The Connecticut Sea Grant College Program is sponsored by the National Sea Grant College Program, administered through the National Oceanic and Atmospheric Administration (NOAA) and the University of Connecticut. This document reports the program's activities during the calendar year of 2002.

The program is based at the University of Connecticut at Avery Point in Groton, Connecticut, and has a branch office at the Yale School of Forestry and Environmental Studies in New Haven. It is one of a network of university-based programs in coastal and Great Lakes states. The Sea Grant Program was established by Congress in 1966, modeled after the Land Grant Colleges.

Additional copies of this report can be obtained at no charge, while supplies last, by making a written request to:

Connecticut Sea Grant Communications Office
The University of Connecticut
1080 Shennecossett Road
Groton, Connecticut 06340-6048
http:www.seagrant.uconn.edu

CTSG-04-10

Design by Peg Van Patten, Connecticut Sea Grant Communications Office.

2003 CTSG External Technical Experts Panel

Dr. Chryssostomos Chryssostomidis, MIT Sea Grant
Dr. Ames Colt, Rhode Island Sea Grant
Dr. Rich Langan, NOAA/UNH CICEET
Dr. John Waldman, Hudson River Foundation, NY
Dr. Edward Monahan, Director CTSG, *ex officio*
Dr. Robert Johnston, Associate Director CTSG, *ex officio*
Dr. Jonathan Eigen, NOAA Sea Grant National Office, *ex officio*

2003 CTSG Users and Stakeholders Panel

Nancy Balcom, CT SG Extension
Allen Berrien, LISS Citizens Advisory Committee
Donald Landers, Dominion Nuclear Power Environmental Lab
Diana Payne, CT SG Education
William Shadel, Save the Sound
Tessa Simlick-Getchis, CT SG Extension
Felicia Sirchia, CT Audubon Coastal Center
Peg Van Patten, CT SG Communication
Dr. Edward Monahan, Director CTSG, *ex officio*
Dr. Robert Johnston, Associate Director CTSG, *ex officio*
Dr. Jonathan Eigen, NOAA Sea Grant National Office, *ex officio*

CTSG Program Review Panel 2003

Dr. Diane Brousseau, Fairfield University
Dr. Larry Dunn, Mystic Aquarium, Mystic
Dr. James Hughes, NOAA Lab, Milford
Dr. Richard Langan, University of New Hampshire, Durham, NH
Dr. Steve Loomis, Connecticut College, New London
Mr. Joe Schnierlein, The Maritime Aquarium, Norwalk
Dr. Johan Varekamp, Wesleyan University, Middletown
Mr. Harry Yamalis, Connecticut Department of Environmental Protection
CTSG *Ex-Officio* and Observers:
Dr. Robert J. Johnston, Associate Director CTSG
Dr. Edward Monahan, Director CTSG
Nancy Balcom, Director of Advisory Program, CTSG
Peg Van Patten, Communications Director, CTSG
Jamie Krauk, Communications, NOAA Sea Grant (substituting for Jonathan Eigen)

Connecticut Sea Grant Annual Report 2003

Contents

Letter from the Director's Desk

In 2002, we were privileged to have several new staff join our Connecticut Sea Grant team, and in 2003 the contributions of these new faces became manifest. Connecticut Sea Grant has long prided itself on maintaining a modest, but effective, international Sea Grant component. Late in 2003 Connecticut Sea Grant co-sponsored, with La Universidad de Los Lagos and UConn's Office of International Programs, a very effective workshop on "Aquaculture, Ecology, and Economics: Towards a Sustainable Paradigm" in Puerto Varas, Chile, with Dr. Rob Johnston, one of our "new faces of 2002" contributing to this effort. Also, just before the year ended, Dr. Bob Pomeroy, another of the "new faces of 2002", participated in a workshop on the campus of La Universidad Autonoma de Baja California in Ensenada, Mexico. This workshop, sponsored by UConn and the Department of Agricultural Development of the state of Baja California, was devoted to the quintessential Sea Grant topic of "Vinculation entre la Academia y el Gobierno con la Industria Pesquera y Acuicola", i.e. extension practices between the university and government as it relates to the fisheries and aquaculture industry. Sea Grant Assistant Extension Educator Tessa Getchis participated in both of these initiatives, as did I.

But while facilitating the international, two-way, flow of practical information on aquaculture, our Connecticut Sea Grant program never forgot its responsibilities to the people of Connecticut, and to the researchers housed in Connecticut's universities. While we were pleased to provide support for a new marine biotechnology project being conducted by Professor Tom Chen in Storrs, much of our work during the year 2003 was focused specifically on Long Island Sound issues. Included among this set of projects was a study by Professor Johan Varekamp of Wesleyan that looked at the hatting industry as a source of mercury, an investigation by Professor Jim Kremer of UConn on one important aspect of eelgrass habitats, and an effort supervised by Professor Benoit of Yale on trace metals in the sediments of our coastal estuaries. A further study, being conducted by Professor Dan Codiga of UConn, had as its goal the automatic collection of important physical data on Long Island Sound from the ferries that ply the waters between nearby New London and Orient Point. Each of these studies is valuable in its own right, but when taken together the whole is greater than the sum of these individual investigations.

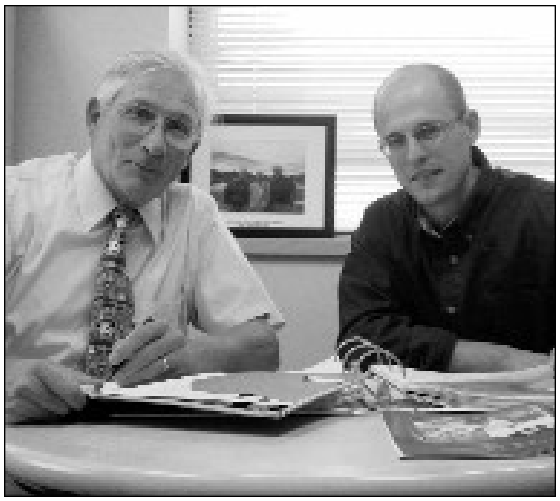
The year 2003 saw our program in the thick of the Long Island Sound Lobster Research Initiative, a multi-year effort aimed at elucidating what killed off so many of the lobster in the Sound in 1999. With investigators from California, Georgia, Maine, Maryland, Massachusetts, and Virginia joining investigators in Connecticut in carrying out work funded via our program, significant progress has been made on this complex problem. Nancy Balcom, our Marine Extension program leader, has effectively facilitated the work of the NOAA/NMFS Steering committee, a committee charged with coordinating the lobster studies being funded via the various agencies.

As the calendar year 2003 drew to a close, our program found itself again working with international partners on several fronts, all complements to the Connecticut and Long Island Sound thrusts, that are the life's blood of our Connecticut Sea Grant program.

Sincerely,

Edward C. Monahan, Ph.D., D.Sc.
Director, Connecticut Sea Grant College Program
Professor of Marine Sciences, and of Resource Economics

Program Management: Administration and Planning



Edward Monahan (left) and Robert Johnston (right) strategize during a program planning session.

Overall program management is the responsibility of the full-time Connecticut Sea Grant Director, Edward C. Monahan, and the part-time Associate Director, Robert J. Johnston. Other members of the management team are CTSG Extension Leader, Nancy C. Balcom, and the Communications Director, Peg Van Patten. Office support services are provided by Karen L. Massaro and Irene K. Shalla.

Like all Sea Grant programs, CTSG carries out a statewide competition to fund activities in research and education by soliciting, evaluating, selecting, and funding proposals that have special relevance to Connecticut and Long Island Sound. The program is a partnership between the University of Connecticut and the National Sea Grant College Program, implemented through the National Oceanic and Atmospheric Administration (NOAA), Department of Commerce. Key core program components include Administration and Management, Extension, Communications, and Education.

Implementation is based upon guidance gleaned from CTSG's Strategic Plan 2002-2006, conceived in 2001, which in turn meshes with the priorities outlined in the NOAA Sea Grant Strategic Plan. Input for the program's strategic plan was provided by the program's Senior Advisory Board, which consists of representatives from key academic institutions, public educational facilities, and relevant state agencies (see page 32). Further program planning input was provided by the CTSG Research Advisory Panel, composed of faculty from academic institutions, and its Extension/ Stakeholders Advisory Panel, which includes representatives from maritime industries, vo-tech education, nonprofits, and the Connecticut Seafood Council.

This year was the second in the biennium spanning the current funding period, so most projects began in 2002 and continued this year, although new initiatives also appear in the following pages. When funding decisions were made for 2002-2004, peer-reviewed preliminary proposals were selected following a full day of discussion by a CTSG External Technical Experts Panel. Members were chosen for their expertise, and, to ensure objectivity, neither worked or resided in Connecticut. The following day, the CTSG Users and Stakeholders Panel met and discussed the same preliminary proposals. Finally, ranked proposals were winnowed to a short list, reviewed again by the program's Senior Advisory Board and an Independent Technical Review Panel. Successful proposals are documented in layperson's terms in this volume; for more technical information, there are formal Completion Reports available from each investigator.

In the course of developing strategic planning for the program and implementing the proposal selection and funding process, Monahan and Johnston build on the core capabilities of the program by improving infrastructure and supporting personnel development for staff. They both serve on many advisory boards and committees both internal and external to the university, building partnerships in a broad network of universities and colleges, government agencies, nonprofit organizations, and private industry. Emerging issues affecting coastal and marine resources are addressed both in advisory capacity and by disseminating supplementary development funds as needed. Both serve as members of the national Sea Grant Association.

Monahan has carried out extensive research on bubble-mediated air-sea exchange, apart from his Sea Grant duties, and also holds faculty appointments as a Professor of Marine Sciences and of Resource Economics. Johnston is also an Assistant Professor in the UConn Department of Agricultural and Resource Economics, and carries on research in environmental and resource economics, while concurrently teaching courses for UConn undergraduates.

The CONNECTICUT SEA GRANT COLLEGE PROGRAM

The Connecticut Sea Grant College Program (CTSG), based at the University of Connecticut's Avery Point campus, is one of a national network of 32 Sea Grant programs based at flagship universities in coastal and Great Lakes states. Its mission, fostering the wise use and conservation of coastal and marine resources, corresponds to its Strategic Plan, and the mandate of the National Sea Grant College Program. The program funds research, outreach, and education activities that have special relevance to Connecticut and the Long Island Sound estuary. Implemented as a partnership between the University of Connecticut as the State's Sea Grant College, and the National Oceanic and Atmospheric Administration (NOAA), U.S. Department of Commerce, the program awards grants for marine research, provides marine extension outreach services, and carries on educational activities.

Major Research Projects Supported by Core Funds for 2003:

- A Ferry-Based Observing System for Long Island Sound: Application to Physical Influences on Hypoxia. D. Codiga, University of Connecticut (year 2)
- Responses of Eelgrass Habitats to Land-Use and Nitrogen Loading. J. Kremer, UConn Marine Sciences (year 2)
- The Connecticut Hatting Industry as a Mercury Source for Long Island Sound. J. Varekamp, Wesleyan University (year 2)
- Characterization of the Biological Function of Somatolactin - Identification of the Somatolactin Receptor and Determination of the Somatolactin Target Tissues. T.T. Chen and B-Y. Yang, University of Connecticut (year 1)
- Sediment Dynamics in Connecticut Estuaries: ^{7}Be,^{210}Pb, ^{137}Cs, Trace Metals, and Modeling to Investigate Delivery, Erosion, and Accumulation. G. Benoit, Yale University (year 2)
- Phytoplankton Dynamics in Long Island Sound: Influence of Environmental Factors on Naturally Occurring Assemblages. J. E. Ward and K. Strychar, University of Connecticut (year 2)
- A suite of research projects to investigate the cause(s) of the Long Island Sound lobster industry crash continued, with a Third Annual Lobster Health Symposium held in Bridgeport.
- Yale/Sea Grant Coastal Internship Program. G. Benoit, M. Smith. Yale University. Graduate interns develop research projects to address watershed policy issues.
- The NEMO program (Nonpoint Education for Municipal Officials), originated as a partnership between CTSG and Cooperative Extension, expanded nationally and held its third national training workshop at Avery Point. The Connecticut Coordinator is funded by CTSG.

* Some of the projects described inside were continuations from earlier work, externally funded initiatives, or NOAA Special Initiatives. These are not listed here. See text for explanation.

