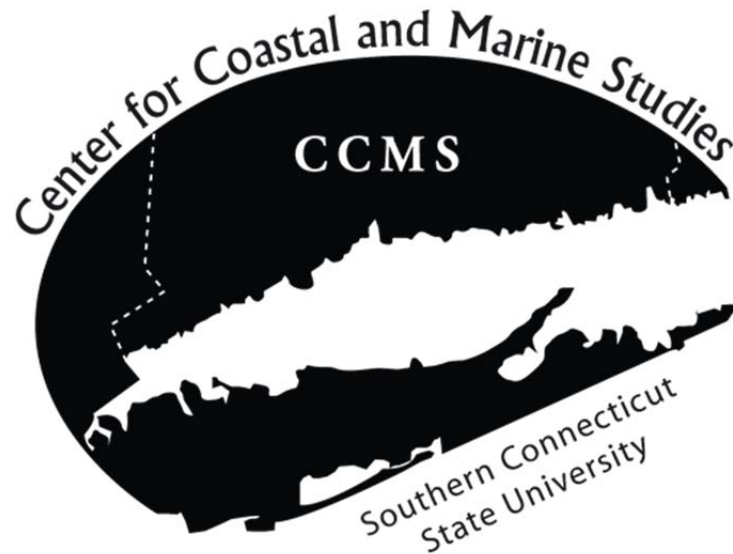


Southern Connecticut State University

Center for Coastal and Marine Studies



CCMS Annual Report 2009-2010

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Prepared for:

The Werth Family Foundation, Woodbridge, CT

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CCMS Annual Benchmark/Evaluation Report 2009-2010

Each year the participating faculty of the CCMS will prepare and submit to the Werth Family Foundation an annual report describing the Center activities. This report will be generated each year and will be made available in electronic and hard copy form. It will provide definitive information and detailed summaries of all yearly projects, events, activities, forums, and accomplishments conducted/achieved by the Center and its personnel. The CCMS Annual Report will be completed and submitted to the Werth Family Foundation during February of each year. Contents of the CCMS 2009-2010 Annual Report are described below.

I. Research Projects

Student and faculty research projects conducted each year are a central focus of the center. This year (2009-2010), CCMS participating faculty were involved in laboratory and field research programs involving ten undergraduate and graduate SCSU students. A complete description of 2009 initiated and ongoing research projects are described below.

US Department of Agriculture Grant 2008-2010

Principal Investigators:

Vincent Breslin, SCSU
James Tait, SCSU
Sean Grace, SCSU
Dwight Smith, SCSU

Clayton Penniman, CCSU
Jerry Jarrett, CCSU
James Boyle, WCSU
Suzanne O'Connell, Wesleyan
John Roy, Sound School, New Haven
Joseph Schnierlein, Norwalk Maritime Aquarium

The Eastern oyster (*Crassostrea virginica*) has played an important ecological, economic, and historical role in Connecticut's coastal waters. The shallow brackish waters of Connecticut's harbors historically provided ideal habitat for a thriving oyster industry. Until the mid 1990's, Connecticut's oyster industry represented over 90% of the entire northeast regional production and about 6% of the entire U.S. production of oysters. In spite of this historic prominence, current Eastern oyster production levels in Connecticut have been dramatically reduced over the past few years, resulting in a significant negative impact to the economy in this area and to its workers and communities.

The Center for Coastal and Marine Studies has drawn upon expertise within the Connecticut State University system and community stakeholders to examine the changes occurring in Long Island Sound which may affect the reestablishment and long-term viability of the Connecticut oyster industry. A primary objective of this research is to assess the extent and quality of current oyster habitat (particular emphasis on New Haven and Norwalk harbors, public and private leased beds) and to identify new (underutilized) areas along the CT coast that may also provide suitable oyster habitat. Results of this study will provide detailed environmental information on existing shellfish beds, identification of potential alternative shellfish locations, and results concerning how environmental changes occurring within Long Island Sound may impact the

future of the CT oyster fishery. High spatial resolution sampling of New Haven and Norwalk harbor sediments will provide detailed maps of sediment grain size and metal contamination in coastal harbors. Additionally, this study will determine if the commercially important eastern oyster exhibits variability in tissue metal concentrations and tissue pathologies that is consistent with the variability in sediment and water column metal concentrations associated with different watersheds and different locations (east-west) along the Connecticut coastline. Results of this study will be communicated to scientists, regulators, the commercial shellfish industry, university and K-12 students and the public. Results of this study will lead to specific recommendations to improve the recovery and long-term viability of Connecticut's shellfish industry.

Results to Date/Significance

The collaborative USDA Oyster Research grant was granted a one-year no-cost extension (scheduled to term August 31st, 2010) and CSU researchers continue to conduct laboratory and field activities and analyses in support of this research program. A mini-symposium was conducted at SCSU on October 19, 2009 to review and summarize the results to date for research activities in support of the USDA Oyster grant (See agenda below).

