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 to19.18 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.

<u>The Effects of Temperature on the Photosynthetic Yield of Intertidal Apozooxanthellate Colonies of Temperate Corals</u>

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 is 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.

<u>Testing for the Presence of Seasonal Beach Profiles on the Connecticut Coast</u>

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.

<u>Macroalgae as Bioindicators for Mercury Contamination in Long Island Sound</u>

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 Hammonnasset 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 essense 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.

<u>Subtidal Recruitment and Settlement of the Temperate Scleractinian Coral *Astrangia poculata*</u>

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-cota 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.

<u>GIS Maps of Connecticut Coastal Harbor Sediment Metal Contamination</u>

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.

<u>Hurricanes and Coastal Resilience: Palaeostorm Evidence from the Geological Record</u>

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.

<u>Examination of Atlantic Herring (*Clupea harengus*) for the Presence of Microplastics</u>

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).