

# Science Atlantic

Environment Conference

Environmental Remediation and Mitigation:  
Our Responsibility

**2019 ABSTRACT GUIDE**



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## ORAL PRESENTATIONS

### WINTER DISTRIBUTION OF THE BLACK GUILLEMOT (CEPPHUS GRYLLE) IN ATLANTIC CANADA

PRESENTER: JULIA BAAK

Supervisor: Marty Leonard, Robert Ronconi

The understanding of animal movements contributes important knowledge on spatial and temporal distribution. In particular, research on the movements of seabirds, which are important ecological indicators, can provide new insights and understanding of the physical and biological aspects of the marine environment. Information on distribution can also be used to delineate marine protected areas and oil spill response planning. Black Guillemots (*Cepphus grylle*), are a passive-drifting seabird in the family Alcidae that are particularly susceptible to oil spills. As oil exploration moves further offshore, the effects on Black Guillemots may go unobserved and it is therefore essential to understand their movement and overwintering locations in order to respond to oil spill effects. Little is known about Black Guillemot distribution in Atlantic Canada, particularly in the winter (nonbreeding) season. To examine the winter distribution of non-breeding Black Guillemots, 7 Global Location Sensing (GLS) tags were deployed and recovered on Black Guillemot individuals at two breeding colonies in Nova Scotia, Canada, and New Brunswick, Canada, during 2017-2018. Mean and maximum distance from colony, distance from shore and depth were described and core overwintering areas were identified for both colonies. The application of GLS tagging methods on Black Guillemots enhances our ability to examine seabird distribution and to use seabirds as ecological indicators.

### EVALUATING THE ASSOCIATION BETWEEN CANCER AND ARSENIC EXPOSURE USING TOENAIL SPECIATION BIOMARKERS IN THE ATLANTIC PATH COHORT STUDY: TOWARDS AN EVIDENCE-BASED CANCER PREVENTION AND CONTROL STRATEGY

PRESENTER: KALLI HOOD

Supervisor: Kim, Jong Sung



**Introduction:** Chronic exposure to environmental arsenic has been associated with many diseases, including cancer. Studies have shown that arsenic speciation is a biomarker for cancer; yet to date, few studies have used long-term indicators. Moreover, profiles between disease groups have not been compared using arsenic speciation and long-term indicators. **Primary objective:** Use toenails as an indicator of chronic arsenic exposure to investigate the association between arsenic speciation and the outcome of skin, lung, bladder, kidney, prostate, breast, and cervical cancers. **Methods:** This cross-sectional study will use toenail samples and questionnaire data from the Atlantic PATH cohort study. Samples from healthy participants, and participants with a history of cancer will be analyzed. Speciation profiles will be determined using high performance liquid chromatography paired with inductively coupled plasma mass spectrometry. **Statistical analysis:** A one-way analysis of variance of the proportion of monomethylated arsenic of cancer subgroups and healthy participants; multiple logistic regression to determine if arsenic speciation is associated with increased odds of cancer; and multiple regression to identify factors associated with heterogeneity in speciation. **Anticipated Results:** This study will use novel techniques to measure arsenic species and other metals in toenails. This research will directly contribute to the understanding of the association between arsenic species and cancer, and provide evidence of toenails as a long-term biomarker. **Significance:** This research can improve our ability to identify high-risk populations, and provide a foundation to develop targeted intervention strategies to mitigate adverse health effects of chronic environmental arsenic exposure.

## ANTIFOULING PERFORMANCE OF SILOXANES AND NETMINDER

PRESENTER: EMMERSON WILSON

Supervisor: Russel Wyeth

*Other authors: Michelle Hodgson, Katerina Basque, Amelia MacKenzie, Russel Wyeth*

An environmentally friendly strategy for preventing biofouling is needed in the aquaculture industry, as more toxic methods are abandoned or prohibited. This study field tested two environmentally-friendly antifouling strategies against uncoated control materials. First, we tested silicone-based fouling-release surfaces enhanced with biodegradable surfactants (i.e. soap) or silicone oil. This class of coatings reduces attachment strengths, and we sought to introduce surfactants as biocides that would not accumulate in the environment and silicone oil to further decrease attachment strengths. Antifouling performance was assessed by comparing percent cover by mussels at approximate weekly intervals. Silicone oil treatments caused the greatest delay in fouling (14 days), while treatments with surfactants caused a moderate delay (3 days). The silicone oil treatments require further testing for potential environmental impacts, as well as the development of formulations that can be applied to surfaces or netting. Second, we tested antifouling performance of commercially available Netminder, which causes a short but significant delay (7 days) in fouling. To better assess the utility of Netminder, further testing on full-size net pens is required, alongside a cost-benefit analysis, comparing costs for coating against savings from less frequent cleaning.



## SELECTIVE HIGH SURFACE AREA POLLUTANT SCRUBBERS: METAL-ORGANIC FRAMEWORKS FOR SEQUESTRATION OF ATMOSPHERIC NITROUS ACID

PRESENTER: DEVON MCGRATH

Supervisor: Dr. Michael Katz & Dr. Cora Young

A variety of nitrogen oxides (NO<sub>x</sub>) are present in both indoor and outdoor air. The NO<sub>x</sub> species posing the most significant threat to both the environment and human health are nitrous oxide (NO) and nitrogen dioxide (NO<sub>2</sub>). NO<sub>2</sub> can interact with other compounds present in the atmosphere to produce a wide array of secondary pollutants. An example of this is the reaction of NO<sub>2</sub> with water on surfaces (e.g. buildings, sidewalks, and paint) to produce nitrous acid gas (HONO). In the absence of sunlight, HONO builds up via these reaction pathways. During the day, HONO undergoes photolysis to form NO and hydroxyl (OH) radicals, which can take part in atmospheric oxidation to form other dangerous compounds (e.g. ground-level ozone). Posing a threat to indoor air quality, levels of HONO are over 10× higher than outdoors. HONO can react with amines, such as those from cigarette smoke, to form carcinogenic nitrosamines. Due to the constant flux of NO<sub>x</sub> from various sources, there is a necessity for a material to selectively decontaminate NO<sub>x</sub> and its reaction products.

Metal-organic frameworks (MOFs) are porous materials known for their wide-spread applications such as chemical sensing, separations, gas storage, and chemical reactivity. The advantage of MOFs, versus other porous or high-surface area materials, is that every reactive site in the MOF is readily accessible. With this in mind, this presentation will report the successful employment of a functionalized MOF for improved quantitative measurements and selective decontamination of environmentally relevant concentrations of nitrous acid.

## DIVERSITY OF FUNGI FROM MARINE WOOD FROM THE BAY OF FUNDY, NOVA SCOTIA, CANADA

PRESENTER: SARAH ADAMS

Supervisor: Allison Walker

Marine fungi play an integral role in the decomposition of intertidal organic substrates, but remain poorly studied in coldwater habitats. Lignicolous (wood decay) marine fungi are key players in the breakdown of organic material and aid in nutrient cycling in the intertidal zone. Wood decay fungi can produce powerful extracellular degradative enzymes; some are of interest for their ability to break down hydrocarbons. Marine fungi may have potential uses in bioremediation efforts to remove the legacy of oil spills and other environmental contaminants from our coastal waters; however further research is needed to determine key players. The marine fungi associated with marine inundated wood (i.e. wharf posts, driftwood) found at 30 sites within 3 subregions (Chignecto Bay, Minas Basin, open Bay of Fundy) were identified. Marine wood samples were collected over 11 days between March 25 - July 5, 2018 and





plated onto multiple media types. Unique fungal cultures that emerged on the plates were isolated and identified using DNA barcoding. Preliminary results have identified 52 species of fungi from 16 sites, 9 in Chignecto Bay and 7 in the Minas Basin. 35 of these species are new records for the Bay of Fundy and the Western Atlantic Ocean. The ability of marine fungi to degrade hydrocarbons will be assessed with controlled experiments during the summer of 2019.

