

# Abstract Book



**June 4-7<sup>th</sup>, 2024**  
St. Andrews New Brunswick



## **Tides of Change: Accelerating Conservation and Protection Efforts in Atlantic Canada's Estuaries and Coastal Waters**



Presented by:



# Oral Presentations

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## EFFECTS OF EXTREME WEATHER ON STAGING SHOREBIRDS AND THEIR HABITAT IN ATLANTIC CANADA

Climate change is increasing the frequency and intensity of severe storms, and coastal regions of Atlantic Canada are particularly vulnerable. The timing of these storms coincides with migration of shorebirds through the region. Shorebird populations are declining, and additional stress of extreme weather during migration is concerning, particularly for juvenile birds making their first migration. We studied the effects of Hurricane Fiona on juvenile Semipalmated Plovers and the invertebrate community on which they depend at Petit Cap beach, NB. We captured, tagged and tracked plovers throughout the season, and collected prey samples before and after the storm. The hurricane had a profound effect on birds. Birds present during the storm remained in the region roughly twice as long as those that did not experience it. This was probably driven by weight loss; exposure to the storm led birds to lose almost all fat they had gained. Their weight loss may have been partially driven by their inability to feed during the storm, but also by changes it imposed on the habitat. Small bivalves, a common prey for plovers, were buried deeper in the sediment after the storm, while polychaetes became more abundant near the surface. Although they had to restart fattening post-storm, they added weight at approximately the same rate as before the storm, suggesting dietary flexibility or prey community recovery. Our results highlight the need for more detailed studies of storm effects on intertidal habitat and in Atlantic Canada, and for such effects to be considered in conservation planning.

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**THE IDENTIFICATION OF MICROPLASTICS AND OTHER MICROPARTICLES IN THE SAINT JOHN RIVER WATERSHED – Preliminary Analysis**

Microplastic pollution has continued to gain attention as mounting evidence confirms the detrimental effects on aquatic and coastal wildlife, habitat, and human health. The existing baseline data for microplastic plastic pollution in freshwater and marine environments in Atlantic Canada is lacking which may limit the effectiveness of policy and management actions. An effective habitat risk assessment and implementation of an equally effective plastic pollution reduction effort requires the local characterization of the degree, type, and potential pollution sources across different sites, habitats, and environmental matrices. Recent studies have emphasized the importance of confirmatory analysis as much of what is interpreted as being 'microplastic' has turned out as microparticles of cellulosic material, some of which are highly processed natural fibers containing preservative chemicals and pigments giving a polymer-like appearance. Focusing on the Wolastoq/Saint John River watershed, data on potential microplastics and archived potential microplastic samples were provided by project partners from a variety of environmental matrices including biota from both freshwater and marine ecosystems. The first 2 years of this 3-year project saw 1314 of these potential microplastic particles undergo Fourier Transform Infrared Spectroscopy for confirmatory (FTIR) analysis to add to the FTIR analyses previously completed for some of the datasets. For confirmed microplastic data, the influence of variables such as abundance, shape, size, and chemical composition is currently being analyzed to infer sources (and sinks) of plastics, their movement and breakdown in the environment, their pathways into freshwater and marine ecosystems, and potential impacts on ecologically and commercially important species.

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**CONTRIBUTION OF SEASONAL MIGRATIONS TO CONNECTIVITY OF ADULT AMERICAN LOBSTER (*HOMARUS AMERICANUS*) IN THE BAY OF FUNDY**

American lobster, *Homarus americanus*, supports a significant commercial fishery with a value of over \$2 billion in landings for Canada in 2021. Five of the defined Lobster Fishing Areas in Canada occur within the Bay of Fundy and have accounted for 40% of the total Canadian lobster landings for the last two decades. Despite its considerable socio-economic importance, knowledge gaps still exist concerning the seasonal migration paths of the species. This study aims to quantify the impact of movements on the connectivity between the inshore and offshore populations of lobster, as well as between the currently defined Lobster Fishing Areas in the Bay of Fundy. It also aims to increase our understanding of where adult lobsters go to overwinter, as well as potential interactions between American lobster and anthropogenic activities, such as open pen aquaculture, during their migrations. To better understand the seasonal migrations of the American lobster within the Bay of Fundy, the migrations will be examined using archival satellite tags that will collect depth and temperature data experienced by the lobster at regular intervals. These data will then be combined with physical models of the Bay of Fundy bathymetry and temperature to reconstruct the most-likely movement tracks of each lobster. This study will provide the most detailed empirical data to date concerning the movement of adult American lobster within the Bay of Fundy.

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**THE OCEAN AND US IN AN ERA OF CLIMATE CHANGE**

Creating, sharing and using marine and environmental information about the Bay of Fundy and its watersheds has been the longstanding mantra of BoFEP. A Working Group on Ocean Literacy was set up in 2018 to enhance this communication effort in an era of climate change. We need a more informed public and “youth”, in whose hands the future of the Bay and its coastal waters lies. After many presentations, panels, and informal discussions, we have now engaged and worked with the public education school system in NS. Recently we conducted a Professional Development (PD) Day for high school teachers, focusing on the ocean and its relationship with climate change. The planning and delivery of the PD Day was carried out in collaboration with a number of experienced teachers familiar with the current “Oceans 11” program in NS. We report on this achievement and describe the presentations and support materials (tool kit) developed for teachers’ use in their classrooms and outside. The post PD Day review will point to a follow-up agenda. Ocean and climate literacy continues to be a major focus of BoFEP, in line with the UN Decade on the Ocean and the activities of groups in Canada such as the Canadian Ocean Literacy Coalition (COLC) and the Canadian Network for Ocean Education (CANOE). This talk should galvanize discussion about the importance of ocean literacy throughout the Bay of Fundy community and beyond. An engaged, informed and proactive community will lead to better protected and managed maritime coastal waters.

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## ESTABLISHING A FOUNDATION FOR MOLECULAR MONITORING OF MARINE PROTECTED AREAS IN THE CANADIAN ATLANTIC

Metabarcoding techniques are a promising tool for biodiversity monitoring in Marine Protected Areas (MPAs); however, the current utility of these techniques is hindered by limited reference sequence availability for coastal marine invertebrates in Atlantic Canada. The goal of this research project is to expand the DNA barcode reference library for Atlantic Canadian marine invertebrates. We identified focal groups with poor barcode-coverage and available taxonomic expertise, including bryozoans (~3% of known species barcoded in Atlantic Canada), sponges (~2%), and polychaetes (~11%). We focused our collection efforts in the Bay of Fundy, the Scotian Shelf and the Gulf of St. Lawrence. Specimens were collected using primarily SCUBA and ponar grab sampling. Specimens were identified, photographed, and tissue-sampled for standard DNA barcoding using the mitochondrial COI marker and additional markers where needed. To date, approximately 2000 specimens representing 350 species have been collected. Of these, 175 were target species (commonly cited in the region but not yet barcoded). The resulting DNA barcode database will be of great value for stakeholders and scientists utilizing molecular methods such as metabarcoding or eDNA to study existing and candidate Atlantic Canadian MPAs. The publicly available reference pages, with photographic and habitat information, and sequence data will also be a valuable resource for the international research community. Additionally, we aim to create a project website providing information on taxonomy and identification features for collected species.

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**CONCRETE BLOCKS AS AN ALTERNATIVE HABITAT RESTORATION APPROACH IN A FRAGMENTING EELGRASS LANDSCAPE: A CASE STUDY IN PRINCE EDWARD ISLAND, CANADA**

Many eelgrass beds in Atlantic Canada are patchy, fragmenting, and declining due to multiple regional stressors. While transplanting eelgrass can help reestablish some of this habitat, this restoration approach is labour intensive and has mixed success. Exploring alternative habitat restoration methods that promote similar biodiversity in eelgrass beds is thus warranted. We explored the use of artificial oyster reefs to create biodiverse habitat in a fragmented eelgrass bed on PEI. Concrete bricks were deployed in bare patches of the eelgrass bed from 2021-2023. In October 2023, reefs were sampled to assess sessile and pelagic biodiversity; abiotic conditions were also monitored in July 2023 to document any abiotic effects of the reefs. Maximum sessile biodiversity ( $18 \pm 2$  taxa) was achieved within one year of reef deployment, and substantive growth in biomass was observed the following year; oysters and aquatic vegetation accounted for most (X%) of the biomass on reefs deployed in 2021. Numerous pelagic species were observed passively and actively using the reefs, including fishes and lobster using the reefs as shelter, displaying typical homing and resource protecting behaviours. Significant differences in pH were observed between reef and reference sites, with reefs reducing overall pH and driving day-night pH cycles relative to the reference site, likely via increased metabolism on the reefs. Ultimately, this study suggests that artificial oyster reef structures can serve to promote both benthic and pelagic biodiversity in a patchy eelgrass landscape and may be a suitable alternative habitat restoration method.

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**CAN SIPHON HOLE MORPHOMETRICS BE USED FOR POPULATION ASSESSMENTS OF INTERTIDAL SOFT-SHELL CLAMS, *MYA ARENARIA*?**

Measuring infaunal population dynamics relies on destructive sampling that disturbs sediments and removes animals from their habitat. Establishing effective, non-invasive sampling methods for monitoring infaunal populations can reduce the impact of scientific sampling and facilitate more efficient population assessments. Using intertidal soft-shell clams (*Mya arenaria* L.) in eastern Canada, we explored the potential for estimating population density and size structure from visible siphon holes. Across four sites with varying sediment characteristics and infaunal species assemblages, we predicted the presence of *M. arenaria* with 78-100% accuracy by visually assessing siphon holes. Smaller holes (<7.5 mm) were more likely to be misidentified. Siphon hole count was a strong predictor of actual clam count and biomass at most sites, except the site with wet muddy sediment and high densities of other infaunal species. Siphon hole length was positively related to clam shell length and wet weight at all sites; however, relationships typically had low R<sup>2</sup> values (<0.35). Ultimately, visual assessments of intertidal siphon holes can be effective for estimating *M. arenaria* densities and size structure in some habitats where this species resides. Testing the application of this method to other habitats and species is warranted.

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**THE INCREDIBLE SHRINKING PUFFIN: DECREASING BODY SIZE, AND INCREASING SIZE OF BILL RELATIVE TO BODY, IN ATLANTIC PUFFINS NESTING AT MACHIAS SEAL ISLAND.**

Climate change imposes physiological constraints on organisms particularly through changing thermoregulatory requirements. Bergmann's and Allen's rules suggest that body size, and the size of thermoregulatory structures, differ between warm and cold locations, where body size decreases with temperature and thermoregulatory structures increase. However, phenotypic plastic responses to malnutrition during development can result in the same patterns while not necessarily conferring fitness benefits.

The Gulf of Maine (GOM) is warming faster than most of the world's oceans, and many of the marine species here are at the southern edge of their distributions, including Atlantic puffins (*Fratercula arctica*; hereafter "puffin"). UNB has continued monitoring of puffins and other seabirds at Machias Seal Island (MSI) since 1995. We asked whether changes in adult puffin body size, and the proportional size of bill, have changed with observed rapid ocean warming.

We found that the size of fledgling puffins is negatively related to sea surface temperature anomalies (warm conditions = small fledgers), adult puffin size is related to fledgling size (small fledgers = small adults), and adult puffins have decreased in size in recent years in response to malnutrition during development. Bill size in relation to body size has increased, likely in response to some mix of malnutrition during development and increasing air temperatures.

This is the first study addressing changes in seabird morphology in relation to ocean warming. Our results suggest that puffins nesting in the GOM have morphological plasticity that may help them acclimate to ocean warming.

