Monday, May 6th- Burke Building, 5932 Inglis St

7:45-8:30 Registration

Defining Success & Developing Frameworks
Chair, Danika van Proosdij, Saint Mary's University
Room Burke Theatre B

8:30-9:00- Land Acknowledgement & Welcome Remarks
Geri Musqua-Leblanc, Dalhousie Elders in Residence
Danker Kolijn, CBCL Limited, Co-Chair.
Danika van Proosdij, Saint Mary's University, Co-Chair.

(*) Presenting Author

9:00-9:30- Keynote Speaker Dr. Brian McFall, PE. An Introduction to the US Army Corps of Engineers' Engineering With Nature® Initiative. Research Civil Engineer, U.S. Army Engineering Research and Development Center (ERDC)

The U.S. Army Corps of Engineers (USACE)'s Engineering With Nature® (EWN®) Initiative enables more sustainable delivery of economic, social, and environmental benefits associated with water resources infrastructure. The initiative began in 2010 with the goal of creating project value through the use of natural systems and processes, solution co-development through partnership and collaboration, and innovation in water infrastructure development through field-scale demonstrations. Since its inception, the EWN portfolio has grown considerably with R&D that is distributed across the navigation, ecosystem restoration and flood risk management business lines, and the initiative continues to produce practical tools and solutions that support the Planning, Engineering, and Operations' efforts to engineer with nature. Partnerships and collaborations across government, academia, and the private sector are also being used to leverage the knowledge and experience of other organizations both nationally and internationally. This presentation will provide attendees with: (1) an overview of EWN practices and example projects that promote resilience, flood risk reduction, enhance ecosystem services and/or increase social benefits; (2) an introduction to a diverse number of EWN solutions, which include a systems approach that incorporates the use of natural and nature-based features (NNBF); (3) insight into current efforts to quantify EWN "triple win" outcomes; and (4) highlights from collaborative efforts that illustrate the importance of continuous community and stakeholder engagement.

9:30-10:10- Panel Discussion. Reflections on the implementation of nature-based adaptations (NbA) and building with nature in a northern climate: visions for the future. Danika van Proosdij (Chair); Brian McFall, US Army Corps of Engineers; Kala Pendakur, Standards Council of Canada; Sabine Dietz, Aster Group; Danker Kolijn, CBCL Limited.; Mary-Ann Wilson, Natural Resources Canada

10:10-10:30 CBCL Limited Networking Break

10:30-10:50- Developing new tools: how standards can support vulnerable communities adapt to climate change.
Kala Pendakur[1]*; B. Zupancic[2]. 1 Standards Council of Canada; 2 Canadian Standards Association

Since 2011, the Standards Council of Canada (SCC) has been supporting the development of standards that help Canadians adapt to, and mitigate, climate change risks. Standards help address climate change threats by providing engineers, design professionals, and others with guidance that they can feel confident in. The Canadian Standards Association (CSA) Group and SCC are now working to develop a new national standard of Canada that will support northern communities facing coastal erosion.

In addition to the driving processes for erosion and sedimentation common to other regions (e.g., waves, currents, river flows etc.), northern adaptations for erosion and sedimentation risk management require the consideration of changing ice regimes and permafrost soils, particularly in regions with already-warm permafrost and/or ice-rich soils. Efficiency and resiliency are critical elements of built infrastructure in the North and are required to mitigate the effects of weather-related or natural processes, construction-related changes, or climate change-related processes. This presentation will outline how standards can be used to address climate change

impacts, including erosion, and will subsequently discuss the upcoming standard "Erosion and Sedimentation Management for Northern Community Infrastructure" which was developed with the assistance of erosion experts across the country.

10:50-11:10- Collaborative action on coastal adaptation under Canada's Adaptation Platform. John Sommerville[1]*, M. A. Wilson[2]. 1 Policy Analyst, Climate Change Impacts and Adaptation Division, Natural Resources Canada; 2 Program Manager, Climate Change Impacts and Adaptation Division, Natural Resources Canada

Canada's Adaptation Platform, led by Natural Resources Canada (NRCan), brings together representatives from government, industry and professional organizations, to collaborate on adaptation priorities and advance action. The Adaptation Platform aims to create an enabling environment for adaptation, where decision-makers in regions and industry are equipped with the tools and information they need to adapt to a changing climate. Climate-resilient natural infrastructure or ecosystem-based adaptation is a priority area for Canada's Adaptation Platform, given its flexibility for responding to the impacts of climate change and ability to provide multiple benefits that conventional approaches may not. However, there exists a number of technical, institutional, regulatory, and financial challenges preventing the widespread use of natural infrastructure in Canada. Challenges include a lack of technical expertise and guidance, limited number of real-world examples, regulatory bias towards grey infrastructure, and mechanisms for valuing and financing natural infrastructure. To address these challenges and support the uptake of natural infrastructure as a flexible and effective adaptation measure, Canada's Adaptation Platform has supported a suite of projects and research, and facilitated collaboration and stakeholder engagement in this area. This presentation will highlight the Adaptation Platform's progress to date in enabling effective ecosystem-based adaptation across Canada, focusing on past successes and future priorities.

11:10-11:30- Municipal flood mapping project – a framework for coastal and riverine climate change scenarios. Eva Mooers[1]*; R. Jamieson[2]; B. Kurylyk[2]; E. Rapaport[3]; P. Manuel[3]; D. Van Proosdij[4]; H.; Beltrami[3]; J. Hayward[3]; J. KarisAllen[2]; K. Clark[3]; C. Tusz[3]; R. Jahncke[4]; A. García-García[5]; F. J; Cuesta-Valero[5]. 1 Nova Scotia Department of Municipal Affairs; 2 Dalhousie University; 3 Dalhousie School of Planning; 4 Saint Mary's University; 5 St. Francis Xavier University

The Department of Municipal Affairs, which up holds the provincial statement of interest on flooding, is currently working on a multi-year initiative to establish standards and guidance for how flood hazard maps are created. Specific to climate change the objective of the standard is to develop a standardized framework for the incorporation of future climate changes into municipal riverine and coastal flood mapping in Nova Scotia. The proposed framework was developed with the intention of providing a scientifically defensible, consensus-based approach that is practical to implement. Climate change is expected to impact several variables that influence the development of riverine and coastal flood maps. These include rainfall characteristics, relative sea level rise and storm surge. The Government of Nova Scotia has worked with multiple academic institutions in recognition of the need to obtain expert consultation and has established an interdisciplinary working group comprised of researchers in various fields. These fields included: municipal planning, water resources engineering, coastal hydraulics and climatology.

11:30-11:50- Incorporating living shorelines principles in shore protection on the Great Lakes. Josh Wiebe, Baird & Associates

Living shorelines encompass a range of design techniques that aim to stabilize eroding shorelines and rehabilitate degraded coastal habitat. Examples of how habitat enhancements and bioengineering techniques may be incorporated into traditional "hard" shoreline protection are discussed. The examples include the use of artificial reefs, artificial headlands and beaches, large woody debris, and vegetative plantings.

11:50-12:00- Chair wrap-up & questions

12:00-1:00 Lunch

Lessons from the Field: Collaborations & Cross-disciplinary Boundaries
Chair, Danker Kolijn, CBCL Limited.
Room Burke Theatre B

1:00-1:20- The 'Living Breakwaters' project: A multi-layered approach to coastal adaptation. K. Lokman; Tugce Conger*. Institute for Resources, Environment and Sustainability

Coastal erosion is a growing challenge across Canada, which boasts the longest coastline in the world. Rising sea levels and increased frequency and severity of extreme weather events due to climate change, damage coastal buildings, infrastructures, and beaches, impacting municipalities, First Nations, and Provincial and Federal governments. In order to implement mitigation and adaptation strategies, Natural Resources Canada has provided generous support to the Living Breakwaters project at the University of British Columbia to develop a layered approach to coastal adaptation.

The Living Breakwaters project is an umbrella project to advance climate change adaptation knowledge in the Lower Mainland and to develop nature-based solutions for the erosion of the cliffs at the University of British Columbia's Point Grey campus. Within the Living Breakwaters project, our team developed a range of sub-projects that are at once broad and specific in their approach to coastal adaptation and flood/erosion risk and vulnerability reduction. These sub-projects not only investigate the coastal processes, historical transformations and existing conditions that contribute to the erosion of the cliffs, but also develop tools and visuals to explore coastal adaptation pathways that incorporate living systems and enhance local and regional ecosystems and spatial quality.

This presentation will showcase three sub-projects that were undertaken by a multi-disciplinary and multi-sectoral team of researchers and practitioners, including the use of native vegetation to reduce cliff erosion, multi-criteria assessment of different nature-based and engineered erosion protection measures, and visualization tools for innovative adaptation options.

1:20-1:40- Adapting to climate change: the importance of site-specific plant considerations for increasing success of living shorelines projects. Jessica Foley*; R. Mandel. Ramboll

Due to changes in temperature, precipitation, sea level rise, and carbon dioxide, climate change is already influencing revegetation establishment, vigor, survival, and reproduction. As a result, the specification and implementation of more adaptable species with ecological flexibility is likely to result in greater success and resiliency when revegetating living shoreline areas. Furthermore, as climate change is likely to alter the frequency and intensity of disturbances, including storms, insect outbreaks, and the occurrence of invasive species, the use of locally-sourced, site-specific native species with increased tolerance and speed of recovery from these challenges will become increasingly important. The best way to help ensure revegetation success in these dynamic environments is to incorporate revegetation expertise at the initial project planning stage so that correct measures are included to improve overall project success, meet plant cover and/or diversity goals, and more quickly provide shoreline stabilization. Key considerations to incorporate in the project planning stage include sourcing and diversity of plant materials, seeding and planting strategies, germination, ecoregion, phenotypic plasticity, soils, microbiota, and genetics. This presentation will cover the importance of these site-specific plant considerations from submerged grasses to high/low marsh to upland dunes, offer recommendations, and showcase a couple case studies relevant to the Cold Regions Living Shorelines Community of Practice.

1:40-2:00- An ecologically informed approach to the design, build, and monitoring of cold water living shorelines in Atlantic Canada. Colin McVarish*, N. MacDonald, J. Bernier. CBCL Limited.

Sustainable adaptation to mitigate the risks associated with climate change has been a growing concern for the public, ecologists, and engineers. As a result, a shift from hard engineered structures to ecologically informed infrastructure provides an opportunity to increase ecological and social benefits. Further, hard coastal-defence structures have been demonstrated to provide habitats for exotic and invasive species. Ecologically informed coastal engineering practices are necessary to facilitate a successful design of living shorelines and minimize associated risks. Achieving the goal of identifying the prerequisite knowledge and understanding of the ecological and environmental context requires collaboration between engineers, ecologists, and regulators from an early stage in the project. In our presentation, we discuss the importance of collaboration between ecologists and engineers from the pre-design to the post-construction phase of living shoreline projects. We identify potential management and monitoring approaches and briefly discuss ongoing and future opportunities for the application of living shorelines for coastal protection and regulatory considerations for the application of living shorelines approaches. We also discuss the potential benefits to local and regional biodiversity, as well as the potential for unintended consequences due to the application of coastal protection projects.

2:00-2:20- Taking off the training wheels: how twenty years of collaboration and experience in tidal wetland restoration can inform the discussion on climate change adaptation in Nova Scotia. Tony Bowron[1,2]*; J. Graham[1,2]; D.

van Proosdij[2]; B. Pett[3]; K. Bekkers[4]. 1 CBWES Inc.; 2 Saint Mary's University; 3 Nova Scotia Department of Transportation and Infrastructure Renewal; 4 Nova Scotia Department of Agriculture

Globally, the practice of re-introducing tidal flow to former agricultural dykelands, the removal of tidal barriers and the restoration, or creation, of coastal habitats such as salt marshes, where feasible, has been identified as a viable adaptation method to current and future hazards associated with climate change. As countries throughout Europe and coastal US States increasingly employee alternatives to traditional hard engineering approaches to shoreline management and erosion control, there continues to be strong resistance in Atlantic Canada. The apparent lack of tangible Canadian examples and a skepticism around the effectiveness of these "soft" approaches in our more northern climate are the oft touted objections. However, one needs look no further than the two decades of collaboration and nearly 500 ha of restored tidal wetland habitat as proof that we have the experience and the science to support the use of nature-based solutions to climate change. From site design, implementation and monitoring, to community engagement and rights-holder co-management, the lessons that we have learned from these restoration and managed realignment pilot projects can, and are, informing the discussions and actions which will be taken over the next several years that will determine the shape of our coastal communities for the next fifty.

2:20-2:30- Chair wrap-up & questions

2:30-3:00 CBWES Inc. Networking Break

Barriers & Drivers to Nature Based Adaptation: Social, Economic, Institutional, Environmental Considerations
Chair, Danika van Proosdij, Saint Mary's University
Room B205

3:00-3:10- Workshop introduction: what are your experiences, past and present, with nature-based adaptation?

