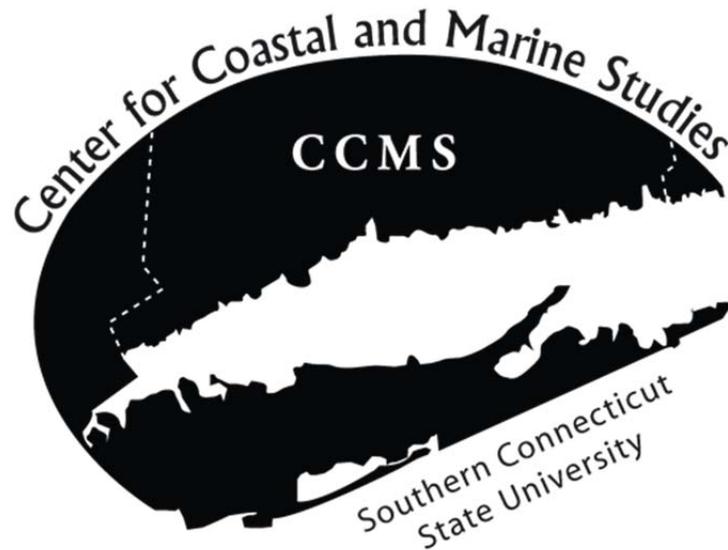


Southern Connecticut State University

Center for Coastal and Marine Studies



CCMS Annual Report 2011-2012

Prepared by:

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Prepared for:

The Werth Family Foundation, Woodbridge, CT

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CCMS Annual Benchmark/Evaluation Report 2011-2012

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 2011-2012 Annual Report are described below.

I. Research Projects

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

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

Student Participants

Summer 2011; Fall 2011; Spring 2012

Megan Coyne, Undergraduate Student, Marine and Environmental Studies
Damian Grzybko, Undergraduate Student, Biology and Marine Studies

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. Using sediment copper concentrations, grain size data, and loss-on-ignition (organics content) data, a multivariate linear model was created that allowed prediction of copper concentration at sample stations from grain size and loss-on-ignition data alone.

The importance of other possible controlling factors, such as proximity to a current or historical source for copper, can be examined using the *residuals* of the model, i.e., the difference between the model predictions and the actual observed copper concentration values. In this study, samples in which the observed value is significantly larger than the value predicted value are defined as *hot spots*. A hot spot indicates that grain size and organic content are insufficient to explain the copper concentration. Such a hot spot might indicate a nearby source of copper.

The project has been expanded to include more sites and additional harbors so that between-harbor variability can be examined and geographic dependencies identified. It has also been expanded to measure zinc concentrations along with copper so that variability that is a function of metal can be examined.

Results to Date/Significance

The application of a simple model to copper concentrations sampled from Norwalk harbor produced promising results. The observed copper concentrations and the copper concentrations predicted by the model were mapped using spherical interpolation techniques. The similarity between the two maps is visually striking. Statistically speaking, correlation between model and observations of copper concentrations had a correlation coefficient (“r”) of 0.812, indicating “strong” correlation.

This research is ongoing and is currently supported by a CSU research grant entitled *Estimating Sediment Metal Concentrations Using Sediment Mean Grain Size and Loss on Ignition Data*. The grant is co-authored by Dr. James Tait, and by Dr. Ray Mugno in the Mathematics Department at SCSU. Current efforts are being focused on expanding the database for the models by including new data sites in Norwalk Harbor and by adding data from Bridgeport Harbor and New Haven Harbor. The added data will help generalize resulting statistical models and will allow better understanding of which variables carry the greatest weight. Grain size analyses, loss-on-ignition tests, and copper and zinc analyses are currently being conducted by undergraduate researchers Megan Coyne and Damian Grzybko.

Characterization of Nearshore Benthic Habitats

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

Student Participant(s)

Fall 2011; Spring 2012

Megan Coyne, Undergraduate Student, Marine and Environmental Studies
Kachi Ihuegbu, B.S. Geography, SCSU

Project Description

There are two primary goals in this habitat characterization study. Identifying the sedimentary environment conducive to oyster aquaculture in terms of sediment grain size, and current strength is one of them. Determining whether sediments have the potential for sequestering high concentrations of heavy metals that could enter the food chain via oyster bioaccumulation is the other. 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 sediment samples grain size. 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. Sediment grain size analysis has and is being performed by students at Southern. The analysis is being performed using a Horiba LA-950 particle size analyzer. Results of the grain size analysis are being combined with data collected by Breslin and others on sediment metal concentrations and with data on the organic content of the sediments. The side scanning sonar data was found to have limited value due to problems of scale. Large-scale variation in grain size (order of km) was distinguishable, but the level of resolution required to match grain size sampling was lacking. However, the combined data sets of sediment metal concentrations and grain size characteristics continue to be correlated and are being spatially referenced using GIS maps by Mr. Ihuegbu and Ms. Coyne. A very large set of samples have been collected for Norwalk, Bridgeport and the Housatonic Estuary, New Haven Harbor, and East Haven. Their efforts are currently being focused on Norwalk and New Haven Harbors as the two main oyster culture centers in the state of Connecticut.

