Marine Affairs Program

Making Waves 2022

Master of Marine Management Class of 2022

Graduate Project Presentations

Thursday and Friday, December 8 & 9, 2022

10:00 am to 3:00 pm

MacMechan Room, Killam Library

Dalhousie University Campus

Online via Zoom

DALHOUSIE UNIVERSITY

Making Waves 2022 Schedule - Thursday December 8, 2022

https://us02web.zoom.us/j/86396998590?pwd=SkFaQlUraW40QVByM2orS05FRU9RQT09
Meeting ID: 863 9699 8590
Passcode: 708946

9:45 am	**Coffee/Tea**	
10:00 am	Introductory Remarks – Jerry Bannister, Director, Marine Affairs Program	
10:05 am	Claire Armstrong-Buisseret	Transformative change in shellfish food systems: Overcoming barriers to Indigenous Food Sovereignty in coastal BC
10:26 am	Dylan Seidler	Marine-Based Research in a Changing Climate Lessons and Methods for Community Engagement from Nunatsiavut Canada
10:47 am	Armand McFarland	Developing an Equitable Framework to Support Indigenous Co-Governance of St. Anns Bank Marine Protected Area
11:08 am	**BREAK**	
11:20 am	Ela Cichowski	A Program and Policy Review of Canada's Federal Ghost Gear Fund in the Maritimes Region
11:41 am	Victoria Winslow	Objectives of conservation measures and their use in strategic marine spatial planning in Canada
12:02 pm	**LUNCH**	
12:30 pm	Raven Elwell	The Integration of Climate Change Modeling, Monitoring and Management for Cold-Water Coral and Sponges in Eastern Canada
12:51 pm	Laurel Genge	Coastal Adaptation and Vulnerability Assessment (CAVA) on the Tourism Industry for Sea-Level Rise in Lunenburg, Nova Scotia
1:12 pm	Hannah Kosichek	Assessing the potential for seaweed aquaculture in Nova Scotia
1:33 pm	**BREAK**	
1:45 pm	Krish Thapar	Evaluating the current aquatic invasive species (AIS) treatment methods and exploring different restoration tools that could aid in ecosystem recovery in freshwater ecosystems of Nova Scotia
2:06 pm	Samanta Martinez	Determining effectiveness of Ecologically Significant Areas (ESAs) for protecting Striped Bass (*Morone saxatilis*) spawning habitat in the Stewiacke River, NS

Each student is allotted 20 minutes for their presentation (13 minutes for presentation, 7 minutes for questions). There is a 1 - minute break for change-over of presenter.

Making Waves 2022 Schedule – Friday December 9, 2022

https://us02web.zoom.us/j/84643865738?pwd=UWpCU1ErMFBSeE93S25BT0EzSkduQT09
Meeting ID: 846 4386 5738
Passcode: 237967

9:45 am	**Coffee/Tea**	
10:00 am	Welcome Back – Jerry Bannister, Director, Marine Affairs Program	
10:05 am	Abdirahim Ibrahim Sheik Heile	Estimating the Impacts and Benefits of Foreign Fleets Fishing in Somali Water
10:26 am	Debra Sinarta	What's in our toolbox: Exploring and unlocking Canada's blue carbon potential
10:47 am	Marine Courtois	A systematic review of the socioeconomic outcomes of the European Union's trade-based measure for seafood sustainability
11:08 am	**BREAK**	
11:20 am	Cailey Dyer	Fishing Fairness: The Case of Class B Lobster Fishing Licenses
11:41 am	Ian McLean	Forage fish in decline: Understanding the usage and management of bait fisheries in the Maritimes Region
12:02 pm	**LUNCH**	
12:30 pm	Michaela Mayer	Sea Otter Monitoring to Inform Future Population Management Actions on the Coast of Vancouver Island
12:52 pm	Gwen Marty	Revealing the Seafloor: Exploring Local Knowledge and Interpretations of Benthic Spaces along the Eastern Shore of Nova Scotia, Canada
1:12 pm	Carly Green	Limited Options in Canada's Regulatory Tools for Addressing Underwater Noise
1:33 pm	**BREAK**	
1:45 pm	Kyle Gordon	Identifying potential spatial use conflicts between the commercial fishing industry and offshore wind development in Nova Scotia
2:06 pm	Maryam Nakhostin	Assessing Appropriate Conservation Strategies for Carpet Sharks
WRAP UP		

Each student is allotted 20 minutes for their presentation (13 minutes for presentation, 7 minutes for questions). There is a 1 - minute break for change-over of presenter.

Making Waves 2022 Abstracts

(in alphabetical order)

Claire Armstrong-Buisseret

Armstrong-Buisseret, C. 2022. Transformative change in shellfish food systems: Overcoming barriers to Indigenous Food Sovereignty in coastal BC [graduate project]. Halifax, NS: Dalhousie University.

Abstract

Clams and other shellfish are central to many aspects of coastal First Nations communities including food security, health and nutrition, economy and trade, and culture. However, the current shellfish management systems in BC have created barriers to a flourishing shellfish food system. This research project explores the concept of transformative change towards Indigenous Food Sovereignty (IFS) as a pathway to restore shellfish food systems. The objectives of this research project are to (1) synthesize a framework for IFS in shellfish food systems, (2) identify and describe barriers to harvesting shellfish, and (3) explore levers for change to re-establish a thriving shellfish food system that benefits both people and nature. This research project employs literature review with a mixed-methods qualitative approach using NVivo 12. Inductive coding was used to develop a framework that categorizes barriers based on pillars and indicators of IFS. Deductive coding was used to explore levers that instigate transformative change in shellfish food systems. The main barriers identified were: (1) high levels of shellfish contaminants that pose risks to human health; (2) a lack of monitoring that contributes to long-term closures at shellfish harvest sites; (3) limited access to shellfish harvest sites due to land privatization and coastal development; and (4) loss of Indigenous culture relating to shellfish management practices. The main recommendation is to establish a specific organization with the mandate to support Indigenous shellfish harvesters. This support could include three main components: regional pollution identification and correction programs, regional phytoplankton monitoring and shellfish testing, and eco-cultural restoration programs that provide opportunities for cultural resurgence.

