

Coastal Adaptation and Vulnerability Assessment (CAVA) on the
Tourism Industry for Sea-Level Rise in Lunenburg, Nova Scotia

By

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Abstract

Climate change and associated Sea-Level Rise (SLR) are impending 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). 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 (26), business (36) and organization (18) 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 pandemic-related public health restrictions (15.1%), operational capacity (12.9%), and increasing cost of operations (9.7%) represented by the relative frequency of mentioned themes. Most notably, the operational capacity to host a growing tourist population was an immediate concern for the accommodation and restaurant sector (12.9%). As such, this study addresses 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.

Key Words

Risk perceptions, sea-level rise, climate change, tourism stakeholders, mitigation strategies

List of Abbreviations

IPCC AR6 - Intergovernmental Panel on Climate Change Assessment Report 6

SLR - Sea-Level Rise

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Chapter 1: Introduction

Climate change refers to the long-term shifts in temperature and weather patterns, although these shifts may have natural causes, they are accelerated by human industrial activity since the 1800s (United Nations, 2022). For many coastal areas, the anticipated shifts in social, economic, and cultural conditions from climate change related Sea-Level Rise (SLR) and extreme weather events are complicated by increased demand for coastal development and associated growth in coastal populations (Field et al., 2010; Lane et al., 2013; World Bank, 2009). Coastal communities in Canada experience susceptibility to immediate and long-term threats to the natural environment (e.g. ecosystems, habitats, species diversity), infrastructure (e.g. water treatment facilities, transportation, tourism), and local populations (e.g. vulnerable populations, physical locations, livelihoods, cultural assets) (Orford et al., 1999; Nicholls, 2002; Bigano et al., 2008; Paola, 2012; Marzeion & Levermann, 2014; Mostofi & Lane, 2015; IPCC, 2022;) When seeking attainable adaptation measures for climate change related impacts, coastal communities experience limitations based on perceived risks, access to resources, and knowledge (Dolan & Walker, 2006; Measham et al., 2011). Coastal communities are part of a distinctive set of stakeholders, disproportionately affected by climate change compared to other regions in Canada (Lane et al., 2013; Mostofi & Lane, 2015; Lemmen & Warren, 2016).

Coastal regions are also a popular tourist destinations, contributing to the Canadian economy, but also heavily influenced by weather and climate change (Hewer & Gough, 2018). In 2019, pre COVID-19 pandemic, the tourism industry generated \$43.7 billion (2.03% of GDP) in value to the Canadian economy and employed 748,000 individuals in food and accommodation services (Destination Canada, 2019). For the province of Nova Scotia, the preliminary estimates for 2019 and 2020 tourism revenues are \$2.64 billion and \$1 billion respectively with a decrease of \$1.64 billion, largely attributed to the severe impact of the COVID-19 pandemic on tourism in 2020 (Tourism Nova Scotia, 2020). In 2021, Canadian Port Authorities generated \$4.3 billion in economic activity by welcoming ~1.3 million cruise ship passengers (Association of Canadian Port Authorities, 2021).

However, in the face of climate change, the coastal related tourism economy is put in jeopardy. Climate change impacts, including SLR and increased storm frequency and intensity, will pose significant challenges for decision-makers, including future investment decisions, infrastructure maintenance, and development (Franck, 2009). For example, hurricanes have been shown to impact cruise ship and airplane arrivals to tourism destinations (Chanfón et al., 2021). The future of coastal tourism will face large uncertainties when confronted with damaged infrastructure, coastal erosion, and the potential loss of tourism destination status (Lipiec et al., 2018, Lemmen et al., 2021). Without a sustainable tourism economy, the economic structure will be forced to change to sustain coastal communities. Although climate change poses social, economic, and environmental threats to coastal zones, adaptation strategies and preparedness are an integral part of small coastal community protection (Franck, 2009).

Due to the importance of climate change preparedness for small tourism-dependent coastal communities, this project examines the perceived risk, preparedness, and adaptation potential of small coastal communities using the Town of Lunenburg, Nova Scotia, as a case study. Historically, the Town of Lunenburg Nova Scotia was primarily a fishing community, home to 200 fishing vessels at its peak between 1919-1939 (Nova Scotia Archives, 2020). After being designated a World Historic Site by the United Nations Educational, Scientific, and Cultural Organisation (UNESCO) in 1995, Lunenburg is heavily focused on regional tourism to support its economy. The Town of Lunenburg has over 200 established businesses, of which the majority are focused on tourism, making up 24% of the total local workforce, just ahead of health care (14%) and management (13%) (Lunenburg Prospectus, 2022). Lunenburg is located on a drumlin between two peninsulas with harbours on both sides, resulting in an exposed coastline and a waterfront-oriented community. The Town of Lunenburg has also expressed awareness of climate change and the potential social and economic threats they may face in the future (CBCL Limited, 2015). Therefore, Lunenburg, NS provides a well situated case study for assessing coastal community tourism and resilience. Here, a mixed methods approach is deployed in Lunenburg, Nova Scotia to assess local tourism stakeholders: 1) understanding of potential impacts of climate change and SLR on their business or organization, 2) preparedness to

deal with the potential impacts of climate change and SLR, and 3) to summarize the preparedness and resilience/adaptability of the tourism industry to climate change and SLR in coastal communities. It is important to note that while this research presents perceived risks related to climate change, the global COVID-19 pandemic also heavily influenced the tourism industry across Canada, including Lunenburg, NS.

1.2 Management Problem

As SLR becomes an increasing concern to coastal tourism communities addressing perceived risk and adaptation constraints gives insight to tangible strategies that can be introduced at a community level (Scott et al., 2019; Dube et al., 2021). Introducing the Town of Lunenburg, Nova Scotia as a case study, this project explores how perceptions of businesses and organizations from the local tourism industry influence the perceived risk of climate change and SLR. Furthermore, adopting objectives from the Coastal Adaptation and Vulnerability Assessment (CAVA) this project uses an interdisciplinary approach to consider quantitative measures of SLR alongside a qualitative assessment of the perceived risks and adaptation capacity of the tourism industry. Studying the impacts of SLR and the capacity to adapt are fundamental elements to understanding a sustainable future for rural coastal communities.

The significance of this research project stems from a gap in the literature regarding how perceptions of climate change influence perceived risk and adaptation within the tourism industry of small coastal communities. The goal of this project is to better understand the capacity of coastal communities to monitor and adapt to the effects of climate change and SLR on the tourism industry. More specifically, the project explores the local tourism stakeholders' perceptions of the expected effects of climate change and identifies perceived constraints to SLR adaptation. In addition to identifying constraints, the project will propose recommendations for SLR adaptation for Lunenburg, Nova Scotia.

1.2.1 Research Aim and Objectives

The tourism sector, and businesses that are reliant on tourism, will be undoubtedly challenged by a highly variable climate future. To assess the perspectives of tourism-

dependent stakeholders in small coastal communities this project proposes to evaluate risk from a local knowledge perspective. The following project objectives guided the collection of data and presentation of results:

1. Assess local tourism stakeholders' understanding of the potential impacts (opportunities and threats) of climate change and SLR on their business, organization, and/or community.
2. Assess tourism stakeholders' preparedness to deal with the potential impacts of climate change and SLR on their business, organization, and/or community.
3. Assess tourism industry resilience/adaptability to climate change and SLR and the implications towards sustainable tourism in coastal communities.

It is valuable to determine the potential future risks to the tourism industry that are perceived by local tourism stakeholders and recognize impacts the tourism industry has on the marine environment and local economy of the Lunenburg region. Knowledge of future risks is essential for the development of appropriate adaptation strategies and applying similar strategies to other small coastal communities where tourism is a fundamental industry. Self identification and understanding of future uncertainties related to climate change are necessary to foster social change and facilitate community support for implementing adaptation strategies. To understand the importance of stakeholder engagement and the bottom-up process of identifying future risks to the tourism industry related to SLR, this research aims to analyze the resilience and adaptation capacity of the tourism industry in the Town of Lunenburg for SLR adaptation plans and strategies. Additionally, through key interview and survey results, capacity and resilience concepts are explored related to the recent COVID-19 pandemic and its effects on the tourism industry's capacity to adapt to climate change.

1.3 Coastal Tourism, Climate Change, and SLR

One of the observable climate change related phenomena, SLR, will have various adverse effects around the globe including economic, cultural, and social changes (Gornitz, 1991; Nicholls, 2002; Church & White, 2006; Marzeion & Levermann, 2014). More notably, inhabited coastal ecosystems are particularly vulnerable to the impacts of climate change as they are exposed to both extreme weather events and SLR (IPCC, 2022). This vulnerability is exacerbated in rural coastal communities by having limited financial resources and an increasing demand to accommodate larger populations (Dogru et al., 2019; Scott et al., 2019). SLR is often cited as one of the most threatening and measurable effects for small coastal communities. Multi-century global sea-level records and climate models indicate that the 21st century is experiencing the fastest acceleration of SLR (Meier et al., 2007). The average rate of global SLR has been calculated at $\sim 3 \pm 0.4 \text{ mm/yr}$ since 1993, and is now accelerating at a rate of $0.084 \pm 0.025 \text{ mm/yr}^2$ (Nerem et al., 2018). If this rate and acceleration remains constant, the global average sea level will have risen $650 \pm 120 \text{ mm}$ by 2100, consistent with projections in the IPCC AR6 (IPCC, 2022; Nerem et al., 2018). This sea-level change will inevitably affect coastal areas, specifically where coastal tourism destinations dominate the local economy (Weissenberger & Chouinard, 2015).

Considerable discussion on the relationship between climate change and tourism began in the late 1900s to early 2000s and is perhaps best represented by the *First International Workshop on Climate, Tourism and Recreation* held in Greece in October 2001 (and for the 7th time virtually hosted by the University of South-Eastern Norway in March of 2022) and the *First International Conference on Climate Change and Tourism* in Tunisia of April 2003. Most of the recreational activities in tourism destinations, specifically coastal and marine destinations, are dependent on weather and climate conditions (Scott et al., 2008). The authors describe tourism as being a “climate-dependent industry”, which relies heavily on consistency and adaptability to thrive in an uncertain climate future (Scott et al., 2008).

SLR coupled with increased frequency of extreme weather events due to climate change will negatively affect coastal tourism destinations (Bigano et al., 2008; Moreno & Becken, 2009; Scott et al., 2012). In extreme cases, some destinations may suffer the destruction of their tourism product or physically disappear in low-lying coastal areas (Higham et al., 2021). However, to avoid the destruction and disappearance of the local tourism industry, these areas must be flexible and adaptable to changing their current operations.

1.4 The Coastal Tourism Economy of Lunenburg, Nova Scotia

The Town of Lunenburg is a rural coastal community that has a diverse economy including farming, fishing, shipbuilding, and ocean-based commerce which form the foundational industries alongside retail, hospitality, and tourism (Lunenburg Prospectus, 2022). According to the Town's most recent report (Lunenburg Prospectus, 2022), the following information provides insight to the local economy. Aside from the tourism industry, the workforce representation includes healthcare (14%), management (13%), business/finance/admin (11%), and education/law/community and government services (10%). The tourism sector (including hospitality) represents the majority of Lunenburg's workforce (24%) and receives over 430,000 visitors per year. Therefore, the regional tourism industry is an essential part of the local economy of Lunenburg that is at risk of collapse in an uncertain climate future.

Climate change impacts, including SLR, will bring uncertainty and challenges for community planners and decision-makers for the future of coastal tourism in Lunenburg, NS (CBCL Limited, 2019). Coastal zone planning is a complex process requiring the prioritization of various factors and stakeholder group input including economic development, environmental conservation, cultural preservation, and population densification (Franck, 2009). For example, in Lunenburg, managers must consider community needs for industrial, commercial, and residential infrastructure that can sustain climate change events, while also preserving the historic charm and seemingly pristine environmental landscape of the tourist destination (Canale et al., 2019). This research aims to recommend coastal adaptation and mitigation strategies by providing perceptions of climate change risk in the form of tourism industry stakeholder knowledge.

1.5 Lunenburg's Vulnerability and Climate Adaptation Capacity

The concept of vulnerability was originally applied in geography and risk-hazard studies but has extended into the vocabulary of climate change science (Moreno & Becken, 2009; Turner et al., 2003). Vulnerability is defined by the IPCC Third Assessment Report as:

“the degree to which a system is susceptible to, or unable to cope with, adverse effects of climate change, including climate variability and extremes. Vulnerability is a function of the character, magnitude, and rate of climate variation to which a system is exposed, its sensitivity, and its adaptive capacity.” (McCarthy et al., 2001).

Luers et al. (2003) noted that some vulnerability assessments have narrowed their approach in the past, isolating impacts on the natural and biophysical aspects within a system, rather than recognizing the intricate dimensions of coupled human-environment systems. Cutter et al.(2008) suggests that vulnerability assessments should (1) use an interdisciplinary approach and integrate stakeholder participation, (2) be place-specific, (3) consider multiple interacting stresses, (4) account for differential adaptive capacity, and (5) be prospective as well as recognizing historical elements. However, defining credible measures to assess vulnerability is challenging. Here, vulnerability is assessed based on the identified common themes between participants and prompted vs. unprompted risks identified by the tourism industry moving forward in an uncertain climate.

The Atlantic Climate Adaptation Solutions Association (ACASA) found that the Town of Lunenburg is vulnerable to overland flooding, storm surges, increased coastal erosion, loss of socially valued beaches, and SLR (Critchley et al., 2012). Various components of Lunenburg's built infrastructure including wharfs are susceptible to storm surges and projected relative SLR of 180cm by 2025 (Critchley et al., 2012; Linares, 2012; Forbes & Wightman, 2013). Through the MODL2040 project, the Municipality of the District of Lunenburg (MODL) has self-identified the effects of climate change to increase the frequency of extreme storm events and coastal flooding inflicting greater damage to

both coastal homes, businesses, and critical public infrastructure (e.g. roads, bridges, power lines, and water treatment plant) (MODL, 2021). The municipality concludes that the economy would be impacted by the infrastructure damage, restricting access to the region for forestry, agriculture, and tourism industries. Therefore, further supports the requirement to understand the community's preparedness and adaptive capacity to SLR and the implications for the tourism industry.