Causes and Remediation of Chronic Beach Erosion at Hammonasset Beach State Park

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

Student Participant(s)

Fall 2010; Spring 2011; Spring 2012

Mary LaVallee, Undergraduate Student, Chemistry and Marine Studies

Project Description

Beach and dune erosion has been an issue at Hammonasset since the 1920's. Erosion is particularly intense along the west end of the park. Current thinking is that beach sand is being carried to the east end of the 2-mile beach from the west end of the beach by tidal currents. Based on preliminary studies, we believe this is incorrect and that most of the eroded beach sand has been carried offshore and deposited in low, broad underwater bars. We intend to test this hypothesis by surveying beach and nearshore topography using a total station (laser-based surveying instrument).

Results to Date/Significance

A total station was acquired via successful application for a CSU research grant (\$5,000). We have examined the study area via aerial photos and have determined the locations for cross-shore transects to be surveyed in order to determine the volume and other dimensions of the offshore sand bars. We have also set up a liaison with Mr. John Hine, superintendent of Hammonasset State Beach.

The basic plan of research is to survey approximately 30-40 beach and bar profiles. The volume of the sand in the bars will be calculated using the end-area method, and then compared with beach erosion volumes. The hypothesis is that simple beach-based dredging operations could return erode sand to the beach at the end of each winter before the park opens at a minimal cost to the taxpayer, and with a minimal disruption of the natural beach environment. Dr. Tait's students conducted an initial study of the effectiveness of dune fencing at the west end of Hammonasset Beach. However, recent beach erosion associated with Tropical Storm (Hurricane) Irene has shifted our coastal erosion efforts to beach monitoring at East Haven (extreme damage to property), and monitoring of a natural beach and dune system that was severely damaged in West Haven. Resumption of studies at Hammonasset State Beach begins in March of 2012.

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

Distribution and Abundance and Abundance of Monk Parakeet Colonies in Connecticut. Monk Parakeet Nests, Renestings, and Nest Associates

Faculty Dwight Smith
Biology, SCSU

Student Participant(s) **Summer/Fall 2011**

Lindsey Pelletier, Undergraduate Student, Biology
Melissa Krisak, Graduate Student, Biology

Project Descriptions

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

Monk Parakeet nest site construction activities were observed across their range in southern Connecticut, from Greenwich and Stamford in the Southwest to Old Saybrook and Mystic in the extreme southeastern part of the state. These observations included detailed descriptions of nest construction activities, twigs used, location and types of twigs used, impact, if any, of twig

removal for nest construction, and use of nest by other species. Information was obtained from no fewer than 208 nests during the last two years. All information regarding nests and twigs has been and is being entered on Excel files for future reference. Information processing to date has revealed that Monk Parakeets provide both nest substrate materials and also nesting sites for a number of other urban and suburban species including Mourning Dove, Great Horned Owl, Song Sparrow, House Finch, Starling, and Blue Jay. These results suggest that this invasive species is in many ways serves a beneficial function for urban wildlife.

Lipofuscin concentrations at varying temperatures in the American Lobster

Faculty Dr. Sean Grace
 Biology, SCSU

Student Participant(s)

Dana Pietrosimone, Biology, Graduate Student (Graduated Spring 2011)

The concentration and accumulation of the metabolic by-product, lipofuscin, has determined to be an accurate measurement of chronological age in several types of crustaceans. Accurately determining the correct ages of American Lobster (*Homarus americanus*) individuals in harvests can assist in management options for preserving commercial stocks. In this study, I analyze the lipofuscin concentration in the Olfactory Lobe Cell Mass (OLCM) of 193 brain sections belonging to wild-caught *H. americanus* individuals inhabiting three different areas off the coast of Maine, while predicting their ages based upon their carapace length and latitudinal location. Data for the current study demonstrates that lipofuscin concentration in legal sized lobsters is dependent on carapace length, but not area collected. Furthermore, results indicate that legal-sized lobsters have older predicted ages, which is not dependent upon area collected.