USDA Oyster Meeting Agenda, October 19th, 2009

Research Presentations

Vincent Breslin, Professor, SCSU, **Oyster Study Sediment Characteristics**

David Oshana, Graduate Student, SCSU, **Spatial Trends in Oyster Tissue Metal Concentrations**

Neil Geist, Graduate Student, SCSU, **Trends in Oyster Tissue Pathologies**

James Tait, Associate Professor, SCSU, **Synoptic Study of Benthic Sedimentary Habitats**

Rosemary Ostfeld, Student, Wesleyan Univ., **Side-Scan Survey of Long Island Sound**

Melissa Krisak, Student, SCSU, **Phytoplankton of LIS: What is in it for the Oysters?**

Steven Schmidt, Student, WCSU, **Relating Energy Inputs to the Severity of Hypoxia in Western Long Island Sound**

Michelle Allen-Masse, Student SCSU, **Oyster Ecology and Economics: Curricula Development and Education Outreach Programs**

We have also arranged to conduct a special session focused on Long Island Sound research at the Connecticut State University Faculty Research Conference scheduled for April 17, 2010 at Central Connecticut State University. At present, six faculty and student abstracts have been accepted for presentation at the conference.

A summary of the various research initiatives related to the Oyster grant and new research initiatives made possible by Werth Family Foundation support of CCMS are provided below.

Quantifying the Relationship between Metal Concentration, Grain Size, and Sediment Organic Content

Faculty Dr. James Tait
 Science Education and Environmental Studies, SCSU

Student Participant

Jeb Stevens, Geography Department, Undergraduate Student
(Currently a graduate student at University of Connecticut)

Project Description

Previous research has shown a direct correlation between heavy metal concentration and loss-on-ignition (LOI), a proxy for organic content, in sediment samples. It has also shown an inverse correlation to sediment grain size. It would be valuable to understand the expected relationship between metal concentrations and the two factors listed above so that the role of contaminant sources could be more clearly understood. If sediments in a particular locale are heavily contaminated, is it because of factors such as organic content and grain size, or might it be source proximity and rate of flux? Numerous samples from various locations along the Connecticut coast are being analyzed for metal concentration, LOI, and grain size. This data is to be subjected to multivariate correlation in order to quantify and explore this relationship. If good correlation is found, then outliers might be assumed to be source-related.

Results to Date/Significance

This research is still in the data gathering and early analysis stage. Loss-on-Ignition procedures have been run on hundreds of sediment samples with 3 replicates per sample. Recent acquisition of a Horiba LA-950 laser diffraction grain size analyzer, paid for with U.S.D.A. oyster grant money, has allowed us to begin detailed examination of grain size distribution. Heavy metal data for many of the samples to be used in both research projects have already been made available by Dr. Breslin's research group. Methods of analysis are being explored with the assistance of Dr. Ray Mugno, a statistician in Southern's mathematics department.

The results will increase the scientific understanding of the spatial controls on sediment metal contamination.

Characterization of Nearshore Benthic Habitats

Faculty Dr. James Tait
 Science Education and Environmental Studies, SCSU

Student Participant(s)

Jeb Stevens, Geography Department, Undergraduate Student
(Currently a graduate student at University of Connecticut)
Lucien Bouffard, Biology Department, Graduate Student
(Currently a graduate student at Yale University)

Project Description

Previous research has helped leverage a \$278,000 grant from the U.S. Department of Agriculture entitled Recovering the Economic Viability of the Connecticut Oyster Fishery. Faculty members of the Center for Coastal and Marine Studies along with affiliated faculty at other CSU campuses co-authored the proposal. An important aspect of the proposal is the characterization of the benthic habitat in areas where oysters are currently being raised and in areas that offer the potential for development of new beds. Two primary goals in habitat characterization are 1) is the sedimentary environment conducive to oyster populations, and 2) do the sediments have the potential for sequestering high concentrations of heavy metals that could enter the food chain via oyster bioaccumulation. Generally speaking, oysters prefer sandy bottoms (or accumulations of oyster shells) and heavy metals are preferentially sequestered in muds. Two methods are used in conducting benthic habitat surveys. One is grab sampling from a ship or boat and subsequent grain size analysis using laser diffraction, which allows for rapid analysis of numerous samples. The other is the use of side-scanning sonar and correlation of sonogram reflectivity with physical sediment samples obtained from the same area. Coarse-grained sediments are much more reflective, and fine-grained sediments are more absorbent, of the energy produced by the sonar. This difference is visually portrayed in the side scan record as variations in gray-scale.

Results to Date/Significance

Cruises were conducted in the summer of 2009 at Norwalk, Bridgeport, the Housatonic Estuary, and New Haven. Side-scanning sonar data and sediment samples were obtained at each location. The side scan data are being processed by a graduate student at Wesleyan. Sediment grain size analysis is being performed by students at Southern. Early results show a very good correlation between sedimentary provinces, defined using sediment samples and side scan, and contamination of the sediments by metals. Instead of knowing points at which sediments are contaminated regions of contaminated sediments can be identified using sediment maps and side scan mosaics. Such data should enhance state and industry ability to make management decisions for the oyster industry. These same maps can also be used by the state to identify potential sand sources for beach restoration projects.

Spatial Trends in Oyster Tissue Metal Contents in Long Island Sound

Faculty Dr. Vincent T. Breslin
 Science Education and Environmental Studies, SCSU

Student Participant(s)

Summer 2009

Karen Thomas, Undergraduate Student, Biology and Marine Studies
David Oshana, Graduate Student, Environmental Education

Fall 2009

Karen Thomas, Undergraduate Student, Biology and Marine Studies
Mary LaVallee, Undergraduate Student, Chemistry and Marine Studies

Spring 2010

Karen Thomas, Undergraduate Student, Biology and Marine Studies

Project Description

Metal concentrations in bottom sediments vary at different geographic locations in the Sound but the highest concentrations generally occur in the western end of the Sound and decline toward the east. Are there similar east-west trends in oyster tissue metal concentrations; are concentrations higher in the western end of the Sound and lower in the eastern end? Eastern oysters are excellent targets for measuring heavy metal concentrations since they are sessile, have an affinity for the most important pollutants and have high concentration factors (10^2 to 10^5) for metals. Although oysters are good integrators of sediment and water quality, there is no systematic statewide data set for Long Island Sound concerning heavy metal concentrations in oysters. This study seeks to determine if the commercially important eastern oyster exhibits tissue metal concentrations proportional to an east-west gradient in sediment and water column metal concentrations located in four different watersheds along the Connecticut coastline. Metal (Ag, Cd, Cu, Fe, As, and Zn) concentrations will be measured as body burdens from oysters sampled at six locations along the entire Connecticut coastline.

