

# Science Atlantic

Environment Conference

Advancing Policy with Science

Science Atlantic Environment Conference 2018  
Mount Allison University  
March 16<sup>th</sup> – 18<sup>th</sup>



## Abstracts: Posters (alphabetical by surname)

### **Uranium in sediment, a potential environmental impact indicator of shale gas exploitation for the Kennebecasis river watershed in New Brunswick?**

Primary & presenting author: **Hamza Ben Yaala**, Graduate Student, Université de Moncton

Other authors: Delphine Foucher

Supervisor(s): Dr. Olivier Clarisse

While technological development can enhance productivity of natural resources, it can also lead to the enrichment of naturally occurring chemical elements, increasing environmental and human health risks. In the case of unconventional shale gas exploitation, hydraulic fracturing and horizontal drilling, are suspected of inducing the mobilization of contaminants from shale rocks and other subsurface environments to surface water leading to the pollution of these aquatic ecosystems. In the recent years, numerous indicators including natural gas and their C and H isotopic fingerprints, noble gas (He), uranium and other radionuclides (Ra, Sr) has been proposed to investigate fracking environmental impact. In our study, we have decided to focus on uranium in the Kennebecasis river, the single area where active shale gas exploitation have occurred continuously in New Brunswick for the last 15 years. In 2015 and 2017, 61 surface sediment samples were collected in the Kennebecasis river watershed, upstream and downstream the existing producing gas well. Sediment samples were dried, grinded and sieved in 6 fractions to determine the granulometric distribution of U. Prior to be analysed by ICP-MS, all samples were digested using acidic solutions (HF/HNO<sub>3</sub>/HCl). Likewise other trace element, uranium is enriched in the finer fraction highlighting the higher affinity of this radionuclide for clay and silt materials. Uranium concentrations in the finer sediment fraction range from 1.7 to 4.7 µg/g with higher concentration systematically measured downstream existing producing wells. The latter result pinpoint, even if it remains limited, a potential environmental impact of shale gas exploitation.

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### **Contributions of biochar and arbuscular mycorrhizal fungi to the growth of *Geum peckii* (Eastern Mountain Avens)**

Primary & presenting author: **Jacqueline Bradbury**, Undergraduate Student, Acadia University

Supervisor(s): Dr. Robin Browne, Dr. Juan Carlos Lopez, and Dr. Allison Walker

*Geum peckii* (Eastern Mountain Avens) (Rosaceae), a perennial plant species found in sphagnum peat bog habitats in Nova Scotia, is assessed as imperiled globally, critically imperiled nationally and endangered provincially. The only population of *G. peckii* in Canada occurs in Digby County, Nova Scotia and has declined 64% since 1986. Conservation methods for protecting ex situ populations of *G. peckii* along with in situ strategies are required to help mitigate the potential extinction of this species. Investigations of the contributions of arbuscular mycorrhizal fungi and biochar to the growth of *G. peckii* may lead to more efficient tissue culture and out planting techniques for restoration purposes. To identify potential arbuscular mycorrhizal fungi associated with *G. peckii*, DNA extractions were completed on root material from plants grown in the experimental gardens at the K. C. Irving Environmental Centre. Fungal DNA was not detected in these roots using PCR with arbuscular mycorrhizal fungi specific primers. Two greenhouse out planting trials were completed using native arbuscular mycorrhizal fungi inoculum from Brier Island, Digby County, Nova Scotia, and differing concentrations of nutrient charged biochar. Greenhouse out planting trials indicate that using high concentrations of biochar could negatively impact the growth of *G. peckii*. Addition of native arbuscular mycorrhizal fungi inoculum increased *G. peckii* root length if biochar was absent, but decreased root length in the presence of biochar. This study will contribute to increasing the efficacy of out planting *G. peckii* in the future.

## Marine fungal diversity of Nova Scotia

Presenting author: **Deniz Divanli**, Undergraduate Student, Acadia University

Primary author: Allison Walker

Other authors: Sarah Adams, Allison Walker, and Deniz Divanli

Supervisor(s): Dr. Allison Walker

The fungal diversity of Nova Scotian saltmarshes, the tidal marine environments of the Bay of Fundy and the Atlantic coast are underexplored. We are expanding our knowledge of the marine fungal diversity in the waters surrounding Nova Scotia and determine which of the fungi present have potential use in bioremediation after oil spills or in restoration of saltmarsh habitats. There is considerable potential for the discovery and characterization of many new marine fungal species. Collections of sea water, marine sediments and saltmarsh and algal detritus floating in sea water have been taken since the summer of 2015 from sites including Apple River, Kingsport, Halls Harbour, Brier Island, and Bon Portage Island, Nova Scotia. Samples are placed onto saltwater media (saltwater potato dextrose agar, and saltwater agar containing antibiotics) selective for marine fungi. Detrital marine wood and plant samples are incubated in sterile damp chambers to allow for the emergence of fungal reproductive structures used for microscopic identification. DNA extraction and amplification is completed on axenic cultures. ITS rDNA barcode sequences are identified using the online reference sequence database NCBI Genbank. From 11 locations sampled in Nova Scotia, 101 fungi have been identified from marine habitats and two have been confirmed as new fungal species.

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## *Delia* species: identification and impact in commercial onion in Nova Scotia

Primary & presenting author: **Maggie MacDonald**, Undergraduate Student, Acadia University

Other authors: Kirk Hillier and Suzanne Blatt

Supervisor(s): Dr. Kirk Hillier and Dr. Suzanne Blatt

Onion maggot, *Delia antiqua* (Meigen) (Diptera: Anthomyiidae) is considered the predominant *Delia* pest. It is unknown whether *D. antiqua* alone is damaging onion or if it is part of a complex with *D. platura* (Meigen) and *Delia florilega* (Zetterstedt). Objectives of this research are to identify the *Delia* species present in commercial onion fields and quantify the impact of each species on onion development. This project has two components: 1. Commercial field assessments - to determine which *Delia* species are present in commercial onion fields and at what stage of development they are causing damage. 2. Host stage preference assessments - to determine whether *Delia* species (*D. platura* and *D. antiqua*) prefer particular plant growth stages for oviposition and which stages are most impacted by larval feeding under controlled conditions. Results from these experiments have found *D. platura* to have little impact on onion success while *D. antiqua* causes unmarketable damage to onions at all growth stages. Commercial field assessments revealed minimal damage from *Delia* species and the predominant species identified from sticky trap was *D. platura*. Growth chamber studies using *D. antiqua* and *D. platura* are evaluating oviposition preference for onion developmental stages. Although *Delia* flies showed no preference for specific onion stages in the field, results from growth chamber studies suggest that *D. antiqua* females prefer to oviposit on mature onion plants at the 2 true leaf and 5-7 true-leaf growth stages.

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## **Whimbrel (*Numenius phaeopus*) stopover in the Acadian Peninsula: An application of habitat classification using remote sensing**

Primary & presenting author: **Jessie McIntyre**, Undergraduate Student, Mount Allison University  
Supervisor(s): Dr. David Lieske and Dr. Diana Hamilton

Remote sensing (RS) technologies have a wide range of applications including conservation biology. RS can be used to gain knowledge about a species' ecosystem and land use changes that may be critical for their survival. Whimbrel (*Numenius phaeopus*) are a large long-distant migratory shore bird that stops in Acadian Peninsula NB and Atlantic Canada in late summer to refuel for their fall migration to South America. The Acadian Peninsula is the northeastern-most portion of NB which consists of a narrow mainland and two small islands with extensive wetlands, many commercial blueberry and peat farms. Whimbrel, who traditionally fed on coastal bogs have moved inland to a denser prey base to forage in newly expanded commercial blueberry farms but have experienced harassment from farmers as they are seen as a threat to crops. In order to further understand their stopover region, I quantified the amount of key land uses including commercial blueberry and peat farms through eCognition, an object-oriented image classification software using high quality satellite imagery. Whimbrel tracking data gathered from nano and satellite tagged birds caught on the peninsula were combined with classified habitats to allow further understanding of their movement in the stopover region.

