

Southern Connecticut State University

Werth Center for Coastal and Marine Studies



WCCMS Annual Report 2013-2014

Prepared by:

Vincent T. Breslin, Professor
Science Education and Environmental Studies

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Science Education and Environmental Studies

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Biology

Prepared for:

The Werth Family Foundation, Woodbridge, CT

February 2014

CCMS Annual Benchmark/Evaluation Report 2013-2014

Each year the participating faculty of the WCCMS 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 WCCMS Annual Report will be completed and submitted to the Werth Family Foundation during February of each year. Contents of the WCCMS 2013-2014 Annual Report are described below.

I. Research Projects

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

Faculty Dr. James Tait
 Science Education and Environmental Studies

Student Participants

Summer 2013; Fall 2013; Spring 2014

Catherine Cota, Undergraduate Student, Honors College
Kaitlyn Stobierski, Undergraduate Student, Honors College

Project Description

This is a long-term study that is currently ongoing. 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. The objectives of the research are 1) establishing the suitability of nearshore sands for use as beach replenishment material, and 2) establishing beach erosion rates.

Results to Date/Significance

Thirty beach and nearshore topographic profiles have been collected and analysis is ongoing. Profile stations 1 through 30 have now being surveyed and resurveyed out to wading depth. A current challenge that we are working on is how to define the "bottom" of the beach or offshore bar. This is particularly important for the offshore bar since the volume of sand contained in this bar is being presented as a source of beach sand.

Hurricanes Irene and Sandy have put an emphasis on beach erosion. Our efforts have provided us with pre-Sandy beach conditions for both beach and nearshore. This summer we are scheduled to resurvey the beach and offshore profiles for a third time. These three data sets should allow us to assess the suitability of using offshore "borrow" material for beach replenishment and to establish first order erosional trends for the park.

Assessment of Beach Erosion and Coastal Storm Damage Vulnerability at East Haven and West Haven, CT

Faculty Dr. James Tait
 Science Education and Environmental Studies

 Dr. Ezgi Akpinar-Ferrand
 Geography Department

 Dr. Scott Graves
 Science Education and Environmental Studies

Student Participants

Spring 2013; Fall 2013; Spring 2014

Catherine Cota, Undergraduate Student, Honors College
Kaitlyn Stobierski, Undergraduate Student, Honors College

Spring 2014

Alyssa Krinsky, Undergraduate Student, Geography Department
Michelle Ritchie, Undergraduate Student, Geography Department

Project Description

Several research initiatives have been initiated in response to the coastal impacts of hurricanes Irene and Sandy. The cities of East Haven and West Haven suffered severe damages to coastal properties as a result of these storms. Research activities include surveying beach profiles in order to assess beach stability (wide beaches were the most common source of protection against storm wave damage), mapping flood plains from the two storms and potential future storms, and creating coastal vulnerability maps and assessments. This research is being conducted in close liaison with city engineering and public works department to assure maximum usefulness of the data. It is our intention to extend these studies for Fairfield and Middlesex counties.

Results to Date/Significance

Pre- and post-Sandy profiles and observations pointed out the critical role of beaches in protecting shorelines from storm wave damage. The critical point of impact for Irene in CT was the Cosey Beach area of East Haven. The principle reason for this is that residents of the area had allowed their fronting beach to erode to the point of having no beach at high tide. The presence of a beach, even a relatively small one as it turns out, allows wave energy to be dissipated before interacting with structures such as coastal homes. This research led to a conference presentation at the Geological Society of America's Annual meeting in Denver, October 27-30, 2013. It also led to an invitation to write a chapter of a new book to be published by Elsevier on the Impacts of Hurricane Sandy.

The Effects of Dormancy on Competition Outcomes Between Marine Sessile Invertebrates

Faculty Dr. Sean Grace
 Biology, SCSU

Student Participant(s)

Summer 2013; Fall 2013; Spring 2014

Gabrielle Corradino, Biology, Graduate Student

Research suggests that the temperate coral *Astrangia poculata* is overgrown during the winter months by other marine invertebrates because this coral species undergoes dormancy (hibernation). The suggestion is being investigated for the first time in situ by tagging (aluminum tree tags) and following the competitive outcomes of 30 *A. poculata* colonies both in the intertidal (Bass Rock, Narragansett, RI) and subtidal (Fort Wetherill, Jamestown, RI) through the winter months (2013-2014). Using SCUBA, bi-monthly examinations of these interactions are taking place.

