

Southern Connecticut State University

Werth Center for Coastal and Marine Studies



WCCMS Annual Report 2018-2019

Prepared by:

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Prepared for:

The Werth Family Foundation, Woodbridge, CT

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CCMS Annual Benchmark/Evaluation Report 2018-2019

Each year the participating faculty of the WCCMS prepares and submits to the Werth Family Foundation an annual report describing the Center activities. This report is made available in both electronic and hard copy form. The report provides 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 is submitted to the Werth Family Foundation during February/March of each year. Contents of the WCCMS 2018-2019 Annual Report are described below.

WCCMS News and Appointments

The department of the Environment, Geography and Marine Sciences is pleased to announce the hiring of Dr. Emma Cross as an Assistant Professor starting in the fall 2019. Dr. Cross is currently a Post –Doctoral Research Fellow at the Department of Marine Sciences, University of Connecticut, Avery Point, Groton, CT. Dr. Cross received her PhD in Earth Sciences from the University of Cambridge, UK. Her research interests include the adaption potential of marine organisms in response to climate change. We welcome Dr. Cross and anticipate her being an active researcher and participating in Werth Center for Coastal and Marine Studies activities.

Southern Connecticut State University formally signed a Memorandum of Understanding with the Maritime Aquarium at Norwalk in fall 2018. As part of the MOU, SCSU has formally invited Dr. David Hudson to join SCSU as a Research Associate hosted by the Werth Center for Coastal and Marine Studies. Dr. David Hudson is a research scientist at The Maritime Aquarium at Norwalk. Prior to joining the aquarium, he served as an assistant professor at Atlanta Metropolitan State College, Georgia teaching and doing research in marine and aquatic biology. His research uses the behavior and physiology of crustaceans and fish to determine the effects of changes in the physical environment (temperature, salinity, sound, etc.) on distributions, survival, and ecology of marine and aquatic organisms. WCCMS faculty and students look forward to working with Dr. Hudson and the aquarium staff to strengthen and develop research opportunities for faculty and students.

The WCCMS is also pleased to announce the establishment of a twitter account in fall 2018 @Werth_Center. WCCMS researchers use the account to announce new research initiatives, student and faculty accomplishments and WCCMS news and seminar events. The Werth Center twitter content is frequently re-tweeted by others and is also posted on the SCSU twitter account. The account currently has many followers and we will continue to utilize the postings to network with regional and national scientists, universities, and organizations.

I. Research Projects

Water Quality Monitoring in New Haven Harbor

Faculty Dr. Vincent T. Breslin
 Environment, Geography and Marine Sciences

Student Participants

Summer 2018; Fall 2018; Spring 2019

Cassandra Bhageloo, Undergraduate, Chemistry
Mallery Breban, Undergraduate, Biology
Renee Chabot, Undergraduate, Chemistry
Maeve Rourke, Undergraduate, Environment, Geography and Marine Sciences

Fall 2018; Spring 2019

Ian Bergemann, Environment, Geography and Marine Sciences

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 Werth 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), Chlorophyll *a* and pH.

Results to Date/Significance

Results of our monitoring show that water temperature (-0.8 to 26.8°C) at the pier at Long Wharf, New Haven displays a seasonal trend. Dissolved oxygen concentrations (1.65 to 19.18 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). Additionally, there have only been three instances (8/16/12, 7/24/13 and 9/11/15) when the dissolved oxygen level measured below the threshold suitable to sustain marine life (3 mg/L). Salinity at this location at high tide varies within a narrow range (9.8 to 30.5 ppt). Water clarity, as measured using a secchi disk, varies from 0.30 to 2.5 meters. Chlorophyll-*a* concentration measured using UV/Vis spectrophotometry and fluorescence range from 0.13 to 80.6 µg/L. The ranges of these values for

these water quality parameters are typical for similar parameters reported for other Long Island Sound coastal embayments.

Three of our undergraduate students (Bhageloo, Breban and Chabot) co-authored an abstract accepted for presentation at the Many Waters, One State: Utilizing Connecticut's Lake, River, Wetland and Long Island Sound Citizen Science Communities. Three Rivers Community College, Norwich, CT. April 5, 2019.

The Effects of Temperature on the Photosynthetic Yield of Intertidal Apozooxanthellate Colonies of Temperate Corals

Faculty Dr. Sean Grace
 Biology

Student Participant(s)

Spring 2017 and Fall 2018

Julia Honan, SCSU Biology Honors Student

Intertidal temperate corals experience quiescence in the winter (a form of diapause) and thus exhibit no tentacular activity. Though no activity is noted, corals can maintain their symbiotic relationship with unicellular dinoflagellates known as zooxanthellae. Zooxanthellae photosynthesize and translocate the products of photosynthesis to the coral host (energy). This study will examine the photosynthetic yield (rate) of zooxanthellae in quiescent corals during winter 2018 and during their exit from quiescence through spring and summer 2018.

Results to Date/Significance (Honors thesis Defended on 12-13-18)

Astrangia poculata is a scleractinian coral with a far distribution in the Atlantic including the Long Island Sound and throughout the Southern New England coast. This coral, like its tropical relatives, feeds both heterotrophically capturing prey and autotrophically through a symbiotic relationship with the dinoflagellate zooxanthellae, which is present within the gastrodermal tissue of the coral. This coral, unlike its' tropical relatives, can survive with and without zooxanthellae present and thus can exist in a 'bleached' state. This coral is also unique in that it experiences a dormant state called quiescence, during colder months characterized by polyps no longer responding to touch. This study examined the *in situ* photosynthetic yield of zooxanthellae present in brown and white colonies over the course of 10 months, including the time the corals were dormant. Results demonstrated that the photosynthetic yield from zooxanthellate colonies was consistently greater than the azooxanthellate colonies on every visit to the site. Results also demonstrated that the yield from summer months (July, August and September) was significantly greater than the yield from winter months (December and February) and that corals, when quiescent, continue to photosynthesize. These results conclude that *Astrangia poculata* continues to photosynthesize throughout quiescence and bleaching, and that there is a difference between the photosynthetic yield of zooxanthellate and azooxanthellate corals.

Testing for the Presence of Seasonal Beach Profiles on the Connecticut Coast

Faculty Dr. James Tait
 Department of the Environment, Geography and Marine Sciences

Student Participants

Summer 2018; Fall 2018; Spring 2018

Brooke Mercaldi, Undergraduate Student, Environment, Geography and Marine Sciences
Research Coordinator, Coastal Processes Lab

Lauren Brideau, Undergraduate Student, Environment, Geography and Marine Sciences

Volunteers

David Bakies, Undergraduate Student, Environment, Geography and Marine Sciences
Matthew Dupont, Undergraduate Student, Environment, Geography and Marine Sciences
Liz Heikkinen, Undergraduate Student, Environment, Geography and Marine Sciences

Project Description

Ongoing multi-year research focused on testing for seasonal beach profiles on the Connecticut coast continues. Profiles have been measured at five study sites in fall of 2015, winter of 2015, spring of 2016, summer of 2016, fall of 2016, spring of 2017, summer of 2017, fall of 2017, spring of 2018, summer of 2018 and fall of 2018. Previous studies by Werth Center researchers have pointed to lack of energy in the fair-weather wave field as being responsible for chronic erosion of Connecticut beaches and exposing coastal structures and infrastructure to damages. The predominant model for annual beach behavior posits an annual equilibrium between a robust beach during fair weather waves and a smaller, eroded beach during periods of seasonal storminess. In this model, sand is transferred to offshore bars during storms and then returned to the beach by more moderate fair weather waves. Such changes in sand storage are referred to as seasonal beach profiles. The fair-weather waves on most beaches are derived from distant storms. A process called velocity dispersion sorts these waves into highly coherent wave trains (or swell) that are moderate in height and long in period. Such waves transport sand shoreward and rebuild the beach. On the Connecticut coast such waves are filtered out by Long Island. In addition, the small size of Long Island Sound prevents local fair weather waves from gaining sufficient energy to produce onshore transport and beach recovery after storm erosion.

