Southern Connecticut State University

Center for Coastal and Marine Studies

CCMS Annual Report 2008-2009

Prepared by:

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Prepared for:

The Werth Family Foundation
Woodbridge, CT

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CCMS Annual Benchmark/Evaluation Report 2008-2009

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 2008-2009 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 (2008-2009), CCMS participating faculty were involved in laboratory and field research programs involving ten undergraduate and graduate SCSU students. A complete description of 2008 initiated and ongoing research projects are described below.

US Department of Agriculture Grant 2008-2009

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 will draw upon expertise within the Connecticut State University system and community stakeholders to undertake a study 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 tissue metal concentrations and tissue pathologies proportional to an east-west gradient in sediment and water column metal concentrations located in four different watersheds 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.

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

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

Student Participant(s)

Jeb Stevens, Geography Department, Undergraduate Student

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 in the data gathering and early analysis stage. Loss-on-Ignition procedures have been run on 200 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.

The significance of the results should be an enhanced ability for the State of Connecticut to manage coastal water resources, and a better understanding of the controls on the spatial distribution of heavy metals in coastal Connecticut's waterways.

Characterization of Nearshore Benthic Habitats

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

Student Participant(s)

Jeb Stevens, Geography Department, Undergraduate Student

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 were 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. On 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 have been planned for the spring and summer of 2009. During cruises, side-scanning sonar records will be obtained and processes by a graduate student at Wesleyan University. These will be compared with grain size data acquired along the cruise track. Geospatially referenced maps of the benthic environment will be generated and made available. Such data should enhance state and industry ability to make management decisions for the oyster industry. Incidentally, maps of nearshore sediment grain size will also enable the state to identify potential sand sources for beach erosion/restoration projects.

A Comparative Study of Sediment Metal Contamination in Clinton and Milford Harbors

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

Student Participant(s)

Summer 2008

Victoria Church, Undergraduate Student
Karen Thomas, Undergraduate Student
David Oshana, Graduate Student

Project Description

Limited sampling by other investigators shows that WLIS harbors generally have higher sediment contamination than the ELIS harbors. This study will further examine the west to east trend in sediment metal contamination in LIS. Two harbors have been selected for comparison: Milford harbor located in WLIS and Clinton harbor in ELIS. A determination of sediment metal contamination in these harbors will further test the hypothesis that WLIS harbors are more contaminated than ELIS harbors.

The objective of this study is to conduct a high spatial resolution sampling of Clinton and Milford harbors and their tributary rivers, to determine levels of sediment metal contamination. This study will examine the sediment composition and physical characteristics (grain size, and loss on ignition) at representative points in each harbor. This study will also analyze the sediment for metals including iron, copper, zinc, manganese, and mercury. Results of this study will be compared to the results which have been found in previous studies. Sediment metals will be compared to their respective crustal abundances to determine the extent of contamination due to anthropogenic discharges. The sediment metal concentrations will be compared to previously published sediment quality guidelines to determine if sediment metal concentrations are causing harm to living marine resources.

Results to date/Significance

Sediment samples were collected from 12 stations in Milford harbor and 12 stations in Clinton harbor during the Summer 2008. These sediment samples have been examined for physical characteristics (predominant grain size, LOI) and digested for metal analyses. Victoria Church is in the final stages of data analyses and will complete her Honors Thesis in May 2009.

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 2008

Victoria Church, Undergraduate Student
Karen Thomas, Undergraduate Student
David Oshana, Graduate Student

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 2009 and used in the preparation of a M.S. Thesis written by David Oshana.

Surface Water Energy Budget for the Norwalk Harbor Area

Faculty Dr. James Boyle
Physics, Astronomy and Meteorology
Western Connecticut State University

Participating Student

Fall 2008 and Spring 2009

Steven Raymond Schmidt, Undergraduate Student
Western Connecticut State University

Project Description

Hypoxia, low levels of dissolved oxygen in the water column, may negatively influence the oyster population in LIS by limiting or degrading habitat and affecting larvae survival. A critical factor influencing the duration and extent of hypoxic conditions is that atmospheric oxygen in the surface water is inhibited from penetrating to the bottom because the surface waters are warmer (less dense) during the summer months -- approximately June through September. This summertime water column stratification is caused by large energy inputs through the surface combined with a reduction in wind-induced mixing. Solar energy onto LIS is the primary cause of warmer surface waters.

To support water quality and surface energy budget characterization in the Norwalk Harbor region, the proposed project will include establishment of a radiation monitoring station in the Norwalk Harbor region.

