SCHEDULE OF TALKS

Regional Science Consortium
12th Annual Research Symposium
November 2 – 4, 2016
Tom Ridge Environmental Center
at Presque Isle State Park

WEDNESDAY, NOVEMBER 2, 2016

9:00 – 9:55 **REGISTRATION OPENS**
Register, upload presentations

9:55 – 10:00 **Welcome**
Jeanette Schnars, Ph.D., Executive Director, RSC

Presentations

Session Chair: Tammy Zimmerman, RSC Board Member

10:00 – 10:20 **Effects of the medieval climate anomaly on the Great Plains Region of North America**
Maraina Miles*, Patrick Burkhart, Ph.D., Slippery Rock, Department of Geography, Geology, and the Environment

10:20 – 10:40 **Building our understanding of marina debris impacts—Sea Grant efforts and potential collaborations**
Marti Martz, Pennsylvania Sea Grant

10:40 – 11:00 **Emerging environmental pollutants: platinum group elements in automobile catalytic converter nanotechnology**
Deborah M. Aruguete[1]*, Mitsuhiro Murayama[2, 3], Christopher Winkler[3]
[1]Department of Environmental Science, Penn State Behrend, Erie, PA;
[2]Department of Materials Science and Engineering, Virginia Tech, Blacksburg, VA;
[3]Institute for Critical Technologies and Applied Science, Virginia Tech, Blacksburg, VA

11:00 – 11:20 **A comparison of illegal dump sites in Erie over ten years**
Molly Mills, Mercyhurst University

11:20 – 11:40 **Occurrence of Pharmaceutical and Personal Care Products in stream (raw) and drinking-water (finished) samples in the Susquehanna and Delaware Watersheds 2007-2009 compared to 2016 and in the Lake Erie Watershed in 2016**
Robin A. Brightbill*, Andrew G. Reif, U.S. Geological Survey

11:40 – 1:20 **LUNCH – THE SUNSET CAFÉ**

Session Chair: Holly Best, RSC Executive Board Member

1:20 – 1:40 **Identification of the microflora found on the feathers of Purple Martins compared to the microflora found on eggs**
MaryAnn Mason*, Kristen Webster, and Beth Potter, Penn State Behrend, Biology Department

1:40 – 2:00 **Tracking songbirds with nano-tags during spring migration**
Sara Sargent, National Audubon Society

2:00 – 2:20 **A census of the bat population of Gannon University, Erie, PA**
Nick Bengel* and Steve Ropski, Ph.D., Gannon University, Biology Department, Erie, PA

2:20 – 2:40 **Exploring neuronal connections between the mediodorsal thalamus and the brainstem in Cynomolgus monkeys**
Kyle Duffer* and Darlene S. Melchitzky, Mercyhurst University, Department of Biology, Erie, PA

2:20 – 3:10 **BREAK**

Session Chair: Bob Whyte, RSC Treasurer

3:10 – 3:15 **Temperature variability influencing mosquito egg deposition**
Angelea Belfiore, Mercyhurst University
(Speed Talk)

3:15 – 3:20 **Organic matter and environmental factors as predictors of mosquito larva growth in illegally dumped tires**
Ann Helms, Mercyhurst University
(Speed Talk)

3:20 – 3:25 ***Sciara coprophila:* an alternative fly model system with unique and interesting biological characteristics**
Michael Foulk, Mercyhurst University
(Speed Talk)

3:25 – 3:30 **Wild bee assemblages on a land-use gradient in Meadville, PA**
Erica Moretti* and Beth Choate, Allegheny College, Department of Environmental Science
(Speed Talk)

3:30 – 3:35 **Developing an eDNA system to detect and monitor the spread of the invasive Round Goby *(Negobius melanostomus)* in the waterways of Northwestern Pennsylvania**
Zachary Gribik* and Kristen Webb, Allegheny College, Department of Biology
(Speed Talk)

4:00 – 6:00 **RSC BOARD MEETING** – RSC Board Members

6:00 – 8:00 **POSTER SESSION**
All are welcome to attend – *Refreshments provided*

THURSDAY, NOVEMBER 3, 2016

8:00 – 9:45 **BREAKWATER & SAND EROSION MEETING – Committee Members**

9:00 – 9:55 **REGISTRATION OPENS**
Register, upload presentations,
Continental Breakfast

9:55 – 10:00 **Welcome**
Jeanette Schnars, Ph.D., Executive Director, RSC

Presentations

Session Chair: Fred Brenner, RSC Past President

10:00 – 10:20 **Synergistic effects of Resveratrol and Quercetin on cancerous mouse cell line**
Katie Baldwin*, Brooke Knisely, Haley Stephens, Fred J. Brenner, Ph.D., and Durwood Ray, Ph.D., Grove City College, Grove City, PA

10:20 – 10:40 **Development of a real-time PCR method for the early detection of aquatic invasive species in Pennsylvania watersheds**
Benoit Van Aken[1,]*, Srishty Subramanian[1], Sasha Eisenman[2], Erik Silldorff[3]
[1] Civil & Environmental Engineering, Temple University;
[2] Landscape Architecture & Horticulture, Temple University;
[3] Delaware River Basin Commission

10:40 – 11:00 **Genetic analysis of deer dispersal patterns through mitochondria DNA sequence analysis**
Stephanie Judd*, Brendan McCreath, Caitlin Goncz, Kelly Cowher, Anna Conner, Fred. J. Brenner, Ph.D., Grove City College, Hopeman School of Science, Engineering, and Mathematics

11:00 – 11:20 **The fate of terrestrially derived dissolved organic carbon in one sub-tropical and three temperate lakes**
Christopher Dempsey[1]*, Jennie Brentrup[2], Sarah Magyan[1], Lesley B. Knoll[3], and Craig E. Williamson[2]
[1]Gannon University, Biology Department, Erie, PA; [2]Miami University, Global Change Limnology Laboratory, Department of Biology, Oxford, OH; [3]University of Minnesota, Itasca Biological Station and Laboratories, Lake Itasca, MN

11:20 – 11:25 **The role of SCAMP3 in amyloid precursor protein (APP) processing**
Daniel Cooney, Gannon University

11:25 – 12:40 **LUNCH – THE SUNSET CAFÉ**

Session Chair: Jon Titus, RSC Board Member

12:40 – 1:00 **Completed development of online public tools and research goals**
Michael Curtis* and Michael Naber, Penn State Behrend, Science

1:00 – 1:20 **Water-based outdoor recreation users' attitudes towards potential offshore wind energy development in the Great Lakes**
Michael D. Ferguson*, Ph.D., Andrew J. Mowen, Ph.D., and Alan R. Graefe, Ph.D.

1:20 – 1:40 **Limnology and phytoplankton community structure of Bear Lake (Chautauqua County, NY)**
Jennifer Wasielewski*, Courtney Wigdahl-Perry, Jeffrey Diers, State University of New York at Fredonia, Fredonia, NY

1:40 – 2:00 **Determining the presence and possible effects of Round Gobies in the French Creek Watershed on native benthic fishes**
Hannah Eisemann*, Allyson Wood*, Casey Brashaw-Wilson, Ph.D., Allegheny College, Environmental Science Department

2:00 – 2:05 **The effects of plastic pollution on zooplanktons ability to feed and reproduce**
Heather Barrett*, Courtney Wigdahl-Perry, and Sherri Mason, State University of New York at Fredonia
(Speed Talk)

2:05 – 2:40 **BREAK**

Session Chair: Sara Turner, RSC Vice-President

2:40 – 3:00 **The behavior of brine shrimp *(Artemia salina)* in turbulence**
Kato, D.K.*, Wolfe, T.P., Marys, K.A., and Anderson, E.J., Grove City College, Grove City, PA

3:00 – 3:20 **Comparison of tailbeat kinematics during swimming in striped bass *(Morone saxitalis)* of different lengths**
Daningburg[1], K.M.*, Noll[1], A.R., and Anderson[1, 2], E.J.
[1]Grove City College, Grove City, PA; [2]Woods Hole Oceanographic Institution, Woods Hole, MA

3:20 – 3:40 **Investigation of boundary layer flow in swimming squid by flow visualization**
Allen[1], G.C.*, Noll[1], A.R., Turner[1], E.L., and Anderson[1, 2], E. J.
[1]Grove City College, Grove City, PA; [2]Woods Hole Oceanographic Institution, Woods Hole, MA

3:40 – 4:00 **The forces on an undulating plastic panel determined by boundary layer flow visualization and transducer measurements**
Noll[1], A.R.*, Garborg[1], C.S., Lauder[2], G.V., and Anderson[1], E.J.
[1]Grove City College, Grove City PA; [2]Harvard University, Cambridge, MA

4:00 – 6:00 **BREAK**

6:00 – 9:00 **DINNER RECEPTION**
Food and drinks by the Sunset Café
Entertainment by the Salmon Frank Band
Presentation of the Hornady Award
Guest Speakers – "Two Girls and a Tree Named Makeba", Mary Catterlin and Amy Lucas

Need a ticket? It's not too late! Please see Registration Table

FRIDAY, NOVEMBER 4, 2016:

8:00 – 8:55 **REGISTRATION OPENS**
Register, Upload presentations
Continental Breakfast

8:55 – 9:00 **Welcome**
Jeanette Schnars, Ph.D., Executive Director, RSC

Presentations

Session Chair: Casey Bradshaw-Wilson, RSC President

9:00 – 9:20 **Aquatic species inventories of ten state parks in the Commonwealth of Pennsylvania**
Joshua Wisor* and Kyle Clark, The Penn State University

9:20 – 9:40 **Comparison of macroinvertebrate fauna across three Pennsylvania drainages**
Miranda Mussoline*, Sara Mueller, Jar R. Stauffer Jr., The Pennsylvania University

9:40 – 10:00 **Chironomid diversity of Elk Creek, Erie, PA**
Daniel Vogel *, Sara Mueller, Jar R. Stauffer Jr., The Pennsylvania University

10:00 – 10:20 **Separate vs. combined effects of snails, tadpoles, and caddisflies on detritus decomposition in montane kettle ponds**
Liana Leja, Allegheny College

10:20 – 10:40 **Use of DNA technologies in macroinvertebrate bioassessments**
Sara Mueller[1] *, Aaron Aunins[2], Timothy King[2], Jay R. Stauffer Jr.[1]
[1]The Pennsylvania State University; [2]U.S. Geological Survey

10:40 – 10:45 **Lake Malawi Cichlids**
Danielle Pierone, Dr. Jay Stauffer, The Pennsylvania State University (*Speed Talk*)

10:45 – 11:20 **BREAK**

Session Chair: Jeanette Schnars, RSC Executive Director

11:20 – 11:40 **Multiparametric analysis of *Escherichia coli* bacteria in sand on six Presque Isle State Park beaches, Erie, PA**
Amber Stilwell*, Jeanette Schnars, Ph.D., Regional Science Consortium, Erie, PA

11:40 – 12:00 **How does the use of Agion Silver Technology change the bacterial flora found on door handles?**
Michelle Hornedo*, Kathryn Carl*, and Beth Potter, Penn State Behrend, Biology

12:00 – 1:00 **LUNCH – THE SUNSET CAFÉ**

Session Chair: Jerry Covert, RSC Past Executive Director

1:00 – 1:20 **Comparison of diatoms found in restored and unrestored sections of Dead Pond, Presque Isle, State Park, Erie, PA**
Andrew Kubaney [1, 2] *, Jeanette Girosky[2, 3]
[1]Mercyhurst Preparatory School: [2]Regional Science Consortium: [3]Natural History Museum, Tom Ridge Environmental Center

1:20 – 1:40 **Aquatic ecosystem modeling to understand Harmful Algal Blooms in Presque Isle Bay, Erie, PA**
Dr. Rick Diz, PE *, Gannon University, Department of Environmental Science and Engineering

1:40 – 2:00 **Interaction of light, phytoplankton, and zooplankton in Presque Isle Bay during development of a cyanobacterial bloom in summer 2016**
J. Michael Campbell[1] *, Trevor Surgener[1], Angelea Belfiore[1], Rick Diz[2]
[1]Mercyhurst University, Biology Department; [2]Gannon University, Department of Environmental Science and Engineering

2:00 – 2:20 **BREAK**

2:20 – 2:40 **STUDENT AWARDS AND CLOSING REMARKS**
Jeanette Schnars, Ph.D., Executive Director, RSC
Announcement of RSC Fellowship Program
Student award presentations
Closing remarks

ABSTRACTS

Regional Science Consortium
12th Annual Research Symposium
November 2—4, 2016
Tom Ridge Environmental Center
at Presque Isle State Park

ORAL PRESENTATIONS

Wednesday, November 2, 2016

Effects of the Medieval Climate Anomaly on the Great Plains Region of North America

Maraina Miles*, Patrick Burkhart, Ph.D., Slippery Rock, Department of Geography, Geology, and the Environment

The goal of this study is to better understand the effects of the Medieval Climate Anomaly (MCA) on the Great Plains region of North America. Dr. Burkhart has accumulated findings that reveal incision of slopes in the White River Badlands by which sod tables form, dating to approximately 1000 to 1300 AD. We postulate that the MCA forced this change in geomorphology. This time presented an arid climate in the Great Plains, which affected the landscape, wildlife, and vegetation. In order to investigate this assertion, my objective is to complete a literature review of this event, including proxy records of it. The MCA occurred between 950 AD and 1250 AD. Proxies located so far include lacustrine sediments and loess. For example, sedimentation rates in Elk Lake, MN increased in response to greater deposition of dust during drought. Whereas a drought in Moon Lake, ND has been reconstructed from diatom abundances. Studies of eolian deposits show active dunes in northeastern Colorado and in Kansas during this time period. As we continue to understand the effects of the MCA on the Great Plains, we will search for synchronicity in diverse landforms by expanding our studies from sole focus on slopes to include dune field mobility across the same region.