Results to Date/Significance

Results to date (February 2014) suggest that corals are not out-competed for space by a range of other invertebrate species (sponges, hydroids, anemones, tunicates). Assessment will continue throughout the summer months to examine the longer term effects of dormancy on these interactions, if any exist.

Effects of water flow on the capture ability of the temperate coral *Astrangia poculata*

Faculty Dr. Sean Grace
 Biology, SCSU

Student Participant(s)

Fall 2013; Spring 2014

Sarah Koerner, Biology, Undergraduate Student (Biology Honors Major)

Recent work suggests that water flow is important in explaining many aspects of a sessile organism's ecology and physiology. Small, sessile aquatic organisms like corals, anemones and sponges carry on simple respiration, in which dissolved oxygen diffuses into their cells from the surrounding water and carbon dioxide diffuses out of their cells back into the water, so that no specialized respiratory structures are needed. In addition to renewal of essential gases, water flow and mixing provide a continuous supply of nutrients and prey which allows some animals (for example, anthozoans like anemones, corals and hydroids) to feed as passive suspension feeders. Though this may appear to be an ideal feeding mechanism energetically, it has clear mechanical constraints. When water flow is very high, holding structures such as tentacles into

the flow to capture prey may be difficult or impossible and polyps may collapse because of the water strain. Laboratory studies will be designed to determine the relative importance of water flow on the feeding biology of *A. poculata*. Laboratory experiments will be completed in a recirculating flume, (Vogel style racetrack flume) pictured below powered by a 3hp trolling motor.

Results to Date/Significance

Sarah has properly characterized water flow in the flume and will begin experiments this Spring 2014 semester. This coincides with her HON 494 Prospectus course in which she will write up her thesis proposal.

Water Quality Monitoring in New Haven Harbor

Faculty Dr. Vincent T. Breslin
 Science Education and Environmental Studies
 Dr. James Tait
 Science Education and Environmental Studies

Student Participants

Summer 2013; Fall 2013; Spring 2014

Hollie Brandstatter, Undergraduate Student, Marine Studies
MAR 460 Undergraduate Students (9 students) Spring 2014

Summer 2013

Tiffany Ng, Undergraduate Student, Environmental and Marine Studies
Alex Fertel, Environmental and Marine Studies

Long Island Sound is an ecologically diverse environment with rich and varied ecosystems for marine organisms while also providing important environmental and recreational services for Connecticut and New York residents. Despite its ecological and economic importance, water quality throughout the Sound is vastly under-monitored, particularly in the especially vulnerable and densely populated coastal embayments. The Long Island Sound Study recently highlighted the importance of expanding and integrating water quality monitoring efforts throughout the Sound to provide uniform, reliable near-shore monitoring data to watershed managers and the broader scientific/technical community. The students and faculty of the Center for Coastal and Marine Studies at SCSU established a long-term water quality monitoring program at Long Wharf Pier, New Haven harbor in January 2012. Weekly water quality testing at this location occurs once per week coinciding with high tide. Water quality and meteorological parameters measured include salinity (ppt), specific conductance (mS/cm), dissolved oxygen (mg/L), air and water temperature (°C), wind speed (m/s), relative humidity (%), light intensity (lux), secchi disk depth (m), turbidity (NTU), and pH. Chlorophyll *a* measurements at this location will begin in March 2013.

Results to Date/Significance

To date, we have completed one continuous year of monitoring and are now monitoring water quality at this location for a second year. Water temperature (1.1-25.2 °C) at the pier at Long Wharf, New Haven displays a typical seasonal trend. Dissolved oxygen concentrations (5.75 – 13.6 mg/L) at this location also vary with temperature as oxygen solubility in water is a function of water temperature (greater solubility at lower water temperature). Salinity at this location at high tide varies within a narrow range from (9.8 – 26.7 ppt). Water clarity at this location, as measured using a secchi disk, ranges from 0.6 – 2.0 meters. The ranges of these values for these water quality parameters are typical for similar water parameters reported for other LIS coastal embayments. The water quality monitoring program is networked with other similar citizen/scientist water quality monitoring programs throughout LIS.

