

Southern Connecticut State University

Center for Coastal and Marine Studies

CCMS Annual Report 2006-2007

Prepared by:

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Prepared for:

The Werth Family Foundation
Woodbridge, CT

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CCMS Annual Benchmark/Evaluation Report 2006-2007

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 2006-2007 Annual Report are described below.

I. Research Projects

Student and faculty research projects conducted each year are a central focus of the center. This year (2006-2007), CCMS participating faculty were involved in laboratory and field research programs involving sixteen SCSU students. A complete description of 2006 initiated and ongoing research projects are described below.

Faculty: Dr. James Tait
Science Education and Environmental Studies

Student Participant(s)

Heather Lally, Earth Science Department, Undergraduate
Mike Yaguid, Science Education and Environmental Studies, Graduate
Kevin Dennis, Liberal Studies, Undergraduate
Carrie Javins, Earth Sciences, Undergraduate
Ellen Bulger, Science Education and Environmental Studies, Graduate

Project Description

The presence of metal contaminants in marine sediments can have significant impacts on bottom-dwelling marine organisms. Breslin and others have conducted high-resolution sampling of sediments in Connecticut's harbors, including Norwalk, Bridgeport, and New Haven and have found metal contamination to be elevated. The spatial distribution of metal concentrations depends on sediment properties as well as sources and fluxes of contaminants. A pattern of decreasing metal concentration and increasing average grain size, moving from inner harbor to outer, was found and presents an interpretive problem. Do sediment contaminant concentrations decrease seaward because one is getting farther from river and local industrial sources, or is concentration decreasing because sediment grain size is increasing? Smaller grain sizes have more surface area for metal to adhere to per unit volume, have more clay minerals with electrostatic charges, and tend to have more organic material. All of these tend to increase metal concentrations. This research seeks to isolate the role of sediment characteristics in metal concentration in Connecticut's harbors so that the contribution of proximity to sources and magnitude of flux can be more clearly interpreted.

Results to date/Significance

Early results suggest that mean grain size correlates inversely with Zn, Cu, and Fe concentrations. The variability of concentration with respect to grain size remains substantial and may possibly be accounted for by the presence of organic material in the sediments, by differences in sediment composition (e.g., type and percentage of clay minerals), or simply by the limited number of data. De-trended data (actual concentration minus predicted concentration based on grain size effects) indicate that some of the variability may be due to proximity to local sources of contamination.

In New Haven Harbor, sample sites that are adjacent to potential contaminant sources such as the Quinnipiac and Mill Rivers and the Quinnipiac Bridge (SS1-SS2), or the old sewage treatment plant (SS5), or the runoff from Morris Creek (which drains Tweed Airport (NHH28)) have higher than expected Copper concentrations despite factoring for grain size. In Branford, unusually high concentrations of Copper are found in a sample near Outer Island in the Thimbles. There is no obvious explanation for this, but a contamination *hotspot* appears to exist.

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

Student Participant(s)

Erica Ogalin, Liberal Studies, Undergraduate
Joshua Conklin, Liberal Studies, Undergraduate
James Santanelli, Biology, Undergraduate
Sean Garvey, Geography, Undergraduate

Project Description

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. Knowledge of the spatial variation of sediment metal contamination is important in prohibiting the disturbance of contaminated sediment and possible transport of contaminated sediment to clean, or less contaminated areas of harbors. Many harbors also support commercial and recreational shellfish industries and contaminated sediment may adversely affect the health and quality of living marine resources. Our research examines the spatial variation in sediment metal contents in coastal harbors. Current studies also examine the total metal concentration and the bioavailability of metals from the fine grain size fraction (silt/clay) of bulk sediment to assess the ecological consequences of the resuspension of fine grained sediment in coastal harbors

Results to date/Significance

In general, sediment metal contents are lowest in sand sized sediment fractions (0.5 mm-2 mm) and are highest in silt-clay size fractions (<0.063 mm). For example, for two stations in Norwalk harbor where the whole sediment Cu contents were 7.3 mg/kg (outer harbor) and 146 mg/kg (inner harbor), Cu contents of the silt-clay fraction of the sediment increased to 2800 mg/kg and 1200 mg/kg, respectively. Although the mass fractions of the silt-clay sized particles in some harbor sediments may be small (< 5%), these sediment particles are likely ingested by organisms and may be an important route for contaminant metal accumulation. Results of this study will be an important contribution in assessing the effects of grain size on sediment metal contamination assessing current and future impacts to commercial activities and living marine resources.