Keywords: shellfish food systems, Indigenous Food Sovereignty, transformative change, British Columbia, sea gardens

---

Claire completed her internship with Living Lakes Canada (LLC) as part of their Applied Reconciliation team. Claire's main deliverable was a report that documented LLC's Applied Reconciliation Program and made recommendations to continue to develop and expand their reconciliation work in tandem with their water stewardship programming. This involved interviewing LLC program coordinators and doing desktop research on best practices of reconciliation. Throughout her internship, Claire assisted with building a library of resources to build capacity in the LLC team related to working alongside Indigenous Peoples in light of reconciliation. Although the internship did not directly relate to Claire's graduate project, the experience expanded upon her practical understanding of reconciliation, especially as it applies to the work of environmental NGOs.

Ela Cichowski

Cichowski, E. 2022. A Program and Policy Review of Canada's Federal Ghost Gear Fund in the Maritimes Region [graduate project]. Halifax, NS: Dalhousie University.

Abstract

Abandoned, lost, or otherwise discarded fishing gear (ALDFG) has received increased global attention in recent decades owing to its pervasive impacts on the marine environment. As international awareness continues to grow, many nations have since taken steps to enact policies and initiatives to specifically combat ALDFG. This study seeks to examine Canada's efforts towards addressing ALDFG by reviewing the federally led Ghost Gear Fund (GGF), established by Fisheries and Oceans Canada (DFO) over an initial 2-year period (2020-2022). To identify the challenges and opportunities of this program, past GGF participants from DFO's Maritimes Region were invited to participate in an online survey and follow-up interview. Based on this study's findings, it is recommended that any future iteration of the GGF program for DFO's Maritimes Region be implemented over a multi-year timeframe and with the adoption of several administrative changes to address common challenges and issues expressed by past GGF proponents. Additionally, to help inform recommendations for Canada's ALDFG strategies more broadly, legislation and initiatives adopted in the United States (U.S.) and Norway towards ALDFG mitigation were evaluated for comparative purposes.

Keywords: Abandoned, lost, or otherwise discarded fishing gear (ALDFG), Fisheries management, Ghost Gear Fund, Fisheries and Oceans Canada (DFO), Maritimes Region, United States (U.S.), Norway

---

Ela completed her intership with the Department of Fisheries and Oceans Canada (DFO), Maritimes Region. Under the supervison of Kristian Curran and Larissa Goshulak, she supported tasks related to the Ghost Gear Fund (GGF) within the Resource Management division. Specifically, she conducted a review of the GGF over its initial two-year implementation (2020-2022) by surveying and interviewing past GGF proponents from DFO's Maritimes Region. This internship was insurmountable in furthering Ela's understanding of current legislative and regulatory approaches towards addressing Abandoned, Lost, and otherwise Discarded Fishing Gear (ALDFG) on both a global and national level. This internship provided Ela with the opportunity to explore an unfamiliar area of interst and gain valuable work experience related to marine policy and management.

Marine Courtois

Courtois, M. 2022. A systematic review of the socioeconomic outcomes of the European Union's trade-based measure for seafood sustainability. [graduate project]. Halifax, NS: Dalhousie University.

Abstract

Seafood is one of the most internationally traded food commodities, creating opportunities for importing countries to exert influences on exporting countries via the control of market access. Over the past decade, global seafood market states have implemented a series of trade-based measures to improve transparency throughout international supply chains and, where possible, leverage market access to demand certain standards on the fishing practices and management in exporting states. The European Union's IUU Regulation (EC No 1005/2008) is the most prominent and well-established of these trade-based measures and is aimed at closing the European market to seafood harvested through Illegal, Unreported, and Unregulated (IUU) fishing. Through a two-stage process of warnings (yellow card) and import restrictions (red card), the EU-IUU Regulation has been applied to 27 countries, including Belize and Sri Lanka, which resulted in a ban on imports. It is now increasingly viewed as a model for other key seafood market states in promoting sustainable fisheries globally.

This study is a systematic literature review, based on 53 research peer-reviewed research articles from 2010-2022, to assess the observed outcomes of the EU-IUU Regulation in terms of improvements in fisheries management and of the socioeconomic impacts on the affected fishing communities. Despite its presented initial goal of monitoring IUU fishing practices internationally, the regulation presents significant transparency and harmonization gaps, limiting its overall effectiveness. The unilaterality of the regulation and subsequent perceived unbalanced dynamics may represent one of its key weaknesses.

Keywords: EU-IUU Regulation; policy; IUU fishing; trade-based measures; carding system; socio-economic impacts; management; power dynamics.

Marine completed two internships, one for the Nippon Foundation Ocean Nexus Program under the supervision of Dr. Wilf Swartz and the other at Deep Cove Aqua Farms Ltd. with Josh Nikoloyuk. During her internship with Ocean Nexus, Marine worked as a research assistant to assess the outcomes of the European Union's trade-based measure on seafood sustainability based on existing academic literature. Through her internship at deep Cove Aqua Farms Ltd., Marine worked as a project coordinator with three other students to assess the feasibility of developing a sustainable shellfish aquaculture site on the southern Scotian shore. This internship helped shape Marine's skillset on and off the field in collecting and analyzing data, identifying stakeholders and conducting community engagement. Completing two internships was challenging, but it allowed Marine to diversify her fisheries management capabilities by refining her area of expertise while using her background in marine sciences.

Cailey Dyer

Dyer, C. 2022. Fishing Fairness: The Case of Class B Lobster Fishing Licenses [graduate project]. Halifax, NS: Dalhousie University.

Abstract

In 1976 the lobster fishery in Atlantic Canada was overfished and in decline. In response, Canada's federal government implemented a "moonlighter policy" which designated fishers who had employment outside the fishery as a Class B license holder, differentiating them from full-time commercial fishers operating Class A licenses. Under this new designation, their trap numbers were reduced to one-third of the number allowed under a Class A license and, unlike the Class A licenses, the transfer of the license was prohibited, requiring them to be retired with the license holder. As these Class B fishers are aging into retirement, many have requested this policy be amended. They claim the policy is no longer necessary given the present state of the fishery and that the policy deprives them from entering the lucrative lobster license market.

This research reviews the history of the moonlighter policy and examines its implications on individual fishers who were reclassified as Class B through a series of semi-structured interviews with six Class B license holders and their families. Through the experiences and perceptions of these fishers, this study explores the concept of fairness in relation to the policy, its impact on the fishery, and discusses why it has created a humiliating institution.