3:10-3:30- Making Room for Movement: exploring drivers and barriers to implementing nature-based coastal adaptations. Laura McCardle*; M. Conlin. School of Planning, Dalhousie University

This presentation, which is part of the Making Room for Movement Project (funded by Natural Resources Canada), will explore the potential drivers for and barriers to implementing nature-based coastal adaptations in Nova Scotia. In this presentation, we will highlight recent reports that have contributed to the foundational understanding of the drivers and barriers to implementing nature-based coastal adaptations in Canada. We will also highlight the preliminary research and theories from the Making Room for Movement team on what we think decision-makers and influencers may identify as drivers and barriers to implementing these adaptations in Nova Scotia. We hope the presentation of these preliminary findings will lead to dialogue with conference delegates about our approach as we enter the next phase of our study, and hear any suggestions or concerns they may have.

3:30-3:50- Round Table 1- Governmental, administrative, economic, physical, socio-cultural, environmental constraints/opportunities

3:50-4:10- Round Table 2- Past and present experiences – successes and failures

4:10-4:30- Synthesis & wrap-up.

Tuesday, May 7th- Burke Building, 5932 Inglis St

Lessons from the Field: Integrating Coastal Geomorphology and Engineering
Chair, Danker Kolijn, CBCL Limited.

8:30-8:40- Chair intro- Setting the stage

8:40-9:00 Atlantic- Monitoring of gravel beach dynamics and predicting coastal change in Nova Scotia using UAV. Vladimir Kostylev[1], P. Fraser, P. Potter, A. Robertson, D. Whalen, R. Taylor, D. Forbes. 1 Geological Survey of Canada-Atlantic.

Unmanned Aerial Vehicle (UAV) surveys of Long beach (also known as Miseners beach, Eastern Shore) have started in 2016 with two objectives: 1) to familiarize GSC (Atlantic) staff with the use of UAVs in a natural laboratory close to home, in preparation for more remote deployments, and 2) to explore the application of this new technology to coastal mapping and monitoring in well-studied environment. Coastal Group had been visiting the site and surveying beach profiles at Misener's Beach since the 1970s. Through repeat UAV surveys we have collected high-resolution photography and derived digital elevation models of the beach, allowing to quantitatively monitor seasonal beach dynamics. Winter storms of 2018 and 2019 led to several significant breaches of the gravel barrier, followed by partial draining of the adjacent freshwater lake, and temporary conversion of it into a tidal lagoon. The surveys yielded unprecedented quantitative 3D information on the rapid changes of shore morphology. The UAV-derived data were used develop a predictive, site-specific storm surge model, to characterise beach response to storm flooding and overwash, to model water level dynamics in the lake, and to quantify sediment removal. The study improves our understanding of evolution of paraglacial gravel barriers, which could be applied to other gravel beaches in Nova Scotia, and highlights necessity of continuous coastal monitoring.

9:00-9:20- Pacific - Putting the geomorphology back in to nature-based shoreline design – examples from the Salish Sea. Phil Osborne, Golder Associates Inc.

This paper draws from case study experience on Canada's west coast to illustrate the importance and benefits of a geomorphological perspective in the design and development of climate resilient nature-based shoreline solutions to address flooding and erosion hazards. Many of the beaches forming the shorelines of the Strait of Georgia and Puget Sound, in the lower mainland British Columbia and neighbouring State of Washington respectively, and known collectively as the Salish Sea, are derived from sand and gravel eroded from nearby bluffs. The region's glacial history and unique geology make these feeder bluffs an important source of beach sediment. The desire to stabilize coastal bluffs which are naturally subject to erosion to protect valuable upland assets can lead to long term sediment supply deficits and erosion issues on neighbouring shorelines. Understanding the relationships between coastal and feeder bluff slope processes, sediment transport and morphology is integral to avoiding conflict. We present summaries of several case studies of how bluff and shoreline erosion hazards in the Salish Sea environment have been addressed with robust nature-based shoreline solutions that consider coastal processes, sediment budget and geomorphological context.

9:20-9:40- Fundy - Key considerations for application of nature-based designs in hypertidal, muddy estuaries. Danika van Proosdij[1,2]. 1 Saint Mary's University; 2 TransCoastal Adaptations

9:40-10:00 Northern- Living with Ice in the Arctic Shore Zone. Donald L. Forbes, Research Scientist Emeritus, Geological Survey of Canada, Natural Resources Canada

The defining characteristic of Arctic coasts is the presence of ice, in the sea and onshore. Cold temperatures preserve permafrost and massive ground ice, which extend beneath the seabed in some regions. Sea ice with various associated hazards predominates, but its role in shore protection is diminishing as the extent and duration of seasonal ice decrease. Rising temperatures promote accelerated thaw contributing to rapid shore recession on ice-rich coasts. Limited shore protection measures have had generally disappointing results. In some regions, rapid postglacial uplift and falling local sea levels complicate shoreline evolution and engineering works can become stranded. The role and stability of shorefast

ice in Inuit culture, enabling access to critical food resources, is another key issue in a warming climate. New approaches to community knowledge access and dissemination on ice conditions have led to development and rapid expansion of the environmental social enterprise, SmartICE.

10:10-10:30 Break

Lessons from the Field: Successes, Challenges & Problem Solving
Chair, Phil Osborne, Golder Associates
Burke Theatre B

10:30-10:50- Nature-based approaches for bank protection and shoreline management in Atlantic Canada. Kirsten Ellis[1]; J. Graham[1]; T. Bowron[1]; D. van Proosdij[2]; C. Esau[3]; K. Bekkers[3]. 1 CBWES Inc.; 2 Saint Mary's University; 3 Nova Scotia Department of Agriculture, Agriculture and Food Advisory Services, Land Protection

Nature-based solutions such as living shorelines, vegetated buffers, and ecological bank stabilization are gaining traction as sustainable and cost-effective methods for dealing with coastal issues like accelerated erosion, flooding, and storm water management. While these types of projects are becoming more common around the world, there are relatively few examples on public land in Atlantic Canada. Several ongoing pilot projects in Nova Scotia and Prince Edward Island are looking to change that and provide important insight into how nature-based shoreline solutions can be successfully implemented on the Atlantic coast of Canada. These projects include; an ecological bank stabilization on a section of tidal riverbank at the Belcher St. Marshland that combined traditional rock armour with a root wad revetment and living plants; a vegetated buffer to provide storm water and erosion management on the historical Shelburne waterfront; and marsh creation using dredge material from river restoration activities on PEI. We will explore the successes, challenges and lessons learned during the early stages of these projects and discuss the next steps in building on what we've learned.

10:50-11:10- Engineering coastal adaptation in Nova Scotia with living shorelines. Esther Gomes*, V. Fernandez, A. Wilson, D. Kolijn, V. Leys. CBCL Limited.

Extended research in the field of coastal engineering has allowed the development of numerical models that describe and quantify the multiple processes that take place along the shoreline, and impact our coasts. This presentation will discuss the implementation of these principles in the design of living shorelines using two detailed engineering projects as examples in Mahone Bay and Regatta Point. In both cases, a regional computer model allowed the evaluation of wave transformations processes and the estimation of wave agitation and water levels using local long term historical wave, wind and water level data as well as bathymetric information. In combination with environmental surveys and assessments, the results of the evaluation provided fundamental information to identify suitable areas where the establishment of living shorelines is likely to succeed; and to establish a design criteria that reduce risks of failure and maintenance requirements. This presentation will also discuss how the implementation of engineering expertise and principles in the design of living shorelines is able to legitimise the concept with municipalities, removing implementation barriers, and limiting risks to limited capital budgets.

11:10-11:30- Wetland and habitat compensation project using a living-shoreline approach. Justin McKibbon*, S. Renaud, N. Guillemette, T. Fortin-Chevalier, P. Pelletier, G. Latreille. WSP Inc.

A compensation project was approved for the creation of wetlands and habitat for avifauna on a remote archipelago in the Saint-Lawrence River. WSP was mandated to design and build protection measures meant to prevent erosion occurring on one of the islands, while creating suitable areas for the establishment of wetland vegetation. Design selection for the protection measures was arrested on a living shoreline concept consisting of low-crested, offshore breakwaters, profiling and nourishment of the shoreline, and planting of seagrass beds, as well as treed and shrub swamps. Project challenges included designing an efficient concept, capable of dissipating wave energy and maintaining wetland areas under changing water level and ice cover conditions, maximising the compensation surface area and the length of protected shoreline, while minimising visual impacts and complying with the allocated budget. Being located on a federal wildlife reserve and having a footprint on both federal and provincial lands, the project also needed

to comply with several regulations at both levels of government, including Migratory Bird Sanctuary Regulations. Finally, construction challenges included accessing a remote location on the Saint-Lawrence River, using marine-plant equipment and a construction methodology aimed at reducing disruptions caused to the natural environment. A shallow plateau surrounding the archipelago also required the construction of two access jetties, up to 170 m in length, the design of which was highly sensitive to water levels anticipated during construction.

11:30-11:50- Green Shores from coast to coast. DG Blair, Stewardship Centre for BC.

Sea level rise, climate change adaptation planning and balancing many needs brings complexity in determining appropriate courses of action required for shoreline management. DG Blair, Executive Director from the Stewardship Centre for BC will share lessons learned from the BC Green Shores program which builds capacity to implement nature based solutions by providing shoreline design standards (using a credit and rating system), project certification, training for shoreline professionals, and support to communities through a local government working group. She will also outline current work, including updating key resource materials, developing new training methodologies, evaluating the BC model as a possible approach to use across Canada and an update on delivery of Green Shores training in Nova Scotia in 2020.

11:50-12:00- Chair wrap-up & questions

12:00-1:00 Lunch

Lessons from the Field: Capacity Building and Communities
Chair, Danika van Proosdij, Saint Mary's University
Burke Theatre B

1:00-1:20- Natural and Nature-Based Infrastructure A BRACE capacity building project aimed at engineers, land use planners and environmental organizations in New Brunswick. Sabine Dietz[1]*; A. Cheeseman[2]; S. Shet[3]. 1. Aster Group; 2 Nature NB; 3 New Brunswick Environmental Network

Land use planners, engineers and environmental organizations in New Brunswick have long been engaged in climate change adaptation projects. Each of these sectors plays a different role in adaptation and faces unique challenges and barriers. This project, funded by NRCan, addresses these barriers by bringing together land-use planners, engineers (working for municipalities, consultants) and environmental non-governmental organizations to build their capacity to collaborate and use natural and nature-based infrastructure. The project focuses on natural infrastructure as it is generally low cost, easy to implement, has multiple benefits, and is a shared interest among all three sectors. Over the next three years, the project will implement a community of practice, link and promote various natural and nature-based infrastructure initiatives, provide learning opportunities, and develop education materials.

We propose a presentation to introduce the project with a workshop component to explore what the community of practice could look like (components), what kind of training could be made available, and how we can link this work with other adaptation initiatives across Atlantic Canada.

1:20-1:40- Personalizing our shorelines: Re-imagining Atlantic Harbours for 2050 (RAH2050). Kelly Schnare, Director of Re-imagining Atlantic Harbours for 2050 (RAH2050)

Our non profit program includes academia, community groups, corporate and creative professionals with a mission for collective action to prevent pollution in our Atlantic Harbours!

We have 6 projects under the RAH2050 connected to shoreline water management. Each has successfully piloted elements with three years of development. RAH2050's vision is for community-led communications to highlight environmental-impact for pollution prevention. The scope of this program is supporting awareness of land-based influences.

The baseline of all the work RAH2050 does is through grassroots Story collection using The Watermark Project (personal freshwater

narratives). We curate an online inventory highlighting local beneficial use with creative products (collector cards and incentives). We have Written, audio, and visual collaboration opportunities and a fantastic regional basket of stories. Our work is to strategically summarize grassroots voices for municipal planning purposes and also used to inform High-profile, interactive shoreline signage development!

We propose a workshop, booth and table to collect all participants Watermark Stories. Such an inventory will meaningfully contribute to the voice and impact of the Community of Practice by connecting freshwater influences to our coastal infrastructure.

Program progress includes a music video and 250 local Watermarks collected, 2 collection cards styles to be distributed at events / engage the public. Current nationally-supported planning proposals include advancing a green infrastructure using storytelling methods.

1:40-2:00- Living dike for coastal community and ecosystem resilience. Deborah Carlson*; J. Readshaw. West Coast Environmental Law

Faced with adapting to 1 m of sea level rise, communities around Boundary Bay, BC were considering how high to raise their existing dikes. This approach would doom the vibrant coastal wetlands of the area to eventually disappear, as a result of coastal squeeze. Instead, the "living dike" proposes a solution where existing salt marsh is enhanced and extended, and gradually elevated over a 30-year period. This will make it resilient to sea level rise and will also allow it to contribute to provide coastal flood regulation services, meaning that the dikes won't have to be raised as much. Through a collaborative process with policymakers from a range of government agencies, two pilot projects for two communities have been developed, and pending federal funding they will begin implementation in fall 2019. Related research about blue carbon has provided additional information about salt marsh historical extent and regeneration after diking in the late 1800s. In addition to technical considerations, the experience with the Living Dike has raised a number of important law and policy considerations, some of which are yet to be resolved.

