UNDERSTANDING PERCEPTIONS OF COASTAL CLIMATE CHANGE AND NATURE-BASED COASTAL ADAPTATION: USING COMMUNICATIVE FRAMING IN EXPERIMENTAL FOCUS GROUPS IN NOVA SCOTIA, CANADA

by

Krysta Janine Sutton

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Abstract

Transitioning to more nature-based adaptation strategies for coastal adaptation, including coastal retreat, calls for a better understanding of how potentially affected residents might view and experience associated changes to their landscape, lifestyles, and physical locations. The purpose of this research was to find out how coastal climate change is experienced in Nova Scotia, to understand local perceptions of the urgency of coastal adaptation, particularly using nature-based adaptation options, and test whether communicative framing could modify those perceptions. We conducted 14 experimental online focus groups across Nova Scotia's three coasts with 86 coastal residents, who received one of three communication framing treatments based on the climax thinking framework (past, future, and meaning) or a control that shared only information. Results show that participants are experiencing similar climate impacts across coasts and believe that effective adaptation approaches such as nature-based adaptation are necessary to address their coastal risk. Participants receiving the future-framed treatment, which invited participants to discuss what they love about the coast that they want to enable future generations to experience, were most likely to use urgent language when talking about coastal adaptation. The wartime mobilization metaphor used by the meaning framing treatment was also effective but challenging to apply; the past-focused framing that invited participants to view change as a continuum was not effective. The findings offer insights into improvements for coastal adaptation communication and recommendations for coastal policy development.

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CHAPTER 1: Introduction

1.1 Problem Statement

Coastal climate changes are happening at an increased rate worldwide as the effects of greenhouse gasses, naturally occurring landscape changes, and rising world temperatures affect coastal processes. A growing percentage of the world's population is finding itself at risk from climate-related sea level rise, coastal erosion, flooding, and storm surges. Conventional approaches to coastal adaptation include sea walls, and other hard infrastructure; these approaches have been proven to increase risk over time (Leys & Bryce, 2016). Nature-based approaches have been sought as alternatives because of their ecological resiliency and their ability to augment adaptation (Rahman, Manuel, Rapaport, Sherren & van Proosdij, 2020; Vasseur, Thornbush, & Plante, 2017). They have been designed to work with the natural ecosystem to mitigate the effects of climate change, in some cases mimicking natural responses to lessen the risks from flooding and erosion (Leys & Bryce, 2016; NOAA Living Shorelines Workgroup, 2015). Nature-based adaptation falls under the scope of ecosystem-based adaptation which focuses on how to help people adapt to the adverse effects of climate change using biodiversity and ecosystem services as part of a larger strategy (UNEP-WCMC & UNEP, 2019). Ecosystem-based adaptation is a more commonly used term in international literature (Jones, et al., 2020); however, we used nature-based adaptation because it is more common in Canada. It is possible that in focusing on the term nature-based adaptation, we inadvertently limited the results of our literature review.

There is uncertainty as to how to communicate such risks and avoid a maladaptive response to climate change. As it stands, most coastal communities are responding to coastal climate events as they happen, as opposed to preparing in anticipation of climate change impacts (IPCC, 2019). It has been proposed that communication that changes perceptions of climate change risk, and increases public knowledge of climate change, will address the reluctance to make change (Covi & Kain, 2016; Brody et al., 2008).

Framing is a communicative approach that influences how we make sense of a problem by giving weight to certain elements over others, and using carefully considered terms, metaphors, and examples to connect ideas (Nisbet, 2009). Framing can be used to shift perspectives and increase audience relevancy by connecting concepts and tailoring communication (Badullovich, Grant, & Colvin, 2020; Nisbet, 2009). Within climate change communication, framing is often used as a way to make an issue (e.g. sea level rise) more salient, or an option more palatable, to the public, to increase the likelihood of them taking action or responding to the risks (Spence & Pidgeon, 2010). Existing studies of communicative climate change framing are primarily observational in nature and focus on how framing is used in the media (Badullovich et al., 2020). According to a systematic review by Badullovich et al. (2020), framing studies that are experimental in nature make up approximately a fifth (22%) of all climate change communication framing studies.

Experimental framing studies allow researchers to empirically test the effectiveness of frames on attitudes, perceptions, and risk as opposed to media framing studies which focus on content analysis (Badullovich et al., 2020; Fielding et al., 2014). Experimental framing studies such as Scannell and Gifford (2013) and Spence and Pidgeon (2010) test how best to frame climate change to encourage environmentally positive action by manipulating how outcomes of action are framed (e.g. fear, gains vs losses, sacrifice vs motivational). These studies use a quantitative approach, often relying on surveys to compare reactions to the various communicative framing treatments. While surveys allow for a broad understanding of how a community or the public may respond to a framing approach, they do not always capture the rationales as that requires participants and researchers to be able to ask questions and follow up on responses (Kitzinger, 1995; Morgan, 1997). Primary qualitative methods such as interviews and focus groups are almost entirely absent in climate change communication framing research. In a review of the literature on experimental communicative framings, I was unable to find any studies that had used a focus group methodology to understand the impact of framing on climate change perception or on acceptance of climate adaptation

options. My research seeks to fill this gap using experimental focus groups in coastal Nova Scotia to understand public responses to adaptation options under different framing treatments.

1.2 **Purpose of The Study and Research Questions**

The purpose of this research is to explore the impact of framing on public acceptability of nature-based coastal adaptation options by using discursive methods in an online focus group setting employing a replicated quasi-experimental design.

To this end, this thesis answers the following research questions and sub-questions:

1. How do Coastal Nova Scotians perceive coastal climate change, and do they perceive nature-based coastal adaptation to be an alternative to hard protection options?
    a. What kind of environmental changes are participants experiencing on the coast and what responses to those changes are they currently seeing?
    b. Do participating coastal residents of Nova Scotia perceive nature-based coastal climate adaptation as a solution to the changes they experience?
    c. What, if any, information and communication is necessary to build support for these approaches?
2. What is the impact of framing treatments on openness to nature-based coastal adaptation options and adaptation overall?
    a. What comprised the facilitated framing experience for participants?
    b. Is any framing narrative more effective than the others in inspiring discussions of the need for changed approaches?

1.3 **Context: Coastal Nova Scotia**

Nova Scotia is a unique cultural landscape that is shaped by the sea that surrounds most of the province. Located in Atlantic Canada, the province's mainland is connected to New Brunswick by the Chignecto Isthmus and surrounded by the Northumberland Strait, the Atlantic Ocean, and the Bay of Fundy. It is expected that Nova Scotia will experience some of the highest sea level rise in all of Atlantic Canada due to a decrease in coastal land elevation because of ground subsidence from glacial isostatic rebound

and activities like coal mining (James et al., 2014; Johnson, 1917; Sherren, Bowron, Graham, Rahman, & van Proosdij, 2019). This is a concern as over 60 percent of the province's population lives within 20 kilometres of the coast (CBCL Limited, 2009). Coastal communities in Nova Scotia are predominately rural and tend to have an older, aging population (Statistics Canada, 2017), which, when considered in combination with rising sea levels and increased coastal climate changes, suggests problematic levels of coastal risk. Many of these communities are vulnerable to flooding because the various coastal defense structures they have relied upon are now failing to keep the water out as the rate of coastal changes intensifies. As these communities turn towards their governments for help to address the problem, governments are trying to get citizens to take on some liability but are being met with resistance (Henstra, Thistlewaite, Brown, & Scott, 2019).

In April 2019, the Nova Scotia provincial government passed the Coastal Protection Act which recognizes that coastal landscapes are dynamic and constantly changing, both naturally and in response to climate change (Ecology Action Centre, 2020). As such, the Act seeks to make "risk-informed decisions" for climate adaptation in part by determining the feasibility of future coastal developments (Bill 106 RSNS, 2019). The Act seeks to move adaptation away from the "hard" coastal approaches (e.g. sea walls, berms, and dykes) which are commonly used for coastal defense toward approaches that reduce risk to the public and are more environmentally sound (Bill 106 RSNS, 2019). In the last few years, there have been instances across the province where these types of structures have failed, prompting the various levels of government and municipalities to choose between fixing the failing infrastructure or turning towards alternative adaptation approaches that lack many local exemplars (Ecology Action Centre, 2020; Sherren et al., 2019). While the Act acknowledges the causes and effects of coastal climate change and human development on the coast, in its current form it does not provide those who live on the coast with information on how to manage coastal risks and adapt within the principles of the Act. Attempts to communicate the need to turn away from hard infrastructure and adapt using nature or, in some cases,

simply retreat, have been met with resistance by some coastal communities (City of Surrey, 2018a). For instance, residents of Hantsport, Nova Scotia, petitioned the provincial government to rebuild a failed aboiteau (sluice gate) that was part of a private abandoned train track (Sherren et al., 2019). Communicating the problem and the most adaptive options in a way that encourages support from community members is a significant challenge.

Nature-based adaptation approaches are environmentally driven alternatives to hard coastal adaptation. Nature-based protection methods such as wetland buffers, living shorelines, dyke realignment, and managed retreat have the potential to control further erosion, mitigate flooding, and reintroduce environmentally important areas that artificial methods cannot do either economically or ecologically (Leys & Bryce, 2016; Temmerman et al., 2013)**.** As these approaches are becoming more popular with climate change practitioners and planners, it is important to understand the public perception of these approaches in Nova Scotia and how to address any questions or resistance that may arise prior to implementing them in coastal communities.

1.4 **Theoretical Framework**

This thesis tests and experiments with the theoretical framework of climax thinking as a framing tool for climate change communication. Climax thinking is a recently introduced theory by Sherren (2020) that seeks to define and challenge the fallacies that exist within human perceptions of landscape change. The term climax thinking is derived from the climax stage of ecological succession, in which following a disturbance, a predictable sequence of plant communities become established and replace one another until the site reaches a stable dominant plant community (Elmqvist et al., 2003; Sherren, 2020). Climax thinking proposes that human perception of landscape change follows a similar pattern to ecological succession; people often consider their current landscape to be the stable end result of years of human progress which—when challenged by climate impacts—is expressed as a resistance to precautionary landscape change (Sherren, 2020). Although ecologists no longer think of ecological succession in

this way, climax thinking posits that human perception of landscape changes is still stuck in a comparable stage and likewise needs to shift to a non-equilibrium way of thinking with multiple potential futures for a given site. Aspects of this theory have appeared in studies of renewable energy and have contributed to the creation of our experimental framework. The framework in its early form consists of three dimensions of climax thinking, each of which is linked to hypotheses of drivers of resistance to change: past, future, and place/space (Sherren, 2020).

Within the past dimension, the framework suggests it may be useful to help individuals identify proposed public-good landscape changes as the most recent in a series of utilitarian landscape change by drawing attention to past changes. This dimension questions whether the resistance to landscape change is due to a lack of knowledge about the past landscapes that existed or a belief that past landscapes were for simpler times and people and, as such, not comparable to current needs and people (Sherren, 2020). We adapt this dimension into a past framing by bringing attention to past landscape use and challenging individuals to consider the utility of the current landscape for the future in light of past changes.

The future dimension suggests it may be useful to challenge the idea that current solutions (e.g. for coastal climate change) will continue to work for future generations or that future generations will need the same things as the current generation. The framework argues that the two potential causes of this fallacy are ideas that future generations matter less or assumptions that current solutions will continue to work into the future (Sherren, 2020). We adapted this dimension to design a future frame to confront the uncertainty that provokes a resistance to landscape changes regardless of the needs of future generations. By encouraging introspection about what a future landscape could entail and which valued aspects of the current can persist in a changed landscape, we challenge the idea that maintaining the current landscape is the only way that the lifestyle and associated sentiment will continue to exist in the future.