The Department of Fisheries and Oceans Canada (DFO) continues to uphold this policy despite robust evidence of stock recovery and sustainability, commercial prosperity of the fishery, and public outcry. It is the recommendation of this paper that the DFO immediately review its policy and rescind its prohibition on the transfer of Class B licenses.

Keywords: fairness; sustainability; Atlantic Canada; property; livelihood; policy review; judicial review; procedural fairness; substantive fairness; management; economics

---

Nippon Foundation Ocean Nexus Program- Internship 1
The Ocean Nexus Program facilitated many learning opportunities for their interns including meetings with international researchers, provide advice on graduate student projects and facilitate writing workshops. The internship enables students to connect with academics internationally to learn from one another and create lasting relationships.

Maximum Estimated Time to Rescue Project- Internship 2
The Polar Code stipulates that any vessel transiting the Canadian Arctic must be self-sufficient for five days should they require rescue via air or sea. However, this number has never been tested in the Canadian Arctic. The project aims to develop models which can estimate the expected time of rescue in different parts of Canada's Arctic. As an intern, I was responsible for collecting qualitative data related to search and rescue in Canada's Arctic. I had the opportunity to work alongside Dr. Peter Kikkert, Dr. Ron Pelot and Dr. Floris Goerlandt. In addition to desktop research, I was fortunate to travel to Canada's Arctic to observe a live search and rescue exercise performed by the Canadian Coast Guard and to facilitate Roundtables in all 3 of Nunavut's region. The findings from my travels directly impact the research's ability to develop models about the maximum time to rescue and could inform policy decisions and polar code developments into the future.

Raven Elwell

Elwell, R. 2022. The Integration of Climate Change Modeling, Monitoring and Management for Cold-Water Coral and Sponges in Eastern Canada [graduate project]. Halifax, NS: Dalhousie University.

Abstract

Deep-sea cold-water coral and sponges are vital for maintaining ecosystem integrity. Deep-sea coral and sponge species can be found individually or in a grouping, both systems create habitat for marine species by providing an area to rest, spawn, feed and seek refuge. Deep-sea corals and sponges are both sessile species that contain long lifespans and slow-growing times; making them extremely fragile and vulnerable to surrounding threats and pressures. Canada contains multiple coral and sponges' conservation laws, policies and strategies; however, they're 'effectiveness' is being limited by climate change. Direct impacts can be restricted but indirect impacts are estimated to create inhabitable environments for deep-sea corals and sponges which will bring them to extinction. Eastern Canada has yet to fully implement climate change modeling, monitoring, and management plans for the deep-sea; and without proper instructions, these ecosystems will perish within the next 10-20 years. Nonetheless, international countries such as Norway, Australia and New Zealand are further advanced in their coral and sponge research and plans for climate change adaptation and mitigation. Many countries have produced cold-water coral and sponge modeling, monitoring and management measures themselves as they understand the vulnerability and importance of protecting such species. The purpose of this paper is to identify both the successful cases of climate change adaptation into modeling, monitoring and management, and to identify how countries are taking climate action into their own hands. Canada often reviews international nations' strategic measures when developing their own laws, policies and strategies and enforcing modeling, monitoring and management. Therefore, extensively reviewing international nations' coral and sponge conservation measures related to climate change adaptation and mitigation, is crucial for the survival of deep-sea fauna in Eastern Canada and to understand how Canada can adopt methods and adapt their thinking into future, modeling, monitoring and management plans. This review will then allow for the determination of plausible recommendations that will aid in ecosystem success. Our findings will suggest that Canada is focused on direct impact mitigation and remains to neglect the inclusion of climate change modeling, monitoring and management, and that Canada needs to consider developing and implementing the recommendations presented to ensure ecosystem preservation.

Keywords: Eastern Canada, Climate Change, Cold-Water Coral, Management

Laurel Genge

Genge, L. 2022. Coastal Adaptation and Vulnerability Assessment (CAVA) on the Tourism Industry for Sea-Level Rise in Lunenburg, Nova Scotia [graduate project]. Halifax, NS: Dalhousie University.

Abstract:

Climate change and specifically Sea-Level Rise (SLR), are impeding threats to the future of small coastal tourism communities. Although the perception of vulnerability to climate change within the tourism industry is becoming better understood, community resilience and adaptability remain inconsistencies in the scientific literature (Dube et al., 2021; Rangel-Buitrago et al., 2020). The Coastal Adaptation and Vulnerability Assessment (CAVA) process draws on scientific, social, and economic dimensions to consider quantitative measures of climate change alongside a qualitative assessment of the awareness and adaptive capacity of the tourism industry in Lunenburg, Nova Scotia. To assess the resilience of Lunenburg, this research identifies perceived risks and the level of preparedness of the tourism industry via a mixed methods approach. Integrating key informant interviews, business and organization surveys the understanding of potential impacts and existing mitigation strategies are assessed. Therefore, studying the perceived risks of climate change on the community of Lunenburg and their capacity to adapt is essential for decision-making processes within small coastal communities of similar geographic and economic breakdowns. Results highlight that key informant interviews prioritize mitigation strategies for operational capacity, pandemic-related public health restrictions, and increasing cost of operations. Most notably, the operational capacity to host a growing tourist population was an immediate concern for the accommodation and restaurant sector. The significance of the proposed graduate project stems from an important gap in scientific knowledge regarding how perceptions of climate change influence perceived risk and adaptation within tourism-dependent sectors in small coastal communities. More specifically, exploring the local tourism stakeholders' knowledge of the expected effects of SLR and identifying perceived barriers to adaptation will aid in developing future SLR mitigation strategies.

Keywords: Risk perception, sea-level rise, climate change, tourism stakeholders, adaptation strategies

---

Laurel completed her internship with the CAVA team in Lunenburg, NS. Under the supervision of Lorn Sheehan, Andrew Medeiros, Georgia Klein, and Shannon Lin, Laurel contributed to a variety of tasks within the overarching CAVA project. During her internship, Laurel helped compile and summarize literature to identify gaps in climate change mitigation knowledge for the tourism industry. Further, this internship allowed Laurel to conduct semi-structured interviews to gather insight from members of the Lunenburg tourism industry. Through these experiences, Laurel gained valuable experience regarding teamwork in interdisciplinary projects, appropriately scoping personal goals, and gaining inspiration for his own graduate research.

Kyle Gordon

Gordon, K. 2022. Identifying potential spatial use conflicts between the commercial fishing industry and offshore wind development in Nova Scotia [graduate project]. Halifax, NS: Dalhousie University.