2:00-2:30- Chair wrap-up & questions

2:30-3:00 Break

Lessons from the Field: Knowledge Gaps, Research Needs & Opportunities
Chair, Danker Kolijn, CBCL Limited.
Room Burke Theatre B

3:00-3:10- Panel Discussion: what are current gaps in knowledge around successful applications of nature-based designs, and how can we address them?? - Role of CRLS CoP. Danika van Proosdij, Saint Mary's University, Phil Osborne, Golder, Tony Bowron, CBWES Inc., DG Blair, Stewardship Center for BC.

4:00-4:20- Open discussion and questions

4:25-4:30- Synthesis and wrap up.

6:00 Pub Night at Red Stag Tavern, 1496 Lower Water St

Wednesday, May 8th- Sobey Building, 903 Robie St

Free Public & Practitioner Tech-Vendor Trade Show & Reception from 10:00-6:00 pm
Networking Reception from 4:30-6:00
Loyola Conference Hall (L290), 903 Robie St

Tools and Technology
Chair, Danika van Proosdij, Saint Mary's University
Room SB260

8:30-8:50- Monitoring metrics, data collection and analysis for living shoreline approach. Eric Roberts, The Nature Conservancy. T. Ballestero[1]; D. Burdick[1]; Curtis Bohlen[2]; J. Freedman[3]; K. Howard[4]; J. Knisel[5]; J. H. Mattei[6]; J. O'Donnell[7]; P. Slovinsky[8]. Maine Geological Society. 1 University of New Hampshire; 2 University of Southern Maine; 3 Rhode Island Coastal Resources Management Council; 4 New Hampshire Department of Environmental Services Coastal Program; 5 Massachusetts Office of Coastal Zone Management; 6 Sacred Heart University; 7 University of Connecticut, Connecticut Institute for Resilience and Climate Adaptation; 8 University of Connecticut, Connecticut Institute for Resilience and Climate Adaptation

8:50-9:20- Invited 5 min pop-up talks & group discussions.

9:20-9:40- Technical considerations regarding the use of remotely piloted aircraft for monitoring nature-based adaptations. Greg Baker, Saint Mary's University; Maritime Provinces Spatial Analysis Research Centre (MP_SpARC)

Remotely Piloted Aircraft, also known as Unmanned Aerial Vehicles or drones and increasingly being used by researchers to monitor nature-based adaptations to threats caused by climate change. This technical session will provide a summary of new Transport Canada regulations regarding the use of Remotely Piloted Aircraft (RPA) for work and research. It will also provide an introduction to Structure from Motion (SfM) photogrammetry techniques, including the generation of high-resolution orthophoto mosaics and digital surface models (DSMs) for change detection and monitoring, and other uses of low-altitude aerial photography collected by RPA.

Then join us in a conversation to address pertinent issues regarding the application of RPAS and photogrammetry for the monitoring of coastal processes, including:

- Accuracy, quality assurance, and error reporting,
- Ground control surveys and ground control points,
- The use (and mis-use!) of horizontal and vertical datums and transformations between them,
- Spectral characteristics of imagery, including spectral sensitivity, absolute reflectance, bit-depth, exposure, and white balance,
- File formats and databases for the handling of large-volume datasets,
- Flight planning and automated flight deployment software,
- The role of Special Flight Operation Certificates under new regulations,
- And the challenges of applying these technologies specifically to the study of coastal processes

9:40-10:10- Invited 5 min pop-up talks & group discussions.

10:10-10:30 Break/ Free Public & Practitioner Tech-Vendor Trade Show & Reception from 10:00-6:00

Communicating with Stakeholders and Communities
Chair, Danika van Proosdij, Saint Mary's University
Room SB260

10:30-10:40- Finding leverage points: cognitive, psychological, social and cultural responses and barriers to nature-based solutions. Kate Sherren, School for Resource and Environmental Studies, Dalhousie University

The session will explore cognitive, psychological, social and cultural responses and barriers to nature-based solutions, as well as leverage points that might further enable this kind of project in other contexts or scales. Cultural change is key to ensuring the success of nature-based solutions, therefore we need to understand current systems and mindsets in order to understand how change is able to occur. These ideas will be explored through the themes of Cognition and Perception, Motivation and Reasoning, Learning and Negotiation, and Power and Process to highlight the ways in which people perceive change, how 'sense of place' is tied to identity, and how power dynamics shape who is involved in processes and decisions. Understanding the social and cultural elements of nature-based adaptation is essential to properly engaging citizens and stakeholders in these processes. This talk will highlight how we can work towards change by understanding existing barriers and opportunities and working within these to find the leverage points that will allow us to engage citizens effectively.

10:40-11:00- Round Table 1: Generating buy-in with stakeholders

11:00-11:20- Round Table 2: Communicating with the general public

11:20-12:00- Synthesis and wrap up

12:00-1:00 Lunch

1:00-2:30- Free Tech-Vendor Trade Show, Demos & Applied Posters Room L260

C1 Nature-based coastal protection using large woody debris: what is it and does it work? Jessica Wilson[1,2]*; I. Nistor[1]; M. Mohammadian[1]. 1 University of Ottawa; 2 Northwest Hydraulic Consultants

In BC, Canada, and Washington, USA, Large Woody Debris (LWD) are frequently installed with the aim of reducing coastal erosion and wave run-up, while enhancing ecological values. However, this project will be the first systematic research program focused on understanding the design and efficacy of LWD protection systems in a coastal environment, with the final goal of contributing to design guidance. Three methods will be used to achieve these goals: (1) Field studies, (2) Physical modeling, and (3) Numerical modeling.

Field studies will be conducted at approximately 30 sites in BC and Washington to better understand LWD durability, design methods, beach characteristics, and erosion/accretion patterns. Collected data will provide valuable information to ground-truth the physical and numerical models. Data collection will utilize low-cost instrumentation and a structured field survey protocol that can be similarly applied on other nature-based projects. Based on the reviews of the state-of-the-art literature and the authors' preliminary field observations, it is expected that LWD will have the greatest durability in low wave energy environments and may less durable (and potentially damaging) in high energy environments. It is also expected that placed LWD will promote leeward accretion and landward erosion, similarly to more traditional shore protection methods.

This project will contribute to grow the expanding body of knowledge on nature-based approaches and will contribute to best practices and design guidance for such practices.

C2 Using Green Shores® to address coastal flooding- a resilient approach to sea level rise. DG Blair, Stewardship Centre for BC

Green Shores® is a program of the Stewardship Centre for BC that focuses on the protection and conservation of Canada's marine and freshwater shorelines. The program provides tools for planning, design, construction professionals, local governments and shoreline property owners interested in shoreline restoration and minimizing the environmental impacts of their projects in a shore friendly and cost-effective manner. Green Shores applies to both larger-scale projects, like parks, and to residential properties. It promotes an integrated approach with a clear emphasis on cumulative impacts and education/training. Green Shores' sound technical framework uses combination of prescriptive checklists and performance metrics that are detailed in resources (e.g. Green Shores Credits and Ratings guides). The application of Green Shores can incentivize higher environmental performance levels through voluntary adoption of the design guidelines, project certification and training.

C3 Making Room for Wetlands – implementation of managed realignment and salt marsh restoration to enhance resilience of dykeland communities to climate change impacts in the Bay of Fundy, Canada. Danika van Proosdij[1]; J. Graham[2]; T. Bowron[2]; R. Mulligan[3]; C. Ross[4]; K. Bekkers[5]; B. Pett[6]. 1 Saint Mary's University; 2 CBWES Inc.; 3 Queen's University; 4 Nova Scotia Department of Agriculture, Agriculture and Food Advisory Services, Land Protection; 5 Nova Scotia Department of Transportation and Infrastructure Renewal

Managed realignment of dykes, providing space for dynamic coastal movement and the reversion of natural wetlands back to their original state have been identified as a viable nature-based adaptation response to climate change; thereby reducing dyke maintenance costs and re-directing resources to areas of greatest need. This implementation however is not without its challenges and there is a lack of demonstrated, well-documented success outside of Europe. While previous efforts to restore coastal wetlands in Atlantic Canada focused primarily on the restoration of resilient and self-sufficient habitats, the increasingly tangible impacts of climate change combined with changing economic landscapes, regulations, and land use practices have shifted and broadened the objectives of these projects. In addition, social, historical and cultural components of the landscape and stakeholders are increasingly needed to be integrated into project design and implementation, thereby increasing their complexity. The Making Room for Wetlands project is building resilience to climate change impacts of dykelands in the Bay of Fundy, by developing a framework for implementing managed dyke realignment and demonstrating the success of these strategies. Demonstration sites were selected in collaboration with the Provincial body responsible for dyke maintenance, after a comprehensive dyke vulnerability assessment and builds upon over a decade of collaboration and experience in tidal wetland restoration. Completed and on-going managed realignment projects in Nova Scotia will be used as a framework for a discussion on the challenges and opportunities presented for coastal habitat restoration for climate change adaptation and 'making room for wetlands'.

C4 Exploring frameworks for how to implement nature-based coastal adaptation. Claire Tusz, Dalhousie School of Planning

As part of the Making Room for Movement project, which is funded by Natural Resources Canada, this poster will present an overview of the current frameworks for implementation of nature-based coastal adaptation that are accessible to coastal communities. As climate change progresses, coastal communities are feeling the impacts of sea level rise and need to make decisions about adaptation. A framework for how to implement nature-based coastal adaptation will improve the accessibility of nature-based coastal adaptation as a strategy for coastal communities. This poster highlights the themes and consistencies between the frameworks that have been researched thus far.

C5 Making Room for Movement: valuation of nature-based coastal adaptation. Kate Clark*; P. Manuel; E. Rapaport. Dalhousie School of Planning

As part of the Making Room for Movement project, funded by Natural Resources Canada, this poster will summarize the current state of knowledge around the assessment and valuation of nature-based coastal adaptation (NBCA) strategies. It will highlight key social, economic, and environmental benefits of NBCA and discuss approaches to the valuation of NBCA implementation for coastal resilience to climate change. This poster will present key conclusions on the value of NBCA to help inform decision-makers and influencers interested in NBCA as a promising alternative, or hybrid solution, to hard engineering for coastal areas.

C6 Looking back over 15+ years of tidal wetland restoration projects in Nova Scotia, Canada. Tony Bowron[1]*; J. Graham[1]; D. van Proosdij[2]; J. Lundholm[2]; N. Neatt[1]; B. Pett[3]. 1 CBWES Inc.; 2 Saint Mary's University; 3 Nova Scotia Department of Transportation and Infrastructure

Tidal wetlands play a key role in our environment, particularly in the face of the increasing risks associated with climate change and rising sea levels. Since 2000, efforts have been underway throughout Nova Scotia to stem the tide of coastal habitat loss, and to restore, were feasible, some of the 80% of salt marshes previously lost due to the construction of dykes, tidal barriers (causeways), and coastal development. As our awareness of the impacts and implications of climate change for our coastal infrastructure and communities grows, so to is the recognition that new ideas and new ways of managing our shorelines are going to be needed. Although the solutions of the past maybe woefully inadequate for the challenges of the future, the two decades of collaboration and experience in coastal wetland restoration can inform and guide the nature-based approaches to climate change adaptation. This poster will showcase the 19 completed, or in progress, projects restoring almost 500 ha that the collaborative team of CBWES-SMU has

worked on in partnership with the NS Department of Transportation and Infrastructure Renewal and the NS Department of Agriculture.

C7 Personalizing our shorelines. Kelly Schnare, Re-imagining Atlantic Harbours for 2050 (RAH2050)

Our non profit program includes academia, community groups, corporate and creative professionals with a mission for collective action to prevent pollution in our Atlantic Harbours!

We have 6 projects under the RAH2050 connected to shoreline water management. Each has successfully piloted elements with three years of development. RAH2050's vision is for community-led communications to highlight environmental-impact for pollution prevention. The scope of this program is supporting awareness of land-based influences.

The baseline of all the work RAH2050 does is through grassroots Story collection using The Watermark Project (personal freshwater narratives). We curate an online inventory highlighting local beneficial use with creative products (collector cards and incentives). We have Written, audio, and visual collaboration opportunities and a fantastic regional basket of stories. Our work is to strategically summarize grassroots voices for municipal planning purposes and also used to inform High-profile, interactive shoreline signage development!

We propose a workshop, booth and table to collect all participants Watermark Stories. Such an inventory will meaningfully contribute to the voice and impact of the Community of Practice by connecting freshwater influences to our coastal infrastructure.