We have developed a procedure for the determination of chlorophyll-a using the Shimadzu UV-2600 UV/VIS Spectrophotometer and chlorophyll a determinations are now monitored routinely as part of the water quality monitoring program. Weekly chlorophyll-a measurements were initiated in August 2013. Mean monthly chlorophyll-a concentrations decreased from a high of 11.9 mg/L in August 2013 to a low of 2.3 mg/L in December 2013.

Microwave Assisted Digestion of Marine Sediment and Oyster Tissues

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

Student Participants

Fall 2013; Spring 2014

Hollie Brandstatter, Undergraduate Student, Marine Studies
Kristin Russo, Undergraduate Student, Biology

Microwave enhanced acid digestion techniques are considered state-of-the-art methods for the extraction of metals from sediment and biological tissues in preparation for analysis by atomic absorption spectrophotometry. The SE&ES Department acquired a Milestone ETHOS EZ microwave digestion system in September 2012. The microwave digestion process allows more rapid and thorough sediment and tissue decomposition as the digestion is accomplished at high temperature and pressure through microwave irradiation in acid in a closed vessel. This study will adapt previously recommended operational parameters for the digestion of sediment and biological tissues to optimize the microwave assisted digestion of harbor sediment and oyster tissue. Optimizing the time-temperature heating profiles and tissue mass:acid volume ratios for samples in my laboratory will allow for rapid metal extractions while reducing hazardous waste in research and teaching laboratory exercises. The working hypothesis in this research is that higher temperatures and pressures achieved during microwave digestion will result in more rapid sample decomposition and will allow the elimination of hydrogen peroxide and small quantities of perchloric acid added in previously used open-vessel digest techniques while achieving improved digest metal recoveries.

Results to Date/Significance

A time-temperature program was developed for the microwave digestion of sediment. The accuracy and precision of the microwave assisted digest technique was assessed by comparing metal recoveries versus their NIST 2702 Standard Reference Material Inorganics in Marine Sediment respective certified values. Additionally, previously analyzed Stamford harbor sediment samples from three stations were also analyzed using the microwave digest technique. Results showed that the microwave assisted digest technique was able to recover between 90-100% of the copper, zinc and iron certified values for the NIST 2702 Marine Sediment. Comparable metal recoveries were also achieved for the Stamford harbor sediment samples digested using a conventional open vessel wet acid digestion technique used in our laboratory. Current work is focusing on developing a similar microwave technique for the recovery of metals from oyster tissue.

Spatial Trends in Sediment Mercury in Connecticut Embayments

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

Student Participants

Summer 2013; Fall 2013; Spring 2014

Jeremy Flanders, Undergraduate Student, Chemistry and Marine Studies

Harbor sediments, due to the restricted water circulation and the proximity to multiple sources of industrial and municipal wastewater, are often contaminated with metals of environmental concern. Sediment metal contents vary as a function of sediment type and coastal harbors are usually characterized by a variety of sedimentary environments. The presence of contaminated sediment in Connecticut harbors is an issue of concern. WCCMS faculty and students have sampled sediment from 12 Connecticut harbors and embayments over the past decade (2002-2013). Many of the sediment samples collected from these harbors have been analyzed for copper, iron, zinc, loss on ignition and mean grain-size. WCCMS researchers are analyzing these archived sediments for the presence of mercury using the Milestone DMA-80 direct mercury analyzer.

Results to Date/Significance

Sediment mercury concentrations have been determined on archived samples for Black Rock, New Haven, Stamford, Clinton, and Milford harbors during the past year (2013). Sediment from Branford harbor are currently being analyzed. Results of these analyses were reported in the poster titled "Spatial Variations in Surface Sediment Mercury in Connecticut Coastal Embayments" at the Long Island Sound Research Conference, Port Jefferson, NY. April 19, 2013. We anticipate analyzing the mercury content of the archived sediment inventory in 2014.