## THE PROTEIN KINASE CK2 CATALYTIC DOMAIN FROM PLASMODIUM FALCIPARUM: CRYSTAL STRUCTURE, TYROSINE KINASE ACTIVITY AND INHIBITION

PRESENTER: DAVID DONG

Supervisor: David Ruiz Carrillo

*Other authors: Jianqing Lin*

Malaria causes every year over half-a-million deaths. The emergence of parasites resistant to available treatments makes the identification of new targets and their inhibitors an urgent task for the development of novel anti-malaria drugs. Protein kinase CK2 is an evolutionary-conserved eukaryotic serine/threonine protein kinase that in *Plasmodium falciparum* (PfCK2) has been characterized as a promising target for chemotherapeutic intervention against malaria. Here we report a crystallographic structure of the catalytic domain of PfCK2 $\alpha$  (D179S inactive single mutant) in complex with ATP at a resolution of 3.0 Å. Compared to the human enzyme, the structure reveals a subtly altered ATP binding pocket comprising five substitutions in the vicinity of the adenine base, that together with potential allosteric sites, could be exploited to design novel inhibitors specifically targeting the *Plasmodium* enzyme. We provide evidence for the dual autophosphorylation of residues Thr63 and Tyr30 of PfCK2. We also show that CX4945, a human CK2 inhibitor in clinical trials against solid tumor cancers, is effective against PfCK2 with an IC<sub>50</sub> of 13.2 nM.

## MODELING MOVEMENT OF JUVENILE BLANDING'S TURTLES (EMYDOIDEA BLANDINGII) ACROSS A FRAGMENTED LANDSCAPE IN ROUGE NATIONAL URBAN PARK, ONTARIO, CANADA

PRESENTER: AMY FROST-WICKS

Supervisor: Mui, Amy

Rouge National Urban Park is a highly fragmented park in Canada's most populous city, Toronto, Ontario. Habitat fragmentation has been found to hinder conservation efforts due to the associated increased risks of species mortality when travelling between habitat patches. The park contains a population of endangered Blanding's turtles (*Emydoidea blandingii*) augmented through a head-starting program that supplements wild populations by releasing captive raised young. Blanding's turtle habitat size requirements are often underestimated, and little is known regarding the habitat selection of



juvenile Blanding's turtles in fragmented landscapes. This thesis will examine the movement paths and habitat selection of juvenile head started Blanding's turtles within an urban park. 2941 radio telemetry points of juvenile Blanding's turtles collected by the Toronto Zoo as part of the Blanding's turtle head starting program between the months of June to August, from 2016 to 2018, will be examined. Blanding's turtle habitat within the Park will be mapped using PlanetScope 3m Visible-Near Infrared remote sensing imagery. Habitat connectivity will be modelled by completing a graph network and a least cost pathway (LCP) assessment. These assessments will result in an evaluation of landscape connectivity and areas of facilitated turtle movement, as well as an LCP resistance map which will identify discrete barriers to movement. It is anticipated that the resulting model of juvenile turtle movement will help to target management decisions and habitat restoration efforts within Rouge National Urban Park and the surrounding area, thus contributing to both habitat and species conservation efforts in Southern Ontario.

## MOBILE SURVEYING TO ASSESS ARCTIC AND BOREAL FOREST GREENHOUSE GAS FLUXES

PRESENTER: DANIEL WESLEY

Supervisor: Risk, Dave; Zeigler, Sue (Memorial University)

Methane (CH<sub>4</sub>) and carbon dioxide (CO<sub>2</sub>) fluxes from Boreal forest and arctic ecosystems have considerable spatial and temporal variability. Accurately measuring these fluxes will allow us to better assess the CH<sub>4</sub> budget for these vast ecosystems and what impact they will have on climate change. By using mobile surveying for CH<sub>4</sub> and CO<sub>2</sub> sampling we can fill a large gap in scale between eddy covariance towers (~1 km<sup>2</sup>) and aerial surveys (100-1,000 km<sup>2</sup>). Filling this gap in scale will help to better identify and delineate hotspots. This research will also involve development of methods for mobile surveying using off highway vehicles, which will enable us to better access remote and under sampled arctic ecosystems. In an initial pilot study, we conducted vehicle-based surveys of CH<sub>4</sub> and CO<sub>2</sub> mixing ratios, in the Mackenzie-Beaufort Delta region of the Northwest Territories in April, 2018, using a portable gas detector mounted on either a truck or snowmobile. During this study we observed biogenic production of CH<sub>4</sub> during late winter when biological activity is assumed to be negligible. Areas enriched in CH<sub>4</sub> in the southern part of the delta were biologically produced, while enriched areas in the northern part of the delta were a mixture of biogenic and geologic CH<sub>4</sub>. We observed several long areas enriched in CH<sub>4</sub> as well as an area where we suspect high rate geologic venting which could represent a significant source of atmospheric CH<sub>4</sub>. Future studies will include off highway surveys in both boreal forest and arctic ecosystems.



## RECENT RADIAL PRODUCTIVITY AND PERIODS OF SUPPRESSED GROWTH IN SUGAR MAPLES OF FUNDY NATIONAL PARK

PRESENTER: HOUINATO KINDY

Supervisor: Ben Phillips

*Others: Noel, Emilie; Doucet, Casey; Richards, Will*

Declines in sugar maple (*Acer saccharum* Marsh.) populations are being observed throughout their range in North America. A dendrochronological analysis conducted by Phillips (2017) of sugar maples from a single site in Fundy National Park (FNP), New Brunswick, Canada, demonstrated a similar decline in their radial productivity over recent decades, terminating in a long period of abnormally low growth. In order to determine if a more representative sample of sugar maples within the park would reveal the same troubling decline, two additional sites were selected based on their coastal proximity and elevation to capture site variability within the park. Analysis of the chronologies revealed the downward trend and prolonged period of radial growth suppression spanning from 1991 to 2011 to be a strongly shared signal between individuals within each site as well as across the three sites. Additionally, the results of this study reveal productivity has slightly increased to values just above our calculated low productivity threshold in the years following 2011. Despite these initial signs of recovery, the future of sugar maple populations remains uncertain and as such, monitoring for the occurrence of radial growth recovery is highly advised.