Program progress includes a music video and 250 local Watermarks collected, 2 collection cards styles to be distributed at events / engage the public. Current nationally-supported planning proposals include advancing a green infrastructure using storytelling methods.

C8 Living shorelines and nitrogen mitigation on Martha's Vineyard, MA. M. Schoell[1]; Suzanne Ayvazian[2]*; A. Gerber-Williams[3]; M. Chintala[2]; D. Grunden[4]; A. Pimenta[2]; D. Cobb[2]; C. Strobel[2]; K. Rocha[2]. 1 US Environmental Protection Agency, Office of Research and Development, Atlantic Ecology Division; 2 US Environmental Protection Agency, Office of Research and Development, Atlantic Ecology Division; 3 ORISE Fellow, US Environmental Protection Agency, Office of Research and Development, Atlantic Ecology Division; 4 Town of Oak Bluffs Shellfish Department

Increased human development along the coast and the subsequent increased delivery of excess nutrients to estuarine waterbodies can have combined deleterious effects on salt marsh ecosystems. An increasingly popular shoreline stabilization technique is the use of a living shoreline, which uses biodegradable materials such as coconut fiber coir logs and oyster shell bags that cup the marsh edge to reduce wave energy, enhance the robustness of existing marsh, and facilitate the growth of new marsh. In our study, we assess the potential of a living shoreline as a tool for enhancing nitrogen removal. This may result from improved marsh condition, marsh plants, and newly created marsh area. Between June and August 2016, living shorelines were constructed along an eroding salt marsh at Felix Neck Wildlife Sanctuary on Martha's Vineyard, MA. The experimental design consists of three living shoreline sites with associated control sites, each spanning 80 meters of marsh edge. In addition to physical construction, we examined the spatial and temporal changes in denitrification rates of the marsh platform in the presence and absence of a living shoreline restoration site. Denitrification enzyme activity (DEA), a measure of potential denitrification, was measured in soil cores collected on the marsh platform in living shoreline and control sites seasonally beginning in July 2016. Field measurements included an annual survey of the eroding marsh edge using permanent elevation quadrats; sampling of aboveground biomass, soil percent carbon and nitrogen; and water quality monitoring in the tidal pond. Results showed that denitrification rates were higher in experimental sites than controls ($p=0.02$), but there was no significant difference in season or year. Additionally, there was a significant interaction ($p=0.03$) between treatment and distance from the marsh edge. DEA rates along the marsh edge and in the high marsh were not significantly different in experimental areas; however, rates were higher along the marsh edge than in the high marsh in control areas. There was also a negative correlation ($r=-0.72$) between DEA rates and flood duration, which may indicate ideal elevations for nitrification-denitrification coupling for the marsh. This restoration work not only provides novel information about the feasibility and success of living shorelines in New England, but can be particularly relevant to environmental managers and coastal communities facing coastal erosion and water quality challenges.

C9 Development of a coastal restoration program for Prince Edward Island. Angela Banks, PEI Watershed Alliance.

The PEI Watershed Alliance is undertaking several projects using living shorelines techniques to develop and maintain salt marsh habitat while improving fish habitat via channel excavation in largely infilled estuaries. We are currently in year 3 of a 5-year project funded by the Department of Fisheries and Oceans' Coastal Restoration Fund.

C10 Collaborative Action on Coastal Adaptation under Canada's Adaptation Platform. John Sommerville, Policy Analyst, Natural Resources Canada

To address the complex array of changes, common issues, and needs related to adaptation in Canada's coastal zone, a Coastal Management Working Group (CMWG) was created in 2012 as part of Canada's Adaptation Platform, lead by Natural Resources Canada (NRCan). The CMWG brings together key stakeholders from all levels of governments, industry and professional organizations, research institutes, non-profit organizations, and academia. Climate-resilient natural infrastructure or ecosystem-based adaptation is a priority area for the CMWG, given its flexibility for responding to the impacts of climate change and ability to provide multiple benefits that conventional approaches may not. As a result, the CMWG supports projects to better understand the economic and physical effectiveness of natural infrastructure solutions, and the development of tools, resources, and training to support their use. The CMWG also convenes an important network of engaged practitioners and decision makers focused on mainstreaming the use of ecosystem-based approaches into adaptation practices.

2:30-3:00 Break

Indigenous-led perspectives
Room SB255

3:00-4:30- Roger Lewis, Curator of Ethnology, Nova Scotia Museum of Natural History, and Ursula Johnson, Multidisciplinary Mi'kmaq Artist

4:30-6:00 Free Public & Practitioner Tech-Vendor Trade Show & Reception, Loyola Conference Hall, 903 Robie

Thursday, May 9th- Burke Building, 5932 Inglis St

7:45-8:30 Registration

Coastal Habitat Restoration and Climate Change Adaptation
Burke Theatre B

(*) Presenting Author; (GS) Graduate Student; (US) Undergraduate Student

8:30-9:00- Land Acknowledgement & Welcome Remarks
Raymond Sewell, Saint Mary's University Indigenous Student Advisor
Bruce Hatcher, President of ACCESS, Cape Breton University
Danika van Proosdij, Co-Chair, Saint Mary's University

9:00-10:00- CERF Keynote Dr. Ariana Sutton-Grier, The Nature Conservancy. Green Infrastructure & Blue Carbon: Science to Inform Management, Policy and Decision Making

Coastal ecosystems provide many benefits to people. As we better understand their ability to help reduce flood and erosion risk providing adaptation benefits, and the ability of coastal wetlands to sequester carbon and thereby help mitigate climate change, we can use this ecosystem science to help improve coastal ecosystem management and to inform policies and decision making. This talk will explore some of the current science and policy implications of coastal ecosystems and the benefits they provide for climate adaptation

and mitigation.

10:00-10:20 Break

10:20-10:40- Signs of ecosystem recovery after invasive European green crab removals at Kejimkujik National Park Seaside, Nova Scotia, Canada. C. McCarthy[1], D. Kehler[2]; S. O'Grady[1]; Gabrielle Beaulieu[1]*; N. Feindel[3]. 1 Kejimkujik National Park & National Historic Site, Parks Canada; 2 Monitoring and Information Management Directorate, Parks Canada; 3 Nova Scotia Department of Fisheries and Aquaculture

The European green crab *(Carcinus maenas)* is one of the most successful marine invasive species, capable of causing major disruptions to coastal ecosystems. Kejimkujik National Park Seaside (KNPS) protects the single most significant amount of sandy shore, dunes, estuaries and mudflats in Nova Scotia, Canada (CBCL Limited 2009). This study presents the success of management intervention at KNPS to control green crab impacts through intensive trapping as a means of restoring ecological health at Little Port Joli (LPJ) Estuary while using the neighbouring St. Catherine's River (SCR) Estuary as a control.

We chose green crab relative abundance, eelgrass distribution, and soft-shell clam size class distribution as measures of ecological integrity and thresholds were established as ecosystem recovery targets. Staff and volunteers with little previous trapping experience, removed 1.5 million green crabs from this remote estuary over five years with minimal operational footprint (no motorized watercraft or permanent infrastructure) and no significant incidental mortality to native by-catch. Once green crabs were controlled below the 15 crabs per trap per day (catch per unit effort i.e. CPUE) threshold, ecosystem recovery was evident. Both eelgrass and soft-shell clams responded to reduced impacts with a 34% increase in eelgrass extent and a 40% increase in juvenile soft-shell clam abundance; at the control site, no eelgrass has recovered and green crab catches remain above the threshold identified for recovery. This project has also provided opportunities for engaging the public in affecting meaningful recovery action in coastal estuaries.

10:40-11:00- Absence of recovery in a degraded eelgrass *(Zostera marina l.)* bed in Nova Scotia, Canada: results from a transplant study. Erin K. Wilson[1]*(GS); D. J. Garbary[2]. 1 University of Akureyri; 2 St. Francis Xavier University

By the early 2000s, the invasion of the European green crab *(Carcinus maenas)* had contributed to severe declines of eelgrass (Zostera marina) beds in Eastern Canada. Some eelgrass beds have recovered, but Benoit Cove, Nova Scotia the site of a landmark study on eelgrass decline has failed to rebound, and since 2009 has been devoid of eelgrass and other macrophytes except on an intertidal fringe. The primary objectives of our study were to establish if Benoit Cove has reached a new equilibrium in which eelgrass cannot survive, or if the habitat is suitable but constraints on colonization have restricted a return. From 3 July–29 August 2018, we conducted an eelgrass transplant experiment in which we followed 108 eelgrass shoots transplanted to Benoit Cove and an equivalent number of shoots were moved within a healthy eelgrass bed in Tracadie West Arm. We evaluated transplant survival and various above-ground and below-ground parameters as well as physical properties of the substratum, and the macrobiota at both sites. Tracadie West Arm had a final transplant survival of 92% which was significantly higher than Benoit Cove (15%). Above-ground growth was negative in both sites, but all blade size variables were significantly smaller in Benoit Cove. We suggest that the absence of eelgrass in Benoit Cove was associated with chemical and physical properties of the substratum that lead to sediment resuspension and turbidity which limits growth and survival.

11:00-11:20- Incorporating Indigenous knowledge in a habitat restoration project. Merydie Ross[1]*; C. Robertson[2]. 1 Mi'kmaw Conservation Group; 2 Clean Foundation

This presentation will serve as a case study with the focus on the use of traditional indigenous knowledge in the context of the Northumberland Strait Coastal Restoration Project. The project is taking place in part of Mi'kmaki, Mi'kmaq Territory, in the Northumberland Strait region of Nova Scotia, Canada and was developed by The Clean Foundation with the goal of restoring 15 hectares of tidal wetlands between 2017 and 2022. The project partners with Restore America's Estuaries, The Coastal and Ocean Information Network Atlantic, CB Wetlands and Environmental Specialists, The Nova Scotia Nature Trust, and The Confederacy of Mainland Mi'kmaq's Mi'kmaw Conservation Group. As Project Coordinator, Merydie Ross works closely with the Mi'kmaw Conservation Group to engage Mi'kmaq communities in gathering traditional knowledge that is applied to the restoration site selection process. Merydie will discuss the value of traditional knowledge in the context of this project, how it compares, contrasts, and often includes local community knowledge, and the best practices that the project follows in gathering and applying traditional knowledge.

Her presentation will also showcase how traditional knowledge gathering can engage communities, and the challenges faced in gathering and using traditional knowledge.

11:20-11:40- Applying living shoreline approaches to increase resilience and reduce risk in New England. Eric Roberts*, The Nature Conservancy. T. Ballestero[1]; D. Burdick[1]; Curtis Bohlen[2]; J. Freedman[3]; K. Howard[4]; J. Knisel[5]; J. H. Mattei[6]; J. O'Donnell[7]; P. Slovinsky[8]. Maine Geological Society. 1 University of New Hampshire; 2 University of Southern Maine; 3 Rhode Island Coastal Resources Management Council; 4 New Hampshire Department of Environmental Services Coastal Program; 5 Massachusetts Office of Coastal Zone Management; 6 Sacred Heart University; 7 University of Connecticut, Connecticut Institute for Resilience and Climate Adaptation; 8 University of Connecticut, Connecticut Institute for Resilience and Climate Adaptation

Ongoing development pressure along the already highly-developed New England coastline, changing weather patterns, and rising sea levels threaten the New England region's shorelines, habitats, buildings and infrastructure. Increasingly, landowners are pushing for shoreline stabilization. Providing alternatives to hardened shorelines is more urgent than ever. If the current trend continues, New Englanders will lose coastal resources that support economically important recreation areas, fisheries economies, natural storm damage protection, and other critical habitats. Collaborating regionally via the Northeast Regional Ocean Council (NROC) on two NOAA-funded coastal resilience projects, the coastal zone management (CZM) programs and their partners in New England are assessing the short and long-term effectiveness of living shoreline approaches to build coastal community resilience and reduce risk to people, businesses, infrastructure, and natural and historic resources. Project partners are implementing demonstration projects and applying a standardized suite of newly developed monitoring metrics to living shoreline approaches. The regional effort is advancing understanding of proper siting, design, construction, and maintenance of these practices in New England. Additionally, data collection and analysis will elucidate the positive contributions (or lack thereof) that living shorelines have on shoreline stabilization and natural ecological processes and inform local, state and federal regulatory guidance and policies influencing the use of these approaches. The presentation will highlight challenges shared across the region and compare approaches taken in each state to design, permit, construct, and monitor living shorelines in collaborative effort to advance the use of living shorelines throughout coastal New England.