Abstract

Offshore wind (OSW) is beginning to emerge as a major player within the Nova Scotia renewables sector as the province moves to fulfil its commitment of net-zero emissions by 2050. The addition of OSW as a new use in the ocean introduces a risk of spatial conflict with the various pre-existing uses including commercial fishing, shipping, and aquaculture. Ocean planning tools such as Marine Spatial Planning (MSP) seek to consider the needs and requirements of the various users so that potential spatial conflicts can be identified and proactively avoided. Using a two-staged approach this study sought to effectively integrate tools within the greater MSP process to address the potential spatial conflict between future fixed-base OSW development in Nova Scotia and the commercial fishing industry. The first stage of this project used a case study analysis to glean insights related to the OSW planning and siting process of other international jurisdictions. The second stage of this study was a spatial analysis that used the software Marxan to identify areas with high or low potential for spatial conflict between future OSW development and the commercial fishing industry. This study provides a framework for how the decision support tool Marxan can be used to highlight potential spatial overlap and conflict between future fixed-base OSW development and existing ocean uses in Nova Scotia. The results of this study were used to develop a series of recommendations that can be used to inform future research examining potential conflicts between offshore wind and other ocean uses.

Keywords: Offshore wind energy; marine spatial planning (MSP); commercial fishing industry; Marxan; spatial conflict; Nova Scotia; Canada

---

Kyle completed his internship with the Department of Fisheries and Oceans Canada, Maritimes Region. Under the supervision of Elizabeth Nagel. He contributed to a variety of projects within the Marine Planning and Conservation program. During his internship, Kyle helped design an initial spatial analysis evaluating potential spatial conflict between the existing commercial fishing industry and future offshore wind development. Further, this internship allowed Kyle to delve into how marine spatial planning can be applied to a new ocean sector with complex socio-economic and ecological considerations. This internship was instrumental in the completion of his graduate project and allowed him to gain valuable practical experience related to the marine spatial planning process in Canada.

Carly Green

Green, C. 2022. Limited Options in Canada's Regulatory Tools for Addressing Underwater Noise [graduate project]. Halifax, NS: Dalhousie University.

Abstract

Over the last two decades, underwater noise has been recognized as a significant threat to marine ecosystems. With an accelerating blue economy and industrial expansion, human-caused noise continues to increase, deepening this threat and its impacts. Such noise is produced by various human activities that span industries such as tourism, shipping, fishing, and energy. In Canada, these industries fall under a variety of jurisdictions and regulatory authorities, creating silos across noise-producing activities. Holistic management and planning approaches such as Marine Spatial Planning (MSP) can help decision-makers minimize the negative impacts of underwater noise; however, an understanding of how noise might be addressed through existing regulatory tools remains limited. This study provides an assessment of Canada's ocean regulatory tools and their potential to address noise. A deductive document analysis was used to uncover current strengths, weaknesses, and gaps in the legislation. Results indicate minimal noise-related language in legislation and regulations, with explicit mentions being exceedingly rare. Most relevant terminology was found within the *Canada Shipping Act* and the annexed *Interim Order for the Protection of the Killer Whale (Orcinus orca) in the Waters of Southern British Columbia.* While this study highlights a finite capacity for Canada's regulatory tools to address noise directly, it also highlights how the interpretation of these tools, alongside developing programs, initiatives, and management plans, can help to bridge current gaps. As the ocean becomes increasingly busy and noisy, it will be important to embed this threat into marine species and ecosystems in planning and management by first capturing the full potential of existing legislations and regulations.

Keywords: Underwater noise, ocean noise, marine spatial planning, marine regulatory tools

---

Carly completed her summer internship with Fisheries and Oceans Canada on the Marine Spatial Planning (MSP) team at National Headquarters. She supported tasks related to the MSP program policy, brainstorming engagement strategies to be used across the federal departments concerning MSP best practices in Canada. This internship provided experience in policy analysis, preparing and presenting scientific slide decks, and effectively communicating with other government departments. Additionally, Carly developed a report focusing on how underwater noise demonstrates the important role MSP plays in combining regulatory instruments to address emerging issues such as noise. Carly gained valuable insight into the developing MSP processes within Canada and values the relationships she made along the way.

Hannah Kosichek

Kosichek, H. 2022. Assessing the potential for seaweed aquaculture in Nova Scotia [graduate project]. Halifax, NS: Dalhousie University.

Abstract

Growing interest in the seaweed aquaculture industry has focused on the environmental, economic and social benefits it can offer. In Atlantic Canada, it is a small but emerging industry with the potential to grow and contribute to food security, climate change mitigation and coastal economic development. However, limited understanding of this potential has led to slow and fragmented development of the industry, without a clear direction of how to move the industry forward. This research uses Nova Scotia as a case study to understand the potential for the seaweed aquaculture industry by analyzing the perceptions of stakeholder groups (industry, academia, NGO/community and government). A SWOT analysis was completed to understand the main drivers and barriers impacting the industry and was used to develop a Q-methodology survey for identifying the important factors to consider in decision-making, management and planning of the industry. Results indicated that participants generally reflected one of two perspectives: the seaweed skeptic and the seaweed solution. Participant perceptions indicated areas where seaweed aquaculture can be a contributor in Nova Scotia, specifically in coastal community economic development and food sustainability. However, experiential knowledge gaps, uncertainties surrounding climate change impacts and lack of regulations appear to constrain individuals from fully supporting the industry. Further discourse is needed on the stewardship and priorities of how this industry should be developed moving forwards. These findings illustrate possible enabling conditions for the future of this industry in Canada.

Keywords: seaweed aquaculture; Nova Scotia; SWOT analysis; Q-methodology

---

Hannah completed her internship remotely with the Department of Fisheries with the Marine Spatial planning team at the national headquarters region. Under the supervision of Julie Reimer, Hannah conducted research on scenario design, a forward-thinking tool and its use and application in MSP and for emerging uses. While her internship did not directly link to her graduate project, the experience provided opportunities to gain practical experience and give valuable insight into marine planning processes in Canada.

Samanta Martinez

Martinez, S. 2022. Determining effectiveness of Ecologically Significant Areas (ESAs) for protecting Striped Bass (*Morone saxatilis*) spawning habitat in the Stewiacke River, NS [graduate project]. Halifax, NS: Dalhousie University.