## USING SUBFOSSIL MIDGES TO ASSESS THE POTENTIAL IMPACTS OF MINK FARMING ON LAKE WATER QUALITY IN SOUTHWESTERN NOVA SCOTIA

PRESENTER: JULIA CAMPBELL

Supervisor: Kurek, Joshua

The mink fur farming industry of southwestern Nova Scotia (SW NS) is one of the top agricultural exports in NS. This industry has sparked recent debate on water quality declines in surrounding lakes, such as Nowlans Lake, which has experienced reoccurring algal blooms and very high measures of nutrients. Midges from Nowlans were used as bioindicators of environmental change due to their sensitivity to dissolved oxygen concentrations [DO], which can be significantly depleted as a result of eutrophication. Midges were recovered from a lake sediment core spanning the ~1900s to present. Visible reflectance spectroscopy (VRS) chl-a was also measured from sediments as a proxy of whole-lake primary production. Preliminary results indicate that chironomid taxa associated with lower [DO] (e.g. *Endochironomus*) show increasing trends coinciding with greater VRS chl-a. Taxa associated with higher [DO] (e.g. *Stempellina*) displayed decreasing trends from the ~1900s to present. Increasing chaoborids to chironomids was also determined, indicating decreases in [DO] trends. This research will help fill the missing gap of long-term limnological data by using paleolimnological approaches to reconstruct past



environmental changes and determine pre-disturbance conditions necessary to investigate mink farming's contributions to water quality declines in SWNS.

## INCOME POLARIZATION OVER A 15-YEAR PERIOD (2001-2016) AND ITS CORRELATION WITH EXISTING GREEN SPACE IN URBAN HALIFAX, NOVA SCOTIA

PRESENTER: MEGAN FONG

Supervisor: Greene, Christopher

Urbanization can have damaging effects on the growth and development of many cities by exacerbating existing social and environmental inequalities. Income inequality has wide implications on urban environments, not only regarding social and demographic issues, but it also has been found to lead to the polarization of income groups within the physical limits of a city. In other words, a physical separation of high and low-income neighbourhoods within a city. As cities become increasingly polarized, with respect to income, there is evidence to suggest that the inequitable distribution of environmental amenities (e.g., trees, lakes, etc.) will follow. This is an important sustainability issue given the known environmental and health benefits that comes with green space access. In this study, the spatial distribution of median household income in urban Halifax was analyzed using local indicators of spatial autocorrelation to detect the presence of polarization of income groups from 2001-2016. Over 15 years, there are spatially distinct regions in Halifax that have remained predominately low-income and high-income as well as the expansion of high-income into new suburban developments. PlanetScope (4-band VIS-NIR) satellite imagery was used to identify trees, open vegetation, and water features which are important aspects of green space. Using local indicators of spatial autocorrelation from geographic information systems technology, the correlation between median household income and green space will be visually quantified. It is predicted that there is a correlation within the study area as to where the distribution of green space is related to areas of high and low-income.

## INVESTIGATING IMPACTS OF MINK FARMING ON CLADOCERA IN EUTROPHIC LAKES OF SOUTHWESTERN NOVA SCOTIA

PRESENTER: ABBIE GAIL JONES

Supervisor: Dr. Joshua Kurek

Since the mid-20th century, mink farming has been a vital agricultural export in Nova Scotia. The practice is particularly predominant in rural Southwestern areas, a region also rich in freshwater ecosystems. Regional lakes are presumed to have experienced declines water quality within the last decades, although the monitoring record is sparse. Most believe that excess nutrients from the mink industry is the main cause of water quality declines in most monitored lakes. The effects of cultural eutrophication on biotic communities within the lakes, particularly invertebrate communities, are unknown. This study aimed to describe long-term invertebrate community changes within two hyper-



eutrophic lakes in the Southwestern NS area using cladoceran bioindicators preserved in dated sedimentary cores. Cladoceran remains were identified and body sizes were measured, and sedimentary chlorophyll-a concentrations were estimated via visible reflectance spectroscopy (VRS) as a proxy of nutrient loading. Analyses indicated community shifts, while the simultaneous consistency of body sizes through time suggest bottom-up forces as main drivers of ecological change. Further work on this research will serve to provide stakeholders with a perspective into the possible ecological effects of mink farming on regional water quality.

## INFLUENCE OF SALINITY ON MERCURY PHOTOCHEMISTRY IN ESTUARINE RIVERS IN MINAS BASIN, CANADA

PRESENTER: RACHEL CLARKE

Supervisor: Nelson O'Driscoll

*Others: Klapstein, Sara; Keenan, Robert*

Mercury is a trace metal and a toxic environmental contaminant. The chemical characteristics of estuarine water significantly affect the photochemistry and speciation of mercury and therefore likely mercury availability for bioaccumulation in food webs as methylmercury. Mercury loss from natural waters can occur through photoreduction, which is controlled primarily by ultraviolet radiation. Currently, there are limited data on mercury photochemical reactions in estuarine ecosystems. To address these knowledge gaps, the photochemical kinetics of mercury reduction and oxidation with changing salinity will be quantified. It is hypothesized that the rate and absolute amount of photochemical mercury reduction in estuarine waters is inhibited by increasing salinity. Surface water samples from the Jijuktu'kwejk tidal river estuary in the Minas Basin, Nova Scotia, Canada (known historically as the Cornwallis River) were taken in July 2018. Using tangential ultrafiltration, water with a range of salinity but constant dissolved organic matter concentration will be attained and then irradiated over an environmentally-relevant range of ultraviolet intensities between 300–400 nm. Gaseous elemental mercury will be analyzed every five minutes over a period of 24 hours using a Tekran 2573B CVAFS automated mercury analyzer. Gross photoreduction and photooxidation reversible pseudo-first order reaction rate constants and total photoreducible mercury in each treatment will be determined using curve-fitting software. Preliminary data collected and correlations between photoreducible mercury with salinity change will be presented. This research provides fundamental data and rigorous experimental testing which can then be used to predict mercury retention and accumulation in estuaries.

## AQUATIC ECOSYSTEM SENESCENCE OF WETLAND IMPOUNDMENTS IN THE UPPER BAY OF FUNDY, CANADA

PRESENTER: JACOB DEMERS

Supervisor: Josh Kurek



Wetland environments provide important ecosystem services to humans and crucial habitat to wildlife. We investigate ecosystem senescence in 30 freshwater wetland impoundments in the Cumberland Marsh Region (CMR). Impoundments vary from newly flooded to 50 years old and were constructed to compensate for regional wetland losses. Concerns are often raised by wetland managers and researchers of diminishing productivity in aging impoundments. Each impoundment was sampled for macroinvertebrates in its emergent vegetation, submerged vegetation, and open water habitats in spring, summer and fall of 2018. Water quality and soil organic content measurements were collected alongside the macroinvertebrate data. Preliminary findings suggest that macroinvertebrate taxa varied across 5 impoundment age classes during the fall. Ephemeroptera, Hemiptera and Diptera dominated younger impoundments, whereas Tricoptera and Coleoptera were more abundant in older impoundments. Abiotic gradients (e.g. soil organic content, pH, and dissolved oxygen) did not display a relationship to impoundment age classes. This research is ongoing and findings will deepen the understanding of how wetland senescence may structure the biotic and abiotic environments of impoundments.