The current research involves testing the scenario above by measuring beach profiles at five Connecticut beaches on a seasonal (four times per year) basis in order to establish the presence or lack of seasonal beach profiles (i.e., does the beach ever accrete and, if so, is there ever full recovery after a storm?). The beaches included in the study include Sherwood Island State Park, Bayview Beach in Milford, Hammonasset Beach State Park, Rocky Neck State Park, and Ocean Beach in New London. Since the Race at the east end of Long Island Sound is a possible entry point for large ocean swell, it is possible that beaches at the eastern end of the Sound exhibit

seasonal behavior while beaches further from the Race do not. The results of this study will provide key information concerning the state of vulnerability of Connecticut beaches.

A new component has been added to this study by researcher Brooke Mercaldi. Beach profiles will be taken on the south shore of Long Island during the typical period of beach recovery after winter storms. These profiles will be compared with the profiles measured along the Connecticut coast. The expected result is that the south shore profiles will show the onshore transport effects and beach recovery that is lacking on the Connecticut shoreline due to wave filtering by Long Island.

Results to Date/Significance

Measurement of beach profiles at 5 locations along the Connecticut shoreline have nearly been completed spring profiles were measured in March and summer profiles, along with Long Island profiles, will conclude the data gathering portion of the study. Profiles taken in all seasons and over a period of years beginning in 2015 indicate that there is very little-to-no cross-shore movement of sediment such as would be expected if Connecticut's beaches adhered to established seasonal beach dynamics. Small changes such as do exist are possibly due to alongshore shifts in sand due to waves. Contrary to expectations, beach profiles at New London, which are exposed to larger waves entering the east end of the Sound through the Race, also exhibited no seasonal changes.

The significance of these results is that Connecticut's beaches, and the structures located behind them, are particularly vulnerable to erosion and damages due to storm waves because erosion (narrowing of the beach) is not counter balanced by beach recovery during the non-storm season. Currently, eroding Connecticut beaches are periodically replenished by importing sand and placing it on the eroded beach to build the beach back out. This preserves the buffering capacity of the beach as well as the economic value produced by summer tourism. Such replenishment projects, however, are expensive and sources of sand are diminishing. Many of Connecticut's beaches are dangerously narrow and the structures and infrastructure behind them are seriously exposed to storm damage. An alternative strategy to maintaining coastal resilience to storms is suggested by this research. We have termed this *beach reclamation*. In this scenario, sand eroded from the beach and transported offshore into nearshore sand bars is reclaimed and returned to the beach using basic coastal engineering technology. In other words, humans to the work that, on most beaches, is done by nature. Such a strategy is much more economically sustainable than traditional beach nourishment and replenishment approaches. It also greatly simplifies the challenge of finding sediment grain size that match the original beach. Currently studies of beach sediment dynamics for the town of West Haven have led to the city adopting sediment reclamation in their conservation and development, harbor management, and coastal resilience plans. One of the next phases of this research is to use these results to identify areas of high exposure along the Connecticut coast.

Werth Center for Coastal and Marine Studies Aquarium

Faculty Dr. Vincent T. Breslin
 Environment, Geography and Marine Sciences

Student Participants

Summer 2018; Fall 2018; Spring 2019

Maeve Rourke, Undergraduate, Environment, Geography and Marine Sciences
Melissa Beecher, Undergraduate, Biology
Cassandra Bhageloo, Undergraduate Student, Chemistry
Renee Chabot, Undergraduate Student, Chemistry
Malery Breben, Undergraduate Student, Biology

Fall 2018; Spring 2019

Eric Nesmith, Undergraduate, Theatre
Ian Bergemann, Undergraduate, Environment, Geography and Marine Sciences

Werth Center facilities include two large (approximately 2500 gallon each) display aquaria, touch tank (500 gallons) and associated laboratory (SCI 111). WCCMS students and staff have supervised the conditioning of the aquarium system and the introduction of fish and invertebrates. Marine fish were first introduced to the aquarium in December 2015 (Tank #2 coastal aquarium) and January 2016 (Tank #1 open water aquarium). The aquaria were designed to mimic Long Island Sound ecosystems and contain only local fish and invertebrate species. Student interns have performed frequent water quality testing (4-5 days per week) and fish and invertebrate condition observations (6-7 days per week). Student interns are also responsible for daily feeding of the fish and invertebrates in each aquarium and touch tank.

Results to date/Significance

WCCMS student interns have completed three years of water quality measurements on the aquarium system. We continue to add new fish and invertebrates to the aquarium facility. Most recently, a toadfish was donated by the Maritime Aquarium at Norwalk. We hosted the Maritime Aquarium at Norwalk animal husbandry group at the aquarium in August 2018 and prepared documentation to designate the Werth Center aquarium as a non-AZA (American Zoological Association) facility. The designation indicated that the Werth Center aquarium facility conforms to AZA practices and ensure that the facility can provide for the health and well-being of the animals transferred to the collection from the Maritime Aquarium at Norwalk.

Similar to last year, WCCMS will host an Aquarium Open House in March 2019 to allow students throughout the campus an opportunity to tour the facilities and learn about LIS fish and invertebrates. We continue to utilize the aquarium facility in support of educational programming. This spring 2019, the aquarium students participating in Captivating Kids III on February 22, 2019, 9:30am –1:05pm. Captivating Kids is a STEM focused activity and the

aquarium hosted 82 eighth grade students from Bristol, Meriden, New Britain, Wolcott, and Hartford. The aquarium also hosted student visitors from the CT Odyssey of the Mind on Saturday, March 16th. Odyssey of the Mind is an international educational program that provides creative problem-solving opportunities for students from kindergarten through college.