The place/space dimension draws from literature on place attachment and social distance to understand resistance to change (e.g., Agyeman, Devine-Wright, & Prange, 2009; Batel, Devine-Wright, & Tangeland, 2013). The reluctance to change is, in part, connected to place attachment and the belief that we will not be able to adapt to a changed landscape, or simply that we should not be expected to. This dimension calls attention to the intragenerational implications of resistance to change, pushing effect of that resistance to others who may not be able to bear that burden (Sherren, 2020). In asking individuals to consider how they or their community have managed to respond collectively to large scale challenges, this dimension seeks to remind individuals that they are capable of adapting to significant changes when needed. We adapt the place/space dimension into a meaning-oriented framing to influence how adaptation is perceived. In this framing we liken the potential sacrifices associated with local landscape change to a collective effort with a greater (intragenerational) significance or meaning: wartime mobilization in Nova Scotia for the two World Wars. As such, the purpose of this framing to encourage individuals to recognize that even if they have to sacrifice significant landscape settings to adapt, they can still draw meaning from doing so collaboratively.

By adapting these three dimensions into frames for climate change communication it is possible to examine the effectiveness of framing and, in turn, climax thinking in addressing public perceptions of climate change.

1.5 **Methodological Overview**

This research aims to understand, but also test ways to influence, the perceptions and opinions of coastal Nova Scotians as they relate to nature-based coastal adaptation and communicating adaptation approaches. Online focus groups were undertaken with 86 coastal Nova Scotian residents across all three of its coasts (Atlantic Ocean, Northumberland Strait, and the Bay of Fundy). We held 14 focus groups with 6-8 participants in each; each coast had at least four, one of each experimental treatment and a control. The Bay of Fundy coast had two extra experimental focus groups.

We chose focus groups due to their ability to provide an increased depth of response in comparison to surveys. Online focus groups allowed us to reach a wider range of Nova Scotians, as participants in rural areas with access to the internet and a phone could easily participate. As the focus of this study is on understanding adaptation perceptions in coastal areas, and Nova Scotia's coastal areas are predominately rural, this allowed for ease of access for both the researchers and participants. Online focus groups, were also time and cost efficient, allowing us to complete multiple focus groups in a day and eliminated the need for travel for both participants and researchers. Online focus groups have also been proven to encourage participation from individuals who may choose to not participate, or speak up, in in-person focus groups (Kitzinger, 1995). This does not entirely remove the potential for participant bias towards the most outspoken opinion. A caveat of online focus groups is that we were unable to include cues from body language and were unable to recruit participants or facilitate the focus groups ourselves.

Participants were recruited by the marketing research firm Narrative Research using our recruitment criteria, and the online focus groups were facilitated by Narrative Research according to our focus group guide and questions (see Appendix A). As we used an impartial facilitator, we were able to observe each focus group somewhat independently though we were limited in our ability to help the facilitator answer participants' questions. This may have benefitted us by allowing participants to come to their own conclusions through discussion with each other without interference from the researchers which Morgan (1988) says may stifle conversation. Each focus group was approximately 90 minutes long and was comprised of a series of videos, polls, and discussions. Videos on coastal climate change, broad coastal adaptation approaches and nature-based adaptation approaches ensured that all participants had the same base level of knowledge early on. We used polls to generate instant quantitative insight into participants' experiences and perceptions, getting a broad sense of opinions within each focus group that was followed up with further in the discussions. As is typical in focus groups, the discussion sections allowed for conversation between participants and with

the facilitator while providing an opportunity to understand where and why people agreed or disagreed. The discussions also gave participants the ability to collectively frame their experiences with coastal climate change and adaptation within the experimental treatments.

Experimental treatments focus on the three dimensions of climax thinking (past, future, and meaning) identified in the theoretical framework. Participants in the experimental focus groups were asked to consider their landscape through one of the three dimensions in a series of discussion questions that will be talked about at length in Chapter 3. Each coast had at least one focus group using each framing dimension, and one control with only information provided. The future framing and meaning framing were doubled up on the Bay of Fundy coast due to other studies among our wider team in the area and a particular interest in how this coast would respond to nature-based adaptation. The framing discussions took place before the introduction to the nature-based adaptation approaches applicable in Nova Scotia. These discussions encouraged participants to interpret their experiences on the coast and landscape changes through the lens of their focus group dimension.

Text-based data collected from the focus groups were coded and analyzed using NVivo 12 to identify themes, patterns, and analyze participants' responses. We predominately use an inductive approach, to categorize participants' responses within the deductively coded nature-based approaches and discussion questions (Table 1). This way, themes emerged inductively from the data as opposed to searching for specific themes and patterns in participants' responses (Thomas, 2006). To answer the first research question, we inductively coded participants' responses about their experiences with coastal climate change and their experiences with current coastal adaptation by the broad types of coastal adaptation. This allowed us to examine whether coastal climate change impacted participants, what the most common effects are, and if participants believe it is adequately addressed through either status quo adaptation or nature-based adaptation. To answer research question two, we analyzed the discussions of the presented nature-based coastal adaptation options, coding inductively by option,

responses (e.g. seen as a solution, not a solution) and rationales for responses. Matrix queries were then used to explore openness to nature-based coastal adaptation options within the same landscapes (comparing against the control without framing), as well as by framing (using the codes established earlier). This explored any impact of the framings on perceptions of nature-based options in comparison to the responses in the control group groups.

Table 1. Inductive and deductive analysis by research question

Research Question:	Analysis	
	Inductive	Deductive
How do Coastal Nova Scotians perceive coastal climate change, and do they perceive nature-based coastal adaptation to be an alternative to hard protection options?	Experiences with coastal climate change	Discussion of Nature-based approaches by approach
	Experiences with broad adaptation approaches on their coast	
	Perception of nature-based approaches (e.g. sentiment and rationale)	
What is the impact of framing treatments on openness to nature-based coastal adaptation options and adaptation overall?	Perception of nature-based approaches	Discussion of nature-based approaches by approach
	Responses to framing questions (e.g. themes and sentiment)	Framing discussion by questions asked

The research carried out in this thesis has been approved by Dalhousie University's Research Ethics Board, file number 2019-4761. We did not have the contact details for participants. Results from this research were thus disseminated to interested participants as an informational report by Narrative Research. Knowledge gained through this research will be shared with Natural Resources Canada in a framework developed as part of the Making Room for Movement Project led by Danika van Proosdij (PI, Climate Change Adaptation Fund, 2018-2020) at Saint Mary's University. In 2019, it has been presented at conferences such as Behavior, Energy, and Climate Change (Sacramento, USA) and Ocean Frontier Institute Researcher's Workshop (Saint John's, NL), and in 2020 both Adaptation Canada (Vancouver, BC) and the International

Symposium for Society and Resource Management (online). It is also intended to be shared with the wider academic community as publishable papers in academic journals.

1.6 **Positionality Statement**

This research examines framing and coastal climate adaptation from a psychological point of view. As a researcher with a background in social and cognitive psychology, the focus groups were designed to reflect the use of focus groups within the fields of psychology and communication research as opposed to the more participatory or collaborative approach that has emerged within environmental and conservation research. In using experimental focus groups as they were designed to be used in psychology in an environmental setting, I feel it is necessary to address this to avoid confusion in how the data is treated and the results are interpreted.

1.7 **Thesis Outline**

This thesis has been organized into two written papers that, while separate, comprise the descriptive and experimental aspects of the focus groups, respectively. Chapter 2 will answer the first research question as it focuses on local perspectives on the impacts of coastal changes and explores how coastal residents in Nova Scotia viewed nature-based adaptation approaches that have the potential to address these changes. It speaks to the coastal changes experienced by participants and the current coastal responses. The chapter also provides insight into the types of information and communication that coastal communities feel is needed to support nature-based approaches and provides recommendations for future coastal adaptation projects. Chapter 3 answers the second research question. The chapter explores the effectiveness of the three experimental framing treatments on openness to nature-based adaptation, the acceptance of needing to adapt to climate change, and the expressed urgency of that adaptation. It will examine the facilitated framing experience and identify the effectiveness of the framing treatments on inspiring the need for change and offer potential uses for this knowledge within climate adaptation. Chapter 4 summarizes and concludes this thesis.

CHAPTER 2: Coastal Resident Perceptions of Nature-based Adaptation Options in Nova Scotia, Canada.

2.1 **Introduction**

Climate change is an issue for coastal communities worldwide as the impacts to the coast are increasing in frequency and severity. The Intergovernmental Panel on Climate Change (IPCC) recognizes that climate impacts to coastal areas such as increased wind and wave action, extreme sea level rise, storm frequency, hurricanes, and subsidence have the potential to overwhelm current coastal protections worldwide (Wong et al., 2014). Risks such as coastal erosion, flooding, inundation, and storm surges have led to calls for action in Eastern Canada and the United States, as well as beyond (Council of Canadian Academies, 2019; Environment and Climate Change Canada, 2019; Mulligan, 2018; National Research Council, 2014). The Prince Edward Island provincial government, for instance, has recognized for the last decade that they need to act and plan for the severe erosion that is eroding Lennox Island and affecting the lives of the Lennox Island First Nation and has begun an effort to make changes (Bissett, 2016). Likewise, Iles-de-la-Madeleine, in Quebec, have had increasing emergency calls for help because they end up isolated from infrastructure like larger hospitals on the mainland and telecommunications during severe winter storms and storm surges (Lowrie, 2018).

We do not fully understand what motivates residents of coastal communities to choose their responses to the risks associated with coastal climate change. It is understood that presenting evidence of risk can sometimes lead to action (Lieske, Wade, & Roness, 2014); however, these responses often copy what has been done before (Cooper & Pile, 2014; Vasseur, Thornbush, & Plante, 2018). This path dependency and evidence base create a feedback loop biased toward hard infrastructure that is increasingly failing as climate change advances (Cooper & Mckenna, 2008; Cooper & Pile, 2014; Spurrier, Breda, Martin, Bartlett, & Newman, 2019). Nature-based options are theoretically more resilient adaptation approaches (Cooper & Pile, 2014; Leys & Bryce, 2016)— including accommodation and retreat that facilitate natural processes by removing human

pressure— but are less accepted by residents (Braamskamp & Penning-Rowsell, 2018; Vasseur & Catto, 2008; Vasseur, Thornbush, & Plante, 2017). There are few longitudinal studies or large-scale implementations of the approaches testifying to their success, including in Atlantic Canada where these approaches have nonetheless generated interest amongst planners, engineers, and practitioners. Research suggests that these approaches are more ecologically sound and flexible than hard infrastructure but there is an increasing need to understand the human dimensions of utilizing these approaches.

Investment in hard solutions in urban areas makes sense given the amount and value of infrastructure at risk, but it will not necessarily pay its way in rural settings (S. J. Cohen, 2011; Vasseur et al., 2017). Retreat and accommodate options are increasingly considered and/or incentivized by governments wary of the risk exposure of other options but it is more difficult to take these actions proactively rather than post-disaster (Agyeman, Devine-Wright, & Prange, 2009; Braamskamp & Penning-Rowsell, 2018). However, decision-making challenges are exacerbated for private coastal landowners who must often seek solutions independently and often without financial or information supports (Sherren, Bowron, Graham, Rahman, & van Proosdij, 2019).