## WOLVES: FRIEND OR FOE? A SOLUTION TO THE HYPER ABUNDANCE OF MOOSE IN THE CAPE BRETON HIGHLANDS NATIONAL PARK.

PRESENTER: BRADY DOUCETTE

Supervisor: Deanne Van Rooyen

Since the reintroduction of Moose (*Alces alces*) in the Cape Breton Highlands National Park (CBHNP) in 1947-48 their population has grown exponentially and is now approximately four times as dense as the area can successfully support. The hyperabundance of moose has caused a significant loss of the park's boreal forest. There are a number of restoration efforts underway, and a limited moose cull has been introduced, but the population is still growing. Other case studies of hyperabundant ungulates in parks such as Algonquin and Yellowstone show that both have benefitted from the reintroduction of wolves (*Canis lupis*). Wolves were extirpated in the CB Highlands in the early 20th century. Reintroduced wolves could assist in population control for moose and have positive effects on watershed health by controlling ungulates which allows for regeneration of riparian forests. Watershed health is particularly relevant in CBHNP and surrounding areas because of the culturally and economically significant salmon fishery. Atlantic Salmon (*Salmo salar*) is a culturally significant fish for the Mi'kmaq of Cape Breton, a primary food source for wildlife and people, and a generator of tourism within Cape Breton Island. Local concerns regarding the reintroduction of a predator species have to be considered — given strong local fears about the presence of coyotes. Previous work has shown that wolves in Algonquin and Yellowstone have very little interaction with human populations. The areas around CBHNP have a lower population density than the areas surrounding Yellowstone and Algonquin so it is likely that there would be minimal interaction.



## HABITAT AND CARCASS AVAILABILITY AFFECT SCAVENGING RATES IN AN ISLAND SETTING: IMPLICATIONS FOR BIRD-WINDOW COLLISION MORTALITY ESTIMATES

PRESENTER: MEGAN CLARKE

Supervisor: Dr. Ian Warkentin, Dr. Erin Fraser

Bird-window collisions have been identified as the second leading cause of human-related avian mortality for songbirds in Canada. However, our ability to accurately estimate the number of fatalities caused by window collisions is affected by several major biases, including the removal of carcasses by scavengers prior to them being detected during surveys. I investigated the extent to which scavenging may lead to underestimates of these fatalities among habitat types and across the summer season on and around Grenfell Campus of Memorial University, Corner Brook, Newfoundland. The absence of many common North American scavengers (e.g., racoons and skunks) makes Newfoundland an interesting location to study scavenging behaviour. I monitored the fate of bird carcasses placed at building and forest sites using motion activated cameras to determine the identity of scavengers and timing of events. Using two treatments, I assessed how scavenging varied in response to different levels of carcass availability. The results indicated that forest and building habitats have different scavenging communities and that vertebrate scavengers (primarily ravens) have learned to look for carcasses specifically near building windows, where bird-window collision fatalities create a predictable source of food. Additionally, burying beetles were the dominant scavengers at forested sites, completely removing carcasses from sight in less than 24 hours. These findings have implications for estimating bird-window collision mortalities where the local scavenging community includes vertebrates that have learned to quickly exploit this predictable food source, or where invertebrates compensate for reduced vertebrate scavenging populations on islands.

## EFFECTS OF INERT GRANITE DUST TREATMENT ON LILY VOLATILE EMISSIONS AND SUBSEQUENT HERBIVORE RESPONSE

PRESENTER: MEGAN MACISAAC

Supervisor: Faraone, Nicoletta; Hillier, N Kirk

Plants produce a multitude of volatile compounds that have a role in reproduction, stress response, and multitrophic interactions. Current trends in agriculture seek to find safer, sustainable methods for crop protection against pests. Recent work has determined a novel granite dust bio-product (similar to diatomaceous earth) as a natural alternative which has been used as an insecticide and repellent agent with promising results in controlling *Lilioceris lili* (lily leaf beetle), an invasive pest that causes significant damage to *Lilium* spp. (lilies). This study explores how this mineral dust may affect volatile emission and herbivore acceptance in lily plants. Granite rock dust was applied as soil, foliar and soil + foliar treatment to lily plants. Volatiles were collected from untreated and treated lilies over time and analyzed via gas chromatography-mass spectrometry. Electroantennograms were performed in order to investigate the



response of *L. lili* adults to volatiles from treated and control plants. Volatile organic compounds collected from plants at 4 hour and 1 week post-treatment intervals showed untreated plants produce higher quantities of volatiles than all other treatments. Electrophysiological response of lily beetles to foliar and soil + foliar treatments was significantly greater than responses to untreated plants; soil treatments did not elicit significantly different responses. Changes in the volatile emission in treated plants may provide novel approaches for managing insect pests while improving the sustainability of conventional agricultural practices.

## USING ARBUSCULAR MYCORRHIZAL FUNGI TO SAVE NOVA SCOTIA'S DECLINING SALTMARSHES

PRESENTER: TYLER D'ENTREMONT

Supervisor: López-Gutiérrez, Juan and Walker, Allison

Saltmarshes are highly productive ecosystems in decline globally due to cumulative stressors such as rising ocean levels, land reclamation, and human infrastructure. These activities have negative effects on saltmarsh ecosystems which are essential nursery and refuge habitat for juvenile fishes, invertebrates, and birds. Saltmarshes also stabilize coastlines, trap environmental contaminants, provides storm buffering and nutrient cycling, and are crucial contributors to primary production in marine ecosystems. Restoration efforts remain mostly unsuccessful in long term coastal stability. We aim to improve restoration efforts by assessing the role of fungal communities within saltmarsh sediments and the roots of the saltmarsh species *Sporobolus pumilus* (Poaceae), formerly *Spartina patens*, in the Minas Basin, Nova Scotia. Symbiotic arbuscular mycorrhizal fungi (AMF) can improve salt tolerance of plants but are neglected in saltmarsh restoration. We identified and quantified abundance of AMF in *S. pumilus* roots from Wolfville ( $70\% \pm 7.7\%$ ), Windsor ( $67\% \pm 6.3\%$ ), and Kingsport ( $50\% \pm 5.5\%$ ) saltmarshes. We used rDNA barcoding combined with microscopy to assess the mycorrhizal status of *S. pumilus* in the field. An AMF species (*Funneliformis geosporum*, Glomeraceae) we identified from *S. pumilus* in Nova Scotia, was propagated, used in tidal mesocosm growth trials, and was shown to increase growth and survival in both rhizome and seed derived *S. pumilus*. As the only identified AMF species currently known to colonize *S. pumilus* in Nova Scotia, this species may play a crucial role in this important saltmarsh grass's ability to tolerate the dynamic, saline environment of Nova Scotia's megatidal saltmarshes.

## RUNNING ON EMPTY: DETERMINING THE PRESENCE OF FEEDING BEHAVIOUR IN ANADROMOUS ALEWIFE IN JOLICURE LAKE, NB

PRESENTER: SARAH STEWART

Supervisor: Michael Stokesbury

*Other: Aaron Spares*

Alewife (*Alosa pseudoharengus*) are an anadromous species of herring that live in the Atlantic Ocean. Adult alewife spend most of their lives in the marine environment, only travelling into freshwater lakes





to spawn each year. As thousands of these fish pass upstream through rivers on their annual spawning migration, they have become a commercially valuable species for many maritime communities. Although research has been conducted on adult feeding behaviour and prey selection in both their estuarine and marine habitats, there is very little information on adult feeding behaviour whilst spawning in freshwater. As many larger predatory species feed on alewife both in freshwater and at sea, whether or not alewife are feeding at their spawning site could have large implications for nutrient transfer through trophic levels when they return to sea. Stomach contents were removed and weighed relative to a the total stomach weight and fork length of each individual from a freshwater sampled site at Jolicure Long Lake and a marine sampled site at the Missiguash Tide Gate both in Aulac, New Brunswick. Anadromous alewife were found to have a lower mean feeding intensity in freshwater environments than in marine environments.