Highlights at a Glance for calendar year 2003

- Two CTSG staff members, Diana L. Payne and Nancy Balcom, received the Connecticut Secretary of State's 2003 Public Service Award. Payne was honored for her service on the Eastern Long Island Sound Advisory Council. Balcom, Connecticut Sea Grant's Extension Leader, was honored for her service to the Connecticut Seafood Council.
- Robert Pomeroy, fisheries extension educator, received the Catherine T. MacArthur Foundation Research and Writing Award for "*Fish Wars: Conflict and Collaboration in Fisheries Management in Southeast Asia*". Pomeroy also began work writing (as first author) "How is Your MPA Doing?". This manual is intended to assist resource managers in evaluating the effectiveness of specific Marine Protected Areas.
- CTSG continued leadership of the special national Lobster Mortality Research Initiative in which Congressional emergency funds were allocated to address Long Island Sound lobster mortalities. Preliminary results were described in the *Lobster Health News*, and a major symposium was held in Bridgeport in March.
- CTSG continued collaborations with Universidad Autonomous of Baja California, Mexico, working with the UConn Office of International Affairs. To help the Mexican government prepare to decentralize fisheries management to the state level, the State of Baja requested input from CTSG.
- CTSG continued collaborations with Universidad Los Lagos (ULA) in Chile, also in connection with the UConn Office of International Affairs. Three Sea Grant staff members participated in an aquaculture workshop in Puerto Varas, Chile.
- Seven major, and many smaller, regional and pilot research efforts were supported, involving seven academic institutions in the State and their partners. Key research themes include Aquaculture, Biotechnology, Aquatic Nuisance Species, Coastal Ecosystems and Economies, Public Safety, and Marine Education.
- A workshop entitled "Our Changing Coasts: Private Rights and Public Trust" was sponsored and held at Connecticut College in March. CTSG produced a supporting publication for municipal officials, "*Understanding and Providing Public Access in Connecticut*".
- *Wrack Lines*, the program's popular magazine, produced two issues, one showcasing faculty and research of UConn's Department of Marine Sciences; the other introducing the undergraduate program in maritime studies at UConn's Avery Point campus.
- Associate Director Rob Johnston was an invited panelist in the *NOAA Workshop for Monitoring the Human Dimensions Aspects of Coastal Restoration*, at the University of Massachusetts, Amherst.
- CTSG staff wrote 15 articles published in peer-reviewed journals, 13 non-refereed articles, 8 technical documents, and 31 other publications in 2003.
- Seafood industry members were trained in safe handling and processing of fish and shellfish, according to HACCP principles, in conjunction with the Connecticut Dept. of Agriculture, Bureau of Aquaculture, and the University of Rhode Island Sea Grant Program/Cooperative Extension.
- Three workshops on fisheries management were held as part of a regional fisheries extension effort, attracting fisheries industry participants. Topics were bycatch, marine protected areas, and rights-based management.
* A public display of real-time oceanographic data from the ferry observation research was mounted on a commercial ferry, to explain the science to passengers in a participatory mode.

R/ES-19 Evaluation of the Importance of Recreational Ship Hull Fouling Organisms...as a Vector for Transport for Invasive Species

Principal Investigators: Robert B. Whitlatch, Ph.D. Univ. of Connecticut Department of Marine Sciences
Richard W. Osman, Academy of Natural Sciences (MD)
Nancy Balcom, CTSG Extension

Robert B. Whitlatch, ecologist and Professor of Marine Sciences at UConn, is leading a team of biologists to survey and assess the current distribution and abundance of fouling species on docks, pilings, boat hulls, and breakwaters along the Eastern Seaboard. They have begun to monitor survivorship of hull fouling species on boats traveling along the coast to determine the potential of privately-owned vessels to transport species from one region to another. Later, the study will examine assumptions made about the effectiveness of maintenance procedures (e.g., painting, scraping, etc.) to reduce hull fouling.

photo: Sara Koch

Robert B. Whitlatch (left), Jeff Godfrey, and Stephan Bullard prepare to examine fouling organisms on both dock pilings and boat hulls at a marina in Fort Lauderdale. The team is assessing the impacts of fouling organisms traveling on private boat hulls up the Eastern Seaboard. Another team member, Sara Koch, took the photo.

When non-native marine organisms become established in a particular region, they are extremely difficult, if not impossible, to control. Unintentional introductions of non-native aquatic organisms have resulted in the establishment of many species beyond their native ranges. Such introductions pose significant threats to biodiversity, alter local community composition, influence the performance of ecosystems, and can result in significant economic costs. Vectors contributing to the introduction of alien species are very poorly understood, and there has been no systematic evaluation of the role that ship traffic plays in moving species from foreign ports or along the U.S. eastern seaboard.

While the examination of transport of marine species by hull fouling has traditionally focused on large commercial tankers and container ships, smaller privately-owned vessels are also an important vector. For example, in a recent study of ship fouling in New Zealand it was found that privately-owned sail boats and power craft had the highest amounts of hull fouling and that the hulls were the most poorly maintained, relative to commercial cruise ships, cargo vessels and tankers.

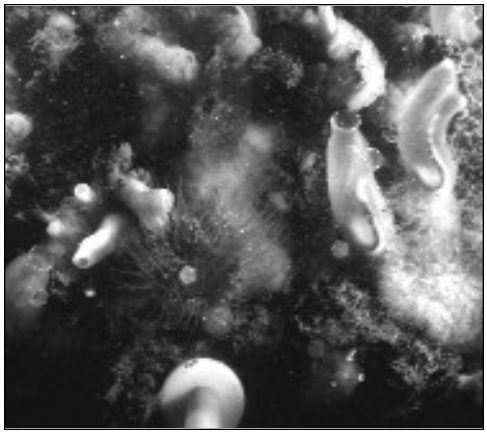


photo: Sara Koch

Fouling organisms found on a boat hull, covering nearly 100 per cent of the surface.

The team will continue to examine the hulls of as many boats as possible that have over-wintered in the Fort Lauderdale, Florida, area and that are planning trips to New England during the spring or summer of 2004.

Nancy Balcom, CTSG Extension Leader, is assisting with the outreach component of the project by identifying contacts for the team to collaborate with along the Atlantic coast. CTSG is contributing an Alaska Sea Grant publication on boater safety, *Water Wise*, to all boat owners who participate in the survey. Once the results of the survey are known, Balcom will develop an outreach plan to convey the information to the boat owners, suggesting ways to minimize their roles as vectors of aquatic invasive species.

R/ER-21 A Ferry-Based Observing System for Long Island Sound: Application to Physical Influences on Hypoxia

Principal Investigator: Dan Codiga, Ph.D.
University of Connecticut Department of Marine Sciences

This project, described in detail in the 2002 report, completed its second year, continuing to collect and analyze oceanographic data in Long Island Sound and moving into the outreach phase.

An innovative observing system is carried aboard a public ferry to collect data on a variety of physical parameters that may influence hypoxia in Long Island Sound. The sampling system aboard the *MV John H* is fully operational. Vertical profiles were collected for about 1500 trips, and surface water properties were sampled during every ferry crossing, typically 8 times per day. Parameters include, for example, salinity, temperature, oxygen, pH, chlorophyll, current velocities and direction, etc. The project is done in eastern LIS, with the cooperation of Cross Sound Ferry, running from New London to Orient Point. A parallel effort funded by New York Sea Grant is being carried out by investigators from SUNY in western LIS with a ferry operating from Bridgeport to Port Jefferson, allowing comparisons to be made at both geographic ends of the Sound.

A buoy deployed to tether CTD/DO profilers is recovered from the Stratford Shoal area of Long Island Sound by the crew of the *R/V Connecticut.*

Complementing the equipment used on the ferry are moored CTD/DO profilers. These were deployed for periods of two months duration during the summer and fall of both 2002 and 2003, with successful recovery.

Together, these observations are revealing much about the evolution of stratification in Long Island Sound. We now know, for example, that the Spring/neap tidal cycle is not a big factor in the process; we know that salt advection by deep residual currents is important, and that restratification after strong winds may occur in just a day or so.

To put it in simple terms, the observations will help the observer to figure out where something in the water, be it a jellyfish, an oil spill, or a diver, will end up, and when. But the most immediate use is the ability to better predict the beginning and end of hypoxic events. Numerical models that are used to guide regulatory actions and management of eutrophication in Long Island Sound will be able to use the data from this project to calibrate and verify their hydrodynamic component, in order to make more accurate assessments and predictions.

To involve and inform the public, a glass display case containing a computer receiving real-time oceanographic data and an explanatory poster were mounted on the *John H*.'s passenger deck. Interested passengers can now "be an oceanographer" during the crossing, learning about what is happening in the waters below the vessel.

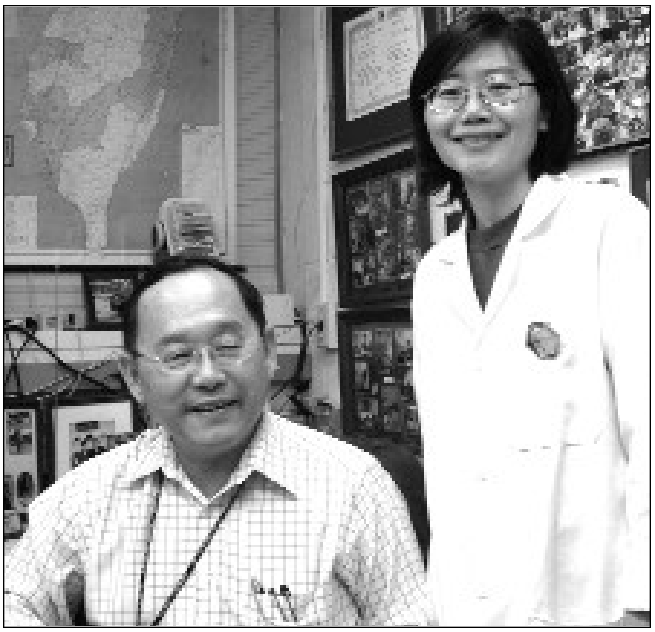
Left: The *John H*., Cross Sound Ferry Services Inc.

R/A-35 Characterization of the Biological Function of Somatolactin-Identification of the Somatolactin Receptor and Determination of the Somatolactin Target Tissues.

Principal Investigators: Thomas T. Chen, Ph.D. and Bih-Ying Yang, Ph.D.
University of Connecticut Department of Molecular and Cell Biology

Many hormones, regulating most of the physiological processes that occur in higher vertebrates, are secreted by the pituitary gland. The most predominant of the peptide hormones are the growth hormones. Somatolactin (SL) is a pituitary protein, discovered in 1990. Clearly related to growth hormone and prolactin, SL is found in many economically important finfish–for example, salmon, flounder, cod, and trout, to name just a few. As you might guess from its name, meaning "body milk" in Latin, it is observed frequently enough to assume that it must perform an important physiological function or functions in these fish, yet exactly what it does and where has not yet been adequately determined.

Scientists want to find the SL receptor (a protein on the cell membrane that binds the hormone in place, which would reveal the location in the organism's body, and in turn would provide clues to its function or functions.) In a strange sort of fishing expedition, Thomas T. Chen and Bin-Ying Yang, in the Department of Molecular and Cell Biology at the University of Connecticut, have used somatolactin as bait to lure proteins, in order to find and isolate those proteins that may interact with somatolactin (SL). They have cloned several proteins in order to have quantities large enough of them to study and test, but have not yet obtained a clone containing the typical receptor for SL. The clones that they have isolated may be involved in modulating the function of SL, although they are not the receptor itself. All the isolated clones need further characterization before the investigators conclude that they are definitely SL-interacting proteins. Chen is regarded as a world leader in the field of finfish biotechnology, and a pioneer in transgenesis (transferring genes from one species to another).



Looking for pieces of the SL puzzle: UConn scientists Thomas T. Chen (left) and Bih-Ying Yang (right) are searching for the protein receptor that binds to somatolactin, a mysterious protein expressed in the pituitary glands of finfish. In the course of doing so, they discovered and described a "new" protein in rainbow trout.

To date, Chen and Yang have also identified and described a new growth hormone-family protein, produced in the pituitary of rainbow trout (*Oncorhyncus mykiss*), that is very similar to somatolactin. The new protein, which has 56% homology, has been termed "somatolactin-like protein (SLP)". Since the messenger RNA of SLP was readily detectable in pituitary glands of two-year-old rainbow trout, but not in one-year-olds, and because the mRNA level in males is two times greater than that of the females, results suggest that this protein may play a role in regulating reproductive maturation in rainbow trout.

Chen and Yang have reported the entire nucleotide sequence of rainbow trout SLP, and patterns of the expression of the gene in various tissues and developmental stages, in the journal *Endocrinology*.