Spatial Trends in Sediment Metals in Stamford and Greenwich Harbors

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

Student Participants

Summer 2013

Kristin Russo, Undergraduate Student, Biology
Jeremy Flanders, Undergraduate Student, Chemistry and Marine Studies
Hollie Brandstatter, Undergraduate Student, Marine Studies

Fall 2013; Spring 2014

Kristin Russo, Undergraduate Student, Biology

The objective of this study is to conduct a high spatial resolution sampling of Stamford, Greenwich and Cos Cob harbors to determine levels of sediment metal contamination. All three of these harbors are located along the Connecticut coastline in western Long Island Sound. This study examines the sediment composition and physical characteristics (grain size, and loss on ignition) at predetermined stations throughout each harbor. This study will also analyze the sediment for metals including iron, copper, zinc, and manganese. 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 17 stations in Stamford harbor and 11 stations in Greenwich/Cos Cob harbor during June 2013. These sediment samples have been examined for physical characteristics (predominant grain size, LOI) and digested for metal analyses. Greenwich and Stamford harbor metal contamination is highest in the fine-grain inner harbor sediment proximate to their respective wastewater treatment discharge areas. Kristin Russo is in the final stages of data analyses and will complete her Honors Thesis in May 2014.

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 2013 to discuss topics concerning the health and quality of Long Island Sound and its environs as part of the **Tenth Annual Seminar Series on Environmental Issues of Long Island Sound 2013**. Partial support for the seminar series was provided by a \$2,500 SCSU Faculty Development Grant awarded to Drs. Breslin, Tait and Grace.

The seminar series was consisted of four separate one-hour seminars by invited experts on Long Island Sound environmental issues during the Spring 2013 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 2013 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
3/13/2013	The Restoration of the Mouth of the Housatonic River, CT: One Point at a Time Mark Beekey, Associate Professor, Biology, Sacred Heart University, Fairfield, CT	21

Coastal regions, at the mouths of major rivers, in areas with high human population densities become polluted, compacted, invaded, degraded and lose their primary ecosystem functions. At Stratford Point, Connecticut we have begun coastal dune upland and salt marsh restoration after intensive clean-up efforts of tons of lead shot deposited at the site over a 50 year period. The Connecticut Audubon Society, The Nature Conservancy, DuPont Corporation, Sacred Heart University, The Housatonic River Estuary Commission and local community members have all participated in this project. The National Fish and Wildlife Foundation funded part of the project and will use the procedure as a model for other coastal areas. Instead of boulders and rip-rap, we have utilized Geotubes to abate wave energy, prevent erosion and enhance sand deposition at the site. We have restored dunes to the site and stabilized them with native grasses, perennials, woody trees and shrubs. The local fire department was employed implement a controlled burn to control invasive plant species and to rid the area of a build up of thatch that could potentially cause a devastating wildfire. The baseline data collected before restoration activities of the plants and animals found at the site will be compared to species that re-colonize the restored coastal dune system. The importance of the reference site, Milford Point will be discussed. Success will be measured by examining the number of native plant species that become established and by the number of birds and insect species that utilize the area compared to pre-restoration activities.

Date	Seminar	Attendance
4/9/2013	Nutrient Bioextraction: Opportunities for Nutrient Management in Long Island Sound through Extractive Aquaculture of Seaweeds Charles Yarish, Professor, Department of Ecology and Evolutionary Biology and Marine Sciences, UCONN, Stamford, CT	29

The objective of this study is to design, demonstrate, and promote the bioextraction of inorganic nutrients from coastal waters using native seaweeds (the red seaweed, *Gracilaria tikvahiae* and the sugar kelp, *Saccharina latissima*). Nutrient extraction for bioremediation was tested using *G.tikvahiae* at two sites: one off Fairfield, CT (LIS); and the other at the mouth of the Bronx River estuary (BRE), during the summer and fall of 2011 and 2012. *Gracilaria* at the BRE site grew 11.8% and 10.0% d⁻¹ at 0.5 m and 1 m deep, respectively in August 2011. The growth rate in July, 2012 was even as high as 5.9% and 6.0% d⁻¹ at the same depths. We have designed a hypothetical nutrient bioextraction 1 hectare *Gracilaria* farm system that assumes 4 meter spacing between longlines. Our hypothetical one hectare nutrient bioextraction *Gracilaria* farm system at the LIS site (in 2011) could remove 2.6 kg N ha⁻¹ mon⁻¹ from Aug-Oct and 5.5 kg N ha⁻¹ mon⁻¹ in Sept. and Oct. at the BRE site. During Aug. 2011 at the BRE site, nitrogen could be removed at 10.3 kg N ha⁻¹ mon⁻¹. These results suggest that nutrients were being rapidly assimilated and used to fuel the growth of new *Gracilaria* tissue at the BRE site, while nutrients appeared to limit the growth of *Gracilaria* at the LIS site during July and Aug. A winter crop, the sugar kelp, *Saccharina latissima* was farmed at the LIS during the winter 2012. After outplanting juvenile kelp (<1mm), it was found that the aquacultured kelp grew as much as 3.0 meters in length and had a yield as much as 18 kg m⁻¹ after 5 months (Dec.-May). Our hypothetical one hectare nutrient bioextraction kelp farm system at the LIS site with 5-10 m spacing between longlines could remove 46-87 kg N ha⁻¹ during that winter-spring growing season. These results suggest that seaweed aquaculture can be a useful technique for nutrient bioextraction in urbanized coastal waters. Since N removal varies with site and season, seaweed bioextraction could be best applied at nutrient hot spots in LIS and New York estuaries.

