14th ANNUAL SYMPOSIUM ON SUSTAINABILITY AND THE ENVIRONMENT

BRIDGEWATER STATE UNIVERSITY
RONDILEAU CAMPUS CENTER BALLROOM

Saturday, November 21, 2015
9:30 AM - 2:30 PM

COMPLETE SYMPOSIUM PROGRAM

14th ANNUAL SYMPOSIUM ON SUSTAINABILITY AND THE ENVIRONMENT

Saturday, November 21, 2015
Bridgewater State University Rondileau Campus Center Ballroom

The 14th Annual Symposium on Sustainability and the Environment will focus on student research posters (including completed, in progress, and proposed research) in all environmental disciplines from colleges, universities and high schools in the Northeastern U.S. Since its inception in November 2001, the Symposium has averaged 100 attendees and over 50 student poster presentations. This Symposium provides an annual forum for discussion of issues related to environmental research and education specific to the New England region, and has opened doors to collaborations in research and education among the participants.

Our guest speaker is Mr. **Scott W. Horsley**, Principal, Horsley Witten Group, Inc., Consultant to Cape Cod Commission, and Adjunct Faculty at Tufts University & Harvard Extension School. Mr. Horsley has twenty-five years of professional experience in the field of water resources and wetlands management. He has worked as a consultant to federal, state, and local jurisdictions, and private industry throughout the United States, Central America, the Caribbean, the Pacific Islands, and China. He is currently serving as a consultant to the Cape Cod Commission in the preparation of the 208 Water Quality Plan with a focus on non-traditional nutrient management practices or green infrastructure.

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Saturday, November 21, 2015
Bridgewater State University Rondileau Campus Center Ballroom

PROGRAM

8:00 – 11:30 AM: Registration and light snacks

9:30 AM: Welcoming Remarks in the Rondileau Campus Center Ballroom:
Dr. Jenny Shanahan, Director of the Bridgewater State University Office of Undergraduate Research

9:45 – 10:45 AM: Guest Speaker

Mr. Scott W. Horsley
Principal, Horsley Witten Group, Inc., Consultant to Cape Cod Commission, and Adjunct Faculty at Tufts University & Harvard Extension School
"Green Infrastructure - Emerging Technologies for Ecosystem and Water Quality Restoration"

11:00 – 12:15 PM – Poster Session I: Boards 1-22, Rondileau Campus Center Ballroom

Please take a guided tour of the "BioBus" given by students from the Southeastern Regional VoTech High School. The BioBus is parked in front of the Rondileau Campus Center.

12:15 – 1:15 PM – Lunch in the Ballroom; take down posters from Session I, put up Session II posters

1:15 – 2:30 PM – Poster Session II: Boards 23-44, Rondileau Campus Center Ballroom

Don't forget to visit the BioBus!!!

Poster Session I Titles and Abstracts: Boards 1-22
Rondileau Campus Center Ballroom (11:00 AM to 12:15 PM)

Board #1: "Foraging ecology of blue crabs (*Callinectes sapidus*) and their potential impact on winter flounder (*Pseudopleuronectes americanus*)," Molly Fehon and David Taylor, Department of Marine and Natural Sciences, Roger Williams University, Bristol, RI 02809

The blue crab, *Callinectes sapidus*, is a temperate species that is expanding its geographic range northward, thus possibly altering benthic community structure in Southern New England waters. This study examined the potential impact of blue crabs on local fauna by analyzing their abundance, size-structure, and diet. Potential crab predation on winter flounder, *Pseudopleuronectes americanus*, was of particular interest due to locally declining populations of this flatfish species. Crabs were collected from the Seekonk River (RI) and Taunton River (MA) from May to August 2012-2015, and subsequently preserved in 95% ethanol. In the laboratory, crabs were measured for carapace width, and prey contents were extracted from stomachs and identified to the lowest practical taxon. Crab abundance exhibited both spatial and temporal variations in the rivers, but overall estimates were consistent with southern Mid-Atlantic populations. Moreover, decomposition of crab length-frequency distributions revealed three distinct cohorts, suggesting that multiple life history stages utilize the riverine habitat. Direct visual analysis of stomach contents indicated that crabs undergo ontogenetic dietary shifts. The main prey of small crabs were crustaceans (e.g., amphipods/isopods, shrimp, and crabs), whereas larger conspecifics preferentially consumed bivalves. There was also evidence of crabs consuming fish, including winter flounder, with rates of predation positively related to predator-prey size ratios. The incidence of crab predation on flounder was minimal, however, and thus crabs may not be an important source of mortality for juvenile flounder. Future research will continue to examine the food habits of blue crabs via visual/genetic analysis of stomach contents and measurements of stable nitrogen and carbon isotope signatures in chelae muscle tissue.

Board #2: "Investigation of the Environmental Impact and Legacy of Pressure Treated Wood on Marine Organisms," Ryan Phelps, Jackie Hugger and Stephen O'Shea, Department of Chemistry, Roger Williams University, Bristol, RI 02809

Pressure treated wood (PTW) has been used for marine dock piling since circa 1950's for structural support due in part to its resilience to environmental deterioration. To enhance lifetime of the wood to biological deterioration, it is treated with three main pesticides: creosote, pentachlorophenol, and cations of copper, chromium and arsenic (CCA). CCA ions pose a myriad of toxic effects to marine organisms including shellfish, crustaceans, and higher trophic level fishes. The focus of this research determine the potential environmental impacts of PTWs on the marine organisms that adhere themselves to the treated wood, as well as those living in the surrounding sediment. Samples collected from PTWs and non PTWs pilings, were subjected to elemental analysis (XRF and ICPMS). Increased CCA concentrations were found in organisms on and about the PTW piling to those of non PTW pilings. Further interrogation of the sediment (elemental composition, percent organic carbon, grain size) elicited the degree of potential leaching from the PTW and possible environmental sediment legacy on removal of the PTW pilings.

Board #3: "Fatty acid profiles of marine fishes from Rhode Island coastal waters," Mary Yurkevicius1, Joshua Jacques[1], Nancy E. Breen[2], and David L. Taylor[1], Roger Williams University, Department of Marine Biology[1] and Chemistry[2], One Old Ferry Rd, Bristol, RI, 02809

Marine fish are an excellent source of omega-3 fatty acids, including eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA), which provide numerous health benefits to human consumers. Further, the majority of consumed fish are of marine origin, thus underscoring the importance of research focused on this topic. In this study, fatty acids were analyzed in Rhode Island coastal fishes, including summer flounder, *Paralichthys dentatus* (n = 10); black sea bass, *Centropristis striata* (n = 10); striped bass, *Morone saxatilis* (n = 6); scup, *Stenotomus chrysops* (n = 11); winter flounder, *Pseudopleuronectes americanus* (n = 10); and bluefish, *Pomatomus saltatrix* (n = 11). Fatty acid profiles of fish muscle tissue were determined by esterification and gas chromatography. Data were categorized as mono-saturated, saturated, omega-3, and omega-6 fatty acids, and results were expressed as concentrations (mg/100 g wet weight; [FA]) and percent

of total fatty acid content (%FA). Irrespective of fish species, mono-saturated fatty acids had the highest [FA] and %FA (mean [FA] = 183.5 mg/100 g; %FA = 46.2%), followed by saturated ([FA] = 146.6 mg/100 g; %FA = 32.7%), omega-3 ([FA] = 44.3 mg/100 g; %FA = 18.6%), and omega-6 fatty acids ([FA] = 7.5 mg/100 g; %FA = 2.5%). Fatty acid profiles also demonstrated significant inter-species differences. With respect to %FA, mono-saturated fatty acids were significantly higher in scup and bluefish relative to summer flounder and striped bass (SCP = 54.6%, BF = 48.8%, SF = 40.1%, SB = 39.3%). Conversely, omega-3 fatty acids were significantly higher in both flounder in comparison to black sea bass and scup (SF = 31.1%, WF = 26.3%, BSB = 12.1%, SCP = 8.3%). With respect to [FA], bluefish had significantly higher concentrations of mono-saturated and saturated fatty acids relative to summer flounder (BF = 245.4-307.4 mg/100 g, SF = 52.5-81.3 mg/100 g). Ratios of omega-6-to-omega-3 (n6:n3) fatty acids were reduced in flounder and striped bass (n6:n3 = 0.14-0.23) relative to scup, bluefish, and black sea bass (n6:n3 = 0.30-0.36); hence suggesting the former species provide greater health benefits for human consumers. Future research will examine total mercury and selenium concentrations of each fish species to further evaluate their respective health risks and benefits to human health.