11:40-12:00- The solstice breach: implementation of managed realignment at the converse marsh, Cumberland basin. Danika van Proosdij[1]*; J. Graham[2]; T. Bowron[2]; K. Bekkers[3]; W. Weatherbee[1]; R. Aykol[1]; E. Poirier[1]. 1 Department of Geography and Environmental Studies, Saint Mary's University; 2 CBWES Inc.; 3 Nova Scotia Department of Agriculture, Agriculture and Food Advisory Services, Land Protection

Managed realignment of dykes, providing space for dynamic coastal movement and the reversion of natural wetlands back to their original state have been identified as a viable nature-based adaptation response to climate change; thereby reducing dyke maintenance costs and re-directing resources to areas of greatest need. This implementation however is not without its challenges and there is a lack of demonstrated, well-documented success outside of Europe. The Making Room for Wetlands project is building resilience to climate change impacts of dykelands in the Bay of Fundy, by developing a framework for implementing managed dyke realignment and demonstrating the success of these strategies. This presentation demonstrates the implementation of managed realignment at the Converse Marsh including bio-physical, archeological, engineering and economic considerations. Approximately 1 km of dyke was removed including one aboiteau structure. Tidal flow was re-introduced on Dec 21, 2018 to effectively restore 15.4 Ha of tidal wetland habitat. Measurements of flow velocity, suspended sediment concentration and flood extents were measured over 3 tidal cycles pre and immediately post breach. The most rapid change in flood extent occurred between 5.75 and 6.5 m CGVD2013 and significant differences in patterns of flow velocity were recorded. Ice blocks also exerted a marked influence on the spatial and temporal patterns of tidal flow within channels. Suspended sediment concentrations at the breach location were relatively consistent between all tides (2 g/l), decreasing to 0.5 g/l during the ebb tide. Deposited material was visible on former agricultural surfaces and within the internal borrow pit suggesting that by spring there may be suitable substrate for colonization by halophytic vegetation. The restoration trajectory will continue to be closely monitored for at least the next 3 years.

12:00-1:00 Lunch

1:00-1:20- Calculating accumulation rates of blue carbon in maritime saltmarsh soils - does reduced decomposition result in more constant rates over time? Gail Chmura, Department of Geography, McGill University

Investments in blue carbon sinks (the organic carbon stored in saltmarshes, seagrass beds and mangrove swamps) require confident estimates of rates of blue carbon accumulation. Multiple methods are available for measuring accumulation rates in shallow cores that can be retrieved with the minimal compaction that is necessary for calculation of bulk density. Marker horizons can give annual rates. Sediment profiles of 137Cs concentrations indicate depths associated with the year 1964 when an abundance of 137Cs was released to the atmospheric from nuclear explosions. Pollen profiles can indicate sediment levels associated with historically recorded land use change and introduction of exotic plant species, thus post European settlement. Concentrations of 210Pb concentrations with depth provide a rate that extends back 100 years. On the coasts of California and Gulf of Mexico carbon accumulation rates determined by 210Pb dating are ~75% of those determined by the shorter-term 137Cs method. In contrast, on the coast of eastern Canada, carbon accumulation rates calculated with these various methods do not show as much of a decrease over time. On average, rates measured by 210Pb are >90% of those measured by 137Cs. This is likely due to reduced decomposition rates in eastern Canada's colder climate, one of the few regions where saltmarsh soils are frozen for extended periods. Thus, even if production of organic matter is lower in our high latitude marshes, slower decomposition rates help maintain the value of our saltmarshes as blue carbon sinks and, as a means to mitigate climate change.

1:20-1:40- Managed realignment of the Belcher St. Marshland: moving the dyke back before it breaks. Jennie Graham[1]*; D. van Proosdij[2]; T. Bowron[1]; K. Ellis[2], K. Bekkers[3]. 1 CBWES Inc; 2 Department of Geography and Environmental Studies, Saint Mary's University; 3 Nova Scotia Department of Agriculture, Agriculture and Food Advisory Services, Land Protection

Globally, the practice of re-introducing of tidal flow to former agricultural dykelands, where feasible, has been identified as a viable adaptation method to current and future hazards associated with climate change. Ideally, realignment provides a "triple win" solution, increasing the level of protection for core agricultural land, reducing the amount of infrastructure and on-going maintenance costs for the regulator, and restoring tidal wetland which will provide crucial ecosystem services. This analysis will focus on how the Belcher St realignment met this objective and restored 6.5 ha (9.7 ha including fringe) of provincially significant salt marsh habitat. Located on the Cornwallis River near the town of Kentville, Nova Scotia, project design focused largely on the core concepts employed by CBWES/SMU: identification of at-risk areas; restoration of hydrology; quantifying baseline conditions (hydrology, vegetation, soils and sediments); and establishing conditions conducive for the natural re-establishment of tidal wetland habitat conditions. The Belcher St project also included a novel approach to shoreline erosion control as a pilot living shoreline was created at an erosional bend in the river. In addition to design, the first year of post-restoration monitoring will be presented and potential restoration trajectories explored.

1:40-2:00- Using unmanned aerial systems, structure-from-motion software and empirical measurements of hydrodynamics to measure borrow pits infill rates in a hypertidal estuary. Graeme Matheson*(GS); D. van Proosdij. Department of Geography and Environmental Studies, Saint Mary's University

In the Bay of Fundy, there are approximately 240km of dykes which protect low-lying coastal areas from flooding. Much of this infrastructure is not currently engineered to a level that will prevent flooding during large storm events that coincide with high tide; a problem that will be exacerbated by climate change and an associated rise in sea levels. In order to meet material needs for dyke topping, dyke managers often excavate borrow pits from the adjacent foreshore saltmarsh. Borrow pits provide this material at a cost that can be up to five times cheaper than importing material from upland sources. Saltmarshes are currently recognized as a viable source of coastal protection, which begs the question: Are borrow pits a sustainable method for dyke building in the context of contemporary dyke management? This research uses unmanned aerial systems (UAS), structure-from-motion (SfM) software and empirical measurements of hydrodynamics to help answer this question. Digital elevation models (DEMs) generates with UAS imagery and processed in Pix4D were examined in ArcGIS to determine infill rates following the excavation of 13 borrow pits in the Bay of Fundy. Many of the borrow pits measured show that while some borrow pits are infilling as desired, other are not, and may reduce saltmarsh resiliency in the long-term. Infill rates were confirmed with hydrodynamic data, which show some borrow pits

contained hydrological and sediment dynamics that are not conducive to deposition. Ultimately, the efficacy of borrow pit excavation should be evaluated on a case-by-case basis, taking in to consideration the local hydrodynamics and the transitional state of the foreshore saltmarsh.

2:00-2:20- Development of a semi-automated classification of hyperspatial imagery to detect landscape change following managed dyke realignment. Reyhan Akyol[1]*(GS); D. van Proosdij[1]; G. Baker[2]; J. Graham[3]. 1 Department of Geography and Environmental Studies, Saint Mary's University; 2 Maritime Provinces Spatial Analysis Research Center; 3 CBWES Inc.

An estimated 80% of former salt marsh habitat has been lost due to historical dyking in the Bay of Fundy Canada. This has resulted in the loss of critical natural buffer zones to protect against rising sea levels and storm surges. The re-establishment of tidal salt marshes in vulnerable coastal zones is an effective long-term adaptation and mitigation strategy for local communities to protect against the impacts of climate change. Monitoring the transition from former agricultural land back into salt marsh habitat, at a high spatial and temporal resolution, as tidal waters are re-introduced, provides important insights into the anticipated trajectory of the restoring ecosystem. In hypertidal, highly turbid estuaries such as the Bay of Fundy, the transitioning landscape is driven by the rapid deposition of fine grained sediments and frequency of inundation which creates a canvas for the formation of tidal creeks, pans and colonization by halophytic vegetation. The rate and spatial patterns of the evolution of the salt marsh landscape after managed realignment of dyke infrastructure have traditionally been poorly quantified and visualized. The availability of hyperspatial images acquired through UAS platforms stocked with a multispectral sensor provides an opportunity to establish a semi-automated classification framework using the methodology of Object-based Image Analysis (OBIA). For this analysis, images were acquired pre-dyke breach at Converse, Nova Scotia in Fall 2018 and will be acquired post-breach after the winter in 2019. Classification rulesets were developed that incorporated not only spectral but also spatial characteristics as well as local expert knowledge through the application of machine learning algorithms, to provide high accuracies and uniform processing standards for change detection. The comparison of classification outcomes from two different observation times will also allow the quantification of the coastal salt marsh restoration progress.

2:20-2:40- The Bay of Fundy blue carbon story (map). Gail L. Chmura*; L. B. van Ardenne. Department of Geography, McGill University

The "Bay of Fundy Blue Carbon Story Map" (https://arcg.is/0DqLzm) informs the public of the importance of organic carbon (internationally known as "blue carbon") stored in Bay of Fundy saltmarsh soils. The story map first explains that the >101 km2 of salt marsh presently on the Bay represents only ~15% of the area originally present when Fundy's shores were first settled by Europeans. It describes how Acadians, who arrived in the 1600s, were the first to drain and transform marshes for agricultural use. Details about the existing soil carbon stocks are t hen provided, noting that, despite this loss, the Bay still holds a large amount of blue carbon that has been accumulating for 3,000 years. Although of similar age, the marshes in the outer Bay, such as Dipper Harbour, have accumulated ~3.4 m of soil while marshes in the inner Bay such as near Mary's Point have accumulated about 8.5 m. It reports the steps in sampling the soil, then analyzing and calculating its blue carbon content. It further explains how this research (by McGill University) reveals that the blue carbon stored in Fundy's saltmarshes is equivalent to >52 million tonnes of CO2 which corresponds to the average emissions of >11 million vehicles over a year. Interactive maps allow users to examine gradients and locate individual marshes. Pop-up boxes for each marsh report carbon density, estimated average soil depth, the calculated stock of carbon and its CO2 equivalent, as well as the number of annual car emissions they would represent.

2:40-3:00 Break

3:00-3:20- Out of sight, out of mind: the overlooked importance of coastal aquifers. Barret Kurylyk*; R. Craddock; J. Cantelon; J. KarisAllen. Department of Civil and Resource Engineering, Dalhousie University

Coastal aquifers function as unseen 'subterranean estuaries' in which high rates of water, thermal, and solute mixing occur between the ocean and connected groundwater systems. This mixing is driven by waves, tides, sea level rise, and density differences between the ocean and adjacent and underlying aquifers, and influences the biogeochemistry, salinity, and thermal regimes of coastal environments. Coastal aquifers serve as conduits that transport contaminants from the terrestrial environment to the coastal ocean by

estuarine baseflow or submarine groundwater discharge. Ocean-aquifer exchanges may also lead to landward contamination, as unpotable seawater can intrude into coastal aquifers due to episodic storm events, rising sea levels, changing groundwater recharge rates, or over-abstraction of groundwater. The intensification of saltwater intrusion due to climate change poses a threat to future drinking water security in coastal regions, which is especially significant considering that global populations are projected to gravitate towards coastal megacities.

This presentation will summarize the physics and implications of ocean-aquifer interactions and highlight plans for recently initiated coastal groundwater research projects in the Canadian Maritimes. These projects include contamination sources and pathways in the Mabou Harbour watershed in Cape Breton. NS, saltwater intrusion dynamics and freshwater decline on Sable Island, NS, and drivers of estuarine thermal regimes and nutrient loading in Basin Head, PEI.

3:20-3:40- Co-creating knowledge to increase social-ecological system resilience: the town of Lincoln, Ontario. L. Vasseur[1]; Bradley May[2]*, M. DeCock[2]. 1 Brock University, Biological Sciences/Environmental Sustainability Research Centre; 2 Brock University, Environmental Sustainability Research Centre

The co-creation of knowledge between researchers and community members is an important aspect of responding to extreme weather events, particularly in the context of adaption to climate change. The Town of Lincoln in the Niagara Region of Ontario lies at the west end of Lake Ontario, along the Niagara Escarpment. During the spring of 2017, the Great Lakes experienced a combination of record high water levels, onshore winds, and persistent rainfall conditions that resulted in extensive flooding. The infrastructure of the Town suffered damage and led to the voluntary evacuation of residents of a shoreline subdivision. The project, funded by Marine Environmental Observation Prediction and Response (MEOPAR) Network, aims to work with the community to co-define potential adaptation strategies that the Town will be able to implement. It uses a community resilience approach involving historical shoreline analysis, interviews, focus groups, and social network analysis, among other techniques, to improve responsiveness to flooding and other extreme weather events in the community. The ultimate goal of this co-created research is to define a participatory process that can lead from planning to action that is transferable to other communities with similar, regional, national or international contexts. The purpose of this presentation is to provide an update on the project, presenting how, by using the theory of change, we are engaging with the Town to ensure that social learning and subsequent actions take place.