To supplement the existing energy budget monitoring program and provide specific information relevant to the Norwalk Harbor region, a suite of radiometers (pyranometer, pyroheliometer and pyrgeometer) with a solar tracker will be place on a convenient rooftop near Norwalk Harbor. Use of a fixed solar tracker system allows derivation of all-sky cloud fraction (Long and Ackerman, 2000) to characterize cloudiness in addition to solar energy input. The amount of solar radiation penetrating into the water will be estimated using the method of Payne (Payne, 1972).

With the assistance of an undergraduate student researcher, data will be logged and processed on-site, then made available to researchers and the public. Data analysis will include assessing the strength of the correlation between solar energy inputs and the near surface/subsurface water temperature difference at the Norwalk Harbor and western MYSOUND buoy locations.

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

Faculty Dwight Smith
Biology, SCSU

Student Participant(s)

Summer 2008

Erin Pinsince, Undergraduate Student
Tania Hussein, Undergraduate Student
Ashleigh Hines-Rundstrom, Undergraduate Student

Project Description

Summer 2008 project was a continuation of our long-term studies of the monk parakeet as an urban species in shoreline towns of Connecticut. The specific focus of this study was a comprehensive documentation of the behavior of this species in the urban habitat. Aspects of this study included (1) identifying and in some cases naming different behaviors (2) describing each of the identified behaviors in detail to provide a comprehensive catalog/dictionary/glossary of these behaviors that might serve as a baseline for all future studies of this species in North America and elsewhere across the globe and (3) obtaining a time activity budget of this species in terms of its changing behavioral activities throughout a diel period of time (4) document behaviors associated with different daily activities such as nest building and maintenance, foraging, care of the young, and interactions with other species. The last is of considerable importance because the monk parakeet has been criticized because of its role as a competitor of other urban wildlife species.

Results to date/Significance

Data was collected via direct surveillance using snapshot focal sampling regimens 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.

Lipofuscin concentrations at varying temperatures in the American Lobster

Faculty Dr. Sean Grace
Biology, SCSU

Student Participant (s)

Summer 2008

Kristina Clark, Biology, Undergraduate
Bethann Balazsi, Biology, Graduate

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 are on our third year of data collection to determine if lipofuscin concentrations change with season and between years. 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.

Results to date/Significance

We are in the process of completing this project and anticipate in total at least two manuscript. In short, we have continued isolating tissue samples from the esophageal ganglia of Gulf of Maine lobsters. 204 lobsters were collected for us from the Gulf of Maine by the Maine Department of Marine Resources. Laboratory processing, clearing and fixing of tissues, and confocal microscopy has taken place at SCSU to determine lipofuscin levels in the neural tissue of 115 lobsters sampled. Up to five sections (5-7μm) of the cell mass was analyzed for each lobster. 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, lobster biologist Colleen Giannini. This comparison will help to delineate the potential age classes of the lobsters collected.

One graduate Master's thesis for Colleen Giannini has been completed because of the funds provided by the center, this project and outside monies.

Attachment Strength in Numbers: of the Northern Kelp *Laminaria saccharina*

Faculty Dr. Sean Grace
Biology, SCSU

Student Participant(s):

Kristina Clark, Biology, Undergraduate
Bethann Balazsi, Biology, Graduate

Project Description

Attachment strength (= tenacity, force to dislodge, holding strength) may be affected by closeness of thalli (Carrington 1990; Johnson 2001; Wernberg 2005). Forces within algal canopies are due not only to hydrodynamic drag on individual thalli, but also the result of physical interactions within the surrounding canopy. Johnson (2001) concluded, increases in density of the canopy cause decreases in the forces experienced. Similarly, Koehl and Wainwright (1977) found detached giant kelp, *Nereocystis luetkeana*, tangled with other *Nereocystis* had torn off the substratum at their holdfasts. These phenomena are also noted in other species including corals (Grace PhD dissertation), barnacles (Bertness and others 1998) and mussels (Bell and Gosline 1997). For example, coexisting species of mussels differ in attachment strength due to direct competition for space (Bell and Gosline 1997).

The objectives of this study were:

1) to determine the difference in attachment strength in the subtidal zone, if one exists between individual and groups of *L. saccharina*.
2) to determine morphological differences among individuals and groups of *L. saccharina.*

Results to date/Significance

A significant difference in holding strength is shown in groups compared to individuals. Of the morphological characteristics measured, only the ratio of length:width ("squatness") show significant differences between randomly selected individuals within groups and individuals. However, t-tests ($p<0.05$) indicate other morphological

characteristics (total length, greatest width, stipe width) differ in individuals within a group when compared to solitary individuals.

