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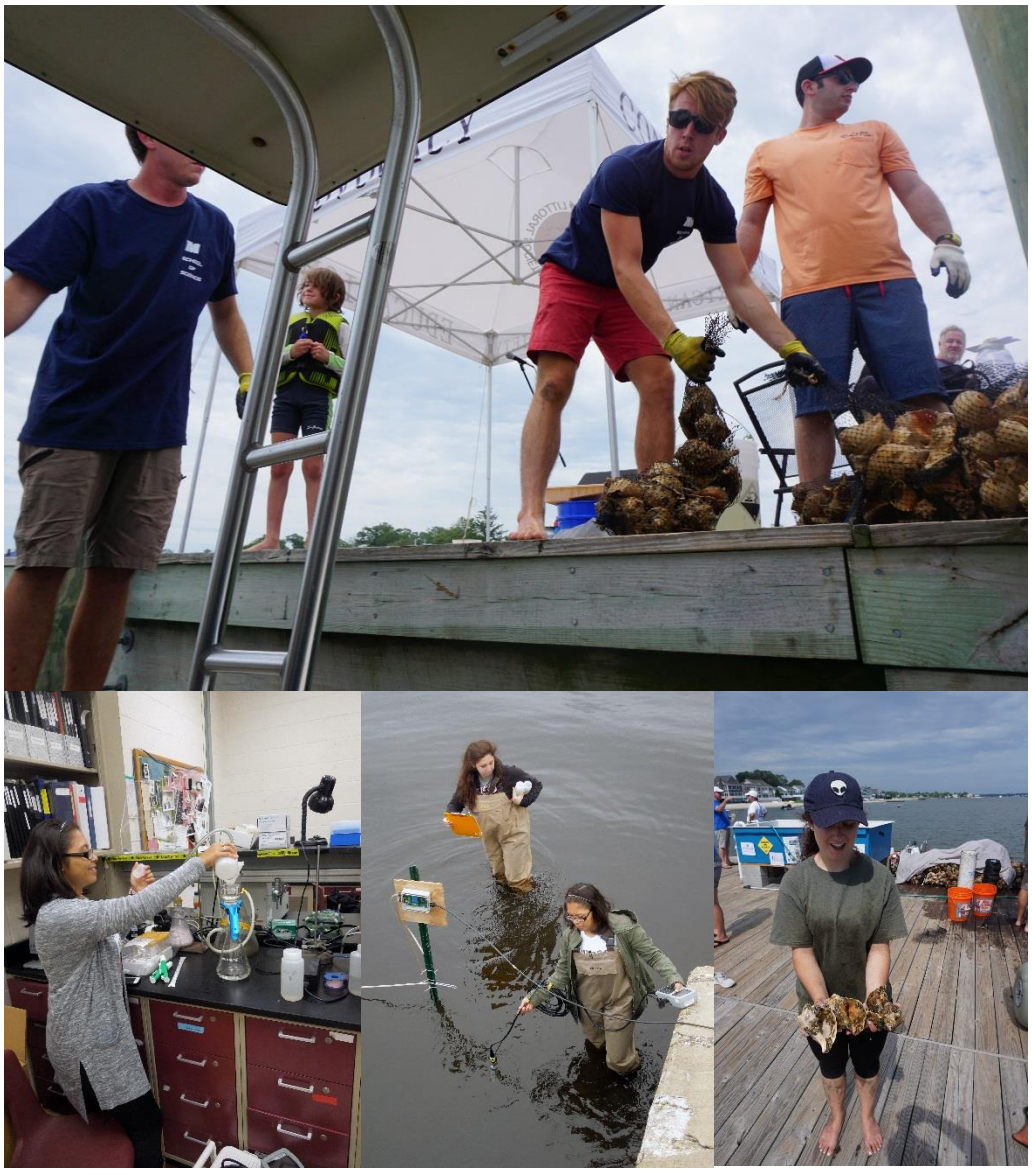