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## **Comparing fungal diversity: Identifying target species for mycoremediation of pulp mill waste in Nova Scotia**

Primary & presenting author: **John Tweedie**, Undergraduate Student, Acadia University  
Other authors: Sarah Adams  
Supervisor(s): Dr. Allison Walker

Mycoremediation is the use of fungi for bioremediation of environmental contaminants, and is a promising method of repairing anthropogenic environmental damage. Fungi possessing lignocellulose-degrading enzymes are of interest for the remediation of waste requiring hydrocarbon degradation, such as pulp mill waste. The purpose of this research was to provide insight into the fungal diversity present at several sites with relation to their proximity to a pulp mill, and to identify target species for remediation research. Fungi from these sites were cultured from decaying wood, water, and sediment. DNA barcoding and phylogenetics were used to identify the fungal species collected. Over 50 fungal species were identified, including a number of species that appear to be previously unidentified. Differences in fungal communities are discussed with relation to sites and substrates sampled, and culture media used. Species profiles for each site and links to toxin degradation from literature may be used to identify target species for further research regarding their remediation capabilities.

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Abstracts: Oral (by day, then session, then time)

Saturday, March 17<sup>th</sup>

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Room: Dunn 106

Session theme: Freshwater aquatic (mostly physical)

Time: 9:30 am

### **Microplastic export from waste water treatment plants in New Brunswick rivers**

Primary & presenting author: **Taylor Crosby**, Undergraduate Student, Mount Allison University

Supervisor(s): Dr. Joshua Kurek

Microplastics are a ubiquitous contaminant found worldwide in terrestrial, freshwater, and marine environments. These contaminants are defined as any plastic smaller than 5mm. They cause concern once they enter the food web. There are high abundances known to exist in the ocean but relatively few studies focus on freshwater microplastic contamination. This study focuses on 10 sites in 7 different rivers across South-Eastern New Brunswick receiving varying amounts of waste water effluent. We investigated whether waste water treatment facilities are a point source for microplastics and if they are being transported further downstream. Using standard methods, water column samples and sediment samples were collected upstream and downstream from treatment facility effluent discharge points, which are predicted to be a source of this contaminant. Microplastics were present in every sample that was collected. In comparing samples collected upstream and downstream we determined based on our observations that more plastics were found proportionally downstream of waste water treatment outfalls. Our findings aid in the understanding of the origin of microplastics in the aquatic environment to mitigate for their impact on ecosystem health.

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Room: Dunn 106

Session theme: Freshwater aquatic (mostly physical)

Time: 9:45 am

### **Investigation of legacy methane seepage into freshwater food webs using novel applications in Stoney Creek, New Brunswick**

Primary & presenting author: **Ifedayo Abel-Adegbite**, Undergraduate Student, UNB Fredericton

Other authors: Brian Hayden and Michelle Gray

Supervisor(s): Dr. Michelle Gray and Dr. Brian Hayden

Legacy oil, gas, and coalfields in the Maritime region have emitted methane into the surrounding ecosystem for more than 100 years. Methane escaping from these legacy sites may have effects on the surrounding environment; for both terrestrial and aquatic environments. In order to determine if fugitive methane is entering freshwater streams and is being incorporated into the local biological food webs, we investigated whether methane could be detected entering freshwater streams in via groundwater inputs in an area with abandoned and active oil and gas wells. Introduction of an unnatural compound, such as fugitive methane, could act as an environmental stressor and, if detrimental, should impact the local food web starting at the lowest trophic level. We predicted that if methane was entering freshwater streams and being incorporated into the food web, we could use stable isotopes as a reliable detection tool. Fugitive methane would have a distinct isotopic carbon signature and could be traced through the various biotic compartments. This project also focused on the novel application of using a small thermal imaging camera to help detect subsurface groundwater inputs into the

stream for site selection. Using this temperature sensing technology, we found and selected 5 suspected groundwater sources flowing into the stream channel. We aimed to collect biofilm (e.g. bacteria, algae, diatoms), benthic macroinvertebrate, and fish from both upstream and downstream of each input site, but with small streams low summer water levels, we were unable to adequately sample the fish community. Stable isotope analysis of the biofilm and benthic macroinvertebrates did not show obvious incorporation of fugitive methane into the food web, though some values were suspect. There are still some research questions that could be explored before ruling this application out as a tool to find and measure fugitive methane emissions in the environment. Additionally, we completed a diatom community assessment applying the Eastern Canadian Diatom Index (IDEC) as a measure of the biological integrity of streams and were able to show that our study sites in the Stoney Creek region are currently considered “slightly polluted”, with a few select locations bordering on “polluted”. These study results raise more questions than they answer but serve as an exploration and application of tools and techniques that have not previously been applied in this context.

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Room: Dunn 106

Session theme: Freshwater aquatic (mostly physical)

Time: 10:00 am

### **Application of the paleolimnological method in the environmental assessment of effluent-influenced freshwater sediment: An example from Northern Nova Scotia**

Primary & presenting author: **Baillie Holmes**, Undergraduate Student, Acadia University

Other authors: Kirklyn Davidson (Acadia)

Supervisor(s): Dr. Ian Spooner (Acadia), Dr. Craig Lake (Dalhousie), Dr. Tony Walker (Dalhousie), Dewey Dunnington (Dalhousie)

A former estuary in Pictou Co., NS began receiving effluent in 1967 from a pulp mill. In 1972 a dam was installed, and the estuary was transformed into a freshwater pond. A paleolimnological approach was applied to the bulk geochemical assessment of the sediment that has accumulated at the site. The sediments in the receiving pond reflect the estuarine and fresh water phases of the water body and comprise marine-influenced clastic sediment overlain by dominantly organic freshwater sediment. This study focused on identifying the sources of metals in the freshwater phase that were identified as representative of impact at the site. Samples were obtained by gravity coring, and metal analysis was accomplished with pXRF. Sediments were also obtained from a nearby freshwater lake and parallel analyses provided baseline reference concentrations for all bulk geochemical parameters. Data was analyzed in R and plotted using QGIS. At both the receiving pond and reference site, metal concentrations generally exceeded Interim Sediment Quality Guidelines; a strong local geogenic and atmospheric contribution is inferred. There appeared to be no strong spatial trend that would be indicative of metal concentrations being localized to specific regions of the basin. Metal concentrations were generally highest at the top of the receiving pond sediment. These data suggest that the composition of the receiving pond sediment may strongly influence the retention of metals. Results of this study demonstrate that geogenic and local atmospheric contribution to metal load at contaminated sites must be determined if site assessment and remediation techniques are to be effective.

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Room: Dunn 106  
Session theme: Freshwater aquatic (mostly physical)  
Time: 10:15 am

### **Effects of helicopter liming on stream water chemistry in an experimental catchment in Nova Scotia, Canada**

Primary & presenting author: **Lobke Rotteveel**, Undergraduate Student, Dalhousie University  
Other authors: Shannon Sterling, Edmund Halfyard  
Supervisor(s): Dr. Shannon Sterling, Dr. Edmund Halfyard (Nova Scotia Salmon Association)

Terrestrial application of limestone via helicopter (helicopter liming) is a freshwater acidification mitigation technique which has been successfully used in European countries to increase stream pH and decrease dissolved aluminum concentration, producing long term water quality improvements. Despite the observed successes of helicopter liming in prior studies, very little liming research and efforts have been conducted in Canada, and specifically, Nova Scotia. Therefore, freshwater response to terrestrial liming is poorly understood within the province and Canada. This research aimed to evaluate the effectiveness of helicopter liming, which is novel to Canada, at mitigating freshwater acidification in the chronically acidified Keef Brook catchment in Sheet Harbour, Nova Scotia. This observational study documented and quantified the changes caused by helicopter liming conducted by the Nova Scotia Salmon Association, where dolomitic limestone ( $\text{CaMgCO}_3$ ) was applied to the riparian zone of the Colwell Creek and MacGregor Brook subcatchments of the Keef Brook watershed. Statistical analysis indicates that water quality significantly improved at treatment sites with respect to pH levels and calcium concentrations, and improved without significance for dissolved aluminum concentrations, while water quality significantly worsened with respect to all aforementioned parameters at control sites. The significant improvements of water chemistry following helicopter liming, especially considering the continued degrading of water quality at the control sites during the same time period, indicate that helicopter liming could be an effective method to mitigate chronic freshwater acidification, increase freshwater habitat productivity, and increase the chemical habitat suitability for the endangered Atlantic salmon subpopulations in Nova Scotia.