Date	Seminar	Attendance
4/10/2013	The Urban Estuary: What Doesn't Kill Ya Only Makes Ya Sick! William Wallace, Professor, Biology Department, College of Staten Island, Staten Island, NY	21

In this study, we assessed importance of sediment-associated trace metals in structuring benthic macroinfaunal assemblages along multiple environmental gradients in chronically polluted salt marshes of the Arthur Kill – AK (New York, USA). More than 90% of benthic macroinfaunal communities at the northern AK sites consisted of a considerably large number of only a few polychaete and oligochaete species. Approximately 70% of among-site variances in abundance and biomass of benthic macroinfaunal communities was strongly associated with a few environmental variables; only sediment-associated mercury consistently contributed to a

significant proportion of the explained variances in species composition along natural environmental gradients (e.g., salinity). Although sediment-associated copper, lead, and zinc were substantially elevated at some of the AK sites, their ecological impacts on benthic macroinfaunal communities appeared to be negligible. These findings suggest that cumulative metal-specific impacts may have played an important role in structuring benthic macroinfaunal communities in chronically polluted AK ecosystems.

Date	Seminar	Attendance
4/24/2013	Going the Distance: Emerging Contaminants in Long Island Sound Penny Vlahos, Associate Professor, Department of Marine Sciences, UCONN, Groton, CT	32

Waste water treatment facilities (WWTFs) input fresh water, nutrients, and contaminants into our waterways. While nutrient loads and concentrations for some pollutants are regulated, there are many emerging contaminants that are not controlled for as the full range of toxic effects are still to be determined, and the regulatory framework controlling their usage and allowable inputs into coastal waters has yet to be established. The water and sediment of the Long Island Sound (LIS) are routinely sampled for concentration data of classical persistent organic pollutants, however there are numerous emerging contaminants, with known endocrine disrupting and bioaccumulating properties, that have yet to be detected in this economically important region. It is critically important to investigate the inputs of emerging contaminants throughout the LIS, in order to determine the potential impacts on this estuarine ecosystem. Several WWTFs which discharge into the LIS watershed were tested for several classes of known endocrine disrupting compounds (EDCs); perfluorinated compounds (PFCs), phthalate esters (PAEs), phenolic compounds (nonylphenol, octylphenol and bisphenol A) and steroidal estrogens. WWTFs are a known point source for these pollutants. While these EDCs have been detected in many water bodies and sediments, partitioning data between environmental compartments is limited. An important factor in the fate and distribution of these target compounds is the scavenging by particulates which increases as a function of ionic strength. In order to determine the effect of salinity on the partitioning of ionic pollutants, the fate and distribution of the perfluoroalkyl compounds between the sediment, suspended particulate and dissolve phases was further investigated during a field survey undertaken along the salinity gradient of the Housatonic River Estuary.

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 recent and on-going Center partnerships include:

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 published in December 2013.

Department of Earth and Environmental Sciences, Wesleyan University: 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 August 2013.

Department Energy and Environmental Protection – Hammonasset State Beach: Dr. Tait continues working in association with Jack Hine, superintendent of Hammonasset State Beach, to monitor beach erosion and estimate potential offshore sands supplies that could potentially be used for beach nourishment.