8TH ANNUAL SUMMER RESEARCH PROGRAM SYMPOSIUM

Thursday, August 11, 2016

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Presentations

Assessment of Vertebrate and Microbial Diversity in Local Ecosystems Using Environmental DNA (eDNA)

Nicole Sivetz, Sara Falotico and Hemangi Patel

Faculty Mentor: Dr. Martin J. Hicks

Small-Scale Oyster Restoration in Barnegat Bay

Gabriella Gerber, Sydney Lucas, and Cameron McMath

Faculty Mentor: Dr. Tiffany Medley and Dr. Christine Thompson

Digital Data Mining and Pattern Analysis: Early Hurricane Detection System

Abid Khan, Sravan Kumar and Rajesh Veeraballi

Faculty Mentor: Dr. Charles Willow

An Examination of Ocean County Municipalities' Participating in the National Flood Insurance Program's Community Rating System

David N. Morales and Albert N. Shalom

Faculty Mentor: Dr. Michael Schwebel

Food Recovery Network (FRN) at Monmouth University

Susan Pagano

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Coastal NJ Small Business

Morissa Schwartz

Faculty Mentor: Dr. Deanna Shoemaker

Wreck Pond Aquatic Vertebrate eDNA Project

Cayla Sullivan and Tatiana Castro

Faculty Mentor: Dr. Tiffany Medley and Dr. Christine Thompson

Tracing nitrogen pathways in salt marshes using nitrogen isotopes

Cayla Sullivan

Faculty Mentor: Dr. Pedram Daneshgar

Assessment of Vertebrate and Microbial Diversity in Local Ecosystems Using Environmental DNA (eDNA)

Sarah Falotico, Hemangi Patel, and Nicole Sivetz
Monmouth University

Faculty Mentor:
Dr. Martin J. Hicks, Department of Biology

Funding Sources:
Urban Coast Institute Marine Science and Policy Initiative and
School of Science Summer Research Program

ABSTRACT

Oceans and waterways are vast with life. The global preservation of biodiversity in marine environments begins at the local level. The challenge is that life underwater is not easily observable and traditional methods to survey the ecosystems can be disruptive, invasive and time consuming. Advances in DNA sequencing, specifically, next generation sequencing and the tools of genetics and bioinformatics have made it possible to more easily and non-invasively detect the distribution and abundance of the vertebrates and the microbial world that makes up these aquatic systems. We have begun preliminary experiments collecting eDNA water samples from local environments, Lake Takanassee and the waterway that connects to the adjacent ocean environment of Long Branch, NJ. Water samples (1L) were collected in January and June-July of 2016, eDNA was filtered onto nylon membranes, using PowerWater eDNA purification kit, we isolated eDNA from all samples. To detect, identify and differentiate between species, primers with Illumina tag adapters for the 12s ribosomal subunit were added to the eDNA samples via polymerase chain reaction (PCR). After gel electrophoresis verification of amplicon sizes, Illumina tags were added with a second PCR in preparation for Next-Generation sequencing. The sequences were then characterized using the National Center for Biotechnology Information Basic Local Alignment Search Tool (BLAST), which identifies and compares nucleotide sequences to existing sequenced genomes of various species. With a threshold of ≥99% similarity, we were able to identify the eDNA of Common Carp, Atlantic Menhaden, American Eel, Harbor Porpoise, Canada Goose, and many other species, including land mammals. It is expected that this novel methodology will become an easily approachable and common tool to be used among students and colleagues in the Monmouth University and Urban Coast Institute Research Community to survey and evaluate the local aquatic environment.