R/ER-23 Responses of Eelgrass Habitats to Land-use and Nitrogen Loading

Principal Investigator: James Kremer, Ph.D.
University of Connecticut Department of Marine Sciences

Eelgrass is one of very few vascular plants that can grow underwater. It provides important habitat for juvenile shellfish and fish such as scallops and flounder. But eelgrass beds have greatly declined in recent years. This project is examining the effects of nitrogen in this important plant.

Direct surveys of eelgrass and macroalgae were conducted in target sites by taking discrete grabs at 40 to 120 stations per estuary, with the number of stations dependent on the size of the estuary. These biomass surveys are complemented by visual aerial coverage of eelgrass compiled by Millstone Environmental Lab (Niantic River, diver survey) and the DEP (Connecticut coastal water bodies, aerial photographs). In addition to the grab surveys, benthic microalgae and water column chlorophyll were sampled at 4 to 10 stations. The resulting data provides information on the relative importance of eelgrass to community primary production in the estuary. Linked with estimates of nitrogen load from the watershed and water column characteristics, the biomass data provides insight into the factors necessary to maintain and encourage the growth of eelgrass.

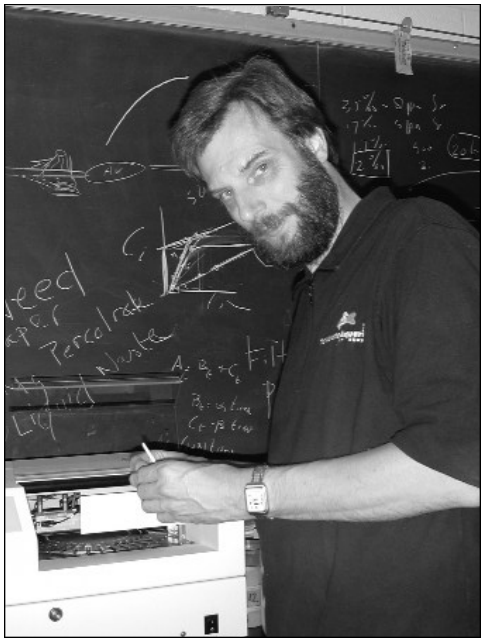
UConn Marine Sciences Ph.D. candidate Jamie Vaudrey deploys YSI continuous monitoring sondes in Mumford Cove. These instruments profile the water column every hour for a two-week deployment, providing information on water column characteristics.

Habitat survey sampling was completed monthly from April through October in most sites. Areas sampled included nine stations in Ninigret Pond, six in the Pawcatuck River, six in the Niantic River, and four in Mumford Cove. In addition to the benthic biomass grabs already mentioned, a suite of measurements and analyses were conducted at each station. These included profiles to characterize the water column (temperature, salinity, dissolved oxygen concentration, *in situ* chlorophyll concentration by fluorescence, turbidity, irradiance); additional grab samples for benthic biomass, per cent organics in the sediments, and the sediment chlorophyll concentration; and surface and bottom water samples for nutrient, chlorophyll concentration, and colored dissolved organic matter concentration analyses. This work added to a 5-year data set useful in tracking and evaluating conditions in these estuaries in relation to the presence of eelgrass. Habitat surveys are complemented by the deployment of continuously monitoring YSI sondes at three stations in Mumford Cove, Niantic River, and Pawcatuck River. These sondes, either deployed in a pair (surface and bottom) or in a profiling mode, provide additional data over varying weather and tidal conditions in the estuaries.

The degree of nitrogen loading from the watersheds is one factor which affects the presence and health of eelgrass in an estuary. The effect of nitrogen is being evaluated directly, through the determination of the percentage of nitrogen in the macrophytes; and is being modeled through the refinement of a nitrogen loading model which predicts the nitrogen delivered to a system from the watershed. Biomass samples have been preserved for upcoming C:N analysis and stable nitrogen isotopic composition. Initial calculations of nitrogen loads from GIS data are complete, but are currently under revision with updated area use provided by the towns located in the watersheds of the study sites. In addition, Jeremy Baronet (undergraduate student) working with Alison Branco (Ph.D. candidate) completed all the GIS compilation necessary to do the nitrogen load calculations for recent and historical data.

R/ER-22 The Connecticut Hatting Industry as a Mercury Source for Long Island Sound

Principal Investigator: Johan Varekamp, Ph.D.
Wesleyan University, Department of Earth & Environmental Sciences



Johan Varekamp, the George I. Seney Professor of Earth and Environmental Sciences at Wesleyan University, has investigated mercury levels in cores of sediments taken from Danbury, Connecticut and surrounding areas. Very high levels of mercury in the sediments remain from the city's historic hatmaking industry.

As documented in the 2002 CTSG annual report, Johan Varekamp, the George I. Seney Professor of Earth and Environmental Sciences at Wesleyan University, has investigated mercury levels in cores of sediments taken from the Still River (Danbury), a tributary of the Housatonic River in western Connecticut, and nearby sites.

For nearly 300 years, Danbury, in western Connecticut, was known as Hat City. At its peak in the 1880's, Danbury was the hat capital of the world, producing five million hats per year in 56 different factories, large and small.

In part of the hatmaking process called "carroting", an orange-colored solution of mercury and nitric acid was used to remove animal fur from pelts. This made the fur fibers mat into felt more easily. President Abraham Lincoln's famous beaver stovepipe hats were made in this fashion. Hat makers continuously exposed to large amounts of vaporized mercury, experienced its effects on their own nervous systems, giving rise to the term "mad as a hatter". Physiological effects included drooling, staggering, slurred speech, disorientation, bleeding gums, hallucinations, and even holes in the brain. Consequently, the use of mercury in hatmaking was banned in the early 1940's. But mercury remains in soil and river sediments not far from where factories once stood.

Varekamp and his students found extremely high levels (10,000 to 20,000 ppb) in the Still River. (To compare, a typical Long Island Sound mercury pollution level would be 100- 650 ppb; natural concentration would be ~50-100 ppb.) He and his team also tested fields, rivers and soils inside the town, and have found mercury levels many times higher than natural levels, including a site that is a children's playground across from a former hat factory. They determined that the mercury contamination coincided with the Industrial Revolution. Now, the team is testing nearby marshes and towns to find out how far the contamination spread. The Still and Housatonic Rivers are both prone to flooding, and Varekamp worries that a future hurricane or storm may flush more mercury into Long Island Sound, threatening its fisheries, and once again imperiling human health through seafood contamination.

In the most recent phase of the study, Varekamp found significantly elevated mercury in a neighboring city as well.

Public lectures, flyers, news articles, and other outreach efforts have been implemented in impacted communities. Public Health advisories warn segments of the population, particularly pregnant women, children, and the elderly not to consume fish caught in these areas, as mercury bioaccumulates in the food chain.

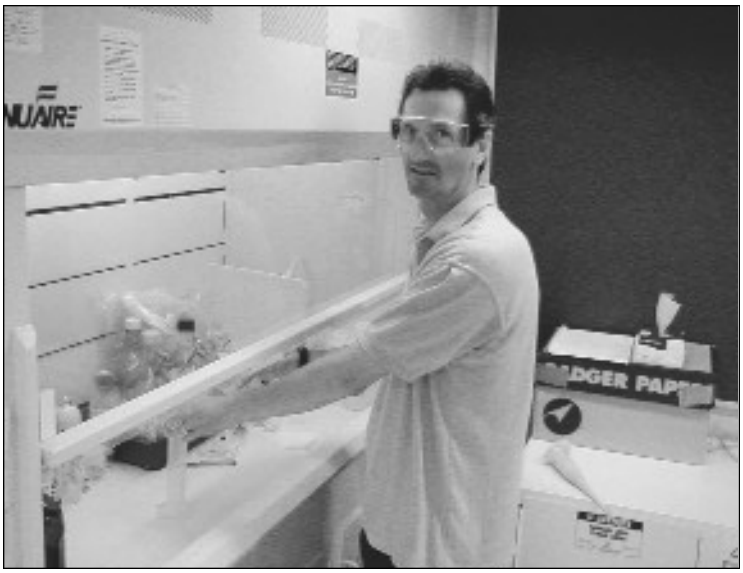
Hatters in the "carroting" room of a hat factory (circa 1890) in Danbury breathed mercury nitrate vapors as they worked. The hatters are gone, but the mercury lingers on.

Photo courtesy of Danbury Historical Society.

R/ER-19 Sediment Dynamics in Connecticut Estuaries: ^{7}Be,^{210}Pb,^{137}Cs, Trace Metals, and Modeling to Investigate Delivery, Erosion, and Accumulation

Principal Investigator: Gaboury Benoit, Ph.D.
Yale University, Department of Environmental Chemistry

Lowly mud doesn't get much attention, at least in a positive sense, from most people. However, gathering information about the content of mud (technically called "sediment") and its movements is important to scientists, in order to keep estuaries healthy. Gaboury Benoit, Professor of Environmental Chemistry at Yale University School of Forestry and Environmental Studies, has sampled muddy coastal and riverine sediments to document the distribution of natural radioactive elements, such as beryllium, lead, and cesium. In the early days of the project, potential sampling sites in Connecticut were evaluated, and the Branford River estuary was selected, along with a nearby pond.



Gaboury Benoit, Professor of Environmental Chemistry at Yale University School of Forestry and Environmental Studies, has sampled muddy coastal and riverine sediments to document the distribution of natural radioactive elements, such as beryllium, lead, and cesium.

The data collected is being used to assess potential and/or existing ecotoxicological risks in the study area, and to assist managers in dealing with the problems. How, why, and where such metals accumulate, and, in turn, how they may become remobilized and travel into and through food webs is crucial to both management and remediation of contaminated sites.

Why beryllium? Beryllium is a radionuclide that occurs naturally in the environment, mostly when cosmic rays collide with nitrogen and oxygen molecules in the atmosphere, breaking them apart and leaving beryllium behind. Beryllium in the atmosphere is carried to the earth's surface by rainfall, and quickly enters the sediments. Its half-life of only 53 days makes it a useful tracer for short-term sediment dynamics. Because it disappears quickly, its distribution is a function of only recent processes. It is particle-reactive, meaning that it quickly absorbs to and "tags" sedimentary particles. In this way it is representative of many other particle-reactive metals.

The 2003 phase of the project concentrated on tracing the transport of 7Be in the Branford River during and after a storm event.

To get a handle on long-term sediment transport in the Branford River, Benoit and his team also examined coastal sediment cores for radionuclides of cesium and lead, (^{137}Cs and ^{210}Pb), with half-lives of 30 years and 22.3 years, respectively. These tests, however, were inconclusive within the tidal portion of the estuary, but suggested a sediment accumulation rate near 0.5 cm/yr, similar to the rate of sea level rise in the region. They were able to definitively establish accumulation rates for lead and cesium in a pond through which the Branford River flows on its way to the estuary. Here, sediments are definitely accumulating at a rate of 0.4 cm/yr.

Endocrine Disruptors Found in Lobsters

Principal Investigator: Hans Laufer, Ph.D. University of Connecticut, Dept. Molecular and Cell Biology

Hans Laufer, Professor Emeritus of Molecular and Cell Biology at the University of Connecticut, and William J. Biggers, (then a UConn lab assistant, currently Assistant Professor of Biology at Wilkes University, Pennsylvania), have found four chemical substances known as alkylphenols in both lobsters and marine sediments sampled from two locations. The investigators believe that this is the first report of alkylphenols in lobster tissues. The alkylphenols, which have double benzene ring structures, are used by industries in various manufacturing processes, notably as antioxidants in making plastic and rubber polymer products. Others are used in making household detergents, paints, and surfactants. All four are known endocrine disruptors in vertebrate animals, including humans. (Endocrine disruptors cause changes in hormones that control basic physiological processes such as reproduction.) All four affected the endocrine systems of the test organisms, and are toxic to crustaceans, including lobsters, at high concentrations. All four were found in lobsters from Long Island Sound. This finding has implications for lobsters both there and elsewhere, and the researchers warn that they raise flags for human health concerns as well.

Perhaps surprisingly, much higher levels of these four endocrine disrupting alkylphenols were found in the sediments themselves, specifically in Vineyard Sound, Massachusetts and in Great Bay, New Jersey (the only two locations these scientists have sampled to date.)

These chemicals are known to be a major public concern for their effects on mammal reproduction as well as interference in fish and invertebrate physiology. Some have already been documented as sediment contaminants in other locations in the world. The chemicals can leach from food and beverage containers into the contents inside, and travel from there through the human digestive system, thence to sewage treatment plants and into the coastal waters, and finally end up in marine sediments. Of course they can also leach directly from plastic products that are lost or dumped in the oceans.