Results to date/Significance

Oysters (20 oysters per site) were collected from Norwalk harbor, Bridgeport harbor, three locations in the lower Housatonic River, New Haven harbor and Westbrook. The condition index of each oyster has been determined and the oyster tissues have been digested in acid for metal analysis. The students are in the process of analyzing metals in the oyster digests. Results of these analyses will be complete in May 2010 and used in the preparation of a M.S. Thesis

written by David Oshana. Results of this study, along with oyster pathology studies were recently presented in a poster presentation at the 30th Annual Milford Aquaculture Seminar, Shelton, CT.

Mercury in the Sediment and Oysters in the Housatonic River Estuary

Faculty Dr. Vincent T. Breslin
 Science Education and Environmental Studies, SCSU

Student Participant(s)

Summer 2009

Karen Thomas, Undergraduate Student, Biology and Marine Studies

Fall 2009

Karen Thomas, Undergraduate Student, Biology and Marine Studies
Mary LaVallee, Undergraduate Student, Chemistry and Marine Studies

Spring 2010

Mary LaVallee, Undergraduate Student, Chemistry and Marine Studies

Project Description

Bivalve mollusks (mussels and oysters) are used worldwide as indicators of metal pollution and are known to accumulate mercury in their tissues. The Housatonic River generates more than one-third of CT's seed oysters from its public oyster beds. Mercury contaminated sediment in the Housatonic River estuary poses a threat to the commercial oyster industry and quantifying the relationship between sediment and oyster tissue mercury contents is necessary for oyster habitat restoration efforts. This study examines the mercury concentration in surface sediment and corresponding oyster tissues in the Housatonic River estuary. The goal of this study will be to test the following hypotheses: (1) sediment mercury content will vary in proportion to sediment grain size and organic carbon content (Loss on Ignition) (2) the mercury content in oyster tissue will vary in direct proportion to the sediment mercury content at that location; and (3) oyster tissue mercury contents in lower Housatonic will, on average, be higher than other regional coastal estuaries.

Results to Date/Significance

Two pieces of equipment acquired during 2008, the Labconco Freeze Dryer and the Milestone DMA-80 Direct Mercury Analyzer, provided the analytical capabilities to conduct this study. Our laboratory has now developed the expertise to accurately and precisely measure mercury concentrations in marine sediment and biological tissues. Using the Milestone DMA-80 direct mercury analyzer and EPA Method 7473 we have achieved mercury measurements for National

Institute of Standards and Technology standard reference materials that show excellent agreement with certified mercury values. To date, we have completed the mercury analysis for oyster tissues collected from three locations (Sites 1, 2 and 3) in the lower Housatonic River on three separate occasions (November 2008, June 2009 and October 2009). Oyster tissue mercury was also determined for oysters sampled from New Haven harbor and Westbrook harbor in November 2008. Oyster tissue mercury concentrations have ranged from $(0.11 \pm 0.01$ to 0.17 ± 0.03 mg/kg dry weight for New Haven lot 72S and Westbrook Town Lease #1 oyster tissues, respectively). Expertise gained from developing mercury techniques led to the development and submission of a separate proposal for funding to measure mercury concentrations in Long Island Sound bluefish for the summer 2010.

Sediment Metal Contamination in the Thames River and New London Harbor Complex

Faculty Dr. Vincent T. Breslin
 Science Education and Environmental Studies, SCSU

Student Participant(s)

Summer 2009

Amanda Lee, Honors College and Marine Studies

Fall 2009

Amanda Lee, Honors College and Marine Studies
Ihueabu Onyekachi, Undergraduate Student, Geography

Spring 2010

Ihueabu Onyekachi, Undergraduate Student, Geography

Project Description

New London harbor is the best natural deepwater harbor in CT. The port area comprises the lower 12 miles of the Thames River and includes the city of New London and the towns of Groton, Ledyard and Preston. The Thames river watershed, and the area immediately surrounding New London harbor, have been historically characterized by industrial activity and are urbanized. Previous studies have been inadequate to describe the extent of sediment metal contamination and the spatial variation in sediment types within the river and harbor. This study examines the physical characteristics and metal contamination in sediments within the Thames River/New London harbor complex. The specific objectives of this research are to: (1) conduct a high spatial resolution sampling of the sediment representative of the entire length of the river and harbor areas; (2) measure the chemical (zinc, copper, manganese and iron) and physical (texture, grain size, loss on ignition) properties of the sediment; and (3) determine the extent of anthropogenic metal contamination in the sediment through a comparison of the results of this study with other similar coastal rivers and embayments in Long Island Sound.