One graduate Master's thesis for Bethann Balazsi has been completed because of the funds provided by the center, and a CSU Research Grant to Sean Grace.

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 2008 to discuss topics concerning the health and quality of Long Island Sound and its environs as part of the **Fifth Annual Seminar Series on Environmental Issues of Long Island Sound 2008**. 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 2008 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 2008 semester attended and encouraged their students to attend the seminar series.

Date	**Seminar**	**Attendance**
3/26/08	Aquaculture and Shellfisheries Management in Connecticut: Past, Present and Future **Tessa Getchis, CT Sea Grant, UCONN Cooperative Extension**	46

Connecticut is a major producer of farm-raised shellfish, including eastern oysters (Crassostrea virginica) and northern quahogs (Mercenaria mercenaria), valued at greater than $16 million in 2006. There are 46 companies cultivating shellfish on over 77,000 acres of town and State grounds in Long Island Sound. Tessa Getchis traced the historical development of the oyster fishery in the State and outlined the major challenges to the future development of the industry.

4/9/09	Filthy Waters, Typhoid Fevers and Oyster Planters: Shellfish Battles in New York and Connecticut, 1880-1925 **Beth Pillsbury, Columbia University**	53

This seminar examined how state officials and shell fisherman in New York and Connecticut reacted to the depletion of natural oyster beds and to the discovery that sewage laden oysters could cause disease in humans. The resulting legal, regulatory and political battles over shellfishing, property rights, and waste disposal in and around Long

Island Sound had far reaching ecological consequences for our marine environment. By examining how decisions made at the turn of the twentieth century effect our choices in the twenty-first, we may better understand how to protect and improve our coastal ecology.

4/23/08 Characteristics of Bottom Dissolved Oxygen in Long Island Sound: Physics vs. Biology 42
Kamazima Lwiza, SUNY Stony Brook, NY

This seminar examined the issue of the variability of dissolved oxygen (DO) in Long Island Sound and the environmental factors controlling the extent and severity of low DO. For the westernmost and shallow (<15 m) stations, bottom DO is correlated with the strength of the density stratification in the water column. The annual spring bloom of phytoplankton seems to e an important source of organic carbon pool and biological uptake of oxygen plays a more crucial role in the seasonal evolution of bottom DO than previously thought. Implications of these results indicate that the goal of 58.5% anthropogenic nitrogen load reduction may not be sufficient to reduce severity of low DO in Long Island Sound.

5/7/08 From Genes to Waders: Managing Oyster Diseases in Rhode Island 63
Marta Gomez-Chiarri, University of Rhode Island

Disease is one of the major challenges facing bivalve aquaculture in Rhode Island. The major disease threats to oysters in New England are dermo and MSX. The most common tools to manage disease in oysters include monitoring farmed and natural oyster populations to look for unusual mortalities, regulations that prevent the introduction of diseased shellfish and knowledge of environmental conditions that trigger disease outbreaks. Researchers are also developing disease resistant strains of oysters to counter the economic impacts of disease.

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: Dr. Breslin along with Drs. Tait, Grace and Smith prepared a research proposal to comprehensively examine the economic viability and

environmental health of the Eastern oyster in Long Island Sound. We propose a collaborative project designed to: (1) conduct a multidisciplinary laboratory and field-based research program drawing upon the expertise of CSU faculty (WCSU, CCSU and SCSU) and community stakeholders to address issues of concern regarding the health and recovery of the Connecticut oyster industry; (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 for the Connecticut oyster fishery. We have been notified that the proposal was funded in the amount of $278,000 for this fiscal year.

Department of Natural Resources, State of Maine, Boothbay Harbor: Dr. Grace has had on 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/.

Drs. Breslin and Tait serve as members of the Science Advisory Committee and participating scientists in the **New Haven Harbor Watershed Environmental Monitoring Program** supported by the National Fish and Wildlife Foundation, Long Island Sound Futures Fund. The watershed program is a collaborative effort among scientists and educators from UCONN, CT Department of Environmental Protection, University of New Haven, NOAA Marine Fisheries, Yale University and the Sound School Regional Vocational Aquaculture Center. The goal of this program is to help establish and maintain an accurate and comprehensive database of the living and non-living factors that are present in this region and Long Island Sound. Our participation in this program involves water quality monitoring, sediment chemistry and benthic community analysis. Dr. Carmela Cuomo and Dr. Vincent Breslin co-authored the approved Quality Assurance Project Plan for this work. Our contribution to the program includes the physical and chemical characterization of New Haven harbor sediment.