Faculty: Dr. Dwight Smith
Biology

Student Participant(s)

Shalyn Zapulla, Biology, Graduate
Anthony Magnano, Biology, Graduate
Tiffany Al-Maquitari, Biology, Undergraduate

Project Description

The Monk Parakeet is an invasive species that contributes biodiversity to otherwise bleak urban landscapes. Unfortunately, the Monk Parakeet nests on transformers cause occasional local power outages. In Fall 2005 the Connecticut UI initiated an eradication program to remove nests from transformers and destroy the birds. Wildlife organizations responded by suing UI which temporarily stopped slaughtering the birds, pending research to alleviate the problem. I am requesting funding to evaluate (1) ecological contributions of Monk Parakeets to urban environments and (2) to determine use of artificial platforms as suitable alternatives. Results may provide a management solution that will eliminate further slaughter, thereby ensuring the continued contribution of Monk Parakeets to urban wildlife diversity.

Results to date/Significance

Monk Parakeet adoption and behaviors at Artificial Nesting Platforms

Dwight Smith (faculty mentor) and Shalynn Zapulla (student researcher). Field work is now completed. Thousands of pages of data have been collected and are being put in excel files for analysis.

GPS Data Collection for Monk Parakeet Nests and Colonies in Southern

Connecticut. Dwight Smith (faculty mentor) and Tony Magnano (student researcher). GPS data has been gathered and is now being placed in computer for review with ARCVIEW and other software that permits enhanced analysis of distribution/dispersion in southern Connecticut.

Metapopulation Analysis of Monk Parakeet Populations. Dwight Smith (faculty mentor) and Tiffany Al-Maquitari (student researcher). Field work to commence this spring 2007. Project is designed to be the first ever application/analysis of metapopulation theory to Monk Parakeet populations as a potential management mechanism as well as elucidating basic population ecology of this important invasive species.

Faculty: Dr. Sean P. Grace
Biology

Student Participant(s)

Tara Driscoll, Biology, Graduate
Coleen Giannini, Biology, Graduate
David Caruso, Biology, Undergraduate

Project Description

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

Results to date/Significance

We have collected all the data and are finishing the early analysis where we compare the results of this work with the results collected from control animals of known age. This is the most exciting part of the research! We hope to finish the comparison by March 1, so we can present some of the results at the Benthic Ecology Meeting in Georgia this coming April. Colleen Giannini and I (Dr. Sean Grace) have worked closely together to streamline the protocol for brain dissection, embedding in paraffin for proper sectioning and the image capturing and analysis systems. We continue to meet weekly on the progress of this and again, hope to prepare this for publication and presentation at national meetings.

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, parochial, 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 2006 to discuss topics concerning the health and quality of Long Island Sound and its environs as part of the **Third Annual Seminar Series on Environmental Issues of Long Island Sound 2006**. Partial support for the seminar series was provided by a \$1,700 SCSU Faculty Development Grant awarded to Drs. Breslin, Tait and Smith.

The seminar series was comprised of four separate one-hour seminars by invited experts on Long Island Sound environmental issues during the Spring 2006 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 2006 semester attended and encouraged their students to attend the seminar series.

Date	Seminar	Attendance
3/29/06	Metal Pollution Sources and Sinks for a Song Island Sound Harbor and its Watershed. Gaboury Benoit , Yale University	50

Dr. Benoit presented a metal pollution balance for New Haven Harbor showing that the preponderance of metals in harbor sediments find their source in the Mill and Quinnipiac River watersheds, are principally reworked historical stream deposits, and have the harbor itself, as opposed to Long Island Sound, as their main sink.

4/12/06	Invasive Sea Squirts in Long Island Sound: Cometh the Blob. Stephan Bullard , University of Hartford	30
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Dr. Bullard discussed the biology of the sea squirt, alternately referred to as tunicates, and its role in the sound as an invasive species. In particular, this aggressive species poses a threat to shellfish beds by using shellfish as attachment objects, smothering the shellfish itself.

4/26/06	Rising Land and Rising Seas: the Origin of Long Island Sound and Early Human Settlements. Johan Varekamp , Wesleyan University	53
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Dr. Varekamp presented new research findings that using inorganic carbon (CaCO_3) derived from planktonic shell material found in the sediments significantly altered the time line of deglaciation in the formation of Long Island Sound. These results have significance to the history of human colonization of the area.

Dr. Sunila presented a summary of her ongoing work on shellfish pathology with a focus on the impacts of metals, including tumor growth, on oysters in New Haven Harbor.