Board #4: "Enhancement of Phytoremediation Through in Situ Metal Chelation," Meghan de Vries, Bryce Rashbaum and Stephen O'Shea, Department of Chemistry, Roger Williams University, Bristol, RI 02809

The legacy of metal pollution is quite widespread within and the surroundings of vacant industrial sites deemed Brownfield Sites. At the majority of these sites, contaminates are capped with soil and/or overgrown with plants. The ability of plants to thrive and flourish in such environments allows for the development of phytoremediaton technology. A survey of contaminated sites shows the growth of a number of fast growing plants while these species are physiologically stressed. Surface stress can be visually seen in bleached and deformed leafs but belies the true nature of the root system. The growth of plants in artificial soil, transparent Crystal Clay® allows for the easy visualization of the developing root system in an increasing vertical concentration profile of heavy metal (Cd, Pb, Zn, and Ni di-cations). This system has allowed us to model depth profile of the roots as it penetrates the gradient of increasing metal concentrations. The metal contaminates were then contrasted at the same concentration to their complexed forms with EDTA and more labile acetate ligand. Metal composition uptake in the leaves, stem and roots were found to be greater by ICP Mass Spectra for the complexed metals even at lower in situ concentrations.

Board #5: "Insitu phytohormone enhanced heavy metal phytoextraction," Bryce Rashbaum, Meghan de Vries and Stephen O'Shea Department of Chemistry, Roger Williams University, Bristol, RI 02809

The increasing amounts of heavy metals in soils can be attributed to many sources notably waste chemical disposal sites, sewage sludge, agricultural fertilizers and industrial tailings. These contaminated sites though toxic are not barren in many cases are covered in foliage. The presence of these plants demonstrates their potential for phytoremediation. To enhance the plants' capacity to phytoextract heavy metals from the soil has been achieved with supplementation of phytohormones. Auxins a class of Phytohormones promote root initiation and are directly involved in cation uptake and cation fluxes, the most widely distributed plant auxin natural product indole-3-acetic acid. The enhanced root development and potential metal (Cd, Pb, Cu and Ni dications) extraction at various isocratic concentrations and gradient profiles can be visually observed in transparent model soil gel. The insitu auxin enhancing root development and phytoextraction levels at inhibitory soil concentrations under normal conditions. The enhanced phytohormone accumulation of the heavy metals in both the roots, stems and leaves were determined by ICP MS.

Board #6: "Influence of gender and establishment period on site fidelity of Ebony Jewelwings, *Calopteryx maculate*," Donyce Abel and Kevin Curry, Department of Biological Sciences, Bridgewater State University, Bridgewater, MA 02324

Site fidelity of adult Ebony Jewelwing, *Calopterx maculata* was investigated at South Brook, Bridgewater MA from July to August 2015. Forty-two Ebony Jewelwings were captured from various locations along a 300-meter section of South Brook, Bridgewater, MA. Pre-selected damselflies consisted of older, established pre-marked individuals and younger, newly arrived yet unmarked Ebony individuals. Each were marked and released at a common site away from the stream.

Newly marked damselflies were tagged with yellow markers. Established damselflies had been previously tagged with either red, white or green markers. Each specimen was removed from their immediate environment and translocated to a designated release site 52 to 160 meters from the capture site. Their degree of site fidelity was determined individually by the numbers returning to their original capture site. Data showed 38% of established Ebony Jewelwings (n = 16) returned to the stream. Male damselflies showed greater site fidelity than females with 56% return (males = 9; females = 7) . Yet data shows that female damselflies were able to orientate as well. A larger number of newly marked damselflies, both male and female, were marked in comparison to the established damselflies. However, a higher ratio of established damselflies were found returning to the stream and to their original site. Establishment time and sex of the Ebony Jewelwing seemed to influence the site fidelity behavior.

Board #7: "Effects of color markings on recaptures of Ebony Jewelwings (*Calopteryx maculata*) in South Brook, Bridgewater, MA," Matthew Bettencourt and Kevin Curry, Department of Biological Sciences, Bridgewater State University, Bridgewater, MA 02325

In the summer of 2015 from May to August adult Ebony Jewelwings (*Calopteryx maculata*) were captured and marked using three different colors at South Brook, Bridgewater, MA. As part of an ongoing study to see if adult Ebony Jewelwings would cross anthropogenic barriers and how far they move, we needed to mark individuals and keep count of recaptures. Observations on marked wings found along the stream raised the question of whether color of the marking could be influencing predation on the Ebony Jewelwings. In this study, we tested whether color used in marking the Ebony Jewelwings influenced the level of survivability. We captured a total of 501 individuals that were marked with either a red, green, or white color on their wings. Of 501 individuals marked, 236 individuals were recaptured (125 males, 111 females). Chi-square analysis revealed there were no significant difference in the frequency of recaptures between the three colors for males or females."

Board #8: "Preliminary assessment of the diamondback terrapin population at Allens Pond Wildlife Sanctuary," Kourtnie Bouley, Nicholas Hathaway and Christopher Bloch, Department of Biological Sciences, Bridgewater State University, Bridgewater, MA 02325

Salt marshes, estuaries, bays, sounds and adjoining uplands are picturesque features of the coastline that serve as nurseries or homes for many species. One reptile in the United States is completely dependent on this habitat: the diamondback terrapin, *Malaclemys terrapin*. Diamondback terrapins are top predators in marshes, so they may be reliable indicators of a healthy ecosystem. This species is currently listed as threatened in Massachusetts, and Allens Pond is one of few sites known to support populations. However, no rigorous studies have been conducted to evaluate the conservation status of the population. The purposes of this study were to determine the size and structure of the terrapin population at Allens Pond, identify terrapin nesting areas, and analyze habitat characteristics and predation pressures. Twenty-three terrapins were collected, with the majority being juveniles and the sex ratio nearly 1:1. The presence of numerous deer, rabbits, and field mice, and only a few canids and felids, suggests low local predation pressure. These data will form a valuable baseline for future research at Allens pond and comparable sites, and for the development of conservation and management strategies to reduce the risk of extinction, which may result in negative consequences throughout the entire ecosystem.

Board #9: "Stream Barrier Removal: A Survey for Kinne Brook, Massachusetts, 2012-2015," Sarah Currier, Deanna Domenichelli and David Christensen, Department of Environmental Science, Westfield State University, Westfield, MA 01086

The environmental conditions of streams are deteriorating as evidenced by the decline of brook trout, indicators of healthy cold-water ecosystems. In an effort to improve watershed connectivity and restore these ecosystems, numerous projects are underway across Massachusetts to remove small dams, culverts and other types of stream barriers. Kinne Brook is a small, second order brook and a tributary to the Middle Branch of the Westfield River located in Chester, Massachusetts. Collaborating with the Massachusetts Department of Fish and Game (MDFG), Division of Ecological Restoration, Trout

Unlimited (TU), the U.S. Fish and Wildlife Service (USFWS) and private landowners, WSU students and faculty worked to identify and coordinate dam removal efforts. Funding for dam removal projects come primarily through the Natural Resources Conservation Service (NRCS). A Smith Root LR24 backpack electrofisher was used to assess fish populations in Kinne Brook following dam the removal of a small dam. Fish populations were accessed in over 2 years, 2014 and 2015, at several sites along Kinne Brook. Findings show that, due to stream geomorphology, trout numbers remained low in both the control site and the site below the dam. An "Ideal" site, dominated by steeper gradients, deep pools and extensive in-stream cover, contained a much higher brook trout population in both 2014 and 2015. Further investigation is needed, specifically of habitat suitability (HBI) and geomorphological changes to make conclusive statements regarding brook trout populations following dam removal in Kinne Brook.