Student Participant(s)

Callie Gecewicz, Biology, Graduate Student (Expected Graduation Spring 2012)

Lipofuscin concentration analysis has been supported as a useful way to estimate age in crustacean populations and has been shown to be more reliable than traditional age determination by body size. This study examines the lipofuscin concentration from the brains of twenty-five, 2-year-old American lobsters held *in situ* at six sites off the coast of Maine, representing different temperature regimes. Lobsters were collected and preserved in 10% neutral buffered formalin. After dissection, brain tissues were prepared through a series of dehydrating ethanol baths and cleared with xylene. The brain tissue was embedded in paraffin wax, sectioned and slide mounted for analysis using a confocal microscope and image analysis software (Image J™). The lipofuscin concentrations did not differ significantly between the site locations therefore suggesting lipofuscin concentration is not temperature dependent.

Mercury Accumulation in Bluefish (*Pomatomus saltatrix*) in Long Island Sound

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

Student Participant(s)

Summer/Fall 2011; Spring 2012

Mary LaVallee, Undergraduate Student, Chemistry and Marine Studies
Gene Wenkert, Undergraduate Student, Marine and Environmental Studies

Project Description

Bluefish are a schooling, migratory pelagic species common in Long Island Sound. Bluefish were the third most frequently caught species in Connecticut coastal waters in 2008 and represent an important recreational fishery. Bluefish are apex predators and bioaccumulate mercury through dietary transfer through the food chain. Mercury is a neurotoxin and is passed to humans primarily via consumption of fish. I propose a study to measure tissue mercury concentrations in juvenile and adult bluefish (*Pomatomus saltatrix*) in Long Island Sound. As a recreational fisherman and consumer of LIS bluefish, I am concerned with the seasonal and long-term trends in tissue mercury concentrations and their associated human health impacts. The goal of this study will be to determine the current concentrations of mercury in LIS bluefish and test the following hypotheses: (1) LIS bluefish tissue mercury concentrations will positively correlate with weight, age and length and (2) LIS bluefish tissue mercury concentrations will be less than mercury tissue contents measured in previous studies. Knowledge of bluefish tissue mercury contents, and its relationship with length and weight, is essential for establishing effective fish consumption advisories and protecting human health.

Results to Date/Significance

Forty eight bluefish were collected during September-November 2010 with the assistance of CT DEEP within Long Island Sound representing a wide range of lengths (432 mm – 845 mm) and weights (771 - 5352 g). The length and weight of the bluefish analyzed were related, with weight increasing linearly with increasing bluefish length. Measured bluefish mercury concentrations (wet weight) ranged from 0.141 - 0.598 mg/kg. Measured mean mercury concentration for bluefish > 508 mm in this study (2010) were similar to mean mercury concentrations for similarly sized bluefish examined in CT DEEP surveys for bluefish captured in 2006 and 2007. The US EPA regulatory advisory level for safe fish consumption is 0.3 mg Hg per kg wet weight consumed. Results of this study show that the 0.3 mg Hg per kg wet weight consumed is exceeded in Long Island bluefish exceeding 24 inches in length. Results of this research will be used to prepare a poster for presentation at the 15th CSUS Faculty Research Conference, Spring, 2013. Results of this research will also be used to prepare an abstract for submission as a poster presentation at the 11th bi-annual Long Island Sound Research Conference during the Fall 2012.

Depuration of Oyster Tissue Metals Following Relay from Restricted Beds

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

Student Participant(s)

Summer/Fall 2011; Spring 2012

Mary LaVallee, Undergraduate Student, Chemistry and Marine Studies
Gene Wenkert, Undergraduate Student, Marine and Environmental Studies

The CT Department of Agriculture Bureau of Aquaculture (DABA) has identified the area adjacent to the Manresa Island power plant in Norwalk harbor as a priority area for potential expansion of shellfish production. The area near the Manresa Island power plant is a very active seed oystering area and oysters are currently relayed from this site to Approved leased beds surrounding the Norwalk Islands. The relay process is effective in reducing pathogens in the oysters. However, DABA has expressed concern over possible sediment metal contamination in the area surrounding Manresa Island, the location of an oil-fired electricity power plant owned by NRG Energy Inc. Oil-fired power plants are known to be significant sources of contaminant metals to coastal harbors and previous studies of Norwalk harbor sediment show elevated levels of Cu and Zn in the sediment. In contrast, the sediment environment surrounding the Norwalk Islands in Approved beds are composed of fine to coarse sand with correspondingly low contaminant metal concentrations. Prior to the successful utilization of the Restricted oyster beds adjacent to the Manresa Power plant a thorough examination of the sediment environments and oyster tissue metal concentrations of both the Restricted and Approved oyster beds is required.