Results to date/Significance

Sediment samples from throughout the Thames River-New London harbor were collected aboard the R/V *Lowell Weicker* on June 4, 2009. Measurements of the sediment physical and chemical properties have been completed and the results of these measurements are being used to prepare an undergraduate student Honors Thesis. Amanda Lee, an undergraduate student will complete her Honors Thesis in Spring 2009 in Marine Studies. Results of the study are also included in interactive GIS maps of the river/harbor complex currently under development by an undergraduate Geography student. Results show that sediment copper concentrations in the river/harbor complex range from 3.2 ± 0.70 to 252 ± 59 mg/kg and are correlated with sediment organic matter content (LOI).

Lipofuscin concentrations at varying temperatures in the American Lobster

Faculty Dr. Sean Grace
 Biology, SCSU

Student Participant(s)

Summer 2009

Bethann Balazsi, Biology, Graduate Student
Callie Gecewicz, Biology, Graduate Student (Fall 2009, Spring 2010)
Dana Pietrosimone, Biology, Graduate Student
Sarah Delvichio, Biology, Undergraduate Student
Joseph Dizenzo, Biology, Undergraduate Student (Spring 2010)

Project Description

Research was completed to determine the age of American lobster (*Homarus americanus*) in the Gulf of Maine (GOM) from multiple orbital carapace lengths (mm). The purpose was to document the age and levels of the aging pigment lipofuscin in lobsters from the GOM. It also will aid in the management of this resource. Recent studies on western rock lobster (*Panulirus cygnus*) indicate that the aging technique proposed in this research would allow independent assessment of population parameter estimates and has shown that most juvenile lobsters are 3-5 years old immediately prior to recruitment (Sheehy 1998). Another study on the European lobster (*Homarus gammarus*) yielded reproducible catch age structures with year-class resolution. In addition, a recent study performed on the European Lobster demonstrated that lipofuscin quantification produced more accurate estimates of age in the species than carapace length (Huglem *et. al.* 2005). This finding has important implications for stock assessments that employ traditional models which include age as an input parameter (Sheehy 1996). We are on our second year of data collection to determine if lipofuscin concentrations change with season and between years.

We have finished our last year of data collection and are beginning our analysis of the complete data set. This is a 3 year grant funded by the State of Maine, Department of Marine Resources.

Results thus far demonstrate no difference in lipofuscin concentrations between sexes within a size class of lobsters. In addition, preliminary analysis demonstrates that temperature does not effect lipofuscin concentration, contrary to present limited literature, in the American lobster.

Results to date/Significance

All brains have been processed, cleared and fixed. Each brain has had five sections image analyzed via ImageSharp software and NIH Image. We are in the process of completing this project and anticipate in total at least two manuscripts. Each of these sections quantify the percent of the olfactory lobe cell mass occupied by lipofuscin, the density of lipofuscin granules in the olfactory lobe cell mass, and the mean diameter of the lipofuscin granules. Data collected with this research is being compared to data collected on known-age lobsters by the Connecticut State Department of Environmental Protection. This comparison will help to delineate the potential age classes of the lobsters collected.

An Examination of Phytoplankton Abundance and Diversity with Relation to Physical Factors in Long Island Sound

Faculty Dr. Sean Grace
 Biology, SCSU

Student Participant(s)

Summer 2009

Melissa Krisak, Graduate Student, Biology

Project Description

Little is known about the effects of physical factors on phytoplankton in Long Island Sound. The purpose was to examine factors that relate to abundance and diversity of phytoplankton, including the effects of site, season, temperature, turbidity and salinity. Abundance and diversity was determined from plankton tow samples, which was examined via microscopy in order to characterize phytoplankton. Other instruments utilized on site were Hobo temperature recorders, a refractometer, and secchi disk. Further phytoplankton abundance analysis took place through the use of flow cytometry from niskin sample collections at the National Marine Fisheries Lab in Milford, CT. Glycogen analysis of oyster tissue was carried out to determine the effect of phytoplankton abundance as an available energy source. The effects of season and site will be examined with a 2-factor ANOVA, where independent variables equal season and site and the dependant variable is abundance of phytoplankton. The effects of temperature, turbidity and salinity on phytoplankton abundance will be examined with Pearson and/or Spearman correlations. If a relationship is found, a parametric ANOVA will be used to examine the effects of each variable on phytoplankton abundance.

Results to date/Significance

Oysters are selective in their feeding, preferring particles, including phytoplankton, that are between 3 and 20 micrometers. The plankton tow and niskin samples and analysis illustrate the diversity and abundance of phytoplankton available for oysters in Long Island Sound throughout the year. All plankton tows have been completed at each site, where turbidity, salinity, and temperature were recorded. Plankton samples have been filtered and ten samples have been analyzed for diversity and abundance thus far. Cement blocks with hobo temperature loggers continue to be deployed and collected from the sampling sites when necessary. Fall plankton samples collected via niskin bottle have been analyzed with the flow cytometer. Currently, spring 2010 samples are being collected, along with temperature and salinity data, and will be analyzed via flow cytometer for particle size and abundance. Some oyster tissue has been collected and dissected and the processing for glycogen analysis has begun. The oyster tissue glycogen analyses show the amount of energy present after the fall bloom, which is an indication of the stored energy available for oyster through the winter.