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*\*Presenting author***ADVANCING THE WETLAND INVENTORY IN NOVA SCOTIA: A NOVEL  
METHODOLOGY FOR ACCURATE MAPPING AND CLASSIFICATION USING  
REMOTE SENSING TECHNOLOGY**

This study introduces a novel approach to wetland identification and functional assessment in Nova Scotia, aimed at enhancing environmental stewardship and climate change mitigation as outlined in the Province's Climate Change Plan for Clean Growth. It recognizes the critical role of wetlands in flood regulation and their extensive ecosystem services, aiming to fortify provincial resilience against flooding through a refined wetland inventory, in alignment with Action 12 of the provincial climate strategy. The limitations of the current Nova Scotia Wetland Inventory, especially its inadequate representation of forested wetland ecosystems, underscore the necessity for an updated inventory to effectively assess climate change impacts, notably flooding. A desktop methodology utilizing lidar and advanced remote sensing and classification techniques at the watershed scale has been developed. This methodology aims to accurately inventory wetlands, pinpoint those crucial for flood mitigation, and identify sites for potential wetland restoration or creation, thereby reducing flood impacts. The enhanced wetland inventory is poised to significantly contribute to Nova Scotia's environmental stewardship and resilience strategies, offering valuable insights into flood risk management and biodiversity preservation. By demonstrating the approach's effectiveness and its potential for future integration with climate change projections, the importance of adopting innovative technologies and methodologies in environmental conservation and planning is underscored. This work represents a significant advancement in the precise mapping and classification of wetlands, setting a new standard for wetland management in Nova Scotia.

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## LEARNING THE CHAOTIC SIGNATURE OF DISSOLVED OXYGEN TIME SERIES TO ANTICIPATE ANOXIC EVENTS

Dissolved oxygen (DO) levels in estuaries present a complex challenge due to the intricate interplay of human activities and natural processes. The ability to predict dissolved oxygen levels in these dynamic ecosystems would enhance our capacity to manage and protect them. Timely information could enable decision-makers, sea farmers, and environmental managers to implement proactive strategies that maintain biodiversity, support aquaculture practices, safeguard water quality, protect public health, and adapt to changing environmental conditions.

Computational methods, specifically predictive models derived from dissolved oxygen time series, could be instrumental in forecasting future variations. However, DO time series often display nonlinear patterns and fluctuations that traditional methods struggle to capture. Chaos theory suggests that these seemingly random variations may originate from deterministic processes within the aquatic ecosystem. The complex interplay of various environmental factors and their nonlinear relationships can create intricate patterns that may appear random but possess underlying order.

Analyzing and modeling dissolved oxygen time series data through the lens of chaos theory could facilitate the development of computational models that are more adept at understanding the system's inherent dynamics and potential for changes and shifts. Notably, features of nonlinear dynamic systems are highly effective for characterizing dissolved oxygen time series from estuaries. Consequently, training machine learning methods to predict events like the expected number of hypoxic events within a given timeframe appears promising when using warning and tipping point sign predictors associated to features measuring the chaos related properties of the time series.

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**HAVE RIGHT WHALES REALLY ABANDONED THE BAY OF FUNDY? OVERVIEW OF SIGHTINGS AND RESEARCH SINCE 2015 AND IMPLICATIONS FOR VESSEL TRAFFIC REGULATIONS**

Most published reports on large whale survey efforts in the Bay of Fundy (BOF) have focused on the critically endangered North Atlantic right whale (*Eubalaena glacialis*; NARW) in their critical habitat in Grand Manan Basin. Annual systematic surveys were conducted in the summers from 1980 through 2020 with considerable interannual variation in the number and location of NARWs. Since 2010, the NARW distribution has shifted, with fewer sightings in the BOF and increased sightings in the Gulf of St. Lawrence (GSL) from May-December since at least 2015. This led to speculation that NARWs had abandoned their BOF habitat. Although fewer in number and with variable residencies, NARWs have been sighted every year since 2015, despite less consistent survey efforts. We will present an overview of NARW monitoring efforts and sightings in the BOF over the last decade, including Canadian Whale Institute's latest survey efforts in Northwest Fundy in 2023 and plans for the next three years. We will illustrate the overlap of these sightings with large-vessel transits in the Northwest Fundy region which pose important implications for management. Vessel strikes and entanglements in fishing-gear are key contributors to the species' decline throughout its range. Fishery regulations are consistently applied in the waters of Atlantic Canada to reduce entanglement risks, however, there are currently no vessel traffic regulations implemented outside of the GSL to mitigate the risk of vessel strike. The recent sightings support the need for vessel traffic regulations when vessel traffic overlaps with right whale residency in the BOF.

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## NON-HUMAN SPECIES ADAPTATION IN THE ANTHROPOCENE EPOCH WITHIN THE BAY OF FUNDY ECOSYSTEM

NON-HUMAN SPECIES ADAPTATION IN THE ANTHROPOCENE EPOCH WITHIN THE BAY OF FUNDY ECOSYSTEM or.... What the Hell are you doing to us. We were here first!

The Bay of Fundy has the highest tides in the world and yet in the short earth time since the ice cover has receded, all the species that call it home now have not only adapted but thrived. What information can we find by researching the adaptation capacity in these non-human species? How can our species help or at least, stay out of their way? This is the purpose of our Foundation.

At the ACCESS BoFEP Joint 2024 Session, we not only want to share what we are developing but encourage discussion and ideas as we finalize our Foundation.

Our property is locally called Deadmans Head which is the smallest peninsula making up part of Blacks Harbour. It is about 110 mostly undeveloped acres with more than two miles of shoreline. It forms the southern side of Deadmans Harbour and on the north side, the Bay of Fundy.

Our website <https://www.livinglaboratory.org/> and the data collection/analysis link, <https://www.inaturalist.org/projects/deadmans-head-forest> are the tools we currently are using for sharing. An example we are encouraging is our relationship with research projects through the University of New Brunswick. Over the last two years we have had UNB Masters level groups researching on our property. Their reports are on the LivingLaboratory website.

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**WIND STILLING AND ITS RECOVERY IN NOVA SCOTIA OVER THE LAST 60 YEARS:  
CLIMATE CHANGE INDEPENDENT OF REGIONAL WARMING**

Wind data was extracted from the Government of Canada Environment and Natural Resources database for five domestic and military airports in Nova Scotia. We describe changing wind metrics for wind intensity and storm frequency by year and month beginning in 1960. For each month we extracted the maximum wind gust speed and counted the number of storm days, here defined as a day in which maximum wind gust was  $> 75 \text{ km h}^{-1}$ . We characterized maximum wind intensity with the following three metrics: annual maximum wind gust for Nova Scotia, mean of the annual maximum from all sites, and means of the monthly maxima from all sites. All metrics showed a consistent pattern of decline, i.e. wind stilling, in which the highest values occurred during the 1960s and 1970s, and declining until around 2000–2006. Subsequently, values significantly increased to 2023, with current values equivalent to those in the 1980s. Increases over the last 15 years had a greater rate of change than during the period of wind stilling. The same pattern was repeated with numbers of storm days per year. These trends are consistent with global patterns of wind stilling and recovery over major continental land masses. The pattern of wind decline was independent of relative temperature stability from 1960–1997 and from 1998–2023 with a step change of about  $1^\circ\text{C}$  occurring between 1997 and 1998.

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**EXAMINING DRIVERS OF ECOMORPHODYNAMIC CHANGE IN THE AVON RIVER ESTUARY**

The Avon River Estuary is a hypertidal, muddy estuary in the upper Bay of Fundy. The system has been in dynamic equilibrium since construction of the causeway in 1970, but recent construction activities and changes in tide gate management have caused an observable shift to disequilibrium. To assess the environmental consequences of these activities, we will examine the relative influence of natural and anthropogenic drivers of ecomorphodynamic change within the Avon River, downstream of the Highway 101 causeway by comparing data from 2019-2023 to baseline conditions, 2007-2019. We hypothesize that anthropogenic activities will hold strong influence over the system ecomorphodynamics. To evaluate the system, we examined changes in channel cross sectional profiles, cross sectional area, surface elevation changes, volumetric changes, grain size, and vegetated area. Changes were compared to tide gate manipulation, construction activities, tidal cycles, and precipitation data to infer what may be influencing the change. Results indicate that there has been a quantifiable change in ecomorphodynamics between the baseline and study period. Additionally, notable changes were around the Windsor Marsh and Newport Bar, near the causeway. Based on patterns in natural and anthropogenic influences and the locations of changes, we believe that construction has had strong influence on the Avon River Estuary while the St. Croix River is mostly unaffected by anthropogenic interference and precipitation may hold primary influence. While future studies need to be conducted and should be based closer to the causeway, these results provide insight into how estuaries experiencing anthropogenic interference may respond and adjust.

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**MULTIPLE PERSPECTIVES ON THE EMERGENCE OF THE INVASIVE COLONIAL TUNICATE *DIDEMNUM VEXILLUM* KOTT, 2002 IN THE WESTERN BAY OF FUNDY, ATLANTIC CANADA**

The invasive colonial tunicate, *Didemnum vexillum* Kott, 2002 was initially observed in Atlantic Canada in Nova Scotia in 2013 and has since been expected to spread to the western side of the Canadian Bay of Fundy due to colonies known to be present in nearby Eastport, Maine. Since 2018, we collected water environmental DNA (eDNA) samples at eight sites in the Quoddy Region in the western side of the Canadian Bay of Fundy. In 2021 and 2022 we used diver-based visual surveys and sample collection, as well as a surface-deployed near-seafloor optical imaging system to document the presence and extent of *D. vexillum* in the Head Harbour/West Isles/Passages Ecologically and Biologically Significant Area (EBSA) within the Quoddy Region. Forty-one dive sites were surveyed via SCUBA, and seven near-seafloor camera transects were conducted at depths deeper than dive limits (~30 m). *Didemnum vexillum* was detected at two sites from eDNA metabarcoding and quantitative PCR in 2018, 2020 and 2021, and observed by divers at 11 sites, two of which exhibited extensive tunicate coverage. *Didemnum vexillum* occurred in all 7 near-seafloor imagery transects to depths of 118 m. *Didemnum vexillum* was observed extensively overgrowing benthic substrates and fauna, possibly threatening the diversity of natural benthic habitats in the EBSA and adjacent areas supporting numerous commercial fisheries. This study is the first to report *D. vexillum* presence in the Canadian western Bay of Fundy. We discuss optimisation of future surveys for detection of *Didemnum vexillum*, including timing of eDNA surveys

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**APPLICATION OF REMOTE SENSING AND IN SITU SAMPLING TO EVALUATE HABITAT SUITABILITY FOR SHOREBIRDS IN ATLANTIC CANADA**

The Northumberland Strait, Canada hosts large populations of southbound migrating shorebirds in late summer and fall each year. Shorebirds rely on these coastal sites to forage and replenish fat stores to continue their migration to non-breeding grounds. To understand what factors might influence shorebird abundance at different sites during staging we used remote sensing and in situ sampling. In 2022 between August and October, we conducted shorebird surveys coupled with invertebrate and sediment sampling at 10 sites along the Northumberland Strait. We modeled shorebird abundance based on our surveys and citizen science data against sediment particle size, organic content, water content, site extent, month, and invertebrate consumable biomass. We found that shorebird abundance and invertebrate biomass differed across sites. Abundance of small sandpipers (*C. minutilla*, *C. pusilla*, and *C. fuscicollis*) was predicted by presence of plovers at a site, and finer sediments with higher moisture and nutrient levels. Plover (*C. semipalmatus*, *C. melodus*, *P. squatarola* and *P. dominica*) abundance was correlated only with higher numbers of late season migrants (*C. alba*, and *C. a. hudsonia*). These later migrants were most abundant at larger sites and where gastropods were abundant. Based on these findings and in combination with analysis of Sentinel-2 imagery, suitable shorebird foraging habitat was mapped for each group of birds. This work will enhance our understanding of regional foraging habitat for different species and help us to make more informed decisions when managing and protecting key staging areas in Atlantic Canada.