Board #10: "The Effects of a Microburst Disturbance to a Forest at Mt Tom State Reservation," Casey R. Duggan and Timothy Parshall, Environmental Science Department, Westfield State University, Westfield MA 01085

Disturbances are discrete events in time that alter system inputs and outputs; which, in turn, influence ecosystem services and biological networks of a community. On October 8, 2014 a forest stand was impacted by a microburst within Mt. Tom State Reservation. An observational study was conducted to investigate this stand's previous composition and compare it with the composition of surviving trees, as well as seedlings and saplings post disturbance. An adjacent section of forest not impacted by the disturbance was also surveyed for comparison. Points and plots were established along transects within both the disturbed and undisturbed stands. Soil samples were extracted and will be analyzed from each area; pH, cation exchange capacity (CEC), and several base nutrients will be quantitatively and/or qualitatively assessed. *Quercus prinus* and *Quercus rubra* were shown to have the highest relative basal area within the impacted stand pre-disturbance. Post-disturbance, *Acer rubrum* had the highest relative basal area of surviving trees. *Betula lenta* and *Quercus rubra* were shown to have the highest relative basal area in the undisturbed stand. Of the seedlings and saplings, *Acer rubrum* displayed the highest relative frequency in both the disturbed and undisturbed stands. The current stand composition of living trees, as well as seedlings and saplings, suggest that the forest that succeeds post-disturbance will differ in composition from the pre-disturbance forest. The data also suggest that the undisturbed area will be susceptible to similar changes in composition.

Board #11: "Developing Methods for Testing E. coli Presence in Storm Water Systems in Westfield MA," Aaron Biasin, Emily Bonnano, Lauren Dick, Jameson Huntley, Willys Ramos, Randi Medley and Tim Parshall, Department of Environmental Science, Westfield State University, Westfield, MA 01085

Maintaining good water quality levels are important to sustain a healthy urban environment. One form of water contamination is the bacteria E. coli (Escherichia coli). E. coli is commonly found in the lower intestine of warm-blooded organisms, but it can survive externally and cause disease when ingested. Our team has been working with the Westfield Department of Public Works to help organize methods to test for the abundance of E. coli in storm sewers. Recently in the Little River, located in the City of Westfield, Massachusetts there has been high levels of E. coli sampled from Outflow Pipe 13 (located at the intersection of Highland and Crane). Our initial goal was to identify the source of this E. coli but we quickly realized that we needed to develop a set of methods and procedures to effectively assess E. coli concentration. Our current goal is to develop an effective set of methods for collecting and testing samples for identifying E. coli that are retrieved in the field. We collected samples from Outflow Pipe 13 and from catch basins within its storm water system. We visited catch basins weekly over a six-week period and, if water was present collected 200mL of water for testing. The samples were tested in the lab using approved EPA testing procedures from Colilert. Initially, all samples had E. coli concentrations that were too numerous to count and we concluded that dilutions between 1-25% were necessary to yield specific quantities. In addition, we also believe that on days with low water flow it is important to avoid contamination of water samples with sediment from catch basins. In conclusion, our methods yielded a process that was documented in order for future groups at Westfield State University to test and track for E. coli in storm sewers.

Board #12: "Extracting the Contribution of the Stagnant Water Layer on the Kinetics of Neutral Nanoparticles Permeating Cell Membranes," Ryan Hamelin and Steven L. Fiedler, Department of Biology and Chemistry, Fitchburg State University, Fitchburg, MA 01420

Simulations of the passive permeation process of neutral molecules through cell membranes are often constrained by limited observation times or ensemble sizes. As such, while significant attention has been devoted to the thermodynamics and kinetics associated with permeant-lipid bilayer interaction, the effect of the adjacent stagnant water layer has received less scrutiny. For this study, we employ a Buckeyball molecule as a probe to extract the contribution of the stagnant water layer on the permeation process.

Board #13: "Streamside Environmental Factors and Occurrence of Breeding Behaviors of Ebony Jewelwing, (*Calopteryx, maculata*) in South Brook," Josh Bryant and Kevin Curry, Department of Biology, Bridgewater State University, Bridgewater, MA 02325

Adult ebony jewelwing (*Calopteryx maculata*) of South Brook, Bridgewater, MA were monitored from May to August 2015 to study their movements and their breeding behaviors. Four 15 meter zones were monitored for territorial and breeding behaviors. Hobo light and temperature probes were placed at the stream level in these four breeding zones to look for habitat correlations with optimal breeding areas and behaviors. Probes took readings every thirty minutes. Behaviors were monitored in each zone over a period of twenty minutes each day. Data collected showed slight variations between the temperatures of the different zones but the stream-side ambient light varied considerably between zones. Observed total activity peaked in mid-July followed by a drop off in every zone except for zone 4, but correlated with a drop off in flow rate of the stream. Areas of local higher temperature tended to have a higher amount of observed behaviors. Further analysis will determine if any correlation exists between light and behavior.

Board #14: "A Preliminary look at Endoparasites Collected from Cold-Stunned Sea Turtles Stranded on Cape Cod," William Grey, Dawilmer Castillo, Tania Greenwood, Robert Prescott, Heather Marella, Jennifer Mendell and Carol Carson, Department of Biology, Bridgewater State University, Bridgewater, MA 02324

Sea turtles suffer from a condition known as cold-stunning, a hypothermic reaction that occurs due to prolonged exposure to cold water temperatures. During the winter of 2014- 2015 over 1,200 cold-stunned juvenile sea turtles became stranded in Cape Cod Bay. The most common species of sea turtle that strand off Cape Cod are the Atlantic Kemp's Ridley (*Lepidochelys kempii*), the loggerhead *(Caretta caretta*), the green (*Chelonia myda*s), and the hawksbill *(Eretmochelys imbricata*). Most perished. These turtles were necropsied by a group of students, biologists and volunteers at the Woods Hole Oceanographic Institute in Falmouth, Mass. For this study, endoparasites were collected from 25 sea turtles during post-mortem examinations and identified to determine their taxonomy.

Board #15: "Bridgewater-Raynham Regional High School Youth Environmental & Social Society – YESS," Heather Reid, Devon Fitzgerald, Kelsey Washburn, Megan O'Gara, Julia Heffernan, and Jessica Lazarus, Bridgewater-Raynham Regional High School, Bridgewater, MA 02324

The Youth Environmental & Social Society (YESS) is an after school club that meets twice a week to recycle, learn about the environment and lead activities that support sustainable thinking within our community. Each year YESS recycles paper and cardboard with an addition of plastic bottles full-time this year. YESS supports local farms through gardening and volunteering, supports a yearly Green Awareness Day for all 1500 students in the high school building during each period of the day where a presentation is given, conducts a yearly recycled fashion show to raise money for waterforcambodia.org and offers learning modules within the environmental movement. Our goals include educating the community on sustainable practices, partaking in visual design contests and displays to explain our views, understanding and raising awareness of issues concerning environmental welfare, and forming new friendships through exciting opportunities and fun times.