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Room: Dunn 108  
Session theme: Spatial & Social  
Time: 9:30 am

### **Characterizing ICI textile waste in Halifax, Nova Scotia**

Primary & presenting author: **Emily Bibeau**, Undergraduate Student, Dalhousie University  
Supervisor(s): Dr. Michelle Adams

Clothing and other textiles continue to account for 12% of the municipal waste stream in Nova Scotia, with half originating from non-residential sources. Indeed, the textile management process among institutions, businesses, and industrial (ICI) organizations in developed jurisdictions remains largely unexplored relative other recyclable materials. As a leader in solid waste management, there is a need to understand the distribution of ICI textiles entering the waste stream in Nova Scotia. This study intends to characterize textile waste within Nova Scotia's ICI sector, providing baseline information on waste quantities, existent management practices, as well as the benefits of and barriers inhibiting textile diversion among ICI organizations. This will be accomplished by interviewing representatives from organizations that produce textile waste in Nova Scotia, with a focus on the Halifax area. To provide background information, interviews will also be sought with waste management stakeholders involved with diversion operations at the regional level. Further, a jurisdictional review will identify any best management practices among exemplary businesses with regards to their textile waste diversion. This exploratory study on ICI textile waste serves to advance textile waste diversion in Nova Scotia by informing future policy decisions, EPR initiatives, and provincial waste management strategies.

Room: Dunn 108  
Session theme: Spatial & Social  
Time: 9:45 am

### **Urban tree canopy coverage**

Primary & presenting author: **Chantelle Fynn**, Undergraduate Student, Dalhousie University  
Supervisor(s): Dr. Daniel Rainham

Urbanization has highlighted the importance of vegetation in city environments. The influx of people into city centres is concentrating larger populations into smaller areas, and this is having a negative impact on the environment. Urban vegetation, particularly urban trees, provides a range of environmental and social benefits to mitigate the negative effects of urbanization. The rapid expansion of city centres is also negatively impacting some residents' access to urban trees and the benefits that they provide. This project will determine whether there is a difference in the distribution of trees amongst neighbourhoods in the urban Halifax Regional Municipality and investigate whether this difference is related to socioeconomic status. Socioeconomic status will be measured using deprivation, where low deprivation equals a higher socioeconomic status, and high deprivation equals a lower socioeconomic status. The relationship between socioeconomic status and tree canopy coverage were analysed using ARC Geographic Information Systems. The 2007 QuickBird multi-spectral satellite imagery and the 2006 Material and Social Deprivation Index were used to determine the tree canopy coverage and socioeconomic status in each neighbourhood in the urban Halifax Regional Municipality. Preliminary results showed that there is a positive correlation between socioeconomic status and tree canopy coverage. Neighbourhoods with high deprivation had lower tree canopy coverage than neighbourhoods with low deprivation. This study's results will help Halifax city planners provide greater access to the benefits of urban trees to more neighbourhoods in the urban Halifax Regional Municipality.

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Room: Dunn 108  
Session theme: Spatial & Social  
Time: 10:00 am

### **Assessing the vulnerability of the HRM urban and rural canopy to the potential arrival of the emerald ash borer**

Primary & presenting author: **Heba Jarrar**, Undergraduate Student, Dalhousie University  
Supervisor(s): Dr. Peter Duinker

Invasive species are an ever-increasing problem in urban and rural forests, and have the potential to severely decimate tree populations. The Emerald Ash Borer is one such invasive species, which targets ash trees. Ash trees are ecologically, socially and economically valuable trees. The Emerald Ash Borer is predicted to move into Nova Scotia, and this is of concern to many forest managers. In this study, I assessed the vulnerability of ash trees in the urban and rural Halifax Regional Municipality to the potential arrival of the Emerald Ash Borer. This assessment was conducted using spatial data compiled from different studies and sources. The locations of ash trees were extracted from these datasets to get a spatial distribution of the ash trees in the Halifax Regional Municipality. An assessment of the distribution was then conducted using the tree metrics provided in the data (e.g. Diameter at breast height (DBH), stem count/plot), the dispersal pattern of ash trees, and the existing literature on Emerald Ash Borer dispersal. The objective of the study is to show how the urban and rural forest will be affected by the Emerald Ash Borer. The spatial distribution will provide forest managers a clear depiction of which areas may be affected the most. It will also aid in deciding which mitigation practices can be put in place to contain the spread of Emerald Ash Borer should it arrive to Nova Scotia.

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Room: Dunn 108  
Session theme: Spatial & Social  
Time: 10:15 am

### **Assessing awareness of ticks and Lyme disease and the impact of geospatial visualization on public perception of risk**

Primary & presenting author: **Anna Jamieson**, Undergraduate Student, Mount Allison University  
Supervisor(s): Dr. David Lieske

Understanding the spatial distribution of ticks in the Maritime provinces is a prerequisite for raising public awareness of ticks and Lyme disease and, consequently, preventing the spread of the disease. During this collaborative project, a web-based geographic information system was developed to make it possible for citizens to view the spatial information collected by the Lloyd tick lab at Mount Allison University. The displayed information encompassed geographic records of three species (*Dermacentor*, *Ixodes cookei*, and *I. scapularis*) gathered between 2012-2016, and incidence of canine Lyme disease. In the case of canine Lyme, a hotspot analysis was conducted using a kernel density algorithm implemented in R and ArcGIS. Following the creation of the Information Portal ([maritimetickmaps.ca](http://maritimetickmaps.ca)), focus groups were held to examine risk assessment and awareness of ticks and Lyme disease. Fifteen participants were gathered from the Tantramar area, presented with a basic overview of the project, and then invited to interact with the website. Focus group questionnaires, in combination with a series of “task related” questions, were used to measure public awareness. Information from the focus groups, prior to and following interaction with the website, was a valuable way to assess the degree to which participant perception may have changed. The Mount Allison Tick Information Portal is an effective way to communicate the spatial patterns of ticks and Lyme disease. It is anticipated that the information portal will raise public awareness and help to lower the risk of Lyme disease transmission via tick bites across the Maritimes.

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Room: Dunn 106  
Session theme: Freshwater aquatic (mostly biological)  
Time: 11:00 am

### **Quantifying land use/cover change and eutrophication in the Carleton River Watershed, Yarmouth County, NS**

Primary & presenting author: **Adam Buchholz**, Undergraduate Student, Dalhousie University  
Supervisor(s): Dr. Christopher Greene

A number of rivers and watershed systems in Southwestern Nova Scotia, Canada have experienced an increase in total phosphorus levels over the past three decades. As a consequence, artificial eutrophication and algal blooms have gained prevalence within these local systems and have prompted concern over the environmental and human-health consequences surrounding them. Studies have shown that eutrophication can be correlated with land use/cover changes. Anthropogenically-induced eutrophication can result when an environment becomes inundated with excess nutrients, such as phosphorus, from residential, industrial or agricultural operations. These excess nutrients boosts primary productivity and can cause algal blooms and increased plant growth. Due to high turnover-rates, the subsequent death and decays of these algae and aquatic plants can then result in increased biological oxygen demand and oxygen deprived environment, with a reduced capacity to support aquatic species. This study examines the extent to which land use/cover change has occurred in the Carleton River system in the past, and attempts to determine if there is a correlation between water quality and land use/cover change. The study uses remote sensing imagery and geographic information systems (GIS) to analyze land use/cover change. A secondary analysis of water quality data was conducted using Statistical

Package for the Social Sciences (SPSS). Preliminary statistical test results show that there has been significant change with respect to the water quality indicators (total phosphorous, total nitrogen, nitrite-nitrate and pH), additionally showing that location is positively correlated with total phosphorus, total nitrogen and nitrite-nitrate. Analysis of Landsat imagery is ongoing.