Results to Date/Significance

This study examines differences in oyster tissue metal contents in oysters sampled from Restricted (Manresa Island) and Approved (Norwalk Island) oyster beds in Norwalk harbor. The environmental quality of each of the Restricted and Approved oyster beds will be determined by measuring sediment (metal concentrations, grain-size distribution, and loss on ignition) and water column (salinity and dissolved oxygen) parameters. The CT DABA continuously monitors water quality (fecal coliform) at both these sites. The goal of this study will be to test the following hypotheses: metal concentrations will be elevated in the Restricted Manresa Island seed oyster bed sediment and oysters compared to comparable oysters sampled from Approved oyster beds surrounding the Norwalk Islands.

Outer Island Website Development

Faculty Dr. Scott Graves
 Science Education and Environmental Studies, SCSU

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

Student Participant

Spring 2012

 Neal Raval, Undergraduate Student, Computer Science

Outer Island is the outermost island in the Thimble Island chain off the coast of Branford, Connecticut. Outer Island was privately owned until October 1995 when Elizabeth Hird donated the island to the U.S. Fish and Wildlife Service, in memory of her husband Basil Rauch. The island is now managed by the U.S. Fish and Wildlife Service as part of the Stewart B. McKinney National Wildlife Refuge. A partnership between the McKinney NWR and the Connecticut State University system has been established to provide access for educational and research programs on the island. Several existing websites feature Outer Island, but each of these websites have glaring deficiencies and a comprehensive website needs to be established to serve our research and educational programs. The Outer Island website is designed to accomplish the following goals: (1) to increase the awareness of educators in Connecticut of the opportunity to accompany CSU faculty and staff on an educational experience to Outer Island and to integrate Long Island Sound environments into their science curriculum; (2) to increase the number of individuals and groups (schools, nature centers, youth groups, etc.) visiting Outer Island each year; (3) to provide a pre-visit and post-visit tool for educators to use in support of their curriculum for increasing student knowledge concerning the ecology of Outer Island and Long Island Sound; and (4) to serve as a general introduction to marine ecology and increase student awareness of the importance of protecting and preserving the diverse natural habitats within Long Island Sound.

Results to Date/Significance

The website development started this Spring 2012 with the conceptual design of the website. Neal Raval, an undergraduate Computer Science major with expertise in web design is assisting Dr. Graves and Dr. Breslin with construction of the website. We have selected iPage (ipage.com) to host the website (3 year initial contract) and the domain name outerisland.org has been registered for our use. We believe the upgrades to the website will significantly improve the outreach and educational activities in the classroom and on the island.

Water Quality Monitoring in New Haven Harbor

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

 Dr, James Tait
 Science Education and Environmental Studies, SCSU

Student Participant(s)

Spring 2012

Hollie Brandstatter, Science Education and Environmental Studies, SCSU
MAR 460 Field and Laboratory Techniques in Marine Studies (11 students)

Water quality monitoring programs are an important aspect of determining the overall health of ecosystems within Long Island Sound. Current monitoring programs within LIS are conducted by interstate, state and local agencies, academic institutions, and volunteer and community organizations. Government agencies and academic institutions have primarily focused on the open sound while community and volunteer organizations have examined water quality within rivers, bays and harbors. The Center for Coastal and Marine Studies recently established a water quality monitoring station in New Haven harbor at Long Wharf in January 2012. The monitoring program was established in response to a lack of high quality monitoring data for New Haven harbor and to provide a long-term continuous record of water quality measurements for the harbor. The water quality data supplements our on-going sediment quality data collected during the past decade. The initial water quality monitoring program is being conducted by a CCMS student researcher and the students in the MAR 460 Field and Laboratory Techniques in Marine Studies. The water quality monitoring at this location will be continued this summer/fall by CCMS student researchers. Water quality parameters examined in this study include temperature, salinity, dissolved oxygen, turbidity, secchi disk depth, chlorophyll a, and pH. Water quality measurements are being measured once per week at slack high tide.

Results to Date/Significance

Water quality monitoring was initiated on January 31st, 2012. Water quality monitoring supplies, including a turbidity meter and chemicals and supplies for chlorophyll a determinations, have been purchased for use in the program.