Board #16: "Our Biobus and Living Sustainably," Amber Purington, Ivonne Recinos, Larissa Bennett, Mariah Nozin and Heather Stoddard, Environmental Biotechnology, Southeastern Regional VoTech High School, South Easton, MA 02375

Our Biobus was created from a retired school bus. It's purpose is to provide a traveling classroom for our community outreach. At schools and communities we teach people about how they could give back to the environment, learn about environmental issues, and how to live sustainably. The Biobus is made entirely of green, recycled and repurposed materials. The floor mats are made of recycled tires, as to reduce waste and use less natural resources. The Biobus is illuminated by LED lights, which are highly efficient, reduce energy consumption (which also reduces emissions), and work great in cold temperatures. The chairs in the Biobus are repurposed from the original school bus; just turned to enhance the classroom setting. The carpet is made from 100% recycled plastic soda bottles, and the paint used for the bus is volatile organic compound (VOC) free paint. All around, the Biobus is made from the most efficient and environmentally friendly materials. The Biobus is all about sustainability and teaching others how to live sustainably and bring about environmental awareness. We do this every time we go out to schools and communities!

Board #17: "Extraction of oil and grease contaminants from stormwater samples in order to facilitate nutrient testing," David Lewis and Cielito DeRamos King, Department of Chemical Sciences, Bridgewater State University, Bridgewater, MA 02325

Bridgewater State University's Stormwater Monitoring System was designed as part of the West Campus "Green" parking lot. The parking lot uses a bioretention system to naturally filter the stormwater run-off before it mixes with the groundwater and continues to nearby streams and lakes. One of the key features of this system is the ability for the BSU Watershed Access Laboratory (WAL) to monitor concentrations of nutrients (nitrites, nitrates and phosphates) in the stormwater. Various storage areas in the system collect the stormwater at different stages along the bioretention filtering process. During rain events, the system automatically triggers the collection of stormwater samples from these different storage areas. Measuring the concentrations of the nutrients at these different staged areas is essential in understanding the success of the system. To date, stormwater samples have been collected, but unfortunately attempts to measure the concentrations of nutrients have been hindered due to laboratory equipment failure. To accurately measure nitrates, a cadmium column is used to reduce the nitrates to nitrites. This cadmium column is degenerating at a fast rate when used in conjunction with the stormwater samples. Due to this degradation, the cadmium column needs to be replaced at an alarming rate and the accuracy of the data collected through the equipment is suspect. According to the manufacturer of the equipment, the degeneration is thought to be caused by the presence of oil and grease contaminants emulsified in the collected samples. Therefore, it was the task of this research project to confirm the existence of oil and grease in the samples and if there, implement an environmentally responsible method to extract the contaminants from the stormwater samples in a way that does not adversely affect the concentrations of nutrients. After trying many different methods, my recommendation based on ease of use, environmental considerations and cost, was to filter the samples using a 0.45 micron cellulose acetate filter prior to running the flow injection analysis."

Board #18: "Determining the effectiveness of bioretention systems in removing toxic heavy metals from stormwater runoff," Krista Greeley and Cielito DeRamos King, Department of Chemistry, Bridgewater State University, Bridgewater, MA 02325

Bioretention systems are becoming widely used in eliminating stormwater pollutants. At BSU, a bioretention area was put into place as part of the design of the "green" parking lot behind the Science and Mathematics Center. Stormwater runoff picks up debris, sediments and other pollutants as it flows through parking lots. These pollutants must be removed from stormwater runoff before reaching streams to prevent devastation of aquatic life. At BSU, stormwater runoff is diverted into the bioretention system. Stormwater samples were collected through automated systems located before and after the bioretention area, preserved with acid, then processed in the lab to solubilize all forms of lead and cadmium. The amount of lead and cadmium were measured using a technique called atomic absorption spectroscopy following standard EPA method. Although we did not get a complete set of stormwater samples from all four sampling sites, the data that we obtained from two rain events revealed levels of cadmium below the instrument's detection limits and are much lower

than the EPA limit of 2 ppm, so it was removed from the project. The data also showed to contain very small levels of lead. Both dissolved and total recoverable Pb were below the EPA water quality criteria of 65 ppm dissolved Pb, meaning that the runoff from the parking lot currently does not pose as a threat before entering the watershed.

Board #19: "The Determination of Contaminants Levels Found in Brewed Tea and an Assessment of Health Impacts," Celina Rouge, Naomi Suminski and Michael Berger, Department of Chemistry and Physics, Simmons College, Boston, MA 02115

After water, tea is the second most popular beverage in the world. There are many health benefits linked to its consumption, and tea is considered to be an overall healthy and even a medicinal drink choice. However, many studies have also found the presence of contaminants in brewed tea, that may arise from tea cultivated in contaminated soil and water. Some of the contaminants in teas leaves and brewed tea have been identified as metals and polycyclic aromatic hydrocarbons (PAHs) that can adversely impact human health. The tea plant *Camellia sinensis* has been shown to incorporate metals from acidic soils (Schwalfenberg, G., Genius, S.J., Rodushkin, I., 2013), and PAHs from the roasting and drying process of tea leaves (Abd El-Aty, A.M., Choi, J.H., Rahman M.M., Kim, S.W., Tosun, A., Shim, J.H., 2014). We are analyzing the levels of aluminum, copper, manganese, and PAHs in twelve different brewed teas using X-Ray Fluorescence, Flame Atomic Absorption, and Gas Chromatography / Mass Spectrometry. We will also conduct a health risk assessment based on our analytical results.

Board #20: "An Investigation of Metal Sequestion by Phragmites Australis in the Muddy River using X-Ray Fluorescence," Rose Dumais, Ali Malarczyk and Michael Berger, Department of Chemistry and Physics, Simmons College, Boston, MA 02115

Following the redirection of the Muddy River in the 1950's to facilitate the installation of a parking lot, ecological diversity and water quality have been impacted severely, with the river itself suffering high levels of pollution and contamination. Significant levels of lead and arsenic threaten the health of the river. The influx of the invasive *Phragmites Australis* has also constricted the flow of the river, making it prone to flooding. Phragmites, also known as the common reed, is a resilient plant, having excellent filtering capabilities; this plant has been used for the phytoremediation and removal of heavy metals and excess minerals in mining areas. By testing the individual parts of the reed - roots, stems, leaves, and flowers - it may also be possible to determine the metal translocation patterns of the Phragmites. Additionally, we have collected sediment and plant samples upstream and downstream of the Landmark Center construction site in order to determine if the construction has affected the release of contaminants. Preliminary X-ray Fluorescence analyses indicate high levels of zinc, manganese, and iron are segregated in the roots. These results are consistent with previous metal translocation experiments.

Board #21: "Tackling the Muddy River with New Analytical Techniques," Amy Chung, Carol Figueiredo, Sydney Haynes, Jennifer Hong, Lydia Kalajian, Sophia Mac, Ali Malarczyk, Charlotte Rivard, Naomi Suminski and Michael Berger, Simmons College, Department of Chemistry, 300 The Fenway, Boston, MA 02115

The Muddy River, part of the Emerald Necklace park system designed by Frederick Law Olmsted in the late 1800's, is the oldest park system in the United States and the largest in Boston. Students collected sediment and water samples from different areas of the Muddy River abutting Simmons College. The sediment samples were analyzed using X-ray fluorescence in order to map the distribution of several naturally occurring and contaminant elements. The water samples were analyzed for dissolved calcium using three different analytical techniques - atomic absorption, X-ray fluorescence, and EDTA titration - in order to classify the water hardness. One goal of the sediment study is to determine if contaminant concentration levels have changed in light of the river's restoration efforts upstream."