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Room: Dunn 106

Session theme: Freshwater aquatic (mostly biological)

Time: 11:15 am

### **Littoral Cladocera distribution in acid and circumneutral lakes**

Primary & presenting author: **Caeleigh Marshall**, Undergraduate Student, Mount Allison University

Supervisor(s): Dr. Joshua Kurek

Shallow lake environments provide crucial habitat for freshwater zooplankton, yet these environments can be heterogenous, as well as highly susceptible to stressors, such as water quality and habitat degradation. Research suggests that habitat structure is more influential to zooplankton than water quality changes. I used paleolimnological techniques to examine zooplankton (Cladocera) community composition in shallow New Brunswick lakes. I sampled macrophytes, surface substrates, and sediment cores from three circumneutral (pH > 7) and three acidic (pH < 6) lakes. Habitats were qualitatively assessed using macrophyte coverage and substrate type. Modern and pre-1900 sediments were used as proxies for overall temporal changes. Statistical analyses will quantify relative variation in Cladocera composition between lakes and shallow-water habitats. If habitat structure is important to cladoceran community composition, then I expect to observe greater differences within lake environments than between acid and circumneutral lakes. Results will lead to a better understanding of the relative influence of environmental factors on bioindicator distributions.

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Room: Dunn 106

Session theme: Freshwater aquatic (mostly biological)

Time: 11:30 am

### **DDT impacts on benthic invertebrate communities in New Brunswick lakes**

Primary & presenting author: **Marley Caddell**, Undergraduate Student, Mount Allison University

Supervisor(s): Dr. Joshua Kurek

During the mid-20<sup>th</sup> century, forestry stakeholders in New Brunswick (NB) operated arguably the world's largest aerial insecticide spray program to manage outbreaks of spruce budworm. Over 12 million lbs of DDT, an organochlorine insecticide that bioaccumulates, bioconcentrates in food webs, and is persistent in the environment, was used between ~1950 and 1970 across >50% of NB. In aquatic ecosystems, many invertebrates are recognized as sensitive to organochlorines when probable effects levels are exceeded. Chironomids, non-biting benthic invertebrates that experience high exposure to DDT, are very abundant, well-preserved, and easily identifiable in lake sediments and thus act as bioindicators of environmental stress. I used chironomid and *Chaoborus* remains from three NB lakes to assess community responses to historic DDT concentrations within dated sediment cores. My goal was to investigate long-term ecological recovery. Within all three lakes, chironomid concentrations prior to DDT use (<1950) were greater than the post-spray period. *Chaoborus* concentrations, another invertebrate that is sensitive to organochlorine, also decreased following DDT use. Overall, fewer primary and secondary consumers in aquatic food webs demonstrate that aquatic invertebrates have not recovered after the ban on DDT in ~1970. This research highlights potential legacy effects of chemical stressors used over 50 years ago.

Room: Dunn 106  
Session theme: Freshwater aquatic (mostly biological)  
Time: 11:45 am

### **Water and sediment chemistry influences on mercury bioaccumulation in freshwater invertebrates from two lakes in Kejimikujik National Park, Nova Scotia**

Primary & presenting author: **Rachel Clarke**, Undergraduate Student, Acadia University  
Supervisor(s): Dr. Nelson O'Driscoll, Dr. Kirk Hillier, Dr. Sara Klapstein

Mercury is a trace metal and a toxic environmental pollutant that can be deposited in remote ecosystems and result in adverse effects on the health of organisms. Elevated mercury levels near the bottom of the food web have implications for significant mercury transfer to higher trophic organisms. Caddisfly larvae, mayfly naiads, lake water, and benthic sediment were collected from two lakes and one wetland catchment in Kejimikujik National Park, Nova Scotia. Methylmercury (MeHg) was analyzed in all samples using gas chromatography-atomic fluorescence spectroscopy (AFS). Evidence suggests that caddisfly MeHg concentration was more highly correlated with sediment MeHg concentration at all locations, while mayfly MeHg concentration was more correlated with water MeHg concentration (at two locations only), although no results were significant. Across all sampling sites, pH had a negative correlation with concentration of MeHg in caddisflies and mayflies, though correlations with caddisflies were not strong. Most sediment and invertebrate samples and all water samples from the wetland catchment were significantly higher in MeHg concentration than the lake locations. No significant relationships were observed between MeHg concentration and sediment MeHg concentration. Results indicate that mayflies are more influenced by water characteristics. Analysis of MeHg bioaccumulation in aquatic invertebrates and the relationships with water and sediment characteristics are key and more research into MeHg bioaccumulation is necessary to better understand food web transfer.

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Room: Dunn 108  
Session theme: Atmospheric  
Time: 11:00 am

### **Development and validation of an autonomous measurement system for soil CO<sub>2</sub> and CH<sub>4</sub> in the Arctic**

Primary & presenting author: **Renée McDonald**, Undergraduate Student, StFX University  
Other authors: Jack Johnson  
Supervisor(s): Dr. Dave Risk

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, and initial data

appears promising. Our approach represents an evolutionary step forward for autonomous gas monitoring in high-latitude environments.

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Room: Dunn 108  
Session theme: Atmospheric  
Time: 11:15 am

### **Sensitivity analysis of spectroscopic retrievals of atmospheric composition**

Primary & presenting author: **Taylor Gray**, Undergraduate Student, Saint Mary's University  
Supervisor(s): Dr. Aldona Wiacek

The Tropospheric Remote Sensing Laboratory (TRSL) uses a Fourier transform infrared (FTIR) spectrometer to record atmospheric trace gas absorption spectra in a horizontal segment of the troposphere at the Earth's surface, so called open-path FTIR spectroscopy. Spectra acquired in this way are analyzed using a nonlinear least squares (NLLS) fitting routine. A forward model of atmospheric absorption is iteratively adjusted to determine the concentration of trace gases and instrumental parameters which lead to a best fit between measured and modelled spectra. In atmospheric physics, this process is called a retrieval. A sensitivity analysis of the NLLS routine "MALT" was performed to characterize the behaviour of retrievals of NO<sub>2</sub>, which is an important atmospheric trace gas involved in tropospheric O<sub>3</sub> production. Retrieval parameters such as NO<sub>2</sub> spectral band, spectral window width, water vapour concentration, atmospheric path length impact the information content of the spectra with respect to the target gas (NO<sub>2</sub>) and the stability of the computational retrieval process itself. This talk will give an overview of these effects in the search for an optimal NO<sub>2</sub> retrieval.

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Room: Dunn 108  
Session theme: Atmospheric  
Time: 11:30 am

### **Characterizing chemical composition of ambient fine particulate matter (PM<sub>2.5</sub>) in Halifax, Nova Scotia**

Primary & presenting author: **Michael Smith**, Undergraduate Student, Dalhousie University  
Supervisor(s): Dr. Jong Sung Kim

Air pollution is a growing environmental problem around the world, worsening air quality and contributing to climate change. Fine particulate matter (PM<sub>2.5</sub>) is a common component of air pollution that is of great concern due to its threat to human health and variable temporal and spatial chemical composition. The chemical composition of ambient fine particulate matter was investigated over Halifax, Nova Scotia from December 2011 to November 2016. Fine particulate matter samples were collected over this five-year period in downtown Halifax through the Canadian National Air Pollution Surveillance network, and analyzed to determine the chemical composition by the Analysis and Air Quality Division of Environment Canada. For each chemical species comprising the fine particulate matter samples, mean seasonal and annual concentrations were calculated and used to reconstruct the total mass of the sampled fine particulate matter based on its major components, of which include: ammonium nitrate, ammonium sulphate, organic matter, elemental carbon, crustal matter, trace element oxides, sodium chloride, and particle-bound water. This data will provide a better understanding of the chemical composition of fine particulate matter in Halifax and its seasonal and annual variation, and has the potential to provide insight into sources contributing to the fine particulate matter load in Halifax as well as to the health effects of this sampled pollutant.