Cities of East Haven and West Haven: Dr. Tait, Dr. Graves, Dr. Akpinar Ferrand and student research assistants are working with Mark Paine, Assistant Commissioner of Public Works for the city of West Haven in documenting and assessing on going beach erosion and other problems. Dr. Tait, Dr. Akpinar Ferrand, and student researchers are also working with Kevin White, City Engineer for the city of East Haven on beach erosion and storm flood plain analysis. The goal is to provide a coastal vulnerability assessment erosion and coastal resilience plan.

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>.

Long Island Sound Coastal Embayment Water Quality Monitoring Program

WCCMS researchers are participating partners in the Long Island Sound Study funded Long Island Sound Embayment Monitoring Project. This program is organizing and standardizing water quality measurements in the region to assure reliable, high quality water monitoring data for researchers and managers. This program is a collaboration between WCCMS, the Long

Island Sound Study, New England Interstate Water Pollution Control Commission, The Maritime Aquarium, UCONN, Save the Sound and the Citizens Campaign for the Environment.

Colleges of Ocean Science Education Excellence (COSEE) Report: Dr. Breslin collaborated with nine co-authors on the soon to be published National Science Foundation supported COSEE OCEAN Inquiry Group Report (http://scholarworks.umb.edu/environment_pubs/1) which provides a fresh look at how broader ocean science literacy can be developed, especially through less-recognized channels such as opportunistic learning, the private and “third” sectors, and the enormously varied activities under the heading of “informal science education.” Collaborators included Paul Boyle, President, American Zoological Association, Jerry Schubel, President, Aquarium of the Pacific, Sartah Schroedinger, Senior Program Manager, NOAA Office of Education and Steven Uzzo, Vice President of Science and Technology, New York Hall of Science.

Department of Chemistry, Coast Guard Academy, New London, CT: Capt. Richard Sanders, has agreed to assist Dr. Grace and Sarah Koerner with the collection of corals from Narragansett Bay and Long Island Sound in support of the coral feeding studies.

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 2013-2014 research presentations is listed below:

Presentations

Tait, J., 2013. Factors influencing the impacts of storm waves on the fetch-limited shoreline of Connecticut during hurricanes Irene and Sandy (abs). Geological Society of America, Annual National Meeting, Denver, October 27-30.

Breslin, V.T. 2013. Mercury Contamination in Connecticut Harbor Sediment and Biota. Long Island Sound Assembly. Regional Water Authority Building, Sargeant Drive, New Haven, CT. September 23rd, 2013.

Breslin, V.T. (2013). Are We Fouling Our Own Nest? Ansonia Nature Center. April 19th, 2013.

Geist, G. N. and Breslin, V.T. (2014). Prevalence of Disease, Growth Abnormalities and Tissue Metal Contents in Eastern Oysters (*Crassostrea virginica*) along the Connecticut Coastline. 34th Milford Aquaculture Seminar, Courtyard by Marriott, Shelton CT, February 24-26, 2014.

Gabrielle Corradino. The effects of dormancy on the competitive interactions with the temperate coral *Astraniga poculata* and other sessile invertebrates. Science/Academic Building Dedication Ceremony Poster Presentation. Southern Connecticut State University, September 20, 2013.

Jremy Flanders. Sediment Mercury Contamination in Stamford Harbor. Science/Academic Building Dedication Ceremony Poster Presentation. Southern Connecticut State University, September 20, 2013.

Hollie Brandstatter. New Haven Water Quality Monitoring Program. Science/Academic Building Dedication Ceremony Poster Presentation. Southern Connecticut State University, September 20, 2013.

Kristin Russo. Spatial Trends in Sediment Copper in Stamford and Greenwich Harbors. Science/Academic Building Dedication Ceremony Poster Presentation. Southern Connecticut State University, September 20, 2013.

Tait, J., Ferrand, E.A., Alyssa Krinsky, Michelle Ritchie, Catherine Cota, Kaitlyn Stobierski, Steve Krozer, Scott Thibault. Coastal Resilience Studies for the Town of East Haven. Science/Academic Building Dedication Ceremony Poster Presentation. Southern Connecticut State University, September 20, 2013.

Publications

Tait, J. *Invited Chapter Author*. The Lessons of Hurricanes Sandy and Irene in Connecticut. In J. Brett Bennington and E. Christa Farmer (eds.), Learning from the Impacts of Superstorm Sandy. Elsevier.

