document that outlines the regulatory process for these types of activities. It will be distributed to all licensed and prospective shellfish producers.
Number of community members investing in CSA based at Noank Aquaculture Cooperative, Groton, CT by 2015	10	0	2011 - The business plan has to be adopted first and the operation established. Development of effort is ongoing and on track. 2012 - CSA not yet ready to seek investors 2013 - 2013: For reasons beyond Sea Grant's control, the members of the Noank Aquaculture Cooperative involved in the project ultimately did not pursue a shellfish Community Supported Aquaculture (CSA) business model. As a result, investors will not be sought.
Number of individuals trained in shellfish aquaculture as part of CSA program by 2013	50	76	2011 - Courses are in development and trainings will be offered. 2012 - Alternative Enterprises (MA, ME) offered. Hatchery course not yet been developed or offered. Training in Spring 2014. 2013 - 2013: Two classes on Alternative Enterprises taught - Chatham and Gloucester MA. Total taught since course developed = 76.
Number of new jobs in shellfish aquaculture as result of establishment of CSA in Groton CT by 2015	1	0	2011 - Effort to establish CSA in Groton is ongoing. 2012 - CSA not yet established 2013 - 2013: For reasons beyond Sea Grant's control, the members of the Noank Aquaculture Cooperative involved in the project ultimately did not pursue a shellfish Community Supported Aquaculture (CSA) business model. As a result, no new jobs are anticipated.
Number of prospective producers who successfully initiated an aquaculture business at least in part with technical assistance from CTSG.	4	6	2010 - Associated with both TAA and CSA programs. 2011 - Fred Emery, Bren Smith, Karen Rivara, Mike Torelli 2012 - Target met in 2011. Anticipated: Montowese Bay Seaweed 2013 - 2013: Montowese Bay Seaweed, DJ King, Branford J. Bella, Westport Target met in 2011.
Number of shellfish aquaculture courses developed as part of CSA program by 2013:	2	2	2011 - Courses are currently in development. 2012 - Alternative Enterprises developed. On-going discussions with industry partners re:content of proposed hatchery course still waiting for copies of coursework from extension colleagues which will be adapted appropriately 2013 - 2013: Alternative Enterprises (CT, MA, ME) offered. Shellfish Aquaculture Methods currently in development to include material from extension colleagues considering partnering with regional vocational aquaculture school to offer courses under adult education
Number of shellfish producers that adhere to best management practices with respect to use of aquaculture structures in and near submerged aquatic vegetation, as suggested by	4	48	2010 - State (Departments of Agriculture and Energy and Environmental Protection) and federal (US Army Corps of Engineers) have developed a memorandum of understanding among agencies. The policy states that new aquaculture gear should not be sited within 25 feet of eelgrass. Individuals already sited within eelgrass and performing short term depuration have not been required to move such gear. 100% compliance by industry achieved. 2011 - Industry members continue to comply with MOU among agencies about the distance from

CTSG-funded research.			eelgrass beds that aquaculture gear must be placed. 2012 - Industry members continue to comply with MOU among agencies about the distance from eelgrass beds that aquaculture gear must be placed. 2013 - 2013: Industry members continue to comply with MOU among agencies about the distance from eelgrass beds that aquaculture gear must be placed.
Time from aquaculture application to permit approval in Connecticut reduced from an average of six to an average of three months for those eligible for a General Permit.	50	0	2010 - DEEP General Permit is under dev & has been established to coincide with USACE updated 2011 Programmatic General Permit for Aquaculture - these two permitting processes will further streamline prcess and increase grower flexibility 2011 - The CT Dept Energy and Environmental Protection (DEEP) has not yet approved the General Permit, so formally tracking percent reduction in time from application to decision is not yet possible however through discussion with industry members making applications, we are aware that some have been able to go through the process within 3 months, which if that trend continues, will represent a 50% reduction in time. 2012 - Target met previously. 2013 - 2013: Target met previously. CTSG helped develop and implement the state's new permitting process for seaweed aquaculture.