To identify the chemicals, the scientists used a technique known as gas chromatography/mass spectrometry. Lobster samples were taken from blood and the hepatopancreas, which functions as a liver in the lobsters. The sediment samples tested came from the upper 6 to 12 inches of the intertidal zone, the part of the shore where the tide goes in and out. The results were specific enough to actually identify specific chemical structures used in manufacturing processes.

One found in higher amounts in Long Island Sound lobsters than in Vineyard Sound sediments, appears to be a pesticide developed and patented by a Connecticut-based plastics manufacturer, intended for use in mosquito control. Ironically, this pesticide was developed in the early 1970's, before the Clean Water Act went into effect, but was never marketed. The scientists did not find any evidence of illegal dumping; rather they suspect that the chemicals made their way through wastewater treatment facilities. Results also indicated that another of the chemicals found in lobsters was used as a polymerizing agent in the manufacture of rubber tires.

Other indicators found in the lobster tissues indicated that environmental contamination by these chemicals, in addition to temperature and other factors, probably contributed to the Long Island Sound lobster mortalities in 1999 and 2000. Earlier research by other scientists showed that the alkylphenols had serious toxic effects on barnacles and crabs, both crustaceans. Earlier Sea Grant-sponsored research by these investigators shows that alkylphenols are toxic to some marine larvae, including lobsters and polychaete worms. In adults, in smaller concentrations, they also interfered with hormones that regulate basic processes such as growth, reproduction, and molting.

Laufer believes that this is the first report of alkylphenols found in lobsters. These alkylphenols have been documented to bioaccumulate (concentrate) in seafood, and are very slow to degrade, raising human health concerns. An estimated 500 million pounds of alkylphenols are used annually worldwide. An additional 1.1 billion pounds of alkylphenol ethoxylates (APEs), which break down into alkylphenols in the environment, are produced. The European community instituted a voluntary ban on APEs in 1995, but their use has not been banned in the United States. The U.S. Environmental Protection Agency is encouraging manufacturers to investigate the toxicity of these chemicals. This project builds on results of several CTSG projects funded prior to this period, as well as research carried out as part of the Long Island Sound Lobster Health Initiative.

R/A-34 Development of an Integrated Recirculating Aquaculture System for Nutrient Bioremediation in Urban Aquaculture

Principal Investigator: Charles Yarish, Ph.D.

University of Connecticut, Depart of Evolutionary Ecology and Biology

Photo: Chris Neefus, UNH

Nori grown in conjunction with cod at the bioremediation aquaculture facility constructed at Great Bay, New Hampshire.

Charles Yarish and collaborators believe that depressed urban areas of Connecticut may be ideal locations for integrated aquaculture systems. They have developed systems that can perform bioremediation–cleansing the waters of nitrogen and phosphorus–while producing harvests of fish as well as seaweed. The team has demonstrated that the same seaweed used to make sushi wrappers, *Porphyra*, is also a powerful environmental cleanup tool. Four species of *Porphyra*, better known as nori, that they tested are capable of removing and sequestering more nitrogen and phosphorus than you would expect from typical fish farm waste effluent.

Co-investigators:

C.D. Neefus
University of New Hampshire
G.P. Kremer
State University of New York at Purchase
T. Chopin,
University of New Brunswick
G. Nardi
Great Bay Aquaculture LLC, Portsmouth NH
J. Curtis
Bridgeport Aquaculture School

When nori is grown on nets surrounding fish pens or shellfish beds, it filters nitrogen, phosphorus, and carbon dioxide from the surrounding waters, soaking up the excess nutrients like a sponge. And what becomes of this seaweed, now packed with nutrients? Unless other pollutants come into play, it's a very nutritious and marketable food product–a win-win situation for both the environment and the food supply. The same nitrogen and phosphorus that in excess can be toxic to fish, or trigger harmful algal blooms if released to the environment, is necessary for protein-building and other basic physiological functions in living organisms.

In earlier projects, the NOAA Office of International Affairs made it possible for Yarish to establish close contacts and to observe technologies in operation around the globe, while Sea Grant supported critical research on the ecophysiology of the algae. Now this project has culminated in the development and construction of two operational demonstration facilities, one in Great Bay, New Hampshire, and the other in Bridgeport, Connecticut. Bridgeport's vocational aquaculture high school is testing and evaluating that facility.

Because high nutrient loading has been identified as a critical concern in coastal waters of the Northeastern United States and the Canadian Maritimes, this work stands to directly benefit the marine aquaculture industries that need to comply with stringent effluent discharge regulations. A healthy, valuable crop is produced at the same time the environment is cleaned, because the seaweed requires exactly the nutrients considered (in excess) pollutants in the water. If commercial facilities modeled after the demonstration projects are undertaken by industries, it could rejuvenate derelict urban facilities along the coast.

During a recent trip to China, Yarish gave the keynote address at the 5th Asia-Pacific Conference of Algal Biotechnology in Qingdao, and presented a workshop for a UNESCO program. This past winter he also co-convened a symposium at the World Aquaculture Society's annual meeting.

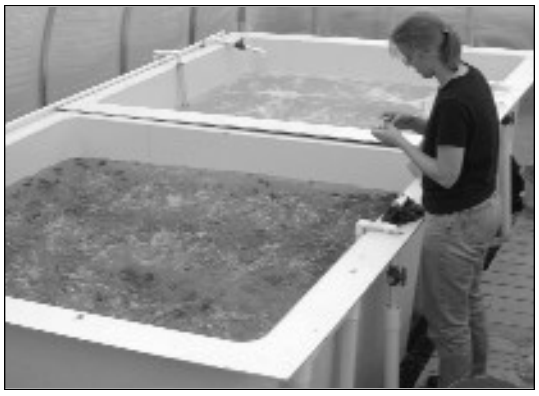


Photo: Chris Neefus, UNH

These tanks are part of the recirculating aquaculture system constructed in Great Bay, New Hampshire prior to the construction of the similar facility in Bridgeport. Jennifer Day, right, did her doctoral research (UNH) on this project.

A/E-18, M/PD-4 Nonpoint Education for Municipal Officials (NEMO)

Principal Investigators: C. Arnold, J. Rozum University of Connecticut Cooperative Extension System

NEMO is an educational program for land use decision makers that addresses the relationship between land use and natural resource protection, with a focus on water quality. The NEMO project was created in 1991 by the University of Connecticut Cooperative Extension Service (UConn/CES) and the Connecticut Sea Grant Extension Program, in partnership with the UConn Department of Natural Resources Management and Engineering. Major funding for NEMO comes from the Connecticut Sea Grant Coastal Community Development funds and from the Connecticut Department of Environmental Protection Nonpoint Source Control Program.

NEMO helps communities to better protect their natural resources while charting the future course of their towns. The project uses advanced technologies,-the predictive power of geographic information systems (GIS), remote sensing, and the Internet-to create effective education programs. NEMO presentations, publications, and Web-based services form an integrated package of information centered around the theme of natural resource-based planning. The presentations help explain the links between land use, water quality, and community character. The project also offers follow-up presentations and materials to help communities move forward on the two major aspects of natural resource-based planning, namely, planning for some areas to be preserved as open space and planning for others to be developed sustainably.

NEMO Success in Connecticut

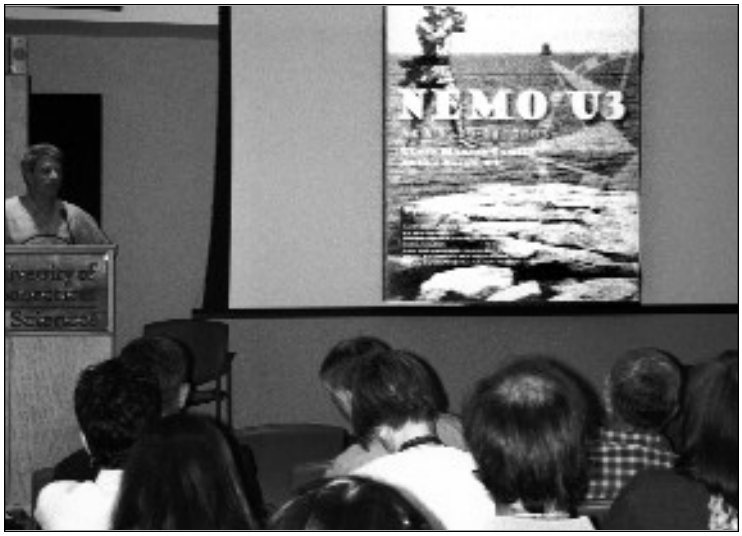
About one-third of the state's rivers and streams and three-quarters of the state's portion of Long Island Sound are impaired, primarily because of nonpoint source pollution from urban and suburban areas and construction sites. Nonpoint source pollution is generated by land use, and most land use decisions in Connecticut are made at the local level by municipal officials and private landowners. Federal and state nonpoint source laws and programs established over the past 30 years have created a growing need for local officials to be more knowledgeable about the causes, effects, and management of polluted runoff. Connecticut's NEMO program has been in operation for 12 years, and by now has engaged most of the 169 municipalities in the State. NEMO has assisted towns in Connecticut to change their land use plans, regulations, and development practices to better protect water quality. NEMO is now an integral part of the state's Nonpoint Source Management Program and statewide Plan of Conservation and Development.

Focus on the Coast is a new multimedia education project that educates local decision makers about the priority coastal resources of the Connecticut coastline, and offers ways to protect and restore them. The project is a collaboration of the University of Connecticut NEMO Program, CTSG, The Nature Conservancy Connecticut Chapter, and the Connecticut Department of Environmental Protection Office of Long Island Sound Programs. Major support was provided by a grant from the NOAA Coastal Services Center. At the Focus on the Coast web site, users can learn to conduct a coastal resource inventory; access digital maps and information on priority coastal resource areas and land cover, and discover links to other valuable land use resource tools.

National NEMO Network

The UConn NEMO Project is the coordinating hub for the National NEMO Network, a growing network of projects around the country adapted from the Connecticut project. As a result of NEMO's success in Connecticut, 34 states have established or are planning to establish technical assistance programs based on the NEMO model. Connecticut Sea Grant provides support to the NEMO Network through a three-year grant to support the UConn Geospatial Technology Program, an affiliated program that develops high-tech landscape analysis tools for use by Network members. In addition, CTSG development funds supported NEMO U-3, the third national "NEMO University" workshop. Sixty-five network members, federal agency representatives, and others attended the workshop, held at the University of Connecticut's Avery Point campus. While previous workshops focused on training and networking, this time discussion centered largely on how the NEMO network can best operate as a collaborative venture, share innovative programs and products, make technology readily available, and implement national

initiatives based on cross-cutting themes. Ideas for expanding the NEMO focus to other partners involved in land development and water management were suggested. A CD was created for distribution to network members. For more information about the NEMO Project, visit http://nemo.uconn.edu.



Left: National NEMO Coordinator John Rozum (far left, at podium) provides the NEMO introduction to network members at the NEMO U-3 national meeting held at the UConn Avery Point campus.

OUR CHANGING COAST: PRIVATE RIGHTS AND PUBLIC TRUST

A conference held on March 28 and 29, 2003

Population and economic growth in the years ahead will likely intensify the pressure for additional coastal development. The conflict between coastal development and conservation calls for a balancing of private development goods with public rights to preservation. One of the most contentious issues in local land-use control for coastal protection is the regulatory "takings" problem: the Fifth Amendment to the U.S. Constitution prohibits the state from taking private property except when the property is taken for public use and the owner receives just compensation.

Associated with coastal development are numerous threats to the quality and ecological functions of coastal environments. For example, these systems are important as spawning sites, nurseries and/or feeding grounds for estuarine-dependent fishes, including many commercially and recreationally important species. They also provide critical habitat for migratory shorebirds. Among the factors that threaten the health and continuity of such productive coastal habitats are increased nutrient loading and relative sea rise.

To address these issues in a balanced fashion, this conference was held in New London on March 28 and 29, hosted by the Goodwin-Niering Center for Conservation Biology and Environmental Studies at Connecticut College. Co-sponsors were the Sea Grant Programs of Connecticut and Rhode Island and The Nature Conservancy. Conference Organizer Diana Whitelaw, CCBES, Connecticut College said the overall goal was to explore the issue of land-use controls for preserving New England coastal areas and the takings problem. The conference focused on the important legal and ecological issues associated with coastal development, as well as the issue of private use and public protection of coastal areas. Among the invited speakers were Robert J. Johnston, CTSG's Associate Director, Virginia Lee, Rhode Island Sea Grant Extension Leader, and Jim Titus, Global Programs Division, U.S. Environmental Protection Agency. Attendees included college students and faculty, concerned citizens, environmental lawyers and activists, representatives of nongovernmental organizations and government officials. Two CTSG staff members served on the planning committee.