Macroalgae as Bioindicators for Mercury Contamination in Long Island Sound

Faculty Dr. Sean Grace
 Biology
 Dr. Vincent Breslin
 Department of the Environment, Geography and Marine Sciences

Student Participants

Summer 2018; Fall 2018; Spring 2019

Cassandra Bhageloo, Undergraduate Student (Chemistry)

Characteristics that make macroalgae good bioindicators for metal contamination include wide distribution and abundance, ease of collection and identification, year round availability, and tolerance of a wide variety of temperatures and salinities. In addition, the use of biological species such as macroalgae to monitor for marine pollution allows for the assessment of effects of contamination on living organisms and their environment as well as their potential for use as a means of bio-remediation. Furthermore, studies focused on the use of macroalgae as bioindicators for trace metal contamination such as mercury show that the concentration of metal in the sediment, water column, and macroalgae are typically proportional. The objective of this study was to determine the effectiveness of macroalgae as bioindicators for mercury contamination in Long Island Sound. The presence of a west to east decreasing trend of mercury in the Sound proportional to anthropogenic sources of contamination was also examined. Characteristics that make macroalgae good bioindicators for metal contamination include wide distribution and abundance, ease of collection and identification, year-round availability, and tolerance of a wide variety of temperatures and salinities.

This study focused on determining the mercury content of seven species of macroalgae including green (*Ulva lactuca*, *Codium fragile*), brown (*Fucus vesiculosus*, *Fucus distichus*) and red (*Chondrus crispus*, *Grateloupia turutura*, *Gracilaria tikvahiae*) algae sampled from seven locations (Stamford to Westbrook) in fall 2017 along the Connecticut shoreline. Freeze-dried algae tissue samples (0.100-0.250 g) were analyzed directly for mercury by thermal decomposition amalgamation and atomic absorption spectrophotometry using a Milestone DMA-80 direct mercury analyzer.

Results to Date/Significance

Good agreement was achieved for measured and certified mercury concentrations (18.6 µg/kg) from European Reference Material (ERM) CD200 Bladderwrack (*Fucus vesiculosus*). Results showed that macroalgal tissue mercury concentrations in Long Island Sound varied by species.

Codium fragile tissue mercury contents were lowest and ranged from 3.5 µg/kg in Norwalk to 8.1 µg/kg in Milford. Highest measured mercury concentrations were measured in *Fucus vesiculosus* with concentrations ranging from 28.4 µg/kg in New Haven to 42.1 µg/kg in Norwalk. In general, mercury concentrations were lowest in green algae species, intermediate in red algae species and highest in brown algae species.

Assessing the Effectiveness of a U.S. Army Corps of Engineers Beach Replenishment Project at Hammonasset State Beach

Faculty Dr. James Tait
Department of the Environment, Geography and Marine Sciences

Student Participants

Fall 2018

Lauren Brideau, Undergraduate Student, Environment, Geography and Marine Sciences
Lead Researcher, Hammonasset State Beach

Brooke Mercaldi, Undergraduate Student, Environment, Geography and Marine Sciences
Research Coordinator, Coastal Processes Lab

Volunteers

David Bakies, Undergraduate Student, Environment, Geography and Marine Sciences
Matthew Dupont, Undergraduate Student, Environment, Geography and Marine Sciences
Liz Heikkinen, Undergraduate Student, Environment, Geography and Marine Sciences

Project Description

This research initiative has evolved into a two-part project located at Hammonasset State Beach. The first part is *Assessing the Effectiveness of a U.S. Army Corps of Engineers Beach Replenishment Project at Hammonasset State Beach*. In October of 2017, the state of Connecticut initiated a \$9 million beach replenishment project at Hammonasset Beach State Park, located in Madison, Connecticut. This plan involved placing 270,000 cubic yards of sand along the western beaches at Hammonasset in order to increase the width of the existing beach. Hammonasset has had chronic erosion problems, particularly along the western beaches. It should be noted that Hammonasset is the second largest attraction in the state of Connecticut after the casinos and is therefore economically important to the state. The beach fill material was dredged from the mouth of the Housatonic River for the purpose of maintaining a navigation channel. It was subsequently shipped 33 miles to Hammonasset by barge then pumped as a slurry onto the beach. The sand was allowed to dewater then it was graded into a design shape which included a wide berm and a gently sloping beach face. The process took several months. However, winter storms in 2017/2018 appear to have undermined the design of the project. Preliminary analysis indicates that the original beach design had the berm located too low relative to mean sea level. Subsequent changes in the project relative to the design will be

tracked by Werth Center researchers. The coastal lab staff have discussed their efforts with staff at the New England Division of the U.S. Army Corps of Engineers in Boston, MA.

This project is part of a larger project provisionally called *Developing a Beach Sediment Management Plan for Hammonasset State Beach*. The object of this research is to find an economically sustainable alternative for addressing beach erosion problems at Hammonasset. The basic plan is to use 29 beach profiles distributed along the length of the beach to 1) measure the volumes of sand and the beach width, 2) to measure erosion, deposition, and infer transport pathways, and 3) to articulate a plan that can be used by the CT DEEP (the agency that manages the park) to address erosion problems. The basic strategy is to monitor beach erosion, determine where the sand goes and to put it back. This is the essence of sand management and reclamation. Measurements will involve using profile data to produce 3-D topographic maps of the beach and the use of serial 3-D maps and calculations based on conservation of mass to locate areas of erosion and deposition.

In sum, Werth Center researchers are working with the Park management and with the Army Corps of Engineers to 1) evaluate the effectiveness of the project design and 2) help the Park develop a sediment management plan by studying sand dispersal patterns. By creating a plan to track, retrieve, and redistribute existing sediments, instead of continuously importing new sediments, the Werth Center will be helping Hammonasset and the state of Connecticut environmentally and economically.

Results to Date/Significance

At this point in time, three triennial surveys have taken place and preliminary results are available. The primary of these is the depiction in the profiles of 1) results of initial storm erosion and profile retreat, 2) overwash of the berm and formation of an elevated berm crest and establishment of an anterior trough that caused ponding of water along the berm, and 3) flattening of the berm with disappearance of the ponding (most likely due to regrading by the park administration). Additional measurement of all 29 profiles is currently underway along with analysis of changes to date.

Assessment of the Walk Bridge Construction on the Water Quality of the Norwalk River

Faculty Dr. Vincent Breslin
 Department of the Environment, Geography and Marine Sciences

Student Participant

Spring 2019

Renee Chabot, Undergraduate, Chemistry

Walk Bridge in Norwalk is a four track, 123 year old swing railroad bridge, connecting Washington D.C., New York, and Boston. This rail line is the most used in America with over 125,000 daily riders. It carries Metro-North's New Haven line, Amtrak, and freight services. The

bridge was electrified in 1907 and added to the National Register of Historic Places in 1987. Walk Bridge is notorious for its aged mechanical mechanisms that have failed time and time again, delaying transportation on and below it on the Norwalk River. The Walk Bridge Project will greatly increase the dependability of service rail, but presents a challenge to the ecology of the Norwalk Harbor.

The Harbor's active shellfishing industry has a large economic and cultural importance to the area; civic leaders and shellfish industry representatives are calling for water quality monitoring to protect the natural resources and shellfish beds during bridge construction. WCCMS researchers have shown that the sediment below the bridge is contaminated with metals of environmental concern. Bridge construction activities may re-suspend contaminated river sediment and transport the sediment to the outer harbor oyster beds. The re-suspended sediment may be ingested by the oysters and cause unacceptably high metal contamination in their tissues.