We held online focus groups with coastal property owners in a highly coastal jurisdiction (Nova Scotia) to understand how they assess coastal risks and nature-based coastal adaptation options. We introduced participants to coastal climate change issues and appropriate nature-based coastal adaptation options using a series of informational videos and facilitated discussion. This paper answers our first research question about how coastal Nova Scotians perceive coastal climate change and nature-based adaptation. Our research sub-questions are as follows: 1) What kind of environmental changes are participants experiencing on the coast and what responses to those changes are they currently seeing? 2) Do participating coastal residents of Nova Scotia perceive nature-based coastal climate adaptation as a solution to the changes they

experience? 3) What, if any, information and communication is necessary to build support for these approaches?

Over the course of this paper we use participants' focus group discourses to address our research questions. We begin with a background on coastal adaptation and nature-based coastal adaptation, followed by a brief explanation of the social aspect of nature-based adaptation. After our methods in which we define our study area and break down the structure of our focus groups, we explain our results in three sections. Section 2.4.1 explores whether our participants are experiencing coastal changes, and what responses they see or make to these changes. In section 2.4.2 we break down each nature-based approach individually to explore participants' perceptions. In section 2.4.3 we summarize participants' responses on the kind of information they think they and their communities would need to implement these nature-based approaches and discuss the ways in which that information can be communicated to communities. We conclude with the implications of these responses on communicating nature-based approaches and coastal climate change.

2.2 **Background**

Climate adaptation is defined as "the process of adjustment to actual or expected climate and its effects" (IPCC, 2014, p. 5). For coastal communities, adaptation is crucial to their survival as it is one of the only ways to reduce the risks of climate change (Lemmen, Warren, & Mercer Clarke, 2016). Coastal adaptation can be generalized into five broad approaches. While there are many names for these approach strategies, including protect and 'hold the line' (Leys & Bryce, 2016), for the purposes of this paper we will address them as: 'do nothing' (no attempt is made to protect from or mitigate climate change impacts), 'hard line' (engineered coastal infrastructure meant to protect land use and prevent erosion and flooding), 'soft line' (nature-based coastal protection that aims to protect the coastal landscape and land use through natural processes), 'accommodate' (adjusting land use and infrastructure to the changing climate to reduce impacts of climate change), and 'retreat' (long-term approach that can be planned or

unmanaged that moves people and infrastructure out of at risk areas) (see Table 2, left column). These approaches are the building blocks of nature-based coastal adaptation approaches that seek to capitalize on the benefits of coastal nature and that we explore in this work (Table 2, right).

Table 2. ***Definitions of broad adaptation categories and nature-based coastal adaptation approaches adapted from Leys and Bryce (2016) and Lemmen, Warren, & Mercer Clarke (2016).***

<table>
<tr><th>Broad adaptation categories</th><th>Nature-based adaptation approaches</th></tr>
<tr><td>Do nothing - Allowing climate change impacts to the coastal landscape without any attempt to protect from or mitigate the impacts to infrastructure and land use.</td><td>See retreat, below</td></tr>
<tr><td>Hard line - Engineered coastal protection that aims to protect the coast from coastal erosion and sea level rise allowing coastal land use to continue without change to either land use or landscape. Often these are short term solutions and need to be replaced over time</td><td rowspan="2">Dyke realignment - Adaptation approach that seeks to provide added coastal protection using a mix of engineered hard and soft coastal approaches by allowing unused inter-tidal land to be reclaimed by saltmarsh through the realignment of existing dyke structures experiencing coastal squeeze.</td></tr>
<tr><td rowspan="3">Soft line - nature-based coastal protection that aims to 'hold the line' and protect the coastal landscape over the long-term by mitigating the effects of coastal climate change through natural processes</td></tr>
<tr><td>Overland flow management - the approach uses the implementation of a series of stormwater management designs and landscaping choices that help control drainage and run-off to reduce erosion</td></tr>
<tr><td>Living shorelines - A group of approaches that use materials that exist in nature to mimic and respond like naturally occurring processes.</td></tr>
<tr><td>Accommodate - Adjusting to the landscape changes through changing land use or infrastructure in a way that does not impact access or utilization of the coast</td><td>Accommodate - see left</td></tr>
<tr><td>Retreat - Long-term approach that can be managed or unmanaged that seeks to protect people and infrastructure through relocation from at-risks areas.</td><td>Retreat - see left</td></tr>
</table>

Nature-based coastal adaptation is an umbrella term for adaptation approaches that use or enhance the capability of the environment to manage wave energy, regulate

erosion and flooding, and enhance ecological resilience to coastal climate change, minimizing built infrastructure (Rahman, Manuel, et al., 2020). This includes options that involve removing human pressures on coastal ecosystems, like retreat.

In Atlantic Canada and beyond, growing interest among practitioners in nature-based coastal adaptation techniques and ecological engineering has inspired increasing information on what can technically be done in Atlantic Canada, but large-scale implementation and longitudinal studies of efficacy are still nascent (Rahman, Bowron, et al., in review).

A review of academic and grey literature on nature-based coastal adaptation in Atlantic Canada identified 5 main groupings of nature-based coastal adaptation options that can be used in Nova Scotia's various coastal environments and used the following definitions for them (Leys & Bryce, 2016; van Proosdij, MacIsaac, Christian, & Poirier, 2016)**.** Overland flow management uses the implementation of stormwater management designs like drains and permeable paving to allow overland flow or surface run-off to settle and drain through the soil rather than run over or pool to mitigate coastal erosion and flooding (Leys & Bryce, 2016). Living shorelines use materials that naturally exist in nature and engineering techniques that mimic and respond like natural processes (NOAA Living Shorelines Workgroup, 2015). Living shorelines can mitigate storm damage, erosion, and flooding by trapping sediment and decreasing wave energy (van Proosdij et al., 2016) and encompasses a variety of techniques such as: bank stabilization (deWet, Williams, Tomlinson, & Loy, 2011), wetland buffers (Wamsley, Cialone, Smith, Atkinson, & Rosati, 2010), beach nourishment, dune building, and oyster reefs and reef balls (Leys & Bryce, 2016; Scyphers, Powers, Heck, & Byron, 2011). Dyke realignment is a hybrid option that consists of building a new dyke further inland than the original dyke and breaching the original dyke to encourage tidal flow and salt marsh restoration that helps prevent the flooding of low-lying areas behind the dyke in extreme tides and storm events (Cooper & Pile, 2014; Sherren et al., 2019; van Proosdij et al., 2016). Accommodation, along with retreat, is a nature-based approach, that

works to facilitate natural processes by removing human pressures. Accommodation allows for continued use of coastal land by changing the way the land is used or adapting its existing infrastructure through techniques such as raising or dry proofing homes and infrastructure (Leys & Bryce, 2016). Retreat is a long-term adaptation approach which aims to help protect people and infrastructure by relocating them away from hazardous coastal areas to areas with lower risk or through policy that prohibits them from building in at-risk areas (King et al., 2014; Vasseur et al., 2017).

Existing literature suggests that further work is needed on the social dimensions of implementing nature-based coastal adaptation if we are to understand how to increase acceptance and uptake. There is a general and growing understanding of the ecological impacts of such adaptations (Middleton, 2011; Phillips, 2018; Wamsley et al., 2010); however, there is a dearth of knowledge of the socio-economic, social, and cultural dimensions of adaptive capacity that enable balanced decisions around coastal climate change (Hadwen & Capon, 2014). For instance, coastal adaptation initiatives need to involve community and property stakeholders to develop trust and buy-in of adaptation strategies (Alexander, Ryan, & Measham, 2012; Lieske et al., 2014).

Borrowing from adjacent fields, Batel, Devine-Wright, and Tangeland (2013) argue that there is a misunderstanding in climate mitigation circles that public acceptance, e.g. of renewable energy infrastructure, is the same thing as support for local construction; this may be a reason why implementing drastic strategies such as retreat has proven to be a challenge as people may accept that retreat is necessary in their community but not for themselves. For property buyout programs and managed retreat on New York's Staten Island post-hurricane Sandy, proactivity was observed to be a challenge as options require the consensus of the whole community to implement and often require a sense of urgency that may only come after a major disaster (Braamskamp & Penning-Rowsell, 2018). Compared to Sandy-affected coastal communities on Staten Island that rejected buyouts, the residents of the Oakland Beach community accepted buyouts and in the years since relocating have struggled to redevelop a sense of community, bonding social capital, and place attachment, suggesting that there are social costs to retreat that must

be considered (Binder et al., 2019; Bukvic, Zhu, Lavoie, & Becker, 2018). Just as sense of community is a social factor in coastal climate change, cultural and livelihood practices (i.e. fishing, clamming, farming, etc.) can also play a role in determining how willing a community is to adapt to climate changes and what approaches they take when adapting but it is not as clear how to include or work around these when making decisions on climate adaptation (Adger, Barnett, Brown, Marshall, & O'Brien, 2013). More knowledge of the individual and social aspects of coastal climate change is needed in order to change perceptions about coastal adaptation, rather than the typical focus on coastal risks themselves (Vanderlinden et al., 2017).

Not much is known about how Atlantic Canadians see the growing need for coastal adaptation on the coast. It is expected that they will respond differently than Canadians on the Pacific coast due to cultural and economic differences. We know that Nova Scotians are willing to engage in conversation around adaptation strategies even as they lack understanding of the impacts of climate change to certain coastal environments (e.g. dykelands) and are uncertain how to effectively respond to climate change (Mostofi Camare & Lane, 2015; Sherren, Loik, & Debner, 2016). Nearby in rural parts of Quebec, New Brunswick, and Prince Edward Island, it has been understood through interviews and surveys that there is an awareness of climate change and that the impacts may be severe though not all consider themselves to be at risk (Khirfan & El-Shayeb, 2020; Lieske et al., 2014; Vasseur et al., 2017). There is some acceptance that hard coastal infrastructure is no longer a long-term solution in certain coastal areas; however, conflict arises around who should pay for more appropriate coastal defenses and what should be considered an effective response to coastal climate changes (Lieske et al., 2014; Minano, Johnson, & Wandel, 2018; Vasseur et al., 2017). Some of these rural communities are mentally and financially stressed by the effects of coastal climate change on their lives, among other causes, while others have used the effects of climate change to spur what they consider to be positive changes in tourism and infrastructure (e.g. building more cottages and larger wharfs) (Vasseur et al., 2017).

2.3 **Methods**

2.3.1 Study Area

Coastal Nova Scotia is currently considered to be one of the most climate-vulnerable regions in Canada with the highest estimated relative rise in sea levels for 2100 at 1.3 metres, including isostatic rebound (Savard, van Proosdij, & O'Carroll, 2016), compared to the IPCC (2014) estimate of a one metre rise worldwide. Surrounded on three sides by the Bay of Fundy, the Atlantic Ocean, and the Northumberland Strait, and with 13,300 kms of coastline, Nova Scotia has a diverse range of coastal environments ranging from cliffs and bluffs to estuaries, cobble beaches, saltmarshes, sand dunes, rocky shores, and built shores (Leys & Bryce, 2016). With a history of increasing flooding, erosion, and storm surges, and having responded to sea level rise by implementing dykes and hard infrastructure in the areas considered most vulnerable, Nova Scotia needs to consider new ways of responding to climate change on the coast (Sherren et al., 2019).