Adaptive capacity is the ability of a system to adjust to climate change, to mitigate potential damages, to take advantage of opportunities, or to cope with the consequences (Parry et al., 2007). The capacity to adapt is contingent on the current social, economic, and institutional status that is specific to each location (Measham et al., 2011). For example, increasing adaptive capacity may include the creation of a large knowledge base regarding climate change issues, access to technology, and expert resources. Having a high adaptive capacity will make the tourism industry less vulnerable to the effects of climate change. Here, an assessment of the adaptive capacity within the tourism industry of Lunenburg, NS is conducted via stakeholder engagement and identifying perceived risks for the future of the tourism industry.

The MODL has developed several action plans to address adaptive capacity and resilience to climate change within the region (Table 1). The Integrated Community Sustainability Plan (ICSP) (MODL, 2010) and the Municipal Climate Change Action Plan (MCCAP) (MODL, 2013) were adopted by the Town Council of Lunenburg in 2010 and 2013, respectively, as a means to consider climate change impacts within the Town boundaries. Adopting the ICSP and MCCAP has provided the town with a framework to proactively plan for climate change and identify where adaptation and mitigation measures are necessary. Moreover, the MODL is under a Climate Emergency as of October 22nd, 2019 recognizing the serious risks of climate change and the requirement to develop a climate resilient community. Under the declaration of a climate emergency, MODL is committed to acting on climate change by joining the Partners for Climate Protection (PCP) program, which mandates the creation of a Comprehensive Community Plan (CCP). Most recently, a Local Climate Change Action Plan (LCCAP) was developed for the Town of

Lunenburg and approved by the Town Council on November 8th, 2022. The LCCAP serves as the foundational policy document that enables the town to strategically plan future developments while considering environmental, economic, social, and cultural issues within the community for the next 40 years (Upland Planning and Design, 2022). By assessing the local tourism stakeholders' perceptions of the potential impacts of climate change this research may provide insight into SLR adaptation strategies that could contribute to determining the adaptive capacity of the tourism industry within Lunenburg, NS.

Table 1. Action plans and strategies adopted by the Town of Lunenburg and Municipality of the District of Lunenburg towards climate change adaptation (Climate Change & Sustainability Municipality of the District of Lunenburg, 2023).

| Action Plan | Acronym | Objectives | Year of Adoption |
|---|----------|---|------------------|
| Integrated Community Sustainability Plan | ICSP | <ul style="list-style-type: none"> Integrate social and economic concerns with environmental realities, and recognize that all three elements are intertwined. Considers how current policy and infrastructure choices are impacting a viable future for residents living here 30 years from now. | January, 2010 |
| Municipal Climate Change Action Plan | MCCAP | <ul style="list-style-type: none"> Identifies how local government is prepared to respond to future climate hazard events in an effective way and prepared to alter existing policy, programs and municipal infrastructure decisions, to mitigate against increased risks, resulting from the hazards associated with climate change. | December, 2013 |
| Partners for Climate Protection | PCP | <ul style="list-style-type: none"> Town of Lunenburg declared a climate emergency to urgently act on climate change | December, 2019 |
| Municipality of the District of Lunenburg 2040 Project (Municipal Development Strategy) | MODL2040 | <ul style="list-style-type: none"> Visualize current settlement capacities and identify opportunity development zones that are suitable for future policy requirements | October, 2020 |
| Comprehensive Community Plan | CCP | <ul style="list-style-type: none"> Protect and maintain character-defining elements. Grow responsibly and invest in new services wisely Provide for a range of housing options Foster local employment Provide a well-connected, intuitive mobility network for residents and visitors Provide a high quality and well-maintained public realm. | November, 2020 |
| Local Climate Change Action Plan | LCCAP | <ul style="list-style-type: none"> 10 year strategic action plan that will guide the Municipality of the District of Lunenburg toward achieving net-zero greenhouse gas emissions by 2050 and support a climate-resilient, healthier, and sustainable future. | November 8, 2022 |

Chapter 2: Context

This chapter will introduce the oceanographic context that helped shape the project, in addition to the interdisciplinary context that the project uses to incorporate qualitative and quantitative data. The context of this project includes the economic, environmental, and social context of Lunenburg, NS while characterizing the tourism activities of this destination.

2.1 Study Area

Lunenburg is a port town located approximately 100 km southwest of Halifax on the South Shore of Nova Scotia (Figure 1). Lunenburg (44°32' N, 64°29' W) is a small tourism oriented coastal community with a population of 2,396 full time residents (Government of Canada, 2022). This research focuses on assessing the tourism industry as part of a larger coastal vulnerability research project, Coastal Adaptation and Vulnerability Assessment (CAVA). Lunenburg was chosen as the primary study site in part because of the UNESCO World Heritage site designation, historical community identity with ocean related activities, the tourism economy, and geographical location. Additionally, the characteristics of Lunenburg are largely relevant to other rural coastal communities in the province of Nova Scotia and potentially national locations that are largely dependent on tourism as a source of revenue.

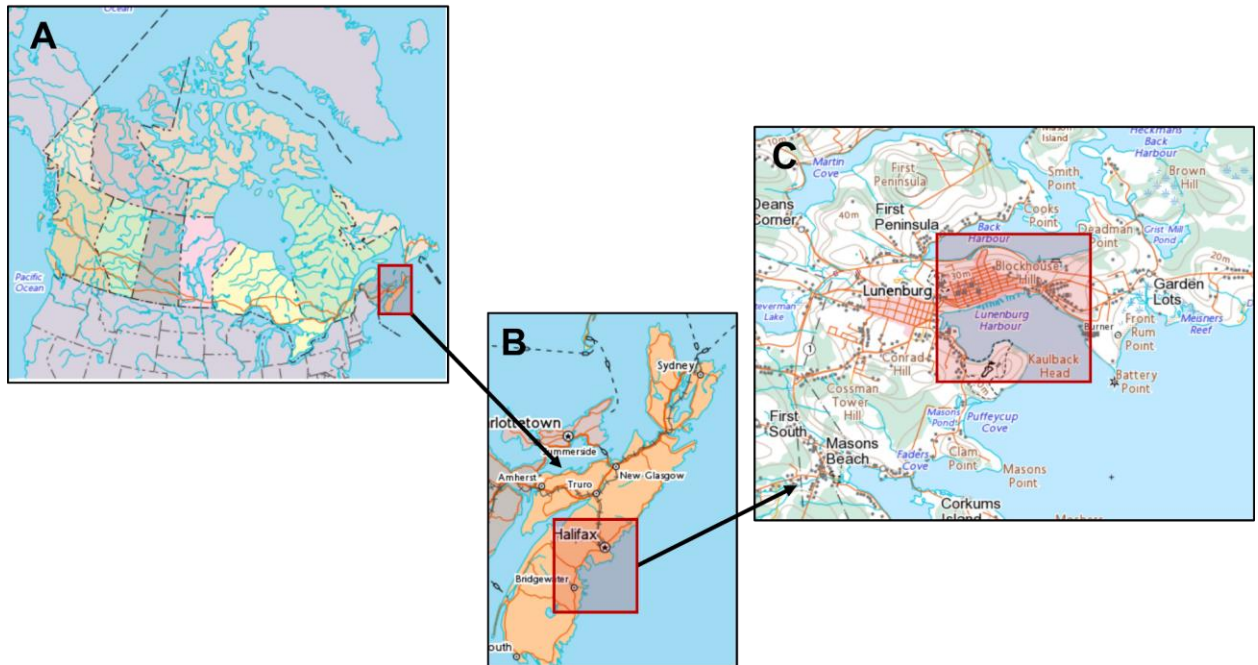


Figure 1. Map of study area (Atlas of Canada; Natural Resources Canada, 2022) of the Town of Lunenburg (C) in relation to the province of Nova Scotia (B), in context to Canada (A). Red boxes identify the geographical area of interest.

Lunenburg is a high demand tourist destination within the province of Nova Scotia, being the second most visited destination in the South Shore Region following Peggy’s Cove (Tourism Nova Scotia, 2019). In 2019, 30% of tourists who stayed longer than 30 minutes or overnight in Nova Scotia visited the South Shore Region. Of this 30%, 50% visited Lunenburg (Tourism Nova Scotia, 2019). The Lunenburg tourism industry provides authentic experiences in historic buildings, picturesque waterfront views, ocean related activities, and traditional culinary experiences. Popular water related activities include deep sea fishing excursions, sailing tours on the Bluenose II schooner, and whale watching tours. One of the key tourist attractions and tourism industry stakeholders in Lunenburg is the Atlantic Fisheries Museum which is located on the waterfront near the wharf and other tourist kiosks. The importance of using Lunenburg as a case study stem from it being a popular tourist destination, with coastal geography. Therefore, the risks associated with climate change are concerning to the future of the local tourism industry. In support of this claim, Lunenburg has been deemed to require special attention and policy change to protect

the town from the adverse effects of climate change with specific attention being given to the impacts on the tourism sector (UNESCO World Heritage Centre, 2019).

2.1.1 Cultural History

Historically, the economy of Lunenburg was primarily based on the offshore fishing industry and is currently the home of High Liner Foods, (established 1899) the largest secondary seafood processing plant in Canada earning an annual revenue of \$14.6 million (April, 2022), employing 1,223 people. In addition to the seafood processing plant, other industries that play a significant role in Lunenburg's cultural history include ABCO Industries Inc., producing engineered metal products; Ocean Gear Inc., providing metal fabrication welding work for marine gear; and the Lunenburg Foundry and Engineering Company (LIFE), providing a drydocking shipyard and ship refit services for the marine community of South Shore, NS. Recently, the LIFE shipyard has been closed and the company is for sale (as of November, 2022) putting the historical shipbuilding and boat repair services at risk. Therefore, the Town of Lunenburg has established a long lasting and key relationship with ocean related activities that provide employment and income to sustain an active fishing community culture and traditions. In addition to the significant ties to the fishing industry, Lunenburg is also well known for its iconic 1800s wooden architecture and original layout that represents a British colonial settlement and has been attracting tourists since the mid-19th century (Nova Scotia Archives, 2020). The preservation of historical architecture and traditional industries led to the UNESCO World Heritage Designation of Old Town Lunenburg in 1995. Despite the heritage designation, Lunenburg remains an active fishing community that is culturally and economically tied to the ocean for employment and tourism attractiveness.

2.1.2 Climate and Geographical Location

Lunenburg is located in a natural harbour approximately 100 km southwest of Halifax, Nova Scotia's capital city. The area features sedimentary deposits, including drumlins, which are a key geographical feature of Lunenburg County. The coastline of the South Shore is largely indented allowing for various natural beaches and coastal settlements. The

Town of Lunenburg is established on a drumlin in the Fairhaven Peninsula, featuring harbours on both the front and back sides of the town (Figure 1).

The regional climate for Lunenburg County, Nova Scotia is considered to be a warm and temperate climate with an average temperature of 7.9°C and 1556 mm of precipitation annually (Environment Canada, 2022). Lunenburg experiences warm summers with an average temperature of 19.2°C and mostly cold wet winters with an average temperature of -2.9°C (Environment Canada, 2022). Although the bordering peninsulas and relatively moderate climate provide natural protection, Lunenburg is still at risk of coastal erosion, SLR, and overland flooding (Critchley et al., 2012).

Chapter 3: Methods

This research project was conducted as part of an internship completed with the Coastal Adaptation and Vulnerability Assessment (CAVA) Project comprising the Rowe School of Business, the School of Resource and Environmental Studies, and the College of Sustainability. The partnership of these disciplinary units aims to assess the perspectives of tourism-dependent stakeholders in small coastal communities. More specifically aiming to assess the potential impacts of climate change on the local tourism industry and the level of preparedness to respond and adapt in an uncertain climate future. This area of research is increasingly important in the context of climate change, accelerating rates of SLR, and frequency of storm surges. Located in rural Nova Scotia and known for its iconic tourism industry, Lunenburg is one region that may experience significant changes related to SLR and storm surges that could be detrimental to the tourism industry in this region. The CAVA research team was able to facilitate community connections with the interviews and survey process, as well as provide support and guidance throughout the project.

The project applied a mixed methods approach to investigate the perceptions of risk and adaptive capacity associated with climate change within the tourism industry of Lunenburg. To gain background knowledge a systematic literature review was conducted based on the concepts of vulnerability, adaptation, and resilience; either in isolation or in combination, to identify how assessments of vulnerability for coastal communities have been undertaken. The extraction of key themes from the literature review found that vulnerability and adaptation research in tourism-based coastal communities are predominantly done through qualitative methods, researched at a higher rate in higher-populated areas of Europe and North America, have a focus on water as a driver of vulnerability, study socio-economic impacts of vulnerability, and emphasize locally-based knowledge in understanding adaptive capacity. The review identified a lack of studies aimed at small coastal communities using tourism operators as key informants. Therefore, this project bridges the literature gap by using a locally-informed case study to assess vulnerability and adaptation capacities in the small coastal community of Lunenburg, NS.

This chapter focuses on the methodologies employed to conduct key informant interviews and survey tourism industry businesses and organizations.