Behaviors and Behavioral Ecology of the Monk Parakeet in Connecticut: Constructing an Ethogram and Ecology for this Species

Faculty Dwight Smith
Biology, SCSU

Student Participant(s) **Summer 2009**

Tania Hussein, Undergraduate Student, Biology
Donna Rose Smith, Undergraduate Student, Biology

Fall 2009

Tania Hussain, Undergraduate Student, Biology

Spring 2010

Rebecca Hart, Undergraduate Student, Biology
Joceylyn Hallet, Undergraduate Student, Biology

Project Description

Monk Parakeet research has continued during the year on a variety of subjects. First, we have continued and extended our study of movement behaviors, movement distance, and movement purpose from nest sites to feeding sites at Hammonasset Beach State Park in Madison, Connecticut. This site was chosen because of its openness and ease of following the individual parakeets on their foraging rounds and sometimes over considerable distances. This work is fundamental to our framed goal of understanding biology and ecological dynamics of an invasive species, the monk parakeet in Connecticut and elsewhere in the Northeast. Second, we have continued to analyze the data we have collected over the past 4 years in the preparation of

publications. While some have already appeared in print and have been included in previous reports we attach a new manuscript which has been submitted for publication entitled “Nest building of introduced monk parakeets (*Myiopsitta monachus monachus*) in Connecticut, United States.”

Results to date/Significance

Data was collected via direct surveillance using snapshot focal sampling regimen to obtain an unbiased estimate of time activity behaviors and the frequency of these behaviors. We also used video photography to photo document both frequency and details of behaviors. By the end of the summer study we accumulated a film library consisting of hundreds of hours of monk parakeet activities filmed at all times of day and under all weather conditions. Our current focus is to digitize these video clips to permit detailed analysis and reconstruction of each behavior. These can then be reviewed and summarized to provide an accurate baseline model of the timing, sequence, and architecture of each behavior in the explicit context (e.g., time of day, biotic and abiotic components) and purpose associated with each behavior. This information is being used to construct the first ethogram (a catalog of behaviors) for this species. It is anticipated that the completed catalog will serve as the standard reference dictionary for this species and provide the reference base for all future studies of monk parakeets.

Oyster Education Outreach: Curricula Development

Faculty Dwight Smith
 Biology, SCSU

Student Participant(s) **Summer 2009**

Michele Allen, Graduate Student, Biology
Erin Pinsince, Undergraduate Student, Biology

Project Description

While most think of oysters as succulent components in delicious seafood meals, the oyster is also extremely important to our ecosystem. Due to their enormous water filtering capabilities, oysters maintain healthier water ecosystems. Oysters provide shelter for marine organisms, enriching the diversity of biota in a given water system. Also, oysters play a vital economic role in the region by providing fishery and food source for humans. Connecticut’s native oyster, *Crassostrea virginica*, often called the Eastern, American, or Atlantic oyster, played an important economic role in Connecticut’s past as a lucrative export product. Oysters were once so abundant that millions of bushels of oysters needed to be harvested each year to maintain market numbers. Today, only about 1% remains due to overfishing, increased water pollutants, and oyster diseases, some introduced by human transport and disruption of the oyster’s marine habitat. The goal of this project will be to develop curriculum materials, linked to Connecticut education standards and learning outcomes, concerning the environmental, social and economic importance of the eastern oyster.

II. Center-Directed/Sponsored Seminars

A goal of the Center is to conduct interactive faculty/student research and educational outreach programs that elucidate findings and provide public education on Long Island Sound and environs at all levels, including public schools, parochial schools, communities, and governmental agencies. As such, the Center sponsors an annual seminar series in the spring of each year. Center faculty invited four regional experts during the Spring 2009 to discuss topics concerning the health and quality of Long Island Sound and its environs as part of the **Sixth Annual Seminar Series on Environmental Issues of Long Island Sound 2009**. Partial support for the seminar series was provided by a \$2,000 SCSU Faculty Development Grant awarded to Drs. Breslin, Tait and Smith.

The seminar series was comprised of four separate one-hour seminars by invited experts on Long Island Sound environmental issues during the Spring 2009 semester. The list of speakers and topics is given below. A number of faculty teaching marine science, marine biology, geography, zoology, environmental science and earth science courses during the Spring 2009 semester attended and encouraged their students to attend the seminar series.

Date	Seminar	Attendance
3/11/09	Climate Change, Sea Level Rise, and Storm Surge Scenarios for Long Island David Major, Goddard Institute for Space Studies, NY	35

The Nature Conservancy is studying the potential impacts of sea level rise and storm surge on coastal Long Island. The initial studies have focused on southern Long Island and focus on adaptation to rising sea level rather than mitigation. The Columbia Center for Climate Systems Research has provided sea level and storm surge scenarios for this study. Global Climate Models project sea level rise ranging from an additional 10 cm in 2020 to 40 cm in 2080 given current IPCC projected global temperature increases. More rapid ice sheet melting could significantly increase the projected sea level increases. Storm surges are also likely to increase in the future adding to the frequency and severity of coastal flooding. Some possible adaptations to more severe coastal flooding include the relocation of key infrastructure and facilities; the construction of flood walls and the retreat from coastal lands through zoning and insurance pricing changes.

3/18/09	Mercury in Estuarine Fishes of Rhode Island David L. Taylor, Roger Williams University, RI	26
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Mercury (Hg) is one of the most widespread and toxic environmental contaminants that adversely affect human health, and exposure occurs principally through the consumption of contaminated fish and shellfish. The following investigation analyzed total Hg concentration in the tissue of bluefish (*Pomatomus saltatrix*), a premier recreational finfish in southern New England. In June-August 2006, bluefish were collected from Narragansett Bay, Rhode Island, using otter trawls, beach seines, and rod & reel. The total Hg concentration of juvenile and adult

bluefish increased significantly with increasing fish size and age. Moreover, rates of Hg bioaccumulation were greater in bluefish relative to other recreational finfish collected from Narragansett Bay (e.g., striped bass *Morone saxatilis*, summer flounder *Paralichthys dentatus*, and tautog *Tautoga onitis*), which is attributed to the feeding ecology of bluefish and their higher trophic level status in the estuarine system. Relative to other targeted finfish, however, bluefish may pose a lower risk to human health because limited fishing regulations for this species enable anglers to catch and consume smaller and younger individuals.