## OBSERVING PLANT REACTIONS FROM MIMICKING FLORIVORY FROM MOMPHA CAPELLA LARVAE ON POPULATIONS OF CROCANTHEMUM CANADENSE (L.) BRITT. (ROCKROSE) IN KINGS COUNTY, NOVA SCOTIA

PRESENTER: HANNAH MACHAT

Supervisor: Dr. Rodger Evans

*Crocantemum canadense* is a small, flowering perennial that thrives in sand barren habitats. It is currently listed as critically imperilled in Nova Scotia with a few, relatively small populations contained in the Kings County areas. This species employs dimorphic cleistogamy as its reproductive system. This specialized mating system produces two different flower types on the same plant in one growing season; chasmogamous (open, insect-pollinated) and cleistogamous (closed, self-pollinating). Populations of *C. canadense* have been declining from habitat loss, lack of genetic diversity, and possibly from florivory by *Mompha capella* larvae. To investigate the reproductive consequences of florivory, *C. canadense* populations in Kings County were subjected to three treatments; control, natural infection, and removal of terminal chasmogamous flowers. Plants were monitored throughout the season for indication of infestation and were then harvested at fruit set to measure several vegetative and reproductive parameters (e.g., lateral branch production and length, cleistogamous flower production, etc.). The objective of this study was to investigate the reproductive properties and consequences of *C. canadense* when subjected to a treatment (decapitation) that aimed to mimic the effects of infestation from *Mompha capella*. Approximately 42.9% of the control plants were naturally infected (N=142). Plants that had their terminal bud removed showed an increased amount of axillary branching. Results from this study will be used to determine future conservation efforts of *Crocantemum canadense* populations.



## METHODS FOR THE ANALYSIS OF UPLAND CATCHMENT LIMING IN MOOSELAND, NOVA SCOTIA

PRESENTER: CAITLIN MCCAVOUR

Supervisor: Sterling, Shannon; Keys, Kevin; Halfyard, Edmund

Nova Scotia's forest soils have naturally acidic bedrock composition with low acid buffering capacity and, have been impacted by acid deposition. Sulfur and nitrogen emissions from industrial practices led to the increased acid deposition in the 1970s. Acid deposition causes base cation leaching, reduced pH and toxic aluminum mobilization in forest soils. Policy changes in 1990 led to the reduction of emissions however, they continue to exceed critical loads and, forest recovery is slow. Increased soil acidification from acid deposition has reduced base cation concentrations in soil causing calcium deprived soils and nutrient deficient trees. Nutrient deficiencies have led to declines in biomass production and forest health. Upland catchment liming for the remediation of forest ecosystems through base cation restoration has been studied in other regions of the world however, not in Nova Scotia. Dolomitic limestone ( $\text{CaMg}(\text{CO}_3)_2$ ) was applied by helicopter at the Otter Ponds Demonstration Forest in Mooseland, Nova Scotia to mature hardwood and softwood forest cover types. A long-term forest monitoring program was established to assess forest parameters for limed and un-limed plots. Inventory growth plots, forest vegetation, regeneration, and forest floor sub-plots are monitored. Mineral soil, forest floor and foliar chemistry samples for sugar maple (*Acer saccharum*), red maple (*Acer rubens*) and red spruce (*Picea rubens*) are analyzed for chemical composition. Emphasis is placed on methods of limestone application in forestry and best measurement practices to assess soil chemical cycles and forest health in Mooseland, Nova Scotia.

## IDENTIFYING THE FUNGAL ASSOCIATES OF THE ENDANGERED PLANT CROCANTHEMUM CANADENSE IN NOVA SCOTIA

PRESENTER: PHILICITY BYERS

Supervisor: Evans, Rodger; Walker, Allison

*Crocantemum canadense* (L.) Britt. (Cistaceae) is a small, herbaceous plant that is critically imperiled in Nova Scotia. Habitat loss, elimination of important ecosystem services, and an insect pest, *Mompha capella*, are contributing to the declining populations. The role of fungal associations in *C. canadense* populations is unknown, and thus the primary goal of this research was to identify fungal symbionts, which was driven by the search for new conservation strategies. Fungi form several types of beneficial symbioses with plants, including endophytic and mycorrhizal symbioses, which can improve plant growth and survival through a variety of mechanisms. Fungi were isolated from the roots, stems, and leaves of *C. canadense* collected throughout six sites at 14 Wing Canadian Forces Base, Greenwood, Nova Scotia. Using DNA barcoding, 43 fungal species were identified from roots, 14 from leaves, six from upper stems, and 11 from lower stems. Six fungi occurred in more than half of the study sites and colonized more than a third of the plants sampled. These included *Pyrenophora tetrarrhenae* colonizing



89% of plants, *Arcopilus aureus* (56%), *Pilidium concavum* (50%), *Phialocephala cf. fortinii* (44%), *Apiognomonina cf. hystrix* (39%), and *Sphaeronaemella fragariae* (39%), all of which are ascomycetes. *Apiognomonina cf. hystrix* and *P. tetrarrhenae* were present in *C. canadense* tissue at all six sites. This research provides a report of the relationships influencing Nova Scotia *C. canadense* populations, and not only provides the first fungal species records from this endangered plant, but could be used to enhance the success of future conservation efforts.

## DEVELOPMENT AND TESTING OF GLACIAL SEDIMENT AS A GROWTH MEDIUM FOR VEGETABLE PRODUCTION

PRESENTER: ZACHARY HARVEY

Supervisor: Galagedara, Lakshman., Thomas, Raymond., & Cheema, Mumtaz

Glacial outwash delta sediment (sand) from Springdale, Newfoundland, was tested as a growth medium for vegetable production, to demonstrate the potential use of local resources as sustainable growth media. Four treatments were used in pot experiments, with varying amounts of biochar and promix as amendments. Bulk density, porosity (saturation), and field capacity, were measured and compared across all treatments. Newham lettuce (*Lactuca sativa*) was grown in a growth chamber under controlled conditions, to test the effects that the growth media had on crop production. By applying equal amounts of water and nutrients to each treatment, as well as maintaining equal growing conditions, the effects of the growth medium alone were able to be observed in terms of plant growth. Two watering techniques were also used throughout the growth period to compare the effects of surface watering and capillary watering on plant growth and resource efficiency. Both the biochar and promix treatments, as well as the combination of the two, enhanced measured soil properties of the growth media. It was found that larger lettuce plants were produced when the growth media was amended with promix, and a mixture of promix and biochar, compared to the control of unamended sand. The treatment of biochar amended sand did not greatly increase the production of lettuce, however, it produced similarly to the control, while more efficiently using the applied water and nutrients. Lettuce production was also increased when water and nutrients were applied to the surface, as opposed to when applied through capillary action.