Abstract

Canada's *Fisheries Act* was modernized in 2019 and included added protections to all fish and fish habitat. To implement some of the new provisions in the *Fisheries Act*, Fisheries and Oceans Canada (DFO) is working on a National Framework for Identifying, Establishing, and Managing Ecologically Significant Areas (ESA). An ESA is a spatial regulatory tool for the protection and conservation of fish and fish habitat and can apply to freshwater (including riparian habitat), estuarine, and marine waters. ESAs are areas of fish habitat that are sensitive, highly productive, rare, or unique. As there are currently no ESAs in Canada, DFO is working on case studies to better understand how ESA provisions could apply in practice and to inform the development of the National ESA Framework. In DFO's Maritimes region, one case study being explored is the Stewiacke River, as it is home to the last spawning ground for the Bay of Fundy Striped Bass (*Morone saxatilis*) population. Striped Bass is an important species in the region. It holds cultural importance to Mi'kmaq and is an important recreational fishery. The DFO *Guidance on Assessing Threats, Ecological Risk and Ecological Impacts for Species at Risk* was used as a guide for completing a risk assessment and adapted for the application to the ESA case study. The risk assessment was used to identify and analyze the human threats to Striped Bass spawning. Recommendations around applicability of the risk assessment for analysis of ESA case studies were made, and next steps for the Stewiacke River ESA case study were identified.

Keywords: Striped Bass, Ecologically Significant Areas, fish habitat, spawning, human impacts

---

Samanta completed her internship with Fisheries and Oceans Canada (DFO) as part of the Integrated Planning team in the Maritimes Region. Under the supervision of Aimee Gromack, Samanta completed a draft report on exploring an Ecologically Significant Area (ESA) case study in the Stewiacke River, NS. She also participated in ESA practitioner's group meetings, which helped tie her work to DFOs work on fish and fish habitat protection. Samanta's work with DFO over the summer set the foundation for her continued work on her graduate project.

Gwen Marty

Marty, G. 2022. Revealing the Seafloor: Exploring Local Knowledge and Interpretations of Benthic Spaces along the Eastern Shore of Nova Scotia, Canada. [graduate project]. Halifax, NS: Dalhousie University.

Abstract

Marine ecosystems are increasingly affected by climate change, understanding impacts, how they might change, or the role they will play in system adaptation is key to protecting the overall marine environment and broader marine socio-ecological systems. The Eastern Shore of Nova Scotia is known for its recreational activities and fisheries, where local identities and ways of life are closely tied to the ocean. The seafloor provides the foundation for many of these activities and is an important factor in determining how people use various areas. This study explored how local recreational and commercial users of coastal and marine spaces engage with and understand the seafloor, through interviews with different user groups. Maps were used to elicit knowledge, and tie observations of place to use and change. Participants spoke about the seafloor structure, composition, features, and species, which varied depending on their purposes, as well as observed changes to marine and coastal environments. The results of this study can contribute to a richer, holistic understanding of the seafloor, as well as how local users experience change. This knowledge can inform decision-making on the Eastern Shore and demonstrates the value of incorporating different ways of knowing, including localized, place-based, and experiential knowledge into marine management.

Keywords: seafloor, benthic ecosystems, Eastern Shore of Nova Scotia, local knowledge, experiential knowledge, place-based knowledge, recreational use, commercial use, coastal and marine change, holistic management.

Gwen completed her internship with Work Package 1.1 (Societal Engagement) of the Benthic Ecosystem and Engagement Project (BEcoME) under the supervision of Dr. Sara Spike, Dr. Patricia Manuel and Dr. Claudio Aporta, this project is funded by the Ocean Frontier Institute. Throughout her internship, she conducted semi-structured interviews to explore how local users of coastal and marine space along the Eastern Shore speak about, use, and understand benthic environments. She had the opportunity to travel to the Eastern Shore to conduct interviews and explored some of the archipelago by kayak. Additionally, she helped the BEcoME team gather and bring together various knowledge and data sets to create a visualization of existing knowledge of the seafloor along the Eastern Shore of Nova Scotia.

Michaela Mayer

Mayer, M. C. 2022. Sea Otter Monitoring to Inform Future Population Management Actions on the Coast of Vancouver Island [graduate project]. Halifax, NS: Dalhousie University.

Abstract

Sea otter populations off the coast of Vancouver Island in British Columbia (BC) have been greatly impacted by human activities. Historical records indicate the presence of an abundant sea otter population in the region prior to the Maritime Fur Trade which drove this species to near extinction. Conservation measures and management actions over the last 60 years have stimulated sea otter population increase in BC and allowed for the partial re-occupation of their historical range. However, increased sea otter presence in the coastal environment can create tensions between stakeholders and rightsholders over access to marine resources. This research project focused on the status of sea otter range expansion in Pacheedaht Territory encompassing the western and central Juan de Fuca Strait and explored insights into appropriate management tools if sea otter densities increase in this area. The various dimensions of sea otter population management and the implications of sea otter range expansion on marine ecosystems and coastal communities were explored. Consideration was given to measures which could facilitate continued expansion of sea otters while minimizing the potentially negative impacts to the socio-economic activities in the region. Through this research, information and insights were obtained from semi-structured interviews, an online survey interview questionnaire and a focused literature review on sea otter expansion to form a mixed-methods, multi-source data set. The data obtained could inform an environmentally, economically, and socially sound plan to accommodate increased sea otter presence with minimal conflict in the study area.

Keywords: sea otter population management; Vancouver Island; rightsholder perspectives; stakeholder perspectives; coastal resource management; coastal communities.

Michaela completed her internship with Sea View Marine Sciences on the Pacheedaht First Nation's systematic line-transect survey on Southern Resident Killer Whales (SRKW). Under the supervision of Dr. Anna Hall, Michaela served as the research team lead for the study out of Port Renfrew, British Columbia. This internship allowed her to spend time in a region of historic sea otter habitat and develop meaningful connections with the people who live and work in the study area. Many of whom became participants and provided their insights on sea otter range expansion in semi-structured interviews and survey interview questionnaires. Through this experience, Michaela explored diverse perspectives on sea otter population management and enhanced her skills in conducting marine research in the field.

Armand McFarland

McFarland, A. 2022. Developing an Equitable Framework to Support Indigenous Co-Governance of St. Anns Bank Marine Protected Area [graduate project]. Halifax, NS: Dalhousie University.