4/1/09 The Influence of Nutrients and Climate on the Dynamics 39
and Toxicity of *Alexandrium fundyense* Blooms in Long
Island Sound Embayments
Christopher J. Gobler, SOMAS, SUNY at Stony Brook, NY

Dr. Gobler's research provides insights into the development and dynamics of red tides, a serious, emerging human health threat in Long Island Sound. Paralytic shellfish poisoning is caused by the ingestion by shellfish of certain strains of algae which produce saxitoxin. Shellfish accumulate this toxin and can, when these contaminated shellfish are consumed by humans or a predator, cause sickness or even death. *Alexandrium fundyense* is the saxitoxin-producing plankton in the coastal waters of Long Island Sound. In recent years there have been widespread commercial and recreational closures of shellfisheries resulting from outbreaks of this organism. The research seeks to establish spatial and temporal patterns for the distribution of this organism and its cysts in relation to temperature, nutrients, and other components of the planktonic community. This research gives fisheries managers and local health departments the essential information they need to protect human health and sustain healthy ecosystems and local economies.

4/29/09 Changes in Species Abundance in Long Island Sound Due 34
to Climate Change
Penny Howell, CT Dept. of Environmental Protection

The CT DEP Long Island Sound Trawl Survey abundance indices, generated annually since 1984, indicate compositional changes among species of fish and invertebrates commonly taken in the trawl. Although the overall abundance and diversity of the Sound has been relatively stable for at least two decades, the species composition and seasonal distribution are changing dramatically. Water temperature records since 1976 show that both winter and summer water temperatures have increased significantly. Significant negative correlations were found between rising bottom water temperatures and the abundance of cold temperate species such as the American lobster and winter flounder. Rising water temperatures also may have contributed to significant increases in the occurrence of warm temperate species in the Sound (summer flounder, striped bass).

Attendance: Attendance was determined using a sign-in sheet, in addition to which, the faculty sponsors counted the attendees during each seminar, noting the names and number of faculty in attendance.

III. Collaborations and Partnerships

As part of our continuing efforts to strive for excellence in research and public education and outreach the Center will focus on establishing working relationships with different local, state, and federal groups and agencies that share this common interest and focus. Each year, the Center provides information concerning the number and nature of collaborations established. Examples of on-going Center partnerships include:

The CSU Oyster Research Project: U.S.D.A. funding received by Drs. Breslin, Tait, Grace and Smith for oyster research has allowed us to: (1) initiate a collaborative, multidisciplinary laboratory and field-based research program with faculty from CCSU, WCSU, and Wesleyan University, as well as drawing upon the expertise of community stakeholders; (2) create sustainable education, research and outreach projects at the participating CSU campuses, the Sound School, Schooner Inc., and the Maritime Aquarium at Norwalk; and (3) produce data and analyses that will provide the foundation for a recovery plan the Connecticut oyster fishery.

Department of Earth and Environmental Sciences, Wesleyan University: Dr. Tait has established research collaborations with Dr. Suzanne O'Connell and Dr. Johan Varekamp focused on salt marsh dynamics, coastal erosion, and marine sedimentation. He has also served as a thesis advisor to Tracy Krueger, a master's student, who studied erosional processes at Griswold Point in Old Lyme.

Department of Natural Resources, State of Maine, Boothbay Harbor: Dr. Grace has had an ongoing relationship with this marine center for the lobster aging study for the past 4 years. This center provides the laboratory space and equipment needed for the dissection of lobster brains in support of the grant awarded to Dr. Grace. See for reference:
<http://www.maine.gov/dmr/index.htm>.

Department of Biology, University of Maine, Machias: Dr. Grace has recently collaborated with Dr. Brian Beals, professor in the biology department at the University of Maine at Machias. Specifically, Dr. Beals has provided Dr. Grace and the center with known age lobsters that have been held in cages along the coast of Maine representing varying temperature regimes. These lobsters will be used to examine the question of how do lipofuscin concentrations differ in known age animals raised at different temperatures. See for reference:
<http://www.umm.maine.edu/>.

IV. Community Outreach, Education, and Research Communication

A continuing goal of the Center is to establish and maintain a variety of community outreach programs that include educational activities at many levels, as appropriate. An important function of the Center will be to prepare and distribute educational materials, including new curriculum, that focus on the importance of Long Island Sound and environs. Communication of research results will be an important role for this Center. It is an expectation that all participating faculty and students will communicate the results of their research to the scientific community, appropriate government agencies and the local community. A list of 2009-2010 research presentations is listed below:

Presentations

Ramirez, C. R., D. G. Smith, and M. L. Masse-Allen. Fighting cholera with an endemic plant from El Salvador: *Aristolochia salvadorensis* (Aristolochiaceae): a potential gift to the world. Connecticut State University Faculty Research Conference, Southern Connecticut State University, Adanti Student Center, April 4th, 2009.