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 2011 to discuss topics concerning the health and quality of Long Island Sound and its environs as part of the **Eighth Annual Seminar Series on Environmental Issues of Long Island Sound 2011**. Partial support for the seminar series was provided by a \$2,500 SCSU Faculty Development Grant awarded to Drs. Breslin, Tait and Smith.

The seminar series was consisted of four separate one-hour seminars by invited experts on Long Island Sound environmental issues during the Spring 2011 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 2011 semester attended and encouraged their students to attend the seminar series. A primary goal of the seminar series is to distribute information about Long Island Sound research among faculty and to encourage interdisciplinary collaborative research at SCSU.

Date	Seminar	Attendance
3/2/11	Nanomaterials as Emerging Pollutants, and Their Impact on Long Island Sound Biofilms Shannon Ciston, Assistant Professor, Industrial, Systems, and Multidisciplinary Engineering, University of New Haven, New Haven, CT	49

Biofilms are complex communities of microorganisms in which cells adhere to each other on a surface usually submerged in or exposed to an aqueous solution. Biofilms can contain many different types of microorganism, e.g. bacteria, protozoa, and algae; each group performs specialized metabolic functions. Biofilms may hold the key to examining the true environmental impact of the chemical nanoparticles that find their way from area kitchens, baths and garages into Long Island Sound. One such controversial compound is titanium dioxide, which is used to whiten and brighten a multitude of products, including candy, cosmetics, toothpaste and paint. The underlying premise for testing the effects of titanium dioxide nanoparticles on biofilms is simple: when some chemicals are in nanoparticle form—ranging in size from 1/100th to 1/1000th of a human hair—they become bioactive, degrading and passing through cell membranes. Noting that "large" particles of titanium dioxide are considered safe by the FDA, this research focuses on how nanoparticles of titanium dioxide affect marine ecosystems, particularly in terms of biofilms. Marine biofilms are critical players in the oceanic environment. In addition to transforming nitrogen and carbon in ways that positively impact the greater food web, biofilms clean waste water by eating harmful organic matter and can even be used to clean oil and gasoline spills through bioremediation.

3/30/11 Protecting Riparian Buffers in the Connecticut River 76
Estuary: Rationale, Research and Regulation
**Judy Preston, Long Island Sound Study Outreach Program
Coordinator, CT Sea Grant College Program, Groton, CT**

Despite abundant scientific research that has been conducted in the Connecticut River estuary, no single study has consolidated information on the existence and condition of shoreline vegetated buffers and riparian areas that are known to be an important natural tool to counter the affects of nonpoint source water pollution. This investigation examined both existing GIS data and field observations in an initial effort to produce a regional tool that can guide further resource protection in the Connecticut River estuary. This study underscored both the extraordinary beauty and vulnerability of the lower Connecticut River region. Restoration opportunities have been identified and mapped according to several criteria: the opportunity to create a buffer where one currently does not exist, the opportunity to enhance an existing buffer, and the opportunity to address invasive species in the buffer area. General recommendations have included enhancing an existing or creating a new buffer by widening or infill planting, and invasive species reduction or elimination where feasible. Opportunities for education about the value and potential for buffer creation or enhancement, as well as invasive plant species information, abound in the project area.

4/12/11 Potential Production of Biofuels using Long Island 43
Sound Macroalgae
**Carmela Cuomo, Associate Professor, Biology and
Environmental Science, University of New Haven,
New Haven, CT**

The purpose of this study was to evaluate the biofuel potential of four locally-occurring acroalgal species from Long Island Sound. In order to be considered a feasible candidate, algae needed to demonstrate significant growth rates in cultivation systems, as well as chemical profiles that are suitable for the production of biodiesel and other biofuels. A novel indoor cultivation system was designed and tested on three different macroalgae: *Ulva lactuca*, *Codium fragile*, and *Fucus vesiculosus*. A fourth algae, *Chondrus crispus*, was grown using established methods. Chemical suitability was evaluated based on overall lipid content and FAME content upontrans-esterification. Results demonstrate that all four species of macroalgae can successfully be grown in culture although growth rates varied among the different macroalgal species as well as with different growth media. Overall lipid content, as well as FAME content, varied among the four macroalgae as well; FAME content for at least one of the species studied was able to be enhanced by altering the growth media. The data support the idea that at least two of the locally-occurring macroalgal species examined in this study have significant potential as biofuel feedstock species. Further study is needed in order to determine the ideal light and growth media dosing regimes for these candidate species. This work was supported by a grant from the Connecticut Center for Advanced Technology.