## ASSESSING THE FEASIBILITY OF TWO SYSTEMS TO HANDLE HOUSEHOLD ORGANIC WASTE: THE DIRT ON COMPOST

PRESENTER: BRITTANY MACNAUGHTON

Adjusting from simply throwing out organic kitchen waste to utilizing it in composting can be seen by some as a time-consuming task. Home composting can help not only divert organics from the municipal waste stream, but also gain compost materials that can be used as high quality fertilizer home gardens or vegetable plots. Over time, soils are depleted of nutrients and modern applications of synthetic chemicals does little to increase the quality and health of the soil. Depleted soils produces less and



lower quality plants. By practicing composting methods and reintroducing these organic products back into the soil to amend the soil, this loss of soil health can be reversed and properly maintained. Composting may increase the health of plants and overall yield of crops, and is a method that is becoming more and more relevant for today's gardening and farming practices, especially with increased awareness around food security. Developing organic compost on a larger scale, maybe also be a way to generate revenue and establish a means to help educate the public and have more conversations about waste, composting, and food security. This report examines the differences between an aerated static compost pile system and a vermicompost system in place at The Ville community centre in Fredericton, New Brunswick, to determine their feasibility and potential for the greatest financial return.



# POSTER ABSTRACTS

## CHARACTERIZATION OF A NEW OBLIGATE MARINE FUNGUS LULWORTHIA NOM. PROV. FUNDYENSE FROM NOVA SCOTIA

PRESENTER: VICTORIA TAYLOR

Supervisor: Dr. Allison K. Walker

*Others: Adams, Sarah; Robicheau, Brent; Walker, Allison*

We are studying the biodiversity of marine fungi in Nova Scotia and their ability to degrade crude oil. These fungi are understudied and contribute to nutrient cycling, as major decomposers in coastal and marine environments. The Walker lab at Acadia isolated a new species of Lulworthia, an obligate marine ascomycete fungus, from recently exposed intertidal wood from Edgetts Beach, Nova Scotia. We morphologically and genetically characterized it using rDNA. The fungus was grown in the laboratory and DNA was extracted and amplified using ITS, 18S and 28S primers to target the corresponding rRNA genetic regions. Phylogenetic trees of 3 rDNA gene regions were constructed, providing genetic evidence that it is a new species of marine fungus, provisionally named Lulworthia fundyense. The fungus grew faster at warmer temperatures and is now being tested for its ability to degrade crude oil for use in bioremediation. This project emphasized the ecological importance of fungi and the need for further research on these organisms on all coasts of Nova Scotia, to develop new strategies to reduce marine pollution.

## DEVELOPMENT AND VALIDATION OF AN AUTONOMOUS MEASUREMENT SYSTEM FOR CO<sub>2</sub> AND CH<sub>4</sub> FROM DISCONTINUOUS PERMAFROST

PRESENTER: RENÉE MCDONALD

Supervisor: David Risk

*Others: Johnson, Jacob*

Quantifying the rate at which CH<sub>4</sub> and CO<sub>2</sub> are released from permafrost degradation is important for understanding carbon dynamics in the Arctic. Autonomous measurement of soil CH<sub>4</sub> and CO<sub>2</sub> provides necessary data on these processes, but are challenging to operate in Arctic environments because of their significant energy consumption. Power is unavailable at remote sites, nor can solar arrays produce enough power during months when the sun is low or absent. In this study, we developed novel approaches to decrease power consumption of an autonomous measurement system. The system uses a custom 12-port automated sampler for CO<sub>2</sub> and CH<sub>4</sub> measurement from several locations with power demands of a single methane analyzer. To reduce power, we developed a dilution analysis procedure to



cut pumping time by experimentally determining the lower limit on sample volume injection into the closed-path analyzer. By understanding mixing dynamics within the analyzer we determined four sample aliquots could be sequentially injected into the analyzer (“stacked”) before analysis exceeded our 5% uncertainty target. Atmospheric air was used as a carrier gas following aliquots to flush the system. A power management algorithm decreased sampling frequency at times when solar panels were generating minimum output. Overall, this work increased energy efficiency allowing the system to run longer outside of sunny months. The system was installed in an area of discontinuous permafrost in Finnmark, Norway, drawing aliquots from soil chambers at depth along a hydrological gradient. Our approach represents an evolutionary step forward for autonomous gas monitoring in high-latitude environments.

## COMMOTION IN THE OCEAN: EXPLORING YOUTH VOLUNTEERISM IN OCEAN HEALTH AND LITERACY COAST TO COAST TO COAST

PRESENTER: HANNAH KOSICK

Supervisor: Deanne van Rooyen

One of the central issues in environmental outreach and education work is the challenges associated with recruitment of new and committed volunteers into programs that target environmental problems. If done well, volunteer programs for youth can provide meaningful learning experiences. Ocean Bridge is a yearlong ocean service program funded by the Canada Service Corps and organized by Ocean Wise. This program engages 40 youth aged 18-30 in ocean literacy through three stages: local service, a wilderness expedition, and an urban expedition. Throughout 2018, Ocean Bridge leaders dedicated many hours to local service in their home communities. Mentored by Ocean Wise staff, the team of youth hosted shoreline cleanups, youth days, and awareness campaigns. On trips to Haida Gwaii and Vancouver, participants came together to immerse themselves in ocean literacy and share their knowledge with fellow youth. Over the course of one year, Ocean Bridge program participants engaged 11 587 people and completed 15 290 hours of ocean service activities. This program has been successful in creating long-term engagement of their volunteers after they leave the program. After the shoreline cleanup in Haida Gwaii, all 40 youth continued leading shoreline cleanups in their local communities. This model of experiential learning and mentorship increases volunteering service and environmental consciousness in youth, not only for the participants but also in the local communities where the volunteers operate through shoreline cleanups, the development educational programming, the restoration of damaged ecosystems, and by creating an overall heightened awareness of environmental issues.



## CARIBOU (RANGIFER TARANDUS TARUNDUS) JAWBONE LENGTH IN RELATION TO PRENATAL WEATHER CONDITIONS

PRESENTER: JULIA HALFYARD, FELICIA HILLIER, KELSEY WHITE

Supervisor: Dr. Christine Campbell & Dr. Julie Sircom

Environmental conditions experienced by animals during gestation and early life can influence body condition in adulthood. For ungulates, such as caribou (*Rangifer tarandus tarandus*), prenatal temperatures can relate to adult jawbone length. Caribou typically mate during the fall, therefore females are carrying young throughout the winter. Severe weather events in winter hence may affect later adult survival. We examined the relationship between total jawbone length and average prenatal winter temperatures using data from 85 hunter-harvested woodland caribou from 1982 to 2011, introduced to Merasheen Island, Placentia Bay, Newfoundland. Only caribou older than 4 years were included as jawbone length is not stable prior to this age. Temperature data were sourced from Environment Canada weather stations located in Argentia and Long Harbour, Newfoundland. Average winter temperatures from 21 December to 20 March was used because breeding females are antenatal during this time, and food availability is lowered with colder temperatures. Caribou were classified according to four age classes (A: 4-5, B: 6-7, C: 8-9, D: 10+). Initial results show that there is a significant relationship between sex and total jawbone length; however, there is no significant relationship between prenatal winter temperatures and total jawbone length for either males or females of any age class.