Ramirez, C. R., D. G. Smith, and M. L. Masse-Allen. Food from the ancient Maya: *Brosimum alicastrum* (Moraceae), the Maya Nut or the Corn Tree is the food to fight malnutrition in Mesoamerica. Connecticut State University Faculty Research Conference, Southern Connecticut State University, Adanti Student Center, April 4th, 2009.

Ramirez, C. R., D. G. Smith, and M. L. Masse-Allen. Biology of the Monk Parakeet in CT and NY: a bird with many friends and foes. Connecticut State University Faculty Research Conference, Southern Connecticut State University, Adanti Student Center, April 4th, 2009.

Bethann Balazsi and Sean Grace. 2009. (Poster). Attachment Strength in Numbers: of the Northern Kelp *Laminaria saccharina*. 38th Annual Benthic Ecology Meeting, Corpus Christi, Texas, March 5, 2009.

Melissa Krisak and Sean Grace. 2009. (Poster). Physical factors and their effects on phytoplankton populations in Long Island Sound. 38th Annual Benthic Ecology Meeting, Corpus Christi, Texas, March 5, 2009.

Callie Gecewicz and Sean Grace. 2009. (Poster). Lipofuscin concentrations in known age juvenile in the American lobster *Homarus americanus*. 38th Annual Benthic Ecology Meeting, Corpus Christi, Texas, March 5, 2009.

Geist, G. N., D. Oshana, I. Sunila and V.T. Breslin. 2010. (Poster) Prevalence of Disease, Groeth Abnormalities and Tissue Metal Contents in Eastern Oysters Along the Connecticut Coastline. 30th Milford Aquaculture Seminar, Courtyard by Marriott, Shelton, CT. February, 8-10, 2010.

Breslin, V.T. 2009. Metal Contamination in Connecticut Harbors: Does it Harm Marine Organisms? Western Connecticut State University, Department of Biology and Environmental Studies, Wednesday April 22, 2009.

Conklin, J and V.T. Breslin. 2009. (Poster) Metal Concentrations in the Sediment of the Lower Housatonic River. 30th Milford Aquaculture Seminar, Courtyard by Marriott, Shelton, CT. February, 8-10, 2010.

Church, V.M.E. and V.T. Breslin. 2009. (Poster) A Comparison Study of Sediment Metal Contamination in Clinton and Milford Harbors. Connecticut State University Faculty Research Conference, Southern Connecticut State University, Adanti Student Center, April 4th, 2009.

Conklin, J and V.T. Breslin. 2009. (Poster) Metal Concentrations in the Sediment of the Lower Housatonic River. Connecticut State University Faculty Research Conference, Southern Connecticut State University, Adanti Student Center, April 4th, 2009.

Publications

Smith, D.G. and T. Bosakowski. 2010. Raptors of the Northeast. Coachwhip Publications. Landisville, Pennsylvania. 210 pages.

Smith, D.G., and Ray Delehant. (In Press). Here, Now, and Future for Global Warming Publishing. Connecticut Journal of Science Education.

Masse-Allen, Michelle, and D. G. Smith. (In Press). Long Island Sound Curricula: Multiple opportunities for student activities. Connecticut Journal of Science Education.

Participation

Breslin, V.T. (**Invited**). Creating Interdisciplinary STEM Projects: A SENCER Model Course Approach. Creating Interdisciplinary STEM Projects Faculty Workshop, CUNY College of Technology, Brooklyn, NY. December 4, 2009.

Breslin, V.T. (**Invited**). Designing Effective Collaborations for Achieving Research Goals. Faculty Senate Colloquium: The Role of Research and Creative Activity at Southern. SCSU Engleman Hall A 120. November 13, 2009

Breslin, V.T. (**Invited**). Recovering the Economic Viability of the Connecticut Oyster Industry: A Research and Education Collaboration. An Evening of Oysters, Schooner Inc., Sage American Grill, New Haven, CT. November 4, 2009.

Breslin, V.T. (**Invited**). Milford Point Ecosystem Science Advisory Committee. May 28, 2009, Connecticut Audubon Coastal Center, Milford, CT.

Tait, J. (**Keynote Speaker**). Water, Water Everywhere: Connections for Research, Education, and Outreach; April 4, 2009; Rutgers University.

Tait, J. (**Invited**) Meeting the Challenges of Great Lakes Stewardship: SENCER Approaches; March 27 – 28, 2009; Cleveland, Ohio.

Student Theses and Reports/Advisors

Amanda Lee, Honors Thesis, Marine Studies (Advisor: Breslin)

Sediment Metal Contamination in the Thames River and New London Harbor. May 2010

Callie Gecewicz, Masters Thesis, Biology (Advisor: Grace)

Lipofuscin concentrations in known age juvenile in the American lobster *Homarus americanus*. (Expected Summer 2010)

Melissa Krisak, Masters Thesis, Biology (Advisor: Grace)

Physical factors and their effects on phytoplankton populations in Long Island Sound. (Expected Summer 2010)

Neil Geist, Masters Thesis, Environmental Education. (Advisor: Breslin)

Incidence of Disease and Growth Abnormalities in Eastern Oysters (*Crassostrea virginica*) vs. Incidence of Heavy Metal Tissue Content from Three Sites in Long Island Sound. May 2010.

David Oshana, Masters Thesis, Environmental Education. (Advisor: Breslin)

Spatial Trends in Eastern Oyster (*Crassostrea virginica*) Tissue Metal Concentrations in Long Island Sound. May 2010.