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 2008-2009 research presentations is listed below:

Presentations

Breslin, V.T**.** and S. Garvey. Interactive GIS Maps of Sediment Metal Contamination in Connecticut Harbors. CSU Faculty Research Conference, Eastern Connecticut State University, Willimantic, CT. March 29, 2008.

Smith, D., V.T. Breslin and J.F. Tait. Mentored Research Studies: Center for Coastal and Marine Studies. Fifth Annual Four-Campus Assessment Conference. Southern Connecticut State University. Michael J. Adanti Ballroom. April 18, 2008.

Breslin, V.T. and J.F. Tait. Science and the Connecticut Shoreline: Storm Hazards and Marine Pollution. The National Center for Science and Civic Engagement, Washington Symposium – 2008 and SENCER Capitol Hill Poster Session. Sheraton Hotel Crystal City, Washington, DC.
April 13-15, 2008.

Breslin, V.T. and J.F. Tait. Evolution of a SENCER Course: Effective Teaching Strategies to Maximize Student Learning. The Future We Create: Science Education for a Scientifically Literate Future. Third Annual SENCER New England Symposium. Adanti Student Center. Southern Connecticut State University, New Haven, CT. January 8-9, 2008.

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

Church, V. and V.T. Breslin. (poster accepted). A Comparative Study of Sediment Metal Contamination in Clinton and Milford Harbors. CSU Faculty Research Conference, Southern Connecticut State University, April 4, 2009.

Conklin, J. and V.T. Breslin. (poster accepted). Metal Concentrations in the Sediment of the Lower Housatonic River. CSU Faculty Research Conference, Southern Connecticut State University, April 4, 2009.

Participation

Lecture (**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 24, 2008.

Participant (**Invited**). CT Sea Grant External Research Advisory Panel. Marine Sciences Building, UCONN Avery Point. November 6, 2008.

Lecture (**Invited**). Change: Implications for Connecticut. Cheshire Exchange Club. June 2, 2008.

Lecture (**Invited**). Climate Change: Implications for Connecticut. Homecoming 2008, Adanti Center Theatre, SCSU. October 29, 2008.

Lecture (**Invited**). Is Long Island Sound Healthy? An Alumni Celebration of the Arts & Sciences, Southern Connecticut State University, Michael Adanti Student Center, April 12, 2008.

Participant. National Science Foundation Regional Grants Conference. Renaissance Providence Hotel, Providence, RI. April 7-8, 2008.

Participant. The Long Island Sound Fishery: Flourishing or Floundering. 18th Annual Long Island Sound Citizens Summit, Holiday Inn & Conference Center, Bridgeport, CT. March 8th, 2008.

Student Honor Theses and Reports/Advisors

Joshua Conklin, Honors Thesis.

> Metal Concentrations in the Sediment of the Lower Housatonic River. 59 pp. December, 2008. Advisor: V.T. Breslin

Victoria Church, Honors Thesis.

> A Comparative Study of Sediment Metal Contamination in Clinton and Milford Harbors. May 2009. Advisors: V.T. Breslin and James Tait

Neil Geist, Masters Thesis.

> Incidence of Disease and Growth Abnormalities in Easter Oysters (*Crassostrea virginica*) vs. Incidence of Heavy Metal Tissue Content from Three Sites in Long Island Sound. May 2009.

David Oshana, Masters Thesis.

> Spatial Trends in Eastern Oyster (*Crassostrea virginica*) Tissue Metal Concentrations in Long Island Sound. May 2009.

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. Equipment Acquisition and Training

Ecological/environmental research at any serious level requires equipment acquisition, equipment updates, and appropriate training in its use. One continuing goal of the Center is to acquire, via grants and gifts, equipment appropriate to data collection and analysis.

Horiba Particle Size Analyzer

This past year we were able to acquire a Horiba Particle Size Analyzer ($60,000). The particle size analyzer is important for determining sediment properties in contaminated environments and for determining suitable habitat for oysters.

Marsh-McBirney Flow Meters

Four Marsh-McBirney Flow meters have been purchased with USDA Oyster Study funds. These electromagnetic flow meters will allow for the accurate determination of flow speeds at each of the sites examined in the oyster research project. They are state-of-the-art and the best flow meters for nearshore shallow water habitats and will store the data collected until they can be downloaded to a computer for analysis.