M/PD-1, M/PD-4 Development Projects

Connecticut Sea Grant development funds are available to sponsor emergency needs, pilot programs, or purchase necessary equipment or travel for investigators as unexpected needs arise. A panoply of development grants this year allowed scientists and students to attend scientific meetings to present their results, or to obtain needed equipment. These development projects, both in-state and regional, large and small, are listed on page 30. A sampling of small projects are described here as examples, followed by some larger-scale efforts.

The National Ocean Sciences Bowl (NOSB)

NOSB is an annual academic competition for high school students, focusing on ocean topics. On March 1, nearly 100 students participated in Quahog Bowl 2003, the CT/RI regional component of the NOSB 2003, sending a team on to the national finals. All participants received "goodie bags" of prizes and services, and students on the top two teams received cash scholarships. CTSG was a co-sponsor.

Coastal Perspectives Lecture Series

For several years, including 2003, Connecticut Sea Grant has assisted UConn's Coastal Studies undergraduate program and the community by sponsoring a semester-long, public lecture series on marine topics, Coastal Perspectives. The evening lectures are free and address a broad range of interests. Held every other week, the lectures help to showcase the University and its marine programs, while also bringing in expert speakers from "outside" to inform the campus community about others' efforts.

Student Internships in Belize

Four University of Connecticut Coastal studies students were provided partial travel support in order to do student internships in Belize, working with a non-governmental organization that manages the Sapadilla Cayes Marine Reserve. The Toledo Association for Sustainable Tourism and Environment in Punta Gorda (TASTE) created assignments for the students in topics such as environmental education and field sampling of environmental data. Students worked with CTSG's Robert Pomeroy.

Faculty Participation in International Workshop

"Aquaculture, Ecology and Economics: Towards a Sustainable Paradigm," a workshop in Puerto Varas, Chile, was one of CTSG's ongoing collaborative international initiatives in 2003. In addition to co-sponsoring the workshop and participation by CTSG staff, development funds were provided to the UConn Department of Marine Sciences for travel, to allow faculty to participate fully.

Thames River Basin Floating Workshop

CTSG co-sponsored another on-the-water workshop for decision-makers developed by the Thames River Basin Partnership held another in June, covering topics relating to transportation issues: boating infrastructure, clean boater programs, dredging and navigation, and port security questions. About 50 watershed stakeholders participated in the workshop aboard the *Enviro-Lab* vessel.

Opportunity for Educator

John Roy, a teacher at the Sound School in New Haven, was supported with travel funds in order to give a presentation on the school's shellfish and lobster hatcheries at the World Aquaculture Society Meeting in Brazil.

Taste, Touch and Smell of Science

This annual summer science youth camp, developed and implemented by UConn Marine Sciences graduate students, was able to accommodate 25 campers in June. Modest CTSG development funds allowed them to keep the registration to only $10.00 per student.

UConn Student Fellowship

Development funds supported a fellowship for an undergraduate chemistry student, Jose Santana, to work with Professor Annelie Skoog (University of Connecticut Department of Marine Sciences) on a project entitled "Effect of particle formation on the concentrations of biologically labile material in natural water samples", as part of the UConn Louis Stokes Alliance for Minority Participation (in Sciences) program. When organic matter (OM) transfers from the dissolved phase to the particulate phase, the fate of the OM may change too, with effects on the carbon cycle. Santana collected water samples from locations in the Thames River estuary, from two salinity regimes, to examine conditions under which the phase transfer occurs. He facilitated particle formation, then carried out analyses for nitrogen and dissolved organic carbon, counting bacteria in the samples. The investigators found and demonstrated a significant transfer of OM from the dissolved phase to the particulate phase in samples from both salinity regimes. This transfer makes previously dissolved organic material available for detritus feeders, instead of just being available for bacteria.

M/PD-4 Phytoplankton Dynamics in Long Island Sound: Influence of Environmental Factors on Naturally-Occurring Assemblages

Principal Investigator: Evan Ward, Ph.D.
University of Connecticut Department of Marine Sciences

Phytoplankton form the base of marine food webs, and are also important indicators of water quality. Evan Ward, Associate Professor of Marine Sciences at the University of Connecticut, leads a team that has developed new techniques to observe the plankton communities of Long Island Sound (see CTSG Annual Report 2002). Assisted by Post-doctoral fellow Kevin Strychar, scientist Gary Wikfors (NMFS, Milford), and undergraduate Dustin Kach, Ward has succeeded in adapting flow cytometry techniques using biochemical reagents to identify as many as five phytoplankton species simultaneously in a mixed water sample, and to identify how a particular nutrient is metabolized by plankton in "real time". This new method is a great improvement over traditional methods, in which samples were preserved and then examined by epifloresence microscopy or bulk chlorophyll analysis. The traditional methods are time consuming, do not determine the relationship of nutrients in stimulating cell growth, and, in the latter case, estimate abundance but do not identify the species that is the source of a dominant pigment.

Left to right: Kevin Strychar, Dustin Kach, and J. Evan Ward deploy equipment used to collect and identify plankton samples in Long Island Sound.

The team uses fluorescent dyes to determine cell viability and how phosphate and nitrate are utilized within a living cell. Then, scientists can put together the observations from different times and locations to show how nutrients and other environmental factors influence the composition and cellular processes of phytoplankton assemblages. Comparisons can now be readily made between the plankton communities and the mix of grazers that consume them. Furthermore, investigators can see how nutrients from different locations in Long Island Sound affect the internal physiologies of the plankton. Field data is undergoing further analysis, but the team can already predict physiological changes in individual cells, influenced by the dynamics of various external nutrients in the water column. In summary, flow cytometry, in concert with biochemical labeling, is a valuable tool to improve our understanding of relationships between nutrient processes, populations of phytoplankton, and their grazers.

M/PD-4 Rapid Detection Methods for Monitoring Biological Indicators of Coastal Water Quality.

Principal Investigator; Claudia Koerting, University of Connecticut

In a CTSG pilot project, researcher Claudia Koerting and colleagues at the University of Connecticut's Coastal Environmental Laboratory have found a novel use for equipment routinely used in airport security systems to detect explosives, and aboard US Coast Guard vessels to find narcotics. Koerting thought that perhaps the Ionscan®, an instrument that uses a technology called ion mobility spectrophotometry (IMS), could have other important applications. In addition to homeland security, they found that the Ionscan can be used to detect bacteria, such as *Listeria*, in food (USDA grant). Much faster than traditional diagnostic methods, Ionscan can distinguish among pathogenic bacterial strains in 5 minutes.

Researcher Claudia Koerting, above, has found that the *Ionscan*® (right), an ion mobility spectrophotometer routinely used by airport security systems and the military for detecting explosives and narcotics, can be applied to the rapid detection of bacteria in food, and presence of organisms that might cause harmful algal blooms. This technology is faster and less expensive than traditional methods.

Now, their Sea Grant project demonstrates that IMS has great potential for yet another important task: rapidly detecting and distinguishing paralytic shellfish toxins (PSP) in the water. Their test case is the toxin produced by the dinoflagellate *Alexandrium tamarense*. IMS requires much less preparation than other methods for the detection of PSP in algae or in shellfish, and is also inexpensive to operate, portable, and is quantitative. This makes IMS a practical alternative to current methods for monitoring toxic algal blooms as well as use in shellfish consumer safety.

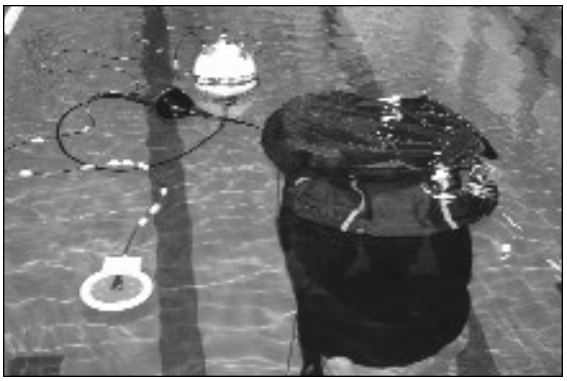
In the laboratory, IMS "fingerprints" for *A. tamarense* and saxitoxin have been produced. These fingerprints will next need to be compared to other toxin-producers. This initial success demonstrates that Ionscan can be used to detect toxins that could potentially become harmful algal blooms. However, further optimization of the method is still necessary. The researchers hope to next use IMS to test other dinoflagellates and tissue samples of their consumers such as shellfish, in complex environments such as seawater.

Work conducted using funds from this Sea Grant project was included in a presentation for the IEEE OES Homeland Security Technology Workshop, "Ocean and Maritime Technologies for Infrastructure Protection" held in Warwick, Rhode Island on December 10 and 11, 2003. The presentation was titled "Rapid detection methods for monitoring biological indicators of coastal water quality."

T-11-02 Continued Development of an In-Situ Heat Flux Measurement Instrument and Measurement Program in Long Island Sound

Principal Investigator: James P. Boyle, Ph.D. Western Connecticut State U., Physics and Engineering

James Boyle's project for developing better instruments to measure heat flux, as described in the CTSG Annual Report 2002, continued on. The *in-situ* multi-sensor float (MSF) that he developed to measure both solar radiation and transfer of heat between ocean and atmosphere was field-tested both at Martha's Vineyard and on Long Island Sound, and was found to be accurate within 15%, compared to the bulk aerodynamic method. A rooftop tank facility was established to characterize MSF response to solar radiation and to compare MSF solar irradiance measurements with research-grade pyranometers. A recoverable drifting buoy was designed and fabricated, to serve as a freely drifting platform for deployment of improved multi-sensor float designs. The performance was excellent.



The *in-situ* multi-sensor float instrument used to measure heat flux.

When the multi-sensor float development design is complete, Boyle envisions that they could be incorporated into NOAA's Global Ocean Observing System/Global Drifter Program, and/or with Argo floats. (The Argo floats are a global fleet of robotic floats designed to collect data to describe the physical state of the upper ocean in near real-time.) They could also be used in concert with other instruments and in air-sea interaction studies of heat and gas transport. Deployed in small inland lakes or estuaries, they could provide data useful in studying these ecosystems.

Assessing the Status of Marine and Freshwater ANS in Connecticut

Principal Investigator: Nancy C. Balcom CTSG/University of Connecticut Department of Extension

Initial work began on a collaborative project led by Extension Leader Nancy Balcom that will produce a comprehensive document summarizing the status of freshwater and marine Aquatic Nuisance Species (ANS) in Connecticut. The document will include a list of new and potential invaders and possible pathways and vectors into, through, and out of the State. A list of agencies, individuals, and organizations involved with ANS will be compiled for the document. Pertinent policies and regulations, and ongoing research, control methods, regulatory, and education efforts addressing ANS will also be included. In the second phase of the project, a draft comprehensive management plan for the State will be developed and submitted for regulatory approval. The final plan will serve as a reference and guide for all entities in Connecticut that are involved with ANS, and it will facilitate coordination of efforts. This will provide clear goals, priorities, and guidance, and bring the State into step with others in the region and the nation to address ANS invasions and their environmental and ecological impacts efficiently. Collaborators include the Connecticut Institute of Water Resources, Connecticut Department of Environmental Protection, the Connecticut Invasive Plant Working Group, UConn Cooperative Extension, The Nature Conservancy, the Connecticut Federation of Lakes, U.S. E.P.A., and various relevant industries. UConn faculty members Les Merhoff, Robert B. Whitlatch, Charles Yarish,and others are participating in the effort. This project is a NOAA Strategic Initiative.

Long Island Sound Lobster Health Initiative

Connecticut Sea Grant (CTSG)'s involvement in the coordination of a multi-state, multi-agency investigation to address the mass mortality of the lobster resource (1999) continued into its third year, under the auspices of the Lobster Management Board of the Atlantic States Marine Fisheries Commission. CTSG works with numerous federal and state agencies, organizations, and industry to oversee the LIS Lobster Research Initiative, a $4.5 million effort supported by federal and State of Connecticut dollars.

There was standing-room only at the 3rd Long Island Sound Lobster Health Symposium, held in Bridgeport in March, during a severe snowstorm. Preliminary results of the first two years' research were presented by spokespersons for research teams.

There are 17 primary and five secondary research efforts underway at academic institutions in Connecticut, New York, Massachusetts, Maine, Maryland, Georgia, California, Louisiana, and Virginia, examining a variety of possible factors in the lobster mortality event. These factors range from environmental and physiological stressors such as high water temperature, ammonia and sulfides, to pesticides used for mosquito control, to a parasitic paramoeba, to an assemblage of bacteria causing lobster shell disease. The individual projects are described in our Annual Report 2002 (pages 11-13), so will not be repeated here.