V. CCMS Website Development

As part of our continuing research and public outreach efforts, the Center has developed and will maintain an internet website. The CCMS website is currently located at <http://www.southernct.edu/departments/ccms/index.html>. The website continues to be upgraded and expanded to provide a vehicle for communication and information to all interested parties. In addition to contact information, the website will provide a resume of the Center's goals/aims, foundation, research and ongoing activities.

VI. Accounting, Budget Expenditures and Grant Writing

Academic Year 2009-2010 Itemized Budget Justification

Funds totaling \$30,600 were requested for Year 4 to support the research and educational mission of the Center (see attached budget spreadsheet). Three columns are shown in the budget sheet showing the Werth Foundation request, the Werth Foundation Fund Disbursement (how dollars were actually spent) and the SCSU Matching Funds (dollars committed by the University or obtained from other sources).

Professional Salaries

Werth Foundation funds were used in support of salaries for faculty mentoring students during the Summer and Fall 2009 (\$2,000). Professor Raymond Mugno, Mathematics, was contracted for \$500 to provide expertise with statistical analyses for data sets concerning metal contents in oyster tissues sampled from Long Island Sound harbors. Professor Dwight Smith received \$1,500 salary in support of summer research concerning monk parakeet and oyster outreach studies. In addition, the CCMS will contract a web designer (\$1,000; Janet Colandrea) to update and maintain the CCMS website. The website is an important component of our education and outreach activities. The SCSU Dean of Arts & Sciences provided faculty reassigned time (3 credits time each for Breslin and Tait) in support of managing the CCMS activities and programs. The reassigned time allow faculty a lesser teaching credit load and the 6 credits time are valued at \$10,384.

Student Research Fellowships

A major portion of the Center budget consists of funds in support of undergraduate and graduate student summer research stipends. A major goal of the Center is to increase undergraduate student participation in the processes of “doing science” through participation in faculty guided research projects. The CCMS awarded fellowships during Summer 2009 (7 students; \$9,200), Fall 2009 (7 students; \$4,750) and Spring 2010 (8 students; \$6,000). Fellowship amounts per student ranged from \$250-\$2,000 per semester (25-200 hours @ \$10/hour). The CCMS has a system-wide mission to support student research. Once again CCMS funds were used to support an undergraduate student under the supervision of Dr. James Boyle, Western Connecticut State University. This past year, the CCMS supported 16 different students in six different academic fields (Biology, Chemistry, Marine Studies, Geography, Meteorology, Honors) in support of faculty-directed research projects during this past year totaling \$19,950.

Travel Funds

Travel funds totaling \$2,000 were budgeted to reimburse costs associated with travel in support of field sampling activities and attendance at local, regional and national scientific meetings. Students and faculty completing their research projects are expected to give talks or poster presentations at scientific meetings. Travel funds (\$408) were used in support of student and faculty travel to field sites in support of their respective research projects.

Permanent Equipment

Werth Foundation funds were not budgeted for this past year for permanent equipment in support of faculty and student research projects. No major permanent equipment purchases were made using Werth Family Foundation funds allocated in 2009-2010.

Ship Time

Funds for chartering ship time were budgeted (\$6,000) to provide access to field sample sites for research and education along the Connecticut shoreline and in Long Island Sound. During the past year CCMS researchers chartered ship time totaling \$5,152 with the following organizations: The Sound School (R/V *Island Rover*; \$600), Cedar Island Marina, Clinton (small boats; \$700), Norwalk Maritime Aquarium (R/V *Oceanic*; \$2,277), Project Oceanology (small boats; \$875), and UCONN Avery Point (R/V *Lowell Weicker*; \$700).

Publication Costs

A total of \$1,000 was budgeted for publication costs for FY 2009-2010. Publication costs were re-budgeted to cover additional expenditures for undergraduate student fellowships.

Expendable Supplies

Funds for laboratory and office supplies (\$1,000) were budgeted to allow the purchase of materials in support of the CCMS research and educational initiatives. Supply funds were used to purchase laboratory chemicals and supplies for the sediment metals research and laboratory supplies and field supplies for the sediment grain size research (\$1,357).

Balance of Funds

We are in the process of distributing the remaining Werth Family Foundation unencumbered funds (\$1,484). A portion of the funds will be used to purchase additional laboratory and office supplies. The vast majority of the remaining funds will be used to contract a web designer (\$1,000; Janet Colandrea) to update and maintain the CCMS website.

Matching Funds

Each of the grant awards listed have been used in support of CCMS research and education activities.

Connecticut State University Research Grant Award 2009

Principal Investigator: Vincent T. Breslin

Project Title: Mercury in the Sediment and Oysters in the Housatonic River Estuary

Award Amount: \$4,400

Connecticut State University Research Grant Award 2009

Principal Investigator: James Tait

Project Title: Synoptic Reconnaissance of Bottom Sediments in the Housatonic Estuary and
Bridgeport Harbor

Award Amount: \$4,700

SCSU Faculty Development Grant 2009

Co-Authors: James Tait, Vincent Breslin, Dwight Smith

Title: Sixth Annual Seminar Series on Environmental Issues in Long Island Sound

Award Amount: \$ 2,000

US Department of Agriculture Grant 2009-2010; One Year No Cost Extension

Recovering the Economic Viability of the Connecticut Oyster Industry: A Research and Education Collaboration. US Department of Agriculture, Cooperative State Research, Education, and Extension Service. V.T. Breslin, D. Smith, J. Tait and S. Grace. Project Duration: September 2008-August 2009. Total Funds \$278,819.