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**INTEGRATION AND DATA SHARING TO EXAMINE THE FATE AND TRANSPORT OF MICROPLASTICS IN THE WOLASTOQ WATERSHED AND SAINT JOHN HARBOUR**

Pollution reduction efforts require characterization of the extent, types, and sources of pollution across ecosystems to understand input pathways, identify sources and sinks, determine risks to ecosystem health, and evaluate effectiveness of guidelines and legislation. Studies of microplastic pollution in Atlantic Canada have generally focused on single habitats and taxonomic groups. To develop a broader understanding of microplastic pollution in our region, we have developed a collaborative network of academic organizations and community partners to better understand patterns of freshwater and marine microplastic pollution in the Wolastoq (Saint John River) watershed, including Saint John Harbour. Our project is leveraging previously collected microparticle data by compiling and mapping existing datasets to allow comparisons across sites and between environmental (water, sediment) and biotic (freshwater and marine mussels, lobster, zooplankton) samples. We are also adding value to archived datasets by sending microparticles for spectroscopic analysis (micro-FTIR) of polymer types to provide information on potential sources of anthropogenically modified microparticles. Another goal of our project is to facilitate comparability of plastic pollution data among research groups and build capacity for plastic pollution research in Atlantic Canada by standardizing methods and enhancing knowledge transfer and data sharing with community groups interested in monitoring for this emerging pollutant. We will discuss project progress to date, including presenting comparisons of microparticle concentrations between some datasets.

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### MONITORING SEALS IN THE SAINT JOHN HARBOUR

ACAP Saint John has been actively monitoring seal abundances known haul-out sites throughout the Saint John Harbour and Musquash Marine Protected Area (MPA) to better understand the present seal population in the area. Seals play a role of both predator and prey, understanding their population changes may give insight into overall ecosystem health. From 2018 to 2022, seals (Harbour and Grey) were observed at six haul-sites biweekly in the Saint John Harbour. Results from the 2018-2022 monitoring show that the seal population has grown, and seasonal movement patterns have changed in the Saint John region compared to the last survey done in the early 90s by Colbourne & Terhune (1991). During our monitoring, we observed seals year round at all sites with notable trends in seal numbers throughout the seasons. These results have led to further questions around understanding of what may be driving these seasonal movement trends and population increases. To better understand seal populations, the presence of grey seals, and what is fueling their diet, we are currently working on a continuation of this project focused in the Musquash MPA. In 2023 a pilot trial explored in addition to seal observations collecting seal scatt samples in the hopes of better understanding seal foraging, which may be influencing the observed seal population. We will take the lessons learned from the pilot season into 2024 where we will collections and observations through a full field season to gather more information about the seal population in the area.

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**DO YOU SEA WHAT I SEE: EXPLORING THE REPRESENTATION OF PLACE-BASED KNOWLEDGE IN SPATIAL PLANNING IN COASTAL NOVA SCOTIA, CANADA**

Spatial planning is essential in the interdisciplinary management of dynamic coastal environments. However, conventional approaches to spatial planning do not focus on the comprehensive representation and visual communication of place-based knowledge. This oversight limits the contextual applicability of planning decisions. To understand this issue's relevance in Nova Scotia, the suitability of six data representation (DR) tools used in spatial planning for representing local perspectives was explored. Through a scoping review and semi-structured interviews with spatial planners, researchers, and users of coastal environments in Nova Scotia, key characteristics that make each DR tool useful in representing place-based knowledge, as well as certain tool design limitations, were identified. Also identified were the generalized stages of the spatial planning process at which each of the selected DR tools was most effective. The results are meant to inform the use and design of DR tools in a way that better serves coastal users throughout different stages of the spatial planning process, thereby supporting informed and equitable decision-making.

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**HYDROPERIOD OF THE SALT MARSH PLATFORM IN MICROTIDAL AND MEGATIDAL REGIMES IN MARITIME CANADA**

Hydroperiod directly mediates access to salt marsh sub-habitats (creeks, pools, platform) by nekton (fish and swimming macroinvertebrates). It is not well-understood how different tidal regimes affect hydroperiod and sub-habitat connectivity. The coastline of the Chignecto Isthmus offers a unique opportunity to study and compare salt marsh hydroperiod in areas with varying tidal ranges (microtidal and megatidal) at relatively close geographic distances. To measure hydroperiod of four focal study sites, water pressure loggers were deployed on the seaward edge of two salt marshes in the Northumberland Strait (tides <2m) and two in the upper Bay of Fundy (tides >8m) in summer–fall 2022–2023. Results indicate that the majority of sub-habitats of the salt marsh platforms in Northumberland Strait sites are flooded more frequently and for longer durations ultimately spending more time inundated, and thus available to nekton, than in Bay of Fundy sites. Studies in the Bay of Fundy help fill gaps in the literature of marsh dynamics, since most previous studies examined geographically distant marshes in areas of micro- or mesotidal ranges (0–4m) and lack information on regions with megatidal ranges. This work contributes to the development of better models to support salt marsh restoration projects and conservation efforts.

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**COMMUNITY BASED MONITORING IN THE SAINT JOHN HARBOUR: A BASELINE APPROACH TO UNDERSTANDING FISH COMMUNITY, WATER QUALITY, AND SEDIMENT POLYCYCLIC AROMATIC HYDROCARBONS CONTAMINATION IN AN INDUSTRIALIZED HARBOUR.**

The Saint John Harbour faces numerous historic and contemporary challenges that could affect the quality of its marine habitat. Situated at the confluence of the Wolastoq and the Bay of Fundy, it serves as a crucial pathway for migratory fishes, marine life, and human activities. A comprehensive understanding of the nekton community, which inhabits the nearshore environments, along with assessments of water and sediment quality, is essential for enhancing our knowledge of the ecosystem.

In 2018, ACAP Saint John undertook a project to gather baseline data through monitoring the nekton community at eight nearshore sites, assessing water quality at 22 nearshore and freshwater input sites, and measuring sediment Polycyclic aromatic hydrocarbons (PAH) concentrations at 13 nearshore sites. The findings from this four-year monitoring endeavor reveal compromised water quality and contaminated sediments at select sites, primarily where freshwater streams converge with the Harbour, known for historical contamination. At 14 sites, *E. coli* concentrations exceeded recommended guidelines, indicating persistent fecal contamination. Moreover, sediment PAH levels were elevated at six sites, notably Marsh Creek. During the project, over 41,000 fish and sand shrimp were collected, showing varying abundances and diversity across the eight sites, influenced by temporal and spatial environmental factors. The data collected not only establishes a valuable baseline for future endeavors but also sheds light on pollution issues within the Saint John Harbour, motivating further studies to comprehensively understand these impacts.

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**ASSESSING THE EFFECTS OF PHOTOOXIDATION ON THE TOXICITY OF OIL TO AMERICAN LOBSTER LARVAE (*HOMARUS AMERICANUS*)**

Changes in International Maritime Organization regulations regarding the lower limits of sulfur content in marine fuel oils have initiated the transition to a new generation of low sulfur fuel oils (LSFO). These new generation fuels are diverse, and their physical, chemical, and toxicological properties are less well understood compared to their traditional counterparts. Little is known about the photooxidation capacity of these LSFOs, or the toxicological significance of the range of photo-products they may form. Trials were conducted with an ultra-low sulfur fuel oil (ULSFO), a conventional heavy crude (CONV, sulfur content ~3.4%), an Offshore Newfoundland crude oil, and 12 different LSFOs selected from 49 LSFO products collected from the Australian Maritime Safety Authority (AMSA). Low energy water accommodated fractions (WAFs) were prepared and mixed either under the light for 18-hr irradiation or in the dark, and full spectrum light exposures were generated using an Atlas Solar Constant lamp. WAFs were prepared at 1 g/L under UV light and in the dark and were tested using only 100% strength solution of the WAF. For 11 of the 12 LSFOs tested, observed toxicity in the UV treated WAF was equal or greater than the WAF prepared in the dark. The LSFOs tested were more toxic than the ULSFO and CONV at the 1 g/L loading, and they showed a full range of immobilization response from 10 - 100%. The findings highlight the diversity in LSFO products on the market, and the data generated will be used to develop and validate models, to predict and assess the toxicity of these new generation fuel oils.

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**THE USE OF MESOCOSMS TO ASSESS IMPACTS FROM ANTHROPOGENIC STRESSORS**

Following the 2010 Pulp and Paper Environmental Effects Monitoring Technical Guidance Document, alternative monitoring methods for benthic invertebrate community monitoring studies are appropriate where there is the presence of hazardous conditions, unsuitable habitat for sampling, the presence of confounding factors. This study sought to provide a feasible alternative monitoring method through the use of indoor mesocosms, which if successful, could be applied to meet the monitoring requirements.

The objective of this study was to validate that the test system can hold and maintain a benthic invertebrate community over the course of 45 days and that an effect can be induced on the marine benthic community in the test system as measured by the benthic invertebrate community (benthic invertebrate density, taxa richness, the Simpson's Evenness Index, and the Multivariate Mantel test using Bray-Curtis dissimilarity matrices.

The establishment of the mesocosms (151-L plastic black ovals) involved the collection marine sediments (~1200-L) and their associated benthic invertebrate community using the Huntsman R/V Fundy Spray with grab sampling using a Van Veen sampler (volume of ~28 L and penetration depth of ~22 cm). The grab samples were coarsely sieved to remove macrofauna and then distributed amongst all 16 mesocosms (~75 L per cosm) within 24 hrs of collection. The mesocosms were allowed to acclimate under flow-through conditions for 12 days prior to the introduction of the test material. A concentrated stock solution of the fertilizer was then continuously added to the 8 mesocosms over the course of 45-days. The mesocosms were monitored daily, with sediment core samples collected in triplicate from each mesocosm at days 0, 21, and 45. The sediments were then sieved and the biota was sorted and identified. Organisms were enumerated and identified to the lowest practical taxonomic level (usually species) by experienced taxonomic technicians. Differences in the benthic invertebrate community metrics were assessed through multivariate analyses.

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**SOCIAL IMPACTS OF MODIFYING TIDAL RIVER CAUSEWAYS AND RIVER RESTORATION**

Throughout the mid to late 1900's around the Bay of Fundy, barriers were constructed across tidal rivers to serve as bases for roads and railroads, connect people to rich agricultural land and growing towns to one another, and limit maintenance on upriver dykes and aboiteaux. These barriers continue to be critical for transportation infrastructure and provide fresh water and recreational spaces. At the same time, they disconnect rivers from their bays, prevent safe fish passage, and have rippling social and ecological consequences. Today, coastal communities and infrastructure are increasingly at risk from rising sea levels, increasing erosion, and severe storm surges. Necessary adaptation and restoration options challenge people's ideals and the way they experience tidal rivers, leading to conflicts within coastal communities. Ecological, social, and economic trade-offs are inevitable in restoration and adaptation, and understanding each is critical for equitable, sustainable decision making. We present research methods and initial findings from the first five months of a study assessing social impacts of potential causeway modifications in Windsor, NS, using a comparative case where restoration has occurred, the Petitcodiac River in Moncton, NB. This study uses a comparative Social Impact Assessment framework and includes retrospective and prospective components. The retrospective approach includes document and longitudinal media analysis, and the prospective approach includes resident surveys and interviews with key informants. This work seeks to provide an applied example of how comparative SIA may be used to understand social impacts of tidal river restoration through tidal barrier modifications and assess local perceptions and experiences with climate-resilient projects.