Abstract

Marine protected areas (MPAs) comprise a large proportion of the conservation measures used to achieve the international conservation commitments of the federal government (10% of Canadian waters by 2010, and now 25% by 2025). There is a substantial overlap of Indigenous territories and these ambitious federal goals that may lead to infringements on Indigenous rights. Sharing management and governance of MPAs could work toward reducing these infringements. Due to a confluence of Mi'kmaq interest, historical treaty rights, and burgeoning federal support, St. Anns Bank MPA (SAB) located east of Unama'ki (Cape Breton Island), may be a suitable location for implementing a framework of shared governance and Indigenous stewardship. Fisheries and Oceans Canada (DFO) is responsible for the management of this MPA; however, the maritime region of this department lacks the extensive co-governance and relationship building experience present on the Pacific coast or within Parks Canada. This research explores the question: how can DFO equitably support and implement a framework of Mi'kmaq participation and co-governance in St. Anns Bank MPA? This question will be addressed with a two-pronged approach: a literature review will first investigate equity in the establishment, development, and management of two sites co-managed by Parks Canada, DFO, and the Haida Nation on the Pacific coast, to identify key principles. Identified principles are then applied using a comparative analysis between the East and West coasts to provide management, policy, and research insights for the co-governance of St. Anns Bank MPA.

Keywords: Marine protected areas, St. Anns Bank, Indigenous governance, Co-governance, Equity, Justice

---

Armand completed his internship with the Department of Fisheries and Oceans Canada, Maritimes Region. Under the supervision of Catherine Schram and Paul Macnab, Armand assisted with several projects within the Marine Planning and Conservation Team. During his internship, Armand worked partly on his graduate project, assisting with completing the St. Anns Bank MPA management plan, and drafting a site profile for a marine refuge. As well as providing Armand with the time and resources to complete his project, the internship gave him a valuable perspective and insight on the internal processes behind MPA site management.

Ian McLean

McLean, I. 2022. Forage fish in decline: Understanding the usage and management of bait fisheries in the Maritimes Region [graduate project]. Halifax, NS: Dalhousie University.

Abstract

Many commercial fisheries of great socio-economic importance in Canada rely on bait, such as the lobster, crab and groundfish fisheries. In the Fisheries and Oceans Canada (DFO) Maritimes Region, traditional species of bait include pelagic fish such as Atlantic herring (*Clupea harengus*), Atlantic mackerel (*Scomber scombrus*) and gaspereau (Genus *Alosa*). In recent years, these stocks have declined due to overfishing and high natural mortality, necessitating closures of the Atlantic mackerel bait and commercial fisheries and quota cutbacks for Atlantic herring, resulting in a reduced supply and increased cost of bait in the Maritimes Region. This paper consists of research into the socio-economic and operational characteristics of the bait fishery in the Maritimes Region, industry perspectives on potential management measures, and insight into the perceptions of alternative bait sources. The bait fishery's characteristics were studied through DFO licensing and catch data analysis. The analysis showed that annual bait licence landings are increasing, and recent increases in bait prices may further incentivize the use of bait licences. Additionally, usage depends upon economic factors, a harvester's geographical location, and the characteristics of their commercial fisheries. Perspectives on bait and management measures were gathered through interviews with bait licence holders and fishing associations. Harvesters had concerns about the supply and availability of bait for the 2022 commercial fishing season and heightened concerns for future fishing seasons. Some harvesters cited that fishing their bait licence can reduce financial strains on their fishing operation through economic savings. Interviews supported implementing a minimum gillnet size and a delayed spring opening in the Maritimes Region's bait fishery. This paper's findings will inform DFO regarding how commercial harvesters utilize their bait licenses and provide key recommendations to improve the management of the bait fishery.

Keywords: Forage fish, Atlantic herring, Atlantic mackerel, bait fish, bait fishery, lobster

---

Ian completed his summer internship with the Department of Fisheries and Oceans Canada on the Resource Management team at the Bedford Institute of Oceanography in Dartmouth, Nova Scotia. He supported tasks related to small pelagic fish species and the bait fishery, including a comprehensive analysis of licensing and fishing data that led to recommendations for improving the management of the bait fishery in the Maritimes Region. His internship provided experience writing formal briefing notes, engaging with the fishing industry, and working in fishery management. Additionally, Ian developed a report and PowerPoint describing how harvesters utilize their bait licences and the bait fishery's current licensing and landings trends. Ian gained invaluable experience working in the Canadian federal government and seeing first-hand the skills and attributes of a successful marine manager.

Maryam Nakhostin

Nakhostin, M. 2022. Assessing Appropriate Conservation Strategies for Carpet Sharks [graduate project]. Halifax, NS: Dalhousie University.

Abstract

Although there is considerable momentum for expanding protected area coverage under the 30x30 paradigm, there is key criticism of the existing targets in that they are not linked to conservation outcomes and marine biodiversity loss continues despite the rise in protection efforts. The success of different forms of conservation strategies is contingent on species-specific characteristics, such as behavior, life-history traits, migratory range, as well as the nature of existing threatening processes. Due to their small average size (<10 km^2), marine protected areas (MPAs) can be more beneficial for endemic species that are localized to smaller regions, than for larger and pelagic migratory species that inhabit and travel over larger ranges. This research develops a conservation classification scheme for the threatened species of the order of carpet sharks, Orectolobiformes, that considers the species based on their distribution, biology, and threats to their populations. This group was chosen due to the large diversity in the size and traits of the species it encompasses; ranging from the Halmahera Epaulette Shark that reaches a maximum length of 70 cm and inhabits a geographic range of 14,446 km^2 versus the significantly larger Whale Shark that can grow to a length of 21 meters and migrates over 171,000,000 km^2. The findings reveal that only a third (39.3%) of the threatened Orectolobiformes would benefit exclusively from site-scale protection whereas the other 60.8% require either a combination of MPAs and broad-scale measures, or solely the latter; illustrating that MPAs might not be the solution for protecting all marine biodiversity. Furthermore, almost no direct relationship was discerned between the species' geographic ranges, habitat types or threats to their populations, and the conservation categories they were classified in; further signifying that conservation actions must match the individual species they are intended for.