Increased social vulnerability to climate change is a contributing factor to the risks Nova Scotians face. The 2016 census puts the population of Nova Scotia at around 953,000 with 20% of the population over the age of 65, making it the province with the third oldest population in Canada (Statistics Canada, 2017). More than 60% of Nova Scotia's population lives within 20 kilometers of the coast and over 40% of the province's population is considered to be rural (CBCL Limited, 2009; Statistics Canada, 2016). With a significantly rural population comes a reduced ability to adapt as rural communities often deal with less investment in infrastructure, information systems, and less effective institutions (S. J. Cohen, 2011). It is expected that the average age in coastal communities will continue to grow and that more than 25% of the province's population will be 65+ by 2030 as Nova Scotia's "age in place" initiative and Shift action plan work to support older adults in the province (Nova Scotia Department of Seniors, 2017; Rapaport, Manuel, Krawchenko, & Keefe, 2015). As they age in place, rural and coastal Nova Scotians are more vulnerable and at risk from climate change due to a lessened ability or desire to adapt (Krawchenko, Keefe, Manuel, & Rapaport, 2016).

Nova Scotia's coasts are not only vulnerable because of their year-round residents but also due to a financial dependence on tourism and seasonal residents. The province has three coastal UNESCO World Heritage sites and one coastal UNESCO biosphere reserve (Joggins Fossil Institute, 2020)— and many Canadian heritage villages, historic forts and landmarks, industrial artifacts, and iconic landscapes dating as far back as the 1600s when the Acadians, the French, and the British settled in Mi'kma'ki, the traditional and unceded territory of the Mi'kmaq people (Nova Scotia Archives, n.d.; Nova Scotia Communities Culture and Heritage, n.d.-b, n.d.-a; Rollinson, 2017). These landmarks, picturesque landscapes and historic sites are major points of tourism during the summer months in Nova Scotia especially for rural communities bringing in 2.3 million visitors and approximately 2.6 billion dollars in revenue for the province in 2019 (Tourism Nova Scotia, 2020).

2.3.2 Online Focus Group Methodology

We chose an experimental mixed methodology using focus groups to explore our research questions. Between June 25 and July 31, 2019, we conducted 14 online focus groups with 96 coastal residents across Nova Scotia (See Figure 1). Online focus groups were determined to be the most effective method of allowing us to engage with a variety of residents in an area dominated by rural communities (Kitzinger, 1995; Rupert, Poehlman, Hayes, Ray, & Moultrie, 2017), while gathering more nuanced discourse and detailed information than a survey would be able to provide (Morgan, 1988). Pre- and post-test focus group surveys were used to gather quantitative data to understand whether there was any change in participants' perception before and after the focus groups. The focus groups also included Likert scale polls to provide a quantitative snapshot of participants' responses throughout the focus groups. The results of those pre- and post-test surveys and the focus group polls will not be addressed in this thesis. We engaged Narrative Research, a marketing research firm, to recruit participants for our online focus groups among coastal land/homeowners to generate a diverse range of opinions and coastal experiences. Potential focus group participants were recruited by telephone through Narrative Research's Atlantic Quarterly omnibus phone survey and

were paid $75 for their participation. To isolate participants who could be personally affected by coastal climate change in Nova Scotia, participants were required to live within five kilometres of the coast and be able to see the coast from their property, be over the age of 18, be a coastal homeowner for five or more years, have access to the internet on a computer, and be comfortable handling a computer and communicating over the phone for an extended period of time. We also specified that focus groups should be composed of a mix of summer, winter, and full-time residents. Participants were excluded if they or members of their households worked in the science or management of climate change, wetlands, extreme weather and storms, or coastal

ecosystems. Participants were provided a one-time use link to log into the focus group on their computers to view materials; they phoned in to provide clear audio. Video and audio were recorded for transcription.

Figure 1. ***Map of Nova Scotia with participant distribution where the dots represent the reported location of participants and the size of the dot represents whether there was more than one participant from that location.***

Most of our participants were over the age of 55, although the focus groups included participants in every age group from 18-55+. While participants had a broad range of economic and educational backgrounds, we did not have any who self-identified as students or those that identified as Indigenous (though we did not actively recruit for participants from either demographic groups and we did not ask participants their ethnic or cultural identity at any point in the recruitment survey). Our participants were

predominantly people who had lived in their community for more than 20 years (70%), with the largest number having lived in their community for over 51 years (25%). Most of our participants had oceanfront properties and were full-time residents. A factor driving these demographics could be the requirement that participants be homeowners and the landline-based recruitment method, but while only a handful of our participants were under the age of 45, Nova Scotia does have an older demographic generally. The average age in Nova Scotia in 2016 was 44 (Statistics Canada, 2017) compared with 40 for Canada as a whole (Statistics Canada, 2019).

2.3.3 Focus Group Design

The focus groups were structured to encourage participants to discuss their experiences with coastal climate change, coastal adaptation approaches and nature-based adaptation approaches, as well as to teach them some things they might not already know. To do so we divided the focus groups up into four main sections designed around three short informative videos we created for the focus groups to introduce participants to sea level rise, coastal climate change, and nature-based coastal adaptation (see Figure 2). Each focus group was limited to participants from the same coast, due to an expectation of similarities in the coastal geomorphology and thus nature-based coastal adaptation options within each coastal region and an interest in comparing coasts. Within each coast we divided the focus groups into three experimental treatments that explored different framing devices designed using Sherren's (2020) climax thinking framework and one control group; the framing experiments will not be addressed in this paper (see Chapter 3). Pre and post tests of resistance to landscape changes were done outside the focus groups and are similarly not discussed here. Four focus groups were run on the Atlantic and Northumberland coasts and six on the Bay of Fundy (doubling up on two framing treatments). Throughout the focus groups participants were given opportunities to share their experience and give feedback on the videos and information presented to them through a mix of on-screen polls and facilitated discussions.

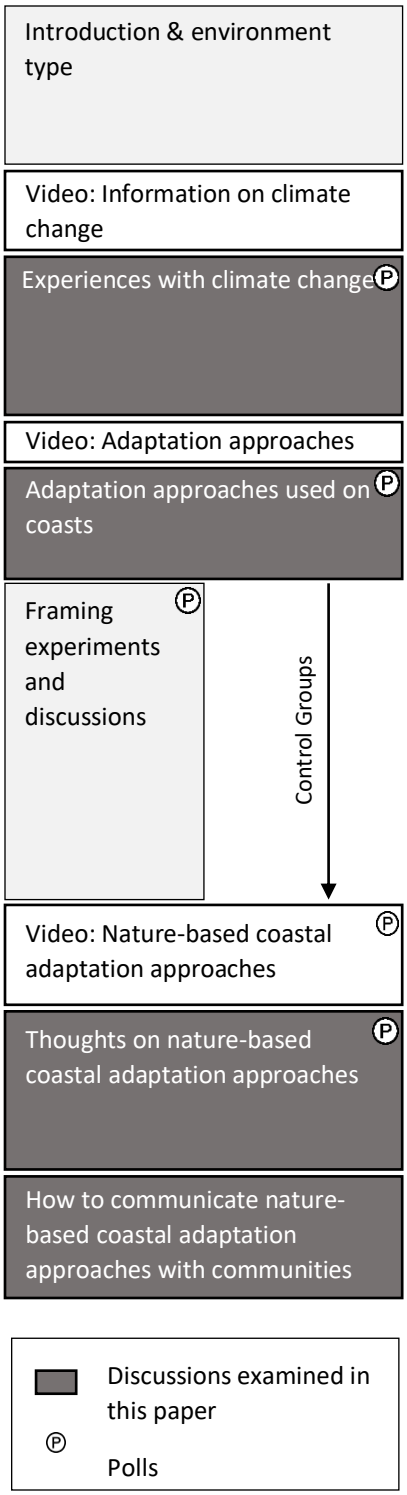

Figure 2. ***Focus group design***

Focus groups were 75- 120 minutes in duration and began with an introduction by our facilitator (see first light grey box in Figure 2). Participants introduced themselves to the

group by first name, stating how long they had lived on their particular coast and identifying what kind of coastal ecosystem they lived on from those in the eight sample images we provided for Nova Scotia. To ensure that our participants all had the same base level of knowledge about coastal climate change, participants were then presented with short video clips of information on sea level rise, coastal erosion, and other ways that a changing climate can affect the coast. This introductory video was followed by a discussion on what kinds of changes, if any, they have experienced on their part of the coast. Following that discussion they watched an additional short video describing and providing a basic explanation of the five main types of adaptation approaches to help them assess and discuss the adaptation responses they use and see in their communities.

Participants were then asked a series of questions relating to one of our framing treatments (for shorthand here, called past, future, and meaning), and asked to consider their landscape and its current and future states based on the treatments as they talked. Our past framing asked participants to talk about how their coastal landscape and its infrastructure had changed in the past as means of framing climate adaptations as only the most recent in a line of utilitarian change. In the future framing we asked participants about the aspects of living in a coastal landscape that they would like future generations to experience as a way of framing climate adaptation as still enabling many of them. In the meaning framing participants were asked to identify ways in which Nova Scotians had made sacrifices for World War I and II efforts as a way of exploring the potential for pride in collective action around climate. Although we do not discuss the framing results in this paper, it is worth noting that there may be a confounding effect from the framing treatments on the preference of the nature-based approaches: the focus group experiences prior to introducing the nature-based approaches were not the same for everyone. We treat the data the same across all focus groups here because no evident differences in preferences existed.

Next, we showed participants a video explaining the basics of the four or five groups of potential nature-based coastal adaptation approaches (depending on their coast) for

Nova Scotia's various coastal environments, already introduced in the Background. We began by explaining living shorelines before moving on to explain the other approaches; the order items are presented to participants in research can influence their responses, but we did not have enough focus groups planned to randomize away this effect (Perrin, Barnett, Walrath, & Grossman, 2001). Due to the diversity of possibilities included within living shorelines as a nature-based approach, we spent more time explaining this group of approaches compared to the other nature-based adaptation approaches. Overland flow management was one of the nature-based coastal adaptation groups presented to participants; however, it is not presented in these results as it prompted little discussion from participants, and few thought that it was a helpful approach. Finally, participants were led in discussions about their assessments and preferences of nature-based coastal adaptation options, and any concerns related to their implementation, as well as discussions about how to engage with communities around such options.

2.3.4 Analysis

The focus groups were analyzed qualitatively with the intent of understanding the experiences of participants as well as their perspectives on coastal climate adaptation and nature-based coastal adaptation approaches. The focus groups were transcribed using InqScribe and the transcripts were then coded. We used hybrid coding using NVivo 12, guided by a general inductive approach (Thomas, 2006) with deductive elements. We draw here on five of the facilitated discussions (those highlighted in dark grey in Figure 2): (1) What changes are you seeing on the coast? (2) What broad adaptation approaches are you seeing used on your coast? (3) What do you think about nature-based coastal adaptation options? (4) What information would you need before implementing nature-based coastal adaptation options? (5) What is the best way to start conversations about coastal climate change and the use of nature-based coastal adaptation with your community? The participant responses were deductively separated for comparison into categories by discussion question and, if applicable, which of the five nature-based approaches was being discussed, as well as focus group

treatment and coast. An inductive approach was used to classify all other discussion content such as climate change impacts and adaptations participants noticed and their perceptions of adaptation options (e.g., sentiment and rationale). Matrix queries were used to cross-tabulate themes, e.g., experiences across coasts and nature-based coastal adaptation approaches by sentiment and rationale. Sandelowski (2001) suggests that using language to imply the quantitative prevalence of themes may help demonstrate the complexity of qualitative results and support the meaning derived from the research. In spite of this, we will not be using a quantitative approach to express implications of importance. Due to time constraints we did not receive answers for each question from every focus group participant, so relatively low counts can still indicate a viable pattern. We do not avoid discussing any topics that came up during the discussion. You will see words like 'commonly', 'a handful', and 'a subset' being used to indicate the key patterns that emerge in the results from what appeared to be majority to minority viewpoints.