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Room: Dunn 108  
Session theme: Atmospheric  
Time: 11:45 am

### **Examining the role of regional biogenic precursors in ground level ozone formation in Halifax**

Primary & presenting author: **Morgan Mitchell**, Undergraduate Student, Saint Mary's University  
Other authors: Li Li  
Supervisor(s): Dr. Aldona Wiacek

Ground Level Ozone is a secondary chemical pollutant that is deleterious to the health of plants, animals and humans. The primary precursors to Ground Level Ozone are nitrogen oxides and volatile organic compounds, which in Nova Scotia are largely emitted by mobile sources and natural sources, respectively. As a small urban centre Halifax does not experience levels of air pollution that are characteristic of megacities, however significantly elevated levels of ozone are observed on some days and the chemistry and meteorology behind these high values are not well researched. For example, the fraction of transported ozone from upstream sources has not been clearly established. In addition, this study focuses on the impact of biogenic volatile organic compounds on ozone production in Halifax, as opposed to anthropogenic. By analyzing long-term trends of ozone and its precursors in Halifax the mechanisms behind high ozone periods will be better understood. This research project has significance for policy-makers who are trying to reduce air pollution in growing cities with a changing climate.

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Room: Dunn 106  
Session theme: Estuarine-marine  
Time: 1:30 pm

### **Storage macromolecule accumulation in phytoplankton after nitrate starvation across taxonomic and cell-size ranges**

Primary & presenting author: **Matthew Hamilton Fyfe**, Undergraduate Student, Mount Allison University  
Supervisor(s): Dr. Zoe Finkel

Under periods of nutrient limitation marine microalgae accumulate storage lipids and carbohydrates as a sink for excess carbon and photosynthetic energy, causing increases in their carbon content and changes in their elemental stoichiometry. This study examined the effect of nitrate starvation on lipid and carbohydrate storage and elemental stoichiometry in four microalgal species representing distinct taxa (class bacillariophyceae and prasinophyceae) and a range of cell sizes (2 mm to 100 mm). Findings show that the amount and type (carb vs. lipid) of carbon accumulation varies greatly among phytoplankton with large effects on phytoplankton elemental stoichiometry and biochemical composition. Nitrate starvation led to large increases in C:N all species due to in large part to increasing TAG (storage lipid) accumulation. Prasinophytes had an unusually high TAG content (10.8% of dry mass and 59.2% of total lipids) compared to diatoms (1.6% of dry mass and 16.4% of total lipid) under exponential growth conditions. With nitrate starvation the prasinophytes are also composed of more TAG relative to biovolume (28.3% of dry weight and 89.7% of total lipids) than the diatoms (8.2% of dry weight and 57.2% of total lipids). We speculate that although taxonomic differences are responsible for the discrepancies presented, cell size does influence storage molecule accumulation in cells, highlighting a potential further research direction. These differences will affect how different phytoplankton species affect aspects of ocean biogeochemistry, such as their contribution to the export of carbon, and the relative value of species as biofuel feedstock.

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Room: Dunn 106  
Session theme: Estuarine-marine  
Time: 1:45 pm

### **Macromolecular dynamics of *Thalassiosira weissflogii* under steady-state and non steady-state phosphorus stress**

Primary & presenting author: **Sally Faulkner**, Undergraduate Student, Mount Allison University  
Other authors: Dr. Zoe Finkel and Dr. Justin Liefer  
Supervisor(s): Dr. Zoe Finkel and Dr. Justin Liefer

Phosphorus (P) is a key limiting nutrient in the global ocean. There is relatively little data on the links between P availability and the biochemical and macromolecular composition of marine phytoplankton. To better understand P allocation in phytoplankton across a gradient of P stress, we investigated P content and major macromolecular composition in the common marine diatom *Thalassiosira weissflogii* under three P stress regimes; steady-state P-replete conditions ( $P_{5.0}$ , 5.0  $\mu\text{M}$  phosphate), and two limiting P concentrations; 0.5  $\mu\text{M}$  and 0.25  $\mu\text{M}$  phosphate. Additionally,  $P_{5.0}$  and P-limiting ( $P_{0.25}$ , 0.25  $\mu\text{M}$  phosphate) cultures were allowed to progress into non-steady state P starvation and sampled from exponential to stationary growth phase. Under  $P_{5.0}$  conditions, cellular phosphorus ( $P_c$ ) declined by 96% and total cellular protein declined by 40%. Under  $P_{0.25}$  conditions,  $P_c$  declined by 63% and total cellular protein declined by 8%. Cellular phospholipid P and RNA P content account for an increasing proportion of  $P_c$  present as cells progress to starvation, and comprise an overall higher proportion of  $P_c$  under  $P_{0.25}$  conditions. Based on these results we infer that diatom cells store more P when exposed to high phosphorus conditions. Further work is required to characterize P storage molecules.

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Room: Dunn 106  
Session theme: Estuarine-marine  
Time: 2:00 pm

### **Investigating late fall nitrous oxide gas in aquatic systems draining agricultural watersheds in Prince Edward Island**

Primary & presenting author: **Lauren Muzak Ruff**, Undergraduate Student, StFX University  
Supervisor(s): Dr. Lisa Kellman

Excessive use of nitrogen fertilizers has been shown to lead to the leaching of inorganic nitrogen in the forms of ammonium and nitrate into aquatic systems. This inorganic nitrogen may in turn lead to elevated emissions of the greenhouse gas nitrous oxide ( $\text{N}_2\text{O}$ ) from aquatic systems during transformations in the nitrogen cycle, particularly anoxic events. The production of nitrogen-based fertilizers has more than doubled the supply of nitrogen on the land surface which alters the biogeochemical cycling and causes effects on downstream biological systems. Nitrous oxide is 300x more potent than carbon dioxide as a greenhouse gas and contributes to stratospheric ozone destruction. This study will focus on nitrogen derived from fertilizers that is leached into aquatic systems and transformed and emitted as nitrous oxide. Previous studies have generally focused only on soil emissions of this gas. The purpose of this study is to characterize late fall  $\text{N}_2\text{O}$  dissolved in water from a range of aquatic systems on Prince Edward Island that have a record of high levels of nitrogen loading and anoxia in order to establish a baseline against which warm weather sampling can be compared. This study also aims to develop a sampling method, which allows for the rapid collection of in-field gas samples. During November of 2017, a comprehensive survey was conducted across PEI, sampling wetlands, rivers and estuaries using a greenhouse gas headspace equilibration method. Gas samples were analyzed using gas chromatography at St. Francis Xavier University in Antigonish, Nova Scotia.

Room: Dunn 106  
Session theme: Estuarine-marine  
Time: 2:15 pm

### **An examination of the distribution and habitat preferences of soft corals (Octocorallia: Alcyonacea) in offshore Nova Scotian waters**

Primary & presenting author: **Lauren Ballantyne**, Undergraduate Student, Dalhousie University  
Supervisor(s): Dr. Susan Gass and Dr. Francisco Javier Murillo Perez

Cold-water corals have been observed in Atlantic Canada since the 1800s and to date, there are 31 confirmed species. Although research on cold-water corals in Atlantic Canada has increased over the last two decades, knowledge gaps remain, especially surrounding soft corals (Octocorallia: Alcyonacea). In light of Canada's recent efforts to protect representative marine ecosystems, more detailed information pertaining to soft corals is needed. This study aims to increase our knowledge of soft coral distributions and habitat preferences by species offshore Nova Scotia by using coral samples and environmental data collected between 2001–2011 and in 2017 by Fisheries and Oceans Canada during their annual multi-species bottom trawl surveys. The trawl surveys were conducted on the Scotian Shelf, Scotian Slope, and Bay of Fundy. Eight species, *Gersemia rubiformis*, *Gersemia fruticosa*, *Drifa glomerata*, *Drifa cf. flavescens*, *Duva florida*, *Anthomastus grandiflorus*, *Heteropolypus sol*, and *Pseudoanthomastus agaricus* belonging to two families, Nephtheidae and Alcyoniidae, were identified. The majority, 68%, of sampled colonies were *Gersemia rubiformis*. The spatial distribution of all soft coral species displayed a strong affiliation with the northern portion of the Scotian Shelf and Scotian Slope. However, the Nephtheidae species are most common on the shelf while the Alcyoniidae species are most common on the shelf edge. This northern affiliation may be attributed to the colder temperatures, 1.8–4.3°C, exhibited on the northern Scotian Shelf and Scotian Slope compared to the warmer temperatures, 5.8–10.4°C, exhibited on the southern portions, and may indicate a preference of soft corals to colder temperatures.