Keywords: carpet sharks, Orectolobiformes, marine biodiversity, marine protected areas, conservation, geographic range, site-scale, broad-scale

---

Maryam completed her internship remotely with the Department of Fisheries and Oceans Canada, National Headquarters. Under the supervision of Melissa Desforges and Alexandra Epp, Maryam contributed to a variety of projects within the Marine Planning and Conservation Team. During her internship, Maryam complied and summarized literature of existing legislation to provide an in-depth report on the concept of ocean zoning in the context of marine spatial planning. The data collected encompassed examples of implementation of zoning done by other nations, presenting the benefits and shortcomings of this policy approach. Her project also exhibited contradicting views that exist on ocean zoning from a range of stakeholders. Additionally, her report provided recommendations on how Canada's national MSP framework can incorporate ocean zoning to advance its conservation goals, as well as its economic and social objectives. Although the internship did not directly relate to Maryam's graduate project, the experience provided opportunities to gain practical experience, develop skills learned in MMM, and give valuable insight into marine spatial planning and conservation processes within Canada.

Dylan Seidler

Seidler, D. 2022. Marine-Based Research in a Changing Climate Lessons and Methods for Community Engagement from Nunatsiavut Canada. [graduate project]. Halifax, NS: Dalhousie University.

Abstract

Historically, Arctic-based research has corresponded to extractive methods that provide little benefit for local communities. To amend the effects of this history, researchers are increasingly encouraged to focus their efforts on ethical and meaningful engagement with community members to develop projects that support local goals. This thesis draws on accounts from Inuit community members, government officials, and researchers working in Nunatsiavut, to explore how researchers can best engage with community members. This was done through conducting 27 interviews with a variety of participants involved in or associated with the Sustainable Nunatsiavut Futures Project. In the Canadian Arctic, the Sustainable Nunatsiavut Futures (SakKijânginnaKullugit Nunatsiavut Sivunitsangit) project aims to co-produce knowledge with Inuit to ultimately support Inuit-led marine planning. Interviewees were identified as representing six different positions (the Nunatsiavut Government, Inuit Research coordinators, Natural Scientists, Social Scientists, Project Leads and Project partners). Similarities and differences between groups were examined. All individuals were clear in their understanding of relationship building as the core for ethical and meaningful community engagement. Community based government officials and Inuit Research Coordinators, in particular, emphasized that engagement has the potential to negatively impact communities. To minimize the likelihood of such negative effects, the Nunatsiavut government's process for permitting research done in the region was identified as an important mechanism through which Inuit could encourage researchers to be critical of the intentions and outcomes of their research. Using the SNF project as a case study, this analysis informs a deeper understanding of how both large-scale projects and individual researchers can work in ways that support community needs.

Keywords: Nunatsiavut, Land-Sea Connection, Inuit, Self-governance, Climate Change, Arctic, Community Engagement, Inuit Self-Determination

---

Dylan completed her internship with the Sustainable Nunatsiavut Futures Project based in Nunatsiavut, Newfoundland and Labrador Canada under the supervision of Hekia Bodwitch. She worked on the community engagement initiative centered on sharing knowledge to work to monitor marine based environmental and ecological changes. Her internship consisted of conducting virtual interviews, attending workshops, and collecting data to support her graduate project findings.

Abdirahim Ibrahim Sheik Heile

Sheik Heile, A.I. 2022. Estimating the Impacts and Benefits of Foreign Fleets Fishing in Somali Water [graduate project]. Halifax, NS: Dalhousie University.

Abstract

Over the past three decades, Somalia has suffered from illegal, unreported, and unregulated (IUU) fishing off its extended coast. Efforts to tackle IUU fishing and generate revenue have included legal selling licenses to foreign fleets. To that end, Somalia has developed an exploratory plan to grant fishing access to 31 Chinese-flagged longlines between November 2018 and November 2019. As a new initiative, the regulatory framework governing Somali fisheries has been the subject of several concerns, including the management structure, license conditions, and mechanisms for monitoring, control, and surveillance (MCS). Due to these concerns, policymakers and the public are still determining the magnitude of tuna harvested by China during its license period. This uncertainty raises additional questions about the proportional value of these catches and the net revenue Somalia generates from these access agreements. This study aims to investigate the impacts and benefits of foreign fishing in Somali waters using two case studies. Firstly, particular attention will be paid to China's recent fishing access agreement to analyze their fishing activities in the Somali EEZ and the Indian Ocean using AIS data. Secondly, the study used standard protocols to document the recovery of abandoned drifting fish aggregating devices (dFADs) within Somali coastal areas to quantify and document their particular IUU contribution, for example through being linked to unregulated purse seine vessels. By examining automatic identification system data (AIS) date, results suggest 71 China-flagged longline vessels were fishing in the Somali EEZ in 2020, of which 30 were likely operating without a license, demonstrating IUU fishing. Data from the Indian Ocean Tuna Commission (IOTC) supports this finding, indicating a disparity between the reported catch and effort on the high seas and the observed likely fishing effort within the Somalia EEZ. Moreover, the study confirmed that significant dFADs drift outside fishing grounds and beach along the Somali coast, with potential implications for ecological sustainability of tuna stocks as well as lost economic potential for Somali fishers. This study has suggested that an estimated 1,069 beaching events of dFADs may occur in the Somalia EEZ each year. Together, these studies suggest that substantial IUU fishing is occurring in the Somali EEZ, despite improvements in government capacity and policies around fisheries development and sustainability.

Keywords: IUU fishing; AIS; FAD; Somalia; Somali fisheries; Tuna resources; Indian Ocean

---

Rahim completed his internship with the Nippon Foundation Ocean Nexus Program under the supervision of Dr. Megan Bailey. During his internship with Ocean Nexus, Rahim was a research assistant to "Estimating the Impacts and Benefits of Foreign Fleets Fishing in Somali Water." During the Ocean Nexus Program, interns met with international researchers, received guidance on graduate student projects, and attended writing workshops. Taking part in an internship allows students to network with academics from around the world, learn from each other, and form long-term friendships. During this internship, Rahim gained expertise in collecting and analyzing data.

Debra Sinarta

Sinarta, D. 2022. What's in our toolbox: Exploring and unlocking Canada's blue carbon potential [graduate project]. Halifax, NS: Dalhousie University.