Board #22: "**Colleges of the Fenway Collaborative Examination of Chemical and Biological Aspects of the Muddy River, Boston, MA,"** Kayla Grosso[1], Naomi Suminski[2], Ian Chamenko[3], Reanna Chen[1], Amy Chung[2], Rose Dumais[2], Ashley Gillis[1], Ashleigh Girton[1], Kaitlin Haines[1], Kelsi Howard[1], Valentina Laclare McEneany[2], Nicole Manzi[1], Amarielis Morales[1], Charlotte Rivard[2], Courtney Scherer[1], Ziquelle Smalls[1], Michael Berger[2], Lisa Lobel[1], Departments of Math and Science, [1]Wheelock College, [2]Simmons College and [3]Emmanuel College, Boston, MA 02215

Abiotic and biotic parameters within Boston's Muddy River were measured and shared between introductory classes in chemistry and environmental science at two neighboring institutions in the Colleges of the Fenway. Environmental science students at Wheelock College participated in the Charles River Watershed Association's biological monitoring program assessing habitat and water quality using benthic macroinvertebrates (BMIs) as bioindicators. During this project sediment samples were also collected for metals analysis by a Simmons College chemistry course. Chemical and biological data were collected from two sites within the Muddy River watershed. The Babbling Brook (MRBB) site was surrounded by parkland and was hypothesized to be a "better quality" habitat containing a diverse assemblage of BMIs as compared to the second site (MRRW), which was in a more urban setting downstream from the Babbling Brook. Students assessed the quality of the habitat using the EPA rapid bioassessment protocol. BMIs vary in their tolerance of poor or contaminated water and can be classified as sensitive, intermediate or tolerant of poor water quality. While the habitat assessment resulted in similar sub-optimal scores for both sites, the MRBB water quality score was "Fair" as compared to the "Poor" score for the MRRW site, based on the abundance and tolerance classes of sampled BMIs. Metal concentrations in sediments were measured by x-ray fluorescence (XRF). Average concentrations of lead, zinc, arsenic and chromium were higher in the samples from the MRRW as compared to the MRBB site. Specifically, average lead concentrations at MRBB exceed threshold effects levels (TEL) but the MRRW site exceeds the probable effect level (PEL) sediment screening guideline for lead. Combining the data from the two classes can give students from each, new insight into the important interactions between the abiotic factors and resulting biota found within the ecosystem.

Poster Session II Titles and Abstracts: Boards 23-44
Rondileau Campus Center Ballroom (1:15 to 2:30 PM)

Board #23: "Are ticks more common in forests with invasive plants?" Daniel O. Robitaille, Andrew Tarani, Samantha Hutchins and Timothy Parshall, Department of Environmental Science, Westfield State University, Westfield, MA 01086

Invasive plants, such as bush honeysuckles, privet, burning bush, and Oriental bittersweet, are quickly taking over native forests in Massachusetts, including the Experimental Forest on the Westfield State University campus. Recent research studies have documented that areas with a higher abundance of invasive shrubs have increased abundance and activity of ticks, especially the *Ixodes scapularis* (the black-legged tick or deer tick). This study examined if there was a relationship between the abundance of invasive plants and the presence of the black-legged deer tick. Overall tick abundance was assessed in two forest plots where invasive plants were present in either very high (> 75% coverage) or low (<20% coverage) abundance. In addition, we evaluated three methods to capture ticks: flagging, dragging, and carbon dioxide traps. The flagging and dragging methods followed four, 25-meter transects in each plot. Five carbon dioxide traps were placed in the same plots to replicate the number of ticks collected by the other methods. The results did not support our hypothesis, as there was no consistent trend toward higher tick abundance in either plot. However, we cannot rule out the effect of chance since the number of ticks caught during any one sampling date was low. Future studies should use a greater number of transects. Our results provide a preliminary description of current black-legged tick abundance and offer a baseline for comparisons with future surveys at the same location. In future studies, during the months of high tick activity (Spring-Summer), we predict the flagging method will most effectively capture *Ixodes scapularis* due to its consistency in trapping more ticks.

Board #24: "Oriental Bittersweet Removal on the Campus of Westfield State University," Joshua Minardi, Edward Lopez, Catherine Snyder, Joe Almeida and Timothy Parshall, Department of Environmental Science, Westfield State University, Westfield, MA 01085

One of the most important challenges for the conservation and management of natural areas is the control of invasive species. Oriental bittersweet (*Celastrus orbiculatus*) is one of the many invasive plant species present in the Experimental Forest on the Westfield State University Campus. Faculty and students in the Environmental Science department have been investigating eradication methods for the Experimental Forest, beginning with Oriental bittersweet in the first phase of this project. In the past, students have utilized mechanical removal techniques, which required them to cut the bittersweet vines from trees and hand-pull vines sprouting from the surrounding soil. Our first goal was to follow up on the status of trees that had already received mechanical treatment and continue mechanical treatment on new trees. Our second goal was to investigate the effectiveness of chemical treatment by applying herbicide bittersweet vines that have been heavily infested. The data collected from trees treated with mechanical methods revealed promising results. There were substantially fewer vines and the health of the trees had improved. Although new sprouts of bittersweet were present, mechanical removal is still a viable method for eradication, so long as proper precautionary methods are taken. This includes removal of root systems as well as removing any vines that have fruit structures on them, indicative of the ability to reproduce new sprouts. Mechanical and chemical treatments were applied to a new plot of trees affected by Oriental bittersweet. It took approximately 60 person hours to apply these treatments as well as removing bittersweet coverage from the base of the trees. Groups taking on oriental bittersweet removal for future projects will need to monitor the progress of each tree that received treatment, specifically those which have received the herbicide application. We propose the creation and implementation of management, education, and restoration plans, the object of which will be to continue the eradication of any invasives, encourage native species, and develop a plan to educate future student on the importance of invasive control and habitat restoration.

Board #25: "Oriental Bittersweet (*Celastrus orbiculatus*) and its Effect on Red Oak (*Quercus rubra*) Radial Growth," Zackary Delisle, Kenneth Parece and Timothy Parshall, Department of Environmental Science, Westfield State University, Westfield, MA 01085

Oriental bittersweet (*Celastrus orbiculatus*) has been invading Massachusetts forests since 1919 and since then this deciduous liana has been changing forest ecosystems. The vine's stem-girdling behavior leads to trunk compression and the biomass of the vines in the canopy increases ice and wind damage. Eventually the bittersweet will out-compete the host for radiant energy and topple the host tree with its own weight. Because of all these destructive attributes, and the difficulty of eradication, a better understanding of how Oriental bittersweet affects natural forests is important. Our study investigated the relationship between bittersweet and red oak (*Quercus rubra*) radial growth. We hypothesized that bittersweet will reduce the amount of radial growth on the red oak host. We took increment cores from red oak trees that were either infested or not infested by bittersweet and compared radial growth rates since infestation. The year of bittersweet infestation was determined by aging cross sections of the vines. We also controlled for other factors that could affect ring widths such as canopy competition for sunlight. This study hopes to uncover the influence of invasive species on native species and habitats. We hypothesize that the bittersweet infestation will decrease the basal growth of red oak trees.

Board #26: "Investigating Bird-Window Collisions on the Westfield State University Campus," Luke Amirault and Timothy Parshall, Environmental Science Department, Westfield State University, Westfield MA 01085

It is estimated that up to one billion birds die from window collisions each year in the United States due to their inability to distinguish reflective windows from the surrounding environment. To investigate avian mortality at Westfield State University, carcass surveys were conducted around six buildings over a two-month period. We hypothesized that birds are more prone to flying into buildings with higher window area and with greater abundance of surrounding vegetation. The amount of surrounding vegetation was calculated for each building as well as window area. Bird count surveys were also conducted near selected buildings to observe bird activity. In total, 13 bird carcasses were located during the survey period and their distribution supports our hypotheses. Buildings with more carcasses had a greater abundance of

vegetation within 50 meters, larger window surface area, and higher bird activity. The abundance of vegetation and level of bird activity were also positively related. We propose that similar studies be carried out in the future centering on the new Westfield State Science Center, which features one side of the building that is entirely glass but with fretted lines to prevent avian morality."