The goal of this study is to determine the potential adverse consequences to the Norwalk River's water quality during bridge replacement construction. This will be carried out through sampling of suspended sediment north and south of bridge construction. Initially, there will be 6 stations selected in the Norwalk river and sediment at each station will be analyzed for grain-size and metals (mercury, copper, and zinc). Suspended sediment sampling in the river will occur on at least two occasions north and south of the bridge construction for water quality. These stations will test the suspended sediment that could theoretically move to the outer harbor. Water quality parameters (salinity, dissolved oxygen, pH) will also be measured.

Results to Date/Significance

Renee Chabot has applied for an Undergraduate Student Research grant to support the proposed research project. Renee has been analyzing sediment metal contamination in Norwalk harbor since last summer. We have had preliminary discussion with Norwalk community groups including the Norwalk River Watershed Association, the Norwalk Harbor Management Commission and the Norwalk Shellfish Commission concerning the scope of work to be conducted. We anticipate starting research this spring – summer.

Subtidal Recruitment and Settlement of the Temperate Scleractinian Coral *Astrangia poculata*

Faculty Dr. Sean Grace
 Biology

Student Participant(s)

Academic Year 2015, 2016, 2017, 2018

Gabriella DiPreta, Biology, Graduate Student

The recruitment and settlement of temperate corals will be examined at 12m depth at Fort Wetherill, Jamestown, RI. The frequency of settlement of corals on temperate reefs is unknown

as is the preferred orientation of settlement substrate (vertical or horizontal). Temperate corals represent a unique model system for tropical species who recruit and settle at specific times throughout the year.

Results to Date/Significance

In summer 2017, terra-cotta tiles have been placed in situ at 12 m depth at Fort Wetherill. Tiles have been secured to the horizontal and vertical substrate with z-spar (splash zone compound). At monthly intervals, the tiles have been photographed and all species settling on the tiles identified to species. Additionally, temperature measurements have been made in situ using Onset Hobo-temp recorders set to record temperature at 5 minute intervals from the initiation of the study till the end of the student (December 2018). Gabriella has collected all data and is currently writing her MS thesis. She has analyzed all videos and pictures and developed an underwater lighting system (that she wrote code for) to investigate coral behaviors and is currently writing. She is fully on track to defend her thesis in the spring 2019 semester.

Cove River Marsh Recovery

Faculty Dr. Scott Graves
 Dr. James Tait
 Department of the Environment, Geography and Marine Sciences

Project Description

The town of West Haven several years ago undertook a salt marsh restoration project that involved replacement of a tide gate and removal via cutting and herbicide of invasive common reed (*Phragmites australis*). Unfortunately, recolonization by native marsh grasses has been very problematic. Studies of marsh elevations, characterization of the marsh surface, water level changes, sediment samples, and observations via drone have been conducted in order to understand current marsh dynamics and to develop hypotheses concerning the failure of the marsh to thrive.

Results to Date/Significance

Marsh elevation data, sediment samples, and extensive drone observations have been collected twice at this point in time. This study is significant in that coastal environments such as salt marshes, which are highly important coastal ecosystems, will come under increasing stress as a result of climate change. Specifically, with sea level rise, marsh surfaces will be subjected to increased periods of inundation by salt water. This will result, eventually, in losses of high marsh grasses such as *Spartina patens* and *Dystichlis spicata*, and eventually loss of low marsh grasses (*Spartina alterniflora*). The grasses are keystone species in the marsh ecosystem. The study is also significant in that it investigates a marsh that is completely surrounded by an urbanized environment. During sea level rise, marshes typically responded by migrating landward. In this case, there is no place for the marsh to go. The surrounding development presents a barrier to marsh migration.

A plan to study the connections between marsh geomorphology and marsh hydrology is in the process of being articulated. Very high resolution topographic measurements are required for this task. As a result, a high resolution GPS investigation of marsh elevations has been planned for the spring of 2019. Centimeter-grade Real Time Kinematic (RTK) GPS and GNSS receivers will be given trial runs in the field during spring semester in order to find one that best fits Werth Center needs.

GIS Maps of Connecticut Coastal Harbor Sediment Metal Contamination

Faculty

Dr. Vincent Breslin
Department of the Environment, Geography and Marine Sciences

Student Participant

Spring 2019

Ethan Mehlin, Undergraduate, Geography

Over the past 16 years, researchers from the Werth Center for Coastal and Marine Studies (WCCMS) have examined the spatial trends of contaminant metals in surface sediments in every major harbor in Connecticut. This sediment database contains the results of the physical and chemical analysis of over 600 sediment samples collected from 14 different Connecticut harbors and is the largest, most comprehensive, sediment metal database for Connecticut coastal embayments. The database includes sediment metals (copper, zinc and iron) and physical properties (% organic matter) and each sediment station is geo-referenced (latitude and longitude). This database represents an excellent opportunity to resolve the physical and chemical factors controlling the spatial distribution of metals in regional coastal harbors. This project will focus on preparing a visualization of the harbor sediment metal contamination using GIS mapping software. The goal is to prepare contour maps for each Connecticut harbor showing the spatial trends in sediment grain-size, organic carbon and contaminant metals. The location of each of the harbor sediment samples collected over the years has been defined by latitude and longitude. This allows for the preparation of maps identifying the location of each sample in a harbor and the use of GIS software to prepare contour maps showing the trends of sediment physical and chemical properties within each harbor.

Results to Date/Significance

These maps can be useful in identifying areas within harbors for shellfish habitat restoration/expansion, identifying areas of concern for dredging projects, inform harbor development activities, and highlight areas of concern for sediment resuspension (storm events). The maps can also serve as a baseline for future sediment contamination studies.

Hurricanes and Coastal Resilience: Palaeostorm Evidence from the Geological Record

Faculty Dr. Jason Kirby
Department of Geography, Liverpool John Moores University, Liverpool U.K.

Dr. James Tait
Department of the Environment, Geography and Marine Sciences

Lauren Brideau, Undergraduate Student, Environment, Geography and Marine Sciences Lead Researcher, Hammonasset State Beach

Project Description

In a time of climate change, there has been much speculation about whether warming ocean water is changing the frequency and intensity of North Atlantic hurricanes. One of the problems with trying to resolve this question is that hurricanes are essentially rare events and the historical record only goes back a few centuries. A much longer record may be contained in marsh sediments in the form of sedimentary (e.g., sandy layers) or chemical proxies.

Results to Date/Significance

This research is still in its initial stages. The target marsh is Hammonasset because it is old and we have good relations with park management, however, additional marshes along the Connecticut coast have been identified. Areas in which storm surge overwash might be likely have been identified. Methodology for obtaining and handling the cores is being developed. Lidar maps have been created. This research, which is a joint Ph.D. project with Liverpool John Moores University in the U.K., was put on hold due to the loss of the original Ph.D. candidate. Undergraduate Lauren Brideau, who has been working on marsh sediment cores at the Northeast Fisheries Science Center Lab in Milford, CT, has expressed interest in assuming responsibility for this project.