2.4 Results

2.4.1 Experiences of and responses to current coastal changes

The focus groups revealed that similar coastal changes are being experienced across coasts regardless of differences in coastal geomorphology and coastal environment. As participants were only asked to identify whether they had experienced changes on their coast we cannot determine whether they attributed all of these changes to climate, but there were participants who did so explicitly. The coastal changes most often described by participants—regardless of coast— were erosion, loss of land (referring to land lost to encroaching waters as opposed to the process of erosion), and storms and storm surges (Table 3). Atlantic residents also noticed an increase in debris such as rocks and seaweed after storms as well as personal property loss whereas Northumberland and Bay of Fundy residents both described experiencing rising water levels and damage to public infrastructure such as roads and guardrails.

Table 3. ***Top 5 coastal climate change impacts identified by participants by coast, in decreasing order of frequency of mention.***

Atlantic	Bay of Fundy	Northumberland Strait
Loss of land (14)	Erosion (20)	Severe storms and storm surges (17)
Erosion (12)	Severe storms and storm surges (17)	Loss of land (11)
Severe storm and storm surges (6)	Loss of land (16)	Erosion (11)
Storm debris (5)	Rising water levels (16)	Rising water levels (9)
Property loss (4)	Infrastructure damage (9)	Infrastructure damage (7)

When asked how people are responding to these impacts, participants most commonly mentioned 'hard line' and 'do nothing' (56 participants and 38 participants, respectively) as the approaches that they saw or used frequently in their coastal community All participants were given the opportunity to respond to this question in a poll and in the focus groups. Participants most often described attempts to keep erosion at bay using hard line approaches like rip rap and armoring the shoreline, or 'doing nothing' due the prohibitive costs of implementing approaches as their rationales for employing these two approaches above the others. Some participants described how 'do nothing' was the only option, and there were those who questioned whether their government in fact had a do nothing strategy, for instance in areas where the road has washed out or is eroding without repair. They also expressed their frustrations at seeing neighbouring summer homes whose affluent owners can afford it defending their properties with a hard line, to the detriment of adjacent neighbours who live there year long and see their shoreline erode more quickly. There was similar frustration expressed by others, however, about summer owners who do nothing and let the coastline erode. This evidenced a lack of consensus on what it means to respond correctly to coastal climate changes or to be a responsible landowner.

2.4.2 Perceptions of using nature-based coastal adaptation approaches

After an instructive video, participants discussed their preferences for the five nature-based coastal adaptation approaches to climate change on their coast. Preferences for

nature-based adaptation approaches were first given as 'most liked' or 'least liked' in a poll, with the facilitator subsequently prompting participants to explain their votes and their rationale. We had participants who were reluctant to give their preferences because they felt that the coastal environment in their community is diverse and their preference may not be appropriate for the entire community:

> I think that declaring one option is the best and one option as the worst is in a way counterproductive. Because if we are just looking at our own property it almost seems like a- well the word selfish is an unkind word but that's what it seems like… So I think that's what I'm trying to say is that there's no such thing as one best or one worst because it depends on what part of the coastline you're living on and also whether you're at a higher elevation or a lower elevation, or whether you make your living farming or fishing or in commerce. So, so much of this, there are too many variables to make a one answer fits all. (Female Northumberland Strait Participant)

The following subsections address our second research question surrounding the perceived value and utility of individual nature-based approaches for coastal climate adaptation and the rationales participants gave for their perceptions.

2.4.2.1 Living Shorelines

Across all focus groups, the majority of participants perceived living shorelines as the most preferable adaptation approach. They saw living shorelines as something "better for the environment" that will preserve the aesthetic of living on the coast due to being more 'natural' than the other approaches. Phrases like "keep things looking natural," "aesthetically pleasing," and "practical" were used by participants to express why they liked the living shorelines approach over the others.

Many participants had never previously heard of the techniques being used for living shorelines, as in the case of oyster reefs and reef balls. A handful of participants described instances of living shorelines variously working (dune building) or failing on their part of the coast due to the dynamic coastal environment or major storm events; others were more confident of their utility because they had a deeper knowledge of coastal climate adaptation through their own background or through people they know in their communities. Those that rejected or dismissed the living shorelines options

identified their environments as ones where living shorelines are not viable financially or because of the sheer power of the ocean. Overall, participants were unsure of the financial cost of implementing a living shoreline as a long-term solution even as they saw living shorelines as something that once viable, and proven successful, could be an effective approach for the coast. For instance, a female Northumberland Strait participant said:

> I think I'm just being hopeful by saying living shorelines, it's the one I favour the most because it's the most proactive and practical for my area although it really wouldn't be that effective I don't feel because we—A large part of our shoreline is the open ocean and it's big hard waves we get. So, I can't fathom how really even the reef balls would do anything but to me that's the most hopeful we could get.

This was echoed by another female Northumberland Strait participant who said: "How much of a shoreline we would save, and for how long? Especially the cost involved because as we all know, everything comes down to dollars and cents in a lot of cases". Such quotes are emblematic of the cautious optimism participants had about the chances of the living shorelines approach succeeding on their coast and whether it could be a long-term solution to the climate changes they are experiencing.

A subset of participants felt proof was lacking that the approach could be used in Nova Scotia and suggested if there were pilot projects in the province that could be used as example sites, they would feel more secure in implementing the approach:

> I guess the living shoreline [is my preferred one]. I've never really experienced the others. We've just always had the dyke and definite erosion on the other side. The living shorelines, it goes, I mean I know there's no guarantee, but I would like to be assured that it would actually work and that the homes would not be affected. That the tide would be controlled. (Female Bay of Fundy Participant)

As illustrated above, living shorelines options were viewed positively and optimistically, but with caveats around cost and long-term viability.

2.4.2.2 Accommodate

Participants' thoughts on accommodation approaches were divided. A lot of them considered this approach to be a "band-aid solution," or not a solution at all, because

they felt it did not address or solve the bigger problem of climate changes on the coast and delayed what they identified as an inevitable move or retreat. There were participants who felt that the financial costs of accommodating could better be used on a pro-active retreat from the coast pointing to the flooding incidents in other parts of Canada and the United States:

> I think accommodation - least favourable option because we've seen what can happen in other parts of the country with the Quebec floods. And it seems like an ongoing thing in New Brunswick too, so I think people gotta be mindful of that and sometimes the only option is to relocate, and I think that's what you're going to unfortunately see more of in the future. (Male Bay of Fundy Participant)

Other participants expressed the necessity for selective accommodation to sustain the economic resources in their community, stressing the fact that wharves need to be raised for fishermen to make livelihoods, and for tourism and important infrastructure like roads:

> I chose accommodate because I think, you know, we got to fix the roads to accommodate for the rising sea level. We've got to ensure that the wharves are- new wharves are built to accommodate the rising sea level otherwise we won't be able to live here. So yeah, it's great to have the conversation. I think we need to have a lot more of these conversations. (Female Bay of Fundy Participant)

Although accommodate was expected to be a more favoured option than retreat, participants determined that it was impractical in many situations, and viewed it as mostly negative.

2.4.2.3 Retreat

Participants had mixed responses to retreat with a small group not considering it to be an option and others seeing it as the only option they have due to their coastal environment, yet it was commonly described it as a last resort. Among those who rejected retreat, having the financial ability to move was the biggest barrier to accepting the approach.

> …there's a lot of marsh land and farm land down through here and you're going to get a lot of- You'd really have to work with the people that were right on the cliffsides of the area because they're the ones that are going to be impacted first. And if they're going to be talking about retreat, they're going to, you know, people can't afford to retreat unless the government's going to help them. It's

> just a fact of life. They can't. We see that up there in New Brunswick along the river. The people say “well, why don’t they move?”. Well that's great to say but how’re you going to be able to sell your house? You can’t afford to buy another one. (Female Bay of Fundy Participant)

Likewise, participants mentioned the effect that a retreat would have on their communities or cultural aspects, such as historical buildings and heritage streets, and values that they attribute to where things in their community currently exist. For instance, a participant on the Atlantic Ocean coast reasoned: "Well retreat is out of the question because a lot of these houses have been here for years, decades, and you know to move infrastructure back, away from the ocean, I think is out of the question." One reason participants rejected retreat, except as a last resort, was that their primary reason for living where they do is the proximity and aesthetic enjoyment of their coastline. Of the participants who responded, those who did not talk about either their home or the view were more likely to see retreat as a sensible choice for the long-term and be against the idea of accommodating.

2.4.2.4 Dyke Realignment

Dyke realignment was only presented as an option to those on the Bay of Fundy, where dykes are generally seen as effective because there is a history of dykes--both Acadian-era and more modern--on their coast. Dykes are perceived as a good way to maintain community and culture as whole communities and agricultural land are protected from the sea by them. Despite (or rather perhaps because of) this positive perception of dykes, participants had mixed opinions on their realignment. There was a small group of participants who were concerned about the loss of drained and protected land if a dyke was to be realigned, regardless of its current use, and about the potential for damage to property and communities:

> The dyke realignment, you know even though it’s not being farmed anymore, there's people living behind those dykes now. And a lot of these small villages, especially off the Bay of Fundy where there's dykes, like Wolfville, in my area Maccan, River Hebert, villages were built there in the 1800s. Like I say it may not be farm but those dykes are protecting their property so I- You start removing

> dykes, I think we're in for another major problem. (Male Bay of Fundy Participant)

Of the participants who gave responses for this approach, a number of them also misunderstood the concept, supporting it because they thought it meant holding ground or advancing rather than pulling back, for instance reclaiming land lost to the sea or maintaining and upkeeping current dykes.

> In Europe, I know I was in the Netherlands and they actually reclaimed land and have a new city over in one area by reclaiming land and by using natural abilities so, the living shorelines and the, I think the dyke realignment would help. (Female Bay of Fundy Participant)

Dyke realignment was supported by participants who had a familiarity with existing dykes and who believed that dykes are effective in the long-term though some misinterpreted what the dyke realignment approach entails.

2.4.3 Information needed before implementing nature-based coastal adaptation

A primary concern of our participants about implementing all of these nature-based coastal adaptation approaches was their cost: who will pay for them, and how? Participants identified a lack of available funds to use towards these adaptation approaches at the household level, as well as at the municipal and provincial government levels, even when they recognize the effects of coastal changes. For example, a Female Northumberland Strait participant said:

> So, I think there are some people who realize they have issues that they have to deal with on the shoreline. They really don’t know how to approach that in terms of they have no idea what the cost is involved, whether there are any provincial or federal programs that can assist with that.

A male participant on the Bay of Fundy coast questioned whether governments would consider the investment into nature-based coastal adaptation approaches in smaller, more rural, communities in Nova Scotia to be worth it. He referenced the federal government's decision to relocate entire communities in rural Newfoundland and Labrador through the 1950s and 1970s for economic reasons:

> What is that plan? And does it include moving us quickly away from our homes? And if it doesn't, how much money is government prepared to spend for

> adaptations locally given the disparity in populations between rural and urban populations in Nova Scotia for instance? The population of Digby county is minute compared to urban populations even in this province. So, is the government prepared to, you know, spend resources to save these areas or do they just want to put up gates and say, 'Do not enter'?

A secondary concern was a lack of information on how successful the approaches are at mitigating or stopping the effects of coastal climate change, particularly less familiar approaches like living shorelines. Participants most commonly felt they needed expert advice about the options and the threats before they would consider implementing any of the nature-based adaptation approaches. When asked what kinds of facts and plans they would need they suggested flood maps and photographic evidence of landscape changes as well as detailed adaptation plans that lay out the risks and consequences of acting or not acting, the timing, which nature-based adaptation could be implemented where, and steps as to how one would go about implementing nature-based coastal adaptation in their community. Participants also intimated that they need more pilot tests of nature-based coastal adaptation approaches for the different coastal environments within Nova Scotia to demonstrate the effectiveness and longevity of the approaches as references for community projects.