3.1 Study Design

This research employed a mixed methods qualitative approach consisting of online surveys of businesses and other organizations and in-depth interviews of key informants. Ethics approval was received from the Dalhousie Research Ethics Board (REB# 2020-3552) and Marine Affairs Program Ethics Review Standing Committee (MAPERSC# 20222-02). Outreach and participant recruitment began after approvals were received. Participants were selected from various stakeholder groups to incorporate local knowledge and implement a holistic approach to identifying perceived risk and adaptation capacity. Using a thematic analysis approach in NVivo 12, surveys and interviews were analyzed to identify perceived risks, vulnerabilities, and adaptation capacities for the tourism industry in Lunenburg, NS.

The design of the survey and interview questions consisted of open-ended, definitive, and Likert scale questions, gradually narrowing to the topic of SLR. Surveys and interviews started with general questions gathering information such as involvement in the tourism industry, location of operations, and collaboration efforts. As the questions continue, participants were asked about future general risks to their business/organization and the tourism industry. Subsequent questions probed for perceptions regarding variable weather, storms, heat waves, flooding, and emergencies. Finally, topics including climate change and SLR were explored (Figure 2).

The purpose behind the strategic placement of specific vocabulary during interviews and survey questions was important to identify prompted vs. unprompted risks and identify at which point during data collection participants consider climate change a risk to the future of their business/organization or the greater tourism industry (Figure 2). The project aimed to include as many tourism stakeholders as possible to be able to gather a broad scope of perspectives.

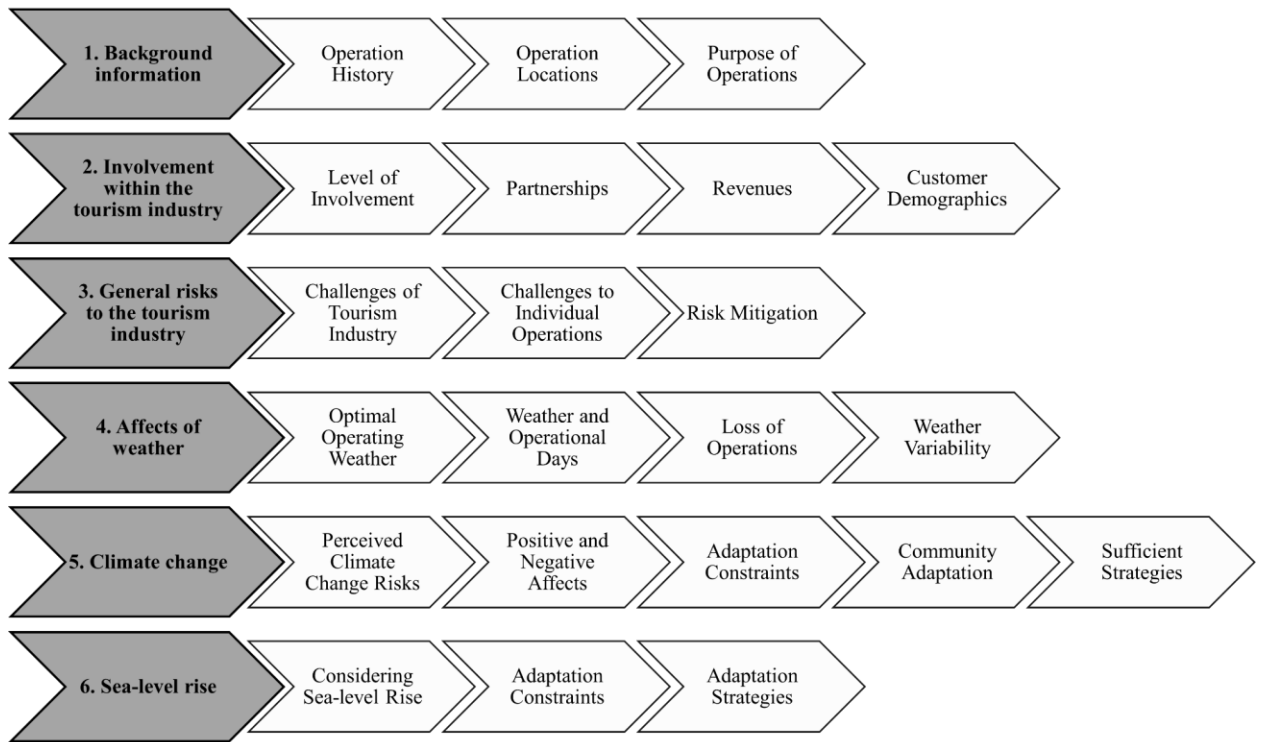


Figure 2. Visualization of information domains used throughout the interview and survey process. Dark boxes represent the information domains of surveys and interviews. Light boxes represent sub-themes relating to the corresponding information domain.

The survey and interview questions were designed to gather information about the risks and level of preparedness perceived by stakeholders of the tourism industry associated with climate change, and more specifically SLR. Of the 213 registered businesses or organizations listed within the Town of Lunenburg, the research team identified 136 (64%) of operators involved in the tourism industry in some capacity (Table 2). The 77 remaining operators were identified as non-tourism related (ex. industrial operations, media production, public educational institutions, healthcare services) and therefore not included in interview and survey data collection (Table 2).

Table 2. Table of registered businesses and organizations (type of operation) within the Town of Lunenburg with a breakdown of the number of operators within each sector of the tourism industry that was approached by the research team for survey or interview participation.

| Type of Operation | Number of Established Operators | Relative Frequency (%) |
|--------------------------|--|-------------------------------|
| Tourism | 136 | 64% |
| Non-Tourism | 77 | 36% |
| Total | 213 | 100% |

| Sector of Tourism Industry | Number of Operators Invited | Relative Frequency (%) |
|--|------------------------------------|-------------------------------|
| Tourism Services: | 43 | 31% |
| • Retail | | |
| • Chamber of Commerce | | |
| Food and Beverage | 24 | 18% |
| Accommodations | 23 | 17% |
| Attractions | 22 | 16% |
| Other: | 10 | 7% |
| • Municipal Government Representatives | | |
| • Provincial Tourism Representatives | | |
| • Insurance Broker | | |
| • Real Estate | | |
| Adventure and Recreation | 9 | 7% |
| Travel Trade: | 4 | 3% |
| • Tour Operators | | |
| • Travel Agencies | | |
| Transportation | 1 | 1% |
| Total | 136 | 100% |

3.2.1 Key Informant Interviews

Key informants were identified based on their political status or level of involvement within the tourism industry. Individuals were considered key informants if they owned various businesses contributing to the tourism experience of Lunenburg or if they played an integral role in the governance and/or communication within the tourism industry. Key

informants are included in the total response rate but are separate from businesses and organizations that were surveyed.

Key informant interviews lasted between 45-90 minutes in length, using a predetermined script consisting of 23 questions, including three multiple choice, two Likert scale, and 15 open-ended (Appendix B1 and B2). Questions 20 through 22 are excluded from the analysis, as they pertain to another project investigating ecotourism as an adaptation strategy. Questions were divided into six sections for analysis: general background (questions 1 through 2), tourism involvement (questions 3 through 5), general risks (questions 6 and 7), weather effects (questions 8 through 11), climate change (questions 12, and 16 through 19), and SLR (questions 13 through 15). The final question before demographics (question 23) asked participants if they had any additional comments about climate change and its effects on their business/organization. Key informants were recruited through the Town Council contact information and business registry found on the Town of Lunenburg website. The list of key informants was expanded using the snowball technique as the interviews were conducted. Interviews were conducted to the point of saturation where no new information was being obtained from additional interviews. The interviews were conducted in person or virtually using the Microsoft Teams program. In-person interviews were completed at the desired location of the interviewee and recorded using an audio recording device. Once key informant interviews were completed, a copy of the original audio and an automatically generated transcript were uploaded into a password secure cloud drive. A total of 26 key informant interviews were completed between August 19, 2021 and July 8, 2022. Participants were given a consent form, allowing them to consent to quotation and anonymity. While most participants agreed to be recorded, some preferred to remain completely anonymous and not be recorded. Therefore, there are differences in how quotes are attributed in the results.

3.2.1.1 Transcript Organization

After the interview transcript was uploaded to the password secure drive, each transcript was labelled using an anonymous labelling procedure, organizing transcripts in chronological order based on the date of completion. The names associated with the interviews were removed to keep data anonymous to researchers. Transcripts were organized into two folders depending on the year of interview completion (2021 or 2022).

3.2.1.2 Transcript Cleaning

Transcripts were produced using the automatic transcript function in Microsoft Teams interviews and the dictation software in Microsoft Word online. The original transcript was then duplicated and labelled accordingly. The original transcripts were kept for reference and used to analyze additional quotes to support NVivo thematic coding. Duplicated transcripts were cleaned to remove interviewer dialogue and unnecessary time stamps. Interview jargon between the interviewer and interviewee that did not pertain to the themes of the project and specific questions from the interview script was also removed. It is important to note that two researchers worked simultaneously cleaning transcripts from 2021 and 2022 separately. Multiple meetings were held between researchers resulting in high interrater reliability. Cleaned transcripts only contain interviewee dialogue answering interview questions. Therefore, the thematic analysis pertains to the answers provided by the participants, the extraction of common themes between answers, and throughout the interview script pertaining to the research questions posed.

Demographic questions remained in the cleaned transcripts to provide context when classifying files in NVivo12 software. Each cleaned key informant transcript was uploaded into a corresponding NVivo12 project based on the classification of the interview - either organization or business - for thematic and comparative analysis.

3.2.2 Business and Organization Surveys

Business and organization surveys consisted of 19 questions, including two multiple choice and 17 open-ended questions (Appendix B3 and B4). Questions 16 through 18 are excluded from the analysis, as they pertain to another project analyzing ecotourism as an adaptation strategy. Questions were divided into six sections for analysis: general background (questions 1 through 4), tourism involvement (question 5), general risks (questions 6 through 8), weather effects (questions 9 and 10), climate change (questions 11 and 12), and SLR (questions 13 through 15). The final question before the demographics section (question 19) asked participants if they had any additional comments about climate change and its effects on the business/organization. All survey questions were optional, allowing participants to skip questions without preventing the survey completion progress.

A list of businesses and organizations was created using the most recent inventory list on the Town of Lunenburg website (Business Guide – Town of Lunenburg, 2023). Businesses and organizations were prioritized based on various SLR and flooding scenarios (Figure 3). The highest priority was given to businesses and organizations within 1.42m of the current highest possible tide (Scenario 1A). Businesses and organizations located higher than 4.41m above the highest possible tide were given the lowest priority (Scenario 2B). Other locations between these two measurements were prioritized based on the proximity from the highest possible tide, respectively.

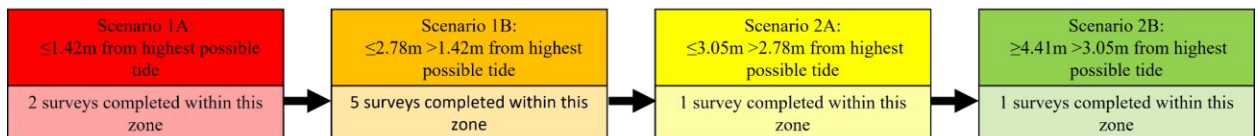
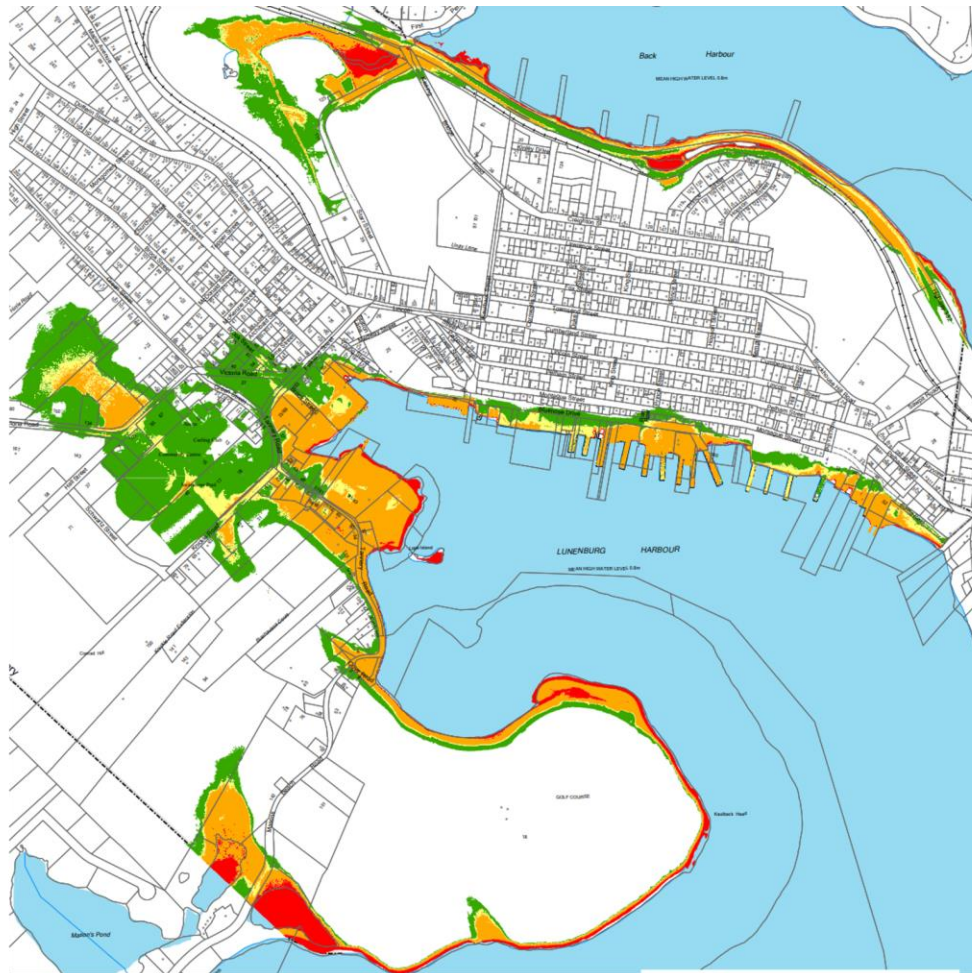


Figure 3. Map of the Town of Lunenburg with projected highest possible tide scenarios adapted from Richards and Daigle, 2011. Businesses and organizations were prioritized based on their proximity to the highest possible predicted tide. Data source: CBCL, February 2016, Municipal Climate Change Action Plan for the Town of Lunenburg, Final Report. Base map: NSGC 1:10000 Topographic Series; NS Property Records Database (July 2015); Zoning boundaries: Town of Lunenburg.