Examination of Atlantic Herring (*Clupea harengus*) for the Presence of Microplastics

Faculty

Dr. Vincent Breslin
Department of the Environment, Geography and Marine Sciences

Student Participant

Spring 2019

Maeve Rourke, Undergraduate, Environment, Geography and Marine Sciences

Microplastics, plastics < 5 mm diameter, are an emerging contaminant and represent a growing threat to coastal ecosystems due to their ability to accumulate hydrophobic contaminants and their ingestion by pelagic and benthic marine organisms. Atlantic herring, due to its mode of

feeding and importance as food, is an ideal marine organism for microplastic studies. Atlantic herring occupy an important ecological niche in the LIS ecosystem as they primarily feed on plankton suspended in the water column and are an important prey for large predatory fish and birds and are directly consumed by humans. Herring are able to use their gill rakers to filter-feed on suspended particulates (phytoplankton and zooplankton) and they are also likely extracting and ingesting microplastic particles they encounter in the water column. Herring therefore, represent a direct pathway for the transfer of microplastics from coastal waters to humans and/or predatory marine organisms. Herring are also a primary food for captive seals and sharks at the Maritime Aquarium at Norwalk. As such, aquarium administrators are concerned about the potential long-term exposure of captive animals to microplastic contamination from consuming Atlantic herring.

Results to Date/Significance

The proposed study is designed to examine the gills and gut contents of regional and local Atlantic herring and will allow for a determination of the potential for microplastic accumulation by humans and marine predators. This study will test the following hypotheses: (1) Atlantic herring gills and digestive systems will contain microplastic particles and (2) LIS captured herring will show a higher prevalence of microplastic contamination compared to herring captured offshore (Mid-Atlantic-Gulf of Maine).

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 three regional experts during the spring 2018 to discuss topics concerning the health and quality of Long Island Sound and its environs as part of the Fifteenth Annual Seminar Series on Environmental Issues of Long Island Sound 2018.

The seminar series consisted of four separate one-hour seminars by invited experts on Long Island Sound environmental issues during the spring 2018 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 2018 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.

Wednesday, February 28th, 1:00 - 2:00 pm, Academic Science Building 210

Colette Feehan, Assistant Professor, Department of Biology, Montclair State University

Phase Shifts in Marine Ecosystems Driven by Storms, Disease, and Glacial Melting

Increasingly, it has been recognized that ecosystems undergo abrupt changes or “phase shifts” in response to perturbations such as storms, disease outbreaks, and climate change. Here I will discuss research wherein I examine the direct and indirect effects of such perturbations on coastal marine ecosystems ranging from kelp beds to coral reefs to polar plankton. A primary focus of my work is to elucidate the environmental drivers of an emerging disease in a kelp bed ecosystem. I highlight the need to broaden our conceptual framework of top-down trophic ecology to include host-pathogen interactions that lead to trophic cascades and ecosystem phase shifts. Marine disease is one of the most complex and pressing issues facing scientists and society. Gaining insight into the processes that mediate disease outbreaks and the community-level effects of these events will be crucial to management and conservation of marine ecosystems.

Wednesday, March 28th, 1:00 - 2:00 pm, Academic Science Building 210

Gary Wikfors, Chief, Aquaculture Sustainability Branch/Lab Director, NOAA
Northeast Fisheries Science Center

The Integrated Pest Management Model as a Framework for Aquaculture Harmful Algal Bloom (Red Tide) Mitigation

Phytoplankton “blooms” are natural phenomena that result from seasonal and other environmental cycles that vary the availability of energy (light and turbulence) and materials (carbon and other nutrients) in space and time. As the geological epoch referred to as the Anthropocene proceeds, there is clear recognition that human activities are playing an increasing role in modifying environmental cycles that influence phytoplankton population dynamics, including those of taxa that are considered harmful, i.e., Harmful Algal Blooms, or HAB. Concurrently, as reliance of human populations upon advanced food-production systems is driving expansion of seafood cultivation – aquaculture – our reliance upon the quantity and quality of primary production becomes more specific and demanding of stability. Within the general context of direct trophic use of phytoplankton by cultivated shellfish, and considering the reliance of all aquaculture enterprises upon enabling environmental quality, HAB are correctly considered to be disruptions analogous to agricultural pests. Accordingly, one approach to developing a comprehensive strategy for managing aquaculture in seas increasingly experiencing HAB is to look toward agricultural models – for example Integrated Pest Management (IPM) – for applicable components. This presentation will explore the applicability of agricultural IPM models to aquaculture management of increasing HAB interactions.

Wednesday, April 4th, 1:00 - 2:00 pm, Academic Science Building 210

Sean Grace, Associate Professor, Biology, Southern Connecticut State University

Interspecific Competition on Changing Temperate Reefs

Southern New England temperate reefs may be experiencing a phase shift from kelp to turf dominance. Comparisons between historical and recent densities of kelp indicate a noticeable decrease and a change in community structure. Kelps that are present can attach to hard substrate or directly to turf macroalgae. In this study, the in situ attachment strength of *Saccharina*

latissimi (Linnaeus) was examined using a modified dynamometer (spring scale) for individuals attached to hard substrate or turf-like macroalgae at 4.5m depth at Fort Wetherill State Park, Jamestown, Rhode Island. Additionally, the density, holdfast biomass, stipe and thalli length of kelp, were measured at 2 and 6m depth from kelp attached to turf or hard substrate. Results show that *S. latissima* was significantly more likely (4 times) to be removed when attached to turf algae versus hard substrate. Also, kelp density decreased but the proportion of kelp attached to turf increased with depth. Kelps attached to turf exhibited greater holdfast biomass and lesser thalli length than those attached to hard substrate.

Wednesday, April 18th, 1:00 - 2:00 pm, Academic Science Building 210

David Hudson, Research Scientist, The Maritime Aquarium at Norwalk

Incorporating the Public into Doing Science and Conservation: Lessons and Projections from 20 Years of Biodiversity Monitoring in the Long Island Sound

For its location, The Maritime Aquarium at Norwalk (TMA) has a unique opportunity to engage citizen scientists to gather and disseminate information related to the health of the Long Island Sound, an EPA "Estuary of National Significance." Since 1997, school group and public participants of the marine life study cruise on TMA's research vessel were directed by trained staff to sample a tract of Outer Norwalk Harbor. Sampling methods included deployment of plankton and trawl nets, a bio-dredge, and the use of a CTD for measurements of water temperature, dissolved oxygen, and temperature. This allowed for participants to learn how to count and measure organisms from three different sections of the water column, and to record data. Since 2006, those data have been governed by an EPA-approved Quality Assurance Project Plan, and entered into a publicly available database on The Maritime Aquarium at Norwalk's website. The database currently has over 3,000 datasets, mostly from Norwalk Harbor, and there are data that go back to 1988. Analysis of these data across species in context with datasets available through the CT DEEP and NOAA allows for more powerful use of the occurrence data through comparison with other trawl data from the area.

Taking a lesson for how the program progressed in the past, TMA is building a conservation and research program that includes areas of: biodiversity, water quality, ocean farming, plastics/plasticizers, climate change/coastal resilience, and ocean soundscapes.

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:

Evaluation of Biofouling Communities on Wind Turbine Foundations at the Block Island Wind Farm, Rhode Island: Dr. Grace is collaborating with Drs. John King and Monique LaFrance Bartley (University of Rhode Island), Paul English (Fugro GB Marine Ltd.) and Anwar A. Khan (HDR) to determine the community structure of sessile and mobile organisms on the offshore wind mill farm at Block Island, Rhode Island. This is part of a U.S. Department of the Interior, Bureau of Ocean Energy Management, Office of Renewable Energy Programs Grant.