2.4.4 Communicating with community

Finally, we asked participants how they thought information about coastal climate change and nature-based coastal adaptation could be shared with their community. The majority suggested public information sessions in the form of open or public forums and town halls as they tend to be well attended by people especially those who are directly affected. Some participants felt that one of the first things that needs to be done to effectively share information with their communities is to make people aware that there is a problem. There were suggestions that social media like Facebook or Twitter, as well as other media like television, radio, newspapers, and websites, could be used to share videos and pictures similar to the ones we showed them (see Figure 3) to be shared to spark conversations.

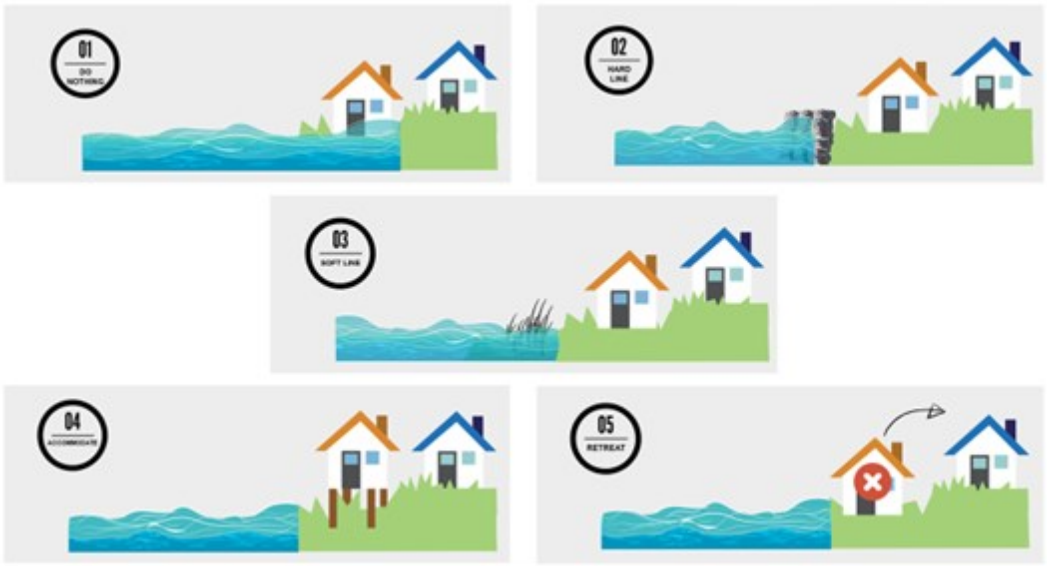

Figure 3. ***Infographic of broad adaptation approaches as presented to participants during the focus groups (adapted from CoastAdapt (2017, May 24).)***

A subset of participants believed that the best way to communicate with communities is to make it personal to the individual by collecting and sharing stories of how coastal climate change has affected individuals in their community:

> I think it has to be personalized. People on the coast are facing erosion, but people in the Midwest are facing more frequent tornados, the air quality in cities, they're affected by that with the temperature changes, the heat is just incredible, the fires out west. Those are all personalized to those residents in those areas. And when we all put our stories together, and the information that we supply and hear about in group meetings, I think it works (Male Northumberland Strait Participant).

A few of our participants believed that they were "too old or cynical" to deal with the impacts of climate change on their coast and reasoned that we should make educating the youth in schools a priority because by being more aware of the effects, they will be ready and willing to make a difference for the future. For instance, a female Atlantic Ocean participant said:

> … it's young people, it's the children who are becoming really good at recycling, it's the children who are talking about global warming, it's the children who are talking about the disappearance of species and that's where we have to really get in there and make these future generations really start to make a difference.

The responses from our participants made it clear that they believe that public education and personal awareness of coastal climate risks and interventions are a starting point for effectively introducing nature-based coastal adaptation into their communities.

2.5 **Discussion**

We set out to elicit experiences of climate change and adaptation from coastal residents in Nova Scotia using online focus groups, and to explore whether and how they perceive nature-based coastal adaptation approaches to be valid alternatives to traditional coastal adaptation. This research is one of very few studies that we know of that elicits responses about coastal adaptation from Nova Scotian coastal residents, particularly as it relates to the use of nature-based coastal adaptation approaches (e.g. Rezeski, Graham, & Baker, 2013; Sherren et al., 2016; Vasseur & Catto, 2008; Vasseur, Thornbush, & Plante, 2017). Here we summarize our results and speak to the

implications of this research for the growing momentum towards nature-based coastal climate adaptation, particularly perceptions of climate impacts, options, and the challenge of language.

2.5.1 **Impacts**

We found that while participants do not necessarily ascribe changes on their coast to climate change, the range of impacts is similar across the coasts. Participants were open to learning about approaches for coastal climate adaptation but ask for more information on risks and timelines, detailed adaptation options, and real-life examples of nature-based adaptation in similar environments to make informed decisions around the viability of these approaches. It is possible that perceptions of nature-based approaches, both positive and negative, are not indicators of willingness to adapt but rather indicators of how social norms like armoring the shore are embedded in coastal culture; lots of participants were aware of climate change impacts on their coast but did not know how else to deal with them than hard options (Cooper & Mckenna, 2008). Vasseur et al. (2018) refer to this as a path dependency, or "lock in" (Wilson, 2014), that they concluded stems from a short-term pragmatist mindset at the individual and community levels; community members relied on what they have always done because they believed it was effective. Sherren, Beckley, et al. (2016) discuss two types of path dependency in the context of hydro dam removal: biophysical path dependence, in which the choice to continue on the path previously chosen is made because there is a physical structure that exists and limits future options so there is either no physical way to deviate from it and/or no way to recover from the impacts of that past decision (Marshall & Alexandra, 2016); and cultural/emotional path dependence, in which there is an element of uncertainty and reluctance in moving away from what we know works and security in possibilities we can imagine (Wilson, 2014). The responses from participants about the nature-based adaptation approaches presented to them suggests that it is both biophysical and emotional path dependence in the ability of any specific option to mitigate coastal changes without a significant loss or sacrifice, that determines how much they will support the approaches.

2.5.2 **Options**

What do our focus groups tell us about nature-based coastal climate adaptation? Participant responses, cautious as they are, provide more insight into how nature-based coastal adaptation approaches are understood by the public. The effectiveness of nature-based adaptation approaches were expressed in hopeful rather than convinced tones by participants in all focus groups, indicating that while there is generally a positive view of nature-based coastal adaptation, there is scepticism associated with their support of these approaches. Uncertainty is a known barrier to the acceptance of coastal adaptation approaches (Covi & Kain, 2016). As experts have also observed (Bowron, Neatt, & van Proosdij, 2012; NSDMA, 2017; Sherren et al., 2019), participants felt more evidence is needed about how well an approach has proven itself in terms of overall feasibility and effectiveness, and the financial aspect of implementing nature-based coastal adaptation approaches. Participants sought expert-based or physical proof that impacts from climate change are occurring more frequently or will in fact occur in the future with more risks to the coast than in the past and that nature-based adaptation approaches will do what advocates claim they will do. Participants wanted good flood maps and other visualizations that Lieske et al. (2014) also noted would be able to demonstrate risks and consequences in a way that verbal information alone cannot. Scientific proof as well as local proof were seen as a requirement for both choosing a nature-based adaptation approach for a coastline and in getting a community onboard with coastal climate adaptation in their area. As Vasseur and Catto (2008) observed, there is a lack of individual capacity to handle the costs of implementing coastal adaptation in the resource-dependent economies and aging population of rural coastal communities in Atlantic Canada; it is thus critical to reduce uncertainty about what needs to be done to address coastal risks and provide strong government support.

Many participants described retreat as a 'last resort', citing their desire to maintain coastal communities and cultures. For Nova Scotia, this is not unsurprising as many Nova Scotian coastal communities are long-established by North American settler

standards, and have significant attachment value for their residents, but several (e.g. Lunenburg, Grand Pré, and Cheticamp) are also heritage sites for their quintessential coastal community aesthetics with significant value for the province's economy ("Landscape of Grand Pré - World heritage sites in Canada," 2019; "New space to showcase Chéticamp's Acadian culture," 2017; "Old Town Lunenburg - UNESCO World Heritage Centre," n.d.). These values, aesthetics, and lengthy histories create a sense of place in residents that may make coastal residents such as our participants reluctant to retreat or otherwise make changes even if they recognize the need to adapt. This association between place, culture, and values is consistent with what Clarke, Murphy, and Lorenzoni (2018) found led to resistance to climate adaptation in residents of Clontarf, Ireland. Adger et al. (2013) similarly recognized that adaptation that affects a connection to place is less likely to be accepted than approaches that allow people to remain in their communities. Studies have shown it is common to connect retreat with a failure to keep the cultural values and pride related to a place like a coastal community, but in some instances retreating, even as a 'last resort', will be what keeps people from losing those cultural connections completely (Adger et al., 2013; Braamskamp & Penning-Rowsell, 2018).

Dyke realignment was a poorly understood option. As a hybrid option that combines retreat from the current 'line' with wetland restoration on the foreshore side of the new dyke (i.e. living shoreline), this option requires an understanding that there will be changes to land use behind the previous dyke. This option is complex and thus poorly understood, but it also seemed to reveal a general lack of understanding that the dykes were not natural or inevitable. Of the participants who gave responses for this approach, there were those who chose to ignore the realignment part of this option, opting instead to focus on the dykes as endemic, or long-lasting structures in their landscapes that are necessary and important to the communities that live behind them because they are seen as an effective protective measure that holds the 'line' (Sherren, Loik, et al., 2016). Like the rejection of retreat, the rejection of dyke realignment appears to stem from concern of losing the aesthetics or cultural meanings associated

with the dykes (of Acadian heritage and agriculture) (Adger et al., 2013; Sherren, Loik, et al., 2016).

Accommodation was generally rejected as a "band-aid solution" because participants felt it was impractical given the trajectory of sea-level rise and coastal erosion in the long term. The concerns participants raised about this approach are valid given that the economic capacity to adapt in Nova Scotia's coastal communities is low. We had expected this option to be more palatable to participants than retreat because it would allow residents and their communities to remain in place. These responses suggest a willingness to address the impacts of coastal changes for the long-term that outweighs the resistance to change that accompanies an appreciation for the aesthetics of living on their coast. Baird et al.'s (2016) transboundary water governance research considers this kind of practicality to be a pragmatic and adaptive response and a way to move forward; the participants have taken into account both the context of coastal adaptation to climate change and the data about how it will affect them in their decision-making. As Kettle & Dow (2016) established, the perceived risks (e.g. coastal climate impacts such as flooding) associated with climate changes directly influence how much support a solution receives based on how well it reduces overall susceptibility to those changes. The responses from our participants indicated that while accommodation may be a short-term approach for dealing with coastal adaptation, they also recognized it as a maladaptive one in the long term. Barnett & O'Neill (2010) state that climate change maladaptation leads to an inability and a lack of flexibility to adapt to impacts in the future although the approach in question may work currently and has worked in the past.