3:40-4:00- A citizen science success story on Canada's East Coast: the iNaturalist city nature challenge. Mary Kennedy[1]*; A. Baccardax Westcott[2]; C. D'Orsay[3]. 1 iNaturalist Canada (member); 2 COINAtlantic; 3 Parks Canada

In order to introduce the use of iNaturalist to Nova Scotians, Halifax was registered to participate in the international City Nature Challenge (CNC). iNaturalist is being promoted as the best mobile / online application for natural history identification - iNaturalist is now a National Geographic platform, hosted globally by California Academy of Sciences, and within Canada by Canadian Wildlife Federation and the Royal Ontario Museum. The geographic scope chosen for this local CNC project extended beyond the urban areas of Halifax, Dartmouth, and Bedford to all of HRM extending from Hubbards to Ecum Secum and included Sable Island. The objectives of the event were to encourage people to get outdoors, to explore, to observe nature, to share observations, and to have fun! Lessons learned during this and past bioblitz events will be discussed along with recommendations for future activities. People are concerned about our environment and climate change but don't know what they can do to effect change. After reviewing the level of participation from the community in the April 2019 City Nature Challenge, we would like to suggest that citizen science programs such as iNaturalist can meet their needs and help collect data suitable for research on an ongoing basis.

4:00-5:00- ACCESS Annual General Meeting
Burke Theatre B

6:30 ACCESS Networking Reception at the Discovery Centre's Ocean Gallery
1215 Lower Water St

Friday, May 10th- Burke Building, 5932 Inglis St

8:30-8:50- Are caged blue mussels *(Mytilus edulis)* a viable sentinel for environmental monitoring in Saint John Harbour? A study of reproduction, growth, mortality, and species complex in wild and caged blue mussels in Southern New Brunswick. Vincent A. McMullin[1,3]*; H. Hunt[1]; K. Munkittrick[2]; S. Courtenay[1,3]. 1 University of New Brunswick St John; 2 Cold Regions and Water Initiatives; Wilfred Laurier University; 3 Canadian Rivers Institute at the School of Environment, Resources and Sustainability, University of Waterloo

Intraspecific variation in reproductive effort is an important consideration for determining an effective sentinel species for monitoring in marine ecosystems. The spawning rhythm of the proposed sentinel species Mytilus edulis was examined from November 2013 to August 2014 in both a nearshore habitat in Passamaquoddy Bay near Ministers Island and submerged caging in Saint John Harbour, New Brunswick, Canada (45° N). The species complex at our collection site, on Bar Road, Ministers Island, was also investigated through PCR markers (MAL-I, Glu-5′ and ITS) and was found to be pure M. edulis. Out of (n=40) samples, not a single M. trossulus allele at Glu-5′ was identified, there were 2 M. trossulus alleles (both in heterozygotes) at ITS and one M. trossulus allele at MAL-I. Adult mussels (>50 mm shell length) collected from Ministers Island were deployed at 6 sites (n=100 per site) in Saint John Harbour in November 2013. Up to 20 mussels, sampled from each site monthly April - August 2014, were examined histologically and gonadosomatic index (proportion of wet tissue weight of the mantle) was calculated to establish the presence of spawning phases. Caged mussels experienced a single peak in spawning while nearshore wild mussels experienced two distinct peaks. Caged mussels (M. edulis) appear to be an effective sentinel species for environmental monitoring given variability was low for reproductive endpoints, including between sexes and survival rates were high at approximately 65%.

8:50-9:10- Macromolecular content of microphytobenthic biofilm at two intertidal mudflats in the upper Bay of Fundy, Canada. Matthew Mogle[1]*(GS); D. Hamilton[1]; M. Barbeau[2]; J. Liefer[1]; M. Fyfe[1]. 1 Mount Allison University; 2 University of New Brunswick-Fredericton

Microphytobenthic (MPB) biofilm is an integral food resource for intertidal communities. While it serves as the base of the food web for invertebrates, recent studies have shown that Calidrid shorebirds also utilize biofilm as part of their diet. Nutritional quality of MPB biofilm depends on phytoplankton species present, season, and time of day. Because nutritional quality varies based on a suite of factors, analyzing the macromolecular composition of biofilm over the course of three months provides insight into trends in its nutritional quality. We determined concentrations of carbohydrates and proteins in microphytobenthic biofilm at two intertidal mudflats in the upper Bay of Fundy, Canada in July, August, and September 2018. Chlorophyll a concentrations were also assessed as a proxy for biofilm standing crop. Biofilm standing crop increased throughout the field season at Pecks Cove, but peaked in August at Grand Anse. However, the mean concentrations of proteins and carbohydrates did not reflect the trend shown in chlorophyll a concentration. Despite the mean chlorophyll a concentration being higher in September at Pecks Cove than Grand Anse, carbohydrate and protein concentrations were higher at Grand Anse across all months. This suggests that nutrients in the sediment that are not biofilm, such as detritus, may be more heavily contributing to protein and carbohydrate values at Grand Anse than Pecks Cove. Differences between mudflats accounted for most of the variability observed in the concentrations of carbohydrates, proteins, and chlorophyll a across the sampling period. Nutritional quality of MPB biofilm may be strongly correlated to characteristics inherent to a particular mudflat. Better understanding of spatial and temporal variation in macromolecular content and subsequent nutritional quality may elucidate patterns of shorebird habitat use and pinpoint areas of high conservation importance.

9:10-9:30- Colonization dynamics in experimentally disturbed areas of mudflat in the Upper Bay of Fundy, Canada. Gregory S. Norris[1]*(GS); T. G. Gerwing[1]; M. A. Barbeau[1]; D. J. Hamilton[2]. 1 University of New Brunswick; 2 Mount Allison University

Drivers of infaunal community dynamics in mudflats are not well understood. Based on sampling multiple intertidal mudflats in the Bay of Fundy, infaunal community composition is stable within a mudflat over multiple years but varies among mudflats. Further, community composition appears mostly uncoupled from biotic interactions and local abiotic conditions, perhaps because conditions are relatively benign for animals adapted to inhabiting mudflats. We hypothesize that priority effects are an important structuring force of communities. We are conducting a large disturbance experiment with multiple start times on two mudflats to test conceptual models of succession and provide insight into community structuring forces. Treatment (i.e., disturbed) and control plots are repeatedly sampled over ~2 months post-disturbance for their infaunal community, sediment properties, and taxa in the water column at high tide. Preliminary assessment reveals that our experimental disturbance is effective. We use conceptual successional models to predict

potential succession patterns in treatment plots. If priority effects are important, we expect that initial colonizers will dominate in treatment plots, resulting in communities that are different from those in control plots. Enhanced knowledge of mudflat infaunal community dynamics will inform decisions on conservation and management of migratory shorebirds and fisheries.

9:30-9:50- Genetic analysis of selection on Atlantic lineages of strongylocentroid sea urchins across an ecological gradient. Taylor Burke*(GS); J. Addison. University of New Brunswick Fredericton

Studying the process of speciation and population structure of free spawning benthic invertebrate species is often complicated by their complex, multiphasic life cycle. As a result, ecologists and population biologists often study the adult benthic phase because they are easily manipulated and relatively sessile. However, the ecological interaction of organisms at all developmental stages can impact the regulation of adult populations and species assemblages. Therefore, to understand the relative importance of selection at each developmental stage in shaping population substructure and causing speciation, it is key to examine selection at several life stages at once. My research on Strongylocentrotus droebachiensis and Strongylocentrotus pallidus will examine how selection shapes species dispersal along an ecological gradient in the Bay of Fundy and off the coast of Nova Scotia. Previous work revealed urchins in water <33m are exclusively a shallow cryptic type of green urchin, while depths of > 65m exhibited both a deep cryptic type of green urchin and S. pallidus. This correlation between genotype and environment suggests a strong role for ecologically based divergent. By sampling sea urchins at each developmental stage and ancestry using species-specific SNPs, I will identify at what stage selection acts to remove urchins found in deep environments from shallow water habitats. These results will provide the necessary context for previously conducted research on strongylocentroid sea urchins at stages of development by identifying the relative importance of mortality at each developmental stage, elucidating what drives speciation of not only sea urchins, but other benthic invertebrates with similar life history traits.

9:50-10:10- Rocky intertidal community structure and benthic-pelagic coupling in wave-exposed environments along the Nova Scotia coast. R. A. Scrosati; Matthew J. Freeman*(GS); J. A. Ellrich. Department of Biology, St. Francis Xavier University

Understanding the patterns and drivers of community structure is a central goal of ecology. Previous studies on intertidal communities along Nova Scotia's Atlantic coast have mostly focused on wave-sheltered habitats, where local environmental effects prevail. In contrast, wave-exposed habitats, where the influence of open-ocean conditions normally prevail, have received much less attention. Wave-exposed intertidal communities have mostly been studied on eastern ocean boundaries, along which community structure exhibits considerable variation that is often explained by coastal sea surface temperature (SST) and phytoplankton abundance (Chl-a; food for filter-feeders). To determine the prevalence of such patterns in Nova Scotia, we measured the summer abundance of basal species (seaweeds and sessile invertebrates) at mid-intertidal elevations from 8 bedrock locations spanning the entire Atlantic coast of mainland Nova Scotia (ca. 415 km). Multivariate analyses identified a northern group and a southern group of locations, with geographic patchiness within both groups. Interestingly, most of the observed patterning was shaped by only six (of the 24) sampled taxa (barnacles, mussels, and four seaweeds), which are possibly acting as foundation species. Overall, SST explained 30 % of the total variation in species composition, while Chl-a just explained 12 %. By revealing biogeographic structuring and evidence of benthic-pelagic coupling along Nova Scotia's coast, this study contributes to broadening our knowledge for western ocean boundaries. Ongoing research is expanding the spatial and temporal coverage described in this presentation.

10:10-10:30- Break

10:30-12:00- ACCESS Poster Session
Room B205

A1 Effects of environmentally-relevant levels of microplastics on tissue structure in mytilus edulis (blue mussels). Ben Hewins*(US); A. Rideout; W. Harding; E. MacDonald; L. Ferguson; G. Gibson. Acadia University

A major environmental stressor facing marine organisms is the near-ubiquitous glut of microplastics in ocean ecosystems. We investigated the effects of microplastics on the histology of the bivalve mollusc Mytilus edulis, filter feeders that are highly abundant in coastal ecosystems. Our objective was to determine if microplastics are taken up into tissues at high risk of exposure (e.g., gills, hepatopancreas) and to use histochemistry to look for tissue-level effects. We exposed mussels to polystyrene particles (5 micrometer diameter) at a low concentration that is typical of water samples of the mid-Atlantic Ocean (1-2 particles/ m3) and at a higher concentration characteristic of some coastal areas (100x low). Controls included field-sampled mussels and mussels cultured in the lab

but without polystyrene exposure. After a six-week exposure, we compared the histology of the gills and hepatopancreas in paraffin section using histochemistry. We examined potential changes in basic tissue structure (Hematoxylin and Eosin, Gomori trichrome), mucin production and distribution of hemocytes (periodic-acid Schiff-Alcian Blue), as well as classic indicators of immune responses including lipofuscin production and melanisation (Nile Blue). Preliminary results suggest that polystyrene exposure, even at these low concentrations, was associated with several stress-related responses in both organ systems.

A2 Two new species of marine fungi (ascomycota) isolated from intertidal plant and algal detritus, with notes on a bacterial mycoparasite. Bruce W. Malloch*(GS); A. K. Walker. Department of Biology, Acadia University

Large multicellular plants and macroalgae are important primary producers in North Atlantic coastal ecosystems. Much of the biomass these species accumulate ends up in detrital food webs, but the species composition of these communities have received little to no scientific attention. Two new species belonging to the fungal genera Pithoascus (Microascaceae) and Corollospora (Halosphaeriaceae) were isolated from beached detritus of eelgrass (Zostera marina, Zosteraceae) and the invasive green alga Codium fragile (Codiaceae) respectively using substrate inoculations onto no-nutrient agar. This study proposes the establishment of these two new species based on their distinct morphological characters, as well as offering molecular support through sequence data from the 18S, 28S and ITS regions of ribosomal DNA. Both species produced holomorphs in pure culture, and morphological descriptions for both species as they appear in vitro are provided. The species of Corollospora treated here was also found to host a peculiar species of intracellular bacteria which swells the host cells to sizes much larger than their original dimensions, and can inhabit both fungal hyphae and conidia. This behavior does not appear to have been recorded for any bacterial parasite of fungi and may represent a novel survival strategy for intracellular bacteria. This study offers molecular evidence for the taxonomic placement of this bacterial species as well as notes on its natural history.