Boyle, P., V. T. Breslin, L. C. Brisson, J. Fraser, A.J. Friedman (editor), K. Gardner, S. Schoedinger, J. Schubel, S. Uzzo, and S. Yalowitz. (2013). Opportunities for Creating Lifelong Ocean Science Literacy. Colleges of Ocean Science Education Excellence (COSEE) Ocean Inquiry Group Report. National Science Foundation sub-award number OCE-1038853 to the New York Hall of Science, in collaboration with Award OCE-1039130, to the University of Massachusetts, Boston.

Breslin, V.T. and M. LaVallee, and G. Wenkert. 2013. Mercury Accumulation in Bluefish (*Pomatomus saltatrix*) in Long Island Sound. In: Proceedings of the Eleventh Biennial Long Island Sound Research Conference, April 19, 2013.

Varekamp, J.C., A.E. McElroy, J.R. Mullaney, B.J. and V.T. Breslin. 2014. Metals, Organic Compounds, and Nutrients in Long Island Sound: Sources, Magnitudes, Trends and Impacts. Chapter 5. Long Island Sound: Prospects for an Urban Sea. Editors: Latimer, Swanson, Tedesco, Yarish, Stacey and Garza. Publisher: Springer Series on Environmental Management. 558 pp. ISBN: 978-1-4614-6125-8.

Participation

Tait, J, A. Krinsky, and M. Ritchie. East Haven Town Festival (9/6/13). Poster Display and Informal Discussion with Concerned Citizens. *Coastal Resilience Studies for the Town of East Haven*.

Tait, J. Consultation with West Silver Sands Coastal Erosion and Flood Control District on mitigating storm impacts on coastal homes. January, 2014.

Student Theses and Reports/Advisors

Neil Geist	Incidence of Disease and Growth Abnormalities In Eastern Oysters (<i>Crassostrea virginica</i>) in Long Island Sound	December 2013
Kristin Russo	Sediment Metal Contamination in Stamford and Greenwich harbors.	May 2014
Sarah Koerner	Effects of water flow on the capture ability of the temperate coral <i>Astrangia poculata</i>	December 2014
Kaitlyn Stobierski,	Economic Analysis of Beach Sand Replenishment by the City of West Haven, CT	May 2015 Spring 2015.

Grants

A Diagnosis of the Impacts of Hurricanes Irene and Sandy on the Connecticut Shoreline with Recommendations for Improving Resilience. P.I. Tait, J. SCSU Faculty Creative Activity Research Grant Program. \$2,500.

Submitted: *Coastal Resilience Studies for Connecticut Shoreline Communities: Coastal Flood Plain Mapping, Beach Stability Studies, Coastal Vulnerability Assessment*. P.I.'s J. Tait, E. Akpinar Ferrant. CSU Research Grant Program. \$10,000.

Outer Island Programs. Community Foundation of Greater New Haven, Outer Island Executive Committee. Project Duration: June 2013 – May 2017. PI – V.T. Breslin. Total Funds \$41,600.

Microwave Assisted Digestion of Marine Sediment and Oyster Tissues. Connecticut State University 2013 Research Grant. Project Duration: June 1, 2013– May 30, 2014. PI – V.T. Breslin. Total Funds \$4,650.

Tenth Annual Seminar Series on Environmental Issues in Long Island Sound. Southern Connecticut State University Faculty Development Grant. Spring 2013. PIs – V.T. Breslin, S. Grace and J. Tait. Total Funds \$2,500.00.

The Effects of Dormancy on the Competitive Interactions Between the Temperate Coral *Astrangia poculata* and other Sessile Marine Invertebrates. Connecticut State University 2013 Research Grant. Project Duration: June 1, 2013– May 30, 2014. PI – Sean Grace. Total Funds \$3,818.

VI. Accounting, Budget Expenditures and Grant Writing

Academic Year 2013-2014 Itemized Budget Justification

Funds totaling \$55,000 were requested for Year 8 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 2013. Professors Breslin (\$3,000), Tait (\$2,000) and Grace (\$1,000) were compensated for mentoring student research projects. Fringe benefits on faculty salaries totaled \$1080. CCMS will contract a web designer (\$1,000; Sebastian Smith) to update and maintain the CCMS website during Spring 2014. 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) during the academic year in support of managing the CCMS activities and programs. The reassigned time allows faculty a lesser teaching credit load and the 6 credits time are valued at \$12,621.