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

III. Collaborations and Partnerships

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

Department of Earth and Environmental Sciences, Wesleyan University: Dr. Tait of SCSU and Dr. Johan Varekamp of Wesleyan University have agreed to collaborate on studies of marsh surface subsidence and habitat loss at the Charles E. Wheeler Wildlife Management area in the estuary of the Housatonic River. In conjunction with the Office of Long Island Sound Programs, Drs. Varekamp and Tait have discussed the benefit of installing several SET devices in the marsh. The Surface Elevation Table (SET) is a portable mechanical leveling device for measuring the relative elevation of wetland sediments. Such precise measurements are necessary for determining the role of sea level rise and other processes in marsh surface drowning and consequent habitat loss. Collaboration is in the discussion stage at present. See for reference: <http://www.pwrc.usgs.gov/set/>.

University of New Haven and the Connecticut State Agricultural Experiment Station: Presentation of results of grain size studies and heavy metals at the most recent Long Island Sound Research Conference led to a proposed collaboration between Dr. Roman Zajac, a benthic ecologist at the University of New Haven, a plant pathologist at the Connecticut State Agriculture Experiment Station, and Dr. Tait in an interdisciplinary investigation of the processes of marsh degradation at U.N.H's wetland observation site in Stony Creek. This is an area that has been subject to severe "sudden wetland dieback", a condition of rapid marsh deterioration characterized by the sudden loss of vegetation. See for reference: <http://wetland.neers.org/>.

The CSU Oyster Research Project: Dr. Breslin along with Drs. Tait, Grace and Smith prepared a research proposal to comprehensively examine the economic viability and environmental health of the Eastern oyster in Long Island Sound. We propose a collaborative project designed to: (1) conduct a multidisciplinary laboratory and field-based research program drawing upon the expertise of CSU faculty (WCSU, CCSU and SCSU) and community stakeholders to address issues of concern regarding the health and

recovery of the Connecticut oyster industry; (2) create sustainable education, research and outreach projects at the participating CSU campuses, the Sound School, Schooner Inc., and the Maritime Aquarium at Norwalk; and (3) produce data and analyses that will provide the foundation for a recovery plan for the Connecticut oyster fishery. The proposal is being considered as a member item in the 2008 US Dept. of Agriculture budget.

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 2006-2007 research presentations is listed below:

Poster Presentations at the Eighth Biennial Long Island Sound Research Conference, US Coast Guard Academy, New London, CT, October 26-28, 2006

Gain Size Effects on the Distribution of Metal Contaminant Concentrations in Sediments in Connecticut Harbors. Lally, Heather*, M. Yagid*, J. F. Tait
Center for Coastal and Marine Studies Southern Connecticut State University, New Haven, CT 06515

Partitioning of Metals on Size-Fractionated Harbor Sediment
Breslin, Vincent T., Santanelli*, James, Ogalin*, Erica and Conklin*, Joshua
Science Education and Environmental Studies

10th Connecticut State University Faculty Research Conference Western Connecticut State University, Saturday, October 14th, 2006

Corals in Long Island Sound: How *Astrangia*!
S.P. Grace. Biology

Aging the American Lobster (*Homarus americanus*); Does Size Matter?
C. Giannini*, S. Crawford and S. Grace. Biology

Metal Contamination in Connecticut Coastal Sediment
V.T. Breslin, E. Ogalin* and J. Conklin*. Science Education and Environmental Studies

Phase Association and Bioavailability of Metals in Harbor Sediment
V.T. Breslin and J. Santanelli*. Science Education and Environmental Studies

*denotes student co-author

Papers Published/In Press/In Preparation

Smith, D. G. Monk Parakeets: Urban Bane or Urban boon? Action Line 17-22. Fall 2006 issue.

Smith, D. G., and M. Johnson. Monk Parakeet use of Artificial Nest Platforms. Submitted to Urban Wildlife.

V. CCMS Website Development

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

VI. Equipment Acquisition and Training

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

Basic equipment for a sediment and analytical laboratory was acquired with the assistance of 2006 CSU research grants awarded to Tait and Breslin:

- 1) RO-TAP shaker and sieves for coarse- grained sediment fraction
- 2) Vacuum Pump for Dewatering Samples
- 3) Isotemp Oven for drying sediment samples
- 4) Barnstead International Muffle furnace for determining the % organics content of sediment samples via loss-on-ignition (LOI) procedures
- 5) Mettler Toledo Precision Balance for weighing sediment samples
- 6) Two Refrigerators and a Heavy Duty Freezer for storing sediment samples
- 7) Fisher Scientific Model 225 Benchtop centrifuge

Software acquisitions include Maptech Chart Navigator Pro, Starpath Chart Trainer and Nobeltec Tides and Currents. These software packages will be used in support of the field sampling activities and used for the education and training of students in basic navigation.