Board #27: "Antibiotic Adsorption to Soil Components," Thanh-Phuong Le and Rachael Kipp, Department of Chemistry and Biochemistry, Suffolk University, Boston, MA 02108

Sulfamethoxazole (SMX) is a sulfonamide antibiotic that is commonly used in the human and veterinary medical fields. Pharmaceutical products in the water cycle pose a significant concern as they are finding their way into the environment. Antibiotics are a particular concern as their presence in the environment contributes to bacterial resistance. SMX is detectable in water via fluorescence, a convenient means of studying its interactions with different soil components. Preliminary work demonstrated that SMX was binding to natural soils, but not to either the sand or clay components. However, recently published work (Marie-Christine Morel, Lorenzo Spadini, Khaled Brimo, Jean M.F. Martins. March 2014) indicates that sulfonamide sorption onto soil is enhanced in the presence of Cu (II). This is thought to be the result of binary and ternary surface complexes of reactive organic and mineral soil phase. The aim of this study is to determine the impact of Cu (II) on the binding of SMX to various soil components.

Board #28: "SEAL: Solar Water Splitting for the Future," Kaffa Cote and Rachael Kipp, Department of Chemistry and Biochemistry, Suffolk University, Boston, MA 02108

In the next seventy years, many of the nonrenewable resources that are used as sources of energy will be gone. Renewable energy technology must be developed to meet the energy needs of the future. The goal of the Solar Energy Activity Lab (SEAL) is to discover metal oxide semiconductors that can split water into oxygen and hydrogen atoms using sunlight. Metal solutions are made and spotted in different concentrations on a plate that is then run on the SEAL kit to determine the potential generated at each spot. This is an improvement from the Solar Hydrogen Activity research Kit (SHArK), which was more challenging to work with and did not produce as many results. The focus of this project is to continue studying different metal oxide combinations using a combinatorial approach to find an optimal combination and concentration that is efficient and inexpensive for solar water splitting in the future.

Board #29: "A comprehensive comparison of nicotine and other minor components in tobacco products," Kassandra McCarthyand Andrew S. Dutton, Department of Chemistry and Biochemistry, Suffolk University, Boston, MA 02114

Nicotine is a stimulant with addictive properties associated with its usage, giving it an important role in the manufacture of tobacco products. A comprehensive analysis of different tobacco products was carried out in order to quantify the differences between these products. A multi-analyte extraction in methanol was performed on cigarettes, cigars, smokeless tobacco, Swedish snus, and several types of tobacco leaves in order to determine relative differences in nicotine concentrations between them. Using GC/MS analysis, it was determined that the uncut burley and dark fire cured tobacco leaves contained the most nicotine per gram of tobacco sample, with 1.72 ± 0.11 mg and 1.63 ± 0.02 mg of nicotine respectively, while the Canadian flue cured tobacco leaves contained the least amount of nicotine per gram of tobacco sample, 0.36 ± 0.01 mg. The extraction solutions were then concentrated using rotary evaporation in order to identify other compounds that were present in the tobacco samples. Among the compounds that were detected were other minor tobacco alkaloids, such as cotinine and anabasine, flavor compounds, and carcinogens. Although in the preliminary steps, this work can potentially have an application in environmental studies given that tobacco smoke can effect indoor air quality.

Board #30: "Sweet Potato As An Alternative To Grains In Commercial Food Products And Their Nutritional Benefits," Omar Biyari and Patricia Hogan, Department of Chemistry and Biochemistry, Suffolk University, Boston, MA 02114

Sweetpotato, *Ipomoea batatas L.* (Lam.), originated in Central America and is now the world's fifth most important crop in developing nations. Many indigenous populations in Central and South America, Japan, Africa, and the Caribbean use sweetpotato as a staple food because of its short production cycle of 90 to 120 days, adaptability to a wide variety of growing conditions, and its nutritional value. This research study focuses on using sweetpotato as an alternative to grains in commercial food products and developing methods to assess sweetpotato food products for their nutritional benefits. The larger environmental issues related to sweetpotato cultivation and food product development is the variable abiotic stress caused by global climate change. Sustainable global crop production will be challenged under future climate conditions as competition for water resources increases, and drought is regarded as the main environmental factor limiting plant growth and productivity on a global scale.

Board #31: "Bridging the Educational Divide Between Diesel Use and Social Justice: A Participatory Action Research Approach," Julianne Hooper[2], Daliza M. Cardoza[1] and Edward J. Brush[1], [2]Department of Social Work and [1]Department of Chemistry, Bridgewater State University, Bridgewater, MA 02325

Participatory Action Research (P.A.R.) is a blooming educational outreach initiative that is sweeping throughout the United States, gaining well deserved attention as an educational approach to solving social justice issues. Our research team has initiated a study on populations who are more exposed and vulnerable to the effects of particulate matter from diesel exhaust, creating an issue of environmental and social injustice. As inner city children are particularly vulnerable to the negative health effects of diesel exhaust, P.A.R. is the ideal tool to both aid in learning about the multifaceted topic of diesel and its relationship to society, while giving these children an opportunity to conduct their own research and propose solutions to the problem. Our research team has collected and evaluated the important elements of P.A.R. and has incorporated them into an educational program for middle school teachers to utilize. Key elements of this program include journaling, class led discussions, activities to illustrate the overall lesson, group work, and student conducted research. Through this action, the necessary communicatory bond between the humanities and the sciences will be joined in one program to aid individuals who are being directly impacted by an environmental issue, turned social injustice, and will further contribute to the awakening of sustainable practice and the future of green chemistry. This research was supported by a summer research grant from the BSU Adrian Tinsley Program, and a grant from the EPA P3 program (SU835696).

Board #32: "Application of green chemistry principles to improve the efficiency of biodiesel synthesis from waste vegetable oil: Optimizing methanol use and recovery," Phoebe Kurriss and Edward J. Brush, Department of Chemistry, Bridgewater State University, Bridgewater, MA 02325

The process of synthesizing biodiesel from cooking oil is inefficient due to the wasteful use of reagents and water. My research addresses the excessive use of methanol, a required reactant in biodiesel synthesis. The challenges include a chemical equilibrium process, and production of methanol vapors that are hazardous and flammable. The goal of this research was to apply Green Chemistry principles to evaluate static fluid reflux condensers to optimize methanol recovery. Reflux condensers require the unsustainable use of cold water, and have explored static liquids to improve efficiency. Static liquids were selected based on their heat capacities: water, ethylene glycol, glycerol, and air serving as the control. Different styles of reflux condensers: Liebig, Allihn, Graham, and air condensers were also investigated. Our results with static fluids were compared with condensers using cold and room temperature flowing water recirculating in a closed system. Based on our data, we have found that using glycerol as the static fluid in an Allihn condenser has potential to make the biodiesel process more efficient and sustainable, reducing negative impacts on human and environmental health. This research was supported by a summer research grant from the BSU Center for Sustainability and Adrian Tinsley Program, and a grant from the EPA P3 program (SU835696).