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 2013 (7 students; \$10,200), Fall 2013 (8 students; \$5,500) and Spring 2014 (8 students; \$6,000). Fellowship amounts per student ranged from \$300-\$2,000 per semester (30-200 hours @ \$10/hour). The CCMS has a system-wide mission to support student research. This past year, the CCMS supported eleven different students in six different academic fields (Biology, Chemistry, Environmental Studies, Marine Studies, Geography and Honors) in support of faculty-directed research projects during this past year totaling \$21,700.

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. Travel funds (\$266) were used to support the travel of one faculty member and one student presenting a paper at the 34th Milford Aquaculture Meeting, Shelton, CT, February 24-26, 2014. Additionally, CCMS funds supported Dr. Tait's travel (\$823) to the Geological Society of America's 125th Anniversary Annual Meeting & Expo in Denver, CO, October 26-30, 2013. Dr. Tait presented a paper concerning the factors influencing the impacts of storm waves on the shoreline of CT during hurricanes Irene and Sandy.

Permanent Equipment and Service Contracts

Funds in this budget category were used to purchase a service contract for fiscal year 2013-2014 for the PerkinElmer Analyst 800 Atomic Absorption Spectrophotometer (\$6,924). SCSU provided partial matching funds support by purchasing a one year service contract (2013-2014) for the Milestone DMA 80 Direct Mercury Analyzer (\$2,500). The remaining balance for the 2013-2014 DMA-80 service contract (\$1,800) was supported from Werth Foundation funds.

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 two research/education cruises to sample sediments in two western Long Island Sound harbors in the Summer 2013. CCMS researchers chartered the R/V Oceanic, Maritime Aquarium at Norwalk, CT in support of sediment sampling activities in Stamford harbor (6/4/2013; \$1,100) and Greenwich harbor (6/12/2013; 1,100). Funds totaling (\$1,050) were used to charter the R/V Island Rover, Sound School, New Haven, CT on 6/27/2013 to collect sediment in New Haven harbor in support of the graduate EVE 537 Analytic Techniques and Instrumentation course. We anticipate using some of the remaining funds (\$750) later this spring 2014 to charter the R/V Island Rover in support of educational cruises in New Haven harbor for the undergraduate MAR 460 Field and Laboratory Techniques in Marine Studies.

Publication Costs

A total of \$600 was budgeted for publication costs for FY 2013-2014. Funds (\$250) will be used to purchase the recently published Long Island Sound: Prospects for the Urban Sea, Springer Series on Environmental Management.

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, tank gas for instrumentation, and supplies for the sediment metals research and laboratory supplies and field supplies for the sediment grain size and beach surveying research (\$3,869). Supply purchases were also made in support of research diving (\$766). Additional funds were used for the purchase of chemicals, supplies and reagents for chlorophyll *a* determinations and general office supplies. Additional supply funds will be used in support of student-faculty research projects during Spring 2014.

Balance of Funds

To date, CCMS has a 2013-2014 balance of \$4,770. The majority of the unencumbered funds are earmarked for the Spring 2014 Long Island Sound Seminar Series (\$1,500), a stipend for the student completing work on the WCCMS website (\$1,000), and the Spring 2014 charter of the R/V Island Rover (750). Additional funds will be used for supply purchases during the Spring 2014 semester in support of student research projects.

Matching Funds

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

Connecticut State University Research Grant Award 2013

The Effects of Dormancy on the Competitive Interactions Between the Temperate Coral *Astrangia poculata* and other Sessile Marine Invertebrates. Connecticut State University 2013 Research Grant. Project Duration: June 1, 2013– May 30, 2014. PI – Sean Grace. Total Funds \$3,818.

Microwave Assisted Digestion of Marine Sediment and Oyster Tissues. Connecticut State University 2013 Research Grant. Project Duration: June 1, 2013– May 30, 2014. PI – V.T. Breslin. Total Funds \$4,650.

SCSU Faculty Development Grant 2013

Tenth Annual Seminar Series on Environmental Issues in Long Island Sound. Southern Connecticut State University Faculty Development Grant. Spring 2013. PIs – V.T. Breslin, S. Grace and J. Tait. Total Funds \$2,500.00.