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### EXPOSURE OF FEMALE LOBSTERS TO SEDIMENTS SPIKED WITH EMAMECTIN BENZOATE: EFFECTS ON EGGS AND LARVAE EARLY DEVELOPMENT

In Canada, the salmon aquaculture industry is a major economic activity. For fish health control and management, the use of drugs and pesticides in 75% of the facilities between 2016 and 2018 has been reported by science advice documents of Fisheries and Oceans Canada. In-feed products like emamectin benzoate (EMB) enter the marine environment accumulating in sediments, potentially remaining bioavailable to non-target organisms from months to years.

The American lobster (*Homarus americanus*) is a key species in the Northwest Atlantic with high economic and ecological value. With increasing aquaculture production, the potential impact of therapeutants used in this industry needs to be addressed to ensure limited impact on this organism to promote and sustain a state of collective well-being among all stakeholders. Adult ovigerous lobsters were exposed for 10 days in a flowthrough system at 4 levels of EMB spiked sediments to assess intra and trans-generational effects. Two 70-L tanks per treatment with 2-3 lobsters per tank were set up with daily assessment and water quality checks. At the end of the exposure, animals were maintained in common housing until embryos were ready to hatch. Endpoints considered included hatching success, duration of hatching window, larval quality, adult and larvae molting ability, and adult post-molt meat quality.

Results indicate that an indirect mid-term exposure of EMB at concentration 30x higher than environmentally relevant (1061 ng/g DW) causes limited effect in the adult and freshly hatched American lobsters.

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**DO SEABIRDS SING ... – FORECASTING THE STATUS OF FISH-BASED FORAGE PROVISIONING PELAGICS OFF GRAND MANAN**

.. for their supper yes, clearly and in tune. The waters around Grand Manan Island, a major regional trophic hub for a great number of species, have evolved over millenia as habitat for fish such as Atlantic herring; these in turn provide forage for other hub constituents such as seabirds. As with many associated species, knowledge about food sources tells much about consumer populations. The reverse is also readily apparent. While forage sources indicate a lot about avian predators for example, seabirds reveal much about the broader characteristics of the prey they eat. This study adds to our understanding of interdependence in several largely-pelagic predator-prey associations near Grand Manan. I use published data and chance observations to investigate seabird-fish linkages, especially between chick diets (reference ALAR) and juvenile fish (management sources). Results include demonstration of a strong relationship between weir-fishery landings of juvenile herring and the relative quantities of first-year herring fed to razorbill chicks. The most consistent avian indicator of forage health remains the Atlantic puffin, which also quantifies sand lance (herring-competitor) relative abundance. Of interest, the association between white-sided dolphins and the Fundy male killer whale suggests similar delphinid-fish predation interactions. Starting ~2022 the delphinids made several brief late-summer forays north of Grand Manan, potentially indicating minor changes re juvenile herring. This study contributes, independently to the continued development of potential ecosystem-based inputs, by non-fishery research, to future fishery models. Fishery science leading to ecosystem-based fisheries for the Grand Manan region has fallen far behind conservation essentials.

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**HYDRODYNAMIC MODELLING OF WATER RENEWAL TIME AND POTENTIAL DISSOLVED MATTERS IN SHEDIAC BAY (NEW BRUNSWICK, CANADA)**

This study examines the hydrodynamic regimes in Shediac Bay, located in New Brunswick, Canada, with a focus on the breach in the Grande-Digue sand spit. The breach, which was developed in the mid-1980s, has raised concerns about its potential impacts on water renewal time and water quality in the inner bay. The aims of this study using mathematical modelling approaches are to evaluate the flow regimes passing through the breach and influences on the distribution of dissolved matter, providing insights into whether the breach should be allowed to naturally evolve or be artificially infilled to prevent contaminant stagnancy in the Bay. The study has considered three simulation scenarios to comprehend the water renewal time and the role of the breach in the environmental management of the Shediac Bay. Results indicated that completely closing the breach would significantly increase the water renewal time in the inner bay, although the spatial extent of this increase is limited. However, the study has identified some limitations, including the need to better define the concentration limit for considering water as renewed and the lack of consideration of dynamic factors such as winds and waves effects.

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**POPULATION STRUCTURE AND DISTRIBUTION OF THE RIBBED MUSSEL (*GUEKENSIA DEMISSA*) IN SALT MARSHES ON THE GULF OF ST. LAWRENCE OF NOVA SCOTIA**

Climate change and sea level rise have impacted coastal plant communities in estuaries of the southern Gulf of St. Lawrence and resulted in conspicuous marsh erosion. The ribbed mussel (*Geukensia demissa*) has as its primary habitat the lower marsh fringe where it is attached to the rhizomes of the cordgrass *Sporobolus alterniflorus*. In numerous sites, the salt marsh is eroding, resulting in the death of the cordgrass and thereby a loss of the primary mussel habitat. We investigated population density and mussel size in 16 populations in the southern Gulf of St. Lawrence from Pugwash Harbour in the west to Cheticamp Harbour in the northeast. Population metrics were measured in three marsh elevation zones: (1) a dead, low elevation zone with intact peat but no living *Sporobolus* shoots, (2) an intermediate zone with low density of living *Sporobolus*, and (3) a higher elevation, dense zone of *Sporobolus*. Mussel size was related to position, with the smallest mussels occurring in the intermediate zone and the largest mussels occurring in the dense zone. Higher mussel density occurred in intermediate zones primarily in the western end of the transect. Marshes with extensive dead zones had the largest mussels and lower population densities. Low mussel density and absence of relatively small mussels, i.e. < 3 cm, occurred at the most degraded marsh sites. We conclude that as sea level rise impacts the lower marsh fringe that populations of the ribbed mussel are becoming less able to recruit and maintain healthy populations.

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**A NEW ACOUSTIC TELEMETRY TAG THAT IDENTIFIES AND REPORTS CARRIER MORTALITY BY MONITORING CARRIER ACTIVITY**

Current acoustic telemetry technology relies on complex data modelling, interpretation of environmental sensor data, or the occurrence of a predation event to determine the death of a tagged subjects. We present a new acoustic telemetry tag capable of detecting whether its carrier stops moving for long enough to presume the organism has died, and of reporting the time elapsed since movement ceased. This 'mortality-sensing' tag was designed to increase the power of acoustic telemetry for investigating population dynamics and ecological threat processes by making it easier to establish when, where and how the animals of interest die. We present a series of field tests of these tags, conducted in New Brunswick: tags implanted into two species of salmonids in a closed freshwater lake (Long Lake, Victoria County); tags implanted into seaward-migrating Atlantic salmon (*Salmo salar*) post-spawning adults (Miramichi); and tags implanted into seaward-migrating Atlantic salmon smolts (Miramichi). We demonstrate that the new tag achieves its main objective, but that the programming of the inactivity sensor needs careful consideration for species that are routinely inactive for extended periods. The mortality-sensing tag will be a valuable addition to the acoustic telemetry toolbox, with immediate application to ACCESS and BoFEP work research on migratory marine and diadromous organisms.

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### GENERATING GLOBALLY STANDARDIZED BIODIVERSITY DATA FOR INTERTIDAL ROCKY SHORES AND SANDY BEACHES UNDER THE COASTAL ENVIRONMENTAL BASELINE PROGRAM

The Department of Fisheries and Oceans' Coastal Environmental Baseline Program (CEBP) was formed nationally to better understand and manage Canada's coasts and waterways that are vulnerable to impacts of coastal development and marine shipping. The Program works with organizations across many sectors to support the collection and publication of priority data to collaboratively build a more complete understanding of our coastal ecosystems. Since 2021 the CEBP team has used Marine Biodiversity Observation Network (MBON) protocols to record intertidal species on both rocky shores and sandy beaches. This international Network of researchers implements standardized efforts to characterize marine biodiversity around the globe and builds capacity across participating groups to investigate coastal ecosystems and share data openly. Yearly systematic surveys were conducted at three respective rocky shore and sandy beach habitats along the Northwestern Bay of Fundy Coastline. This effort has generated a baseline inventory of invertebrate and algae species that span the intertidal area within each habitat. This inventory can be used to track changes in species composition and abundance over time. These data are being shared openly online and will help to increase knowledge of species that utilize these vulnerable habitats across the region.

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**ATLANTIC SALMON SMOLT MIGRATION IN THE GASPEREAU RIVER, PREDATION HOTSPOTS AND ANTHROPOGENIC BARRIERS**

The Atlantic Salmon (*Salmo salar*) population in the inner Bay of Fundy has declined in abundance and has been listed as endangered by the Species At Risk Act since June of 2003. The Gaspereau River population is of interest due to its reported genetic uniqueness, the presence of hydropower infrastructure within the watershed, and dependence on live gene bank supplementation. In the Gaspereau River, smolts must pass the White Rock hydropower station. If migratory delays occur, they may increase rates of predation, inhibit smoltification, and disrupt the timing of entry into tidal water. Previous studies on the smolt run in the Gaspereau River have not included critical sections of the river system, including the White Rock headpond, above the Hydropower Dam. It is crucial that impacts on smolt migration be better understood to manage and conserve the stock. To examine migration delay and rates of predation, 50 Atlantic Salmon smolt were acoustically tagged with V3D predation tags and passively tracked through White Rock Pond and the Gaspereau River in the spring of 2022. In our preliminary findings, we have observed previously unknown predation hotspots for migrating Gaspereau River Atlantic Salmon smolts.

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**CHARTING CONSERVATION PATHWAYS: INSIGHTS FROM AN OPINION SURVEY AND LITERATURE REVIEW ON RESEARCH AND CONSERVATION IN THE INNER BAY OF FUNDY**

The Inner Bay of Fundy (IBoF) holds immense ecological and cultural value, boasting the world's largest tides, critical habitats for species at risk, and a rich human history intricately tied to its coastal landscapes. The IBoF has received several national and international designations that recognize its significance; however, the marine component of the IBoF remains underrepresented within Canada's marine protected and conserved areas. The IBoF has been highlighted as an area for a marine National Wildlife Area (mNWA) to be designated by 2025, which provides an important window of opportunity to enhance marine conservation in the region. Oceans North has undertaken various initiatives aimed at promoting marine conservation in the IBoF, including a community opinion survey and a literature review on research trends over recent decades. In 2021, telephone interviews (n=500) were conducted by Oraclepoll Research Ltd, on behalf of Oceans North, with residents in seven counties adjacent to the IBoF. Survey findings demonstrated considerable community support for marine conservation, despite a sizeable lack of awareness of existing marine conservation initiatives in the region. Furthermore, findings from a literature review (n=886) conducted in 2022 highlighted an upward trend in publications related to the IBoF since 1976, with a shift from mainly academic authorship towards citizen science involvement, as well as a more recent transition from natural sciences to human activities and species at risk. This wealth of knowledge and widespread community support underscores the necessity of designating an mNWA in the IBoF to safeguard its ecological integrity and cultural heritage.