Board #33: "Development of green chemistry metrics to assess improvements to the efficiency in the synthesis of biodiesel from waste vegetable oil," Kevin Roebuck and Edward J. Brush, Department of Chemistry, Bridgewater State University, Bridgewater, MA 02325

Biodiesel is an alternative fuel that is made by a simple chemical process that we have found to be highly inefficient and hazardous. Our research is focused on applying green chemistry principles to develop more efficient chemical processes. However, there is currently no reliable set of metrics for assessing the application of green chemistry principles. The goal of this research was to develop and apply green chemistry metrics as part of an assessment plan to evaluate the efficiency of biodiesel synthesis. We reviewed an extensive set of metrics that include green chemistry principles and reaction efficiency indicators, are quantitative and qualitative, and have been integrated into an assessment rubric. The rubric was tested using the traditional biodiesel process, and individual metrics evaluated by changing reaction parameters. The assessment plan will benefit the scientific community as there is currently no generally accepted assessment rubric for evaluating chemical processes to make environmentally conscious decisions. This research was supported by a summer research grant from the BSU Center for Sustainability and Adrian Tinsley Program, and a grant from the EPA P3 program (SU835696).

Board #34: "Green and Environmental Chemistry Laboratory," Brianna Brosnan, Tatiana Buchanan, Brian Funaiole and Meghna Dilip, Department of Chemistry, Worcester State University, Worcester, MA 01602

At Worcester State University as part of a Green and Environmental lab, traditional environmental analyses were evaluated to determine their greenness. For example, in one experiment two alternative methods were used to determine dissolved oxygen concentrations in a local lake and compared to the standard EPA method. In a separate experiment, phosphate levels were evaluated using both a standard method and an alternate procedure that uses thiourea and no metals. Furthermore, inspired by a New York Times article questioning nail technician safety, analytical techniques were used to quantitatively and qualitatively evaluate hazardous components in nail products.

Board #35: "Artificial Ocean: using novel design tools to show how plastics are affecting seabird populations," Kaci Dumas and Jennifer Koop, Design Department and Biology Department, University of Massachusetts Dartmouth, North Dartmouth, MA 02747

Ocean gyres refer to major currents that move water through the Earth's five oceans. At the center of each of these gyres are some of the largest single collections of plastic on the planet. The Great Pacific Garbage Patch, one of the most well-studied gyres, encompasses the Midway Atoll which lies nearly equidistant between the East coast of Japan and the West coast of the United States. The Midway Atoll is home to a large diversity of marine life, including the largest population of nesting Laysan Albatross on the planet. These birds live along littered beaches, where plastics are a major component of the sandy substrate. Nearly all Laysan Albatross residing on the Midway Atoll are believed to have ingested plastic, which can result in premature death from intestinal blockage or starvation. My research aims to bridge the gap between primary scientific literature and the general public by presenting information in a novel, entertaining format. Visualized data and infographics are used in place of heavy blocks of text to better communicate how ocean plastics are harming seabird populations. My goal is to create awareness of this growing issue and reenergize the public's interest in finding a solution. I am producing a series of posters that describe the human role in creating plastic waste, the permanency of plastics in the environment, and the ecological impacts of plastic waste. Here, I will present one poster from this collection highlighting the effect of plastic waste on a critical seabird population, the Laysan Albatross.

Board #36: "Incorporating 4-aminopyridyl groups into coordination polymers," Jona Koka, Amanda W. Stubbs, James A. Golen and David R. Manke, Department of Chemistry & Biochemistry, University of Massachusetts Dartmouth, North Dartmouth, MA 02747

Since the beginning of the industrial revolution, the concentration of carbon dioxide in the atmosphere has increased substantially with current levels over 390ppm - a forty percent increase in the past 150 years. The resulting (and

accelerating) accumulation of carbon dioxide in the troposphere is increasingly linked to global climate change. One promising method to mitigate the impacts of greenhouse gas emission is Carbon Capture and Sequestration (CCS). An effective material for CCS must selectively bind carbon dioxide while not interacting with other gases that are present. It must be easy to regenerate, requiring a small energy input to release the pure carbon dioxide so that it can be isolated from the environment. My research focuses on the development of Metal-Organic Frameworks, or MOFs, for this purpose. MOFs are compounds consisting of metal ions or clusters coordinated to organic molecules to form one-, two-, or three-dimensional structures that can be porous. My strategy involves the inclusion of Lewis Basic sites within the pores of MOFs in order to increase selective for the adsorption of carbon dioxide relative to other atmospheric gases. I will present my efforts to this end, including the synthesis and structure of linkers and materials featuring 4-aminopyridyl functionalities.

Board #37: "Lewis base derivatized metal-organic frameworks for carbon capture," Brian M. Glazier, Caitlin E. Bien, James A. Golen, David R. Manke, Department of Chemistry & Biochemistry, University of Massachusetts Dartmouth, North Dartmouth, MA 02747

Carbon dioxide is a great contributor to the current problem of global climate change. One method of solving this problem is through the capture of carbon dioxide followed by its sequestration. One promising method for this is the adsorption of carbon dioxide onto metal organic frameworks (MOFs), which are incredibly porous and customizable materials. To improve the selectivity of the MOFs toward carbon dioxide adsorption, Lewis basic sites were incorporated into the frameworks. I will discuss the general strategy for generating a useful carbon capture media, as well as the synthesis, structure and preliminary gas adsorption properties of a number of MOFs.

Board #38: "Covalent Metal-Organic Networks (CMONs) for carbon capture," William T. Hutchinson III, Alessandra Lonardo, James A. Golen and David R. Manke, Department of Chemistry & Biochemistry, University of Massachusetts Dartmouth, North Dartmouth, MA 02747

The continued production and release of carbon dioxide for human energy consumption is leading to global climate change, the outcomes of which remain difficult to gauge. To address this issue, our group explores materials that can be used in carbon capture and sequestration (CCS). To be a successful and efficient carbon capture media, the material used must trap only carbon dioxide gas while not trapping other atmospheric gases. The material must also be reusable in the sense that minimal energy can be used to regenerate the material for reuse and the carbon dioxide can be sequestered. Our group has a research strategy to generate metal-organic frameworks (MOFs) lined with Lewis basic sites. MOFs are a crystalline porous material generated from organic ligands binding metal ions. Each combination of various organic ligands and metal ions create a unique lattice. My work is on a specific subset of metal-organic frameworks which have significantly stronger metal-linker interactions. These covalent metal-organic networks (CMONs) should demonstrate a greater thermal stability than standard MOFs which are based upon ionic or dative interactions. The strongly covalent bonds in CMONs lead to syntheses that are kinetically very quick, and powder formation dominates rather than the production of crystalline materials. To alleviate this, we are working with protecting-group strategies to slow the growth of CMONs and yield the desired crystalline materials. The synthesis, crystal growth and structures of these materials will be explored in this presentation.

Board #39: "Depolymerization of Lignin to extract Phenols by Microwave Pyrolysis," Ryan Burnett, Derrick James, and Yong Woo Lee**,** Department of Chemistry, Salem State University, 352 Lafayette St, Salem, MA, 01970