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Room: Dunn 108  
Session theme: Flora & Fauna  
Time: 1:30 pm

### **Genetic variability of *Erioderma pedicellatum* in Newfoundland**

Primary & presenting author: **Katherine Flores**, Undergraduate Student, Grenfell Campus – MUN  
Supervisor(s): Dr. Michele Piercey-Normore

*Erioderma pedicellatum* is a Critically Endangered cyanolichen with a sporadic global distribution. Within Canada, *Erioderma pedicellatum* is listed as a species of Special Concern in Newfoundland and Labrador and an Endangered Species in Nova Scotia and New Brunswick. Although population declines have been attributed to various factors, such as reduction in suitable habitat and acid rain, essential baseline information on the life history strategy and genetic variability of the lichen is unknown. The lichen reproduces mainly through sexual reproduction, but the details of the reproductive cycle are not understood. It is thought that the lichen may possess a complicated life cycle with an additional species involved that may act as a barrier to efficient reproduction. Population genetics and the extent of gene flow among stands within Newfoundland is also unknown. The objective of this project was to describe the genetic variability within populations of the species found in three forest stands in Newfoundland. The Internal Transcribed Spacer (ITS) of nuclear ribosomal DNA (rDNA) and the transfer RNA for Leucine (TrnL) regions of the mycobiont and photobiont were sequenced with phylogenetic and population genetic analyses conducted. Phylogenetic trees show variability within each of the mycobiont and photobiont species for the ITS rDNA and TrnL regions. Analysis of Molecular Variance (AMOVA) was used to determine gene flow. Results will be discussed with respect to the findings of other species to show the extent of genetic variability and potential for gene flow among forest stands.

Room: Dunn 108  
Session theme: Flora & Fauna  
Time: 1:45 pm

### **Growth and morphological development of eastern white pine along an elevation gradient in western Newfoundland**

Primary & presenting author: **Nickolas Lake**, Undergraduate Student, Grenfell Campus – MUN  
Supervisor(s): Dr. Dmitry Sveshnikov

Eastern white pine located on the island of Newfoundland is at the most northern limit of its distribution range. Under these generally adverse climatic conditions, the height and shape of trees can vary dramatically within the same geographic area. In order to investigate this phenomenon, an elevation gradient with a morphologically diverse population of the eastern white pine was selected in the Blow Me Down region of western Newfoundland. Seasonal growth and development of buds, needles and tissues were studied in juvenile and mature trees. The location on the gradient, temperature, soil structure and moisture, and the onset, duration and weather conditions of the growth season are considered as potential causes of the observed variety of phenotypic growth responses. Information gathered from this project has the potential to be applied in future studies on assisted migration of this species to new suitable habitats that may become available due to climate change.

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Room: Dunn 108  
Session theme: Flora & Fauna  
Time: 2:00 pm

### **Effects of altered forest succession on nocturnal insects in areas of Gros Morne National Park with hyperabundant moose**

Primary & presenting author: **Vanessa Manuel**, Undergraduate Student, Grenfell Campus – MUN  
Supervisor(s): Dr. Julie Sircom and Dr. Erin Fraser

Hyperabundant populations of ungulates can contribute to excessive browsing rates, which can ultimately result in long-term ecosystem alterations, such as alternate successional pathways and homogeneity of habitat. On the island of Newfoundland, non-native moose populations have reached hyperabundance in some areas and, due to excessive browsing, have altered the successional patterns of disturbed landscapes in Gros Morne National Park. I investigated the impacts of this large-scale disturbance on nocturnal insect populations within the park boundaries by sampling and comparing nocturnal insect communities among three forest stand types (moose meadows, regenerating stands, and mixed mature forest stands). I used LED- illuminated insect bucket traps to collect nocturnal insects over 2 four-day periods from 3 of each forest stand type ( $n=9$ ) in late July and early August 2017. I identified all collected insects to order and measured the dry biomass of each sample. I compared insect abundance, diversity, and biomass among the three forest stand types.

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Room: Dunn 108  
Session theme: Flora & Fauna  
Time: 2:15 pm

### **Nest density of orange-belted bumblebees (*Bombus ternarius*)**

Primary & presenting author: **Brock Burgess**, Undergraduate Student, Acadia University  
Supervisor(s): Dr. Dave Shutler (Acadia University); Steve Javorek (Agriculture and Agri-food Canada)

Pollination services are critical for the maintenance of global biodiversity and success of the agriculture industry. Global pollinator decline has been well documented, putting the delivery of ecological services at risk. Despite global importance of wild pollinators such as bumble bees (*Bombus* spp.), little research has been done to investigate their nesting preferences. The objectives of this study are (1) to use microsatellites to estimate sibling relationships in worker bumble bees (*B. ternarius*) in agricultural systems and (2) to evaluate the relationships between land cover and nest density. Six microsatellites were amplified in bumblebee workers collected from three locations of different landscape configurations. Although the number of workers varied greatly among sites, the ratios of nests to workers were similar (0.79, 0.83, 0.85). More bees nested in evenly distributed, heterogeneous landscapes with agricultural components. This confirms crops are valuable foraging resource for this bumblebee, and suggests that a diversity of landscape features is a desirable nesting preference. Ultimately, nesting preferences of bumble bees need to be further explored, as this study was constrained to three study sites.

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## **Abstracts: Oral (by day, then session, then time)**

### **Sunday, March 18<sup>th</sup>**

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Room: Dunn 106  
Session theme: Graduate – Aquatic  
Time: 9:30 am

### **The Chinese mystery snail – An aquatic invasive species to North America**

Primary & presenting author: **Sarah Kingsbury**, Graduate Student, Saint Mary's University  
Other authors: Linda Campbell, Molly LeBlanc, Emily Chapman, Nimisha Grover, Christine Moore, Shane Dalton, and Annabelle Lamothe  
Supervisor(s): Dr. Linda Campbell

The Chinese mystery snail, *Cipangopaludine (Bellamya) chinensis*, is invading freshwater ecosystems in North America and Europe. This species of snail, which is native to Asia, was first introduced to the United States of America in the 1980s in the Asian food markets. Due to aquarium release and boating activity, *C. chinensis* has spread across North America at an alarming rate. To better manage the spread, researchers have tried to estimate the number of young born per female per year and the affect of *C. chinensis* on native species. However, previous research has focused solely on fecundity and assemblage of native species. Our research shows that fecundity may not be the best indicator of reproductivity and that reproductive rates vary depending on competition levels. Moreover, *C. chinensis* excretes large amounts of nitrogen that could affect native species that are sensitive to such water chemistry changes. *C. chinensis* able to change the environment in which it invades and can out compete native species for valuable resources and space.

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Room: Dunn 106  
Session theme: Graduate – Aquatic  
Time: 9:45 am

### **Response of intertidal communities on a tidal gradient to high and low suspended sediment concentrations**

Primary & presenting author: **Eileen Haskett**, Graduate Student, Acadia University  
Other authors: Glenys Gibson  
Supervisor(s): Dr. Glenys Gibson

Suspended sediment is an important, yet overlooked, factor in the survivorship of intertidal invertebrates that rely on its availability for food and shelter. In this study we investigated how the taxonomic and functional diversity of tidal flat invertebrates is affected by high and low concentrations of suspended sediment. Cores were collected from low-, mid-, and high-intertidal zones in the Minas Basin and placed in tidal mesocosms with either low ( $10 - 30 \text{ mg/L}^{-1}$ ) or high ( $100-400 \text{ mg/L}^{-1}$ ) suspended sediment concentrations for up to four weeks. Invertebrates were sorted and identified to determine changes in diversity. Sediment characteristics (chlorophyll concentration, organic content, sediment composition) were also analyzed. Species from the low-intertidal zone were negatively impacted by low suspended sediment concentrations; for example, key species *Clymenella torquata* and *Spiophanes bombyx* dropped in abundance, and deposit-feeding, herbivorous, and scavenging functional groups also decreased. Species from mid- and high-intertidal zones responded positively to being placed in the mesocosm, with key species (*Chaetozone setosa*, *Pygospio elegans*, and *Streblospio benedicti*) and most functional groups maintaining or increasing in abundance at both sediment levels. Sediment characteristics from all intertidal zones were unaffected by treatment. The sensitivity of the low-intertidal zone to a decrease in suspended sediment concentration raises the question of how it will respond to anthropogenic factors (i.e., tidal turbine farm implementation) that alter tidal flow and associated suspended sediment, potentially impacting the predators, including migratory shorebirds and endangered Atlantic sturgeon, that rely on the low-intertidal invertebrates for food.