A list of businesses and organizations was generated using the Lunenburg Board of Trade membership and business directory for the Town of Lunenburg website. Businesses and organizations were excluded from the survey if operations were located outside of the UNESCO World Heritage designation of Old Town Lunenburg. A total 136 businesses or

organizations were asked to participate, 26 completed key informant interviews. From the 136 invited participants, 54 individuals responded to the survey (Table A1). Out of the 54 participants, nine surveys were completed within the prioritized flood zone scenarios, with the remaining 45 conducted outside of the flood zone scenarios (Figure 3).

To recruit participants from business and organization, the owner or manager was contacted via phone to introduce the study and ask for survey participation, purposely describing the study without using climate change vocabulary. If the operator was interested in participating, an online Qualtrics survey was shared via email, or completed in person with a research team representative at the location of the operator's choice. Once survey data were collected for all participants, in-person surveys were transferred into the online Qualtrics format for thematic and comparative analysis.

3.2.4 Analysis: Thematic Coding

Each key informant interview transcript and Qualtrics survey was uploaded individually and categorized into separate cases based on demographics; classified as an organization or business. Using an inductive content analysis method the data was analyzed in Nvivo 12 software, to identify prominent themes, and relevant information was extracted for analysis. Extracted information included classification demographics and dialogue pertaining to the overarching information domains. To outline and review the common themes identified by question script proceedings, the qualitative software NVivo 12 was used to generate a word frequency query across all data. The query included the 50 most frequent words in the participant dialogue, filtered to include stemmed words (active; activity; activities), as well as synonyms (activity; participation; dynamic; trigger). Words were omitted if they were less than 3 characters in length, as well as conjunction words, names, and years (Appendix Figure D1). The top 10 most-used words from all of the included surveys and interviews were then compared to supplement information domains identified by question scripts (Appendix Figure D2). Words used less than 7 times were not found to be consistently relevant, and repetitive of themes already illustrated by higher-frequency words. Then, data was coded based on identified themes, the results were summarized to describe the key findings within the thematic grouping. The number of

participants that shared a common theme in their results were noted. Prompted vs unprompted risks or “pivot points” (based on the point at which climate change vocabulary was introduced by the research team member) were also identified between themes with a specific focus on identifying perceived risks to the future of the tourism industry.

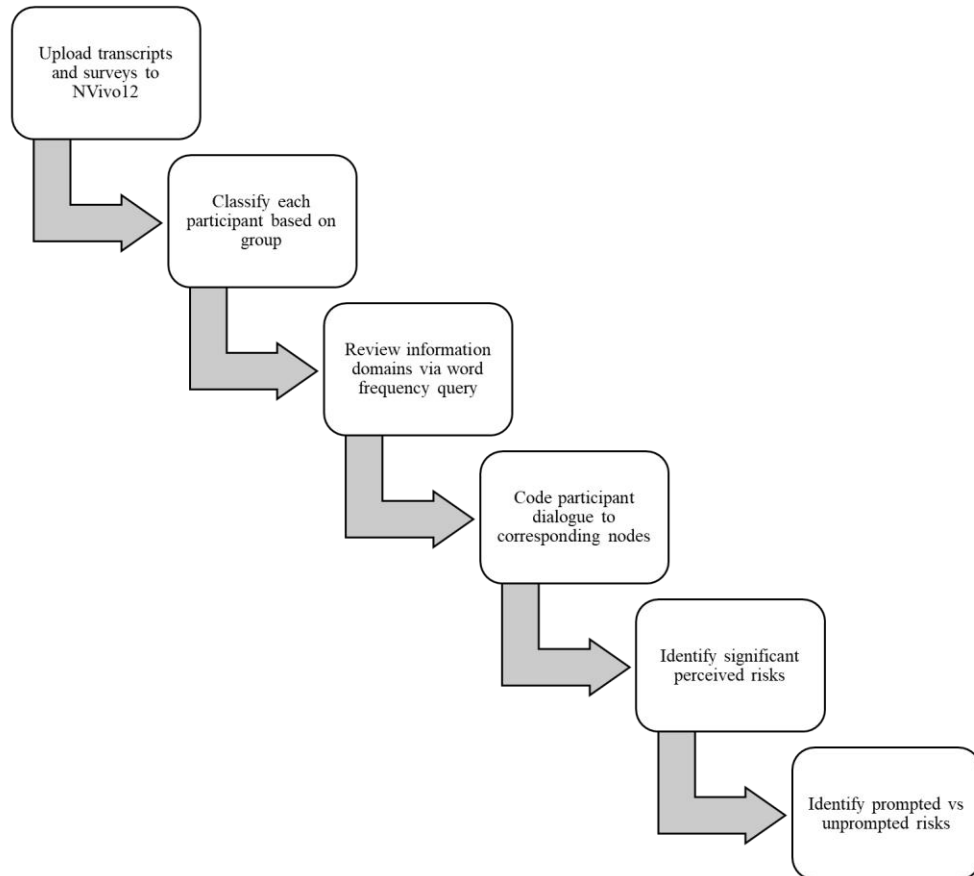


Figure 4. Flow diagram of thematic analysis methodology used to identify perceived risks, vulnerability, and adaptation capacity for study participants.

3.2.5 Analysis: Relative Frequency Tables

Once prominent themes were identified, prioritized, and tallied after thematic analysis, the relative frequency was calculated. Relative frequency is the experimental probability of a specific risk being identified compared to the total number of responses, represented

as a percentage. Here, relative frequency tables are used to describe the response rate and the degree of consensus among tourism industry stakeholders.

Chapter 4: Results

By targeting stakeholders of the tourism industry, it was possible to address the proposed research questions through analysis of tourism stakeholders' perspectives on climate change preparedness, resilience/adaptability to SLR, and the implications for sustainable tourism in coastal communities. The first research question, relating to perceptions of risk and understanding the potential impacts of climate change on the future of tourism operations, utilizes thematic content directly from the interviews and surveys. The second research question uses a review of existing strategic action plans adopted in Lunenburg and thematic content analysis to assess the level of preparedness toward addressing climate change impacts. The third research question uses thematic analysis from interviews and surveys to determine the resilience and adaptation capacity for climate change for the tourism industry in Lunenburg.

From the 136 tourism stakeholders invited to participate, 80 individuals consented to participation with 6 people refusing to participate and 50 not responding (Appendix A1). From this, the participation rate was calculated to be 58.8% (Appendix A1). Overall, 67 participants responded to all questions, 26 of those being key informant interviews. From the 80 participants, 30 organization operators participated, completing 12 key informant interviews and 18 surveys (Appendix A1). Business operators completed 14 key informant interviews and 36 surveys, totaling 50 participants (Appendix A1). The experience of the tourism stakeholders that participated ranged between 2 and 35 years with an average of 14.72 years' operating a business or organization in Lunenburg, NS (Appendix A1). Participants were able to identify more than one risk within each question during the survey or interview. As a result, some tables show more than 80 responses (where individuals could provide multiple responses).

4.1 Understanding Potential Impacts of Climate Change

Participants were asked to identify general risks they perceive for the future of the tourism industry. Risks were identified by participants without any thematic prompts from the interviewer, identified by the third grouping of scripted questions (Figure 2). In total, 93 responses were recorded from open ended general risk questions (Appendix B1, B2, B3,

B4). Out of the total responses, 17 unique risks were identified for the future of the tourism industry and 2 participants did not provide an answer (Table 3). The top four most frequently identified risks include labour shortage (17.2%), occurrence of another pandemic (15.1%), operational capacity to host staff and tourists (12.9%), and increased cost of operations (9.7%). The top four identified risks represent 54.9% of total responses (Table 3). Other risks identified by participants include seasonality of the tourism industry (7.5%), loss of authentic experiences (6.5%), and parking availability (5.4%). When respondents were asked to identify general risks for the future of the tourism industry, extreme weather (1.1%) was the only perceived risk related to climate change (Table 3). General risks identified by the tourism industry that had a relative frequency of less than 5% have been omitted from further discussion to stay within the scope of the research project and requirements of the Masters of Marine Management program.

Table 3. Relative frequency of unprompted risks identified by tourism stakeholders for the future of the tourism industry.

| Unprompted Risks for the Tourism Industry Moving Forward | Frequency of Responses (N= 93) | Relative Frequency (%) |
|---|---------------------------------------|-------------------------------|
| Labour Shortage | 16 | 17.2% |
| Pandemic Occurring Again | 14 | 15.1% |
| Capacity to Host Staff and Tourists | 12 | 12.9% |
| Cost of Operations (Inflation) | 9 | 9.7% |
| Seasonality of the Tourism Industry | 7 | 7.5% |
| Loss of Authentic Experiences | 6 | 6.5% |
| Parking Availability | 5 | 5.4% |
| Reluctant to Changing Tradition | 4 | 4.3% |
| Single Revenue Stream from Tourism | 3 | 3.2% |
| Industry Conflict | 3 | 3.2% |
| Poor Marketing | 3 | 3.2% |
| Aging Population | 2 | 2.2% |
| Public Access to Shoreline | 2 | 2.2% |
| Development Bylaws | 2 | 2.2% |
| Reputation as a Destination | 1 | 1.1% |
| Lack of Public Transportation to Lunenburg | 1 | 1.1% |
| Extreme Weather | 1 | 1.1% |

Participants were also asked to identify perceived risks that may impact the future of their individual operations. Risks were identified by participants without any thematic prompts from the interviewer (Table 4). In total, 87 responses were recorded. From this, 16 unique risks were identified and 5 participants did not provide an answer (Table 4). The top four most frequently identified risks include the occurrence of another pandemic (18.4%), increased cost of operations (16.1%), extreme weather (14.9%), and labour shortage (13.8%). The four most frequently identified risks represent 63.2% of total responses (Table 4). Other risks identified by participants include losing government grants (3.4%), fire (2.3%), and parking availability (5.4%). When respondents were asked to identify risks to the future of their individual operations, three unique risks were identified related to climate change. Extreme weather (14.8%), fire (2.3%), and SLR (1.1%) were identified representing 18.4% of total responses (Table 4).

Table 4. Relative frequency of unprompted risks identified by tourism stakeholders for the future of their individual business or organization.

| Perceived Risk | Frequency of Responses (N= 87) | Relative Frequency (%) |
|--|---------------------------------------|-------------------------------|
| Pandemic Occurring Again | 16 | 18.4% |
| Cost of Operations (Inflation) | 14 | 16.1% |
| Extreme Weather | 13 | 14.9% |
| Labour Shortage | 12 | 13.8% |
| New Rules and Regulations | 4 | 4.6% |
| Industry Competition | 4 | 4.6% |
| Lawsuit | 3 | 3.4% |
| Losing Government Grants | 3 | 3.4% |
| Seasonality of the Tourism Industry | 3 | 3.4% |
| Fire | 2 | 2.3% |
| Retail Markups | 2 | 2.3% |
| Reputation as a Destination | 2 | 2.3% |
| Film Industry | 1 | 1.1% |
| Aging Population | 1 | 1.1% |
| Sea Level-rise | 1 | 1.1% |
| Losing UNESCO World Heritage Designation | 1 | 1.1% |
| No Response | 5 | 5.7% |

Participants were then asked to consider and identify risks associated with variable and extreme weather events. In total, 52 participants considered weather to be a risk to the future of their operations, representing 65% of the respondents, 10 did not consider weather to be a risk (12.5%), and 18 did not respond (22.5%) (Appendix A3). One participant

discussed the impacts of extreme weather on their operations by saying “*I’ve had three or four hurricane related events that were just complete disasters, I mean, we couldn’t go, and I put a lot of effort into making it work.*” (P6). Participant 13 who identified extreme weather as a risk to their operations said “*My operations are cut in half in bad weather, discreetly it does impact our business.*”.

Additionally, participants identified specific risks related to variable or extreme weather that may impact the future of their operations (Table 5). In total, 86 responses were recorded. From this, 19 unique risks were identified, 10 participants did not perceive any risks related to weather (11.6%), and 18 participants did not provide an answer (20.9%) (Table 5). The top four most frequently identified risks relating to weather include more severe storms (17.4%), flooding (16.2%), heat waves (6.9%), and power outages (6.9%). The four more frequently identified risks represent 47.4% of total responses (Table 5). Participants who did not identify weather related risks only discussed minor weather events including rainy, overcast weather. One participant said “*...not really. In truth, when it’s rainy sometimes the shop is busier because people come in to hide.*” (P4). Participant 15 who did not identify risks associated with extreme or variable weather said “*weather doesn’t affect us, we are going to be bust one way or another.*”.