Small-Scale Oyster Restoration in Barnegat Bay

Gabriella Gerber, Sydney Lucas, and Cameron McMath
Monmouth University

Faculty Mentors:
Dr Christine Thompson, Department of Biology
Dr Tiffany Medley, Department of Biology

Funding Sources:
Urban Coast Institute Marine Science and Policy Initiative, Santander Bank, American Littoral Society**,** Barnegat Bay Partnership

ABSTRACT

Oysters are an important ecological resource for bayside ecosystems. Their multidimensional reefs provide vital habitat for many other organisms that require shelter or suitable substrate. Through filter feeding, oysters also provide filtration of seawater by removing oceanic particulates such as contaminants and sediment suspended in the water column.
Barnegat Bay once had a thriving oyster population, however both environmental and anthropologic activities caused a near depletion of oyster beds. The purpose of this project was to continue efforts made by the American Littoral Society (ALS) to restore oyster populations and their ecological functions, as well as monitor the success of the previous year's work.
Depleted oyster stocks make it harder for oyster larvae to attach to a suitable substrate, so it is necessary to assist in the development of oyster larvae and then remotely plant them in the desired location for the new oyster reef. To do so, bags of whelk shell were used as a settlement material in a 500-gallon tank located on a public pier in Ocean Gate, NJ. Three separate sets of oyster larvae were introduced into the tank for a period of 7-17 days. Marked bags from the top, middle and bottom layers of the tank were counted to assess the total amount of oysters set from each effort and analyze whether a given layer had greater settlement. Oysters were released at Good Luck Point, the designated location for the restoration project. Results of these efforts produced a 5.9% yield on larvae settlement, a four-fold improvement on last year's efforts. Monitoring of the reef established in 2015 showed that oysters are present on 2-7.5% of shell as well as a diverse community of mobile and epifaunal organisms. We expect this year's efforts to contribute to the success of the reef and to improve future restoration efforts.

Digital Data Mining and Pattern Analysis: Early Hurricane Detection System

Abid Khan; Sravan Kumar; Rajesh Veeraballi
Monmouth University

Faculty Mentor:
Dr. Charles Willow, Department of Management and Decision Sciences

Funding Source:
Urban Coast Institute Heidi Lynn Sculthorpe Research Grant

ABSTRACT:

The research team over the summer of 2016 completed *Phase One* (I) of developing a real-time Graphical User Interface (GUI) for informing the residents of coastal areas the dynamics of potential hurricanes.

Phase Two (II), as an extension to this project, will involve developing a state-of-the-art data analytics model for the problem of estimating future hurricane patterns. We are, at present, experimenting with a dedicated server to develop a comprehensive hurricane-detection model encompassing the following set of meteorological attributes as major parametric variables:

- Tidal Wave Patterns (sporadic, random, cyclic, etc.)
- Tidal Wave Height (ft)
- Wind Velocity (mph)
- Coastal Temperature (F)
- Temporal Intervals (min)
- Tidal Trajectory (North, South, West, East)

This application may have some economic impact, which embraces real-world value illustrated by the current MU strategic plan. In addition, and perhaps most importantly, it will provide an experiential learning experience for the three graduate students aforementioned.

An Examination of Ocean County Municipalities' Participation in the National Flood Insurance Program's Community Rating System

David N. Morales, Albert N. Shalom
Monmouth University

Faculty Mentor:
Dr. Michael Schwebel

Funding Sources:
Urban Coast Institute Marine Science and Policy Initiative

ABSTRACT

One may not normally expect significant flooding to occur from a source outside of an Ocean, such as a river or tributary. For this reason, there is a quest to discover Ocean County municipalities' participation or nonparticipation in the National Flood Insurance Program's Community Rating System (CRS). Faulty notions of what it means to reside in Ocean County can result in misleading perceptions of how best to combat flood damage.

The purpose of this project was to examine how and why the municipalities within Ocean County, New Jersey participate or do not participate in CRS. It is to be noted that previous research in this field has been aimed at analyzing the quantitative effects of CRS participation. There was a desire, as well as a need to study the qualitative effects. Such qualitative effects included the political, economic, and social underpinnings of participation or nonparticipation. Such research has aimed to foster new perspectives on what synergies exist between municipal residents and their authoritative role-models.