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Room: Dunn 106  
Session theme: Graduate – Aquatic  
Time: 10:00 am

### **Identifying invertebrate biomonitors and assessing biotransport risk at contaminated historical gold mine sites**

Primary & presenting author: **Molly LeBlanc**, Graduate Student, Saint Mary's University  
Other authors: Linda Campbell, Emily Chapman, and Sarah Kingsbury  
Supervisor(s): Dr. Linda Campbell

Gold (Au) mining has been an important part of Nova Scotia's social and economic history since the mid-1800s. There are currently 64 gold districts, containing over 360 gold mines, spread across the mainland. Although many of the mines are long-abandoned, a legacy of environmental contamination remains at most sites. The Au amalgamation extraction process involved using mercury-coated copper plates. Residual waste material, "tailings", often contained elevated levels of mercury (Hg) and was deposited into aquatic environments and wetlands. Additionally, the mined ore was often naturally elevated in arsenopyrite. Therefore, when tailing material was deposited on the surface and exposed to weathering processes, elevated arsenic (As) may also occur. Little work has been done to assess the transfer of Hg and As from tailings to aquatic and terrestrial wildlife. Forming the base of many food webs, aquatic invertebrates play an invaluable role within many ecosystems. However, because they are in direct contact with soil, water and sediment, invertebrates can

bioaccumulate significant levels of contaminants, transferring them from sediments to higher trophic levels. The objective of this work was to identify Hg and As levels in invertebrate species, so that they may serve as biomonitors of total mercury (THg), methylmercury (MeHg) and As in impacted wetlands. Additionally, to assess the transfer of contaminants to nearby terrestrial ecosystems via emergent (hatching) insects. Initial findings are presented on bioaccumulation of THg and As in aquatic and emergent invertebrates from impacted wetlands at five historical Au mine sites, and two reference sites.

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Room: Dunn 106  
Session theme: Graduate – Aquatic  
Time: 10:15 am

### **Development of a bacteria water quality index to examine long-term trends for the New Brunswick Surface Water Monitoring Network**

Primary & presenting author: **Obehi Betsy Ugerase**, Graduate Student, UNB Fredericton  
Supervisor(s): Dr. Michelle Gray

The quality of surface water can be affected by natural phenomena such as erosion from rainfall, the topography of watershed, weather, seasons and unnatural human inputs. The quality of a waterbody can be determined by testing the physical, chemical and biological components to track its state over time. Standard guidelines are put in place and vary based on different uses. The objective of my research project was to analyze the seasonal and long-term quality of freshwater in New Brunswick using guidelines established for the protection of aquatic life and recreational activities. The focus was on the presence of fecal bacteria (*Escherichia coli*) as an indicator of anthropogenic and land use inputs, using a modified Canadian Council of Ministers of the Environment (CCME) water quality index (WQI) to achieve this. This simplifies reporting of complex water quality results by categorizing the quality from poor to excellent (on a scale of 0-100; the higher the WQI value, the better the quality). To calculate a WQI with a bacterial focus (WQI<sub>B</sub>), we included the following related water quality parameters: nitrate, nitrite, nitrogen, phosphorus, total dissolved solids, pH and dissolved oxygen. As a case study, long-term trends of *E. coli* and associated land use activities were examined for stations along the mainstem Saint John River. The project results highlight that NB rivers are largely in fair to excellent condition, with the autumn demonstrating a decline in water quality at many stations. Along the Saint John River, some stations have *E. coli* concentrations that frequently exceed the recreational guideline, and the application of the WQI<sub>B</sub> shows how the water quality fluctuates as you move downstream in response to adjacent land use and other anthropogenic inputs.

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Room: Dunn 106  
Session theme: Graduate – Aquatic  
Time: 10:30 am

### **Groundwater-sourced cold-water fish habitat in present and future climates**

Primary & presenting author: **Dr. Barret Kurylyk**, Faculty, Dalhousie University (not adjudicated)

Salmonid reliance on cold-water thermal refugia is expected to increase in future decades as rivers and streams warm. However, the potential for groundwater-sourced thermal refugia to also experience future warming is generally overlooked. Results from several recent groundwater temperature field and modelling studies are presented to illustrate the thermal sensitivity of shallow groundwater to atmospheric climate change. The timing and magnitude of groundwater warming is shown to depend on the climate scenarios, soil thermal properties, groundwater flow, and aquifer configuration. Groundwater-sourced thermal refugia are also threatened by

deforestation, excessive groundwater pumping, and aggregate extraction (i.e. sand and gravel pits). These imminent threats to thermal refugia integrity, and hence cold-water fish populations, may be mitigated by preserving existing thermal refugia, augmenting thermal anomalies that are not utilized as refugia, and creating new thermal refugia in uniformly warm river reaches. Existing thermal anomalies may be enhanced by controlling advective thermal mixing between cold-water tributaries and the river mainstem flow, installing riparian shading, and adding temporary structures for protection from avian predators. New refugia may be created by temporarily pumping groundwater to discrete points within the river during periods of thermal stress. These activities should be informed by local ecological, hydrological, and hydrogeological knowledge.

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Room: Dunn 108

Session theme: Graduate – Terrestrial

Time: 9:30 am

### **Les colonies d'oies supportées par les activités anthropiques dans les écosystèmes tempérés peuvent-elles affecter l'activité des prédateurs de la toundra? Une comparaison multi-sites à l'échelle circumpolaire**

Primary & presenting author: **Audrey Bédard**, Graduate Student, Université de Moncton

Other authors: Joël Bêty, Olivier Gilg, Interactions Working Group

Supervisor(s): Dr. Marie-Andrée Giroux

Les écosystèmes sont modifiés par les activités humaines à un rythme sans précédent. Cependant, certaines espèces réussissent à tirer profit de ces changements. Par exemple, l'oie des neiges a vu ses populations augmenter de façon exponentielle depuis les années 1970 en raison de l'intensification agricole dans les écosystèmes tempérés. Ces oiseaux, étant migrateurs, contribuent à connecter les écosystèmes qu'ils fréquentent et peuvent ainsi affecter les espèces avec qui ils partagent ces milieux. Certaines études montrent que l'augmentation des populations d'oies peut soutenir les populations de prédateurs arctiques à plus grande abondance que ce que les proies locales peuvent supporter. Cela suggère des impacts négatifs sur les limicoles faisant face à une pression de prédation accrue. Nous manquons présentement de données empiriques pour anticiper l'ampleur de ces effets à l'échelle circumpolaire. L'objectif est donc d'étudier l'impact de la présence croissante des populations migratrices d'oies sur les indices d'activité du renard arctique, un prédateur généraliste, à une échelle circumpolaire. Pour ce faire, nous utiliserons des protocoles ayant été harmonisés à travers 12 sites de l'Arctique localisés au Canada, en Alaska, au Groenland, en Suède et en Russie. Nous comparerons les sites avec et sans présence de colonie d'oies en utilisant les indices d'activité des prédateurs issues de données d'observations opportunistes récoltés en période estivale. Cette étude permettra d'étudier l'impact, à grande échelle, des colonies d'oies sur les communautés de prédateurs et, éventuellement, sur la pression de prédation des nids de limicoles arctiques.