2.5.3 **Language**

The specific language used to name some options seemed to influence how they were perceived, although participants may also have been influenced by the amount of time spent on each. Living shorelines was the most preferred option of those we presented, but we also spent more time explaining it because of its novelty and the complex set of approaches it represents. This extra time and detail undoubtedly emphasized the option

and made it seem more technical and perhaps thus more viable. Support for living shorelines options stemmed at least in part from timing, but also likely, from the word 'living' giving the perception that it was better for the environment. Participants felt that because it uses natural materials it would not significantly impact everyday life and the ability to enjoy the coastal landscape. This is what Moore (1959) calls a naturalistic fallacy or an appeal to nature; we associate a natural physical object (e.g. living shorelines) with a quality (e.g. good) and determine that because living shorelines are part of the natural environment and can protect the shoreline, we should implement them because they must be good for us and the environment (Batavia & Nelson, 2017). McCumber (2018) expands on the naturalistic fallacy and suggests that the way we define nature and what is natural is based on a set of aesthetic ideals we create in our heads, rather than facts, that urges us to keep the environment as natural as possible for that aesthetic regardless of how it will affect our place in it. Language is helping living shorelines get 'the benefit of the doubt'; it may be that in practice some of the living shorelines may disappoint in aesthetic terms (e.g. dunes blocking views), and this could drive a backlash against such options.

Similar to the above language issues, retreat was deemed a last resort, despite the knowledge that it works, because participants felt that as an approach it was more like giving up than addressing climate change impacts. Few linguistic alternatives exist that do not also suggest surrender. Participants' responses to retreat suggest that it is difficult for the non-expert to move past the literal meaning of the word retreat to see any positive aspects of coastal retreat. Koslov (2016) argues that a distinction must be made in how we define retreat (as an adaptation vs. as a reference to loss or war); the current definition of retreat in climate change adaptation strategies implies that water is something that must be fought against. Cooper and Pile (2014) refer to managed retreat as a "surrender of previously reclaimed land" to allow it to be taken back by nature, which is reminiscent of the Oxford English Dictionary (2010) definition of retreat as a falling or moving back, or withdrawal, often in reference to an army, when faced by a superior force. Monbiot (2014) asks us to consider the rewilding of nature —as happens

in a managed retreat— as a "reinvolvement" rather than a human retreat and a chance to interact with and enjoy nature as it exists. It is evident that the vocabulary we use to describe nature-based coastal adaptation approaches needs to change in order to improve perceptions.

Information needs to flow from both researchers and decision makers as well as from the community for coastal adaptation to be considered. Participants emphasized the importance of having community voices in the decision-making process as they suggested open and public forums and meetings were the best way to communicate information about implementing nature-based coastal adaptation approaches. Our participants were loath for their perceptions and preferences of coastal adaptation approaches to be applied in a blanket way; the coastline in Nova Scotia is long as well as geologically and culturally diverse, so what may work for them may not work for the neighbouring community. Likewise, it is important to note there was conflict in the way that permanent residents talked about how they dealt with climate changes versus how they felt summer residents responded to coastal climate changes. Clarke et al. (2018) argue in the context of implementing coastal flood defenses in Clontarf, Ireland, that, in adaptation planning, it can be maladaptive to choose or prioritize the perspectives of just a small segment of the community based on their experiences or lack of exposure to risk, especially when place attachment may be a factor. While we should not generalize coastal experiences and risks, engaging those who are directly impacted by coastal climate change in the search for solutions is important as it provides an opportunity to understand property owners' concerns and provide them with the information they need early on. Agyeman, Devine-Wright, and Prange (2009) argue that integrating community knowledge of the land and its changes with science and policy for managed retreat can encourage public acceptance rather than resentment. Further, engaging communities and gaining their insight can encourage collaboration which can spur grassroots action with community groups, public action, and local government involvement; indeed, some of our participants had previously set up community groups to maintain their sand dunes, trails, and beaches and this social capital could be

leveraged in adaptation efforts (Lieske et al., 2014; Vasseur & Catto, 2008). Clearly there is space for a two-way approach to establishing viable adaptation with communities.

2.6 **Conclusion**

We set out to understand how a sample of Nova Scotian coastal landowners are experiencing and responding to coastal climate risks and how they understand and perceive the potential for nature-based coastal adaptation in their communities. As the impacts of coastal climate change are increasingly felt, it is important that coastal communities understand coastal risks at a personal level and the ways nature can be used to adapt and lower vulnerability to coastal climate impacts and increase resilience in coastal residents.

Grounded proof of risks and options is needed to reduce uncertainty and bring communities onboard. The burden of proof is on policy and decision-makers to demonstrate that nature-based coastal adaptation approaches can be more resilient and cost-effective than other coastal adaptation infrastructure especially for those in smaller coastal communities who have less economic flexibility to test multiple options. Likewise, processes seeking to implement nature-based coastal adaptation must be inclusive and geographically fine-grained; the perspectives of communities are affected by multiple social factors that shape public acceptance. Municipal planners can work with governments to develop pilot test locations that can be maintained by the community, involving them in the decision-making process and increasing understanding of how these approaches work which will encourage support and acceptance from community members by addressing uncertainty.

More attention also needs to be paid to the effect of the words we use on how risks and adaptation options are received and make efforts to develop more effective vocabularies. It is important that the language used to describe nature-based coastal adaptation approaches such as living shorelines and retreat is easily understood and does not hold either unrealistically positive or negative connotations or have mixed meanings. Nova Scotia provincial government and policy makers should consider

developing distinct definitions for nature-based approaches in conjunction with researchers and the public to address unhelpful linguistic connotations. These terms should be developed to be used within climate adaptation communication and policy which will reduce confusion from community members who may have alternative definitions or misperceptions of their own. These definitions could be included in legislation such as the recently introduced Coastal Protection Act, that is still under regulatory development.

A limitation of this study is that although the participant demographic is illustrative of Nova Scotia's rural population, it is biased toward older individuals and the opinions of younger coastal landowners are not as evident. Aiming a future study at a younger demographic may help to understand whether there is a generational difference in how coastal climate change and nature-based coastal adaptation are understood and supported. As Nova Scotia's coasts have a mix of year-round and seasonal residents, it is recommended that future studies also explore the differences between resident groups as our participants pointed out that disparities in their ability, or willingness, to adapt may exist but we did not have enough seasonal residents in the sample (n=8) to allow a robust comparison. Another limitation of this study is that while we recognize that the order of presenting the nature-based approaches may have had an impact on perception of the approaches, we could not test alternative orders as the focus group's primary purpose was to test the framing experiments discussed in Chapter 3. Alternating the order of the nature-based approaches would have helped to create a better understanding of perception of the approaches but with only 14 focus groups, it would have added too many variables to properly analyze the effects of the framing experiments on adaptation.

Further work should examine perceptions of the living shorelines approach alone as the time spent on the approach was unbalanced compared to the other options due to their more technical descriptions and may have led to bias among participants. A more parallel approach of the options within living shorelines is necessary to get a more

granular understanding of how the sub-approaches within living shorelines are individually perceived.

CHAPTER 3: Framing coastal climate adaptation with climax thinking to support nature-based alternatives: an experimental focus group approach

3.1 Introduction

One of the primary challenges that arise in discussions of climate change adaptation is resistance *in situ* to changing the approaches we use (Temmerman et al., 2013). Hard infrastructure like sea walls and berms have been used in the past to protect the coastline (Leys & Bryce, 2016); however, these types of infrastructure often result in coastal squeeze (which occurs when the shoreline is blocked from moving landward) in the long-term and they encourage maladaptation such as development that is closer to the shore than is safe (Barnett & O'Neill, 2010; Vasseur & Catto, 2008). Garnering support and adoption of nature-based adaptation approaches —an assemblage that includes softening shorelines with vegetation and elements of changed land use, home construction and managed retreat—has proven to be challenging in at-risk coastal communities (City of Surrey, 2018b).

There is evidence to suggest that using framing in climate change communication can encourage adaptive behaviour and the adoption of adaptive measures (Lakoff, 2010; Spence & Pidgeon, 2010). However, this is not a 'one size fits all' solution as using the wrong framing approach can also be maladaptive (Brulle, 2010). Within climate change communication, framing has been used to address perceptions of climate change and alter perceptions and behaviours using tailored strategies that move the discussion from abstract examples towards more meaningful ones for the audience in question. Some such approaches include: shifting to thinking of local actions instead of large-scale global action, focussing on gains over losses, or emphasizing current impacts over future impacts (Badullovich et al., 2020; Stern, Brousseau, O'Brien, Hurst, & Hansen, 2020). This communicative framing of climate change provides us with innovative ways to introduce new and different perspectives into climate change discourse. Framing climate change communication is often focussed on diagnosing causes, suggesting remedies, making moral judgements, and defining problems that are often scientific,

economic or environmentally minded (Badullovich et al., 2020). Climax thinking is a new idea that hypothesizes drivers of resistance to landscape change, often expressed as a sense that landscapes have reached their experiential apex (Sherren, 2020). It contributes to this set of framing options by providing a new theoretical lens by which to organize existing and discover potential new framing options.

Most research on communicative climate change framing is done based on analysis of media output or experimental surveys, instead of conversations with people. Media-based research in climate change communication can inform us about the types of framing that exist but lacks the ability to determine their effectiveness in changing public perception (Badullovich et al., 2020). Comparably, climate change framing surveys (e.g. Gifford and Comeau (2011)), can tell us broadly how a large, representative group of individuals respond to different frames, but often do not provide participants with an opportunity to provide rationales for their answers and even less frequently, an opportunity to engage in further dialogue about their answers (Morgan, 1997). This research gap is exacerbated by a lack of focus groups within climate change framing research as focus groups not only allow for clarification of responses, but also simulate the kind of verbal delivery by which people often receive such framing messages.

We held focus groups with coastal landowners in a climate-vulnerable jurisdiction of Canada to test three different framing treatments on discussions of nature-based coastal adaptation approaches and adaptation. Instead of crafting narratives about each of the coasts in question, we facilitated discussions with participants so that they could be authentic sources of the framing content for one another. To answer our second research question and understand the impact of framing treatments on openness to nature-based coastal adaptation and adaptation generally, our research sub-questions were as follows: 1) What comprised the facilitated framing experience for participants? 2) Was any framing narrative more effective than the others in inspiring discussions of the need for changed approaches?

3.2 **Background**

3.2.1 Framing and climate change communication

Research in climate change communication looks for the most effective way to motivate behaviour changes to mitigate, or adapt to, climate change. One such method of communicating and encouraging a change in behaviour is framing. Framing encourages an individual to think about a subject from an angle that may appeal to their personal worldview and perspective, thus influencing the associations that can be drawn about options, solutions, and evidence for a particular outcome (Trout, 2005). Relatedly, priming encourages an individual to use the associations that were previously presented to them when presented with a related decision (Hallahan, 1999). We do not differentiate these, consistent with Druckman et al. (2009) who argue that the effects of priming and framing are interchangeable in the context of communication. The purpose of framing is to attempt to encourage a change in behaviour or belief by adjusting attitudes towards consideration of an issue rather than avoidance or rejection (Chong & Druckman, 2010). Psychologists Tversky and Kahneman (1981) are among the first to apply framing in experimental decision-making scenarios around risks, gains, and losses. Hallahan (1999) identifies seven models through which framing is used: situations, attributes, choices (gain and loss), actions, issues, responsibility, and news. These seven models of framing are the building blocks for the many ways framing is used to communicate changes in behaviour and perception, particularly in the field of climate change communication.