Chemicals found in plastic bottles and detergents may make lobsters more susceptible to the disease. Chemicals like alkylphenols are washed into waterways mainly from landfill and water treatment facilities, and eventually find their way to the ocean. Of the about 1 million tons of BPA produced annually, 60 percent of it ends up in the ocean. Lobsters accumulate alkylphenols from their food, mostly mollusks such as clams and mussels that filter the chemicals from the water. In the western Long Island Sound, the southern shore of Massachusetts, and Cape Cod Bay, as many as half of the lobsters surveyed were contaminated with the chemicals. Laboratory studies have also shown that moderate levels of chemicals can double the amount of time it takes for a lobster to molt its shell and to create a hardened new shell. During this time, the lobsters' thin skin is more vulnerable to pathogens, such as the bacteria that cause shell disease. By increasing the length of this vulnerable period, the ocean-borne chemicals effectively increase the chances that a lobster will get sick. Lobsters have also been observed to molt their shells more often when afflicted with shell disease. Molting is the only effective way for lobsters to temporarily rid themselves of the disease, but mother lobsters afflicted by the disease have been observed to molt even when carrying eggs on the undersides of their shells, and this effectively kills their unborn offspring. The only way to reduce the chemicals' impact on living organisms is to reduce our use of plastics.

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:

Department of Environmental Protection Marine Fisheries Division, Old Lyme, CT: Kurt Gottschall, CT DEP, has agreed to assist Dr. Breslin with the collection of bluefish from Long Island Sound in support of the bluefish tissue analyses for mercury. The bluefish collection will occur during the annual Fall trawl survey of fish and invertebrates conducted each year for the past 20 years by the CT DEP.

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. Dr. Breslin has collaborated with Professor Johan Varekamp in the preparation of a manuscript titled "Contaminants in Long Island Sound: Sources, Magnitudes, Trends and Impacts. The manuscript is being prepared for inclusion as a chapter in the Long Island Sound Synthesis book scheduled for publication in 2013.

Department Energy and Environmental Protection – Hammonasset State Beach: Dr. Tait has established relations with Jack Hine, superintendent of Hammonasset State Beach. The purpose is to acquire access for research at Hammonasset and to align research outcomes with management information needs of the park.

Cities of East Haven and West Haven: Members of the city government offices of the towns of East Haven and West Haven have expressed interest in cooperation in beach erosion and recovery studies, as well as ongoing monitoring. Dr. Tait will meet with members of city government later in 2012.

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/>.

State of Connecticut Department of Agriculture, Bureau of Aquaculture, Milford, CT
Dr. Inke Sunila is a Shellfish Pathologist employed by the Bureau of Aquaculture at the Milford Fisheries Laboratory, Milford, CT. Dr. Sunila has extensive research experience and is recognized as an expert identifying and diagnosing Eastern oyster pathologies in Long Island Sound. The CT DABA also provided ship time in support of Dr. Breslin's sediment sampling in Norwalk harbor in July 2011.

Norm Bloom and Son, LLC. 7 Edgewater Place, Norwalk, CT.

Norm Bloom provided two boats equipped with oyster dredges to support Dr. Breslin's oyster sampling in Norwalk harbor in June 2011. Oysters were collected from oyster beds leased and cultivated by Norm Bloom and Sons, LLC.

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 2011-2012 research presentations is listed below:

Presentations

LaVallee, M, Oshana, D. and V.T. Breslin. Trends in Eastern Oyster Tissue Metals in Connecticut Harbors and Estuaries. 32nd Milford Aquaculture Seminar, Water's Edge, Westbrook, CT. March 12-14th, 2012.

Breslin, V.T. and J.F. Tait. Trends in Sediment Copper and Zinc in Connecticut Coastal Embayments. 47th Annual Meeting of the Northeastern Section, Geological Society of America, Hartford, CT. March 18-20, 2012.

LaVallee, M, Oshana, D. and V.T. Breslin. Trends in Eastern Oyster (*Crassostrea virginica*) Tissue Metals in Long Island Sound. 47th Annual Meeting of the Northeastern Section, Geological Society of America, Hartford, CT. March 18-20, 2012.

Breslin V.T. and J.F. Tait. 2011. A SENCER Model Course Focused on Coastal Connecticut. SENCER Regional Conference. Fairfield University, Fairfield, CT. May 31-June 1, 2011.

Varekamp, J.C., A.E. McElroy, J.R. Mullaney, B.J. Brownawell, V.T. Breslin, M.A. Altabet, and M.R. Buchholtz ten Brink. 2011. Contaminants in Sediment from Long Island Sound. New England Estuarine Research Society Spring 2011 Meeting, Danfords Hotel and Marina, Port Jefferson, NY. May 5-7, 2011.