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**BURIED CARBON DYNAMICS IN A NORTHUMBERLAND STRAIT SALT MARSH**

Salt marshes are highly productive ecosystems that provide many ecosystem services and help mitigate the effects of climate change through sediment accretion and carbon sequestration. The Northumberland Strait is a microtidal environment (tides <2 m) where the salt marsh platform is flooded twice daily. As tidal water enters the creeks and inundates the platform, it could be bringing in offshore organic matter that gets buried within the marshes. As well, the vegetation that grows in the marsh (namely, *Spartina* spp.) may contribute to organic matter within the soil after it dies. Plant species and proximity to hydrological features have been shown to contribute to the amount and composition of buried organic carbon compounds within salt marsh sediments. Here, we sampled the Cape Jourimain salt marsh to assess spatial differences in organic carbon compound quantity and source. We used stable isotopes  $\delta^{13}\text{C}$  and  $\delta^{15}\text{N}$ . Preliminary analysis suggests the percentage of buried carbon varies spatially and with depth. Source contributions appear to be dominated by decomposing *Spartina* in sediments closer to the surface, while more negative  $\delta^{13}\text{C}$  values occur at deeper depths. These depleted  $^{13}\text{C}$  values could indicate phytoplankton contributions or be remnants of past management practices. Fully understanding how energy and matter move through and how matter is deposited in salt marshes could alter the way these environments are conserved and restored. Further, results may lead to improved management practices and possibly provide opportunities to stakeholders to offset greenhouse gas emissions through salt marsh restoration.

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**VULNERABLE MARINE ECOSYSTEM SPECIES PRESENCE AND SPATIAL DISTRIBUTION IN THE WESTERN LOWER BAY OF FUNDY, CANADA**

Since 2016, we have collected near-seafloor underwater imagery across several areas of interest for conservation network planning in the lower western Bay of Fundy. A total of 141 continuous near-seafloor video transects to depths of 82 m (covering a linear extent of 80 km) were conducted in 2016 and 2017 from which high-resolution still imagery was analyzed for benthic species presence and also quantified the abundance of two vulnerable marine ecosystem (VME) species, the sea potato *Boltenia ovifera* (Linnaeus, 1767), and the horse mussel *Modiolus modiolus* (Linnaeus, 1758). Species distribution models were developed using a range of abiotic environmental variables (including high-resolution bathymetry) against biological response variables and identified locations for conservation management consideration. Hot-spot analyses identified additional deep-water locations to ground-truth predictions using a newly-developed optical imaging system, which can be used to 200 m depth. Seven preliminary transects completed in 2022, covering an estimated area of 1945 m<sup>2</sup> in the Head Harbour/West Isles/Passages EBSA, found little *B. ovifera* presence and instead encountered extensive patches of the invasive colonial tunicate *Didemnum vexillum* Kott, 2002 across a spatial extent of 858 m<sup>2</sup>. Field observations from a further 24 video transects (maximum depth of 141 m, covering a linear extent of 18 km) conducted in 2023 found more extensive tunicate patches, *M. modiolus* beds and little *B. ovifera* presence. Future in-depth analyses of the 2023 optical imagery survey will better inform marine spatial planning on the status and spatial extent of VMEs and the implications of an extensive tunicate invader.

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### USING EDNA METABARCODING TO ASSESS INVERTEBRATE BIODIVERSITY OF EELGRASS (*ZOSTERA MARINA*) BEDS ACROSS NOVA SCOTIA

Eelgrass (*Zostera marina*) beds are a common feature of Atlantic coastlines and represent diverse, productive marine communities that are highly valued for their ecosystem services. As near-shore communities, however, eelgrass beds are under threat from a host of anthropogenic factors and require periodic monitoring to evaluate community composition and track changes with time. Environmental DNA (eDNA) metabarcoding is an exciting new tool for monitoring aquatic biodiversity, yet its ability to provide a comprehensive assessment of invertebrate communities within eelgrass beds relative to more traditional methods (e.g., visual surveys/sediment cores) remains to be determined. In this study, eDNA COI metabarcoding was used to characterize invertebrate biodiversity in 17 eelgrass beds spanning the breadth of Nova Scotia, from Chebogue to Aspy Bay. Across the 17 sites, 168 invertebrate species were identified with a taxonomic probability assignment of >95%. Of the species detected, only 57 (34%) were reported from traditional surveys. Conversely, 71 taxa documented using traditional methods were not found in eDNA analyses. eDNA was successful, however, in detecting 18 of the 23 most common invertebrate taxa based on published species records from 11 Nova Scotian eelgrass beds. eDNA methods also recorded several non-native invertebrates, including *Juxtacribrilina mutabilis*, a non-native bryozoan first reported in Maine (2018), which was present at 10 of 17 sites. While eDNA metabarcoding represents a new tool for monitoring eelgrass communities, further work is needed to establish the limitations of this approach in documenting species based on factors such as taxonomic grouping, ecology (infaunal/epifaunal), body size, and abundance.

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(University of Prince Edward)**AIDING CONSERVATION IN AN ESTUARINE SYSTEM: DOES THE GIANT IRISH MOSS  
PLAY A ROLE BEHAVIOURALLY MEDIATED INDIRECT INTERACTIONS?**

The giant Irish moss (*Chondrus crispus*), named after its broad fronds, is a red alga found exclusively in the Basin Head Marine Protected Area, Prince Edward Island. The alga forms clumps with blue mussels (*Mytilus edulis*), which are known to contribute to local diversity and provide habitat and refuge to native mud crabs (*Panopeus herbstii*) against predation by invasive European green crabs (*Carcinus maenas*). However, little is known about their potential role in behaviourally mediated indirect interactions (BMII). We assessed whether this and two other habitats (bare sediments and blue mussel clumps), had an influence on the interactions between green crabs, mud crabs and a bottom level prey (juvenile eastern oysters, *Crassostrea virginica*). Field tethering experiments showed that the most complex clumps (Irish moss-mussels) reduce mud crab mortality from green crab predation. Laboratory experiments showed the same outcome for oyster mortality rates against mud crabs. However, in the presence of a green crab, oyster mortality increased as habitats became more complex. Such results can be explained by a change in mud crab behavior due to the presence of the green crab, which reduced its activity rates and increased its sheltering. Through the outcome of these trials, the habitat provided by giant Irish moss-mussel clumps plays an important role as a mediator of both direct and indirect interactions.

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**STAGING ECOLOGY OF ADULT AND JUVENILE SHORT-BILLED DOWITCHER (*LIMNODROMUS GRISEUS*) IN SOUTHERN NOVA SCOTIA**

Atlantic Canada provides critical staging habitat for shorebirds to refuel during southbound migration before making long flights to tropical non-breeding grounds. Habitat selection and use at staging sites are critical to survival, particularly for inexperienced, juvenile shorebirds that may be vulnerable to unpredictable resource availability. Southwestern Nova Scotia is a region of conservation importance, supporting a diverse migrant shorebird community, including Short-billed Dowitcher (*Limnodromus griseus*), a priority species that has declined by 50% since 1970. However, staging behaviour and habitat use in Atlantic Canada are relatively unknown for *L. griseus*. We used automated radiotelemetry to track adult and juvenile *L. griseus* at their staging grounds. We also assessed consumption rates and habitat selection using behavioural observations and sampling the invertebrate community. Juveniles remained longer in the region than did adults, and individuals of both ages mostly remained near where they were captured. *L. griseus* selected foraging sites where invertebrate biomass was higher than surrounding areas. Prey intake rate increased with increasing prey availability. Analyses of stable isotope ratios of C and N in blood plasma suggests that adult and juvenile birds have a similar diet. Through this work, we identified potentially important staging habitat for *L. griseus* in Nova Scotia. The reliance of individuals on habitat in a restricted area suggests that conservation measures should focus on multiple sites in the region. The longer staging period for juvenile birds, together with their later migration, suggests susceptibility to late-season perturbations, such as severe storms, which could have population-level effects.

**Undergraduate Student**

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## SAILING THROUGH TIME: A VOYAGE INTO THE LEGACY AND FUTURE OF DALHOUSIE'S MARINE AFFAIRS PROGRAM

Dalhousie University's Master of Marine Management (MMM) program stands out globally as a distinctive, transdisciplinary course-based professional program spanning 16 months. Since its humble beginnings as an interdisciplinary certificate program in 1986, the program has proudly produced over 500 graduates, hailing from more than 60 countries and 10 Canadian provinces and territories. The program's strength lies in its diverse student body, comprising individuals from various backgrounds including social sciences, law, engineering, oceanography, and marine biology. This diversity enriches the learning environment as students come together to engage in coursework and projects designed to develop essential skills shared among our graduates. These skills include a holistic understanding of contemporary coastal and marine issues, honed critical thinking abilities, adept communication skills, and the cultivation of 'honest brokers' within the marine management sphere. Integral to the program is a summer internship lasting four to 16 weeks, traditionally aligned with the graduate project. This culminates in a final report delving into practical management challenges and offering insightful, evidence-based recommendations for future solutions. This hands-on approach not only provides students with invaluable real-world experience but also exposes them to diverse career pathways, while simultaneously offering internship hosts and academic supervisors the opportunity to collaborate with enthusiastic students brimming with fresh and innovative ideas. In this presentation I will introduce the Marine Affairs Program, provide an overview of the evolution of the MMM degree, and invite audience participation as we shape potential future directions and chart a course for continued innovation and academic excellence.

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CB Wetlands and Environmental Specialists

van Proosdij, D (Saint Mary's University; Supervisor)

**UNDERSTANDING PARAMETERS FOR SITE CHARACTERIZATION AND THEIR INFLUENCE ON RESTORATION IN TIDAL MARSHES IN NOVA SCOTIA, CANADA**

Accelerated changes in vegetation distribution and pattern, vertical accretion, and erosion of low-lying coastal ecosystems, such as tidal wetlands, have called into question the sustainability of these ecosystems into the future. This study investigated the characterization of ten restoration and six natural tidal marshes by assessing site similarities and differences pre-restoration. Using previously collected data, a PCA identified three groupings along with environmental variables and some ungrouped sites and variables. The characterization of tidal marshes pre-restoration is possible at select sites; one grouping—BEL, SCP, and SCW—shared similarities both pre- and post-restoration. While the PCA yielded groupings of sites with clusters of environmental variables to consider, not all groupings were well-suited and differed based on other environmental variables. Clusters identified during subsequent analyses were by sediment type (organogenic or minerogenic) and incorporated present-day data. Pre-conditions may influence the restoration trajectory of certain sites, particularly former agricultural lands and impoundments.

**Masters Student**

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\*These authors are now with Environment and Climate Change Canada but did the work while with DFO

### CHARACTERIZING NOVA SCOTIA'S UNDERWATER SOUNDSCAPES: THE COASTAL ACOUSTIC MONITORING PROJECT

Anthropogenic noise, from sources including vessels and coastal and offshore development, is increasing throughout the world's oceans and has been identified as a threat to marine species across taxa. Marine mammals are particularly vulnerable as they use sound for important life processes including communication and mate attraction. Many species of marine mammals frequent the waters off Atlantic Canada and there are several busy ports and coastal developments across Nova Scotia, yet the province's coastal underwater soundscape has previously been under-studied. To better understand the year-round occurrence of baleen whales and the composition of the soundscape off Nova Scotia, the Coastal Acoustic Monitoring (CAM) Project was initiated by Fisheries and Oceans Canada in 2018. Since its inception, the CAM Project has included sites near Lunenburg, the mouth of Halifax Harbour, Sheet Harbour, Ingonish, Scatarie Island, and four sites within Chedabucto Bay. Data are collected using passive acoustic recorders mounted in modified lobster traps. Data analysis is ongoing and includes the use of automated detectors to identify potential sei, humpback, North Atlantic right, blue, fin, and minke whale calls. As well, the percent contributions of wind, vessels, and all "other" sources to the overall soundscape are calculated for six 1/3 octave bands for several sites. To date, we have confirmed the presence of blue, fin, humpback, sei, and North Atlantic right whales. Here, we will introduce the topic of ocean noise, briefly discuss its impacts on marine ecosystems and species within, and provide an overview of the CAM Project results to date.