Building our understanding of marina debris impacts—Sea Grant efforts and potential collaborations

Marti Martz, Pennsylvania Sea Grant

Though the issue of marine debris is well known on marine coasts, researchers have discovered that the Lower Great Lakes contain higher quantities of plastic particles than the world's oceans. The National Sea Grant College Program funded a marine debris training for Great Lakes Sea Grant staff in April of 2016. Presentations provided an overview of current research on the presence and distribution of marine debris, especially plastic, in the Great Lakes, along with potential impacts on water quality and wildlife health. Though a secondary goal was to develop an outreach campaign for the Great Lakes basin, participants determined that research gaps hinder that effort. A sub-set of participants worked together to develop a list of research gaps which was shared with program directors. Sea Grant staff is working to elevate the issue within our strategic planning in an effort to generate additional research funding. Collaborations will leverage these resources.

We invite researchers, educators and students to join us at this session to learn more about this effort and how you can get involved.

Emerging environmental pollutants: platinum group elements in automobile catalytic converters nanotechnology

Deborah M. Aruguete[1]*, Mitsuhiro Murayama[2, 3], Christopher Winkler[3]
[1]Department of Environmental Science, Penn State Behrend, Erie, PA;
[2]Department of Materials Science and Engineering, Virginia Tech, Blacksburg, VA;
[3]Institute for Critical Technologies and Applied Science, Virginia Tech, Blacksburg, VA

Automobile catalytic converters (ACCs) have been an essential application of nanotechnology (technology based on materials 1-100 nm in dimensions) since the 1970s, and are responsible for great improvements in air quality by reducing harmful automobile emissions. The active components in an ACC are platinum group element (PGE) nanoparticles of platinum (Pt), palladium (Pd), or rhodium (Rh) as well as nanoparticles of oxides including ceria, alumina, and zirconia. Pieces of ACC materials are emitted constantly from automobiles, and rising levels of PGEs in environmental systems are attributed to these emissions. Soluble forms of PGEs potentially released from ACC nanomaterials are highly biologically active, as evidenced by the use of Pt salts in chemotherapy. Nanomaterials are of concern as they can be toxic.

In this talk, we report a study of soluble PGE release from ACCs. We subjected a commercially-available palladium-dominated ACC material (Honda) to leaching in environmentally-relevant solutions and employed elemental analysis to track the release of PGEs. Along with these chemical studies, results of a thorough materials characterization of the ACCs with HRTEM, SEM/EDX and XRD are reported. While prior studies have only shown PGE release from ACCs at very low pH, we have found significant soluble PGE release at the environmentally-common pH value 8. The environmental implications of this work for both the aqueous chemistry of PGEs and the behavior of heterogeneous nanomaterial mixtures will be discussed.

A comparison of illegal dump sites in Erie over ten years

Molly Mills, Mercyhurst University

Introduction: Illegal dumping has serious implications for the habitats it disrupts and the people in close proximity with these areas. In Pennsylvania, there are risks associated with illegal dumping that are preventable. For example, tires provide a favorable habitat for mosquito larvae, presenting a source of West Nile Virus. We sought to compare illegal dump sites reported in Erie county from ten years ago (2005) to the present, in order to identify changes in dumping behavior and total volume of dumping.
Methods: A total of 82 known dumpsites in Erie County were re-surveyed from ten years ago. New sites were also recorded and analyzed. Those sites from ten years ago that still exist were compared to assess the changes in materials that are being dumped in Erie county, the changes in the condition of the habitat, and what measures are lacking to discourage illegal dumping.
Results: As of current survey counts, 59% of the original 82 dump sites remain active today, with an addition of 10 new sites. Despite a decrease in the total number of dump sites, overall tire volume has increased. Final results are pending completion of surveys in October.
Conclusions: Although many dump sites have been cleared since the initial survey, new sites continue to be created and pre-existing sites grow, causing an overall increase in dumping in the county. Conclusions to be reported once final results are analyzed.

Occurrence of Pharmaceutical and Personal Care Products in stream (raw) and drinking-water (finished) samples in the Susquehanna and Delaware Watersheds 2007-2009 compared to 2016 and in the Lake Erie Watershed in 2016

Robin A. Brightbill*, Andrew G. Reif, U.S. Geological Survey

Concern is growing over the presence of pharmaceutical and personal care products (PPCPs) in waters of the United States and worldwide. PPCPs are found in many streams that are used as a drinking-water source (Kolpin and others, 2002). Studies have shown (Benotti and others, 2009 and Stackelberg and others, 2007) these PPCPs are removed by the chlorination or ozone oxidation process, and by combined water treatments of clarification, disinfection, and granular-activated-carbon filtrations used at most water treatment plants.

Previous research by the USGS, in cooperation with the Pennsylvania Department of Environmental Protection, at streams near drinking-water intakes within the Susquehanna and Delaware River Basins between 2007 and 2009 indicated PPCP concentrations greater than reporting levels, with caffeine (71%), sulfamethoxazole (40%), and acetaminophen (25%) being the three most commonly detected (Reif and others, 2012). A new study funded by PA Sea Grant will investigate if concentrations of PPCPs have changed at three stream sites near drinking-water intakes within the Susquehanna and two within the Delaware Watersheds over the last 10 years. The study will also investigate differences of PPCPs concentrations between six raw samples near drinking-water intakes and their associated finished water samples from water treatment plants in the Susquehanna, Delaware, and Lake Erie Watersheds.

Identification of the microflora found on the feathers of Purple Martins compared to the microflora found on eggs

MaryAnn Mason*, Kristen Webster, and Beth Potter, Penn State Behrend, Biology Department

Previous work in our lab has focused on determining the composition of the microflora found on the surface of Purple Martins (*Progne subis*) eggs. Interestingly, the bacteria identified from the egg surface were more similar to those found on the surface of House Wrens and Pied-Flycatchers rather than members within the same family including Tree and Violet-Green Swallows. Since Purple Martins and Tree and Violet-Green Swallows tend to share similar breeding habits and diets, we believe the differences in bacterial composition are due to differences within the uropygial gland secretions of these birds. We are beginning to look at this possibility by first identifying bacteria found on the feathers of mothers and babies and have preliminary data revealing the composition of the microbial flora.

Tracking songbirds with nano-tags during spring migration

Sara Sargent, National Audubon Society

In May 2016 we deployed 13 “nano-tags”, very lightweight radio transmitters, on three species of northward migrating songbirds at Presque Isle State Park (PISP). Individuals were relocated using a hand-held receiver and antenna during the remainder of their stopover in the park and adjacent areas, then were detected by fixed recording stations that are part of the Motus network as they continued their migration into Ontario. The three species differed in their likelihood of crossing Lake Erie as they when they departed from PISP. All three Swainson’s Thrushes crossed quickly and were detected at a sequence of stations across the lake in Ontario on the night they departed from Presque Isle. Only two of the five Magnolia Warblers were detected after leaving PISP, and these were stations to the east of us on the southern shore of Lake Erie, suggesting that this species is unlikely to cross the lake. Of the five Blackpoll Warblers, three crossed Lake Erie on departure from PISP, while the other two followed the lake shore towards the northeast. Several used habitat off of the park near the Erie sewage treatment plant before departing.

A census of the bat population of Gannon University, Erie, PA

Nick Bengel* and Steve Ropski, Ph.D., Gannon University, Biology Department, Erie, PA

For the past seven summers, a census of the bat population has occurred on the Gannon University campus in Erie, PA. The numbers for the first three years held relatively steady, but the data for the past 4 years indicates a dramatic decline. White Nose Syndrome was first reported in 2006 in a cave in New York. The disease has killed an estimated 6 million bats in the eastern United States since then and has spread throughout Pennsylvania and into northeastern Ohio. This fungal infection has killed 95% of bats in some caves and may result in the listing of three bat species as endangered in Pennsylvania, including the Little Brown Bat (*Myotis lucifugus*), the predominant bat on the Gannon campus. This study will compare yearly data by building, time of year, building side and species composition to determine how White Nose Syndrome has affected the Gannon campus bats. A decrease in numbers may be partially responsible for an increase in West Nile Virus in the area. The results will also be used to place bat houses at appropriate locations to encourage bat presence on campus.

Exploring neuronal connections between the mediodorsal thalamus and the brainstem in Cynomolgus monkeys

Kyle Duffer* and Darlene S. Melchitzky, Mercyhurst University, Department of Biology, Erie, PA

The mediodorsal thalamus (MD) has been shown to have reciprocal neuronal connections with the prefrontal cortex (PFC), and damage to the MD has been shown to have effects similar to damage to the PFC itself, such as working memory deficits. While these connections between the MD and PFC have been studied in detail, empirical evidence of possible connections between the lateral MD and the brainstem is lacking, and thus was the subject of this research. In a previous study, cynomolgus monkeys (*Macaca fascicularis*) were injected in the lateral MD with the retrograde tracer Cholera Toxin Subunit B. Slides from that study were used to determine the number of labeled neurons in the brainstem using digital photography and ImageJ software. The most abundant projections from the lateral MD were seen in the deep mesencephalic nucleus (DpMe), and the oral pontine nucleus (PnO). The dorsal raphe nucleus (DRN) and median raphe nucleus (MRN) also had strong projections to the MD relative to their small size. As these areas of the brainstem have been indicated in diverse functions such as sleep patterns and REM in the PnO, vestibular functions in the DPME, and serotonergic innervations from the raphe nuclei, these connections from the brainstem to the lateral MD may be a means of modulating vital autonomic, homeostatic, and integrative information between the brainstem and the PFC.

Temperature variability influencing mosquito egg deposition

Angelea Belfiore, Mercyhurst University

Introduction: As temperatures increase with changing climate, conditions are created and diminished for organisms that are temperature sensitive, as well as the areas they can deposit their eggs. As this shifts, these species, such as mosquitos, are using man-made structures for their new homes. This poses threats to human health as mosquitos move closer to developed areas, especially those containing dumped tires. We sought to determine the variance between sunlight and shade, resulting in temperature variance, as predictors of larval growth in illegally dumped tires.

Methods: Using a site on Mercyhurst University campus, we set up four tires, 1A, 1B, 2A, 2B. The ones were in full sunlight. The twos were in shaded area. These tires were monitored positive or negative for mosquito larvae. Measurements of temperature were recorded and samples were taken of larvae, if present.

Results: Of the four tires, 1A did not contain any larvae and 1B had one larvae found. The second group both contained larvae, 2A had two while 2B had one. The tires contained minimal water initially. Three days after they were placed, there was a heavy rainfall. This additional water could have influenced

mosquito selection on where the eggs were deposited. Data will shift as we continue to survey the tires. Conclusions: The management of tires and their storage directly related to its ability to retain water. If tires are stored in shaded areas that can accumulate water, then their likelihood increases of being hospitable for mosquito larvae.

Organic matter and environmental factors as predictors of mosquito larva growth in illegally dumped tires

Ann Helms, Mercyhurst University

Mosquito growth in illegally dumped tires in urban settings is highly correlated to increased infection rates of tropical diseases. Artificial container species such as *C. Pipiens*, a West Nile virus carrier, is the most abundant species in Erie County. Its presence in discarded tires is nearly ubiquitous in illegal tire dumps. There are multiple factors that affect mosquito densities such as availability of artificial containers, tree shade, water quality (in the container) and amount and type of debris collected at the bottom of the tire. This study focuses specifically on the leaf detritus as a habitat for other macro- and micro-invertebrates and their presence as a source of food for the mosquito larva. We address the question of how the presence of these living organisms affects the density of the mosquito population. Preliminary observational studies have shown leaf litter debris in the tire help determine the number of larva found in the tire. We will analyze the collected debris using a Tulgren funnel to collect arthropods and other living organisms. Water temperature, and the amount of sunlight the tire receives will be examined as confounding factors for the presence of both positive and negative larval growth. The implications for vector and infectious disease control in Erie County will be discussed.