Table 5. Relative frequency of variable or extreme weather related risks identified by tourism stakeholders for the future of the tourism industry (n=86).

| Perceived Risk | Frequency of Responses (N = 86) | Relative Frequency (%) |
|--|--|-------------------------------|
| More Severe Storms | 15 | 17.4% |
| Flooding | 14 | 16.2% |
| No Risks Identified | 10 | 11.6% |
| Heat Waves | 6 | 6.9% |
| Power Outages | 6 | 6.9% |
| Increased Precipitation Days (Reduced Revenue) | 5 | 5.8% |
| Damage to Infrastructure (High winds) | 4 | 4.6% |
| Storm Surge | 4 | 4.6% |
| Damage to Infrastructure (Flooding) | 3 | 3.4% |
| Coastal Erosion | 1 | 1.1% |
| No Response | 18 | 20.9% |

Next, participants were asked to consider and identify impacts (positive or negative) specifically associated with climate change (Table 6). In total, 85 responses were

recorded. From this, 11 unique responses were identified, 23 participants did not perceive any impacts after being prompted with “climate change” (27%), and 18 participants did not provide an answer (21.1%) (Table 6). The top four most frequently identified impacts related to climate change include SLR (10.5%), broader storms (9.4%), weather patterns affecting agriculture (5.8%), and extended tourist season (3.5%). The four most frequently identified impacts represent 29.2% of total responses (Table 6).

Participants who did not identify any impacts associated with climate change mentioned “*Climate change isn’t having a direct impact and I don’t project that it would anytime soon*” (P5) and “*Risks? I don’t know, I don’t think so*” (P6). One participant in discussing risks related to climate change and new development said “*The only reason the coast may be threatened is the water levels are rising so if they come here [new development] shouldn’t be right on the coast. That is going to be an issue here*” (P13). Participant 1 discussed risks related to storms and said “*Some of the main roads into Lunenburg during Dorian flooded quite thoroughly, and man, that was just a baby step*”. Other perceived impacts include increased frequency of heat waves (3.5%), flooding (2.3%), more mild weather (2.3%) and wastewater treatment capacity (2.3%) (Table 6). One of the participants who identified mild weather as an impact said “*We get that question a lot. We expect broader storms and we expect this season to be longer, I’ve heard that from quite a few businesses.*” (P21). Overall, the most common responses after being prompted with climate change were either no response (21.1%) or not identifying any impacts (27%) (Table 6).

Table 6. Relative frequency of climate change related impacts identified by tourism stakeholders for the future of individual operations (n=85).

| Perceived Impact | Frequency of Responses (N=85) | Relative Frequency of Responses (%) |
|---------------------------------------|--------------------------------------|--|
| No Impacts Identified | 23 | 27% |
| Sea-Level Rise | 9 | 10.5% |
| Broader Storms | 8 | 9.4% |
| Weather Affecting Agriculture | 5 | 5.8% |
| More Variable Weather | 4 | 4.7% |
| Extended Tourist Season | 3 | 3.5% |
| Coastal Erosion | 3 | 3.5% |
| Increased Frequency of Heat Waves | 3 | 3.5% |
| Increased Price of Gas | 3 | 3.5% |
| Flooding | 2 | 2.3% |
| More Mild Weather | 2 | 2.3% |
| Harbour Wastewater Treatment Capacity | 2 | 2.3% |
| No Response | 18 | 21.1% |

4.2 Assessing Preparedness of the Tourism Industry to Perceived Risks

To assess the preparedness of the tourism industry to react to perceived risks, participants were asked if they felt any of the identified risks could be mitigated (Appendix A4). Most respondents (33.8%) felt some risks could be mitigated, 26.3% said that they were unsure, 17.5% (n=14) said there were no risks that could be mitigated, and 22.5% had no response (Appendix A4). Additionally, respondents identified the specific risks they felt could not be mitigated (Table 7). From the 14 respondents who felt that there were risks that could not be mitigated, the specific risks that were mentioned include; extreme weather (7.5%), staffing shortages (6.3%), accessibility regulations (2.5%), and public health regulations (1.3%). One participant who identified public health regulations as an unmanageable risk said *“Obviously when we are shut down I cannot operate. That is that.”* (P5). Another participant said *“Can’t mitigate the ocean. In terms of risk... we follow all the industry standards and do our best to be prepared for instances and try to make smart decisions.”* (P8) when discussing extreme weather as an unmanageable risk. Staffing shortages were also discussed by a participant who said *“It’s very hard to manage. We’re trying to make up for three people today. It’s a major issue.”* (P22). Another risk that was perceived to be unmanageable is the accessibility regulations for businesses and operations within the Town of Lunenburg. One said *“Down the road requires that all restaurants, whether they’re new or not, comply with the accessibility guidelines and that will have a major impact. So that’s one thing that I’m really, really concerned about”* (P24) when discussing accessibility regulations. Overall, the majority of participants felt that perceived risks are within their control (33.8%) and can be managed by *“making people feel comfortable when storms occur.”* (P26) and *“creating policies that state we do not refund or cancel in an extreme weather event.”* (P17).

Table 7. Relative frequency of perceived risks that cannot be mitigated by tourism stakeholders (n=14).

| Perceived Risk | Frequency of Responses (N=14) | Relative Frequency (%) |
|---------------------------|--|-------------------------------|
| Extreme Weather | 6 | 7.5% |
| Staffing Shortages | 5 | 6.3% |
| Accessibility Regulations | 2 | 2.5% |
| Public Health Regulations | 1 | 1.3% |

To address the perceptions of climate risk mitigation and preparedness, participants identified perceived involvement of the community in climate change mitigation. Overall, 7 unique climate change mitigation actions were identified, although 47.8% of participants were unaware of the community's role in climate change mitigation, and 25% did not respond (Table 8). From the community actions identified, there were 3 policy frameworks identified (CCP, CCAP, and coastal development bylaws) and 4 other mitigation strategies (improving wastewater system, improving waterfront infrastructure, changing tourism operations, and extending tourist season). The top three most frequently identified actions include wastewater system improvements (7.5%), the comprehensive community plan (6.2%), and waterfront infrastructure improvements (5%) (Table 8). The perceived mitigation actions that were mentioned the least include the Climate Change Action Plan (2.5%), change in operations (2.5%), coastal development bylaws (1.3%), and the extension of the tourist season (1.3%) (Table 8).

Table 8. Relative frequency of perceived actions of the community being involved in climate change mitigation.

| Perceived Mitigation Strategy | Frequency of Responses (n=80) | Relative Frequency (%) |
|--|--------------------------------------|-------------------------------|
| Unaware of Community Role | 39 | 48.7% |
| Wastewater System Improvements | 6 | 7.5% |
| Comprehensive Community Plan | 5 | 6.2% |
| Waterfront Infrastructure Improvements | 4 | 5.0% |
| Climate Change Action Plan | 2 | 2.5% |
| Change in Operations | 2 | 2.5% |
| Coastal Development Bylaws | 1 | 1.3% |
| Extended Tourism Season | 1 | 1.3% |
| No Response | 20 | 25.0% |

Furthermore, participants determined whether or not the identified climate change mitigation strategies are sufficient enough. Although, it is important to note that the following questions were not included in the businesses survey scripts (Appendix B4). Therefore, the following data excludes business surveys, gathering 44 responses (Tables 11,12, &13) (n=44). To assess perceptions of community preparedness, participants were asked if they thought the current perceived mitigation strategies were sufficient (Appendix A9). Most respondents (38.6%) were not sure if the strategies were sufficient, followed by 34.1% providing no answer, 20.5% disagreeing that current plans are sufficient, and 6.8%

saying that they are sufficient (Appendix A9). When discussing mitigation strategies with participants, 11 unique recommendations were identified (Table 9). However, most respondents were unsure what steps should be taken (39.1%) and 32.6% did not provide a response. The two suggestions that were mentioned at a relatively high frequency include preparing for SLR (4.3%) and increasing public engagement/awareness (4.3%). Participant 5 said *“I know that they're aware of the potential rise in the water levels and how that will affect the town so they've been proactive.”* when discussing SLR mitigation strategies for the community. To increase public engagement Participant 19 suggested *“...more public engagement between the town, residents, and business owners. Using that to kind of educate residents about what specific risks Lunenburg could have in the future where they explained that in more detail and reminded people of where we are and what could happen.”*. Overall, the majority of the respondents were unsure of appropriate steps to mitigate climate change impacts or did not respond (72.7%; Appendix A9).

Table 9. Relative frequency of suggested adaptation strategies for climate change mitigation at the community level.

| Suggestion | Frequency of Responses (n=46) | Relative Frequency (%) |
|---|--|---------------------------------------|
| Unsure | 18 | 39.1% |
| Prepare for Sea-level Rise | 2 | 4.3% |
| More Public Engagement | 2 | 4.3% |
| Hire an Environmental Assessment Position on Council | 1 | 2.2% |
| Develop Sustainable Businesses | 1 | 2.2% |
| More Indoor Activities | 1 | 2.2% |
| Collaborate with Provincial and Federal Government for Funding | 1 | 2.2% |
| Declare a State of Climate Emergency | 1 | 2.2% |
| Install Solar Panels | 1 | 2.2% |
| Determine Development Priorities | 1 | 2.2% |
| Regulate Coastal Development | 1 | 2.2% |
| Manage Storm Drainage | 1 | 2.2% |
| No Response | 15 | 32.6% |

Participants were asked to identify who should be responsible for implementing the suggested adaptation strategies. There were equal proportions of participants who were unsure who should be responsible or did not provide an answer (33.3%). The most common

response indicated that municipal, provincial, and federal governments should share the responsibility (14.6%). Following this suggestion, 6.3% of respondents said that the town council should be responsible, 4.2% mentioned that either everyone or the Board of Trade should be responsible, and 2.1% of respondents said either provincial governments or environmental NGOs should be responsible for implementing climate change adaptation strategies (Table 10).

Table 10. Relative frequencies of participants who answered “*Who should be responsible for implementing suggested adaptation strategies?*” (n=48)

| Response | Frequency of Responses (n=48) | Relative Frequency (%) |
|--------------------------|--------------------------------------|-------------------------------|
| Unsure | 16 | 33.3% |
| All Levels of Government | 7 | 14.6% |
| Town Council | 3 | 6.3% |
| Everyone | 2 | 4.2% |
| Board of Trade | 2 | 4.2% |
| Provincial Government | 1 | 2.1% |
| Environmental NGOs | 1 | 2.1% |
| No Response | 16 | 33.3% |

4.3 Assessing the Resilience and Adaptability of the Tourism Industry to Climate Change

To assess the resilience and adaptability of the tourism industry to climate change, participants identified constraints to implementing climate change adaptation strategies. Most participants (58.8%) did not respond to the question and 31.3% did not perceive any constraints to implementing climate change adaptations (Table 11). The most common constraint was the financial cost of climate change adaptation (5%) followed by UNESCO regulations (2.5%). When discussing UNESCO regulations as a constraint, Participant 10 said “*there is a whole new set of challenges when you're in a UNESCO destination because you're not allowed to put solar equipment and stuff on your roof*” identifying policy constraints related to installing solar energy in a residential area. To highlight the financial constraint to climate change adaptation strategies, a participant said “*the individual organizations here just cannot afford to adapt, so we just keep going as usual*” (P7). Other than financial and policy constraints, increased cost of operations and travel restrictions were the least mentioned with a relative frequency of 1.3%.

Table 11. Relative frequencies of perceived constraints identified by participants with respect to implementing climate change adaptation strategies (n=80).

| Perceived Constraints to Climate Change Adaptation | Frequency of Responses (n=80) | Relative Frequency (%) |
|---|--------------------------------------|-------------------------------|
| No Perceived Restrictions | 25 | 31.3% |
| Financial Restrictions | 4 | 5.0% |
| UNESCO Policy Regulations | 2 | 2.5% |
| Increased Cost of Operations | 1 | 1.3% |
| Travel Restrictions | 1 | 1.3% |

More specifically, participants were asked if they take SLR into account for future operations to assess adaptability. Most respondents (48.7%) did not respond to this question, followed by 30% of respondents identifying that they do not consider SLR as a factor for the future of their operations, and 21.1% taking SLR into account for future operational decisions (Appendix A5). When discussing SLR with respondents, Participant 21 said *“Yeah, totally yeah, I mean I think it's something that's on our minds, but I don't necessarily think it's something that we have incorporated into like an official long term plan yet”*. Another participant mentioned that *“Well, and we just redid our municipal planning strategy and land use bylaw this past fall. So it's quite recent and dealing with...the new regulations around new buildings and so on to try and protect property. So we don't know, but just kind of hang in there for a year or two, but we are trying to get ahead of some of this in our bylaws and regulations”* (P17).

To elaborate on assessing the resilience of the tourism industry participants were also asked to identify constraints associated with creating SLR adaptation plans (Appendix A6). The majority of participants (56.2%) did not respond, 37.5% identified that they do experience constraints to creating SLR adaptation plans, and 6.2% did not (Appendix A6). Participant 17 identified one of the most challenging constraints related to physical boundaries as *“that we've been here for 300 years and um. We can't tear everything down that's too close to the water.”*. Another major constraint was identified as *“the ability to adapt and respond is a huge, huge factor because even if we know what we probably need to do well, how do we get the resources to do it type thing. So yeah, money”* when describing economic constraints to creating SLR adaptation (P20).