Breslin, V.T. and K. Thomas. 2011. (Poster). Oyster Tissue Mercury Contents in the Lower Housatonic River Estuary. *Connecticut State University Faculty Research Conference*, Western Connecticut State University, Danbury, CT. April 16, 2011.

Breslin, V.T. and K. Thomas. 2011. (Poster). Oyster Tissue Mercury Contents in the Lower Housatonic River Estuary. 31th Milford Aquaculture Seminar, Courtyard by Marriott, Shelton, CT. February 7-9, 2011.

Tait, J., 2012. *Energy Asymmetry, Urbanization, and the Fate of the Connecticut Coast*. Invited Speaker, Pathways to Academic Excellence Program (PAcE), Southern Connecticut State University, New Haven, CT, March 2, 2012.

Publications

Varekamp, J.C., A.E. McElroy, J.R. Mullaney, B.J. and V.T. Breslin (in review). Contaminants in Long Island Sound: Sources, Magnitudes, Trends and Impacts. *Long Island Sound Synthesis Volume*.

Breslin, V.T. and K. Thomas. 2011. Mercury in the sediment and Eastern oyster tissues in the Housatonic river estuary. Abstract. *Journal of Shellfish Research*, 30(2): 443.

Participation

Breslin, V.T. Participant. SENCER House Call Event: Bringing SENCER to Liberal Education, Southern Connecticut State University, New Haven, CT. April 15, 2011.

Breslin, V.T. Participant. (Invited). SENCER-ISE Conference, Liberty Science Center, Jersey City, New Jersey. March 6-8, 2011.

Student Theses and Reports/Advisors

Megan Coyne, Honors Thesis, Marine and Environmental Studies. (Advisor: Tait)

A Study of the Spatial Relationships Amongst Grain Size, Organic Content and Metal Contamination in the Sediments of Norwalk Harbor, Connecticut. May 2012.

Mary LaVallee, Honors Thesis, Chemistry. (Advisor: Kowalczyk/Breslin)

Spatial Trends in Oyster Tissue Cadmium Concentrations with Variations in Salinity in Norwalk and Housatonic Estuarine Waters. May 2012.

Charles Nixon, Honors Thesis, Environmental Studies. (Advisor: Breslin)

An Assessment of Existing Alternative Fuel Technologies to Determine a Viable Replacement for Fossil Fuel Use in Transportation in the United States. May 2012.

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. August, 2012.

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

An Examination of Phytoplankton Abundance and Diversity with Relation to Physical Factors in Long Island Sound. August, 2012.

Dana Pietrosimone, Masters Thesis, Biology. (Advisor: Grace)

Neural Lipofuscin Concentration as an indicator of Age and Temporal Habitat in the American Lobster, *Homarus americanus*. May 2011.

Grants

Depuration of Oyster Tissue Metals Following Relay from Restricted Beds. Connecticut State University 2011 Research Grant. Project Duration: June 1, 2011– May 30, 2012. PI – V.T. Breslin. Total Funds \$4,375.

Estimating Sediment Metal Concentrations Using Sediment Mean Grain Size and Loss on Ignition Data. Connecticut State University 2011 Research Grant. Project Duration: June 1, 2011– May 30, 2012. PIs – James Tait and Ray Mugno. Total Funds \$3,500.

Eighth Annual Seminar Series on Environmental Issues in Long Island Sound. Southern Connecticut State University Faculty Development Grant. Spring 2011. PIs – D. Smith, V.T. Breslin and J. Tait. Total Funds \$2,500.00.

VI. Accounting, Budget Expenditures and Grant Writing

Academic Year 2011-2012 Itemized Budget Justification

Funds totaling \$55,000 were requested for Year 6 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 2011. Professors Breslin (\$2,000), Tait (\$1,500) and Smith (1,500) were compensated for mentoring student research projects. Fringe benefits on faculty salaries totaled \$900. CCMS will contract a web designer (\$1,500; Janet Colandrea) to update and maintain the CCMS website during Spring 2012. CCMS will also provide salary (\$1,000) for Dr. Scott Graves, Science Education and Environmental Studies, to provide expertise and oversight of the Outer Island website development. CCMS will also provide salary (\$1,000) for Dr. Ray Mugno, Mathematics Department, to provide assistance with statistical analysis of research data. 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 \$11,448.