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Room: Dunn 108  
Session theme: Graduate – Terrestrial  
Time: 9:45 am

## **What happens when you add prey to an Arctic ecosystem? Modelling the apparent competition between snow goose and semipalmated sandpiper**

Primary & presenting author: **Sarah Jacques**, Graduate Student, Université de Moncton  
Other authors: Joël Bêty and Sophie Léger  
Supervisor(s): Dr. Marie-Andrée Giroux

The combined effects of climate change and agricultural intensification have led to an exponential increase in snow geese. Millions of geese migrate annually, in the spring, from agricultural lands to the Arctic generating a massive flow of resources. These additional resources support a higher abundance of Arctic predators. This could be the cause of indirect impacts on other prey species. In particular, this interaction may be one of the causes underlying the recent decline of several shorebirds populations. Indeed, several studies have found that predation risk on shorebirds nests increased near goose colonies. At the same time, shorebirds are less prone to predation during years of high abundance of lemming, the preferred prey of most arctic predators. Despite local empirical evidence of the consequences of snow goose and lemming abundance on shorebirds nest survival, we lack the tools to predict the extent of these impacts at a circumpolar scale. Thus, **the main objective** of this project is to predict the effect of increasing snow geese populations on the predation rate of a declining shorebirds species' nest, the semipalmated sandpiper. To achieve this, we are currently using parametric differential equations with data from arctic sites with and without goose colonies covering different years of the lemming cycle. Our model will provide a crucial predictive tool to better guide conservation efforts for declining shorebirds species.

## **Que se passe-t-il quand on ajoute des proies dans un écosystème arctique? Modélisation de la compétition apparente entre l'oie des neiges et le bécasseau semipalmé**

Les effets combinés des changements climatiques et de l'intensification agricole ont mené à une augmentation exponentielle de l'oie des neiges. Des millions d'oies migrent annuellement, au printemps, des terres agricoles vers l'arctique générant un flux massif de ressources. Ces ressources supplémentaires supportent une abondance supérieure de prédateurs arctiques. Ceci pourrait être la cause d'impacts indirects sur d'autres espèces de proies. Notamment, cette interaction pourrait représenter une des causes sous-tendant le déclin récent de plusieurs populations de limicoles. En effet, plusieurs études ont trouvé que le risque de prédation sur les nids de limicoles augmentait à proximité des colonies d'oies. Simultanément, les limicoles sont moins sujet à la prédation lors des années de fortes abondances de lemming, la proie préférentielle de la majorité des prédateurs arctiques. En dépit des évidences empiriques locales des conséquences de la présence d'oies des neiges et des lemmings sur la survie des nids de limicoles, nous manquons d'outils pour prédire l'ampleur de ces interactions au niveau circumpolaire. **L'objectif principal** de ce projet est de prédire l'effet de la présence croissante de l'oie des neiges sur le taux de prédation des nids de bécasseau semipalmé, une espèce de limicole à statut de conservation précaire. Pour ce faire, nous utilisons présentement des équations différentielles paramétrisées avec des données provenant de sites en arctiques avec et sans colonie d'oies couvrant différentes années du cycle de lemming. Notre modèle va fournir un outil crucial de prédiction pour mieux orienter les efforts de conservation chez les espèces de limicoles en déclin.

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Room: Dunn 108  
Session theme: Graduate – Terrestrial  
Time: 10:00 am

### **Free meals for Arctic-nesting shorebirds: Can increased productivity lead to positive effects on Arctic-nesting shorebirds?**

Primary & presenting author: **Laurent Montagano**, Graduate Student, Université de Moncton  
Other authors: Shawn Leroux, Marie-Andrée Giroux, and Nicolas Lecomte  
Supervisor(s): Dr. Nicolas Lecomte, Dr. Shawn Leroux

Free meals for Arctic-nesting shorebirds: can increased productivity lead to positive effects on Arctic-nesting shorebirds? Arctic ecosystems are facing intensifying impacts of climate change, notably an increase in air temperature. Such a rise can both advance and boost the food supplies accessible to arctic breeding birds. Yet whether such a resource surge can be used and benefit these breeders during laying and incubation is unclear. In the context of growing conservation concerns for arctic shorebirds, we examined whether increased productivity driven by climate change could directly benefit shorebirds during a critical period of their life history. Here we experimentally determined the effect of increased prey abundance on the body condition, nesting patterns, and nesting success of the white-rumped sandpiper, an Arctic-nesting shorebird that has not yet shown signs of population decline. We supplied mealworms to incubating white-rumped sandpiper females on the island of Igloolik (Nunavut) located in the Canadian Arctic. We captured females at the beginning and end of their incubation period to assess body condition and we installed small temperature probes inside their nests to obtain a detailed schedule of their incubation recess patterns. We regularly monitored 28 experimental and control nests to estimate nest survival during two consecutive summers. Tracking climate change impacts on consumers can be challenging as the time scales on which they act can greatly vary. Through a relatively simple manipulation, our study will help to elucidate mechanisms through which impacts of climate change on individual consumers can create changes in population abundance.

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Room: Dunn 108  
Session theme: Graduate – Terrestrial  
Time: 10:15 am

### **Comparing automated species-level identifications of bat echolocation recordings made in Newfoundland, Canada**

Primary & presenting author: **Darrian Washinger**, Graduate Student, Grenfell Campus – MUN  
Other authors: Tom Knight (Parks Canada)  
Supervisor(s): Dr. Erin Fraser

Newfoundland is unaffected by white-nose syndrome, making it a significant refugium for two endangered bat species, but little is known about bat distribution on the island. Bat populations can be monitored by making acoustic recordings and using specialized software to identify species. No software performs perfectly, and the most appropriate approach for analysis must be carefully selected. We compared the outputs from two commercial automated identification software packages (Sonobat 4.2.1 and Kaleidoscope Pro 4.3.2) using two different settings (“recommended” and “relaxed”) to select the best method for conducting analyses in Newfoundland. We collected 1989 recordings using SM2BAT+ detectors deployed throughout Gros Morne National Park, Newfoundland in summer 2017. Using the recommended settings, Sonobat and Kaleidoscope identified 676 and 750 recordings to species, respectively, and the programs agreed on the identification of 375 recordings (55% of species-level identifications by Sonobat and 50% by Kaleidoscope). The majority of the inconsistencies (644 of the total recordings) occurred when one identified a recording to species while the other

characterized it as “noise” or failed to make an identification. Only 16 recordings had conflicting species identifications. Using the relaxed settings, the programs agreed on more identifications, but there were also more inconsistencies. In summary, there was relatively low agreement between packages, but fairly high agreement when both programs made a species-level identification. We conclude that the most appropriate approach for analyzing bat identifications in Newfoundland is by using two independent techniques to analyze echolocation records and only accepting identifications agreed upon by both packages.

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Room: Dunn 108

Session theme: Graduate – Terrestrial

Time: 10:30 am

### **Direct and indirect effects of climate on a simplified trophic network in the Arctic tundra**

Primary & presenting author: **Claire-Cécile Juhasz**, Graduate Student, Université de Moncton

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Climate change can impact ecosystems by reshaping dynamics of resource exploitation for predators and their prey. The accelerated changes in summer rainfall and air temperature in the High Arctic observed over the last 20 years could explain a higher nesting success of the Greater Snow Goose. Considering that predation intensity of the Arctic fox on goose eggs is modulated by lemming abundance, which is also influenced by climate variables, how can climate change benefit arctic breeding geese? Here we aim to identify direct and indirect mechanisms driven by climate change that affect the predator-prey relationship between nesting geese and Arctic foxes in a large breeding colony (Bylot Island Nunavut, Canada). We used a combination of models mapping multiple links among variables derived from several long-term databases. We obtained several possible scenarios linking global climate factors (Arctic Oscillations) and local conditions of temperature and precipitation to the various trophic relationships of the tundra. Our results suggest that both global and local climate factors have both direct and indirect impacts on the breeding of predators and their prey. These results will extend our understanding of the complex effects of climate change on Arctic species and predator-prey interactions. It will also provide essential information for the management of an overabundant population of Greater Snow Geese.