In addition to SLR adaptation plans, participants were asked to rank a set of constraints based on a Likert scale ranging between 1 = *not a constraint at all* to 5 = *a very significant constraint*. Constraints to making SLR adaptation plans were categorized into economic (e.g. insufficient funds), physical (e.g. unable to move locations), political (e.g. UNESCO regulations, policy constraints) and others that were identified by the

respondents. Overall, 31 participants responded and gave varying answers depending on the constraint (Appendix A7). The most frequently ranked value for each constraint is as follows; economic (1, not a constraint at all), physical (1, not a constraint at all), political (1, not a constraint at all), and other (3, neutral). The average value identified for each constraint is as follows; economic (2.6, neutral), physical (2.4, somewhat a constraint), political (2.3, somewhat a constraint), and other (2.5, neutral) (Appendix A8). When discussing categorized constraints one participant ranked economic constraints as a very significant constraint and said *“Mostly because there's a lack of will, but because our resources are very much finite in a small town like this. So we do anything we have to partner with other levels of government.”* (P17). Physical constraints were ranked at 2.4 on average and one participant described their decision by saying *“the reason I'd put that at a three is I think some of the assets are removable, particularly the ones on the on the coast like directly coastal, but at the same time, I think Lunenburg has got a pretty advantageous topography.”* (P18). Participants ranked political constraints at 2.3 on average, Participant 23 said *“from my understanding is that it's very difficult, though I think they're going to have to look at being more efficient and more lenient in approvals [for new development].”*. The other constraints that were identified include UNESCO regulations, ranked at a 3 (neutral). Participant 17 said *“They don't give us money, but they give us rules. Ohh yeah, it's high it's a five. We just do it. It's a lot of stuff to navigate.”* when describing UNESCO Heritage policies. In addition to UNESCO heritage policies, participants also identified pushback from the community as somewhat of a constraint (Ranked at a 2). When describing community push back Participant 17 said *“We definitely had push back when we were looking at doing our own plastic bag ban. That got a little complicated because we couldn't pursue any kind of a plastic ban if it was felt that it was being done for environmental reasons, So we had to kind of frame it around waste reduction.”*.

Chapter Conclusions

After assessing perceived impacts, preparedness and resilience to climate change and SLR, it is evident that the tourism industry perceives current events including pandemic, labour shortage and inflation as more urgent risks that need to be addressed (Table 2 and 3). The

response rate from participants decreased as script questions became more specific and focused on climate change and SLR. In addition to climate change related risks primarily being identified after prompted vocabulary, almost 48.7% of the tourism industry is unaware of initiatives and action plans being implemented by the local government (Table 10). More specifically, SLR is only considered as a future risk 30% of the time. Therefore, results of perceived risk show that the tourism industry in Lunenburg, NS is prioritizing present and short-term issues before considering the long-term impacts of climate change. To reiterate, participants had the opportunity to discuss any further thoughts on climate change and its impacts on the tourism industry. Comments included:

- *“You know, we're barreling towards the end without really exploring the means and what it's gonna cost. I don't know if we're getting a true cost benefit analysis for those people on average or lower than average incomes and how it's going to impact them.”* (P16)
- *“I really hope that it does become more of a focus of importance for people.”* (P19)
- *“Yeah, not a lot of thoughts in terms of the organization, you know, it's uh Yeah, will be more reactive than proactive in terms of that in terms of the society”* (P25)
- *“We just seem to be getting much, much longer periods of warm weather. Which is obviously very good. Milder winters tends to happen overall, so that just extends our patio season in essence”* (P4)

General comments on the future of the tourism industry include:

- *“Yeah, we're gonna have to change the way we operate eventually and and just it still operate, but we have to be more flexible”* (P7)
- *“Anticipate a lot of stronger hurricanes or coastal flooding so we might have to plan our strategies how we can either retrieve those areas which are closer to waterfront or either prone to flooding and hope we can now adapt to those changes”* (P11)
- *“we're redoing our ...right now and one of the key themes that's coming out of that is OK, how do we adapt heritage for climate change”* (P18)

- *“some of the ongoing issues like rising inflation and you know, all of the costs going up like for fuel and food and things like that and how that affects tourism.” (P19)*

From the direct quotes, it is evident that the tourism industry is aware that climate change will have an impact but is unable to identify and implement mitigation strategies. This lack of awareness and forward thinking could potentially place the tourism industry in a vulnerable position in terms of climate change resilience and proactive mitigation strategies.

Chapter 5: Discussion

There is substantial research on assessing vulnerability to coastal erosion, SLR, and extreme weather events (Foden et al., 2019; Füssel & Klein, 2006; Giri et al., 2020; Gumel, 2022). The IPCC technical guidelines for assessing climate change impacts and adaptations equip users with current and relevant data to formulate and conduct national climate change vulnerability assessments (Ishtiaque et al., 2022). Based on this, Natural Resources Canada *“Handbook for Small Canadian Communities: methods for climate change adaptation”* (Bowron & Davidson, 2011) was designed to prepare and implement a Climate Change Adaptation Plan (CCAP) at a system or industry level. However, neither of these methodologies addresses the specific requirements of the tourism sector. Recent advances in vulnerability research identify the need of focusing on coupled human-environment systems (Stevens et al., 2021). Coastal tourism is highly dependent on the natural environment while also interacting with numerous human factors, showing tourism is a relevant example of such a system. The initial literature review for this project identified studies pertaining to small coastal communities using tourism operators as key informants as a gap in the literature (Soontiens-Olsen et al., 2022). Therefore, this project bridges the literature gap by using a locally informed case study to assess vulnerability and adaptation capacities in the small coastal community of Lunenburg, NS.

This project assessed perceptions of climate change impacts, preparedness, and resilience of a coastal tourism destination. Gathering the perceived impacts of climate change from tourism industry stakeholders identified concerns from a local-knowledge

perspective. This paper argues that tourism stakeholders provide useful insight into how small coastal communities are addressing climate change impacts and provides recommendations that can be applied to proactive climate change mitigation strategies identified at an industry level. It is important to note that although exogenous factors including the COVID-19 pandemic certainly contributed to perceived risks, it also proves as a unique case study assessing industry reactions to unprecedented events, such as flooding or storm surge, causing major disruptions to the tourism industry operations.

5.1 Understanding Perceived Impacts of Climate Change

While tourism heavily contributes to the economy of Lunenburg, NS it is also recognized as a highly climate-sensitive industry and a contributor to anthropogenic climate change (Lunenburg Prospectus, 2022; Scott et al., 2008). However, the impacts of climate change are diverse, complex, long-term, and not directly observable. These attributes can lead to uncertainty and confusion among the tourism industry. This research suggests that tourism businesses and organizations in Lunenburg are primarily concerned with observable and direct risks including labour shortage, inflation, and the capacity to host a growing tourism industry. Additionally, the results show that as questions become more specific to climate change and SLR more participants either refuse to respond or feel unsure about how climate change poses threats to the tourism industry. Although this could be attributed to the recent COVID-19 pandemic which heavily impacted travel, it could also be an outcome of perceived limited resources and capacity to address and navigate environmental risks linked to climate change (Skanavis & Sakellari, 2011; Škare et al., 2021). However, when participants were asked to discuss impacts associated with variable and extreme weather, the majority of respondents considered them as risks. The increased frequency of variable and extreme weather events - such as floods, droughts, and heat waves - is a direct and measurable indicator of human-induced climate change (Stott, 2016). It is interesting to note that although participants identified risks associated with weather, the psychological barriers connecting the cause of measurable impacts (extreme weather events) to climate change are evident. Moreover, participants also frequently identified SLR and broader storms as impacts of climate change, but only after being prompted by the researcher. In order to understand and improve this cognitive dissonance the physiological barriers must

be identified and addressed through educational initiatives (Shi et al., 2016). In this case, the most relatable psychological barriers include judgemental discounting and uncertainty (Gifford, 2011). Judgmental discounting refers to the undervaluing of distant or future risks. Atkinson & Jacquet (2022) conclude that people tend to discount future environmental risks or assess risk incorrectly, creating an augmented perception across varying temporal and spatial scales. If conditions are presumed to be worse elsewhere and later, individuals may possess less motivation to mitigate climate change impacts at the present and local level. Uncertainty is another physiological barrier that may explain the scarcity of perceived risks associated with climate change identified by tourism stakeholders. In this case, uncertainty about climate change is also quite likely a justifiable reason for inaction or postponed action to mitigate perceived impacts (Schmitt et al., 2020). Research has shown that knowledge of climate change is a critical factor in shaping attitudes, concerns, and behaviours towards climate action (Gifford, 2011; Hoffman, 2021; Skanavis & Sakellari, 2011). Therefore, it is recommended that educational initiatives should be implemented in the Lunenburg region to improve the intellectual connection between measurable weather events and their relationship to climate change. Education and awareness should begin with consumers and gradually incorporate tourism businesses and organizations as leaders in their community. This could be reached through collaboration efforts between established NGOs and tourism stakeholders.

5.2 Assessing Preparedness of the Tourism Industry to Perceived Risks

Coastal zones have always attracted visitors because of their recreational activities, cultural values, and are a special sense of place at the interface between land and sea (Jarratt & Davies, 2020). The development and utilization of coastal areas for tourism have greatly increased and are undergoing tremendous socio-economic and environmental changes. Lunenburg is an iconic historical tourism destination that is exposed to a range of coastal hazards including erosion and SLR (Critchley et al., 2012; Priestley et al., 2021). Understanding how the tourism industry perceives current risks gives insight to how well prepared they are to deal with climate change derived impacts coupled with population densification at the businesses and organization levels.

Here, perspectives of risk mitigation and strategies were used to assess the preparedness of the tourism industry at the community level. Surprisingly, a relatively small proportion of respondents felt that there were risks that could not be mitigated. The most frequently identified unmitigable risk was extreme weather events. With this in mind, it is interesting to note that the other risks that were identified do not incorporate climate change impacts and instead focus on current, measurable impacts of events and regulations coming from authorities using a top-down approach. This supports the idea that top-down approaches may not be the most effective method for increasing preparedness for climate change for the tourism industry. Furthermore, Koning et al. (2019) highlight that integrating policies with bottom-up drivers of individual climate adaptations is needed to increase the implementation of successful contingency plans against climate change and SLR. In light of coupling policies with tourism industry priorities, it is recommended that the implementation of the Nova Scotia Coastal Protection Act is met with industry consultation to ensure goals and objectives are fully understood (Bill 106 - Coastal Protection Act, 2019).

This research found that although participants could identify existing legislature and action plans (CCAP and CCP) they were largely unaware of the community role in climate change adaptation. This could be supporting evidence of cognitive dissonance between current events and the overwhelming sense that climate change is a wicked problem that cannot be mitigated at the community level. In addition to physiological barriers the notion that action plans are implemented using top-down approaches could explain the lack of awareness at the tourism industry level. Implementing bottom-up approaches and considering tourism industry perspectives as foundational elements to appropriate policy implementation strategies could lead to an essential shift in industry patterns towards preservation of the natural environment and proactive mitigation strategies (Rayner, 2010). Involving the tourism industry in policy implementation could also increase the perception of sufficient steps towards climate change and sea-level rise mitigation, which is currently assessed that most businesses and organizations are unsure or disagree that mitigation strategies are sufficient enough.

There is a notion from the tourism industry that all levels of government should be responsible for implementing adaptation strategies to prevent climate change and SLR

impacts. This perception could be attributed to the small tax base that was identified throughout interviews and surveys, leaving the impression that individual organizations and businesses feel negligible in their contribution to mitigating risks associated with climate change. However, it is recommended to create a tourism board to foster lateral collaboration and determine bottom-up approaches that can aid in awareness and preparedness of the tourism industry. This unison may give individual operators confidence to take control and become more aware of community initiatives while being able to incorporate new provincial regulations.

5.3 Assessing the Resilience and Adaptability of the Tourism Industry to Climate Change

Resilience is concerned with how a system, community, or individual deals with disturbance and surprise. It reflects the capability to withstand crises or disruptions by anticipating risk, limiting the impacts, and rapidly recovering in the face of changes such as those associated with climate change and SLR (Jarratt & Davies, 2020). Becoming resilient encompasses a wide variety of strategies that respond to vulnerabilities or adapt to recent or anticipated risks. In this study, it was surprising to find that the majority of participants did not perceive any constraints associated with implementing climate change adaptation, despite the heightened awareness that the tourism industry should be doing more. This is also unexpected because participants identified various incidents of infrastructure damage associated with previous storm surges and extreme weather events. Furthermore, out of the constraints that participants identified there was a low sense of urgency to improve on adaptation strategies. The lack of urgency to adapt shows that the Lunenburg tourism industry is highly vulnerable to the impacts of climate change and SLR. In an effort to increase resilience, Lunenburg has developed substantial climate change action plans and collaborated with academia to create municipal documents specific to SLR adaptation (Critchley et al., 2012; Forbes & Wightman, 2013). This raises the question of how can a fundamental industry fall short of adaptation awareness and determination? These characteristics could be attributed to research fatigue, the idea that the public may lose interest in the issue of climate change because of over exposure (Lu, 2022). This is identified to be a major obstacle to gaining and receiving meaningful attention for climate change adaptation. However, participants also mentioned they have noticed more mild

weather which could contribute to an extended tourist season. This positive perception of climate change could actually help in gaining recognition and play a role in steering conversations towards the creation of a resilient industry that can also benefit from some impact of climate change.

Financial constraints were also prevalent throughout the assessment of resiliency. Participants emphasized that there are limited financial opportunities due to the small tax base and highly seasonal tourism industry. Financial restrictions cannot only discourage but also prevent businesses and organizations from making proactive investment decisions towards climate change mitigation. This constraint could be somewhat minimized by collaborating with surrounding municipalities or provincial and federal agencies to create financial agreements that would allow coastal communities to reduce their vulnerability and increase resilience simultaneously (Nguyen et al., 2022).

Recommendations

In order to improve the adaptation capacity for climate change and SLR of the tourism industry in Lunenburg, Nova Scotia, educational initiatives, modifications to new and existing regulations, and external partnerships are necessary. The following recommendations have been synthesized based on this project's findings to reduce vulnerability and implement sustainable tourism in coastal communities:

1. Education Initiatives

Education and awareness are integral in fostering environmental behavior change. The proposed educational program is an effort to create more accessible and measurable information surrounding climate change and SLR adaptation strategies.

Demographic and Age Group

Educational programs should include but not limited to established businesses and organizations involved in the tourism industry at any capacity.

Goals and Objectives

- **Short term objective:** facilitate behavioural change by improving the understanding of the bases for public support and opposition to policies and technologies for limiting climate change impacts. This should include optimizing messaging strategies in general and for the specific population of the tourism industry. This may include tourists, residents of the area, tour operators, tourism proportion agencies, community government agencies, and tourism investors.
- **Long-term objective:** facilitate environmental transformation change, where tourism industry views and environmental beliefs change to match and fully embody preserving and proactively mitigating risks associated with climate change and SLR.