VII. Accounting, Budget Expenditures and Grant Writing

Academic Year 2006-2007 Itemized Budget Justification

Funds totaling \$40,110 were requested for Year 1 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). Werth Foundation requested funds were budgeted in support of salaries for faculty mentoring undergraduate student researchers during the summer months.

Professional Salaries

Werth Foundation funds were used in support of salaries for faculty mentoring students during the Summer 2006 (\$2,000). In addition, the CCMS contracted a web designer (\$1,000; Intersecting Technologies) to design and maintain the CCMS website. The website is an important component of our education and outreach activities. The SCSU Dean of Arts & Sciences provided faculty reassigned time (3 credits time each for Breslin and Tait) in support of managing the CCMS activities and programs. The reassigned time allow faculty a lesser teaching credit load and the 6 credits time are valued at \$8970.

Student Research Fellowships

A major portion of the Center budget consists of funds in support of undergraduate 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. We initially anticipated awarding six stipends of \$2,560.00 each (40 hours/week x \$8/hour x 8 weeks) to support student research (\$15,360.00; Year 1). Due to student demand, the CCMS decreased the amount of each fellowship (20 hours/week x \$10/hour = \$2,000) and increased the number (nine students) of fellowships provided to students during the Summer 2006 (\$18,000). The student research fellowships were once again offered during the Spring 2006 semester to prepare students for summer research. CCMS faculty currently support seven additional students (@\$500/student) during the Spring Semester. The CCMS has supported 16 different students in five different academic fields in support of faculty directed research during this past year (\$21,500).

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. Travel funds were used in support of student and faculty travel to the Long Island Sound Research Conference at the Coast Guard Academy in New London, CT in October 2006. Travel funds were also used in support of student and faculty travel to field sites in support of their respective research projects.

Permanent Equipment

Werth Foundation funds were used to purchase equipment in support of faculty and student research projects. A laptop computer was purchased as a field computer to allow faculty to travel to field sites and have access to a computer for the collection and logging of field data and observations (\$1,979). A laboratory clean bench was purchased for the laboratory in Jennings Hall 314. A clean bench filters the particles from the laboratory air and provides a Class 100 clean space for the preparation of reagents and samples in the absence of possible contamination (\$3,231). The SCSU Office of Sponsored Programs and Research (SPAR) allocated \$3,000 to the CCMS in support of research and academic programs for the 2006-2007 academic year. These funds were used to purchase professional grade surveying equipment (\$2,933) in support of research programs monitoring beach erosion along the Connecticut shoreline.

Ship Time

Funds for chartering ship time were budgeted to provide access to field sample sites for research and education along the Connecticut shoreline and in Long Island Sound. Ship time was chartered aboard the *R/V Island Rover*, a 46 foot vessel equipped to conduct coastal research and education programs operated by the Sound School, New Haven, CT. We requested \$5,250 to be used to charter boats in support of research and education programs. We have currently used \$3,050 to charter the *R/V Island Rover* and a smaller CT DEP boat in support of coastal research projects. We anticipate using another \$500 in April to charter the *R/V Island Rover* in support of education programs (MAR 250 Introduction to Coastal Pollution and MAR 160 Introduction to the Coastal Ocean).

Expendable Supplies

Funds for laboratory and office supplies (\$3,000) were budgeted to allow the purchase of materials in support of the CCMS research and educational initiatives. Supply funds were used to purchase SCUBA wetsuits for the coral research, laboratory chemicals and supplies for the sediment metals research and laboratory supplies and field supplies for the sediment grain size research (\$3,420). Navigation software (\$627; Windows compatible) was purchased for use in mapping the harbors, developing cruise plans and archiving sample locations.

Balance of Funds

We are in the process of distributing the remaining Werth Family Foundation unencumbered funds (\$2,540). A portion of the funds will support further website development and revision. We have also planned two educational cruises this spring 2007 to bring our students out into New Haven harbor and Long Island Sound to study marine ecosystems and we will purchase additional supplies to support on-going research projects.

Matching Funds

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

Connecticut State University Research Grant Award 2006-2007

Principal Investigator: James Tait

Project Title: The Role of Grain Size in Determining Metal Contaminant Concentrations in Marine Sediments at Norwalk Harbor, CT

Award Amount: \$5000

Connecticut State University Research Grant Award 2006-2007

Principal Investigator: Vincent T. Breslin

Project Title: Phase Association and Bioavailability of Metals in Harbor Sediment

Award Amount: \$5000

Connecticut State University Research Grant Award 2006-2007

Principal Investigator: Dwight Smith

Project Title: Monk Parakeets in Crisis: Ecological and Economic Issues in Conservation and Management.

Award Amount: \$5000

SCSU Faculty Development Grant 2005-2006

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

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

Award Amount: \$ 1700