DMA -80 Mercury Analyzer

Werth Foundation funds supported the purchase of a DMA-80 Direct Mercury Analyzer manufactured by Milstone, Inc., Shelton, CT. The DMA-80 provides a rapid, accurate and reproducible analysis of mercury in solid or liquid environmental samples. The DMA-80 Direct Mercury Analyzer analyzes liquid and solid samples without prior sample preparation and no waste disposal. The DMA-80 employs a thermal decomposition technique allowing for a direct mercury analysis, eliminating chemical pretreatment and waste disposal. Mercury is effectively trapped within the instrument eliminating the need to vent mercury emissions. The benefits of the DMA-80 mercury analyzer will allow for the use of this instrument in undergraduate environmental and analytical courses. Additionally, the protocols used for direct mercury analysis are compatible with EPA standard methods and protocols. Dr. Breslin has submitted a Connecticut State University Research Proposal to use the DMA- 80 mercury analyzer in support of a study to examine mercury in the sediment and oyster tissues in the lower Housatonic River.

VII. Accounting, Budget Expenditures and Grant Writing

Academic Year 2008-2009 Itemized Budget Justification

Funds totaling $33,550 were requested for Year 3 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 2008 ($2,500). In addition, the CCMS contracted a web designer ($1,000; Janet Colandrea) to design and maintain the CCMS website. The website is an important component of our education and outreach activities. Neil Geist, Graduate Student and Sound School Faculty, was contracted ($800.00) to provide services as a small boat captain in support of the Milford and Clinton harbor sampling cruises. 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 $9,890.

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 Summer research fellowships in the amount of $1000-$2,000 (10-20 hours/week x $10/hour). Nine students received fellowships during the Summer 2008 totaling $16,000. The student research fellowships were once again offered during the Fall 2008 and Spring 2009 semester. The CCMS has a system-wide mission to support student research. This past year was the first year CCMS funds ($2,000) were used to support an undergraduate student under the supervision of Dr. James Boyle, Western Connecticut State University. The CCMS has supported 10 different students in five different academic fields in support of faculty directed research during this past year ($18,000).

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 ($501) were used in support of student and faculty travel to field sites in support of their respective research projects. Travel funds were also used to support the travel of student Bethann Balazsi to the 38th Annual Benthic Ecology Meeting, Corpus Christi, Texas, March 5, 2009.

Bethann will present the results of CCMS sponsored research on *Laminaria* attachment strength.

Permanent Equipment

Werth Foundation funds were used to purchase equipment in support of faculty and student research projects. No major permanent equipment purchases were made using Werth Family Foundation funds allocated in 2008-2009. Funds in this budget category ($4,000) were transferred into student support and technical services to support additional students and website development. Major pieces of permanent equipment were purchased with funds from the USDA Oyster Grant (Horiba Particle Size Analyzer and Current Meters). The Werth Foundation approved the purchase of the DMA-80 Mercury Analyzer with a separate grant ($38,670).

Ship Time

Funds for chartering ship time were budgeted to provide access to field sample sites for research and education along the Connecticut shoreline and in Long Island Sound. Ship time was chartered aboard the *R/V Island Rover*, a 46 foot vessel equipped to conduct coastal research and education programs operated by the Sound School, New Haven, CT ($500.00). We requested $5,750 to be used to charter boats in support of research and education programs. Matching funds for ship time were available this year in Connecticut State University grants to Dr. Breslin reducing the need to use Werth Foundation funds for ship time. Later this Spring 2009, we have scheduled cruises aboard the R/V *Island Rover* and the R/V *Oceanic* for access to coastal harbors in support of student projects and the USDA Oyster grant sampling.

Expendable Supplies

Funds for laboratory and office supplies ($1,500) 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 ($1,497).

Balance of Funds

We are in the process of distributing the remaining Werth Family Foundation unencumbered funds ($7,712). A portion of the funds will be used to purchase additional laboratory and office supplies. The vast majority of the remaining funds ($5,250) will be used to charter ship time later this Spring 2009 in support of ongoing projects.

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 2008

Principal Investigator: Vincent T. Breslin

Project Title: Spatial Distribution of Contaminant Metals in the Housatonic River Estuary.

Award Amount: $5,000

Connecticut State University Research Grant Award 2008

Principal Investigator: Dwight Smith

Project Title: Alternatives to Eradicating Monk Parakeets? Adoption of Artificial Nest Platforms

Award Amount: $5,000

SCSU Faculty Development Grant 2008

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

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

Award Amount: $ 2,000

US Department of Agriculture Grant 2008-2009

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. PI.- **V.T. Breslin**. Project Duration: September 2008-August 2009. Total Funds $278,819.

Werth Family Foundation Equipment Grant 2008

Milestone DMA-80 Direct Mercury Analyzer. Werth Family Foundation, Woodbridge, CT. PI. Vincent Breslin. August 2008. Total Funds $38,670.