A3 A survey of marine macroalgal species of Bon Portage Island, Nova Scotia. Caryn Cooper*(US); A. K. Walker. Department of Biology, Acadia University

Intertidal and subtidal algae are significant players in determining and maintaining the ecology of the intertidal and littoral zones. To investigate the macroalgal species most prevalent on the coast of Bon Portage Island (Outer Island), Shelburne County, Nova Scotia, specimens were collected from the intertidal zone and identified using macroscopic and microscopic morphological characteristics. Species were identified with Illustrated Key to the Seaweeds of New England (Villalard-Bohnsack), although species names were updated after data collection due to recent taxonomic reclassification, and were tracked using the iNaturalist application. Thirty-three different macroalgal species were identified (19 phaeophytes, 8 rhodophytes, and 6 chlorophytes). Thirty species of both deep-water and intertidal algae were found on solid substrates or in the drift, and 3 species (Elachista fucicola, Polysiphonia lanosa, and Halothrix lumbricalis) were epiphytic on other algal species. A species accumulation curve was plotted for the identified algal species over the study period, but did not approach an asymptote, suggesting that the total number of macroalgal species in the Bon Portage ecosystem is greater than the identified number. Algal profiles also varied depending on the energy of the environment, with wracks more frequently found in high-energy environments and filamentous algae and L. digitata more common in low-energy environments. These data represent important marine biodiversity information for intertidal and littoral ecosystems at the southern tip of Nova Scotia.

A4 Vertical zonation and molecular identification of littoral zone lichens. Cole Vail*(US); A. Walker. Department of Biology, Acadia University

Maritime rocky intertidal zones are widely recognized as very diverse and rich ecosystems. However, research on vertical zonation and biodiversity of lichens in these habitats is limited. Lichens are primary producers, providing minerals and energy to consumers. Lichens can alter their substrate, providing a slow degradation to hard bedrock that would otherwise only be worn down by the erosion of the tides or rains. Through these biogeochemical processes, lichens provide an excellent source of minerals that will make their way through the energy-web present in their ecosystem. We are examining the vertical distribution and abundance of several species of the Verrucariaceae in two sites of rocky intertidal habitats in Dyers Bay, Maine, and Barnaby Head, New Brunswick (Bay of Fundy). rDNA barcode sequencing was done on three collections to confirm morphological identifications. We found intertidal lichen diversity as well as abundance increased with vertical zonation. As well, a higher abundance and diversity of lichen species was found at the Barnaby Head site. Three species were identified with DNA barcoding from the Barnaby Head site. These three species were identified as Wahlenbergiella mucosa, W. striatula, and Hydropunctaria aractina. We are examining phylogenetic relationships, documenting the species present, and their vertical zonation in Nova Scotia littoral zones in 2019 to provide a foundation for

understanding the role of lichens in our coastal habitats. DNA barcode data and herbarium voucher specimens contribute reference material for littoral Verrucariaceae.

A5 Quantifying the interaction between salmon aquaculture waste and juvenile American lobster (Homarus americanus) in southwest Bay of Fundy. Emily Paton[1]*(GS), R. Rochette[1]; B. Hayden[2]; 1 University of New Brunswick St John; 2 University of New Brunswick Fredericton

Salmon aquaculture in the southwest Bay of Fundy is a significant source of employment. However, potential impacts of aquaculture on surrounding systems exist, including through the release of organic waste (fish feces and uneaten feed). Another major contributor to the New Brunswick economy is the American lobster (*Homarus americanus*) fishery, and there exists a spatial overlap between the aquaculture industry and the habitats in which larval lobsters settle and live out the early years of their benthic lives. Although concerns have been expressed regarding aquaculture affecting lobsters, few field studies have investigated this interaction, and all have focused on adult lobsters. The purpose of this study is to investigate the interaction between salmon aquaculture and young lobsters by comparing the (i) abundance of settlers, (ii) consumption of salmon feed by juveniles (using stable isotope analysis), (iii) nutritional condition of juveniles (by measuring digestive gland moisture content), and (iv) abundance of juveniles at different distances from aquaculture pens. The study involved three pairs of study sites, with similar conditions between sites in a pair (substrate, temperature, water flow), except that one was "near" and one was "away" from a given aquaculture lease. Additionally, six "reference" sites expected to be unexposed to aquaculture effluents were also used. A better understanding of interactions between these economically important industries may aid in their coexistence.

A6 Recruitment of corophium volutator into existing macrofaunal communities. Erin MacDonald*(US); A. Bunbury-Blanchette; G. Gibson. Acadia University

The Minas Basin, Bay of Fundy, is megatidal estuary (15m) with expansive tidal flats and patchy distribution of macrofauna such as Corophium volutator, direct-developing amphipods that are critical food sources for ground feeding fishes and migratory birds. We asked how biological and environmental factors impact recruitment of C. volutator into established assemblages of macrofauna. Sediment cores, with original macrofauna intact, were collected from three sites with abundances of C. volutator that ranged from high (~200/ 10 cm core) to low (~3 Corophium/core, dominated by Heteromastus filiformis). Field sites had similar sediment composition but differed in organic content. Cores were placed in a mesocosm bench on simulated tidal cycles and C. volutator were added. After two weeks, cores were sieved and C. volutator and other macrofauna counted. We found that: 1) C. volutator recruited to all three assemblages, even those with low abundance of C. volutator in the field, 2) recruitment by both adults and juveniles occurred, 3) brooding and non-brooding females were capable of recruitment, and 4) after recruitment, males and females were found in approximately the same female-biased sex ratio as occurs in the field. Preliminary observations indicate that adults may displace juveniles as recruitment occurs.

A7 Climate change adaptation framework for parks and protected areas. Gabrielle Beaulieu, Kejimkujik National Park

In accordance with the Government of Canada's climate change plan, Parks Canada's response to climate change encompasses recognizing and positioning protected areas as the "natural solution" that they inherently offer. Given the breadth of this commitment in the context of ecosystem resilience and the social well-being of Canadians, Parks Canada has developed a Climate Change Adaptation Framework to guide sites in assessing expected climate change impacts and identifying adaptation options to prioritize. We present this framework to showcase how Parks Canada is structuring climate change discussions and developing adaptation strategies as a potential resource for the coastal conversation on climate change adaptation in natural areas.

A8 Controls of marsh hydrology, climate and photoperiod on availability of the maritime ringlet's nectar sources. Gail L. Chmura[1]*; L. B. van Ardenne[1]; S. Jolicoeur[2]. 1 Department of Geography, McGill University; 2 Département d'histoire et de géographie, Université de Moncton

The endangered Maritime Ringlet Butterfly *(Coenonympha nipisiquit)* spends it entire lifecycle in a single salt marsh. Its ~2-week lifespan as an adult means that, to maintain its population, the blossoms that serve as its nectar source must be available when adults emerge. We are examining environmental factors to assess their control on the initial blooming of its primary nectar sources: sea milkwort (*Lysimachia maritima = Glaux maritima*), sea lavender *(Limonium nashii)*, and seaside goldenrod *(Solidago sempervirens)*.

Over the 2018 growing season, citizen scientists regularly visited marshes to document the first appearance of buds and blossoms of these three species. Soil temperature and water levels were continuously recorded at five observation sites within each marsh. Our calculation of soil growing degree days (>5°C) shows little correspondence to first appearance of buds or blossoms. However, our data suggest that first appearance of sea lavender's buds and the first appearance of goldenrod's flowers may be driven by increased soil drainage. As there is no significant difference in timing of appearance of buds and blossoms, or maximum cover of blossoms among marshes, photoperiod may be a critical driver of blooming initiation. Thus, we cannot discount the possibility that if a warming climate hastens the emergence of adult Ringlets, it will be asynchronous with its nectar sources, resulting in an increased threat to the species' survival.

A9 High resolution, low-altitude aerial photography for habitat restoration, monitoring and mapping. Jennie Graham[1]*, T. Bowron[1]; D. van Proosdij[2]; G. Matheson[1]; Greg Baker[2]. 1 CBWES Inc.; 2 Department of Geography & Environmental Studies, Saint Mary's University

One of the technologies that we have been using for the past eight years to design and monitor coastal habitat restoration projects has been low-altitude aerial photography. For example, our use of helium balloon and drone-based camera systems to produce high resolution digital imagery which enables us to track changes in landscape level morphological conditions and vegetative re-colonization at a fraction of the time, effort and cost of traditional monitoring methods or aerial photography. The use of this technology continues to enhance our ability monitor habitat conditions, is less intrusive and enables us to produce a high-quality product at an affordable rate. As the technology evolves, so does the range of scientific and management applications in which it is making a positive impact. This poster explores a few of the primary and derived products that are being used to benefit restoration and research efforts, and to aid public and private decision-makers.

A10 Contributions of invasive phragmites to soil volume and (blue) carbon in a St. Lawrence saltmarsh. Jiali Gu* (GS); L. B. van Ardenne; Gail L. Chmura. Department of Geography, McGill University

Phragmites australis, common reed, is a cosmopolitan species that grows in fresh to brackish wetlands. It is assumed that a new genetic strain was inadvertently introduced following settlement of the New England colonies. Characterized by a more robust growth and wider environmental tolerance, this strain has spread widely throughout North America. In the last few decades, it has invaded salt marshes on the St. Lawrence estuary. To date, most research on this invasive has focused on its rate of expansion and possibilities for its control, with little study of its contributions to soil carbon or soil accretion – and we are aware of no studies in St. Lawrence saltmarshes. At a salt marsh near la Pocatiere, Quebec, we collected soil cores and aboveground biomass from an invasive Phragmites stand bordered by a dyke on its upland edge and Spartina patens marsh on its seaward side. Cores were sectioned every 2 cm over 20 cm depth. Each section was halved. One half was analyzed for bulk density and total organic (blue) carbon. In the other half, the source of belowground organic matter was determined and its biomass and volume were measured. Cores from the Phragmites-dominated stand held 38-74% more organic carbon than cores from Spartina patens-dominated marsh. Based upon measurements of their diameters, Phragmites rhizomes could be contributing 7.0-10.6 cm of vertical accretion in the upper 20 cm of soil. Our results indicate that invasive Phragmites increases soil volume and carbon storage, the former contributing to marsh resilience to sea level rise.

A11 Blue carbon estimation for a recovered eelgrass *(Zostera marina)* bed at Kejimkujik National Park Seaside, Port Joli, Nova Scotia. Laura Bartlett[1]*; L. Ross[2]; G. Beaulieu[3]. 1 Dalhousie University, School for Resource and Environmental Studies; 2 Dalhousie Marine Affairs Program; 3 Parks Canada

Blue carbon estimation is an emerging field valuing the carbon sequestration and storage capabilities of coastal marine ecosystems including mangroves, saltmarsh and seagrass habitats. Sampling intertidal sediments within eelgrass (Zostera marina) beds for blue carbon provides evidence for supporting the conservation and restoration of these effective marine carbon sinks, particularly as decision-makers are looking to natural carbon storage as a climate change mitigation option. This study provides insight into the carbon storage capacities of recovered temperate eelgrass beds in Nova Scotia, Canada. Sediment sampling across the 2017-18 field seasons yielded average organic carbon values of 31.3 MgC/ha ± 8.5 SD, comparable to global values for blue carbon stored in temperate eelgrass. Given that coastal communities worldwide are looking to implement climate change adaptation strategies, field collection and lab methodology remained accessible to a variety of stakeholder groups interested in monetizing blue carbon storage values. Financial evaluation indicates that blue carbon stored in Little Port Joli Estuary is valued at $30,394 at $50/ tonne of CO2.

These results warrant further sampling and recording of blue carbon estimates for eelgrass beds along coastal Nova Scotia. In doing so, could argue the case for conserving eelgrass along Southwest Nova as a carbon offset project in 2022, when the Nova Scotia Cap and Trade Program is accepting offset project proposals.

A12 The population genetic structure of a commercial holothurian *(cucumaria frondosa)* using radseq. Matthew S.A. Penney[1]*(GS); D. T. Stewart[1]; T. A. Rawlings[2]. 1 Acadia University; 2 Cape Breton University

With the collapse of many finfish fisheries, considerable interest has emerged in the development of sustainable invertebrate fisheries. Sea cucumber fisheries have become important economic components of many nations in tropical and temperate marine environments. However, due to mismanagement and overfishing, these fisheries are often short-lived and quickly collapse. This results in both economic and ecological strain. Management strategies such as rotational harvesting can help to reduce the likelihood of collapse, and studies have shown that incorporating genetic information into management an increase long-term yield, as well. However, rotational harvesting requires adequate information to correctly identify stocks and their boundaries. Many plans do not examine population genetic structure, leaving fisheries assessments underinformed.

The emerging fishery for the Atlantic Sea Cucumber *(Cucumaria frondosa)* off the coast of Nova Scotia currently lacks genetic information for designated fishing zones. A powerful tool developed for population genetic analysis, Restriction Site-Associated DNA Sequencing (RADseq), generates large datasets consisting of thousands of Single Nucleotide Polymorphism (SNP) from a subset of the whole genome for population genetic analyses.

The specific method used in this study, Double Digestion RADseq (ddRAD), which is a useful method for non-model organisms, will be used to generate SNP data for evaluation of ancestry, Wright's F-statistics, Analysis of Molecular Variance (AMOVA), Isolation by Distance (IBD) and Resistance (IBR), heterozygosity, and migration. This study will provide information about genetic structuring, such as source-sink dynamics, to better inform future management plans for this emerging fishery.