***Sciara coprophila:* an alternative fly model system with unique and interesting biological characteristics**

Michael Foulk, Mercyhurst University

The fungus fly, *Sciara coprophila*, is a lower dipteran fly, relatively distantly related to *Drosophila* species. This fly exhibits numerous unique biological features that makes it a potential alternative fly model system. The unique biological features of *Sciara* include: a unique sex determination scheme, chromosome imprinting, elimination of parental chromosomes during male meiosis (mono-polar spindles in male meiosis I, non-disjunction of the X-dyad during male meiosis II), elimination of germ-line limited (L) chromosomes from somatic cells, replacement of telomeres on the X chromosome with rDNA repeats, high irradiation resistance and developmentally regulated gene amplification. Recently, a transformation system has been developed for *Sciara* and a draft assembly of the genome is in the process of being published and made available to the broader research community. These developments poise *Sciara* to be a useful model system for the study of its unique biology. Here I will introduce *Sciara* as a potential model system and briefly discuss the use of *Sciara* to study developmentally regulated gene amplification.

Wild bee assemblages on a land-use gradient in Meadville, PA

Erica Moretti* and Beth Choate, Allegheny College, Department of Environmental Science

Growing concern over honey bee declines has highlighted the dearth of information available on wild bee species and a need for their conservation. Particularly in urban settings, where it is widely understood that bee species richness and abundance declines as the degree of urbanization increases, only more recently has research focused more on how the species composition shifts within these environments. Given wild bees' dependence on forage availability and nesting habits, they are closely tied to their nesting sites. In this way, urban environments have been observed to alter species composition in part based on nesting site availability. Specifically, soil-nester abundances tend to decline while cavity-nesting species become more prominent as the degree of urbanization increases. This study will seek to

determine if these patterns, a decline in wild bee richness and abundance and a shift in species composition based on nesting habits, can be seen on a local scale. Using GIS, collection sites will be categorized based on the ratio of impervious to pervious surfaces, a measure of urbanization. Species data from bees collected over two summers (2015-16) at 17 collection sites across Meadville, PA will be used to determine if species richness and abundance declines across the gradient and to assess species assemblages across the gradient of urbanization.

Developing an eDNA system to detect and monitor the spread of the invasive Round Goby *(Negobius melanostomus)* in the waterways of Northwestern Pennsylvania

Zachary Gribik* and Kristen Webb, Allegheny College, Biology Department

The round goby (*Neogobius melanostomus*), an invasive species of fish, has recently been spotted in French Creek, an ecologically important ecosystem in Northwest Pennsylvania. Invasive species pose threats to the native biodiversity, and tracking invasive species using traditional techniques, such as electrofishing, can be expensive, cumbersome, and inaccurate when species are present at low densities. An alternative approach for tracking invasive species uses environmental DNA (eDNA) obtained directly from the water. eDNA detection has yet to be applied to study the presence of round goby in French Creek. We are working to develop a system to track the round goby using eDNA in order to characterize the distribution of the population. The methods include identifying potential confounding variables and optimizing collection, filtration, DNA extraction, and target loci amplification procedures prior to implementing the system for tracking the round goby. For effective management of the invasive population, the distribution of the population must first be characterized. The present study will characterize the distribution of the round goby population in an efficient manner, allowing for proper allocation of resources in future management efforts, while simultaneously producing a procedure that can be mimicked in future studies involving environmental DNA surveillance.

Thursday, November 3, 2016

The fate of terrestrially derived dissolved organic carbon in one sub-tropical and three temperate lakes

Christopher Dempsey[1]*, Jennie Brentrup[2], Sarah Magyan[1], Lesley B. Knoll[3], and Craig E. Williamson[2]

[1]Gannon University, Biology Department, Erie, PA; [2]Miami University, Global Change Limnology Laboratory, Department of Biology, Oxford, OH; [3]University of Minnesota, Itasca Biological Station and Laboratories, Lake Itasca, MN

Freshwater aquatic ecosystems are well known to outgas a significant quantity of carbon dioxide (CO_2). In regards to the processing of dissolved organic carbon (DOC) this contribution has been shown to be related to a combination of biodegradation and photodegradation. Recent research in Arctic ecosystems (lakes and streams) suggests that the oxidation of terrestrially-derived DOC to CO_2 is largely the result of photodegradation in contrast to previous findings. We studied three temperate lakes ranging in trophic status and one sub-tropical lake during the summer of 2016 to assess whether biodegradation or photodegradation was the dominant process leading to the oxidation of DOC to CO_2. Additionally we assessed changes in dissolved inorganic carbon (DIC), dissolved oxygen (DO), and colored dissolved organic carbon over the course of our experiments. Data collected from our study sites indicates that sunlight is more important than microbial communities in degrading DOC in two of our four lakes. At two of our study lakes 40-50% of the DOC was photodegraded, which resulted in significant production of DIC (CO_2) and significant consumption of DO. Our results indicate that DOC photodegradation is more important than biodegradation and therefore this process should be further studied at other temperate and low-latitude lakes.

Development of a real-time PCR method for the early detection gof aquatic invasive species in Pennsylvania watersheds

Benoit Van Aken[1,*], Srishty Subramanian[1], Sasha Eisenman[2], Erik Silldorff[3]
[1] Civil & Environmental Engineering, Temple University;
[2] Landscape Architecture & Horticulture, Temple University;
[3] Delaware River Basin Commission

The widespread occurrence of aquatic invasive species is a worldwide issue impacting the environment and the intended use of water. Conventional methods for the identification of aquatic invasive species are laborious and time-consuming, preventing the timely application of eradication measures. On the contrary, molecular biology methods based on the detection of specific DNA sequences are fast and sensitive, and have raised increasing interest for monitoring invasive species. Aquatic organisms release in the water DNA, which constitutes species-specific signatures and can be detected with great sensitivity by PCR. The objective of the proposed research was to develop an innovative method based on real-time PCR for the early detection of three aquatic invasive plants, *Myriophyllum spicatum*, *Trapa natans*, and *Hydrilla verticillata*, and the invasive alga, *Didymosphenia geminata*. Using resources from genomic databases and sequence alignment tools, we designed real-time PCR assays which allowed the specific and selective detection of all four target species. Quality control of the assays was performed, showing linear standard curves, wide dynamic range of detection, and amplification efficiency within 95 – 110%. Field validation of the assays showed that specific DNA signatures of three target plant species, *T. natans*, *H. verticillata*, and *M. spicatum*, could be detected in water samples miles away from the contamination point. The specific DNA signature of the alga, *D. geminata*, was detected in water samples hundred yards downstream a location where the species was historically detected, although the alga was not visible at the time of sampling.

Genetic analysis of deer dispersal patterns through mitochondira DNA sequence analysis

Stephanie Judd*, Brendan McCreath, Caitlin Goncz, Kelly Cowher, Anna Conner, Fred. J. Brenner, Ph.D., Grove City College, Hopeman School of Science, Engineering, and Mathematics

The white-tailed deer (*Odocoileus virginianus*) is both an ecologically and socially important species in the Eastern United States. White-tailed deer affect the environment and crops and are an important game species. Understanding the dispersal patterns of this species is important for its management. Unmanaged deer populations can increase the spread of tick-borne illnesses in an area, cause increased property and crop damage, and cause an increase in the number of deer-related traffic accidents. This project seeks to understand the migration patterns and genetic diversity of the white-tailed deer within the rural and urban habitats of Ohio and Pennsylvania in order to improve the management of this species. Samples of liver and/or muscle were taken from deer from the Dayton Ohio Metro Parks (Germantown, Englewood, and Taylorsville), Mercer County Pennsylvania, and Presque Isle State Park in Erie, Pennsylvania. DNA was extracted from these samples and the mitochondrial displacement loop (D-loop) was examined to allow the maternal lineages and the nucleotide diversity of the herds to be calculated. We expect to find low migration between the deer in the Metro Parks and high migration between the deer in Mercer County.

Synergistic effects of Resveratrol and Quercetin on cancerous mouse cell line

Katie Baldwin*, Brooke Knisely, Haley Stephens, Fred J. Brenner, Ph.D., and Durwood Ray, Ph.D., Grove City College, Grove City, PA

The purpose of this study was to determine synergism between quercetin and resveratrol compounds in a cancerous cell line. The compounds tested were resveratrol (3, 4', 5-trihydroxy-trans-stilbene), a phenolic phytoalexin, and quercetin (2-(3, 4-dihydroxyphenyl)-3, 5, 7-trihydroxy-4H-chromen-4-one), a

flavonoid. The cell line used in these experiments was Grove City College's T2A mouse cancer cell line. (Ray et al. in Press). The T2A cells were plated 3 days prior to the start of the experiment so that the average confluency of the cells on day 1 was approximately 1-10%. Quercetin and resveratrol were dissolved in DMSO and then prepared in media such that all solutions had a final DMSO concentration of 0.1%. T2A cells were treated with either resveratrol or quercetin in a range of concentrations from 0-300μM. The concentration of quercetin was held constant at 12μM while the resveratrol was in range from 0-300μM. Photomicrographs were taken of six randomly preselected $2mm^2$ regions on days 1-4. Based on the LD50's established in prior research, the framework of initial concentrations was determined. For further study, the synergism between the compounds on the T2A cell line was compared to the results of the compounds on other cell lines (NIH Swiss, T1A immortal, T3HA hepatic, and T4PA pulmonary metastatic cancer cells) and the opposite study was performed switching the compound held constant and the compound in varied concentrations. Upon completion of the T2A cell line, the T3HA cell line will be further examined using the same methodology.

The role of SCAMP3 in amyloid precursor protein (APP) processing

Daniel Cooney, Gannon University

Alzheimer's disease is a neurodegenerative disease associated with loss of memory and cognitive function. The formation of extracellular plaques containing aggregated β-amyloid peptide is related to the proteolytic processing of the amyloid precursor protein (APP). APP is cleaved into two parts, one of which is amyloid beta protein which, in mutant forms, is associated with Alzheimer's pathology. APP can be ubiquitylated in a manner that promotes its targeting to ILV. This protein is normally sorted into multivesicular bodies and targeted for degradation in the lysosome. Current research indicates that the endosomal sorting complexes required for transport (ESCRTs) target APP to be degraded in lysosomes. Disruption of ESCRT function leads to accumulation of β-amyloid. Secretory carrier membrane protein 3 (SCAMP3) interacts with ESCRT proteins to transport and sorting of membrane proteins and are required for budding of ILV. Since APP is membrane protein, SCAMP3 may therefore regulate APP trafficking.

Completed development of online public tools and research goals

Michael Curtis* and Michael Naber, Penn State Behrend, Science

Lake Erie Arboretum at Frontier (LEAF) is a non-profit organization, partnered with Penn State Erie - The Behrend College, that strives to create educational opportunities and outdoor experiences for the local community. LEAF is supported through donations from the local patrons, however the staff had limited resources for handling and utilizing the information collected. The purpose of this project was to develop public search functionality of the GPS map embedded on the LEAF website, (http://www.leaferie.org/gps-locator/) in conjunction with a real time GPS marker for the users' position inside the park. The completion of this project resulted in an intuitive tool for navigating the arboretum. The staff and public can quickly locate, identify, and navigate to any tree, bench, or other landmark in the park. Ultimately, the accomplishment of the research objectives provided the staff and public intuitive means to track and locate all the landmarks and expand the communities' curiosity in biology, wildlife, technology, and GPS.

Water-based outdoor recreation users' attitudes towards potential offshore wind energy development in the Great Lakes

Michael D. Ferguson*, Ph.D., Andrew J. Mowen, Ph.D., and Alan R. Graefe, Ph.D.

As the demand for renewable energy production in the United States continues to increase, wind energy remains one of the most viable domestic options. While numerous land-based wind installations are

currently in operation, offshore wind installations have typically received stark opposition in the U.S. for various social, ecological, and political reasons. Due to recent capital investments, however, Lake Erie is now positioned to receive North America's first freshwater offshore wind energy project. Much of this proposed offshore wind energy infrastructure will either be within or adjacent to public lands, waters, and protected areas, raising concerns about the potential environmental and social impacts on recreation stakeholders in these areas. This case study examined water-based outdoor recreationists' (*n*=242) attitudes, impacts, coping responses, and support or opposition to potential offshore wind energy development within the Pennsylvania section of Lake Erie. Study findings and their implications for water-based natural resource management will be discussed.