In the efforts to accomplish our qualitative research, we as co-researchers have taken on the task of traveling to a plethora of Ocean County municipalities to conduct in-person interviews with CRS officials, construction officials, and any other authorized personnel that would be familiar with their respective jurisdiction in linkage to the sentiments and needs of their residents. On rare occasions, interviews via email and telephone were conducted. Such information was then transcribed and compiled to assess the qualitative foundations behind CRS participation and nonparticipation. It was discovered that municipalities that resided along the Atlantic Ocean and major bay fronts were the most likely to participate in CRS. Jurisdictions that were inland tended to not participate or have no prior knowledge of CRS. There was also the call from some inland and/or Pineland municipalities to have CRS reach beyond their scope of flood mitigation and extend, in example, toward wildfire mitigation.

Food Recovery Network (FRN) at Monmouth University

Susan Pagano
Monmouth University

Faculty Mentor:
Nancy J. Mezey, Associate Dean, Department of Political Science and Sociology

Funding Source(s):
Urban Coast Institute Heidi Lynn Sculthorpe Research Grant

ABSTRACT

Hunger and food insecurity are issues that impact communities at the international, national, and local levels. The epidemic of food insecurity in the United States exists in every county within the country. Furthermore, when many consider the issue of hunger within the United States, they typically conceptualize hunger as an issue that could be remedied by increasing food production. However, this is not the case, as an estimated 30% of food grown, processed, and transported around the world, even in the United States, is wasted each year. A reduction in food waste and an increase in food redistribution can aid in feeding those in need and tackling the issue of hunger.

The Food Recovery Network (FRN) is one organization that attempts to tackle the issue of hunger by reallocating food waste. FRN is a national non-profit that works to reduce food waste on college campuses by recovering leftover food from dining halls that would otherwise be thrown away and donating it to local pantries and soup kitchens. Monmouth University has a new, official FRN chapter and has partnered with university officials, Gourmet Dining, the FoodBank of Monmouth and Ocean Counties, and local pantries and soup kitchens (e.g., Reformation Church Food Pantry and Meal at Noon). This project discusses the nature and prevalence of hunger and food waste at the global, national, and local levels, and how food recovery is a prime mechanism for remedying, but not fixing, the unsustainable nature of food waste. Additionally, this project evaluates how the reallocation of unused food from Monmouth University dining halls to local food pantries and soup kitchens aids community sustainability.

Coastal NJ Small Business

Morissa Schwartz
Monmouth University

Faculty Mentor:
Dr. Deanna Shoemaker, Department of Communication

Funding Source(s):
Urban Coast Institute Heidi Lynn Sculthorpe Grant

ABSTRACT

'Shopping small' is a great way to take part in being environmentally friendly and community-minded. The goal of my website, CoastalNJSmallBusiness.com is to show community members and students that shopping at small businesses is good for the environment and supportive of the community at large. Through my project, I explore local coastal small businesses, the people who own and operate them, how students can benefit from shopping locally, and the overall importance of small businesses on the coastal community.

The positive changes that occur as a result of people 'shopping small' have been scientifically proven. When an individual supports a small business, they help the environment. They travel less, thus emitting less pollution in addition to less congestion. This has even been shown in scientific studies, including "Neighborhood stores: An overlooked strategy for fighting global warming" by Stacy Mitchell, who states, "Independent, community-serving businesses are people-sized. They typically consume less land, carry more locally-made products, locate closer to residents and create less traffic and air pollution."

Another example is even the 'shop small' tote bag initiative, where many small businesses give customers free fabric tote bags instead of plastic bags to thwart the effects of plastic waste on the environment. Locally owned shops tend to be more ecofriendly, from locally grown produce to candles cultivated from beeswax. They often have locally grown or manufactured products, which save the environment while also making their prices more affordable for university students.