## OPTIMAL ALPHA – VALIDATING A BETTER METHOD FOR MAKING DECISIONS

PRESENTER: MILIA AIDEMOUNI

Supervisor: Dr. Jeff Houlahan

Null Hypothesis Significance Testing remains a statistical method of choice used to provide evidence for an effect. The common threshold used among researchers to identify significant results is  $\alpha = 0.05$  following Neyman-Pearson's and Fisher's recommendations. Many of the drawbacks of null hypothesis significance testing revolve around the arbitrary choice of  $\alpha = 0.05$ , the sensitivity to sample size, and the poor understanding of statistical power (Stephens et al., 2007). A better alternative has been described in Mudge, et al., (2012), which is the use of optimal alpha – a threshold that is study-specific and that minimizes the probability/cost of making either a Type I or II error. Thresholds based on optimal alpha are theoretically superior to the 0.05 threshold because they minimize errors, but if both thresholds resulted in the same conclusion then the superiority of optimal alpha has little practical importance. 100 ecology research articles were sampled and conclusions that were originally published using the 0.05 threshold were compared to the conclusions that would have been reached using optimal



α. Results show that 23% of the time conclusions were inconsistent. This suggests that using the traditional threshold is often leading us to wrong conclusions in ecology. In this paper we are recommending an approach that decreases our mistakes in conclusions by 23%.

## A GEOSPATIAL ANALYSIS OF LAND USE AND COVER CHANGE IN PEI, 1969-2010

PRESENTER: CHOYCE CHAPPELL

Supervisor: Dr. Joshua MacFadyen

The University of Prince Edward Island's GeoREACH lab researches agricultural land use and cover change in Atlantic Canada, primarily by using Geographic Information Systems (GIS). Prince Edward Island is the basis for most of the research, due to its manageable size, islandness, and relevance to the environmental history of food and agriculture. The literature on environmental history suggests that PEI experienced a complete socio-ecological transition in the post-WWII period, following national and continental trends, and many authors point to a 1969 Federal-Provincial Comprehensive Development Plan as the catalyst. This poster provides some of the first quantitative analysis of these claims. A property boundary map developed for the 1969 plan has been located and scanned, allowing for the first time the analysis of land ownership and land use at multiple scales in GIS. This poster is based on a digital database of the ownership boundaries created from the historical map, allowing for comparison between 1969 and 2010 rural land use. A sample of six townships (two in each of PEI's three counties) has been taken from the map for digitization and to compare properties between 1969 and today. This new database will be compared to pre-existing historical land use inventories based on aerial imagery, which allows for a study of land use and cover change at multiple scales within these townships. Further work may be done in the future on the entirety of PEI based on the digitization of this map and using these case studies as a template.

## USING PEG- LINE METHODOLOGY TO DETERMINE ANNUAL RATES OF SHORELINE EROSION ACROSS PRINCE EDWARD ISLAND

PRESENTER: CATHERINE KENNEDY

Supervisor: Dr. Adam Fenech

*Other: Granzoti, Juliana*

The coastline of Prince Edward Island is expected to be the most negatively impacted by climate change. Increased storm intensity and sea level rise can lead to geomorphological changes such as dune and cliff erosion. Understanding the average rates of erosion across the island can allow home/ cottage owners, areas with large infrastructure (wind turbines), and harbor facilities to plan for the present and future and help guide decision making. The PEI Department of Communities, Lands, and Environment provided resources since 2014 to the UPEI Climate Research Lab to re-measure coastal erosion monitoring sites each year across Prince Edward Island. Two pins are installed at each measurement area, one 10 m





perpendicular to the shoreline, and another a further 10 m back. Each year, the distance from the coastline is measured to the 10m pin using the 20m pin as a directional aid. Though the results show that the average rate of erosion has decreased from .53m in 2015 to .31m in 2018, the number of sites with shoreline loss greater than 1 meter has increased significantly from 2 sites in 2015 to 9 sites in 2018.

## CHARACTERIZATION OF MARINE FUNGAL DIVERSITY ASSOCIATED WITH TIDAL MUDFLAT SEDIMENT AND WOOD FROM THE MINAS BASIN, NOVA SCOTIA

PRESENTER: JACOB REICKER

Supervisor: Walker, Allison

Coastal and open ocean ecosystems rely on understudied marine fungi for their role as the primary decomposers of plant material, including wood and other organic debris. Some fungal enzymes responsible for degrading the lignin and cellulose components of plant material are in turn capable of metabolizing crude oil hydrocarbons. As contamination of aquatic communities during transportation and storage of crude oil remains a persistent issue, the need for reliable remediation strategies increases. However, marine fungal species native to the Bay of Fundy are underexplored. Marine fungi were collected from the Kingsport and Wolfville Harbour intertidal zones of the Minas Basin, Nova Scotia using sediment coring along transects and woodblock bait trap collection methods. Species were identified via culturing and DNA barcoding. Twenty-two morphologically distinct cultures were obtained from Kingsport sediment, yielding 13 species from 9 ascomycete genera. Fungi of interest discovered in our study include the cosmopolitan *Pseudeurotium bakeri*, known to survive in high levels of diesel fuel contamination, and the yeast *Candida sake*, known to survive in Antarctic waters and commonly used as a biocontrol agent against various apple molds and infections. Of the 13 identified species, only *K. lactis* and *C. sake* have been previously recorded in the Minas Basin. Future research includes evaluating the enzymatic and surfactant abilities of candidate strains which may assist in the breakdown of marine and coastal crude oil contaminants, including GC/MS to study contaminant breakdown.

## BRING BACK THE BOREAL: MAINTAINING ECOLOGICAL INTEGRITY THROUGH CONSERVATION AND RESTORATION

PRESENTER: SHANE CORMIER

Supervisor: Deanne van Rooyen

*Other: D'Orsay, Clayton*

Cape Breton Highlands National Park (CBHNP) has a long history of ecological disturbance, recovery, and monitoring. The native moose species (*Alces alces americana*) was extirpated in Cape Breton Island in the late 1800s early 1900s and reintroduced to the park in 1947-48 through the settlement of the Albertan species (*Alces alces andersoni*). The CBHNP landscape was quickly colonized



by the introduced moose, and the population grew very quickly. Coupled with the Spruce Budworm (*Choristoneura hebenstreitella*) infestation of the 1970-80s, the resurgent moose population presented significant challenges for managing the boreal forest regions of the CBHNP which are now characterized by a lack of forest regeneration. What would normally be a healthy Boreal forest abundant with Balsam fir (*Abies balsamea*) and White birch (*Betula papyrifera*), the over-browsing caused by moose have allowed a species of grass (*Calamagrostis* spp.) to overshadow and prevent regeneration of a once healthy forest.

The CBHNP, in cooperation with the Unama'ki Institute of Natural Resources (UINR), has a number of strategies in place to restore the ecological integrity of the boreal forest. These include an annual moose cull, or harvest, to strategically reduce the populations of *Andersoni*. Accompanied with the reduction of moose populations, vegetation monitoring through the use of moose exclosures and additions of softwood species through tree planting, these targeted approaches are aimed at providing the boreal a chance for natural regeneration.

This presentation shows data from the “Bring back the Boreal” project, collected over a 5-year period. The data shows the successful regrowth of natural tree species in the CBHNP, specifically the North and French Mountain regions. The ecological integrity of these regions is being continually monitored through the Resource Conservation section of Parks Canada and shows significant success of reduction of hyperabundant moose populations as well as prominent forest regeneration.