Limnology and phytoplankton community structure of Bear Lake (Chautauqua County, NY)

Jennifer Wasielewski*, Courtney Wigdahl-Perry, Jeffrey Diers, State University of New York at Fredonia, Fredonia, NY

Bear Lake (Chautauqua County, New York) is a popular fishing destination in western New York. However, very little has been documented about lake chemistry, water quality, or plankton communities. In this research project, the basic limnology of Bear Lake was studied in order to establish a baseline for water quality and algae species present. Data were collected in June, July, and August at two different sites, including secchi depth and Hydrolab profiles (dissolved oxygen, pH, temperature, and conductivity). Water was collected from these sites for additional laboratory analyses for chlorophyll and algae community structure (three depths at one site and two depths at the second). Water clarity declined from June to August, with secchi depth changing from 3.35 meters to 1.1 meters. Dominant phytoplankton included chrysophytes (*Dinobryon)*, cyanobacteria (*Anabaena),* and diatoms (*Tabellaria)*. These data on lake water quality and biota will be used to develop a watershed management plan for this important environmental asset.

Determining the presence and possible effects of Round Gobies in the French Creek Watershed on native benthic fishes

Hannah Eisemann*, Allyson Wood*, Casey Brashaw-Wilson, Ph.D., Allegheny College, Environmental Science Department

Round gobies, an invasive fish from the Black and Caspian Seas in Eurasia were introduced to the United States in 1990 and have recently moved from the Lake Erie Watershed into the French Creek Watershed, specifically LeBoeuf Lake and creek. Literature has shown that round gobies disrupt local ecosystems, threatening native aquatic species, particularly small benthic fauna. The objectives for this project were to determine if round gobies have colonized the main channel of French Creek, to document the extent of their spread since discovery in the French Creek watershed in 2013 and to determine if they are displacing native fishes. Preliminary observations reveal that round gobies can tolerate a variety of habitat conditions, they have colonized the main stem of French Creek from the confluence of LeBoeuf Creek, and observations indicate darter diversity may have declined in the presence of gobies. Although a riffle at the invasion front may be temporarily retarding the spread of round gobies in French Creek, it is likely they will continue to expand their range downstream through larval drift. Round gobies continued unchecked presence will likely disrupt the lower levels of the trophic system by displacing and outcompeting small, benthic fish, and potentially mussels. The resulting trophic cascades may eventually harm the biotic integrity of the watershed.

The effects of plastic pollution on zooplanktons ability to feed and reproduce

Heather Barrett*, Courtney Wigdahl-Perry, and Sherri Mason, State University of New York at Fredonia

Concern over plastic pollution has been growing over the last ten years particularly in respect to microplastics. Although the presence of microplastics has been documented in various environments, little is known about the implications for aquatic ecosystem health, structure, and function as a result of these contaminants. Zooplankton, microscopic organisms that feed on algae, exist in nearly all water systems and are a major food source for fish. As filter feeders, they sift through the water column for algae cells where they could possibly be picking up micro-plastics tangled in their food. This presentation will outline the problems this specific type of pollution creates for zooplanktons' ability to feed and what inhibiting their feeding could entail on the entire aquatic community of the Great Lakes.

The behavior of bring shrimp *(Artemia salina)* in turbulence

Kato, D.K.*, Wolfe, T.P., Marys, K.A., and Anderson, E.J., Grove City College, Grove City, PA

Understanding the behavior of plankton—organisms critical to the health of the biosphere—is important to guide the proper management of aquatic resources. In this work, we examine the behavior of brine shrimp, *Artemia salina*, in a jet-stirred turbulence to compare their behavior to that of the planktonic oyster larvae, which were studied in the same tank in previous work. The use of jet-stirred turbulence tanks is new in the field of plankton behavior. Brine shrimp, which are both easy and inexpensive to culture, are ideal organisms to use for evaluating this new tool. We subjected brine shrimp to five levels of turbulence spanning a range that could be expected in nature and imaged them with a high speed, high resolution digital video camera. The brine shrimp and passive particles (egg cases) in the tank were tracked automatically to determine the true swimming speeds and directions of the brine shrimp in still water and turbulence. We found that in still water brine shrimp tend to swim downward, while at low turbulence levels they exhibit upward swimming. As turbulence increases, the brine shrimp continue to swim upwards, but at lower velocities. By contrast, oyster larvae tend to have an average vertical velocity near zero in still water, but like brine shrimp they tend to swim upward in low to medium turbulence. In the future, we plan to use the phototaxic responses of brine shrimp to "force" particular behaviors and determine if they are measureable in jet-stirred turbulence.

Comparison of tailbeat kinematics during swimming in striped bass *(Morone saxitalis)* of different lengths

Daningburg[1], K.M.*, Noll[1], A.R., and Anderson[1, 2], E.J.

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Previous research reveals evidence of resonance in swimming by striped bass based on highly resolved measurements of tailbeat frequency vs. swimming speed. The work suggests that at some speeds and body lengths, striped bass exhibit "sweet spots" and "sour spots" in swimming performance similar to resonant behavior observed in flapping plastic panels. In this study, we conducted similar experiments with two striped bass of shorter length (L = 32.9 and 33.6 cm) than previous experiments (L = 37.3 – 48.0 cm) as part of an ongoing developmental and comparative study. We tracked the trailing edge of the tail of the striped bass in real-time with a stereoscopic camera setup while the fish swam in a high-speed flume. The stereoscopic system resulted in more consistent tracking of the fish tail and thus more data. The fish were swum at approximately 240 different speeds, ranging from the slowest speeds that yielded a regular tailbeat to speeds at which the fish was no longer swimming aerobically. Swimming speeds ranged from 0.2 – 1.0 m/s (i.e., 0.6 – 3.0 body lengths/s). The tail position data from the stereoscopic setup was used to determine the 3D position of the tail, and the tailbeat frequency and amplitude. We compare these new results to those from previous years from larger striped bass, and results from other

species in the literature to investigate further the details of tail kinematics and the potential of resonance in swimming fish.

Investigation of boundary layer flow in swimming squid by flow visualization

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The drag on a swimming squid and the time varying behavior of the flow near the body of the squid--the "boundary layer"--has not been previously measured. This has limited our understanding of the hydrodynamic performance and energy budgets of swimming squid. In this work, we expand on our previous work to measure shear stress and local friction coefficients at various positions along the squid (mantle, orifice, head, arms) and throughout the jet and refill cycles. We used particle tracking velocimetry (PTV) to visualize the flow in the boundary layer around a squid swimming in a flume. Particle image velocimetry (PIV) and manual PTV were used to determine the flume speed and the motion of the squid in the camera field of view. This information was used to determine where our data fell in the locomotory cycle of the squid--during jetting or refilling. Preliminary results show that shear stresses on the squid are close to what would be expected for laminar flow over a flat plate, and our overall drag calculations are in good agreement with past theoretical studies. In addition, our results indicate the possibility of boundary layer suction at the refill orifice, a phenomenon that could reduce drag. The results of this work—the first direct measurement of drag on a swimming squid--will provide information significant not only to cephalopod biologists, but also to engineers looking to biology for inspiration for the design of marine vehicles and propulsion systems.

The forces on an undulating plastic panel determined by boundary layer flow visualization and transducer measurements

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A full force balance in undulatory propulsion, as in swimming fish, including pressure and friction drag, has not been previously measured. In this work, we measured the time varying behavior of the flow in the boundary layer over a flapping plastic panel in a flow tank. Particle tracking velocimetry (PTV) was used to visualize the flow. This information was used to calculate shear stress and local friction coefficients along the length of the flapping foil throughout the undulatory cycle. Boundary layer theory and linear regression of the tangential velocity gradient at the panel surface were used to determine shear stress. The time varying friction drag on the entire panel is then calculated from the shear distribution over the panel. The friction drag is compared with force transducer data taken during the experiments. Results from a stationary, non-undulating panel show excellent agreement between calculated friction drag and the transducer measurements. Therefore, a prediction of the net pressure forces on undulating panels is possible by subtracting the friction drag from the transducer forces. In the future, we plan to validate the pressure forces using recently developed tools. Our work furthers the understanding of the interaction of fluids with undulating propulsors, providing useful information to the fields of fish biology and marine vehicle design.

Aquatic species inventories of ten state parks in the Commonwealth of Pennsylvania

Joshua Wisor* and Kyle Clark, The Penn State University

This summer a team of Penn State researchers completed comprehensive surveys of the aquatic life in ten state parks throughout Pennsylvania. The state parks included in this effort were M.K. Goddard, Chapman, Cook Forest, Clear Creek, Bendigo, Laurel Hill, Pine Grove Furnace, Swatara, Nescopeck, and Promised Land. The goal of this project was to determine the fish, amphibians, turtles, and macroinvertebrates found within each park. In order to reach this goal all streams, rivers, lakes, and ponds were surveyed. This was accomplished by using backpack and boat electrofishing, SCUBA videography, area constrained streambank surveys, hoop-net turtle traps, and d-frame kick-netting. Some major findings of this project include the discovery of several wild Brook Trout populations as well as encountering rare species such as the Queen Snake and the Northern Red Salamander.

Comparison of macroinvertebrate fauna across three Pennsylvania drainages

Miranda Mussoline*, Sara Mueller, Jar R. Stauffer Jr., The Pennsylvania University

Macroinvertebrates are an important food source to many species of fish. In addition, macroinvertebrates help in the process of the nutrient cycling. Understanding these processes helps in maintaining better ecosystem function and health. The objective of this study is to compare macroinvertebrate fauna in three drainages of Pennsylvania: the Ohio, the Susquehanna and the Delaware. Kicknet samples were collected in five streams throughout three state parks: Pine Groove Furnace, Promised Land, and Laurel Hill. Entire samples were preserved in ethanol and taken back to the laboratory for processing. Each sample was sorted and identified to the family level. Brillion's Index was calculated for each sample and ordination based analysis was conducted to determine similarities and differences among parks.

Chironomid diversity of Elk Creek, Erie, PA

Daniel Vogel *, Sara Mueller, Jar R. Stauffer Jr., The Pennsylvania University

Non-biting midges (Chironomidae) can be used as a source of information about stream health and water quality in fresh water systems. Chironomidae are usually only identified to the family level due to the complex identification of the larval form. Identifying Chironomidae to the subfamily, tribe, or genus level can provide a better understanding of Chironomid diversity and increase the accuracy of diversity indices for steam ecosystem assessments. Samples for this study were collected from upstream and downstream sites on Elk Creek from 2011 to 2015. Previously, these samples had been sorted and persevered in 70% ethanol and Chironomids identified to the family level. Subsamples of the Chironomids at each site have been prepared with 10% potassium hydroxide (KOH) and slide mounted in glycerin. Slides have been identified to the lowest possible taxonomic unit using dichotomous keys. The new data has been combined with historic macroinvertebrate data to compare the Brillouin Index and ordination analysis for accuracy based on taxonomic resolution.

Separate vs. combined effects of snails, tadpoles, and caddisflies on detritus decomposition in montane kettle ponds

Liana Leja, Allegheny College

Species diversity affects ecosystem processes, which in turn determine the ecosystem services upon which people depend. Detritus processing plays a major role in nutrient cycling and energy flow in both terrestrial and aquatic ecosystems (Moore et al. 2004). Wetlands are home to a multitude of organisms that impact nutrient cycling—most notable detritivores. Caddisflies are the most commonly identified

detritivore in wetlands, and multiple studies have confirmed that they enhance detritus decomposition (Klemmer et al. 2012). Amphipods have also been shown to process detritus, but rarely studied in most wetlands. Moreover, recent studies found that snails and tadpoles (previously described as grazers) might contribute to detritus processing as well (Brady & Turner 2010, Stoler et al. 2016). Although wetland food webs are typically assumed to be energetically driven by the abundant vegetation that is often so conspicuous, the dynamics of detritus decomposition are poorly understood compared to the large body of research in streams (Batzer et al. 2015). The purpose of my study was to determine how these "cryptic detritivores" (snails, tadpoles, amphipods) interact with well-known detritivores (caddisflies), and specifically how they contribute to the detritus decomposition rates in wetlands. I compared the separate and combined effects of these taxa on detritus processing to determine if their effects are additive, more than additive (i.e., facilitative) or less that additive (interference). I hypothesized that because these different taxa used different feeding strategies, they will in combination have synergistic effects on pond ecosystem processes. Alternative hypotheses included 1) the combined effects of these species are less than predicted, which would suggest interference or some other type of competition, and 2) the effects are simply additive.