Similarities and differences between genomes of temperate and tropical corals: Dr. Grace is collaborating with Drs. (Ilaina Baums, Katie Barott, Kathryn Stankiewicz, Sheila A. Kitchen, and Meghann K. Devlin-Durante: Department of Biology, Pennsylvania State University; Koty Sharp: Roger Williams University; Hollie Putnam: University of Rhode Island; Randi Rotjan, Sarah Davies, John Finnerty, and Leslie Kaufman: Boston University) to determine the genome of the temperate coral *Astrangia poculata*. By determining the order of DNA nucleotides (the genome) in this corals species which, unlike tropical corals, exists over a large geographic and temperature range (0° – 30° C) we will be able to examine the factors that are expected to affect corals and their survival in the future when sea-water temperatures and pCO₂ levels are expected to increase. As of January 23rd, 2018 Dovetail has completed the sequencing and have begun the initial assembly of the genome. We hope to have a draft very soon!

Hidden problems in secret corals; exploring microplastic abundance in local, temperate corals along an urban gradient: Dr. Grace is collaborating with Dr. Randi Rotjan (Boston University, New England Aquarium); Dr. Juanita Urban-Rick (University of Massachusetts Boston –School for the Environment); and Dr. Koty Sharp (Roger Williams University, Department of Biology) to determine the extent and impact of microplastics (beads and fibers) and microbial bio-films in a temperate coastal coral along an urban gradient. The highly populated New England coast's only scleractinian coral *Astrangia poculata* is likely heavily exposed to pollutants and microbeads. Their level of exposure could depend on an urban areas use of either sewer or septic systems. We hypothesize that there will be a difference between corals growing in areas with sewerage versus septic in terms of microbead accumulation, since microbeads are mostly produced from the personal care industry. However, given the prevalence of microfibers from multiple sources, we hypothesize a more even distribution of microfibers in all urban areas. (Funded through Boston University Grant to Rotjan, Urban-Rich, Sharp and Grace: \$10,000).

The Rise of Turfs: Phase shifts in macroalgal dominance affecting hard bottom reefs in Narragansett Bay and Long Island Sound: Dr. Grace is collaborating with Dr. Colleen Feehan (Montclair State University) examining the ecological consequences of a change in the

dominant macroalgal species in local coastal waters. Typically, Southern New England hard bottom reefs are dominated by the kelp (*Saccharina latissimi*) however this species and all its benefits (increased biodiversity and productivity) has been replaced locally with r-selected 'rattier' turf macro-algal species. This collaboration will examine hard bottom reefs to document this change and determine the factors responsible for these changes.

Cities of West Haven and East Haven: Dr. Tait 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. In particular, they are monitoring the fate of a beach replenishment project that stretches from Tyler Street to Bradley Point. They have also conducted studies on beach stability for the entire West Haven coast that can be used to refine beach sand management for the city. Dr. Tait, Dr. Mathew Miller (EGMS geographer) and student researchers are also working with Kevin White, City Engineer for the city of East Haven, on a comprehensive coastal vulnerability assessment and coastal resilience plan. The goal is to improve the city's resilience to storms and sea level rise with tools such as beach nourishment and a system of raised levee's that would serve as recreational space as well as flood control measures.

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, now referred to as the Unified Water Study, 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.

Sound School, New Haven and UCONN Avery Point vessel operations: WCCMS researchers chartered ship time aboard vessels from the Sound School and UCONN Avery Point. These collaborations are especially valuable as our students gain experience conducting research in Long Island Sound and as long-term users, we have been granted in-house charter rates with both organizations. WCCMS researchers are also collaborating with Sound School faculty and students in monitoring water quality in New Haven harbor.

The Maritime Aquarium at Norwalk and SCSU are developing a memorandum of understanding to facilitate collaborations among faculty, staff and students of our two institutions. At present, Maritime Aquarium staff are assisting Dr. Breslin with the stocking and maintenance of the two large display aquaria associated with the Werth Center in the new science building. The Maritime Aquarium has generously donated most of the fish species currently on display in the aquaria. WCCMS and SCSU are currently developing a memorandum of understanding to formalize this relationship. Three WCCMS students were employed as interns at the Maritime Aquarium during the past year: Hollie Brandstatter, Laura Bracci and Nicole Woosley. We anticipate increasing student internships at the aquarium due to the experience our students are gaining monitoring water quality and feeding the fish and invertebrates in the Werth Center Aquaria.

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 is to prepare and distribute educational materials, including new curricula that focuses on the importance of Long Island Sound and environs. Communication of research results is 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 2018-2019 research and outreach presentations is listed below:

Presentations

Tait, James F. (Oral Presentation). Stationarity, Transformation and Adaptive Capacity. Society for Ecological Restoration, New England Regional Conference, Southern Connecticut State University, October 11-13, 2018.

Mercaldi, Brooke, M. (Poster). Testing for Seasonal Beach Profiles Along the Connecticut Coast. Society for Ecological Restoration, New England Regional Conference, Southern Connecticut State University, October 11-13, 2018.

Brideau, Lauren. (Poster). Coastal Management on an Eroding Shoreline: An Alternative Restoration Technique. Society for Ecological Restoration, New England Regional Conference, Southern Connecticut State University, October 11-13, 2018.

Tait, James F. (Oral Presentation). Building Coastal Resilience in the State of Connecticut via Strategic Sediment Management. Annual Meeting of the American Association of Geographers, Washington, D.C., April 3-7, 2019.

Mercaldi, Brooke M. (Oral Presentation). Examining the Dynamics of the Connecticut Shoreline and their Implications for Coastal Zone Management. Annual Meeting of the American Association of Geographers, Washington, D.C., April 3-7, 2019.

Brideau, Lauren. (Oral Presentation). Coastal Management on an Eroding Shoreline: An Alternative Restoration Technique. Annual Meeting of the American Association of Geographers, Washington, D.C., April 3-7, 2019.

Grace, S.P. (Invited). Competition on changing reefs, do the native species have what it takes? George Mason University, Fairfax, Virginia. February 23rd, 2018.

Grace, S.P. and C.L. Feehan. (Oral Presentation). Holdfast Morphology. 47th Annual Benthic Ecology Meetings. Corpus Christi, Texas. March 29, 2018.

Kathryn H. Stankiewicz, Sheila A. Kitchen, Meghann K. Devlin-Durante, Iliana B. Baums, Sean Grace, Randi Rotjan, Koty Sharp, Hollie Putnam, Sarah Davies, Katie Barott, John Finnerty, and

Leslie Kaufman. The Genome of *Astrangia poculata*. Marine Evolution Conference. University of Gothenberg, Strömstad, Sweden. May 2018.

Grace, S.P. (Oral Presentation). Epi-genomics and the genetics associated with the temperate corals. 3rd Annual Astrangia Working Group Meeting. Roger Williams University, Bristol, Rhode Island. August 2, 2018.