In January 2003, CTSG hosted the Lobster Health Research Working Meeting at UConn, attended by 75 researchers and graduate students. The meeting provided an opportunity for the investigators to share ideas, discuss preliminary findings, and integrate the preliminary research results into the topic themes. Summaries of the themes were then presented at the Third LIS Lobster Health Symposium, held in Bridgeport, on March 7. The symposium was organized by the Connecticut and New York Sea Grant Extension Programs on behalf of the Lobster Steering Committee. Balcom also served as liaison with members of the lobster industry. Despite a severe snowstorm that day, the meeting was packed to standing-room-only, and received a lot of media attention. A newsletter to describe the status of the research effort and the lobster resource was produced as a joint effort and distributed widely. A summary document of the meeting was also produced and distributed to licensed lobstermen in Connecticut and New York.


LONG ISLAND SOUND

Lobster Health News

Extension and Communications staff of Connecticut and New York Sea Grant worked together to produce the *Lobster Health News*.

Although the work was funded for two years, the time frame has been extended for another full year (without additional funds) to allow the researchers to thoroughly address the problems. (See listing on page 31.)

Planning is underway for the final symposium, to be held in October 2004, at which time final results of the research will be presented and summarized, followed by discussion about the best directions for the industry to take in order to restore the resource and move the industry forward, if at all possible.

A/E-1 Connecticut Sea Grant Extension Program

Principal Investigator: Nancy Balcom CTSG/University of Connecticut Dept. of Extension

The Sea Grant Extension Program reaches out to coastal and marine resource users, industry representatives, communities, and other targeted audiences to transfer cutting-edge technology. In the Connecticut program, the staff consists of a program leader, a fisheries resource specialist, and two extension educators, one focusing on aquaculture and one on water quality.. Focus areas for the overall program include aquaculture, aquatic nuisance species, fisheries, safety (both vessel and seafood), and water quality.

Aquaculture

Extension Educator Tessa Getchis has focused on addressing economic and social issues surrounding marine aquaculture. In 2003, she organized the first annual Shellfish Industry Summit, at which industry members identified and prioritized issues of importance in the Northeast U.S. Getchis is addressing the top two priorities identified, social conflicts and environmental impacts, through collaborative research and outreach projects. Continuing her work in aquaculture law and policy, Getchis co-wrote a white paper reviewing legal and policy constraints to aquaculture in the Northeast U.S. Getchis organized a law and policy session at the World Aquaculture Society's Annual Meeting, at which international scientists and industry members discussed constraints to aquaculture.

In January and February, CTSG held its Marine Trades Workshop Series, organized by Getchis. Attendees included fishermen, aquaculturists, state agency employees, and students. Workshops included Introduction to Net Mending, Advanced Net Mending, Long-Line Design for Shellfish Aquaculture, and Shellfish Dredge Design. The workshops will be offered again at the Northeast Aquaculture Conference and Exposition workshop in December 2004, for which Getchis serves as secretary of the executive committee.

Fisheries

Extension efforts largely focused on the Long Island Sound lobster resource disaster, with Nancy Balcom taking the lead for Connecticut Sea Grant. (See previous page.)

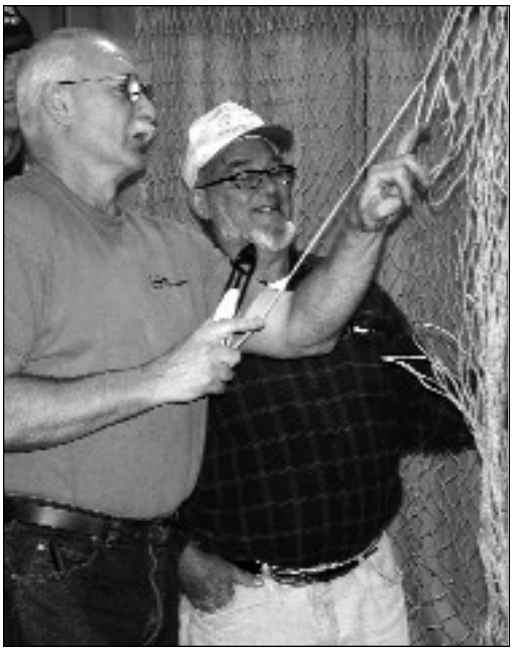


Photo: Tessa Getchis

Left to Right: Dave Beutel, RI Sea Grant, demonstrates net mending to Capt. John Wadsworth. Participants in this Marine Trades Workshop learned basic and advanced techniques for repairing nets.

Other program efforts included three workshops examining different aspects of fisheries management that were held in Connecticut, as the State's component of a regional fisheries extension effort. Sponsored by the National Sea Grant Program, the workshops series was developed in partnership with Sea Grant programs in Rhode Island, New Hampshire, and Maine. (The workshops were repeated in each state.) Tapping the knowledge and expertise of commercial and recreational fishing communities, state regulatory agencies, fishery management councils, environmental organizations, NOAA fisheries, and the Northeast Sea Grant Programs, the workshops provided a science-based platform for discussion aimed at resolving critical fisheries issues. Written summaries of each workshop online provide a focus for continuing discussion in policy deliberations.

The first, held in February, addressed the problems related to bycatch. Bycatch, the unintentional capture of nontargeted species, is one of the most urgent issues of fisheries management. It occurs in multispecies fisheries such as the New England groundfish fishery, and is a compelling concern of managers and fishermen striving to rebuild declining fish stocks. The workshop provided case studies, speaker presentations, and panel/audience discussions on the subject. Participants developed a working definition of bycatch, and learned

about the current state of knowledge of bycatch and its impacts in New England fisheries, and efforts underway to resolve bycatch problems through gear technology and management strategies.

The second in the series, held in March, concerned marine protected areas (MPAs)–areas where fishing is restricted or prohibited. CTSG Fisheries Extension Specialist Robert Pomeroy was one of the primary speakers. Topics included what MPAs are, how they are established, and the various ways they can be used as a fisheries management tool.

The third and final workshop of the series, held in June, focused on the concept of rights-based fisheries management–ways to sustain fish populations without destroying the rights of those whose livelihood is fishing. Individual transferable quotas (ITQs), territorial use rights in fisheries (TURFs), limited entry, and other rights-based management approaches were discussed in an open forum. The economic principles that guide these approaches, and the costs and benefits of each, were presented by Pomeroy.

Additional partners for this workshop included the NOAA National Marine Fisheries Service, New England Fisheries Management Council, Connecticut Department of Environmental Protection, Manomet Center for Conservation Studies, Oceana, and the commercial and recreational fishing communities.

"How is Your MPA Doing? - a Guidebook of Natural and Social Indicators for Evaluating Marine Protected Area Management Effectiveness" is an important publication begun by Pomeroy, as first author. The effort is a collaboration between NOAA, the World Wildlife Foundation, and the World Commission on Protected Areas. Print and CD versions will be published in 2004. Other publications included a fact sheet series on various fisheries management approaches, available in print or online, and Pomeroy's feature article on marine protected areas, which appeared in CTSG's magazine, *Wrack Lines*.

Aquatic Nuisance Species

Non-native, invasive species can cause ecological havoc in an ecosystem by displacing or outcompeting native species. In some cases, there are socioeconomic impacts as well that require expensive maintenance or renovations. Connecticut Sea Grant Extension has had a longstanding outreach program addressing aquatic nuisance species. Balcom serves on the Northeast Regional Aquatic Nuisance Species Panel, and completed a two-year co-chairmanship of the Communications, Education, and Outreach Subcommittee in 2003. In collaboration with the Connecticut Department of Environmental Protection, Balcom received a National Sea Grant award to support the development of a state management plan for aquatic nuisance species (see page 19). That work is currently ongoing, with the assistance of state and federal resource managers, academics, industry representatives, and environmental organizations. Both Balcom and Heather Crawford are members of the Connecticut Invasive Plant Working Group, and Crawford served as a keynote speaker for the Aquatic Nuisance Species Workshop, a national internet conference on aquatic nuisance species through the College of Exploration.

Health and Safety

One of CTSG's goals is to help provide the nation with safe, high-quality seafood. To that end, Balcom continued to train seafood processors and distributors in southern New England in HACCP principles, in collaboration with Rhode Island Cooperative Extension/Sea Grant and the Connecticut Department of Agriculture, Bureau of Aquaculture. These courses help members of the seafood industry meet stringent federal regulations. A new course on sanitation was developed and offered in conjunction with the University of Connecticut Cooperative Extension System and Rhode Island CES/Sea Grant. Sanitation is a key component of safe seafood processing, and requirements for monitoring key elements can be difficult to meet. A voluntary course, this new endeavor was designed to meet the needs of seafood, cider, and juice processors who wish to better fulfill the U.S. Food and Drug Administration requirements. The newsletter, *Seafood Safety Savvy: a HACCP Update*, is issued periodically to update trainees on changes to the HACCP program, seafood safety hazards, or control measures, and to alert industry to new regulations that may affect their operations. Jointly issued with Rhode Island CES/Sea Grant, the newsletter is available online on CTSG's web site. The newsletter is the only one of its kind offered by HACCP trainers, and is periodically utilized by FDA regulators and other HACCP trainers.

Water Quality

Heather Crawford continued her popular "Clean Waters Begin in Your Home and Yard" program, giving presentations on stewardship to homeowners associations, garden clubs, and environmental organizations. She also continued to serve as a member of the NEMO team (Nonpoint Education for Municipal Officials) with colleagues of the University of Connecticut Cooperative Extension System. NEMO's mission is linking the town hall decision-making process to water quality, to help communities make responsible decisions about watershed resources. Crawford also began offering a new NEMO program on wetlands called "Wet Lands."

As the Yale Sea Grant internship program continued in 2003, so did Crawford's role as liaison to the program (page 23). The interns, graduate students in the Yale School of Forestry and Environmental Studies, develop short-term research and outreach projects that focus on coastal watershed issues and policy. Crawford's work with intern Nicole Vickey, described in the CTSG Annual Report 2002, culminated in a publication for coastal planners on how to provide coastal access, published early in 2003. The publication was timely and was distributed at the conference "Connecticut's Changing Coast: Private Rights and Public Trust" (page 15). Crawford also lectured on the impacts of development on water resources for a Connecticut Department of Environmental Protection Professional Training Seminar.

Sea Grant Education

K-12 Education

Most K-12 science teachers lack a background in science, particularly at the elementary level. As an established leader in marine and aquatic science education, Sea Grant assists educators in preparation and professional development to fill the need for research-based ocean science teacher training. CTSG Education Coordinator Diana L. Payne is responsible for CTSG's formal K-12, and sometimes "K through Grey", education component. In 2003, she continued the popular Long Island Sound Mentor Teacher program. The mentor teachers share curricula and resources relevant to Long Island Sound with other teachers in grade-level-appropriate workshops. The CTSG Education office also works with education associations, aquaria, and science centers in the State, providing resources and consultation.

Diana Payne receives a Public Service Award from Secretary of State Susan Bysiewicz.

Payne received a Public Service Award from the State of Connecticut for her service on the Education subcommittee of the Eastern Long Island Sound Advisory Council. (Councils are composed of chief executive officers of municipalities and expert individuals appointed by the Governor, representing academic institutions, industry, and the environment. Councils report to the Long Island Sound Assembly. The Education subcommittee works with the Long Island Sound Foundation to plan activities intended to interest students and teachers in the Sound, such as the annual children's calendar contest.) The award was presented at a ceremony on May 5, 2003 at Central Connecticut State University.

Nationally, a highlight of 2003 was participation in a NOAA Ocean Exploration expedition, "Mountains in the Sea-Exploring the New England Seamount Chain". The venture was part of a NOAA program, intended to enhance America's environmental literacy through the excitement of ocean discovery, by linking teachers and students with ocean explorers in effective collaborations. The team visited three seamounts—Manning, Kelvin, and Bear, where they were able to examine and document coral biodiversity on the seamounts. They also set out basalt blocks, to learn about the settlement and colonization patterns of the seamount corals.

continued next page

Educators and students use the OE website, <http://www.oceanexplorer.noaa.gov/explorations/03mountains/welcome.html>, to learn about the expedition. The cruise was documented with logs, imagery, video, and essays about the discoveries made. A set of lesson plans are available, to help educators bring the excitement of ocean discoveries into classrooms. A curriculum for grades 6-12 ties the lesson plans together and correlates them with the National Science Education Standards. As Education Coordinator, Payne provided an overview of the expedition at professional development workshops held in Connecticut and Massachusetts, to prepare educators to participate in the expedition. She also prepared daily logs.