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Macnab, Paul

### STAYING CONNECTED – A PLACE BASED CONSERVATION APPROACH TO MANAGING THE MUSQUASH ESTUARY MPA

Although the Musquash Estuary Marine Protected Area is one of the smallest MPA's in Canada covering only 7 square kilometers, what it lacks in size it makes up for in complexity. As a small coastal MPA nearby to several smaller and larger coastal communities there are inevitably lives, livelihoods and histories that are inextricably linked to the ocean and Musquash itself. Musquash estuary is almost entirely surrounded by land, making it more susceptible than other MPA's to external pressures and the legacy of human activities past and present. While this presents a number of complex challenges for managing the MPA and the surrounding ecosystem, it has also created a network of deeply passionate and driven members of the conservation community who all share the common goal of protecting one New Brunswick's most vibrant coastal ecosystems.

From abandoned WWII vessels, to dams and drones, through this presentation we will explore in more detail all kinds of connections in the watershed and between people and place. We will also explore some of the disconnection that the MPA, and it's surrounding watershed has experienced over time and the restoration efforts underway that come with their own set of unique challenges. In conclusion, we will provide a window into the world of the collaborative approach employed in monitoring and managing this coastal MPA.

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## Posters: Wednesday June 5<sup>th</sup>

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### AN EVALUATION OF TORONTO'S WASTEWATER TREATMENT AT REMOVING POLYBROMINATED DIPHENYL ETHERS AND ORGANOPHOSPHATE ESTERS IN THE DON VALLEY RIVER

Polybrominated diphenyl ethers (PBDEs) and organophosphate esters (OPEs) are widely used as flame retardants. Both are linked to environmental and health concerns, but OPEs remain unregulated. This study aims to determine how effective Toronto's wastewater treatment is at removing PBDEs and OPEs. Water and sediment samples were taken from three locations along the Don Valley River near the North Toronto Wastewater Treatment Plant. After preparation, samples were analyzed using GC-MS with selected ion monitoring (SIM). PBDE 28 and PBDE 85 were found at 4.25 ng/g and 14.9 ng/g of wet sediment before treatment; these concentrations decreased by 75%, and 68% after treatment. The concentration of PBDE 85 remained above regulation after treatment. Three types of OPE's (TCPP, TEHP, and TPP) were found at concentrations of 51.8 ng/mL, 171.7 ng/mL, and 3.94 ng/mL before treatment and decreased by 59%, 80%, and 63%, respectively, after treatment.

**Undergraduate Student**

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Mi'kmaq), Porter, D. (Marine Institute of Natural and Academic Science),

Andrews, S.N. (Acadia University), Whoriskey, F.G. (Dalhousie University, Ocean

Tracking Network), Bradford, R.G. (Fisheries and Oceans Canada)

Stokesbury, M.J. (Acadia University)

**OVERWINTERING BEHAVIOUR OF JUVENILE JI'KAW (*MORONE SAXATILIS*, STRIPED BASS) IN MINAS BASIN AND MINAS PASSAGE, NOVA SCOTIA, CANADA**

Ji'kaw (*Morone saxatilis*, striped bass) are a large, anadromous, Moronid fish significant to Mi'kmaw culture for food, social, and ceremonial purposes. There was a directed commercial fishery in Pekwitapa'qek (Bay of Fundy) for ji'kaw before it was closed in the 1970s due to a population crash and record low catches. Following population recovery, there is now a valuable recreational fishery, but the commercial fishery remains closed. In Canadian waters, ji'kaw are at the northernmost extent of their range, and local populations spend a large portion of the year overwintering (November – May). However, little is known about their overwintering behaviour and ecology, particularly for juveniles. Ji'kaw can overwinter in a freshwater or marine environment. Some overwintering locations are roughly known, but they are largely undescribed. Using V9-2x HR acoustic tags and a series of acoustic receivers, 20 juvenile ji'kaw were tagged in Minas Basin, Nova Scotia to track their winter movements, identify overwintering habitats, and quantify their spatial and temporal use of Minas Passage. This research is part of a collaborative project between Mi'kmaw knowledge holders, local fishers, community partners, academia, and government, called Apoqmatulti'k (Mi'kmaw for 'we help each other'). Results will be used to inform tidal energy projects, management approaches and strategies for ji'kaw in Pekwitapa'qek to enable better stewardship of this culturally and economically important fish.

**Masters Student**

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Westhead, M. (Dalhousie University), Manuel, P. (Dalhousie University)

**SOCIETAL ENGAGEMENT AS A METHOD FOR BENTHIC ECOSYSTEM MAPPING: AN OVERVIEW OF WORK PACKAGE 1.1**

Work package 1.1 of the Benthic Ecosystem and Mapping Engagement project brings together a diverse team of researchers, marine industry practitioners, coastal community members, and Indigenous organizations with the aim of co-producing knowledge about the benthic environment. By facilitating collaborative data sharing, the work package seeks to co-produce visualizations of benthic environments using data derived from both technology and culture, while also designing a framework to integrate data, information, and knowledge across cultural contexts to support decision-making for marine resource stewardship. The collective objectives of this work package are twofold: first, to establish baseline conditions within chosen locations to recognize environmental changes, especially those related to climate change impacts, and their implications for fisheries and environmental conservation. Secondly, the package seeks to devise mechanisms for sharing knowledge and data and making decisions that contribute to a deeper understanding of benthic systems and their significance, fostering collaboration and informed decision-making processes.

**Masters Student**

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**RURAL APARTMENT RESIDENTS ARE IMPORTANT COASTAL ECOSYSTEM SERVICE BENEFICIARIES AND STAKEHOLDERS IN CLIMATE ADAPTATION DECISIONS**

Climate change is leading to a reimagining of rural coastlines worldwide, including in dyked agricultural land such as polders. Decisions can be locally fraught about where to continue to defend such land uses through higher dykes, where to retreat the line of defense landward or remove it entirely to restore the erstwhile tidal wetlands that provide natural protections. Many ecosystem services are received by local residents from such systems, and just decisions will require a nuanced understanding of who benefits from which landscape arrangements. Ecosystem service disaggregation research rarely explores dwelling type among the variables studied, but those who live in apartments can be overlooked as stakeholders of rural land use decisions. We report in this research on surveys deployed separately to house and apartment residents in the hypertidal Bay of Fundy to understand if and how each group benefits from linear dykes, dykelands and tidal wetlands. More apartment than house residents report benefits from the three landscapes, and they also report using the target landscapes more often. Responses from both cohorts indicate the three landscapes are complementary, together delivering a non-material service bundle centred on nature enjoyment and opportunities for reflection. We then focused in on apartment residents to understand how they evaluated coastal adaptation options in the region. Managed dyke realignment was the preferred option, statistically associated with benefits across the three landscapes. The implications of these results for coastal adaptation decision-making are discussed, filling a gap in the literature on dwelling type and ecosystem service benefit.

**Masters Student**

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**OPTIMIZING EVIDENCE UPTAKE IN CLIMATE POLICY: THE CASE OF COASTAL URBAN MUNICIPALITIES**

Municipalities in Atlantic Canada are critical actors in climate action. Coastal communities, such as those surrounding the Bay of Fundy, are heavily impacted by the intensifying effects of climate change. Though municipal governments exert a high level of control over community-level sustainable development policies and practices, they struggle to implement climate adaptation solutions. This situation is further complicated by the fact that municipal authority to create and implement policies is set and limited by provincial legislation. Little research has been conducted about what enables and restricts the uptake of evidence in municipal decision-making. The research outlined in this poster aims to address this gap by determining how urban coastal municipalities are considering and using evidence in the development of policies and practices to respond and adapt to climate change. Four coastal municipalities will serve as case studies: Halifax Regional Municipality, City of St. John's, Ville de Rimouski, and a Northern community. A literature search, conducted in February-March 2024, used deductive (a priori) and inductive (a posteriori) keywords to identify relevant references. Initial analysis reveals that barriers to evidence uptake may include (1) lack of expertise, (2) lack of capacity to seek evidence, (3) use of poor information management systems, and (4) inaccessible research and evidence. Potential enablers may include (1) funding research that is practical for knowledge use, (2) collaborative research and knowledge co-production, (3) embedded expertise, and (4) open science. This literature review will inform the next stages in the case studies.

**Masters Student**

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Dr. Bertrum MacDonald (Dalhousie University), Dr. Patricia Manuel (Dalhousie University)

**DISRUPTING TOKENISTIC PARTICIPATION: A PARADIGM SHIFT IN MARINE SPATIAL PLANNING FOR THE COASTAL COMMUNITIES OF NOVA SCOTIA**

Marine Spatial Planning (MSP) has gained rapid and wide acceptance, emerging as the predominant strategy for marine resource management on a global scale. In initiating MSP in 2019, Canada is advancing MSP processes in five bioregions. MSP faces both conceptual and practical challenges, however. Notably, social science scholars criticize MSP stakeholder engagement for being tokenistic, especially of local community-level stakeholders. Reimagining a community-oriented MSP requires implementing meaningful local stakeholder engagement. Based on an analysis of interviews and focus groups with stakeholders from seven coastal communities in the Scotian Shelf-Bay of Fundy bioregion (SS-BoF), this study is identifying key elements to foster effective local-level engagement in MSP. This poster will describe the results, focusing on four fundamental components of effective participation: Who participates? How are stakeholders engaged? When are stakeholders engaged? And at what level of the planning processes are stakeholder involved? Moreover, the analysis has determined barriers and enablers for engaging community-level stakeholders, as well as their interests and concerns regarding MSP. A locally adapted MSP for the SS-BoF is technically feasible. This MSP needs to entail creating enabling conditions for its implementation, such as informing local actors about what MSP is, how it works, and how they can contribute to the process, as well as strengthening trust between coastal communities and governmental institutions. Giving attention to the combination of these conditions will promote meaningful local stakeholder engagement, making MSP relevant to coastal communities in the region, and help to overcome tokenistic participation.

**PhD Student**

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**ASSESSMENT OF METHYLMERCURY CONCENTRATIONS IN ESTUARINE SEDIMENTS, POREWATER, AND INVERTEBRATES IN THE JIJUKTU'KWEJK ESTUARY, BAY OF FUNDY**

Methylmercury (MeHg) is a toxic contaminant that readily bioaccumulates and biomagnifies in food webs. Impacts on ecosystem health from MeHg have been extensively studied in freshwater ecosystems, however, much less is known about MeHg retention and biomagnification in estuarine ecosystems. Many estuarine systems in the Minas Basin, Bay of Fundy, like the Jijiktu'kwejk (Cornwallis River), are influenced by industrial anthropogenic activities including agriculture and sewage treatment outflows. High nutrient inputs due to agricultural runoff and waste disposal will result in increased productivity within the estuary system. This, in turn, will facilitate high retention of MeHg in estuarine sediments and invertebrate tissues. Estuaries, like the Jijiktu'kwejk, are important stopover sites for spawning marine fish and foraging migratory birds. Determining uptake of MeHg and other anthropogenic contaminants by invertebrates at the base of estuarine food webs is essential for assessing MeHg and contaminant exposure in these higher trophic level organisms. I plan to investigate changes in the concentrations of MeHg and Total Mercury (THg) in sediments, porewater, and invertebrates from the Jijiktu'kwejk between the low salinity headwater and the saline estuary mouth. I am also interested in the relationship between conductivity and the binding of MeHg to suspended particles and how this relationship changes between fresh and saline water in estuarine environments. I hypothesize that higher concentrations of MeHg and THg will be retained in the sediments, porewater, and invertebrate tissues toward the estuary headwater where there is low salinity and higher organic carbon loading. I hope to further understand specific areas in estuarine systems that are most vulnerable to MeHg and contaminant retention to better inform conservation practices.