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Program Objectives (2010 - 2013)

Program Objective	Achieved (yes/no)	Program Comments
By 2011, CTSG/CT Farm Service Agency/USDA FSA will convene four informational workshops to discuss eligibility requirements for the Non-insured Assistance Program; By 2013, CTSG and NOAA Aquaculture Program will contribute to the development of a web portal on shellfish aquaculture and the environment. By 2015, the site will be utilized for decision-making by at least 50% of state aquaculture coordinators; By 2013, CTSG will contribute to the development of a textbook on shellfish aquaculture and the environment which will be published by a reputable publisher.	Yes	2010 - Three workshops held to discuss eligibility requirements for Non-Insured Disaster Assistance Program (NAP) and other risk management programs (e.g., crop insurance) in 2009 and 20010. Fourth scheduled for NACE mtg in 2012. Ongoing communication with local and federal Farm Service Agency offices continued in order to clarify federal policy on NAP. Website outline and content developed and delivered to NOAA Aquaculture Program, expected to launch in 2012. Book chapter reviewed and accepted in 2010, book (Aquaculture and the Environment) to be published in October 2011 2011 - Fourth educational workshop about risk management options will be offered NACE 2012 in Mystic CT and FSA staff will be present to continue the discussion The Shellfish Equity Act introduced in the Fall of 2011 by Senator Blumenthal of Connecticut to include shellfish (regardless of the method of production) to the list of crops eligible for the USDA NAP has not yet been made into law. CTSG and the Department of Agriculture are working with the Connecticut Delegation to ensure the correct verbiage that will include eligibility for NAP for shellfish producers engaged in bottom cultivation NOAA web portal on shellfish and the environment was launched in 2011 (htto://www.nmfs.noaa.gov/aquaculture) Book on shellfish and the environment with CTSG staff contributions and edited by Sandra Shumway was published in Fall 2011. 2012 - Fourth educational workshop about risk management options was offered during NACE 2012 in Mystic CT. FSA staff were present to continue the discussion Inter-agency memo was approved that extended eligibility of Non-insured Assistance Program (NAP) to all shellfish producers regardless of cultivation method (which negated need for The Shellfish Equity Act

		introduced in the Fall of 2011 by Senator Blumenthal of Connecticut) NOAA web portal on shellfish and the environment was previously launched in 2011 (htto://www.nmfs.noaa.gov/aquaculture) 2013 - 2013: Workshops, web portal and textbook completed.
By 2013, the annual value of aquaculture production in Connecticut will have increased by 25% compared to the 2007 level ($24.7M) with the help of CTSG programs and activities.	Yes	2010 - Since 2007, harvesters have refused to provide harvest numbers to the State due to a bill (which was not placed into law) that proposed a tax on each bushel of shellfish harvested. The State does not have the staff or funds to collect harvest data from harvesters log books (which is the only way to acquire the data legally). As such, CTSG has taken on the responsibility of surveying the industry as an unbiased group. That survey will be conducted in late 2011. 2011 - Following discussions with CT Dept Agriculture, Bureau of Aquaculture about problems encountered with collecting data from shellfish industry members and the reluctance of the largest producer to provide key data, the survey was delayed until spring 2012. 2012 - Economic data was collected in 2012 from all but one producer, who has one of the largest companies in Connecticut. Ability to collect the complete set of data from all companies is questionable and data currently undervalues existing industry. In addition, the Bureau of Aquaculture notes that the total value for 2011 and 2012 may not change as harvest numbers go up for oysters as it appears that the increased oyster production by the larger operations has resulted in a price drop so that the dollar value may stay the same. As oyster production increases typically there is a fall in clam production, however harvest numbers have also dropped for several of the larger clam only operations which came into existence after the lobster die-off. After many years of large clam numbers, the harvest numbers appear to be shrinking. So overall the 2011 and 2012 dollar value may not change unless there are many more oysters being sold then is being assumed at this point. The Bureau usually states that farm gate sales are approaching the $30 million mark (which would be our target) but that may be overoptimistic. CTSG has made significant contributions in terms of helping prospective growers start new businesses and existing and new growers diversify their products, both of which will continue to add to the revenue stream. 2013 - 2013: Updated economic data on state's Bureau of Aquaculture's website only goes to 2010 due to missing data. According to the website "The largest cultivated acreage producer failed to report harvest statistics from 2008 to 2010. As a result, the overall average harvest growth rate was factored into the last reported figures by the company to obtain an estimate for 2010 harvest numbers. However, no growth rate was factored for 2008 harvest numbers." The value of oyster and hard clam landings data for 2007 and 2010 are both about $25M. What are missing to make the determination whether the target was met or not are the unreported landings data from the shellfish producers, particularly the increased production from largest shellfish producer. Since 2007, there are more shellfish producers plus at least two new seaweed producers. Ongoing industry disputes with the State have resulted in no recent landings data for shellfish Until there are 3 or more seaweed producers reporting production numbers, no production data can be shared due to privacy considerations.
By 2014, the time from aquaculture application to	Yes	2010 - DEEP General Permit is under dev & has been established to coincide with USACE updated