Use of DNA technologies in macroinvertebrate bioassessments

Sara Mueller[1] *, Aaron Aunins[2], Timothy King[2], Jay R. Stauffer Jr.[1]
[1]The Pennsylvania State University; [2]U.S. Geological Survey

Aquatic invertebrates have been used for over a century in biomonitoring. Biomonitoring is the use of biological measures to determine the state of or to evaluate changes in the environment. This surveillance method is commonly used as part of water quality monitoring. However, agencies vary in their approach in collecting, sorting, and identifying aquatic macroinvertebrate. The objective of this study is to compare entire collections collected by researchers in 2016 and historic sub-sampled National Park Service collections. Results show that there could be valuable information missing from traditionally collected macroinvertebrate samples. Therefore DNA based technologies may improve macroinvertebrate bioassessments. Additionally, this study begins to explore the use of 16S ribosomal DNA as marker for metabarcoding of aquatic eDNA samples.

Lake Malawi Cichlids

Danielle Pierone, Dr. Jay Stauffer, The Pennsylvania State University

Lake Malawi is known for being a site of explosive adaptive radiation amongst African cichlids. Because of evolutionary radiations in the lake, it is home to over 10,000 species of cichlids and counting. While many different species have been described and observed, total biodiversity has not been sufficiently assessed in distinct areas of the lake at differing depths. In this thesis, we have fifteen sites situated around Thumbi Island (within Lake Malawi) where cichlids have been filmed at four different depths (0-5m, 5-10m, 10-15m, and 15-20m) for 15 minutes each. From this collected GoPro video data and pictures taken every 5 seconds from the video, we are identifying and counting all the different species. With these species counts, we can create biodiversity analyses for each site and each depth. We expect to see more biodiversity at the shallowest depths and along the southern most sites situated around Thumbi Island, with diversity decreasing the further down into the water column.

Multiparametric analysis of *Escherichia coli* bacteria in sand on six Presque Isle State Park beaches, Erie, PA

Amber Stilwell*, Jeanette Schnars, Ph.D., Regional Science Consortium, Erie, PA

Sand has recently become a public health concern at many recreational beaches both nationally and internationally. When a swimming advisory is issued at a public swimming beach, it pertains to avoidance with the water. The sand, however, is still open to the public for recreation. Studies have shown that

beach sand can serve as a reservoir for bacteria including *Escherichia coli* and can possibly become a non-point source of *E.coli* in recreational beach waters (Whitman & Nevers, 2003; Feng *et al,* 2016). Sand samples from three locations on each beaches (low tide terrace, beach face, and berm) were collected weekly at six beaches on Presque Isle State Park and processed for levels of *E.coli*. These bacteria levels were compared to weather conditions such as air and water temperatures, precipitation, wind speed, wave height, and beach angle. The purpose of this study was to answer the following research questions: (1) Does the location of the sand sample on the beach impact the levels of *E.coli* contained within that sand? (2) Is the angle of the beach related to the levels of *E.coli* in the sand or water? And (3) Does sand grain size play a role in *E.coli* residence in sand? Results of this study will be presented at the 12th Annual Research Symposium held by the Regional Science Consortium at the Tom Ridge Environmental Center.

How does the use of Agion Silver Technology change the bacterial flora found on door handles?

Michelle Hornedo*, Kathryn Carl*, and Beth Potter, Penn State Behrend, Biology

In the face of antimicrobial resistance, scientists have been looking to silver technology to help decrease our exposure to potential pathogenic microorganisms. For several years we have been following the effectiveness of silver Agion technology on door handles across campus. This analysis has shown that bacteria can be maintained on both silver-coated and non-coated surfaces; thus we would like to determine if the bacterial populations are different. Individual bacteria have been isolated from swabs since the Spring 2014 semester and PCR techniques have been used to identify the bacteria. Overall, it is the anticipation that this study will provide a deeper insight into the broad-scale use of Agion silver technology for bacterial control.

Comparison of diatoms found in restored and unrestored sections of Dead Pond, Presque Isle, State Park, Erie, PA

Andrew Kubaney [1, 2] *, Jeanette Girosky[2, 3]
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This project provides an essential foundation for future algal studies of the interior ponds for restoration purposes. The objective of this study was to compare the diatom genera of the restored and unrestored parts of Dead Pond. A portion of Dead Pond has endured continued restoration efforts to remove invasive plant species. Dead Pond is located on the the northeast part of Presque Isle State Park in Erie, Pennsylvania. A study of the interior ponds of the park was necessary to better understand these ecosystems. Three types of samples were taken at both the restored and unrestored portions of the pond. Sampling methods consisted of scraping a hard-stemmed plant to collect periphytic diatoms, collecting a full water sample of the sediment and water, and collecting diatoms by allowing them to grow for nine days on microscope slides placed at both sites. This study is ongoing, and each sample will be examined for a relative abundance count of genera of diatoms and compared to the other samples. Thus far, the following families of diatoms were observed in the samples from the restored site: *Cymbellaceae, Eunotiaceae, Fragilariaceae, Gomphonemataceae, Naviculaceae,* and Rhopalodiaceae. The following families of diatoms were observed in the samples from the unrestored site: *Cymbellaceae, Eunotiaceae, Gomphonemataceae, Naviculaceae,* and *Pinnulariaceae*. Very few studies have been completed on the diatom genera of the interior ponds. This study will serve as a starting point for future studies of the algae of the interior ponds, and samples will be catalogued for addition to the Natural History Museum at the Tom Ridge Environmental Center in Erie, PA.

Aquatic ecosystem modeling to understand Harmful Algal Blooms in Presque Isle Bay, Erie, PA

Dr. Rick Diz, PE *, Gannon University; Department of Environmental Science and Engineering

The goal of this project is to understand the factors leading to blooms of so-called harmful algae in Presque Isle Bay. Harmful algae (cyanobacteria) are plankton. Some of them are capable of releasing toxins to the water, which have been shown to harm humans and other animals. It is not clear why profuse growth of the toxin-producing cyanobacteria occurs during some summers but not during other summers. It is known that they respond slightly differently to the availability of sunlight, temperature, and nutrients than do the true algae, which are not toxin producers. In order to accomplish the project goal, samples were collected every two weeks during the summer of 2016 to obtain a coordinated set of Bay water quality measurements along with a plankton analysis. In order to estimate the loadings of nutrients into the Bay from its watershed, water samples were collected by automated samplers during storm events, along with flow levels. Using this combination of data, mass loadings from the streams could then be calculated. By extrapolation, the total loadings from the watershed could be estimated. The data is then to be used in the EPA software AQUATOX to create a model of the Bay's aquatic ecosystem. If successful, the model can be used to evaluate many combinations of loadings, temperatures, and light levels to determine which factors are most likely to lead to a bloom of harmful cyanobacteria. The project continues through the summer of 2017. An update of the status of the project will be provided.

Interaction of light, phytoplankton, and zooplankton in Presque Isle Bay during development of a cyanobacterial bloom in summer 2016

J. Michael Campbell[1] *, Trevor Surgener[1], Angelea Belfiore[1], Rick Diz[2]

[1]Mercyhurst University, Biology Department; [2]Gannon University, Department of Environmental Science and Engineering

The plankton community of Lake Erie's Presque Isle Bay was sampled biweekly from late May through mid-September 2016, to obtain data necessary to refine an ecosystem model for predicting blooms of cyanobacteria. Net phytoplankton and zooplankton were assessed with triplicate vertical and horizontal tows of a 65-micron mesh Wisconsin-style plankton net. Nannoplankton was quantified with whole water samples preserved in Lugol's iodine and concentrated by sedimentation. Light penetration in the bay was measured using a LI-COR submersible photometer. The mean extinction coefficient for light in the bay ranged from 0.565/m on June 28 to 1.581/m at the peak of a cyanobacteria bloom on August 10. Changes in light penetration in the bay were attributable to changes in population densities of phytoplankton. Abundance of phytoplankton-feeding *Daphnia* species peaked in mid-June and then decreased when population densities of non-cyanobacterial nannoplankton declined. When a bloom of colonial cyanobacteria (including *Microcystis*, *Anabaena*, *Aphanizomenon* and *Lyngbya*) developed in late July and August, several species of rotifers and the littoral cladoceran *Chydorus* increased in abundance, while *Daphnia* remained scarce. Large colonial diatoms and cyanobacteria that dominate the net phytoplankton of Presque Isle Bay in summer are probably not directly utilized by feeding zooplankton but may benefit zooplankton by supporting smaller edible epiphytic flagellates and bacteria produced when blooms collapse and decompose.

ABSTRACTS

Regional Science Consortium
11th Annual Research Symposium
November 2—4, 2016
Tom Ridge Environmental Center
at Presque Isle State Park

POSTER PRESENTATIONS

1. Successional changes in summer net phytoplankton of Presque Isle Bay in relation to temperature and weather phenomena

Angelea Belfiore[1] *, J. Michael Campbell[1], Trevor Surgener[1], Rick Diz[2]
[1]Mercyhurst University, Biology Department; [2]Gannon University, Department of Environmental Science and Engineering

In Presque Isle Bay, the effects of increasing temperatures and weather events on the phytoplankton community was investigated on 8 dates from late May to mid-September 2016. We sampled at three locations on the Bay with triplicate 5-m long vertical and horizontal hauls using a 65-micron mesh Wisconsin-style plankton net. Samples were placed in a Sedgewick Rafter cell and enumerated using a compound microscope. Algal groups identified included large/colonial flagellates, green algae, diatoms, and cyanobacteria. The initial water temperature in the bay on May 25 was 17° C. We detected successional fluctuations of diatoms from late May to mid-June, beginning with *Fragilaria crotonesis*, followed by a bloom of *Asterionella formosa*. An unexpected bloom of the dinoflagellate *Certaium hirundinella* was observed in late June (at 24° C), following anomalous weather (storm event and several days of ENE winds) with likely incursion to the bay of water from Lake Erie. In early July there was a green algae bloom including *Gloeocystis*, *Oocystis*, *Eudorina*, and *Coelastrum*, accompanied by a diatom bloom of *Melosira* and *Fragilaria*. When bay temperatures increased to 26° C in late July, a cyanobacterium bloom developed, dominated by *Microcystis aeruginosa*, *Lyngbya*, *Anabaena spiroides*, *Anabaena wisconsinence*, and *Aphanizomenon*. High numbers of the filamentous diatom *Melosira* persisted in the bay throughout the cyanobacteria bloom, which decreased in late August and mid-September when water temperatures in the bay began to drop.

2. Successional changes in zooplankton of Presque Isle Bay in relation to a summer cyanobacterial bloom

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From late May to mid-September 2016, the zooplankton community of Presque Isle Bay was investigated as part of a larger project aimed at modeling biological and physico-chemical factors affecting cyanobacteria blooms. Zooplankton were sampled by both horizontal and vertical tows of a 65-micron mesh Wisconsin-style plankton net and preserved in 5% formalin. Subsamples were subsequently placed in a Sedgwick rafting chamber and enumerated using a compound microscope. Changes occurred over the summer in populations of the three major groups of zooplankton (copepods, cladocerans and rotifers) as temperature, weather events and surges of phytoplankton occurred. Densities of several rotifers including *Polyartha, Keratella earlinea,* and *Trichocera cylindrica* and the cladoceran *Chydorus* were highest during the peak of a bloom of colonial cyanobacteria that occurred in late July to mid-August. Large

predatory cladocerans (*Bythotrephes and Leptodora)* and a predatory rotifer (*Asplanchna priodonta*) detected in the bay on several summer sampling dates may have played a role in affecting fluctuating numbers of both rotifers and small cladocerans. Density variation over time observed for copepods (Calanoid, Cyclopoid and nauplii) appeared to be less variable than what was found for rotifers and cladocerans. Since none of the zooplankton taxa found in the bay feed directly on the large, colonial bloom-forming cyanobacteria, it is unlikely that the bay's zooplankton exert much direct influence on the development of the summer cyanobacteria blooms.