The goal is to allow established businesses and organizations to see how they fit into the role of climate change adaptation leaders and no longer discredit the importance of recognizing climate change as a persistent and immediate risk. The industry should be

able to think of climate change from a holistic perspective and know how to act appropriately in the face of an uncertain climate future.

Format and Approach

The program will begin by priming the selected group of tourism stakeholders with the necessary background information on existing action plans, adaptation strategies, and expected impacts of climate change for the future tourism industry. This will help set the stage for the program. A multi-stage approach is necessary to achieve the programs' short and long-term goals. Addressing the short-term will focus on building a foundational understanding of climate change definition and observable impacts because misinterpretation can act as a situational trigger. Without a confident understanding of the breadth of climate change impacts, participants are likely to revert to ignorance and environmental numbness, which contribute to barriers to behavioural change (Gifford, 2011). To address these barriers, proper educational material needs to be developed pertaining to the individual drivers specific to each stakeholder, while also identifying common values centred in coastal tourism sustainability. Initiatives should start at the consumer level, then move to the industry, and government authority levels. It should also be noted that strategies for climate change and SLR adaptation will likely vary depending on the spatial and temporal scale of proposed mitigation strategies. Addressing the long-term goal will require multiple activities over time that are participatory and collaborative in addressing the barriers underlying industry transformation. This should happen in installments and should prioritize consultation with the tourism businesses and organizations in the design of the program.

Facilitators

Environmental non-governmental organizations will be the initiating institutions. This program was designed with Ecology Action Centre and Coastal Action in mind because they are concerned with translating knowledge to a broader audience and assisting in educating people with their offerings of workshops and accessible online educational material (*Coastal Action, 2022; Ecology Action Centre, 2022*). They have the context needed to support this program and make it a success, but the program could be adapted to

other associations as well. The Board of Trade and Chamber of Commerce would be the program leaders. Key informants and industry leaders who are highly motivated and involved in the tourism industry where they are respected and trusted among other industry sectors are therefore appropriate agents of change in getting others on board with the program. The program will also need support from academia and science to aid in program design, provide scientific information, and provide resources where needed.

Evaluation Methods

The success of the program's short-term objective can be evaluated by determining the number of individuals who have engaged in the activity of assessing existing adaptation plans and identifying areas of misunderstanding. It can therefore be inferred that individuals partaking in behavioural change are no longer dismissing climate change risks, although this could be a false assumption. This assumption can be validated by doing pre and post interviews with participants, asking questions regarding their values, environmental beliefs, and knowledge before and after the program.

Shortcomings and Potential Pitfalls

Using participatory approaches could be a pitfall as it allows participants to bring forward their concerns, which may or may not be outside the scope of the program. To design with this in mind, the program should have multiple chapters to address different concerns, the first being measurable outcomes of climate change that can be observed at the tourism industry level. Age and education demographics are also potential shortcomings because they will determine the appropriate methods of program design, implementation, and evaluation. To design with this in mind all material must be written at the 8th grade level using plain, clear language while being available in print and digitally.

2. Implementing Coastal Protection Act

The Coastal Protection Act is a framework implemented by the provincial government to protect coastal areas by restricting development and unnecessary disruptions. To ensure this act is effectively implemented into the tourism industry dynamics of Lunenburg, NS a

bottom-up approach should be used. The tourism industry should form an official board of key members to synthesize issues and voice concerns to appropriate decision-makers. This group will also act as a local perspective in consultation processes which may increase social license to properly implement regulations. For this to be successful it must have full transparency between tourism stakeholders and decision-makers. To increase this social trust the government authorities must consult the tourism industry more frequently and meaningfully in a proactive manner. Future studies should also consider the feasibility of implementing the Coastal Protection Act at the industry level to incorporate best practices. Using formal guidelines to frame objectives and create attainable outcomes for development in coastal communities will also ensure the protection of preventing infill of coastal wetlands, acting as buffers to storm surge and sea-level rise (Were et al., 2019).

3. Funding Partnerships

Reducing the financial burden of climate change adaptation strategies will allow small coastal communities to make proactive decisions and sustain livelihoods that rely on coastal characteristics. To reduce financial constraints businesses and organizations should partner with surrounding municipalities and regions to implement climate change and SLR adaptation strategies that will ultimately benefit all stakeholders, including residents. As a recommendation, the provincial and federal governments should develop grants and partner with small coastal communities. This partnership will allow financial contributions from both parties to incentivize meaningful investments which may increase awareness and urgency to properly implement regulations. For this to be successful it must have full transparency and consultation between tourism stakeholders and decision-makers throughout all stages of the project. The implementation of financial partnerships may also allocate time and effort towards proactive mitigation measures, therefore increasing community resilience toward climate change impacts.

Study Limitations

While this study has provided new information on climate change preparedness and adaptation capacity for the tourism industry in Lunenburg, limitations and weaknesses may have influenced the project's findings. Due to the limited time frame for data collection,

businesses and organizations located outside of the historic core were unable to be included in the project. In addition, trying to schedule interviews with tourism stakeholders during peak season was challenging at times as they were preoccupied. The lack of transportation sector, tourist, and resident perspectives limits the ability to interpret different attitudes and prevents determining a collective perspective for the tourism industry overall. Although, due to sampling techniques, the sample size was representative of organizations and businesses as time allowed for it to be. Another weakness would be that not all survey questions were open ended, to keep surveys to a reasonable time. If all survey questions could be explained, results could show more detailed perspectives and reasoning behind certain decisions. Working with qualitative data poses limitations because of subjectivity and researcher bias. If another researcher were to have coded the data, perhaps the analysis would vary slightly, although the results would largely be the same, and is therefore only a slight weakness. Lastly, some issues brought up during the interviews had to be excluded from the discussion as they fell outside of the study's scope. Although, these issues were valid in representing the tourism industry's concerns and therefore should be addressed by government agencies and academia.

Conclusions

Overall, this study emphasizes that tourism industry stakeholders can inform current perspectives on climate change impacts, preparedness, and adaptation capacity. Local tourism businesses and organizations are important partners for identifying current issues and areas of improvement and should therefore be considered when implementing climate change adaptation strategies. While government agencies are integral in maintaining tourism organization and function, they must be accessible and inclusive when implementing climate change adaptation plans. Ultimately tourism stakeholders do not want to jeopardize the industry their livelihoods depend on and want to sustain it for future prosperity. Moving forward, collaboration through participatory and educational approaches should be used in determining what methods are feasible to mitigate the impacts of climate change and SLR on Lunenburg's tourism industry. Through a combination of top-down and bottom-up measures, such as the Coastal Protection Act and collaborative, participatory approaches within the community can help to promote

sustainable practices. Ultimately, to create resilient communities in the face of an uncertain future, the tourism industry must be an integral part of the planning process which is in their interest when referring to revenue dependent coastal communities, specifically when the loss of the UNESCO World Heritage status is put into jeopardy.

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Appendices

A - Results Tables

Table A1. Participation rate of surveys and key informant interviews during data collection (N=136; n=80).

| Participant Response | Number of Participants | Percentage (%) |
|-----------------------------------|-------------------------------|-----------------------|
| Business Survey Completed | 36 | 26.4% |
| Key Informant Interview Completed | 26 | 19.1% |
| Organization Survey Completed | 18 | 13.2% |
| Refused to Participate | 6 | 4.4% |
| No Response | 50 | 36.7% |
| Population Size | 136 | 100% |
| Participation Rate | 80 | 58.8% |

Table A2. Range and average number of years participants have been operating businesses or organizations in the Lunenburg tourism industry (n=80).

| Range of Years in Operation | Average Number of Years in Operation |
|------------------------------------|---|
| 2-35 | 14.72 |

Table A3. Relative frequency of participants considering variable or extreme weather as a risk to future operations (n=80).

| Response | Number of Participants (n=80) | Relative Frequency (%) |
|-----------------|--|-------------------------------|
| Yes | 52 | 65.0% |
| No | 10 | 12.5% |
| No Response | 18 | 22.5% |

Table A4. Relative frequencies of participants who answered “*Do you feel any identified risks can be mitigated?*” (n=80)

| Response | Number of Participants (n=80) | Relative Frequency (%) |
|-----------------|--|-------------------------------|
| Yes | 27 | 33.8% |
| Unsure | 21 | 26.3% |
| No | 14 | 17.5% |
| No Response | 18 | 22.5% |

Table A5. Relative frequency of participants who answered “*Do you take sea-level rise into account for future investment decisions?*” (n=80)

| Response | Number of Participants (n=80) | Relative Frequency (%) |
|-----------------|--|-------------------------------|
| Yes | 17 | 21.2% |
| No | 24 | 30.0% |
| No Response | 39 | 48.7% |

Table A6. Relative frequency of participants who answered “*Do you experience constraints to creating sea-level rise adaptation plans?*” (n=80)

| Response | Number of Participants (n=80) | Relative Frequency (%) |
|-----------------|--|-------------------------------|
| Yes | 5 | 6.2% |
| No | 30 | 37.5% |
| No Response | 45 | 56.2% |

Figure A7. Frequency of responses plotted against categories of constraints to creating sea-level rise adaptation plans. Responses are based on a Likert scale where 1=not a constraint at all, 2=somewhat a constraint, 3= neutral, 4= significant constraint, and 5= a very significant constraint. (n=31).

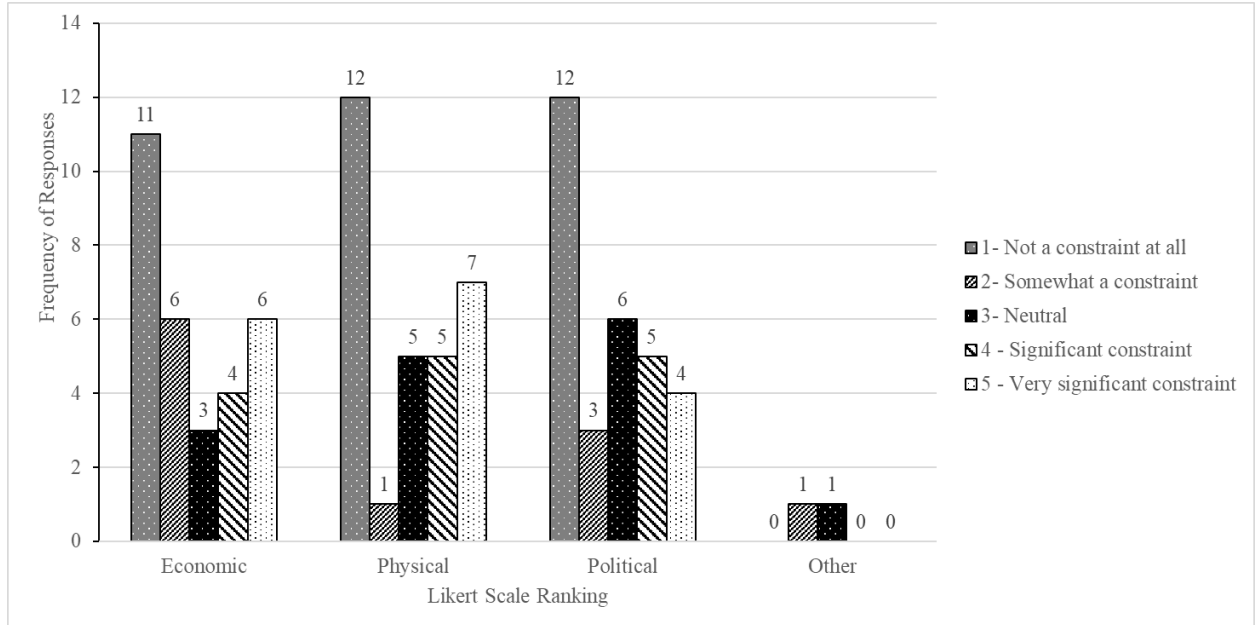


Table A8. The mode and average ranking of constraints to sea-level rise based on a Likert scale, where 1= not a constraint at all and 5= a very significant constraint (n=31)

| Constraint | Average Ranking (n=31) | Mode (n=31) |
|------------|------------------------|-------------|
| Economic | 2.6 | 1 |
| Physical | 2.4 | 1 |
| Political | 2.3 | 1 |
| Other | 2.5 | 3 |

Table A9. Relative frequency of participants who answered “Are the perceived mitigation strategies sufficient?” (n=44)

| Response | Number of Participants | Relative Frequency (%) |
|----------|------------------------|------------------------|
|----------|------------------------|------------------------|

| (n=44) | | |
|-------------|----|-------|
| Yes | 3 | 6.8% |
| No | 9 | 20.5% |
| Unsure | 17 | 38.6% |
| No Response | 15 | 34.1% |

B1 - Interview Questions: Organizations

General Background Questions

- 1) How involved is your organization in the tourism sector?
 - a) Not involved __ Somewhat __ Very involved
- 2) Who within the sector does your organization work with?
 - a) Tour operators (Local, Nova Scotia, National or International)? Who?
 - b) Tourism promotion organizations (local, regional, provincial, national)?
Who?

General Risks to the Tourism Industry

- 3) When you think of risks to your organization, what comes to mind? For each risk:
 - a) How significant is this risk? [on a scale of 1 to 10 . 10 = extremely significant]
 - b) Why?
 - c) Are there any risks you feel that you cannot mitigate?
 - d) Why do you feel they cannot be mitigated?
- 4) What are the main challenges you perceive currently for the tourism sector moving forward?
- 5) Do you believe your organization, or its area of concern are prepared for an emergency//unforeseen disruption?
 - a) If yes, how so?
 - b) If not, why not?