permit approval in Connecticut will be reduced from an average of six to an average of three months for those eligible for a General Permit.		2011 Programmatic General Permit for Aquaculture - these two permitting processes will further streamline prcess and increase grower flexibility 2011 - The CT Dept Energy and Environmental Protection (DEEP) has not yet approved the General Permit, so formally tracking percent reduction in time from application to decision is not yet possible however through discussion with industry members making applications, we are aware that some have been able to go through the process within 3 months. 2012 - Target previously met. 2013 - 2013: Target previously met. CTSG helped develop and implement new state permitting process for seaweed aquaculture.
By 2015, 100% of producers planning projects in and around SAV will have modified their practices as a result of a CTSG study to better understand what effects shellfish and shellfish depuration activity have on submerged aquatic vegetation (SAV), specifically Zostera marina L. (eelgrass).	Yes	2010 - State (Departments of Agriculture and Energy and Environmental Protection) and federal (US Army Corps of Engineers) have developed a memorandum of understanding among agencies. The policy states that new aquaculture gear should not be sited within 25 feet of eelgrass. Individuals already sited within eelgrass and performing short term depuration have not been required to move such gear. 100% industry compliance achieved. 2011 - Adherence by industry to the MOU established among the regulatory agencies specifying the minimum distance from eelgrass beds that aquaculture gear can be placed continues. 2012 - Target previously met. 2013 - 2013: Target previously met.
By 2015, CTSG, Connecticut Department of Agriculture and USDA Farm Service Agency will modify FSA policy to reflect new eligibility requirements for the Non-insured Assistance Program.	No	2010 - Communication with FSA is ongoing. CTSG and partners developed a report identifying inconsistencies in FSA policy. Awaiting the Department of Agriculture's final response to the last of FSA's inquiries. Anticipate FSA will communicate decision. 2011 - The Shellfish Equity Act introduced in the Fall of 2011 by Senator Blumenthal of Connecticut to include shellfish (regardless of the method of production) to the list of crops eligible for the USDA NAP has not yet been made into law. CTSG and the Department of Agriculture are working with the Connecticut Delegation to ensure the correct verbiage that will include eligibility for NAP for shellfish producers engaged in bottom cultivation. 2012 - Inter-agency memo was approved that extended eligibility of Non-insured Assistance Program (NAP) to all shellfish producers regardless of cultivation method policy is under review by OMB will then be issued for public review and comment pending approval, producers will be eligible to apply for NAP in fall 2013 for coverage for coverage in 2014. 2013 - 2013: Target will be met only after USDA modifies the NAP program and policy handbook. Efforts to achieve these modifications have been in play for more than 10 years. 2014: USDA solicited public comments on entire NAP program in March 2014. In addition, USDA is convening an internal work group to review the whole 1-NAP policy handbook. CT state Farm Service Agency rep is participating on this group and CTSG is assisting this rep. USDA has reported that they do not have time to change the program so that producers can sign up for a policy to cover 2014 crop year. 2013: Sent revised policy to OMB for review.
By 2015, CTSG/Applied Sustainable Aquaculture will have expanded their reach with the Coral Bank to 20 public aquaria, 10 research institutions and 5 high schools.	Yes	2010 - Unable to determine whether on target or not as primary contact relocated to new company on west coast. Following up with alternative local contacts and seeking new contact information for primary. 2011 - Former CTSG researcher Justin Grabel is currently Director of Coral Culture for The Global Coral Repository (TGCR), which is establishing primary coral banks in the US and UK, as well as regional repositories,

		with the purpose of restoring degraded coral reef systems worldwide. Grabel is working in LA, developing an industrial scale coral farm and commercial lines of captive grown coral. He is also building a collaboration with the Marine Science Magnet HS in Groton CT, TGCR,and the government of St. Martin. The non-profit organization, Applied Sustainable Aquaculture, is defunct due to a lack of time and staff resources to maintain it. However, its Coral Bank is now part of TGCR as a regional repository, and its reach is now global, far beyond 20 public aquaria, 10 research institutions and 5 high schools. 2012 - Target met in 2012. 2013 - 2013: Target met in 2012. New effort ongoing to establish coral reef restoration research and education center on St. Martin involving PI from CTSG development project and Hofstra University. 140 acres of property have been donated for center. Former PI has also established successful new wholesale business for aquacultured coral species.