**Masters Student**

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Millard, K. (Carleton University)

**INCREASING CANADA'S ABILITY TO QUANTIFY THE CARBON STORAGE CO-BENEFITS OF COASTAL WETLAND RESTORATION AS A NATURE-BASED SOLUTION FOR NATIONAL GHG INVENTORY REPORTING**

Investing in 'nature-based solutions' to conserve, restore, and enhance ecosystems that store and capture carbon is an important aspect of Canada's climate change mitigation strategy. Restoration of coastal wetlands has received increasing global attention as a potential climate solution due to the large amounts of 'blue carbon' that these ecosystems store relative to their spatial extent. Before Canada can incorporate nature-based solutions such as blue carbon into its National Greenhouse Gas (GHG) Inventory to the United Nations, more robust scientific knowledge is needed to understand how coastal wetland restoration influences carbon sequestration and GHG emissions within Canada. Along the Bay of Fundy, there is significant opportunity for restoration of tidal marsh ecosystems through managed realignment of historically dyked salt marsh habitat. An ongoing PhD project in the region aims to understand and quantify the carbon storage co-benefits of restored salt marshes to assess their capacity for climate regulation. Through an internship with the Agriculture, Forestry and Other Land Use Section of the Pollutant Inventories and Reporting Division of Environment and Climate Change Canada, knowledge and data collected as part of this PhD project will be used to help inform government policy and programs related to nature-based solutions and inventory reporting frameworks. This poster will provide an overview of this internship, including research into best practices of coastal carbon accounting from other jurisdictions around the world and preliminary work that involves scaling-up field-collected data to estimate coastal wetland GHG emissions rates in the upper Bay of Fundy.

**PhD Student**

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CPAWS

**ENABLING EFFECTIVE CONSERVATION IN THE INNER BAY OF FUNDY, CANADA**

Since 2020, an integrated coastal and marine conservation planning initiative has been supporting conservation planning in the Inner Bay of Fundy (IBoF). The initiative was established in response to Canada's international commitments to conserving 25% of its oceans by 2025 and 30% by 2030 and is led by the Canadian Wildlife Service (CWS). The overarching goal is to develop a marine conservation mosaic plan that will guide future marine conservation tools in the IBoF. The Conservation Planning Initiative (CPI) team is comprised of rights holders and interested parties and aims to foster shared rationale and support for implementation of priority strategies expected to measurably enhance the health of the Inner Bay of Fundy land and seascape. Since its inception, the CPI team has made important progress in adopting the Conservation Standards planning framework, facilitating coordination, and ensuring transparency of evidence-based decision-support. Actions taken to date have included the development of conservation targets, assessment of target health, identification of pressures acting on targets, refining of strategies to reduce pressures, and assessment of monitoring required to track results and inform adaptive management. Priority strategies identified by the planning team include the establishment of a marine National Wildlife Area and implementation of large-scale saltmarsh restoration within the initiative's scope area.

Through this poster presentation, members of the CPI team will provide an overview of this initiative, including reflections on lessons learned and best practices for enhancing collaboration in marine conservation.

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### ACCESSING ARCHIVED MUSSEL SAMPLES FROM THE GULFWATCH CONTAMINANTS MONITORING PROGRAM

Gulfwatch was a Canada-USA transboundary coastal chemical contaminants monitoring program, organized and administered by the Gulf of Maine Council on the Marine Environment (GOMC). The program ran formally between 1993 and 2012. It involved the collection of blue mussels (*Mytilus edulis*) at rotating sites in state and provincial jurisdictions around the Gulf of Maine and Bay of Fundy (GoM/BoF). Following mussel collection and processing, scientific laboratories in both countries analyzed whole tissues for toxic chemicals formally designated by the United States Environmental Protection Agency; these included polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), chlorinated pesticides, and metals. Although the Program's analyses ended in 2012, archived mussel samples dating back to 1992, both extracts and whole tissues, are currently stored and maintained at the Huntsman Marine Science Centre in St. Andrews, New Brunswick. The GOMC (Gulfwatch subcommittee) and DFO are making these unique samples available to the scientific community to determine the presence, levels, and spatial distribution of previously unmeasured environmental contaminants of concern and contaminants of emerging concern (CECs) in the GoM/BoF during this time period. Here we present details on the history of Gulfwatch, the contents of the archive, and how researchers can request and access the samples. They present an invaluable opportunity to gain a regional perspective on the distribution and concentrations of chemicals previously unmeasured, establish a baseline reference for future monitoring efforts, and improve our understanding of the hazards that chemical contamination presents to the marine life and coastal resources of the GoM/BoF.

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Enhancing ocean literacy in the Fundy community: Continued activities of BoFEP's OL working group

This poster describes the activities to date of our Ocean Literacy Working Group. It covers the topic in general (with an overview and description of objectives), our progress, our proposed next steps, and invitations to join the WG. The poster compliments our OL talk. Our WG has been working on this topic since 2018 and most recently has conducted a Professional Development (PD) Day with local high school teachers on the topic of the ocean and climate change. Talks were given by local specialists and an ocean OL "tool kit" with teaching materials was prepared and distributed. Further such initiatives are being planned. It is hoped that our talk and this poster will generate interest on the ocean literacy topic among the conference participants. We look forward to their suggestions and support for future BoFEP OL WG activities.

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## Posters: Thursday June 6<sup>th</sup>

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### **Asnicar, Davide**

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Huntsman Marine Science Centre

de Jourdan, B. (Huntsman Marine Science Centre), Wildish, D.J. (Huntsman Marine Science Centre)

#### EXPLORING DIGESTION AND FOOD PREFERENCES IN SALT MARSH TALITRIDS

Detritivores such as talitrids play a key role in the salt marshes of Atlantic Canada, where they contribute to carbon sequestration, nutrient cycles and microhabitat structuring. Their digestive physiology is poorly understood and has not been studied experimentally.

Here we explored the cellulolytic ability of the salt marsh talitrid *Orchestia grillus* collected at Pagan Point Nature Preserve in St. Andrews, N.B. *O. grillus* was hypothesized to be strictly bacterivorous. Our laboratory evidence presented here suggests the possibility that cellulose is hydrolyzed by endosymbiotic bacteria resident within the peritrophic membrane of the midgut.

Cellulolytic microbial activity (expressed as CFU/ml/mg gut DW) was found in the gut of animals fed with cellulose-rich salt marshes grass, but also in talitrids fed with cellulose-poor wrack macroalgae. In both cases the cellulolytic microbial activity was many times higher in the animal gut than in the food, thus providing evidence that the gut of *O. grillus* is a site of cellulose-breakdown.

Control animals kept in starving conditions ate the substrate (Whatman filter paper) which was essentially pure cellulose. Similar levels of cellulolytic microbial activity were detected in their gut too.

These findings open questions about *O. grillus* food preferences. Living in a salt marsh their main food source must be decaying salt marsh plants. However, because of the many plants within the salt marsh, we need to determine the food preferences of the talitrids living there.

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**SALT MARSH RESTORATION IN NEW BRUNSWICK: INITIAL CONDITIONS AND RECOVERY PATTERNS**

Salt marsh restoration accesses ecosystem services in coastal areas where they have been lost or reduced due to anthropogenic activities. Our objective is to present four ongoing salt marsh restoration projects in New Brunswick, which are occurring in different water bodies and with different starting conditions. Ultimately, we are interested in defining critical phases of restoration that are specific to a project's location and site history, as well as those that can apply regardless of these. The four restoration projects are as follows. (i) Aulac is in its 14th year of a managed realignment, located at the head of the upper Bay of Fundy with relatively high wind and wave exposure, megatidal, and a former pastureland. (ii) Rockland is 4 y old, located along the Memramcook River in the upper Bay of Fundy, protected, megatidal, and a former freshwater impoundment. (iii) Musquash is 6 y old, located in the Musquash Estuary and adjacent to a Marine Protected Area in the outer Bay of Fundy, macrotidal, and a former freshwater impoundment. (iv) Rivière-du-Nord is 4 y old, located at the head of Caraquet Bay in the southern Gulf of St. Lawrence, influenced by much freshwater input, microtidal, and a former freshwater impoundment. We conduct various monitoring activities, including sediment deposition, on-the-ground and remote vegetation dynamics, invertebrate dynamics, salt pool establishment, hydroperiod, and use by fish. Our work contributes to best practices for salt marsh restoration in the diversity of soft-sediment shorelines, tidal regimes, and site histories in Maritime Canada.

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**INVESTIGATING VARIATION IN ASSEMBLAGES OF FISH AND DECAPOD CRUSTACEANS IN THE SOUTH-WEST BAY OF FUNDY OVER THE PAST 15 YEARS**

Climate change has caused significant increases in ocean temperature and extreme marine climate events, causing shifts in ecological structure including changes in species abundance, distribution, and overall diversity. The Gulf of Maine has experienced one of the fastest rates of warming of any ocean ecosystem. This study aims to (i) quantify changes in diversity and species abundance of a community of fish and decapod crustaceans colonizing cobble-filled bio-collectors at four sites in the Quoddy region of the Bay of Fundy from 2009-2023, and (ii) link this variation to average summer bottom temperature, average yearly sea surface temperature, NAO index, and presence of marine heat waves. Multivariate analysis will be done to compare communities in bio-collectors in different years and sites. Univariate analyses will be done to assess inter-annual trends in yearly average diversity and abundance, and to assess their relationship to abiotic variables. Expected results include evident temporal variation within the community and individual species, either a consistent trend over time or temporal variation but no evident trend over time. I expect temperature variables to be related to temporal variation and abundance of focal species, especially for species near their preferred thermal tolerance in the region. This research is significant as it will document how communities inhabiting cobble bottom, which is an important (but difficult to sample) nursery habitat, have changed during climate and temperature shifts within the region.

**Masters Student**

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**EFFECT OF TIDAL BARRIERS AND RESTRICTIONS ON WATER LEVELS ALONG THE POKEMOUCHE RIVER IN THE ACADIAN PENINSULA**

The east coast of New Brunswick is characterized by a series of tide-dominated estuaries that occupy drowned river valleys. The presence of sand spits and narrow tidal gullies at the seaward limit of these estuaries, and other natural or anthropogenic tidal barriers and restrictions located upstream (ex: causeways, culverts), makes it more difficult when predicting the time and height of peak water levels for astronomical tides or storm surge events. In order to improve coastal flood predictions used by local government entities for their climate change adaptation plan, the New Brunswick Geological Survey worked in collaboration with University of Moncton on a case study for the Pokemouche River in the Acadian Peninsula. This river includes a 20-km long estuarine section featuring several narrow passages that limit tidal exchange. In 2023, HOBO data loggers were installed at seven locations along the estuary and georeferenced with a Leica DGPS to determine their elevation in relation to the geodetic and hydrographic datums. Water and barometric pressures were recorded between August 19 and October 19, and although their impact was limited in the region, flood levels associated with Lee and Philippe post-tropical storms provided some interesting information. The data from the federal tidal gauge in Escuminac was also examined to confirm the magnitude of the two storms. Preliminary results indicate that there is frequently a 5-hour and 40-cm difference in peak water levels between the seaward and landward limits of the estuary, an important information to consider during the emergency response planning process.