Payne also served as Secretary of the National Sea Grant Educators Network, and was elected Chapter Representative of SouthEastern New England Marine Educators (SENEME), a chapter of the National Marine Educators Association (NMEA).

At the sixth annual Quahog Bowl (RI/CT regional National Ocean Sciences Bowl, co-sponsored by CTSG) on March 1, Payne served as a scorekeeper. This event is an ocean science competition for teams of high school students, who often make presentations to their communities after the bowl.

E/T-10 Marine Science for the Deaf: Classroom of the Sea

Principal Investigators; Peter M. Scheifele, Ph.D.; Ivar G. Babb, Ph.D.
University of Connecticut, National Undersea Research Center *2002 project but was deferred

Working with teachers from the American School for the Deaf, these investigators continued to address the challenges of teaching science to deaf learners and recognizing the deficiencies inherent in American Sign Language with regard to science vocabulary. This project is primarily supported by the National Science Foundation; as fully described in previous annual reports; CTSG's contribution provided funds for equipment to establish infrastructure for a wireless network at UConn, in order to be able to transmit live video from UConn's research vessel, the *R/V Connecticut*, directly to a classroom at the American School for the Deaf.

CTSG in Higher Education

Approximately 17 masters students, 7 doctoral candidates, and 10 undergraduates and a number of post-doctoral fellows were involved in CTSG-supported research projects this year. Ten master's degree candidates at Yale University were supported and supervised as Sea Grant Interns. Two graduate students were supported as Knauss Sea Grant Marine Policy Fellows (see p. 25).

Yale Sea Grant Coastal Interns

The coastal interns program at the Yale School of Forestry and Environmental Studies links graduate students with policymakers, resource managers, and citizens. Graduate students at the Yale University School for Coastal and Watershed Studies have taken the opportunity to become Sea Grant interns again in 2003. Selected candidates carry out a project that ties together coastal and watershed science and policy. To date, 54 interns have been supported by CTSG. Following are reports of projects completed and underway in 2003.

Hydraulics of Nature-like Fishways

Laura Wildman produced a report documenting the design of two fishways that simulate nature. One is located in Connecticut; the other in Maine. These fishways emulate natural appearance and conditions more than the traditional "fish ladder", and accommodate more than one species of fish. These multi-species fish passages are more common in Europe, but this report may help to promote their use in North America.

Yale Internships, continued

Water In, Water Out? An Analysis of Water and Nitrogen Use in the City of New Haven

Hahn-Ning Chou documented the quantities of water and nitrogen that flow in and out of the New Haven, a coastal urban city with a population of 120,000, and as a subset, Yale University. The flows were categorized according to source, land use, etc., in order to create a nitrogen budget; water use at Yale was categorized by building and function. Another intern, Ying Qiu, studied New Haven residential water use by sector and neighborhood, examining demographic and other factors influencing residential water use. Two detailed reports were submitted to CTSG.

PROGRESS REPORTS

Richard Karty's Summer 2003 internship contributed to his doctoral dissertation on urban stream buffer characteristics. The goal of the project was to observe the effects of disturbance due to urbanization on vegetation and community composition in riparian zones. A report was provided to the NEMO program as well at CTSG.

Long Island Sound Fellowship

The LIS fellowship program sponsors simultaneously one graduate student fellow in Connecticut and one in New York, as a partnership between the EPA Long Island Sound Study (LISS) and the relevant Sea Grant programs. As a Long Island Sound Fellow, Alison Branco had the opportunity to attend meetings of the LISS Science and Technical Advisory Committee to the Long Island Sound Study and have input to scientific discussion and policy issues. With the NY LIS Fellow, Branco is working on updating the Long Island Sound's Contaminants of Concern list. Alison is focusing on organic contaminants like pesticides and PCB's. They plan to produce a report summarizing recent work on contaminants in Long Island Sound and recommending changes to the current list. Branco is a Ph. D. candidate in the Department of Marine Sciences at the University of Connecticut, whose thesis research focuses on the effects of colored dissolved organic matter (CDOM) on light availability in Long Island Sound's shallow embayments.

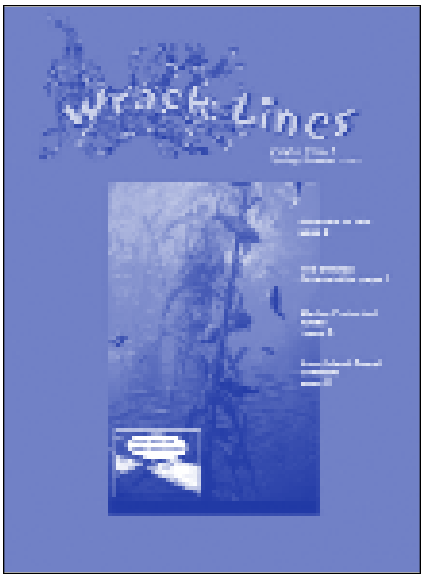
John A. Knauss Sea Grant Marine Policy Fellowships

Jen Linn's John A. Knauss Sea Grant Marine Policy Fellowship was with the Coastal Management Branch of the U.S. EPA's Office of Water. Her work there centered around a few theme areas: the National Estuary Program, coastal habitat restoration, invasive species, and coastal policy reform (in connection to work of the Pew Oceans Commission and the U.S. Commission on Ocean Policy). Linn found the fellowship to be an excellent opportunity to experience Washington DC, work and interact with leaders on coastal issues, and become involved with policy decisions. She currently continues to work in the Coastal Management Branch of EPA as a contractor.

Laura Rear's placement was in the NOAA Office of Exploration (OE). As Marine Archaeological Program Assistant, she accompanied a maritime archaeology team aboard a Russian research vessel to the site of the remains of the *RMS Titanic*. The team goal was to examine the current condition, management, and future preservation of the wreck site as a historic landmark of national importance to the nation's maritime cultural heritage. Rear was in charge of logistics for the cruise, and for logging metadata, such as weather information, samples collected, times that divers were in the water, etc. Later, she participated in a bio-prospecting cruise in the Gulf of Mexico. When not at sea, she worked on the preparation of documents to establish formal relationships between NOAA and several state historic preservation officers.

M/CP-1 Sea Grant Communications Program

Principal Investigator: Peg Van Patten CTSG/University of Connecticut



Wrack Lines magazine, Spring/Summer 2003 issue.

CTSG's Communications Office links program components, packages the Sea Grant messages intended for targeted audiences, and distributes information to users and the Sea Grant Library. Key duties include oversight of publications, media relations, support for program activities, and participation on the CTSG management team.

Peg Van Patten, the full-time Communications Director, performs these duties and also serves as the program's web master. The site has expanded to include the home page, staff page, pages and subsections for every program component, publications, research, news, and funding opportunities. Van Patten creates and maintains a separate site for *Wrack Lines*, the program's magazine, as time allows.

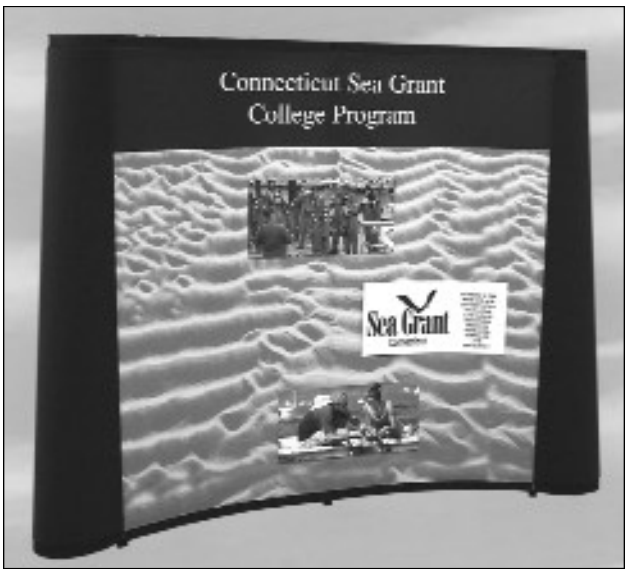
Van Patten edits and designs *Wrack Lines*, which has continued for another year with partial Sea Grant support and assistance from other sponsors. One of the two bi-annual issues featured the University of Connecticut's new undergraduate programs in Maritime Studies; other features included articles by Sea Grant Extension faculty on topics such as Marine Protected Areas, fisheries economics, and the Long Island Sound lobsters. She presides over the editorial board and also manages the mailing of the magazine.

Highlights of 2003 included working with Extension staff to plan and carry out publicity and media relations in conjunction with the 3rd Long Island Sound Lobster Health Symposium (page 20). Extensive media coverage resulted in a number of television and radio interviews, as well as news articles in print. The Communications office assisted the Extension program with the editing, design, and production of an issue of the *Long Island Sound Lobster Health News,* and two series of fact sheets developed by the CTSG Extension program, one on aquaculture and one on fisheries management.

A major effort in 2003 was editing, preparation, production, and publication of the 172-page 6th Annual Long Island Sound Research Conference Proceedings 2002 volume. Van Patten was both editor and designer, and co-authored the introductory background on the state of Long Island Sound.

Van Patten also assists Long Island Sound outreach by serving on the Communications subcommittee of the E.P.A. Long Island Sound Study, helping to develop and disseminate educational materials about the region's largest estuary.

New in 2003 was the development and completion of a large, free-standing display that can be customized and easily transported to meetings and conferences in a rolling container. This was done in conjunction with the CTSG Education office, with funds from the EPA LISS. Removable panels to suit the needs of both CTSG and the LISS were created.



A large, free-standing colorful display was developed and commissioned. The display is customizable and easily transported to meetings.

International Initiatives

One of CTSG's strengths has always been its international initiatives. These expanded again in 2003 when several staff members participated in two initiatives: a U.S. - Mexico Training, Internships, Exchanges, and Scholarships (TIES) Program, culminating in a plan to develop a Sea Grant-style Extension program in Baja, and a collaborative workshop in Puerto Varas, Chile.

TIES Program - Mexico

The University of Connecticut's Office of International Affairs and the Autonomous University of Baja California (UABC) obtained TIES (Training, Internships, Education and Scholarship Partnership) funding to collaborate on a project addressing coastal resource issues. The project was initiated because the Tijuana-Ensenada Corridor (TEC) in northern Mexico faces ecological and economic pressures due to the development of the region, similar to issues faced in Connecticut. When Mexico's Department of Agriculture, Livestock, Rural Development, Agriculture, Fisheries and Food (SAGARPA) was preparing to decentralize fisheries management to the State level, representatives from the State government in Baja requested input from Connecticut Sea Grant. CTSG agreed to assist the State Government of Baja California create a program, modeled after the Sea Grant Extension Program, to proactively form relationships among the government agencies, the university researchers, and maritime industries.

Three Mexican government officials, led by Juan Pablo Hernandez Diaz, Secretary of Agriculture for Mexico (Secretario de Fomento Agropecuario), visited UConn in February, to learn about CTSG and its marine extension program. They also visited industry members and regulatory agencies and discussed Sea Grant's role in fisheries and aquaculture. The visitors were interested in how Sea Grant works with the seafood industry in promoting fisheries and aquaculture, and training methods for seafood handlers to ensure product safety. Hernandez requested that members of Sea Grant Extension, and the Sea Grant director visit Baja to learn more about the government structure and their interaction with industries.

In December, CTSG Director Edward Monahan, and Extension faculty Robert Pomeroy and Tessa Getchis visited with representatives of UABC, the State of Baja California and federal Departments of Agriculture, and fishing and aquaculture industry members. At a workshop hosted by UABC, participants discussed the important role that Sea Grant Extension plays in aquaculture. Approaches to fisheries management and options for Baja California to utilize were presented by Pomeroy and Getchis. Afterward, Extension staff visited oyster and clam culture operations and tuna farms. At the conclusion of the exchange, Juan Pablo Hernandez Diaz, Luz del Carmen Martinez-Zabatdeny (State Agriculture Secretary), and Fabiola Lafarga de la Cruz (coordinator for fisheries and aquaculture for the State of Baja California), discussed the possibility of developing a formal extension program in Baja California. This initiative will continue in 2004.