The aim of the present study is to make use of Lignin as a model compound for renewable phenols and fuel reproduction by catalytic microwave pyrolysis. An ideal treatment for the organic raw material, Lignin, a by-product from the paper-pulping industry. It is the second most abundant aromatic polymer in the world and is composed of three different phenyl monomers (coniferyl alcohol, syringyl alcohol, and coumaryl alcohol), depending on the plant species. The majority of the lignin being produced as a byproduct of the paper pulping process and cellulosic ethanol industry is just burned to recover its heat value. In the United States alone over 50 billion pounds of lignin are burned annually. In spite of the

advantages, the believed inherent disadvantage of lignin, in the past, have been the separation from black liquor. This generally increases the price of Lignin but also the molecules become less reactive and more spherical. The spherical shape reduces the number of active sites that are easily accessible to other reactive molecules. Lignin biomass is easily available worldwide and considered to be renewable. Although it has very complex structure, the use of lignin is rapidly expanding for the production of useful chemicals from pyrolysis. It has been discovered that black liquor can be mixed with crude waste glycerin for isolation of phenol and other valuable phenolic compounds. Depolymerization of Lignin under microwave pyrolysis, a process that helps transfer heat from the inside to the surface of biomass without the presence of oxygen by microwave irradiation. The advantages of microwave pyrolysis include a fast and selective heating process, which is relatively more energy efficient and more cost effective compared to the conventional pyrolysis. By mixing 1g Lignin from a black liquor source with 0.1N NaOH and Glycerin, placing the solution inside the microwave for 10 mins at 230°C/ 220psi, allowing for depolymerization. Then, applying centrifugation separated the solid particles and acidified the supernatant liquid. Finally, by using an ethyl acetate solvent for extraction to be analyzed by NMR. Once NMR was received, no phenol was produced. A second study is in progress with the Lignin source being concentrated with Glycerin and water. Depolymerized Lignin will undergo previous recordings, only to use Dichloromethane as an extraction solvent. By completing new GC-MS and NMR analysis, recent study has shown our end product will produce some phenolic. The effects of reaction temperature and weight hourly space velocity on product yield will be investigated and models to predict the product yields will be established as well. Therefore, we hope this present study will shed light on the reaction pathway of microwave pyrolysis of lignocellulosic biomass and application of Lignin.

Board #40: "Application of Chromophoric Dyes With Applied Bias To Increase Photoconversion Efficiency of Dye Sensitized Solar Cells," Connor Sweet, Craig Rockwell, Brian Sheetz, Amanda McCabe, Clifford Murphy, Clifford Timpson, Clifford Murphy, Department of Chemistry and Physics, Roger Williams University, Bristol, RI 02809

Dye-sensitized solar cells (DSSC) have garnered attention for renewable energy applications, due to their promising photo-conversion efficiencies, and potential for cheap production. In previous work we have applied microwave heating to the deposition of N719 dye to silanated and unsilanated TiO2 layers on FTO, resulting in more rapid dye deposition. Additionally, microwave heating appears to increase the efficiency of our DSSCs in comparison with conventionally heated slides. We hypothesize that this may be due to the surface carrying charge due to microwave excitation which may influence coupling of the polar dye molecule. Here we present dye deposition by applying a low voltage bias in an electrolytic solution, using chronoamperometry. Biased silanated and unsilanated substrates were compared with non-biased substrates with heating. Preliminary data suggests that dye application with bias increases photoconductive efficiencies, with a positive correlation with increasing voltage (silanated: 0.072%-0.3V, 0.070%-0.2V, 0.014%-0.1V, 0.032%-conventional; non- silanated: 0.033%-0.3V, 0.022%-0.2V, 0.031%-0.1V, 0.008%-conventional).

Board #41: "Dye Sensitized Solar Cells utilizing polyethylenedioxythiophene (PEDOT) cathodes and a new light-absorbing dye complex," Kate L. Digan, Connor A. Sweet and Cliff J. Timpson, Department of Chemistry and Physics, Roger Williams University, Bristol, RI 02809

Dye-sensitized solar cells (DSSCs) have yet to emerge as a major alternative to fossil fuels due, in part, to the overall cost associated with manufacturing DSSCs and the overall efficiencies at which they operate. This implies there are at least two ways to make DSSCs more economically attractive: reduce their cost and/or improve their efficiencies. We wish to investigate lowering the overall cost of traditional DSSCs by exchanging platinum, a critical component of the cell, with a less expensive, conductive polymer based on ethylenedioxythiophene (EDOT). In a parallel effort, we are also investigating a new ruthenium dye species that may help to minimize an unwanted redox pathway that is known to decrease the overall photo-conversion efficiency of liquid-based DSSCs. Our efforts to explore the utility of polymerized EDOT cathodes, along with our efforts to modify the ruthenium-based, chromphoric dyes to try and improve the overall efficiencies of DSSCs will be presented.

Board #42: "Development of a photo and electrochemical detector of thiocyanate in marine environments," Amanda R. McCabe, Connor A. Sweet, Craig R. Rockwell, Brian S. Sheetz and Clifford B. Murphy, Department of Chemistry, Roger Williams University, Bristol, Rhode Island 02809

Due to the million-dollar aquarium trade, cyanide fishing poses a threat to coral-reef systems around the world. Fish caught by cyanide fishing will produce thiocyanate ions as a metabolic product that could serve as a marker for this activity. There needs to be a chemosensor device that is both sensitive and selective to thiocyanate ions to aid in the identification of fish obtained by cyanide fishing. Porphyrins with metal centers present good candidates for chemosensors due to their ability to bind thiocyanate ions and be analyzed photo- and electrochemically. Here we present synthetic strategies to synthesize functionalized porphyrins to incorporate into a solid-state chemosensor device. UV-Visible absorption spectra and cyclic-voltammetry characterize the response of copper (II), manganese (III), cobalt (II), and iron (III) porphyrins to thiocyanate exposure in seawater. These devices were created through Sonogashira coupling functionalized porphyrins to silanated TiO2 on FTO glass.

Board #43: "XRF analysis of the otolith: A potential environmental bioindicator of salinity and toxic metal exposure," Jackie Hugger, Ryan Phelps and Stephen K. O'Shea, Department of Chemistry, Roger Williams University, Bristol, RI 02809

Otoliths result from the accretion of aragonite ($CaCO_3$) and grow by the deposition of daily and annual increments throughout the life of the fish by elements such as Sr, Mg, Mn and Ba, which occur at a relatively high abundance in calcified structures. These are accompanied by trace elements derived from the surrounding water, thus fish otoliths are ideal biological proxy tracers of physico-chemical conditions in elucidating fish habitats histories (Sr:Ca ratios). They can be used to draw inferences about past heavy metal exposure with X-ray fluorescence (XRF) methods allowing for nondestructive otolith surface maps of the elemental distributions feasible for approximate elemental concentrations. These values were compared to whole fined ground otolith samples by XRF elemental analysis and ICP MS analysis. Fish were harvested from waters of Narragansett Bay, RI and the estuarine environment reflected in their otolith Sr:Ca mmol:mol ratios values 4:7. The composition of these otoliths Mn, Ag, Ni, and Fe remained constant across the harvest locations and year, while there was variation concentration of Cu 30ppm (± 50%).

Board #44: "Biomimetic CFCs Degradation: an Insight to Biotic Halogen Cycling," Mitchell Crick and Stephen K. O'Shea, Department of Chemistry, Roger Williams University, Bristol, RI 02809

Understanding the marine microbial metabolic degradation pathways of natural halo-carbons is important not only from a climate perspective but also for what it reveals about the overall balance of biotic halo-carbons cycling and their release into the ecosystem, of which there is currently only limited knowledge. This research aims to discern the scope and mechanism for the oxidation and reduction of iron porphyrins by volatile halo-carbons as biomimetic models of marine heme systems. Furthermore, understanding the roles of marine iron porphyrin reductive dehalogenation in the transformation of halo-carbons gives insight into potential routes of anthropogenic chlorofluorocarbons marine decomposition and their metabolites potential impact on the halo-carbons global budget. Understanding the mechanism of reaction of reductive dehalogenation of these halo-carbons is important because eventually this chemistry could be used to rid the environment of these potentially harmful and robust compounds by converting them into simpler, less harmful ones. By understanding the redox potential of these porphyrins, it may be possible to use other similar pentadentate ligand complexes that achieve the same results. Rates of reaction were determined by monitoring the change in the UV-Vis absorption spectra. Products were determined in situ and from head-space of the reaction mixtures by GC-MS compared to authentic standards. It was determined that the redox of the carbon-halo bond regulates the rate of reaction, where the iodo reactions were found to have higher kinetic rates in comparison to those of the fluoro-organics.