DiPreta, G. (Oral Presentation). Early settlement and growth of temperate corals. 3rd Annual Temperate Reef Ecology Meeting (August 2018). Roger Williams University, Bristol, Rhode Island.

Grace, S.P. D. Veilleux, C. Feehan, C. Navraez. (Poster) *Arbacia punctulata* Aquaculture, A Possible Control for the Rise of Turf Macroalgae. 11th Annual Northeast Aquaculture Conference & Exposition and the 39th Milford Aquaculture Seminar. Boston, Massachusetts, January 2019.

Bhageloo, C., Breban, M. and R. Chabot. (Poster). Long-term Water Quality Monitoring at Long Wharf, New Haven (2012-2019). Many Water, One State: Utilizing Connecticut's Lake, River, Wetland and Long Island Sound Citizen Science Communities. Three Rivers Community College, Norwich, CT. April 15, 2019.

Bhageloo C, Grace S. and V.T. Breslin. (Poster). Macroalgae as Bioindicators for Mercury Contamination in Long Island Sound. Long Island Sound Research Conference, March 15, 2019. Danfords Hotel, Port Jefferson, NY.

Mendez, Q. and V.T. Breslin. (Poster). An Examination of the Tissues of American Oysters for the Presence of Microplastics in the Housatonic River Estuary. Northeast Aquaculture Conference and Exposition and the Milford Aquaculture Seminar. Boston Park Plaza Hotel, Boston, MA. January 9-11, 2019.

Breslin, V.T. (Invited). Plastics in the Ocean: Global and Regional Impacts. Environmental Issues Seminar, Three Rivers Community College, Norwich, CT. April 17th, 2019.

Bhageloo, C., Breslin V.T. and S. Grace. 2018. (Poster) Macroalgae as Bioindicators for Mercury Contamination in the Long Island Sound. 57th Annual Symposium of the Northeast Algal Society, University of New Haven, New Haven, CT. April 13-15, 2018.

Breslin, V.T. Seminar (Invited). Microbeads – Macro Problems: The Environmental Consequences of Consumer Plastics in Long Island Sound. Washington Garden Club presents A Mary Anne Erichsen Community Program: Plastic Pollution: A Persistent Problem. Rumsey Hall School, Washington Depot, CT. June 21st, 2018.

Breslin, V.T. Seminar (Invited Keynote). Factors Controlling the Distribution of Contaminant Metals in Connecticut Coastal Harbors. The Third Annual Student Research Symposium of the New Haven Local Section of the American Chemical Society. Quinnipiac University, North Haven, CT. April 28, 2018.

Publications

Feehan, C.J., S.P. Grace and C.A. Narvaez. (Accepted). Ecological feedbacks stabilize a turf-dominated ecosystem at the southern extent of kelp forests in the Northwest Atlantic. Scientific Reports.

Grace, S.P. and B. Patrizzi. 2018. Presence of the northern star coral (*Astrangia poculata*) as an epibiont on the carapace of the spider crab *Libinia emarginata* in the central Long Island Sound, USA. Reef Encounters

Grace, S.P., M. LaFrance-Bartley, P. English, J.W. King, and A.A. Kahn. 2019. Evaluation of Biofouling Communities on Wind Turbine Foundations at the Block Island Wind Farm, Rhode Island. Draft Report to the U.S. Department of the Interior, Bureau of Ocean Energy Management, Office of Renewable Energy Programs. OCS Study BOEM 2019.

Grants

Characterization and Quantification of Microplastics in Wastewater Treatment Facility Effluent. Connecticut State University 2018 Research Grant. Project Duration: June 1, 2018– May 30, 2019. PI – V.T. Breslin. Total Funds \$4,250.

Plastic Microbead Accumulation in Eastern Oysters, SCSU Faculty Creative Activities Research Grant. PI – V.T. Breslin. Total Funds \$2,500.

Characterization of Microplastics in Treated Wastewater Effluent Discharged to the Quinnipiac River. Submitted to the Quinnipiac River Fund, Community Foundation for Greater New Haven. Project Duration: May 2019-April 2020. PI - V.T. Breslin. Total Funds: \$19,815. Status: Pending.

Examination of Atlantic Herring (*Clupea harengus*) for the Presence of Microplastics Connecticut State University 2019 Research Grant. Project Duration: June 1, 2019– May 30, 2020. PI – V.T. Breslin. Total Funds \$5,000. Status: Pending

Chabot, R. (Submitted). Impacts of the Walk Bridge Construction on the Norwalk River Water Quality. Undergraduate Research Grant. Southern Connecticut State University. March 2019. Total Funds \$3,000. Status: Pending.

Grace S.P. 2018. Kelp Farming: a potential contributor to kelp restoration in Long Island Sound. \$2,500.00. Faculty Creative Activities Research Grant.

Grace S.P. 2018. Subtidal community development and monitoring on the wind turbine at the Block Island Wind Farm, Rhode Island. \$10,000.00, Collaboration with John King (University of Rhode Island Graduate School of Oceanography).

Grace S.P. 2018. Hidden problems in secret corals; exploring microplastic abundance in local, temperate corals along an urban gradient. Boston University Marine Program Research Grant.

\$10,000.00, with Randi Rotjan (Boston University), Dr. Juanita Urban-Rick (University of Massachusetts Boston) and Dr. Koty Sharp (Roger Williams University).

Grace S.P. 2018. Science Pedagogy III: Engaging students with Research in the Classroom. CSU-Faculty Development Grant. \$4,000.00, with Dr. Rachel Jeffrey.

Participation

Breslin, V.T. (Invited Committee Member). Synthetic Microfiber Working Group, CGA Environment Committee 2018. September 18th November 14th, 2018. CT DEEP, Hartford, CT.

Grace, S.P. 2018. Dr. Grace was co-host and co-organizer for the 3rd Annual Temperate Reef Ecology Meeting held at Roger Williams University in summer 2018 (August 2-4). This meeting introduced over 50 coral scientists/students to temperate corals and how these corals may be used as a model system to study tropical reef systems that are currently under threat. A fourth meeting is planned for summer 2019 as well.

Brideau, Lauren; Mercaldi, Brooke; Bakies, David; Tait, J. (Presentation) Visiting Scholars Event, Amity High School. Research at the Werth Center for Coastal and Marine Studies Coastal Lab. December 17, 2018.

Mercaldi, Brooke and J. Tait. (Invited). Research at the Werth Center for Coastal and Marine Studies Coastal Lab. Singles Under Sail. Norwalk, CT April 18, 2019.