3. Water quality of Presque Isle Bay and nutrient loadings from its watershed: measurements in support of understanding Harmful Algal Blooms in Presque Isle Bay

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The goal of this project is to understand the factors leading to blooms of so-called harmful algae in Presque Isle Bay. For this purpose, water samples were collected during the summer of 2016. Harmful algae (cyanobacteria) are plankton. Some of them are capable of releasing toxins to the water, which have been documented to harm humans and other animals, including farm animals and potentially fish. It is not clear why profuse growth of the toxin-producing cyanobacteria occurs during some summers but not during other summers. It is known that they respond slightly differently to the availability of sunlight, temperature, and nutrients than do the true algae, which are not toxin producers. The goal of this phase of the project was to measure the water quality of the Bay simultaneously with the collection of plankton samples by others. In order to estimate the loadings of nutrients into the Bay from its watershed, water samples were collected by automated samplers during storm events, along with flow levels. Using this combination of data, mass loadings from the streams could then be calculated. By extrapolation, the total loadings from the watershed could be estimated. The results of the sample collection and analysis for the Bay and the watershed will be presented.

4. Assessing monthly changes and the degradation of terrestrially derived dissolved organic carbon in a temperate lake

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Aquatic ecosystems are known to release significant quantities of carbon dioxide (CO_2) to the atmosphere. In the past, it has been thought that heterotrophic microbial communities were responsible for processing dissolved organic carbon (DOC) into carbon dioxide through a process known as biodegradation. Recent research in Arctic ecosystems showed that sunlight is also capable of processing DOC to CO_2 through photo-degradation. This study focuses on how terrestrially sourced DOC from 3 temperate lakes was processed on a seasonal basis. Changes in DOC concentration were measured and absorbance scans were generated to assess qualitative changes to the DOC. Samples were collected for the months of June, July, and August from shallow groundwater lysimeters installed near the lakes. The goal of this project was to understand if the terrestrial DOC source changed seasonally and whether photo-degradation or biodegradation was more important to the processing of DOC. The amount of DOC in groundwater as it was obtained from lysimeters increased throughout the summer for two of the study lakes, and decreased for the lake with the highest DOC concentrations. Our data showed that the treatments that allowed both photo-degradation and biodegradation processed the largest concentration of DOC. This was followed by the photo-degradation only samples and then by the biodegradation samples. This trend was observed across all three lakes that were sampled during the summer of 2016.

5. Status and trends of atmospheric deposition in the Great Lakes Region of Pennsylvania

Elizabeth Boyer, Jeremy Harper*, Kevin Horner, Jeffrey Grimm, and Nathaniel Irwin

We characterize the contemporary status (2015) and trends (2000-present) of precipitation chemistry and atmospheric deposition in Erie, Pennsylvania. Airborne emissions can be transported from short to very long distances in the atmosphere before being deposited to the landscape in wet and dry atmospheric deposition. Our research group has been monitoring atmospheric deposition in Presque Isle State Park in Erie (site PA30), following protocols of the National Atmospheric Deposition Program (NADP). Our related research advances understanding of how acidic and mercuric compounds affect ecosystems; and how air pollution affects the Great Lakes region.

6. Monitoring long term tree disease, deer overgrazing, climate change forest plots, and establishing coarse woody debris protocols

Samantha Fleming*, Jonathan Titus, State University of New York at Fredonia, Biology Department, Fredonia, NY

Twenty-nine 900m^2 permanent plots have been established in 6 upland and wetland forests in Chautauqua County. In the plots all trees are tagged and DBH measured is annually along with snags and downed woody debris assessments. Each plot contains 3 16m^2 understory quadrats. This long-term study is driven by the dramatic forest change occurring across the region due to forest pests including emerald ash borer, hemlock woolly adelgid, beech bark disease, invasions by aggressive invasive plant species, intense deer grazing, and climate change.

Thus far, it has been found that the upland plots have the largest trees, fastest growth, and the highest productivity. Younger sites grew much more slowly. Trees at Elm Flats exhibited hump-shaped basal regions and had a high proportion of shade-tolerant trees. This suggests that Elm Flats may have some old growth characteristics. The other wetlands have characteristics similar of successional forests.

This is part of a long-term study to determine over and understory vegetation change. The data collected will be used to see which specific aspects of the natural areas have changed the most over the course of many years.

7. Inventory of the vascular flora of the bentonite clay site in Cassadaga, NY

Alex Lefever*, Sarah Kettles, Kurt Moeller, Amber Topor, Michelle Ferry, Nicholas Pomponio, Gabriel Puccio, Adrianna Stennett, Julia Torres.

Bentonite clay (also known as Dunkirk Shale) is a soil type known for its ability to absorb large amounts of moisture. It can therefore expand and contract quite substantially. This leads to geological features, such as crevasses, and events, such as landslides, due to the inherent instability of the clay heavy soil. This instability also affects the plants that can grow upon it. Trees and larger shrubs have difficulty in coping with such stresses to their roots, therefore the vegetation is dominated by herbaceous species. Thus far, 140 species of plants have been identified within 5 habitat types in a ~2 km^2 area along Route 60 near Cassadaga, NY. Sixty-four of those species were found to be non-native with 7 of those qualifying as invasive. The two most prevalent families found were Asteraceae with 22 species and Poaceae with 18 species. Both of which also contributed the largest number of non-native species as well. A few unusual or uncommon species such as *Juniperus communis* and *Pycnanthemum virginianum* have been found which originally hinted at the unusual soil type. The purpose of this inventory is to understand what native species are adapted to bentonite clay soils and what non-natives species can invade these sites.

8. Invasive plant removal at Wintergreen Gorge

Jacob Marfin*, Hanna Simon, Dr. Michael Naber, Mrs. Ann Quinn, Penn State Behrend, Environmental Science, Biology

The purpose of Weed Warriors is to preserve the natural habitats at Penn State Erie, the Behrend College and Wintergreen Gorge trail system by tagging and removing invasive plant species that are devastating the natural environment. This program is modeled after the Weed Warriors on Presque Isle as the areas covered have similar invasive species. Two Lead Stewards worked on this project to cover all of the ground work and create baseline data used for the future.

ARC GIS was used to create a map of invasive plant species with points and a color-coded system containing information about covered areas, inaccessible areas, and areas that contained no invasive species as well as which species were found in areas covered throughout the Behrend campus. Species tagged included Multiflora Rose, Privet, Japanese Honeysuckle, Garlic Mustard, and Wild Grapevine. Knowledge about what the invasive plant species look like, and when and where these plants grow is crucial so that they are properly tagged and recorded on the GPS. Any correlation and problem areas can be seen and taken care of as a priority by using this method. This procedure is innovative since Weed Warriors rely heavily on volunteers to aid in removal and pinpointing invasives on a map will make removal straightforward and successful.

The outcome from this program is to spread awareness about the importance of preserving the natural environment, why invasive species are so harmful, and how to prevent and eradicate the species that do not belong.

9. Techniques for controlling invasive *Phragmites australis*

Julia Torres*, Jonathan Titus, Ph.D., State University of New York at Fredonia, Environmental Science

Originating in Eurasia and Africa, Common Reed (*Phragmites australis*) is a non-native, perennial grass that can reach heights of 4.5 meters. *P. australis* grows in dense stands, which include both live stems and previous year's growth. Due to its aggressive nature, *Phragmites* can be found in many types of habitats including roadsides, lakeshores, river edges, brackish and freshwater marshes, and disturbed areas. From a subsurface perspective, *Phragmites* forms a compact network of rhizomes which can descend up to one meter in depth. *Phragmites* is an indicator of wetland disturbance due to the way in which this species propagates. Native species are outcompeted leaving a *Phragmites* monoculture. Herbicide treatment is currently the most effective means of controlling the species but some alternative options such as mowing and burning, have also been implemented.

The research was focused on cutting and eventually controlling a 0.4 hectare patch of *P. australis* at the College Lodge Nature Preserve in Chautauqua County and determining what native species are able to persist within the *Phragmites* patch. The patch was divided into two sections – the outer edge and the inner area in order to determine species survival within the patch as it ages. This knowledge is important for the native flora and fauna which inhabit the marsh habitat but are at risk from the spread of *Phragmites.*

10. Prevalence of Chytridiomycosis in amphibian populations on Presque Isle

Natalie Popielski*, Sara Turner, Ph.D., Mercyhurst University, Biology

Batrachochytridium dendrobatidis is a widespread fungal pathogen that causes the cutaneous infection chytridiomycosis in amphibian populations. Presque Isle is home to approximately 13 species of amphibians. This fungus has been documented in areas surrounding Erie, Pennsylvania and in close proximity to Presque Isle. The population decline and increased mortality of infected individuals could

endanger any or all of the populations on Presque Isle. The prevalence of the chytrid fungus on Presque is currently unknown. By using qPCR to test for the presence of chytrid zoospores on collected skin swabs, we propose to determine the presence and extent of chytridiomycosis on Presque Isle. This information can be used in future studies to determine methods to protect the amphibian population on the peninsula from future infection and possibly to devise methods to increase survival in infected populations on Presque Isle.

11. Chemical and microscopic biological predictors of larval growth in dumped tires

Amber R. Matha, Mercyhurst University

Introduction: Container-breeding mosquito species are important vectors for multiple arboviruses of public health importance including West Nile Virus. In Pennsylvania, illegally dumped and improperly stored tires, a favorable habitat for egg deposition, presents a preventable source of WNV vector growth. We sought to determine if the composition of the water in dumped tires predicted larval growth.
Methods: Known dumpsites in Erie County were surveyed to quantify the number of tires present, a subset of which were sampled to determine the proportion holding water and positive for growing larva. Water from tires positive and negative for mosquito growth were sampled by pipet and stored for chemical and biological analysis. A subset of tires was surveyed to determine the most commonly occurring mosquito species.
Results: A total of 10 dump sites contained one or more tires with an estimated total of over 500 tires. Preliminary results from tires negative for mosquito larvae show a large amount of cyanobacteria and microscopic protists which were not present or limited in quantity in tires positive for larvae. *Culex* mosquito larvae, the vector for WNV, were the predominant species of larvae in samples taken from tires positive for growth (99%). Results of chemical analysis are pending completion of surveys in October.
Conclusions: Based on counts during peak season, illegally dumped tires yielded over 10,000,000 mosquitoes in Erie County in 2016. This estimate does not include improperly stored or dumped tires on private land. WNV prevention should focus on tire removal in addition to existing chemical approaches.

12. Mating and courtship behavior in the Fungus Fly, *Sciara coprophila*

Nicolette Borella* and Michael S. Foulk, Mercyhurst University

The fungus fly, *Sciara coprophila,* exhibits numerous unique biological properties including, a unique sex-determination scheme, mono-polar spindles in male meiosis I, chromosomal imprinting followed by elimination and developmentally regulated gene amplification. A detailed understanding of the mating and courtship behavior in *Sciara* would allow researchers studying these aspects of *Sciara* biology to better maintain laboratory stocks. Here we report on our initial studies describing mating and courtship behavior in *Sciara coprophila*. We have observed over 85 individual matings and have generated a narrative description of the courtship and mating process. Similar to *Drosophila*, *Sciara* has a distinctive courtship ritual involving chasing and wing song behaviors. A unique aspect of courtship involves the male curling under his abdomen to grab the female with claspers on the posterior end of his abdomen. Initially, the male attaches to the side of the female, but if the female is receptive the male will attach to the posterior end of the female abdomen and reposition himself so that mating takes place with the flies facing away from each other. Additionally, we have collected quantitative data on the optimal age of both males and females resulting in mating success, time to interaction, time to mating and copulation duration. These data provide a baseline on which we plan to build by testing several different parameters of *Sciara* courtship and mating, including the effect of temperature on mating, light sensitivity and if *Sciara* produces a distinct pheromone.

13. Investigating the effect of floral composition on native bees in Meadville, PA

Paige Hickman*, Beth Choate, PhD, Allegheny College, Environmental Science Department

Loss of biodiversity can have vast negative impacts on ecosystems. Bee populations are declining due to factors such as climate change, habitat fragmentation, pesticide use, and disease. Aside from the non-native honey bee, the United States alone is home to over 4,000 species of native bees. All native bees play important roles in the environment, especially as pollinators. The extent of native bee declines is not well-known because populations are not consistently surveyed in many parts of the country. My study strives to provide a survey of native bee species present in northwestern PA and to investigate means by which we can promote native bee diversity. More specifically, my focus is the effect of floral composition on native bees. Using bee species data from the summers of 2015 and 2016, I am investigating diversity in relation to flowering angiosperms present at sites of bee sampling. Many native bees are oligolectic, meaning they are specialized to access and thereby more efficiently pollinate native angiosperms with which they co-evolved. My question is then as follows: how does floral composition dominated by naturally-occurring native angiosperms impact native bee diversity? Ultimately, I expect there to be a greater diversity of native bees at sites with a higher percentage of native flowering plant species. Through building an understanding of how the presence of certain flowers effects native bee diversity, we can ultimately learn how to manage landscapes in a way that preserves and promotes our native bees.