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 2011 (6 students; \$11,000), Fall 2011 (3 students; \$3,000) and Spring 2012 (6 students; \$6,500). Fellowship amounts per student ranged from \$500-\$2,000 per semester (25-200 hours @ \$10/hour). The CCMS has a system-wide mission to support student research. This past year, the CCMS supported nine different students in five different academic fields (Biology, Chemistry, Marine Studies, Geography, Computer Sciences and Honors) in support of faculty-directed research projects during this past year totaling \$20,500.

Travel Funds

Travel funds totaling \$1,500 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. This past academic year CCMS supported two students and one faculty member’s travel (\$550) to the 32nd Milford Aquaculture Seminar, Water’s Edge, Westbrook, CT, March 12-14th, 2012. Additionally, CCMS funds supported two students and one faculty member’s travel (\$449) to 47th Annual Meeting of the Northeastern Section, Geological Society of America, Hartford, CT. March 18-20, 2012. Travel funds (\$419) were also used in support of student and faculty travel to field sites in support of their respective research projects. Remaining travel funds will be used in support of students and faculty traveling to field sites and to support participation in regional meetings.

Permanent Equipment and Service Contracts

Werth Foundation funds were not used this past year for the purchase of permanent equipment in support of faculty and student research projects. Funds in this budget category were used to purchase a service contract for fiscal year 2011-2012 for the PerkinElmer AAnalyst 800 Atomic Absorption Spectrophotometer (\$6,528). SCSU provided matching funds support by purchasing a two-year service contract (2011-2013) for the Milestone DMA 80 Direct Mercury Analyzer (\$7,000).

The CCMS was recently notified that our request for state bond fund support for the purchase of a Milestone Ethos EX Closed-Vessel Microwave Assisted Extraction System was approved (\$35,550). The microwave system offers many benefits compared to our current use of open-vessel wet digestion procedures for metals extraction from sediments, soils and tissues. Microwave extractions can be completed within minutes, yield higher analyte recoveries than older methods, use polar or non-polar solvents and the software-based control of all reaction parameters ensures method reproducibility.

Ship Time

Funds for chartering ship time were budgeted (\$4,500) to provide access to field sample sites for research and education along the Connecticut shoreline and in Long Island Sound. Werth Foundation funds supported three research cruises in New Haven harbor (\$2,362.50). CCMS researchers chartered the R/V Island Rover, Sound School, New Haven, CT. The cruises were chartered in support of sediment sampling activities. Funds totaling (\$1,400) have been encumbered to support two additional cruises during the Spring 2012 semester. Both New Haven harbor cruises will be conducted in support of educational programs: MAR 250 Introduction to Marine and Coastal Pollution; MAR 460 Field and Analytical Techniques in Marine Studies.

Publication Costs

A total of \$600 was budgeted for publication costs for FY 2011-2012. Funds (\$120) were used to support the printing of large format posters for presentation at regional meetings. Additional funds will be used in Spring 2012 to photocopy and bind student theses and reports for distribution.

Expendable Supplies

Funds for laboratory and office supplies (\$5,000) 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 (\$3,832). Supply purchases include the purchase of a turbidity meter (\$639), chemicals, supplies and reagents for chlorophyll a determinations (\$711), and leveling rods and cases (\$399) for beach surveying. Additional supply funds will be used in support of student-faculty research projects during Spring 2012.

Balance of Funds

To date, CCMS has a balance of \$3,762. The majority of the unencumbered funds are earmarked for ship time (\$800), laboratory supplies (\$1,068) and student stipends (\$1,500). We anticipate utilizing the remaining student stipend funds and laboratory supply funds prior to the end of the fiscal year in June.

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 2011

Depuration of Oyster Tissue Metals Following Relay from Restricted Beds. Connecticut State University 2011 Research Grant. Project Duration: June 1, 2011– May 30, 2012. PI – V.T. Breslin. Total Funds \$4,375.

Connecticut State University Research Grant Award 2011

Estimating Sediment Metal Concentrations Using Sediment Mean Grain Size and Loss on Ignition Data. Connecticut State University 2011 Research Grant. Project Duration: June 1, 2011– May 30, 2012. PIs – James Tait and Ray Mugno. Total Funds \$3,500.

SCSU Faculty Development Grant 2011

Co-Authors: James Tait, Vincent Breslin, Dwight Smith
Title: Seventh Annual Seminar Series on Environmental Issues in Long Island Sound
Award Amount: \$ 2,500

Connecticut State Bond Fund

Principal Investigator: Vincent Breslin
Milestone Ethos EX Closed-Vessel Microwave Assisted Extraction System
Award Amount: \$ 35,550