Three representatives of the Mexican government met with Connecticut Sea Grant to discuss fisheries management and the Sea Grant extension concept. Left to right, top: Edward C. Monahan, CTSG Director; Juan Pablo Hernandez-Diaz, Secretary of Agriculture for Mexico; Victor Guardado, coordinator for fisheries and aquaculture for the State of Baja California, and Miroslava Villavicencio, seafood marketing and global trade promoter for Baja

Aquaculture, Ecology and Economics: Toward a Sustainable Paradigm - Chile

Twelve UConn professors, three Sea Grant staff, and a graduate student participated in this international workshop held in Puerto Varas, Chile in December. The workshop was part of a continuing collaboration between CTSG, UConn, and the Universidad Los Lagos (ULL.) Key themes included ecology and ecosystem modeling, aquaculture production, economic models, and public policy.

FINANCIAL REPORT 2003

Project Number	Title	Investigator(s)
Core Program Elements		
M/PA-1	Program Management and Planning	E. Monahan
M/PD-1	Program Development	E. Monahan
M/PD-4	Multi-program and Regional Initiatives	E. Monahan
A/E-1	Sea Grant Extension Program	N. Balcom
A/FE-1	Fisheries Extension Enhancement	E. Monahan, R. Pomeroy
A/E-18	Land Use Education and Tools for Coastal Communities	C. Arnold
M/CP-1	Communications Program	M. Van Patten
E/T-11	Connecticut Sea Grant Education Program	E. Monahan, D. Payne
Research Projects		
R/ER-21	A Ferry-Based Observing System for Long Island Sound...	D.N. Codiga
R/ER-22	The Connecticut Hatting Industry as a Mercury Source for LIS	J. C. Varekamp
R/A-34	Integrated Recirculating Aquaculture System for use in Urban Aquaculture	C. Yarish
R/A-35	Characterization of the Biological Function of Somatolactin...	T.T. Chen and B-Y. Yang
R/ER-19	Sediment Dynamics in Connecticut Estuaries: 7Be,210Pb, 137Cs, Trace Metals...	G. Benoit
R/ER-23	Responses of Eelgrass Habitats to Land-Use and Nitrogen Loading	J.N. Kremer
National Strategic Initiatives, Additional NOAA Awards, and External Awards		
no SG number	Exotic Species in Long Island Sound: Raising Public Awareness ..(EPA)	N. Balcom, T. Getchis
R/ES-19	Evaluation of the Importance of Ship Hull Fouling ...as a Vector ...(NOAA)	R.B. Whitlatch *et al.*
A/E-31	Assessing the Status of Marine and Freshwater ANS in Connecticut...(NOAA)	N. Balcom
T-11-02-CT	Development of *In-Situ* Heat Flux Instrument and Measurement...LIS	J. Boyle
-	Earth Grant Geospatial Technology	S. Prisloe
NA03OAR4170183	Communications for National NEMO network	J. Rozum
-	Ship Time (NOAA)	D. Codiga
-	EPA Smart Growth Coastal Community Development in Connecticut	E. Monahan
Education and Outreach Initiatives		
A/E-3	Yale/Sea Grant Coastal Internship Program	G. Benoit
-	Facilitating K-12 Formal and Informal Educators' Use of LIS.. (EPA LISS)	D. Payne, N.Balcom *et al.*
E/K-8	John A. Knauss Sea Grant Marine Policy Fellowship	L. Rear
E/K-9	John A. Knauss Sea Grant Marine Policy Fellowship	J. Linn
-	Long Island Sound Fellows Program (CTSG/EPA LISS)	A. Biddle-Branco

TOTALS

Institution	Federal Funds($)	State Funds	Total Funds
University of Connecticut	192,990	202,451	395,441
University of Connecticut	48,000	17,829	65,829
University of Connecticut	5,000	17,829	22,829
University of Connecticut	143,000	72,428	215,428
University of Connecticut	50,000	25,497	75,497
University of Connecticut	20,000	39,351	59,351
University of Connecticut	133,000	0	133,000
University of Connecticut	50,000	17,829	67,829
University of Connecticut	83,658	21,036	104,694
Wesleyan University	22,303	21,691	43,994
University of Connecticut	55,000	31,869	86,869
University of Connecticut	76,002	51,569	127,571
Yale University	37,740	60,625	98,365
University of Connecticut	23,070	20,570	43,640
University of Connecticut	8,864	0	8,864
University of Connecticut	109,350	82,450	191,800
University of Connecticut	51,450	25,882	77,332
Western Connecticut State Univ.	93,500	0	93,500
University of Connecticut	50,000	0	50,000
University of Connecticut	50,000	0	50,000
University of Connecticut	6,800	0	6,800
University of Connecticut	5,000	0	5,000
Yale University	25,737	12,992	38,729
University of Connecticut, LIS Fdn.	60,052	4,922	64,974
University of Connecticut	38,000	0	38,000
Yale University	38,000	0	38,000
University of Connecticut	32,000	0	32,000
	1,508,516	**726,820**	**2,235,336**

M/PD-1

Institution	PI	Title	Amount
UCONN DMS	C. Rosetta, A.Smith	Taste, Touch, and Smell of Science Program	350
TRBP	E. Thomas	Thames River Basin Partnership's Floating Workshop	600
UCONN Library	J. Heckman	IAMSLIC Conference	500
UCONN DMS	E. Ward	Student travel to Oyster Research Conference	325
UCONN CANR	C. Arnold	NEMO U-3	2,000
UCONN CTSG	T. Getchis	Challenges Facing Connecticut's Aquaculture Industry	575
UCONN AVPT	E. Anderson	Coastal Perspectives Lecture Series 2003	768
UCONN CEL	C. Koerting	Ion mobility spectrophotometry...paralytic shellfish poisons	1,911
UCONN CTSG	R. Pomeroy	Student internships in Belize	1,800
UCONN CTSG	D. Payne	Laptop computer for K-12 outreach on NSF project	1,700
UCONN DMS	A. Skoog	E. Svensson, field work hydrothermal vents	800
UCONN DMS	A. Skoog	Effect of particle formation...biologically labile material	2,790
UCONN CTSG	P. VanPatten	*Sound Facts* transparencies	780
UCONN MCB	H. Laufer	Reprints: Lobsters and juvenile...alkylphenols	124
UCONN CTSG	D. Payne	Long Island Sound Educators Conference	2,000
Sound School	J. Roy	Travel to World Aquaculture Society meeting	500
UCONN EEB	C. Yarish	Visit of Professor Sohn from South Korea	3,000
UCONN/NURC	P. Auster	Underwater Tour of Long Island Sound CD	1,000

M/PD-4 Regional and Multi-Program Projects

URI	Gail Scowcroft	CT/RI Regional National Ocean Science Bowl	2,500
UNH	D. Morse	Northeast Aquaculture Conference and Expo 04	1,000
UCONN DMS	J. Kremer	Responses of Eelgrass ...to...Nitrogen Loading	3,030
VIMS	J. Sutinen	North American Association of Fisheries Economists	500

Lobster Research and Outreach Projects Funded:

LR/LR-1 Stress Indicators in Lobsters (*Homarus americanus*): Hormones and Heat Shock Proteins
Primary P.I.: Ernest S. Chang, Ph.D, Bodega Marine Laboratory, University of California, Davis
2-Yr. Funding Totals: $170,115 (Sea Grant); Matching Funds: $155,197

LR/LR-2 Development of Assays for the Evaluation of Immune Functions of the American Lobster (*Homarus americanus)* as a Tool for Health Assessment
Primary P.I.: Sylvain De Guise, Ph.D, University of Connecticut
2-Yr. Funding Totals: $198,271(Sea Grant), Matching Funds: $67,734

LR/LR-3 Determination of the Toxicity and Sublethal Effects of Selected Pesticides on the American Lobster *(Homarus americanus*)
Primary P.I.: Sylvain De Guise, Ph.D, University of Connecticut
2-Yr. Funding: $140,000 (Sea Grant), Matching Funds: $70,201

LR/LR-4 Oligonucleotide-based Detection of Pathogenic *Paramoeba* Species
Primary P.I.: Rebecca J. Gast, Ph.D, Woods Hole Oceanographic Institution
2-Yr. Funding: $113,587 (Sea Grant) Matching Funds: $37,681

LR/LR-5 Phenotypic and Molecular Identification of Environmental Specimens of the Genus *Paramoeba* Associated with Lobster Mortality Events
Primary P.I.: Patrick M. Gillevet, Ph.D, George Mason University
2-Yr. Funding: $299,761 (Sea Grant), Matching Funds: $100,477

LR/LR-6 Acute Effects of Methoprene on Survival, Cuticular Morphogenesis Shell Biosynthesis in the American Lobster, *Homarus americanus*
Primary P.I.: Michael N. Horst, Ph.D, Mercer Univ. School of Medicine
2-Yr Funding: $230,000 (Sea Grant) Matching Funds: $100,000

LMP/A-1 LIS Lobster Disease Research Management
Primary P.I.: Edward C. Monahan, Ph.D, D.Sc, Connecticut Sea Grant College Program
2-year Funding: $35,000 (Sea Grant) Matching Funds $11,900

LMP/D-1 LIS Lobster Disease Program Development
Primary P.I.: Edward C. Monahan, Ph.D, D.Sc, Connecticut Sea Grant College Program
2-year Funding: $98,266 (Sea Grant) Matching Funds 0

Maintenance of a *Paramoeba* culture and exploration of a mitochondrial cytochrome b genetic marker
Primary P.I.: Senjie Lin, Ph.D, University of Connecticut $ 8,000

Monitoring of Bottom Water and Sediment Conditions at Critical Stations in Western LIS
Primary P.I.: C. Cuomo, PhD. Yale University, $10,000

The Comparative Pathology of Shell Disease in the American...and Spiny...Lobsters: characterization of Gross, Light Microscopic, and Utrastructural Pathology"
Primary P.I.: R. French, Ph.D, DVM, UCONN $9,996

LA/E-1 LIS Lobster Extension Program
Primary P.I.: Nancy C. Balcom, Sea Grant Extension Program Leader
3-year Funding: $165,000 (Sea Grant) Matching Funds $58,700

*Additional lobster projects were funded by the Connecticut Department of Environmental Protection, the NOAA National Marine Fisheries Service, New York Sea Grant, and the U.S. Environmental Protection Agency.

** Funding listed was for the initial two years. Projects were continued for a third year without additional funds.

CTSG Senior Advisory Board

Dr. Janet Greger, Vice-Provost for Research and Graduate Education
University of Connecticut, Storrs –Board Chair
RADM Michael W. Bordy, USN(ret.), President,
The Maritime Aquarium, Norwalk
RADM Douglas H. Teeson, UCGA (ret.), President,
Mystic Seaport Museum, Mystic
Dr. Anthony J. Cernera, President,
Sacred Heart University, Fairfield
Dr. Gerald Burrow, President,
The Mystic Aquarium and Institute for Exploration, Mystic
Dr. Laura B. Grabel, Dean of Natural Sciences and Mathematics,
Wesleyan University, Middletown
Dr. Orin Grossman, Acting Vice President for Academic Affairs,
Fairfield University, Fairfield
Dr. Thomas Haas, Dean of Academics,
U.S. Coast Guard Academy, New London
Dr. Herman Lujan, Chief Acad. Officer for Acad. Affairs and Research,
Connecticut State University System, Hartford
Dr. J. Gustave Speth, Dean of School of Forestry and Environ. Studies,
Yale University, New Haven
Dr. Marc Zimmer, Dean of Natural Sciences,
Connecticut College, New London
Dr. Anthony Calabrese, Director,
National Marine Fisheries Service Milford Laboratory, Milford *(ex officio)*
Mr. Arthur J. Rocque, Jr., Commissioner,
Connecticut Department of Environmental Protection, Hartford *(ex officio)*

CTSG Research Advisory Panel

Dr. Gaboury Benoit, Yale University
Dr. Jim Boyle, Western Connecticut State University
Dr. Hans Dam, University of Connecticut Avery Point Campus
Dr. Bruce Larson, University of Connecticut
Dr. Hans Laufer, University of Connecticut
Dr. Annelie Skoog, University of Connecticut Avery Point Campus
Dr. Scott Warren, Connecticut College

CTSG Extension/Stakeholders Advisory Panel

Pat Doyle, CT Maritime Coalition and Project Oceanology
Bill Gash, Executive Director, CT Maritime Coalition
Barbara Gordon, Executive Director, CT Seafood Council
Rick Kanter, Waterford-East Lyme Shellfish Commission
Alex Pesarik, Ella T. Grasso Vocational-Technical School
Judy Preston, Coastal Marine Conservation Director, The Nature Conservancy
Thaxter Tewksbury, Director, Project Oceanology
Mike Theiler, Jeanette T. Fisheries
Beth Troeger, Solomon Schechter Academy, New London
Bob Williams, Ledyard High School
Larry Williams, Jessie D., Inc. Milford, CT
Ralph Yulo, Eastern Connecticut State University