14. A preliminary pitfall trapping survey of beetles *(Coleoptera)* in Erie Bluffs State Park

Stephanie Snyder

A pitfall trapping survey of Coleoptera was conducted in Erie Buffs State Park, Erie County, Pennsylvania from mid-June to early September, 2016. Six total pitfall traps were installed on the park. One trap was set in the restored oak savannah dune to compare to the past surveys. Three traps were placed in different areas of forest and two were set in the recovering farm land of the park to see if different species were present. These locations were selected to assess biodiversity and differences in habitat use. The specimens will be pinned and identified to species to generate a species list that can be compared to previous surveys and add to knowledge of the park's biodiversity.

15. Determining the prevalence of *Borellia burgdorferi* in *Ixodes scapularis* in Presque Isle State Park

Robert Wood*, Sara Turner, Ph.D., Department of Biology, Mercyhurst University, Erie, PA

Tick samples collected from Presque Isle state park and the greater Erie region were collected and identified by species, life stage, and sex. Collected samples were then halved and subjected to digestion with Proteinase K, followed by DNA extraction and subsequent Polymerase Chain Reactions (PCR). The PCR was used to amplify and isolate a genetic sequence of the tick and spirochete bacterium *Borellia burgdorferi*, which is the causative agent of Lyme disease. PCR amplified samples were analyzed using gel electrophoresis to detect the presence of tick DNA and *B. burgdorferi* in its tick vector. Results to date have shown that 25 of the 83 ticks analyzed have tested positive for the presence of Lyme disease spirochete. This study can help to determine the prevalence of *B. burgdorferi* in Erie County and provide insight into the pattern of infection rate over multiple years in the local area.

16. Small mammal diversity in habitats dominated by invasive *Phragmites australis* compared to habitats dominated by native plants

Zarah Pratz*, Samantha Horodyski, and Sarah Bennett, Mercyhurst University

A rigorous program aimed at restoring wetland habitats at Presque Isle State Park by destroying the invasive common reed, *Phragmites australis*, has been underway for the past several years. Interestingly, a study conducted at the park in 2005, prior to these efforts, found that small mammal diversity was highest in locations dominated by *Phragmites australis*.[1] The purpose of the current study was to compare

small mammal diversity in habitats dominated by *Phragmites* to diversity in field habitats dominated by native species.

Two different locations at the park were trapped. The un-mowed field adjacent to the playfield at the park was trapped for 74 trap nights and 5 *M. pennsylvanicus* were caught. Additionally, a wetland habitat along Graveyard Pond Trail was trapped for 54 trap nights and no specimens were captured. No *Phragmites*-dominated habitats suitable for trapping were found at the park in 2015 due to high water levels or in 2016 due to the destruction of *Phragmites* by spraying. A *Phragmites*-dominated site at the James Preserve at Asbury Woods was trapped in August 2015 as an off-park comparison. In 46 trap nights, 11 specimens belonging to three different taxa were captured, including 8 *Peromyscus leucopus*, 2 *Blarina brevicauda*, and 1 *Microtus pennsylvanicus*. While the sample size is too low to provide strong evidence, these preliminary results may support the initial hypothesis that *Phragmites* can promote high diversity of small mammal taxa.

17. Active surveillance of human pathogen carrying ticks from Presque Isle State Park (Erie, PA)

Corbyn Minich*, Nancy Carty, Ph.D., Christopher C. Keller, Ph.D., FNAOME, Lake Erie College of Osteopathic Medicine, Laboratory of Human Pathogens, Erie, PA

Objectives: Black-legged ticks (*Ixodes scapularis*) and dog ticks (*Dermacentor variabilis*) transmit pathogens to humans, including *Borrelia burgdorferi, Babesia microti,* and *Rickettsia rickettsii*. Our previous studies have shown both tick species are present throughout Erie County with the highest prevalence on Presque Isle State Park (PISP). This is an area of interest due to its public access and increased attention as a tourist attraction, particularly during the summer. Therefore, this study was designed to examine the distribution of the tick population on PISP in order to identify areas with a high tick load and factors affecting their presence.
Methods: Questing adult and nymph *I. scapularis* and *D. variabilis* ticks were collected from PISP during June 2016 via flagging. Parameters such as time of day, temperature, humidity, overall weather conditions and trail area were recorded during the collection process. The data was pooled and examined for various factors affecting tick collection.
Results: Ticks (n=335) were found through active surveillance within the trail areas of PISP. Sidewalk Trail, Pine Tree Trail and Dead Pond Trail were the areas with the highest tick load in decreasing order. Nymphs (n=244) were the most predominate life cycle stage that was collected in June. Additionally, the evening hours seemed to yield the highest number of ticks, with the highest tick load collected between 8-10 pm.
Conclusions: Ticks are present in high numbers on the trails of PISP in June, with nymph ticks being predominate and tick load highest during evening hours.

18. A small mammal population census of the habitat islands at the Tom Ridge Environmental Center at Presque Isle State Park, Erie Pennsylvania

Yasmin Mamani*, Lauren Reilly*, and Steve Ropski, Ph.D., Gannon University, Biology Department, Erie, Pa

The principal objective of this research was to obtain a diverse sample of the mammal population using the habitats created in the parking lot of the Tom Ridge Environmental Center. There are ten islands throughout the parking lot containing native plant species. Sixty-five small and large Sherman box traps were evenly distributed throughout the ten islands and baited using peanut butter and oatmeal. The traps were checked and re-baited every morning. Animals were marked using non-toxic paint and then released. This process spanned the time period of 22 August 2014 to 5 November 2016. The majority of animals found were mostly male Peromyscus leucopus (white footed mice). This research will provide valuable information regarding whether these habitat islands can successfully be used as natural mammal habitats.

19. Blacklegged tick infestation of small mammals at Presque Isle State Park

Samantha Horodyski*, Zarah Pratz, and Sarah Bennett, Mercyhurst University

Pennsylvania consistently has one of the highest incidences of Lyme disease in the United States[1]. Additionally, a recent survey by the Department of Environmental Protection found that blacklegged ticks (*Ixodes scapularis*) infested with *Borrelia burgdorferi* are now found in all 67 counties in Pennsylvania[2]. The purpose of this study was to determine tick loads on small mammals at Presque Isle State Park. In 519 trap nights, 37 *Peromyscus leucopus* and 1 *Microtus pennsylvanicus* were captured. One *P. leucopus* was found to have a single *I. scapularis* nymph in its ear, but no other ticks have been observed on the ears, faces, or ventral aspects of any other specimens. We do not believe that these results are representative of tick loads on small mammals at the park. It may be that ticks will be found in locations that we have not been able to see given our handling procedures. It is also possible that tick loads will be higher in the early spring when tick nymphs are most active. Future efforts will include trapping beginning in March of 2017 and exploring additional handling methods to better assess tick loads.

20. Assessing red fox (*Vulpes vulpes)* and coyote (*Canis latrans*) populations on Presque Isle State Park using remote cameras: year two

Tyler Chrispen*, Mark Mullinger*, Amy Burniston

Concurrent with the surrounding Northwestern region, Erie County is seeing an increase in ticks and Lyme disease. Lyme disease results from infection with *Borrelia burgdorferi,* a spirochete that is carried by the black-legged tick, *Ixodes scapularis,* and transmitted to humans by bite. The bacterium is transmitted to the tick through a small mammal reservoir such as the white-footed mouse (*Peromyscus leucopus*). Studies have suggested that when small mammal predators, such as the red fox (*Vulpes vuples*) actively prey upon the reservoir species the tick population remains low. However, across the northeast United States, the expansion of the coyote (*Canis latrans*) has led to the displacement of red fox populations; potentially leading to an increase in bacteria-harboring tick populations due to magnitude of predator populations and differences in eating habits. Thus, the purpose of this study was to gather baseline data on the red fox and coyote populations on Presque Isle State Park through the use of remote cameras. Currently in year two, a total of 10 remote cameras were displaced throughout the park at approximate 1km intervals and ran continuously for a total of 186 days. This resulted in 10 camera captures of red foxes and 84 camera-captures of coyotes, with a total of 4 unique adult coyotes identified. Additional animals caught on camera included deer, turkey, raccoons, and opossum. Camera captures of coyote were highest around high human activity and during the winter and spring seasons. This project will continue for the next three years to assess annual and seasonal changes in the populations. Future projects include trapping and radio collaring red fox and coyotes, DNA analysis of coyotes in our area to look for hybridization with the Eastern wolf, as well as collaboration with other researchers currently exploring different aspects of the black-legged tick life cycle.

21. Nematode infections of Ruffed Grouse (*Bonasa umbellus*) in Pennsylvania.

Erin Debelak[1]*, Hannah Widlicka[1]*, Edward Phillips[1], Justin Brown[2]

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Ruffed grouse (*Bonasa umbellus*) were collected from 14 counties in Pennsylvania. Necropsies were performed on the intestines and ceca of the grouse to remove parasitic nematodes. Two species of nematodes were collected, *Ascarida bonasae* from the intestines and *Heterakis* sp. from the cecum. The prevalence (% of birds infected) and intensity (mean infection per infected bird) of both species of nematode were analyzed in all birds combined, by county of harvest, and by sex and age of the bird. Grouse from 8 of 14 counties were infected with *A. bonasae,* and birds from 12 of 14 counties were

infected with *Heterakis* sp. Overall infection rates showed that 53.7% of grouse were infected by an average of *4.5 Ascarida bonasae*, with 21 worms being the heaviest infection of a single bird. The overall infection rate of *Heterakis* sp. was 82.9%, with a mean infection of 50.9, and the most heavily infected bird had 291 *Heterakis* sp. Analysis using t-tests showed no significant difference in prevalence or intensity of infection based on sex or age of birds.

22. The effect of essential plant oil combinations on growth inhibition of *Pseudomonas aeruginosa*

Robert Waters*, Nancy Carty, Ph.D., Christopher C. Keller, Ph.D., Lake Erie College of Osteopathic Medicine, Laboratory of Human Pathogens, Erie, PA

Introduction: *Pseudomonas aeruginosa* is a Gram negative opportunistic pathogen that causes infections in immunocompromised patients and is resistant to many antibiotics. The goal of this study was to determine the effects of individual essential oils and combinations of essential oils on inhibiting *P. aeruginosa* growth compared to the oils individually.
Methods: The zone of inhibition (ZOI) of individual essential oils and combination of essential oils was determined for *P. aeruginosa* using disk diffusion assay. The ZOI of the essential oil combinations was compared to the ZOI of the individual essential oils to determine if the combination was synergistic.
Results: The maximum cinnamon cassia oil had a ZOI significantly larger than all the combinations. The combination of cinnamon cassia oil with tea tree oil significantly inhibited *P. aeruginosa* growth compared to 5 uL of each oil. The combinations of ginger oil with either cinnamon cassia oil or tea tree oil did not display a significant difference from the oils individually at 5 uL.
Conclusion: Cinnamon cassia oil and tea tree oil had an additive effect on inhibiting *P. aeruginosa* growth. However, Cinnamon cassia oil alone had the greatest effect on *P. aeruginosa* growth. Future studies should be done to determine if the same results are seen in additional strains of *P. aeruginosa*.

23. PPCPs in raw and treated drinking water from Lake Erie

Michelle Homan, Ph.D.* and Hwidong Kim, Ph.D.*, Gannon University, Department of Environmental Science and Engineering

The goal of this study is to evaluate exposure and risk assessment methods for pharmaceuticals and personal care products (PPCPs) in drinking water derived from Lake Erie. Grab and long-term integrated water samples will be collected at various collection points at the Erie Water Works Wasielewski Treatment Plant. The specific objectives of this study include:

1.) determine the concentration of 9 target PPCPs (acetaminophen, mapicillin, caffeine, metformin, naproxen, ofloxacin, sulfamethoxazole, triclosan, and trimethoprim) in raw and treated drinking water originating from Lake Erie;
2.) compare the rapid low-cost ELISA test to validated laboratory analytical methods (i.e., LC-MS-MS) for at least two of the nine target PPCPs; and
3.) develop a model for estimating the human health risks from low-dose exposure to multiple PPCPs.

Samples will be analyzed to determine the concentration of nine target PPCPs. Compounds found at detectable levels will be included in an assessment to estimate the human health risks. A nested study within this project will include a method evaluation comparing the results of the enzyme-linked immunosorbent assay (ELISA) test with that of traditional laboratory analytical techniques for a subset of the nine target PPCPs. The data and results generated from this project will be shared with the general public, interested governmental agencies and the scientific community. The project is currently in the data-gathering stage and will be completed by December of 2017.