A13 Evaluating seagrass habitats as biodiversity surrogates for conservation planning. Melisa C. Wong*; L. M. Kay. Fisheries and Oceans Canada

Marine conservation aims to maintain ecological functioning through the protection of biodiversity, frequently relying on habitat categories as representative surrogates for biodiversity. Habitat biodiversity surrogates typically represent taxonomic diversity, despite species functional traits being more directly linked to ecosystem functioning. Here we evaluate habitat biodiversity surrogates based on taxonomic and functional diversity of fish assemblages in seagrass ecosystems of Nova Scotia, Canada. We do so by assessing congruence in habitat differences (i.e., seagrass vs adjacent bare sediment) between biodiversity components across varying environmental conditions, and also by identifying relationships of fish biodiversity with environmental, habitat and landscape variables. We found only partial agreement in habitat differences for each biodiversity type, that is, habitat differences in taxonomic diversity were only sometimes reflected by functional diversity. In fact, taxonomic diversity was consistently higher in seagrass than bare sediment while this was not always the case for functional diversity. Similar functional diversity between habitat types resulted from redundancy in functional traits and consistent expression of dominant traits. Regression analyses indicated that taxonomic diversity was determined by habitat complexity (canopy height, sediment organic content), wave exposure, and seagrass bed size (R^2 ~0.60). Functional diversity was determined by habitat complexity (shoot density, canopy height, sediment organic content) and wave exposure ($R^2 = 0.475$), suggesting the importance of environmental filtering in selecting a certain set of functional traits. Our study suggests that multiple biodiversity components combined with knowledge of the environmental context are necessary for optimal use of habitat biodiversity surrogates in conservation planning.

A14 Diversity of fungi from marine wood from the Bay of Fundy, Nova Scotia, Canada. Sarah Adams*(GS); A. K. Walker. Department of Biology, Acadia University

Marine fungi play an integral role in the decomposition of intertidal organic substrates, but remain poorly studied in coldwater habitats. Wood decay (lignicolous) marine fungi are key players in the breakdown of organic material and aid in nutrient cycling in the intertidal zone. The Bay of Fundy is home to the highest tides in the world with an 16 meter tidal range which creates an expansive and highly dynamic intertidal zone. The majority of the known marine fungal diversity of this region was discovered using microscopy based identification prior to the advent of molecular techniques. Our study expanded on the known diversity of this region through the use of ITS rDNA barcoding. Samples of marine inundated wood (i.e. wharf posts, driftwood) were collected from 30 sites

within 3 subregions (9 in Chignecto Bay, 10 in the Minas Basin, and 11 in the open Bay of Fundy), and plated onto plates of artificial salt water agar plus antibiotics, Czapek's medium and Dextrose Peptone Yeast Agar. Unique fungal cultures were isolated and identified using their DNA barcodes and macro and micromorphology. Preliminary results have identified 59 species of fungi from marine wood, 3 Basidiomycota and 56 Ascomycota. Of these species 42, 3 Tremellomycetes, 24 Sordariomycetes, 11 Dothideomycetes, 1 Leotiomycetes and 1 Eurotiomycete, are new records for the Bay of Fundy and the Western Atlantic Ocean. Marine fungi identified as true lignicolous fungi will be assessed for their ability to degrade hydrocarbons with controlled experiments during the summer of 2019.

A15 Looking back over 15+ years of tidal wetland restoration projects in Nova Scotia, Canada. Tony Bowron[1]*; J. Graham[1]; D. van Proosdij[2]; J. Lundholm[2]; B. Pett[3]. 1 CBWES Inc.; 2 Department of Geography & Environmental Studies, Saint Mary's University; 3 Nova Scotia Department of Transportation and Infrastructure Renewal

Tidal wetlands play a key role in our environment, particularly in the face of the increasing risks associated with climate change and rising sea levels. Conservative estimates for Nova Scotia (NS) put the loss of tidal wetland habitat at greater than 50% province wide, and that number jumps to approximately 80% for the Bay of Fundy, mostly associated with dyking and conversion to agricultural land. Although these activities are of historical and social significance, it is now recognized that the large scale loss of habitat, species and primary productivity that has resulted from the construction of dykes, modern tidal barriers (causeways), and coastal development have had considerable adverse ecological impacts. Since 2000, efforts have been made to mitigate the loss of tidal wetland habitat in NS. During that time over a dozen tidal wetland projects, complete with comprehensive long-term ecological monitoring programs have been undertaken. These projects have ranged from replacing tidally restrictive culverts (i.e., Cheverie Creek), to the breaching of agricultural or impoundment dykes (i.e., Walton River) and allowing for passive restoration of wetland species and function, to the inclusion of more active restoration efforts such as the design and construction of tidal channels and pannes (i.e., St. Croix). This poster will provide a look back over nearly a decade and a half of tidal wetland restoration projects in NS highlighting successes in the field, advancements in restoration design, lessons learned, and a look forward to what the next decade may hold for tidal wetland restoration in the region.

12:00-1:00- Lunch

Coastal Systems & Climate Change
Burke Theatre B

1:00-1:20- Use of coastal and Bay of Fundy sites by migrating Semipalmated Sandpipers. Rebeca C. Linhart[1]*(GS); S. S. Davis[1]; D. J. Hamilton[1]; J. Paquet[2]. 1 Mount Allison University; 2 Canadian Wildlife Service, Environment and Climate Change Canada

Semipalmated sandpipers *(Calidris pusilla)* are a migratory shorebird that uses stopover sites in Atlantic Canada during their annual fall migration from the Arctic to South America. While activities of adult sandpipers in the Bay of Fundy are well understood, other sites in coastal New Brunswick and Nova Scotia are studied less. Juveniles, which migrate later in the season than adults, have also received little attention. We are investigating how C. pusilla use stopover sites in the Bay of Fundy versus the Northumberland Strait. We are also directly comparing activities of juveniles and adults. In summer 2018 we captured adult and juvenile sandpipers at Johnson's Mills NB (Bay of Fundy) and Petit-Cap NB (Northumberland Strait). We fitted birds with radio tags and collected blood samples for analyses of plasma triglycerides (an index of fattening rate) and stable isotopes of C and N. We also collected prey and habitat data from both regions. Using the Motus Wildlife Tracking System, we determined how long birds remained in the region, and the extent to which they moved between the Bay and the Strait. Results suggest that while the prey base is very different between the two sites, birds are feeding at similar trophic levels and appear to have similar fattening rates. Birds from the Northumberland Strait were also detected in the Bay of Fundy. Conversely, birds tagged in the Bay of Fundy tended to remain there and did not venture to coastal sites. Juveniles behaved in ways similar to adults, though appeared to gain weight more slowly early in their stopover.

1:20-1:40- Using heat to trace groundwater-pond exchanges on a small barrier island in the North Atlantic. Jason KarisAllen*(GS); B. Kurylyk. Department of Civil and Resource Engineering, Dalhousie University

Sable Island is a crescent-shaped barrier island located 160 kilometres off the eastern coast of mainland Nova Scotia. Satellite imagery has revealed a pronounced decrease in the surface area of freshwater ponds on Sable Island over the past 40 years, which raises concerns over their long-term sustainability. Developing a comprehensive understanding of the vulnerability of these freshwater ponds is critical for future conservation efforts focused on its rich and unique ecosystem, which includes a population of wild horses and many rare and/or endemic species.

The primary objective of this study was to determine if these small-island ponds are groundwater-sourced or sustained by runoff. This question was investigated by applying heat as a natural tracer to quantify the vertical exchange of water between the ponds and the underlying sandy aquifer. Groundwater flow advects heat and influences subsurface and surface thermal regimes. Analytical heat transfer models were developed in the VFLUX 2 software package in MATLAB to simulate the one-dimensional distribution and attenuation of diurnal temperature signals as they propagated downwards into the subsurface. Temperature-time series at multiple sediment depths were recorded from six pond beds over 31 days in August and September of 2018. These thermal data were analysed to yield quantitative estimates of water flux magnitude and direction. The analysis indicated that five ponds are likely characterized by summer downwelling conditions, with a range of estimated downward fluxes between 0.017 and 0.17 metres per day, and one pond is likely characterized by summer upwelling conditions, with estimated upward fluxes between 0.037 and 0.17 metres per day. This precursory study is the first of its kind on Sable Island and is expected to serve as a valuable contribution to the existing body of knowledge regarding Sable Island hydrological processes. The results will help inform more extensive field campaigns in the summer of 2019.

1:40-2:00- Approaches to calculating the physical sensitivity of Canada's marine coasts to climate change: score aggregation using u-statistics. Scott V. Hatcher*; G. K. Manson. Geological Survey of Canada- Atlantic

Coastal Sensitivity Indices (CSIs) provide information useful to coastal management practitioners. Traditionally a CSI is calculated as the geometric mean of coastal sensitivity indicators. These indicators are ordinal ranks on an arbitrary 1-5 scale, and are the result of assigning ranks to underlying data. Though some standard has emerged for CSIs, this standard has come under scrutiny for both its mathematical assumptions as well as its sensitivity to the number of input variables. In this paper we propose a new method of calculation that addresses these concerns. The proposed method uses u-statistics, which were developed to aggregate ordinal rank variables. These u-statistics provide a mathematically sound method of aggregating ordinal indicators and have a number of advantages over the use of the geometric mean. Results, when applied to the entire Canadian coastline, show that the explanatory power of the proposed method remains comparable to the current standard method. Additionally, it retains construct validity by design, which is not true for the geometric mean. This relieves the necessity of empirical validation that weighs on the previous standard, a process that is imprecise for coastal sensitivity measurement. For these reasons, we suggest the adoption of this method for the calculation of coastal sensitivity indices when the underlying variables are ordinal and with disparate distributions.

2:00-2:20- The changing physical sensitivity of Canada's marine coasts. Gavin K. Manson*; S. V. Hatcher. Geological Survey of Canada – Atlantic

Adapting to climate change along Canada’s marine coasts requires baseline and predictive mapping of physical sensitivity to multiple forcings. CanCoast is a collection of data that describe the physical characteristics of Canada’s marine coasts, which can be analysed to identify areas of high sensitivity and to understand where and how sensitivity is expected to change in the future. CanCoast includes wave-heights including the effects of sea ice (early and late 21st century), sea-level change (early and late 21st century), ground ice content, coastal materials, tidal range, and backshore slope. These are mapped to a common high-resolution shoreline and used to calculate indices that show the change in coastal sensitivity over the 21st century. The sensitivity of much of Canada’s coasts is expected to increase, but other areas are projected to experience negligible change or small decreases. The largest increases are in the western Arctic which is subject to some of the highest rates of relative sea-level rise in Canada, wave heights are expected to increase with decreasing sea ice, and ground ice is expected to thaw. Decreasing sensitivity is found in areas where there are steep slopes composed of well-indurated materials and where relative sea level is projected to fall. Because of the scales of the input data, the generalised indices are best used to objectively identify regions for further study, rather than local properties or coastal infrastructure with specific characteristics that cannot be resolved in this national-scale approach.

2:20-2:40- Topographic-bathymetric lidar for volumetric assessments of intertidal macroalgae in SW Nova Scotia.

Candace MacDonald[1]*, T. Webster[1]; J. S. Lauzon-Guay[2]. 1 NSCC Applied Geomatics Research Group; 2 Merinov, (Formerly of Acadian Seaplants Limited)

Ascophyllum nodosum (rockweed) is a fucoid seaweed attached to rocky substrata which is found along the east coast of North America, part of an extensive pan-North Atlantic distribution. Rockweed is an intertidal vegetation (existing predominantly between the high and low tide ranges) which lies down over the rocks at low tide and floats mostly straight up at high tide due to small air-filled bladders located along the length of the plant. Acadian Seaplants Limited (ASL) is involved in the processing of rockweed for worldwide food, biochemical, agricultural, and agri-chemical markets. The identification and quantification of the resource is challenging as a result of its occurrence across varied and extensive intertidal zones, and because it is partially or fully submerged half the time. From 2015 - 2017, the Nova Scotia Community College's Applied Geomatics Research Group (AGRG) partnered with ASL to investigate the potential for mapping rockweed using topographic-bathymetric aerial lidar system. To investigate the potential for obtaining volumetric estimates of the resource, each year two lidar surveys were conducted at high tide – one before and one after a measured manual harvest. Various GIS analysis were combined with the results from the manual harvest, as well as ground transects and biomass measurements acquired prior to the aerial surveys, to produce detailed location maps and quantity estimates of rockweed resource in the study area. The results from this 3-year NSERC project will show advancements in the ability to successfully quantify this intertidal macroalgae using a topographic-bathymetric lidar system.

2:40-3:10- Break

3:10-4:00- Hoskin Scientific Student Awards & Closing Remarks