Small businesses are very conscious of being environmentally green and encourage their customers to follow suit. This is why this project is wonderful for both the community and environment.

Wreck Pond Aquatic Vertebrate eDNA Project

Cayla Sullivan and Tatiana Castro
Monmouth University

Faculty Mentors:
Dr Christine Thompson, Department of Biology
Dr Tiffany Medley, Department of Biology

Funding Sources:
Urban Coast Institute Marine Science and Policy Initiative, Santander Bank

ABSTRACT

The aquatic vertebrate environmental DNA (eDNA) project enables the detection of various fish and mammal species found in marine and freshwater habitats. With this technique, specific species inhabiting the water bodies can be identified based on DNA shed into the water without causing stress to the organisms themselves.

Wreck Pond is a semi-enclosed estuarine system currently undergoing a restoration project directed by the American Littoral Society (ALS) to facilitate anadromous fish passage into the pond from the open ocean. From March 2016 through June 2016, twice monthly water samples were taken from four locations throughout Wreck Pond and the adjacent ocean. After collection, water samples undergo vacuum filtration, DNA extraction, and vertebrate DNA is amplified using a 12S mitochondrial DNA primer. Next Generation sequencing is the final step to enumerate specific vertebrate DNA signatures from each sample. Sequence results are compared to known vertebrate 12S sequences to determine species present in Wreck Pond at the time of sampling. These identifications are then compared to fish caught in fyke nets by ALS during the sampling period.

Sequencing results from the March samples revealed that white sucker, four-spined stickleback, American eel, and mummichog DNA are present in the samples as well as DNA from waterfowl. These species match up with species known to be present in the area at the time of sampling. This study is important for further research on anadromous species, like the alewife and blueback herring, because migration patterns for their aggregated spawning can be conducted. A better understanding of fish passage through Wreck Pond will enable further restoration and management for these species in this area. With eDNA identification, these essential species can be protected, conserved, and better understood by the public.

Tracing nitrogen pathways in salt marshes using nitrogen isotopes

Cayla Sullivan
Monmouth University

Faculty Mentor:
Dr. Pedram Daneshgar, Department of Biology

Funding Sources:
Urban Coast Institute Heidi Lynn Sculthorpe Research Grant

ABSTRACT

Salt marshes are ecologically and economically important ecosystems that are vital to the fate of our coasts. Unfortunately, due to coastal development and other anthropogenic factors, salt marshes are at risk for serious degradation. Nitrogen deposition, a naturally occurring process which now is anthropogenically increasing may be a factor that has major impacts on salt marshes. Currently, the specific effects of nitrogen deposition on salt marshes are unknown. Nitrogen isotopes are useful tool to track the fate of nitrogen loading on salt marshes. We explored the fate of nitrogen added through deposition using nitrogen isotope tracers (enriched ammonium nitrate) at six salt marsh locations along the coast of New Jersey and Long Island, New York. At these sites, five different treatments were assigned to 1-square meter of salt marsh: a) a control, b) nitrogen isotope enriched fertilizer added in amounts equivalent to one year of N deposition, c) non-enriched fertilizer added in amounts equivalent to one year of N deposition, d) an isotope enriched doubling of current annuals values of N deposition and e) a non-enriched doubling of current annual values of N deposition. These treatments were implemented in late June and a census was taken of each plots species composition. One month later, a second census was take of each plot and all aboveground biomass was harvested and separated by species. In addition four soil cores were extracted using a soil auger from each plot. Everything collected was dried at 65 degrees C for 48 hours and weighed. Subsamples of above and belowground biomass and soil from each plot will be ground and sent to an isotope analysis facility. With these results, we will be able to examine the fate of N added to salt marshes based upon where they show up as compared to a control. All fertilizer not accounted for was likely lost as leachate. This project will provide a better understanding of the potential degradation of salt marshes and may help provide insight to develop management plans to conserve and restore the salt marsh ecosystems for the future.