Abstract

Despite growing recognition of the ability of blue carbon ecosystems to sequester and store atmospheric carbon dioxide (CO_2) for several decades, their value is often overlooked in marine management decisions and climate change policies. Integrating blue carbon into climate mitigation and marine planning requires quantification of habitat extent and carbon dynamics. Canada has the world's longest coastline and supports an extensive range of productive carbon-sequestering marine ecosystems, yet blue carbon inventories have not been established in of most of these areas. Substantial geospatial data and assessments of carbon stocks and sequestration are necessary to produce inventories, yet their availability remains limited in Canada. This study explores the information required to establish blue carbon inventories and uses IPCC's three-tiered assessment structure to begin assembling inventories in two Canadian case study regions: Owls Head Provincial Park (OHPP), Nova Scotia, and the British Columbia (BC) Northern Shelf Bioregion (NSB) Marine Protected Area (MPA) Network. These assessments demonstrate how carbon inventories can be established in situations with varying levels of data and resource availability, while developing a preliminary estimate of carbon storage in the areas. This research indicates that, while existing data and information has enabled baselines estimates for several blue carbon ecosystems, significant knowledge gaps and limitations remain. On this basis, recommendations for research priorities are provided, and insights are given into integrating blue carbon inventories into the management of Canada's coastlines.

Keywords: Blue Carbon, Blue carbon inventories, Atlantic Canada, Pacific Canada, Northern Shelf Bioregion, Marine protected area network, Owls Head Provincial Park

---

Debra completed her internship with Fisheries and Oceans Canada with the Seascape Ecology and Conservation (SEAC) team in Victoria, British Columbia. Under the supervision of Emily Rubidge and the rest of the SEAC team, she contributed to the planning process of Northern Shelf Bioregion (NSB) Marine Protected area (MPA) Network by creating maps and plotting data related to the biophysical and ecological setting of the Haida Gwaii marine conservation target area. She also worked on interpreting literature related to the threats facing estuaries, to support a Science Advisory report. Using the NSB as a case study region, Debra was able to demonstrate how marine planning initiatives like the NSB MPA Network can establish blue carbon inventories and conserve blue carbon ecosystems in the future.

Krish Thapar

Thapar, K. 2022. Evaluating the current aquatic invasive species (AIS) treatment methods and exploring different restoration tools that could aid in ecosystem recovery in freshwater ecosystems of Nova Scotia. [graduate project]. Halifax, NS: Dalhousie University.

Abstract

Invasive fish species in Atlantic Canada present threats to freshwater ecosystems by out-competing and predating on native organisms, resulting in a shift in biodiversity. This could lead to social impacts, especially for recreational fishers and other users that benefit from the natural resources that are now altered by AIS. As a result of the damage caused by invasive species, some organizations (government and private) have used different types of invasive species management strategies for maximizing the removal of these unwanted fish populations such as scientific angling, electrofishing, and the installation of fish barriers and traps. In practise the methods above are effective in suppressing AIS populations, but almost never succeed in full eradication. This is where managers sometimes turn to rotenone, a piscicide that has proven to be effective in AIS eradication but is more damaging to nontargeted organisms. The objectives of this study are to evaluate common treatment methods used to suppress or eradicate AIS species in Nova Scotian lakes, by analysing its primary function, operational costs, time to implement, and disadvantages (treatment limitation and/or ecosystem impacts). In addition, different restoration frameworks will be reviewed for its potential in recovering the ecosystem from any damages caused from treatment application. Other existing management tools that do not directly assist in AIS removal or ecosystem restoration, but help facilitate management options, will also be explored. Lastly a management guide will be constructed, based on the previous objectives, to assist managers in decision making for dealing with future AIS invasions.

Key words: aquatic invasive species, control, eradication, species at risk, restoration, ecosystem recovery, biological indicator species, framework

---

Krish did his internship with the Coastal Marine Ecology Lab (CMEL) of UNB where they looked at the natural and saltmarsh ecosystem sites that were undergoing restoration that were historically dyked. The CMEL focused on studying fish communities in these sites to measure the relative success of salt marsh restoration and to determine the trophic structure of fish species utilizing the marsh based on their gut content analysis. Tasks included setting up two fyke nets at selected saltmarsh creeks in the evening and retrieving them in the morning to collect captured organisms that were coming from ebb and flood tides. Other jobs included seining the edge of the salt marsh platform during daytime hightide, and studying salt pool communities by fish capture and invertebrate sampling surveys. Saltmarsh study sites were located in the Bay of Fundy, Northumberland Strait, and Gulf of the St. Lawrence.

Victoria Winslow

Winslow V.A., 2022. Objectives of conservation measures and their use in strategic marine spatial planning in Canada [graduate project]. Halifax, NS: Dalhousie University.

Abstract

With increasing use of and dependence on the ocean, conflict between human uses and between human use and a healthy marine environment are certain. To address this, efforts to develop ecosystem-based management that recognize the intersections between marine life and human uses, including the process of marine spatial planning, have emerged prominently. The Government of Canada has committed to delivering marine spatial plans and has a mandate to enact conservation via the *Oceans Act*. Currently, Canada has over 100 laws and regulations that pertain to marine conservation, with diverse objectives that could be considered when developing marine spatial planning. Through qualitative document analysis, this research analyzes the existing suite of marine conservation regulatory tools to determine how marine spatial planning might strategically employ tools to achieve particular objectives. This study identified seven distinct conservation objectives that broadly prioritize human activities, ecosystems, and species, and determined which objectives could be achieved within each Canadian planning region using existing regulatory tools. This study provides insight on how marine spatial planning might enhance marine conservation outcomes in the current regulatory framework, ensuring that marine spatial plans prioritize marine ecosystems and employ fit-for-purpose conservation tools, supporting the blue economy and long-term ocean sustainability in Canada.

Key words: marine spatial planning, marine conservation, ecosystem-based management, marine protected area, marine law, qualitative methods.

Victoria completed her internship remotely at Fisheries and Oceans Canada with the Marine Spatial Planning (MSP) team at national headquarters in Ottawa, Ontario. Under the direct supervision of Dr. Julie Reimer, and the rest of the MSP team, Victoria contributed to a number of projects. Her work primarily focused on collecting data for her graduate project through the qualitative analysis of Canadian marine conservation legislation in the context of MSP. Additional tasks included conducting research on established marine spatial plans around the world, compiling information on suspected emerging marine uses in Canada, drafting briefing notes, creating visuals demonstrating the linkages between MSP and other key concepts, in addition to others. Through this experience Victoria got to work with a wonderful team of people with similar interests, expanded her knowledge and understanding on MSP, and was able to learn more about the dynamics of working for the federal government.