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Endresz, K.C. (University of New Brunswick - Fredericton), Barbeau, M.A.  
(University of New Brunswick - Fredericton)**NEKTON COMMUNITIES USING SUB-HABITATS IN SALT MARSHES EXPERIENCING MEGATIDAL AND MICROTIDAL REGIMES**

Salt marshes are highly productive coastal ecosystems made up of a mosaic of different sub-habitats including intertidal creeks, salt pools, and the vegetated marsh platform. During periods of tidal inundation, these sub-habitats are connected and function together to provide habitat for nekton (i.e., fish and crustaceans). Two distinct biophysical regions exist in Maritime Canada with distinct tidal regimes that drive differences in salt marsh geomorphology and accessibility to nekton. Bay of Fundy salt marshes are exposed to a high energy megatidal (> 8 m tidal range) system while those in the Northumberland Strait experience a lower energy microtidal (< 2 m tidal range) system. Despite having a larger tidal range, salt marshes in the upper Bay of Fundy are flooded less frequently and for shorter durations of time than those in the Northumberland Strait. We sampled the nekton communities using salt pools, the platform, and intertidal creeks using various capture methods in replicate salt marshes (3 sites per region) over four rounds (April-June, November) in two years (2022, 2023). Nekton communities using intertidal creeks and the marsh platform differed between the two regions as well as on a seasonal basis. Salt pool nekton communities did not differ between the two regions. Within both regions, the nekton communities in all sub-habitats differed from one another with evidence of a seasonal influence. Improving our understanding of the nekton communities using various sub-habitats will aid in conserving and restoring the habitat function of salt marshes to nekton in these two distinct tidal regimes.

**PhD Student**

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**BASELINE INTERTIDAL MUDFLAT COMMUNITY ANALYSIS ALONG THE NORTH-WEST BAY OF FUNDY SHORELINE**

Coastal environments are diverse and fluctuate in terms of abiotic conditions. The infaunal organisms that reside within intertidal mudflats experience a range of pH, sediment characteristics, salinity and temperature that directly influence them. This study aims to understand the community structure of intertidal mudflats across the North-West Bay of Fundy with respect to sediment physicochemical properties. This study builds on past research on intertidal mudflats in this region by broadening to a larger number of sites with a wider range of sediment characteristics. Creating a fundamental understanding of how these environmental conditions impact invertebrates in the ecosystem is essential to assess changes over time due to anthropogenic activity or climate change. Cores of sediment were taken along transects perpendicular to the shore at 10 sites along the North-west Bay of Fundy coast in Fall 2023. These cores are being used to determine sediment pH, grain size, alkalinity, and organic content, and for invertebrate species identification. The abundance of larger macrofauna was quantified in 10 cm deep quadrats. This presentation will focus on the project plans and will present data on sediment grain size and pH profiles. Analysis and data collection is on-going for this project.

**Masters Student**

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**EFFECTS OF EXPERIMENTAL ENRICHMENT ON POREWATER pH AND INFAUNAL INVERTEBRATES IN MUDFLATS**

The eutrophication of coastal waters and sediments can alter their chemistry, resulting in decreased pH and oxygen. While considerable research on eutrophication, acidification, and deoxygenation is ongoing, less is known about how infaunal invertebrates respond to these chemical changes in the sediment, especially from a multi-stressor perspective. This project explores the effects of excess nitrogen on intertidal soft sediment chemistry and infaunal communities in the outer Bay of Fundy in New Brunswick. From July through September 2022, a 10-week nutrient enrichment experiment was conducted at two intertidal mudflats. Experimental plots (1 m<sup>2</sup>) were enriched with commercial fertilizer pellets along a concentration gradient from 0–2.0 kg m<sup>-2</sup>. Enrichment occurred at week 0 and again at week 6 to ensure the fertilizer was consistently present throughout the experiment. Abiotic (porewater pH, dissolved oxygen [DO], alkalinity, sediment characteristics, N concentration) and biotic (primary production, species richness, etc.) variables were sampled biweekly and monthly, respectively. Analysis is ongoing, using univariate models to determine how fertilizer concentration may have affected geochemistry (pH, alkalinity, DO) and ecology (biodiversity, species richness, etc.), and multivariate analyses to explore how abiotic variables influenced the infaunal invertebrate community. There was some measurable variation in the sediment pH over time between treatments, but it is still unclear whether that variation is driven by the enrichment treatment or other environmental variables. PERMANOVA shows variation in the benthic community among fertilizer treatments at Pocologan after 10 weeks, especially at the most concentrated treatment. Future analysis will explore potential drivers of this variability.

**Masters Student**

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**SPARTINA PATENS DYNAMICS IN SALT MARSH RESTORATION: THE SECOND SPREAD WAVE**

Since the breach of an agricultural dike in 2010, we have followed the restoration dynamics of salt marshes in Aulac, a mega-tidal location in the upper Bay of Fundy. More specifically, we quantified the spread rate of the salt marsh foundational plant species *Spartina alterniflora* (smooth cordgrass) and *Spartina patens* (salt marsh hay). *Spartina alterniflora* appeared in 2012 and was the first to spread throughout the restoration sites as the marsh surface elevation increased, mostly due to sedimentation (~6 cm/y); *S. patens* started to spread in 2016 from the old dike and elevated patches throughout the sites. *Spartina patens* spreads 8–40cm from the dike edge per growing season, while isolated patches increased by ~50% per growing season (their current size ranges from 5 – 12 m<sup>2</sup>). Although the restoration is well underway, we expect *S. patens* to become the dominant plant (similar to mature salt marshes) in the next decade when the patches coalesce. Considering that the restoration sites are currently ~90 cm lower in elevation than the reference neighbouring salt marshes, we think the spread rate is limited not by *S. patens* spreading capacity but by edaphic conditions. We are now using the collected data to develop a mathematical model that will test our understanding of the relative importance of processes (colonization, reproduction, spread, interspecific competition, edaphic condition) underlying dynamics at different stages of restoration. This model will also provide insight into the efficacy of different restoration strategies for future projects.

**Masters Student**

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**SPATIAL VARIATION IN THE REPRODUCTIVE ECOLOGY OF SOFT-SHELL CLAMS (*MYA ARENARIA*) IN THE SOUTHERN GULF OF ST. LAWRENCE**

The soft-shell clam, *Mya arenaria*, maintains an important ecological, economic, and cultural role in the southern Gulf of St. Lawrence (sGSL). To help manage the soft-shell clam recreational fishery in the sGSL, a minimum legal catch size of 50 mm is enforced (along with a designated fishing season and daily harvest limits). This measure has been implemented to maintain the sustainability of soft-shell clam populations; however, there is a concerning lack of contemporary data to support its effectiveness. To address this knowledge gap, this study will investigate the spatial variation of reproductive traits of the soft-shell clam, including size-at-reproductive maturity, spawning period, and sex ratio, across the sGSL. From May-August 2023, soft-shell clams were collected at 11 targeted sites across the sGSL to assess size-at-reproductive maturity, spawning period, and sex ratio, including whether these traits vary spatially across the sGSL. Size-at-maturity will be statistically computed using sex and maturity stage of clams determined via histology. Non-statistical comparisons between size-at-maturity and the legal size limit will determine if size-at-maturity is equal to, above, or below the limit. In addition, temporal changes in the gonadosomatic index (GSI) will be monitored to estimate time of spawning. Operational sex ratio will also be calculated to determine if sex ratio deviates from the traditional 1:1 ratio. Results will be presented for GSI. The anticipated results of this study aim to provide current scientific information that can be used to inform sustainable fisheries management of soft-shell clam populations in the sGSL.

**Masters Student**

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Danika Van Proosdij

**COMPOSITION OF VEGETATION COMMUNITIES IN SALT MARSHES ALONG THE ATLANTIC COAST & NORTHUMBERLAND STRAIT OF NOVA SCOTIA**

Salt marshes are distinct ecosystems that are generally defined as tidal wetlands that act as transitional areas between land and sea (Rabinowitz & Andrews, 2022). They are significant for several reasons with perhaps the most relevant being their resilience to coastal erosion, particularly with sea level rise. Salt marsh restoration in the region relies on a handful of reference sites for assessments of ecological restoration trajectory. These sites are mainly concentrated in the upper Bay of Fundy, close to the greatest concentration of restoration activity. The current study addresses the gap in knowledge of reference conditions on the other coastlines of mainland Nova Scotia. In the summer of 2023, 30 salt marsh sites around the Atlantic coast and Northumberland Strait were studied. This study quantified nutrient levels and bulk density of sediments, elevation of plots and plant species abundances in 264 1 m X 1 m plots. This data was compiled with previous data collected by the Government of Nova Scotia and the organization CBWES for salt marshes within all coastlines of Nova Scotia.

Data analysis is currently being conducted but it is hypothesized that certain geographical variables, such as latitude will have an impact on environmental variables, such as bulk density, which will in turn impact the vegetation communities that are being represented in Nova Scotia. Multivariate analysis is hypothesized to display the grouping of differing vegetation communities due to elevation and geographic location.

**Masters Student**

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**REWILDING AND RESTORATION OF INTERTIDAL SEDIMENT ECOSYSTEMS FOR CARBON SEQUESTRATION, CLIMATE ADAPTATION AND BIODIVERSITY SUPPORT (REWRITE)**

The recently funded REWRITE initiative brings together researchers from Atlantic coast European universities and agencies, Maritime Canadian universities, and an American university to study coastal intertidal areas of soft sediment that form complex seascapes. These habitats are among the most productive per unit area globally and provide essential ecosystem services, including carbon uptake and sequestration, coastal resilience, and biodiversity support. The provision of such services is presently decreasing because these seascapes are becoming increasingly fragmented and threatened. Rewilding and restoration are nature-based solutions that re-establish natural ecosystem processes, thus reducing human control and “letting (again) Nature do the job”. REWRITE focuses on the intersection of climate-biodiversity-society. The upper Bay of Fundy with its expansive mudflats and salt marshes is one of 10 demonstrator sites (along the European and North American coasts). It has long-term studies, with multiple sites covered by conservation agreements, including the Western Hemisphere Shorebird Reserve Network. The Canadian team is supported by Net Zero Atlantic and in collaboration with European researchers, is working on a project to develop a toolset to evaluate carbon sequestration in intertidal mudflats. This includes quantifying carbon stored in sediments, developing linked satellite remote sensing and eddy covariance methods to map microalgal biofilm biomass and CO<sub>2</sub> gas exchange over mudflats, and conducting detailed study of photophysiology and identification of microbial species and activity (using environmental DNA and RNA). Once developed, this toolset will help assess the role of mudflats as a nature-based climate solution, primarily by providing carbon removal from the atmosphere.

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Dr. Danika Van Proosdij (Saint Mary's University)

**METHODOLOGIES FOR HYDRODYNAMIC SURVEYING OF HIGHLY TURBID RIVERS IN THE BAY OF FUNDY**

The Intertidal Coastal Sediment Transportation (In\_CoaST) Research Unit is a lab at Saint Mary's University that is part of TransCoastal Adaptations Centre for Nature Based Solutions. The In\_CoaST lab examines interactions and feedbacks that occur between topography, biota, hydrodynamics, and sedimentary processes and the resultant adjustment of intertidal morphology. Various instruments and methodologies are used to collect data on weather, waves, currents, sediment, vegetation, topography, carbon flux, tidal energy, and water conditions at various coastal restoration sites across Atlantic Canada. Current research sites include restored tidal wetlands, coastal dune systems, dykelands, and living shorelines.

The 'Methodologies for Hydrodynamic Surveying of Highly Turbid Rivers in the Bay of Fundy' poster that is proposed to be presented at the Access 2024 conference will discuss the challenges of sampling in the highly turbid environment within the inner Bay of Fundy and solutions/methodologies developed by the In\_CoaST lab to work in this system. Such methodologies include using a Sontek M9 river surveyor to collect bathymetric data. By surveying the same cross-sectional profiles year after year In\_CoaST has been able to track sediment deposition and sediment loss within tidal systems such as the Avon river in Nova Scotia. Specialized methodologies have also been developed by In\_CoaST in-order to successfully deploy ADCP's (Acoustic doppler current profiles) and various data loggers in high energy and highly turbid tidal rivers.

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