Effects of Weather

- 6) Would you consider storms, flooding, heat waves, or variable weather as risks to your organization's area of concern?
 - a) If yes, how so?
 - b) If no, why not?

Climate Change

- 7) Has climate change affected your organization in any way?
 - a) Positive changes? What data reflects these positive changes?
 - b) Negative changes? What data reflects these negative changes?
 - c) How has your organization responded to these effects?

Sea-level Rise

- 8) Does your organization take sea-level rise into account in future planning and investment decisions?
 - a) If yes, what information does your organization rely on?
 - b) If not, why?
- 9) Do you face challenges or constraints to creating sea-level rise adaptation plans for your organization?
 - a) If yes, what does your organization consider most challenging and why?
- 10) Rate the following potential constraints to adapting to sea-level rise for your organization. (On a scale from 1-5, where 1=Not a constraint at all and 5=A very significant constraint)
 - a) Economic constraints (insufficient funds)
 - b) Physical constraints (business cannot move)
 - c) Political/Policy constraints (such as support from government representatives, policy constraints, guideline constraints for construction/development, UNESCO building regulations, funding)
 - d) Other constraints (describe_____).
- 11) What steps has your community taken to adapt to or mitigate or take advantage of these effects?
 - a) Are these steps sufficient?
 - b) What other steps do you believe should be taken?

- c) Who should be responsible for these steps?
- 12) Are you aware of any climate-related studies, plans or strategies for your community?
- 13) To what category does your organization belong?
 - a) For Profit
 - b) Government Local Nova Scotia Canada
 - c) Not for Profit
- 14) Are you familiar with the concept of eco-tourism?
- 15) Do you see it as an option for the sector to adapt as a response to future changes?
- 16) Are there any major constraints you perceive for the implementation of ecotourism within the sector?
- 17) Do you have any other thoughts about climate change and your organization?

Demographics

- 1) In total, how many years have you worked in the tourism industry?
- 2) Do you (yourself) live in Lunenburg? Yes No
 - a) If no: Where do you live?
 - i) How long have you lived in your present community? years
 - ii) Where did you live previously?
- 3) Occupation/Job Title
- 4) Age
- 5) Gender _____
- 6) How many FTE (full time employees) do you have?
 - a) How many FTE's do you have at the peak of the tourist season
 - b) How many FTE's do you have during the off-season
- 7) What are your annual revenues?

B2- Interview Questions: Businesses

General Background Questions

- 1) How long have you operated your business?
- 2) Do you have any business locations other than this one? ___Yes ___No
 - a) If yes: Where are your other locations?
 - b) What percentage of your business is derived from the Lunenburg location?
- 3) How much of your business comes from tourists? ___% of customers ___% of revenues
- 4) What proportion of your customers are from:
 - a) United States ___%
 - b) Other International locations ___%
 - c) Canada but outside of Atlantic Canada ___%
 - d) Atlantic Canada but outside of Nova Scotia ___%
 - e) Nova Scotia but outside of Lunenburg County ___%
 - f) Locals (Lunenburg County residents) ___%
- 5) Have you previously owned/operated a different business in the tourism sector?
___Yes ___No
 - a) If Yes: What was the business?
 - b) How long did you own/operate it? ___ years
 - c) What happened to this business?

General Risks to the Tourism Industry

- 6) What are the main challenges you perceive currently for the tourism sector moving forward?
- 7) When you think of risks to your organization, what comes to mind? For each risk:
 - a) How significant is this risk? [on a scale of 1 to 10. 10 = extremely significant]
 - b) Why?
 - c) Are there any risks you feel that you cannot mitigate?
 - d) Why do you feel they cannot be mitigated?

Effects of Weather

- 8) How many 'optimal' operating days do you feel are typical in your business each year?
- a) ___ days OR
 - b) ___ weeks OR
 - c) Season is from ____ (date) to ____ (date)
- 9) Does weather affect your business? __Yes __No
- a) If Yes: In what ways is your business affected? _____
 - b) In a typical year, how many lost days do you experience due to poor weather? ___days
- 10) How many 'poor operating days' do you believe your business could currently endure before becoming unprofitable in any given year? ___ days
- 11) Do you think weather is becoming more unpredictable? __Yes __No. Please explain:

Climate Change

- 12) Are you concerned, or do you feel there are risks or benefits to your business, associated with climate change? __ Yes __ No.
- a) Positive changes? What data reflects these positive changes?
 - b) Negative changes? What data reflects these negative changes?
 - c) How has your business responded to these affects?

Sea-level Rise

- 13) Does your organization take sea-level rise into account in future planning and investment decisions?
- a) If yes, what information does your organization rely on?
 - b) If not, why?
- 14) Do you face challenges or constraints to creating sea-level rise adaptation plans for your organization?
- a) If yes, what does your organization consider most challenging and why?
- 15) Rate the following potential constraints to adapting to seal-level rise for your organization (on a scale from 1-5. 1=not a constraint at all and 5= A very significant constraint)

- a) Economic constraints (insufficient funds)
 - b) Physical constraints (business cannot move)
 - c) Political/Policy constraints (such as support from government representatives, policy constraints, guideline constraints for construction/development, UNESCO building regulations)
 - d) Other constraints, please describe.
- 16) What steps has your business taken to adapt to or mitigate or take advantage of the effects of climate change?
- 17) What are the barriers or challenges to adaptation do you believe exist for your business in an uncertain climate future?
- 18) What steps has your community taken to adapt to or mitigate or take advantage of these effects?
- a) Are these steps sufficient?
 - b) What other steps do you believe should be taken?
 - c) Who should be responsible for these steps?
- 19) Are you aware of any climate-related studies, plans or strategies for your community?
- 20) Are you familiar with the concept of eco-tourism?
- 21) Do you see it as an option for the sector to adapt as a response to future changes?
- 22) Are there any major barriers you perceive for the implementation of ecotourism within the sector?
- 23) Would you like to share any further thoughts based on our questions?

Demographics

- 1) In total, how many years have you worked in the tourism industry? ___ years
- 2) Do you live in Lunenburg? __Yes __No
 - a) If no: Where do you live?
 - b) How long have you lived in your present community? ___ years
 - c) Where did you live previously?
- 3) Occupation/Job Title
- 4) Age
- 5) Gender

- 6) How many FTE (full time employees) do you have?
 - a) How many FTE's do you have at the peak of the tourist season
 - b) How many FTE's do you have during the off-season
- 7) What are your annual revenues?

B3- Survey Questions: Organizations

General Background Questions

- 1) What is your organization's primary area of concern, and purpose?
- 2) How involved is your organization in the tourism sector?
 - a) Not involved __ Somewhat __ Very involved
- 3) Who within the sector does your organization work with?
 - a) Tour operators (Local, Nova Scotia, National or International)? Who?
 - b) Tourism promotion organizations (local, regional, provincial, national)?
Who?

General Risks to the Tourism Industry

- 4) What do you think are challenges to Lunenburg's tourism sector moving forward?
- 5) What comes to mind when you think of risks to your organization? ____
 - a) Why?
 - b) Are there any risks you feel that you cannot mitigate?
 - c) Why do you feel they cannot be mitigated?

Effects of Weather

- 6) Would you consider storms, flooding, heat waves, or variable weather as risks to your organization's area of concern?
 - a) If yes, how so?
 - b) If no, why not?
- 7) Do you believe your organization, or its area of concern are prepared for an emergency?

Climate Change

- 8) Has climate change affected your organization in any way? __yes __no
 - a) If yes: __positive __negative
 - b) Please describe what data reflects these effects ____
 - c) Has your organization responded to these changes? __yes __no
 - i) If yes, how so?
- 9) Are you aware of any steps your community has taken to adapt to or mitigate or take advantage of these effects? __yes __no

- a) If yes, what are they?
- 10) Are you aware of any climate-related studies, plans or strategies for your community?
 - a) Are these steps sufficient?
 - b) What other steps do you believe should be taken?
 - c) Who should be responsible for these steps?

Sea-level Rise

- 11) Does your organization take sea-level rise into account in future planning and investment decisions?
 - a) If yes, what information does your organization rely on?
 - b) If not, why?
- 12) Do you face challenges or constraints to creating sea-level rise adaptation plans for your organization?
 - a) If yes, what does your organization consider most challenging and why?
- 13) Rate the following potential constraints to adapting to sea-level rise for your organization (on a scale from 1-5. 1=not a constraint at all and 5= A very significant constraint)
 - a) Economic constraints (insufficient funds)
 - b) Physical constraints (business cannot move)
 - c) Political/Policy constraints (such as support from government representatives, policy constraints, guideline constraints for construction/development, UNESCO building regulations, funding)
 - d) Other constraints (describe_____).
- 14) Are you familiar with the concept of eco-tourism?
- 15) Do you see it as an option for the sector to adapt as a response to future changes?
- 16) Are there any major barriers you perceive for the implementation of ecotourism within the sector?
- 17) Do you have any other thoughts on climate change on your organization or community?

Demographics

- 1) Is your organization in Lunenburg? __yes __no

- 2) Do you live in Lunenburg? __yes __no
 - a) If no: where do you live? _____
- 3) Where have you lived previously?
- 4) Occupation/Job title
- 5) Role in organization if separate from occupation
- 6) Age
- 7) Gender __
- 8) Are you involved in the tourism sector in any other capacity?
 - a) If yes, how?

B4- Survey Questions: Businesses

General Background Questions

- 1) How long have you operated your business? _____ years
- 2) Do you have any business locations other than this one? __Yes __No
 - a) If yes: Where are your other locations?
- 3) How much of your business comes from tourists? ____% of customers ____% of revenues
- 4) What proportion of your customers are from:
 - a) United States ____%
 - b) Other International locations ____%
 - c) Canada but outside of Atlantic Canada ____%
 - d) Atlantic Canada but outside of Nova Scotia ____%
 - e) Nova Scotia but outside of Lunenburg County ____%
 - f) Locals (Lunenburg County residents) ____%
- 5) Have you previously owned/operated a different business in the tourism sector?

__Yes __No

 - a) If Yes: What was the business?
 - b) How long did you own/operate it? ____ years
 - c) What happened to this business?

General Risks to the Tourism Industry

- 6) Are there any challenges facing tourism in Lunenburg?

- 7) When you think of risks to your business, what comes to mind?
- 8) In what ways is your business affected by weather, if at all?
 - a) How many days in a typical year do you lose to poor weather?
 - b) How many optimal operating days are typical in a year?
 - c) How many 'poor operating days' do you think your business could endure before becoming unprofitable in a given year?

Effects of Weather

- 9) Do you think weather is becoming more unpredictable?
- 10) Do you believe your business is prepared for another emergency/unforeseen disruption?

Climate Change

- 11) Are you concerned, or do you feel there are risks to your business, associated with climate change?
- 12) Has your business taken any steps to mitigate or adapt to or take advantage of the effects of climate change? __ Yes __ No
 - a) If yes, what are they?
 - b) If no, why not?

Sea-Level Rise

- 13) Does your business take sea-level rise into account in future planning and investment decisions?
 - a) If yes, what information does your organization rely on?
 - b) If not, why?
- 14) Do you face challenges or constraints to creating sea-level rise adaptation plans for your business?
 - a) If yes, what does your organization consider most challenging and why?
- 15) Rate the following potential constraints to adapting to sea-level rise for your business (on a scale from 1-5, where 1=not a constraint at all and 5=A very significant constraint)
 - a) Economic constraints (insufficient funds)
 - b) Physical constraints (business cannot move)

- c) Political/Policy constraints (such as support from government representatives, policy constraints, guideline constraints for construction/development, UNESCO building regulations, funding)
 - d) Other constraints (describe_____).
- 16) Are you familiar with the concept of ecotourism?
- 17) Do you see it as an option for the sector to adapt as a response to future changes?
- 18) Are there any major barriers you perceive for the implementation of ecotourism within the sector?
- 19) Do you have any other thoughts about the potential impacts of climate change on your business?

Demographics

- 1) In total, how many years have you worked in the tourism industry? ___ years
- 2) Do you (yourself) live in Lunenburg? __Yes __No
 - a) If no: Where do you live? _____
 - b) How long have you lived in your present community? ___ years
 - c) Where did you live previously? _____
- 3) Occupation/Job Title
- 4) Age
- 5) Online only: Gender _____ Prefer not to say _____
- 6) How many FTE (full time employees) do you have?
 - a) How many FTE’s do you have at the peak of the tourist season
 - b) How many FTE’s do you have during the off-season
- 7) What are your annual revenues?

C1- Participant Categorization

Table C1. Participant numbers and corresponding occupations that were used for a direct quotation.

| Participant Number | Occupation |
|--------------------|----------------|
| P1 | Business Owner |

| | |
|-----|----------------------|
| P4 | Business Owner |
| P5 | Business Owner |
| P6 | Business Owner |
| P8 | Tour Operator |
| P10 | Business Manager |
| P13 | Business Owner |
| P15 | Business Owner |
| P17 | Municipal Government |
| P18 | Municipal Government |
| P19 | Organization Manager |
| P20 | Organization Manager |
| P21 | Organization Manager |
| P22 | Business Owner |
| P23 | Business Owner |
| P24 | Municipal Government |
| P26 | Business Owner |

D- Word Frequency Word Clouds

Figure D1- Word frequency query including the 50 most frequent words in the participant dialogue, filtered to include stemmed words (active; activity; activities), as well as synonyms (activity; participation; dynamic; trigger). Words were omitted if they were less than 3 characters in length, as well as conjunction words, names, and year.



Figure D2- Word frequency query including the 10 most frequent words in the participant dialogue, filtered to include stemmed words (active; activity; activities), as well as synonyms (activity; participation; dynamic; trigger). Words were omitted if they were less than 3 characters in length, as well as conjunction words, names, and year.