24. Presence of Glyphosate in urine samples

Joshuva John* and He Liu
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Glyphosate is a systemic herbicide containing the organophosphorus compound phosphonate that is used to kill weeds. Specifically glyphosate is used to kill annual broadleaf weeds and grasses that often compete with crops. As a result glyphosate is found in commonly consumed foods in the Western diet such as genetically modified (GM) sugar, corn, soy, and wheat. In recent years the impact of glyphosate on the human body has been studied. Glyphosate has been seen to cause extreme disruption of the microbe's function and lifecycle. Specifically in bacteria, glyphosate allows pathogens to overgrow and take over by inhibiting the function of beneficial bacteria. Glyphosate has only recently come into the scope of research as a danger to human health and as a result the FDA does not apply a maximum contaminant level. In this study, urine samples were gathered from students at Gannon University and tested for glyphosate levels. Our results show that glyphosate is present in most of the samples. Correlation between glyphosate levels and other factors such as gender, age, and dietary preferences is currently investigated.

25. Measurement of Atrazine in local water and common foods and urine

Anthony Concilla* and He Liu
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Atrazine is one of the most commonly used agricultural herbicides in the United States to eliminate weeds and grass. Ever since the U.S. approved its use in 1959, about 64 to 80 million pounds of atrazine are used in the United States each year. The Maximum Contaminant Level (MCL) for atrazine in drinking water is 3 ppb. The effect of atrazine on wildlife and humans is currently under EPA review. Multiple studies have shown detrimental effects of atrazine on reproductive function, metabolism, immune function, and cell division. In this study, ELISA method was used to measure concentrations of atrazine in local water and common foods, as well as urine samples collected from undergraduate students at Gannon University. Our results showed the presence of atrazine in various samples. The participants were asked to fill out a survey that included their age, gender, and dietary intake within in the past twenty four hours so the correlation between those factors and atrazine concentration could be investigated.

26. Dysmorphology in the human medial superior olive after environmental exposure to pollution

Kaitlyn Blackburn*, Dr. Randy Kulesza, Lake Erie College of Osteopathic Medicine

Air pollution has long been associated with various health conditions and exposure has been a major concern for many people residing in high pollution areas. The central nervous system in children has recently been studied to determine the effects of pollution on the developing brainstem. Previous research has demonstrated significant structural and functional changes in auditory brainstem neurons after long-term exposure to air pollution. Air quality in Mexico City is consistently poor and is among the worst in the entire world. Indeed, we have identified both functional deficits and structural abnormalities in a small cohort of subjects exposed to air-pollution in Mexico City. Specifically, we have identified significantly delayed brainstem auditory evoked potentials and elevated inflammatory markers in children exposed to pollution. Additionally, children exposed to pollution in Mexico City have accumulated α synuclein and β amyloid in brainstem neurons, further implicating neurodegenerative effects of air-pollution. Finally, we have found severe neuronal dysmorphology of auditory brainstem neurons in these subjects. Herein, we have investigated a larger cohort of subjects exposed to air-pollution and a group of three subjects from northwestern Pennsylvania. In subjects exposed to air-pollution, we have identified a marked reduction in the number of neurons while remaining neurons were significantly smaller and exhibited dysmorphology. These changes suggest that exposure to air-pollution has a significant impact on structure and function of

auditory brainstem neurons. We propose that non-invasive auditory tests could be used to screen for detrimental effects of pollution in children and that such deficits may be permanent as long as subjects continue to be exposed to air-pollution. The long term effects of such damage should be addressed in order to protect children from future exposures and to identify potential hazardous toxins.

27. The role of Ent3 in Put4 trafficking from the *trans*-Golgi network to the plasma membrane

Gabbrielle Acosta*, Robert Ramirez, Quyen Aoh, Ph.D., Gannon University, Department of Biology, Erie, PA

In cells, nitrogen is necessary for the production of many essential cellular products, such as proteins and nucleic acids. Often, nitrogen sources such as amino acids are imported from the extracellular media through transporters. For the brewer's yeast, *Saccharomyces cerevisiae*, a major source of nitrogen is the amino acid proline. Several studies suggest that the expression and transport of Put4 to the cell surface is regulated, much like the general amino acid permease Gap1. Our preliminary data shows that the deletion of the clathrin adaptor *ENT3* reduces the growth rate of yeast grown in proline, suggesting that it regulates Put4 trafficking. In this study, we will tag Put4 with Green Fluorescent Protein (GFP) and determine if Ent3 is required for its trafficking to the cell surface.

28. Contributions to the Fermilab Test Beam Facility

Kevin Shuman[1] *, Many Rominsky[2]
[1]Edinboro University, [2]Test Beam Facility, manager

This poster presentation and research by Kevin Shuman of Edinboro university of Pennsylvania elaborates on three contributions he made to the Fermilab Test Beam Facility (FTBF) over the 2016 summer. The first is the integration of Maximum Integrated Data Acquisition System (MIDAS), which is a data acquisition software developed by TRIUMF, to the FTBF DAQ. MIDAS uses modular networking and a central database to analyze and store data, respectively, from the detectors that characterize the test beam. The second contribution is the development of a time of flight system (TOF), which is a detector that identifies particles by determining the mass of a particle from measuring the time difference between a particle with a known momentum interacting with two detectors separated by a known distance. The last contribution was calibrating a lead glass calorimeter, a device used to measure the energy deposited by a charged particle passing through it.

29. Green roof design for Gannon University's Nash Library

Diana Munoz* and Amanda Hennessy*, Gannon University, Department of Environmental Science and Engineering

This project focuses on the design of a green roof for Gannon University's Nash Library, it's cost, and the ecological and storm water benefits that come with it. The roof of the Nash Library was selected for a green roof because it is currently undergoing a comprehensive renovation. Located on the corner of Sixth and Sassafras Street in Erie, Pennsylvania, it provides a good location for a green roof because of its large flat surface area, with a significant amount of sunlit surface area. Gannon University is located in the heart of downtown Erie. As an urban campus, there is limited space for traditional garden areas; so it is a perfect location to obtain the benefits that come with a green roof, such as stormwater flow reduction, air quality improvements, and the mitigation of urban heat island effects. Many green roofs are constructed in warm climates, but this project will explore the challenges of designing a green roof for the demanding Erie, PA, climate with heavy snows and a long winter. Important factors to be studied include selection of plant species, density of plantings, and soil/subsurface profile. Plants attractive to pollinizers will be favored when possible. To evaluate alternatives, test plots will be constructed and deployed both outdoors and indoors (under artificial lights). Runoff flow and quality will be measured. If a suitable

design is developed with documented benefits, campus officials may decide to add green roofs/gardens at additional sites around the Gannon campus.

30. Aquaponics for food production on an urban college campus

Max Onyenwe*, Jake Norton*, Drew Grabigel*, Jeff Miller*, Gannon University, Department of Environmental Science and Engineering

This project will develop a conceptual plan for a large scale aquaponics system capable of providing food to the Erie homeless community, and to create a pilot-scale version for demonstration purposes. Aquaponics is the merging of aquaculture and hydroponics to create an alternative to traditional land farming. The system operates on the concept that the nitrogenous waste produced from fish can be used as fertilizer for plants grown hydroponically. The plants then purify the water for the fish, providing a self-sustaining relationship. Aquaponics systems are especially useful in areas where the soil may not be suitable for traditional farming. For example, the City of Erie is established on mostly clay-like soil which makes it very difficult for vegetation to uproot. An urban aquaponics system would benefit the community in many aspects: it would provide a source of food production to help combat the pressing issue of "food deserts"; it will provide a chemical and pesticide-free alternative to traditional farming; an indoor system would provide year-round a food yield which would be beneficial during harsh seasons; and it would provide job opportunities in areas struggling with high un-employment rates. To complete this project we will analyze waste production, growth and reproduction rate, and the commercial and nutritional value for a variety of fish. We will also evaluate the level of maintenance, growth, and nutritional value for a variety of vegetables. We will then research and modify tank designs to provide the most efficient and effective model for our system.

31. Heating and pollution potential of three types of biomass fuels

David Bovkun* and Matt Loughner*, Gannon University, Department of Environmental Science and Engineering

The use of split logs and wood fuel pellets for heating homes and businesses has increased in recent years due to the rising cost of petroleum-based fuels. Often, homeowners in rural areas have little or no guidance in the selection of the best woody fuels. The burning of woody fuels in in-home or outdoor furnaces in rural areas often results in widespread air pollution and persons residing in such areas may experience burning eyes and difficulty breathing. Recently, the Pennsylvania Department of Environmental Protection has decided to regulate outdoor wood furnaces as an important source of air pollution. This project will investigate which type of biomass fuel yields the most energy output while emitting the least amount of pollution to the environment. The materials to be evaluated are wood pellets, purpose-grown switchgrass pellets, dried hardwood logs, and hard-shelled corn. Laboratory apparatus to be used in this project include a calorimeter for energy content analysis, a custom-built furnace based on a 'kettle smoker-cooker', and gas chromatography for exhaust gas analysis. Factors to be investigate include burn time and combustion temperature, energy output, and the concentration of pollutants emitted during the combustion process. The effect of initial moisture content on heating value and pollution production potential will also be investigated.

32. Design of portable water filtration device for arsenic removal in developing countries

Anna Barr*, Sidney Smith*, Gannon University, Department of Environmental Science and Engineering

The goal of this project is to design a low-tech portable filter to reduce the arsenic concentration in potable water. Arsenic is a naturally occurring heavy metal known to cause adverse health effects with prolonged exposure. In some areas of the world, surface water is unsafe to drink, and so the population must use groundwater as their primary source of water for drinking, cooking, and bathing. There are

areas around the world, especially in southern Asia, where the concentration of arsenic in groundwater exceeds the US EPA's maximum contaminant level (MCL) of 0.010 mg/L. The MCL represents a safe concentration of chronic exposure to a specific chemical over an average lifetime. The performance goal of the filter would be to lower the concentration of arsenic to the MCL. Our design requirements recognize that a treatment device must be inexpensive, not require the use of electricity, be effective over an acceptable period of time, and not require high technology support or parts, while reducing the arsenic concentration in the water to the MCL. Most likely, the preferred arsenic removal technology will be adsorption and/or precipitation. We will test various filter media and implement the selected filter media into a convenient filter apparatus. The poster will discuss the water chemistry of arsenic, the properties of various filter media, the possible methods of arsenic removal, and the alternative designs for the portable filter. Future work will experimentally compare the best alternatives and arrive at a final design.

33. Seismic investigation of the Lake Erie Bluffs

Francis DeRose*, Nicholas Russo, Brian Miller, Ph.D, Slippery Rock, Department of Geography, Geology, and the Environment

Bluff erosion along the coastline of Lake Erie is a topic of concern. Properties in this area may be susceptible to structural damage as a result of bluff retreat which could be problematic for residents. The geology of the bluffs is primarily glacial and lacustrine deposits. When water travels through the subsurface it may erode the sediment, which may lead to bluff erosion along the shoreline. Using non-invasive geophysical techniques we can image the subsurface to help gain an understanding of the geologic factors that may contribute to bluff erosion. Multichannel Analysis of Surface Waves (MASW) allows us to generate and record seismic waves as they travel through the subsurface. Using this method we can create a 2-D shear-wave velocity profile and correlate the shear-wave velocities with subsurface material properties. Two locations were surveyed: Erie Bluffs State Park and Erie Bluffs Frontier Park. Analysis of the data obtained from these surveys reveals that the geology of the bluffs includes water saturated sand. The water penetrating this layer could be a contributing factor to the higher erosional rates of the bluffs.

34. Knowledge flows downstream: Pennsylvania Sea Grant and Penn State Behrend College build watershed awareness in primary students

Julia Guerrein[1] *, Marti Martz[2], Ann Quinn[3]

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A collaboration between Pennsylvania Sea Grant and Penn State Behrend provided undergraduate students with science-based information about watershed health, water quality and the impacts of excess stormwater. It funded 'meaningful watershed education experiences' for students which fostered their understanding of these issues. This knowledge led students to engage their peers, along with local elementary and middle school students, in identifying and developing methods of water pollution and storm water impact reduction.

This case study describes methods and resources utilized by project staff and students. It highlights PSU Cooperative Extension's "Rain to Drain -- Slow the Flow" curriculum, and details the creation of a hands-on, portable, reproducible water filter which can be used to demonstrate point/non-point water pollution in many educational settings at a nominal cost, allowing students of all ages to become watershed stewards.

As a result of this collaboration, Behrend undergraduate students Using science-based information and educational experiences become agents of change as they work with elementary students and their campus community to build water quality literacy. The resources developed and compiled enable undergraduate students to engage their peers and younger students as stewards of water quality and watershed health.