Student Theses and Reports/Advisors

| Student | Thesis Title | Completion Date |
|--------------------|---|-----------------|
| Qiana Mendez | An Examination of the Tissues of the American Oyster (<i>Crassostrea virginica</i>) for the Presence of Microplastics in the Housatonic River Estuary | May 2018 |
| Julia Honan | The effect of temperature on the rate of photosynthesis of intertidal <i>Astrangia poculata</i> (Ellis and Solander 1786) | Dec. 2018 |
| Cassandra Bhageloo | Macroalgae as Bioindicators for Mercury Contamination in the Long Island Sound | May 2019 |
| Gabriella DiPreta | Early Successional Community Structure and Coral Behavior on Rhode Island Rocky Reefs | May 2019 |
| Brooke Mercaldi | Examining the Dynamics of the Connecticut Shoreline and their Implications for Coastal Zone Management | Dec. 2019 |
| Lauren Brideau | Coastal Sediment Management on an Eroding Shoreline: An Alternative Beach Restoration Technique | Dec. 2019 |

Werth Center Fellows Alumni Update

Sarah Koerner (Werth Center Fellow 2014, 2015) will be finishing her MS degree at NOVA-Southeastern in Florida with Joana Figueiredo, Ph.D. (Coral Larval Biologist) this May 2019 and beginning a PhD program (Natural Resources) at Cornell University this fall 2019 semester.

Undergraduate Research and Creativity Conference

Southern Connecticut State University

Werth Center for Coastal and Marine Studies Participants

April 14th, 2018

Werth Center for Coastal and Marine Studies students were well represented at the fourth annual undergraduate research and creativity conference held at SCSU. The following students presented oral or poster presentations at the conference.

| Students | Presentation Title |
|-------------------------------------|--|
| Joshua Green | A Comparison of Acid Digestion Methods for Marine Sediment to Optimize Metal Recovery |
| Brooke Mercaldi and Jade Serrano | Assessing the Effectiveness of a US Army Corps of Engineers Beach Replenishment Project at Hammonasset State Beach |

VI. Accounting, Budget Expenditures and Grant Writing

Academic Year 2018-2019 Itemized Budget Justification

Funds totaling \$75,000 were requested for Year 13 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 and Honoraria (\$9,260 expended)

Werth Foundation funds were used in support of salaries for faculty mentoring students during the summer 2018. Professors Breslin (\$3,000), Tait (\$2,000) and Grace (\$2,000) were compensated for mentoring student research projects (\$1,260 fringe benefits). The SCSU Dean of Arts & Sciences provided faculty reassigned time (3 credits time each for Breslin, Grace and Tait) during the academic year in support of managing the CCMS activities and programs. Reassigned time (9 credits) for faculty in support of CCMS management totaled \$19,140.

Honoraria (\$500 each) were paid to Dr. David Hudson (Maritime Aquarium at Norwalk) and Dr. Colette Feehan (Montclair State University) for their participation in the 2018 Long Island Sound Seminar Series.

Student Research Fellowships (\$30,500 expended)

A major portion of the Center budget consists of funds in support of undergraduate and graduate student 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 2018 (7 students; \$10,500), Fall 2018 (11 students; \$10,000) and spring 2019 (11 students; \$10,000). Fellowship amounts per student ranged from \$500-\$2,000 per semester (50-200 hours @ \$10/hour). The CCMS has a system-wide mission to support student research. This past year, the CCMS supported fourteen different students in seven different academic fields (Biology, Chemistry, Environmental Systems and Sustainability Studies, Marine Studies, Geography, Theater and Honors) in support of faculty-directed research projects during this past year totaling \$30,500.

Permanent Equipment and Service Contracts (\$14,434 expended)

Funds were used to purchase two Ocean Kayak Scrambler 11 foot sit-on-top kayaks (\$585 each) for use in support of WCCMS coastal ecology research.

Funds in the service contract budget category (\$13,264) were used to purchase a service contract for fiscal year 2018-2019 for the PerkinElmer AAnalyst 800 Atomic Absorption Spectrophotometer (\$8,764). Werth funds were also used to purchase a one year service contract (2018-2019) for the Milestone DMA 80 Direct Mercury Analyzer (\$4,500).

Ship Time (\$3,500 expended)

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. Funds totaling (\$1000) were used to charter the R/V *Island Rover*, Sound School, New Haven, CT to collect sediment in New Haven harbor on July 31, 2018. This cruise was conducted in support of Dr. Breslin's research examining the effects of sediment dredging in New Haven harbor on sediment quality. The R/V *Island Rover* was also chartered (\$1,500) for two three hour cruises in New Haven harbor in support of educational programming. Cruises for MAR 210 were scheduled in the fall semester 2018 for 10/25 and 10/26. Sediment samples obtained during these cruises were examined for metals in support of the WCCMS harbor studies. The R/V Spirit of the Sound (Maritime Aquarium) was chartered (\$1,000) in support of sediment sampling in Norwalk harbor on August 2, 2018.

Long Island Sound Seminar Series (\$1,644)

Funds were allocated to support the annual spring Long Island Sound Seminar Series. This year marks the 15th consecutive year that the Werth Center for Coastal and Marine Studies has hosted the seminar series. Funds were used to purchase refreshments (\$644) for the seminars and a \$500 honorarium was paid to two of the four invited seminar speakers (\$1,000).

Travel and Conference Funds (\$1,211 expended to date)

Travel funds totaling \$1,500 were budgeted to reimburse costs associated with travel in support of attendance at local, regional and national scientific meetings. WCCMS students presented posters at the Undergraduate Research and Creativity Conference at SCSU, the Northeast Algal Society meeting at University of New Haven on April 13-15, 2018, the Northeast Aquaculture Conference and Exposition, Boston, MA on January 10, 2019, the Long Island Sound Research Conference in Port Jefferson, NY on March 15, 2019, and the CT DEEP sponsored Many Waters, One State Water Quality Conference at Three Rivers Community College, April 5, 2019.

Publication Costs (\$402 expended)

A total of \$600 was budgeted for publication costs for FY 2018-2019. Funds were used primarily in support of printing large format posters (3' x 4') for student research posters for scientific meetings.

Expendable Supplies (\$5,949 expended)

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, cartridges for water purification systems, standard reference materials for laboratory instrument calibration, supplies for the sediment metals research and laboratory and field supplies for the sediment grain size and beach surveying research. Additional funds were used for the purchase of chemicals, supplies and reagents for water quality and aquarium supplies and general office supplies. Supplies were also purchased to support educational and aquaculture activities in the Werth Center aquarium laboratory. Supplies include

filter cartridges for 30 gallon aquaria, water quality test kits, and water quality meters. Supply purchases exceeded the budgeted amount as supply needs were increased due to new research initiatives.

Balance of Funds

To date, CCMS has expended \$65,900 of the \$75,000 funds budgeted for FY 2018-2019. A portion of the remaining funds (\$4,000) will be used to purchase materials and supplies in support of WCCMS laboratories and field studies this spring. The remaining balance of funds will be carried over to FY 2019-2020.

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 2018-2019

Kelp Farming: A potential contributor to kelp restoration in Long Island Sound. SCSU Faculty Creative Activities Research Grant. PI – S. Grace. Total Funds \$2,500.

Science Pedagogy III: Engaging students with Research in the Classroom. SCSU-Faculty Curriculum Development Grant. \$4,000. PIs – S. Grace and Dr. Rachel Jeffrey.

Characterization and Quantification of Microplastics in Wastewater Treatment Facility Effluent. Connecticut State University 2018 Research Grant. PI – V.T. Breslin. Total Funds \$4,250.

Plastic Microbead Accumulation in Eastern Oysters, SCSU Faculty Creative Activities Research Grant. PI – V.T. Breslin. Total Funds \$2,500.