## IDENTIFICATION AND CHARACTERIZATION OF PROTEASE ACTIVITY AND POTENTIAL PROTEIN BIOMARKERS OF STRESS IN THE EPIDERMAL MUCUS OF THE ATLANTIC STURGEON (*ACIPENSER OXYRINCHUS OXYRINCHUS*)

PRESENTER: ANNA MURPHY

Supervisor: Dr. Michael Stokesbury, Dr. Russell Easy

Of the 27 sturgeon species globally, 19 are listed as “Endangered” or “Critically Endangered” by the International Union for the Conservation of Nature (IUCN). Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*) are listed by the IUCN as “near threatened”. They are a long living, anadromous fish, with a distribution ranging the east coast of North America from Georges River, Labrador, south to the Gulf of Mexico coast of Florida. In Canada, Atlantic sturgeon support small commercial fisheries in the Saint John River, NB and the St. Lawrence River PQ. Atlantic sturgeon spend much of their marine feeding phase in near shore environments where they may encounter anthropogenic stressors including capture as by-catch in marine fisheries, and interaction with coastal engineering projects such as developments for harvesting tidal power. These anthropogenic stressors can cause physiological and behavioral changes in the fish that can negatively impact their viability. This study used a proteomic approach to identify and characterize indicators of stress by identifying proteins and enzymes found in Atlantic sturgeon skin mucus during stressful events. Skin mucus samples were collected from Atlantic sturgeon in the Minas Basin in June/July 2018 after capture by brush weir and otter trawl. Captured fish



were sampled before and after surgical implantation of acoustic-tags. This research aims to identify potential protein biomarkers of stress in the epidermal mucus of Atlantic sturgeon that will enable researchers to form predictive models of physiological reactions to stressful events, including gear specific capture, and surgical tag implantation.

## DOES LAND-USE AFFECT BIRD ABUNDANCE

PRESENTER: JACOB PROSSER

Supervisor: Dr. Jeff Houlihan

Birds fill many roles within ecosystems such as seed vectors, pollinators, and provide provisioning and regulating services. Reduction or removal of these key functions would result in millions of economic losses. Growing concerns over increased habitat change, fragmentation, and loss have led to increasing conservation work. I investigated the ability of two machine learning approaches (random forest and boosted trees) to model the relationship between bird abundances and land-use throughout the United States. Bird abundance data was acquired from the North American Breed Bird Survey (BBS); the BBS is an international bird monitoring program performed by skilled amateur and professional ornithologist along BBS routes during the height of breeding season. Land-use data was gathered by the Multi-Resolution Land Characteristics (MRLC) consortium. The MRLC compiled the data from satellite imagery collected at a resolution of 30 x 30 meters. The models produced a mixed ability to accurately predict abundances based on land-use. Of the 21 species tested 13 of the models resulted in the model better predicting abundance compared to the mean (PE |0.296| - | 40.017|). The models were shown to better predict the training data compared to the test data for 12 of 21species. A high R2 was shown to have a negative predictive ability on the training dataset models.

## EXPLORING ARBUSCULAR MYCORRHIZAL FUNGI OF *EX SITU* EASTERN MOUNTAIN AVENS, *GEUM PECKII* PURSH (ROSACEAE) IN DIGBY COUNTY AND KINGS COUNTY, NOVA SCOTIA.

PRESENTER: REBECCA S. DODGE

Supervisor: Dr. Robin Browne, Dr. Allison Walker

*Geum peckii* (Rosaceae) is a rare and endangered flowering herbaceous perennial that only exists atop the White Mountains of New Hampshire and among coastal peatlands of Digby County, Nova Scotia. A drastic decline in numbers following agricultural ditching events of Big Meadow Bog on Brier Island has spearheaded research towards ways of understanding and protecting this wetland species, recently through *ex situ* conservation research. The objective of this study was to characterize and identify arbuscular mycorrhizal fungi (AMF) associated with *Geum peckii* from *ex situ* locations in Digby County and Kings County. AMF are a common form of plant-root symbiosis that allow an exchange of nutrients and carbohydrates between the two partners and has been documented for its beneficial influence on plants as well as restoration of degraded lands. The seed bank at Acadia University was used to develop



a population of *G. peckii* in tissue culture and subsequently outplant them into Balancing Rock bog on Long Island, Digby County. The plants were either inoculated with a commercial mycorrhizal inoculant, a Brier Island mycorrhizal inoculant, or left untreated. Plant and peat samples from this population were collected and analyzed for presence of AMF using root staining techniques, microscopy, DNA extractions and phylogenetic analyses. AMF was confirmed to be colonizing *G. peckii* on Long Island, with median per cent root colonization ranging from 40-49%. However, no significant differences were found between inoculated vs. non-inoculated plants both in per cent colonization and with vegetative morphologies. Using the above techniques, a separate *ex situ* research plot of *G. peckii* at the K.C Irving Center was determined to contain a potential *Glomus sp.* This is the first time AMF have been taxonomically identified in *G. peckii*, but it is unclear the identity of species in the Long Island population. The information from this study will hopefully help to inform future research on *Geum peckii* and aid in the recovery of this rare and endangered species in Nova Scotia.

## EFFECTS OF INVASIVE FISH PREDATORS ON ATLANTIC SALMON (*Salmo salar*) SMOLT SURVIVAL

PRESENTER: SHAWN FEENER

Supervisor: Michelle Gray, Edmund A. Halfyard, Brooke Nodding

Atlantic salmon (*Salmo salar*) populations are declining throughout most of their range. In some rivers, they have been extirpated entirely. There are many factors causing the widespread declines; however, the purpose of this research is to observe the freshwater survival rates of Atlantic salmon smolt within the freshwater habitat and how they are affected by invasive fish predators. More precisely, to measure the predation rates by chain pickerel (*Esox niger*) and smallmouth bass (*Micropterus dolomieu*) on the Atlantic salmon smolt during their downstream migration of the LaHave River, Nova Scotia. To measure predation on the smolt there are two important questions to answer. Firstly, what are the populations of the invasive species? Populations were estimated using a mark and recapture method where a subset of the population was marked and released, then recaptured and recorded. Secondly, what are the predation rates of smolt by the invasive species? This research will be completed in 2019 using a gastric lavage technique to obtain stomach contents of the invasive species. Knowing what the invasive species are consuming and how much will allow us to create a diet. Once we have estimated the populations of invasive species and we have created a diet for the invasive species, we can then estimate the level of impact these invasive fish predators have on Atlantic salmon smolt during their migration to saltwater.



## A PRELIMINARY INVESTIGATION INTO THE REMEDIATION OF OIL SPILLS USING BIODEGRADABLE IONIC LIQUID OIL DISPERSANTS

PRESENTER: KATRINA TURRIE

Supervisor: Clyburne, Jason A.C.

*Other: Sherren, Cody N.; Murphy, Luke J.; Thamer, Peter; King, Thomas; Robertson, Katherine N.*

Oil spills caused by leaking ships, damaged wells, and other industrial practices have led to increased pollution of our oceans. Oil can be catastrophically damaging to aquatic ecosystems and can therefore indirectly affect those who make a living on and around the ocean. Efforts to contain and remove spills are often no better for the environment than the oil they are trying to remove. We have prepared and characterized a number of biodegradable oil dispersants using ionic liquids. These could potentially facilitate the rapid dispersal of oil slicks allowing the smaller particles to be degraded and removed through natural processes, i.e. microbial digestion. We have tested the dispersion capabilities of four ionic liquids, choline oleate, choline laurate, choline linoleate, and choline erucate using the standard Baffled Flask Test. The results suggest that the ionic liquids are, in fact, capable of dispersing oil and, through further refinement, may be applicable in treating large scale oil spills.