Many different framings have been used within climate change communication to try and influence behaviour. The consistently least successful of these has been fear and negative loss framing (Spence & Pidgeon, 2010). Fear and loss framings, often used by the media, were found to be more maladaptive than useful for climate change, scaring those who they were trying to communicate with by using words that could be considered alarmist, like “catastrophe” and “terror” (Ereaut & Segnit, 2006; Lück, 2018). Personal dimensions also matter when it comes to framing, which requires the audience to be well understood by those seeking to communicate with them. Steinhorst &

Klöckner (2018) argue that pro-environmental instrinsic motivation towards energy saving is neither decreased nor increased when comparing the effects of framing extrinsic benefits (e.g. monetary benefits) to framing environmental information (e.g. emphasizing environmental benefits). This challenges the notion that appealing to self-interest is an effective way to frame pro-environmental behaviour change and suggests that a greater understanding the target audience is important. Other research that suggests that past or traditional framing of the environment —in which conserving the environment is talked about as preserving heritage rather than as a duty to future generations— is more effective for those who lean toward conservativism than future framing (Baldwin & Lammers, 2016).

Within climate change communication in Canada, Beaulieu, Santos Silva, and Plante (2016) argue that encouraging communities within a Quebec municipality to think about a desired future during climate change planning helps to make discussions of adapting more approachable and productive. Likewise, a survey in Ontario that tested attitudes towards personal sacrifice and motivational frames found that sacrifice framing (e.g., 'I am going to have to get used to driving less, turning off the lights, and turning down the heat") is less effective on women than men and is less preferred than a motivational message (e.g., ''we help solve climate change when we take transit, compost, or buy green energy") when looking to change environmental behaviours around the home and transportation (Gifford & Comeau, 2011). Scannell and Gifford's (2013) framing of climate change for personal relevance compared local and global messages in British Columbia and found that local frames are more effective at spurring action due to place attachment. Such studies in Canada indicate that framing climate change communication can work here. The extent to which they work for climate change messages over the long-term remains to be seen, however.

Little research has been done on the effects of framing around coastal adaptation, and what has been done is somewhat inconclusive about effectiveness. Wong-Parodi, Fischhoff, and Strauss (2015) find the way we frame management responses to coastal flooding and sea level rise (e.g. adaptation vs. resilience) is important to how acceptable

these responses are found to be, but also determined that the framing of them is generally not as important as their ability to prompt people to action. They did determine (much like we did in Chapter 2) that the specific terms used have different connotations that affect the way people respond, and that the term adaptation is better than resilience to spur individual action. Altinay (2017) did a similar study to Scannell and Gifford (2013) but in Australia, surveying undergraduate students in a vulnerable coastal area to look at the effects of local vs. global framing on risk perception and engagement around coastal climate change and they found that local framing of climate change risks engendered concept saliency but was no better at generating support for local mitigation policy.

Climax thinking is a framework that pathologizes our Western tendency to see our current landscape as in its ideal state, thereby rejecting landscape changes, including those for the public good (Sherren, 2020). The framework uses time and space dimensions to examine public understanding of landscape changes. This past dimension asks whether resistance to change is because we know very little about the past landscape—the simple fact of prior versions having existed—or assumptions that we have evolved it into something better than previous inhabitants could have (Sherren, 2020). The future dimension explores the fallacy that the current landscapes will suit future generations, if we consider them at all, as their needs will be the same as the present. Where the future dimension is about intergenerational dynamics, the space/place dimension is about intragenerational: local stasis is enforced in the ignorance (or avoidance) of the fact that it often has implications for people and places elsewhere (Sherren, 2020). These three dimensions can be drawn upon to design frames to explore how perceptions of landscape and climate changes affect a sense of urgency or willingness to adapt.

Existing climate change framing studies fall into four methodological categories: experimental, observational, discussion, and synthesis, with the majority of the studies being observational studies looking at the news/media for discourse analysis (Badullovich, Grant, & Colvin, in press). Experimental studies, those that use an

intervention and primary data collection, comprised only 22% of the studies in a recent review and most used environmental frames. Surveys were the primary data collection method for experimental framing studies and only half of those studies used control groups in their methodology. Badullovich et al. (in press) do not identify any experimental focus groups in the studies they reviewed, which, along with Schäfer and O'Neill's (2017) work on framing climate change communication suggests that experimental focus groups may be a largely unexplored methodology within the study of climate change framing.

3.2.2 Nature-based coastal adaptation

Nature-based coastal adaptation encompasses approaches that integrate natural processes into protecting the coastal landscape by mitigating the effects of climate changes (Leys & Bryce, 2016) or removing human pressures to allow natural processes space. Some of these approaches take advantage of coastal ecology (e.g. salt marsh grass slowing wave action and reducing erosion) to enhance ecological resilience in ways that also benefits human use of coastal landscapes (Rahman, Manuel, et al., 2020). As mentioned in Chapter 2, we focused on four nature-based approaches in this study: Living Shorelines, Dyke Realignment, Accommodation, and Retreat. We defined 'living shorelines' as a series of approaches that use naturally existing materials and natural engineering techniques to create environments that mimic and respond like natural processes, for instance trapping sediment and mitigating erosion and flood damage (NOAA Living Shorelines Workgroup, 2015; van Proosdij et al., 2016). Dyke realignment is a specific nature-based approach that requires building a new realigned dyke behind an existing, usually at-risk dyke, to allow for tidal flow and salt-marsh restoration in front to reduce coastal squeeze and prevent flooding of low-lying areas behind the dyke (Cooper & Pile, 2014; Sherren et al., 2019). Accommodation is an approach that looks to adjust coastal land use and infrastructure according to the changing landscape and climate while keeping the same places used (Leys & Bryce, 2016). Lastly, retreat is a long-term approach that aims to protect people and infrastructure in at-risk areas

through relocation or migration in a managed or unmanaged manner (Lemmen et al., 2016).

Across Canada, nature-based approaches to climate change adaptation have been considered for coastal jurisdictions and in some cases, they have been successfully implemented. In Perth-Andover, New Brunswick, managed retreat and accommodation were supported for individuals and communities who were affected by a flood in 2012 (Kovacs, Guilbault, Darwish, & Comella, 2018). The community's preferred adaptation approach was to accommodate; however, after recognizing that their businesses were still at risk if the river flooded again, the community requested that the government provide more funds to relocate them (Kovacs et al., 2018; Lane, 2013, p. 29). In Anse au Sud, Quebec, after the destruction of a protective sea wall during a severe storm, the town opted to re-nourish their beach in order to further protect their boardwalk and nearby tourism and heritage buildings (Kovacs et al., 2018). Unlike Perth-Andover and Anse au Sud, the residents of Surrey, British Columbia (BC) eventually rejected the idea of a managed retreat as a possible approach for their coastal residents as they perceived it as too drastic (City of Surrey, 2018b; Kovacs et al., 2018). In Grand Forks, BC, managed retreat after a major flood in 2018 left affected residents disheartened and stranded when the government offered to buy out homes at their post-flood value (Smart, 2019). In Nova Scotia, recent cases of spontaneous dyke or berm failures in Hantsport and Big Lake prompted residents to demand improved land defenses from government rather than consider retreat (Sherren et al., 2019). Even where adaptation has been adopted, such conversations are always difficult as they represent a significant change from *status quo* ways of thinking about our power relative to that of the ocean.

3.3 **Methods**

3.3.1 Study Area

The province of Nova Scotia (NS) is a highly coastal jurisdiction in Atlantic Canada surrounded by three bodies of water, the Northumberland Strait on the north, the Atlantic Ocean on the eastern coast, and the Bay of Fundy on the west coast, and connected to mainland Canada by the Chignecto Isthmus. There are a variety of coastal

environments across the province from rocky and sandy shores to estuaries, cliffs and bluffs, and salt marshes. NS is increasingly vulnerable to climate change and sea level rise as the province is affected by isostatic rebound and subsidence due to glacial melt (Savard et al., 2016). This means that Nova Scotia is expected to have a relatively higher rise in sea level than other parts of the country and region (James et al., 2014). The NS coast and its residents are also at risk of increasing erosion, flooding, and storm surges as over 60 percent of the province's population of just under a million lives within 20 kilometres of the coast (CBCL Limited, 2009; Statistics Canada, 2017). Over 40% of the population is also considered rural, and as such, more at risk than urban populations to the effects of coastal climate change due to less investment in infrastructure, information systems, and institutions (S. J. Cohen, 2011).

Social dynamics also lead to increased vulnerability. NS is considered one of Canada's oldest provinces with 20 percent of the population being over the age of 65. As that percentage is expected to rise, there are growing concerns around how this aging, rural, population will adapt to climate change as they become more socially and place vulnerable (Rapaport et al., 2015). Increasingly, important infrastructure, assets, community design, and land-use planning enable older people to continue living in at-risk areas. Seniors have been found to be more reluctant to move than young people, and less likely to have the financial means to adapt or prepare for climate change (Greenberg, 2014). In Nova Scotia, social issues such as homelessness, poverty, addiction, and food and economic security are exacerbated by the fact that services meant to help aid the vulnerable are less likely to be utilized by those who need them (Karabanow, Naylor, & Aube, 2014). For these groups, sustainability looks different than it does in larger communities and cities where there is more capacity to address disparities and meet community needs (Andrée, Langille, Clement, Williams, & Norgang, 2016). Coastal Nova Scotia is also socially vulnerable due to its reliance on international and cruise ship tourism and summer residents to help boost the economy (Tourism Nova Scotia, 2020; Chesworth, 2016). These two economic sources are dependent on the maintenance of coastal infrastructure and an emphasis on the aesthetics of the

coastline with its history as one of the earliest European-settled places in Canada and thus known for its many heritage buildings, parks, and iconic views.

3.3.2 Focus groups

We held 14 online focus groups with 86 participants from coastal communities across Nova Scotia in June and July 2019. Participants were recruited through Narrative Research's Atlantic Omnibus survey and were required to be at least 18 years of age, a homeowner, live within 5 kilometres of the coast, and to have lived in their home for at least 5 years. People were excluded from the study if they or their family members work in coastal adaptation, climate change, and wetland fields. Our participants were predominantly older, with 70 percent over the age of 55, and 20 percent between the ages of 45 and 55, likely biased by the land-line phone recruitment and ownership constraints. Most of our participants self-identified as parents and had spent more than 10 years living in their community; nearly half identified themselves as being retired. Our participants were predominantly middle to upper class individuals with an average declared household annual income of between $65000 and $85000.

We chose to facilitate online focus groups due to the highly rural nature of coastal Nova Scotia. To get a distributed sample of coastal Nova Scotians to attend in-person focus groups significant travel would have been necessary for participants, presenting a practical and cost barrier. Not doing so would mean participants for any given location would likely all know one other. With the online focus groups, we were able to recruit a geographically diverse group of participants for each coast and focus based on coastal postal code and town/village listings. As part of our recruitment we chose to avoid cities and larger towns, like Halifax and Sydney, focusing on the smaller, rural communities in Nova Scotia. Participants were also able to participate from the comfort of their homes as they would with online surveys while still providing the nuanced discourse associated with in-person focus groups (Morgan, 1988). We offered a monetary incentive of $75 to our participants for their time.

Our focus groups were facilitated by Narrative Research using Adobe Connect to our design and participants were provided a one-time use link that connected them to their focus groups on their computers. Using an external facilitator had the added benefit of us being able to independently observe our participants and their responses during each focus group. Participants were also required to phone into the focus groups, rather than use a microphone on their computers, to provide clear audio for transcription purposes. We collected audio recordings of each focus group for transcription, results from a series of polls that were run to prompt the discussions (Figure 4), and a pre- and post-focus group survey done outside the focus groups to determine the effectiveness of the framing treatments on climax thinking. For this paper we will focus primarily on the audio transcriptions, which included discussions about the poll results (but not the poll results themselves).

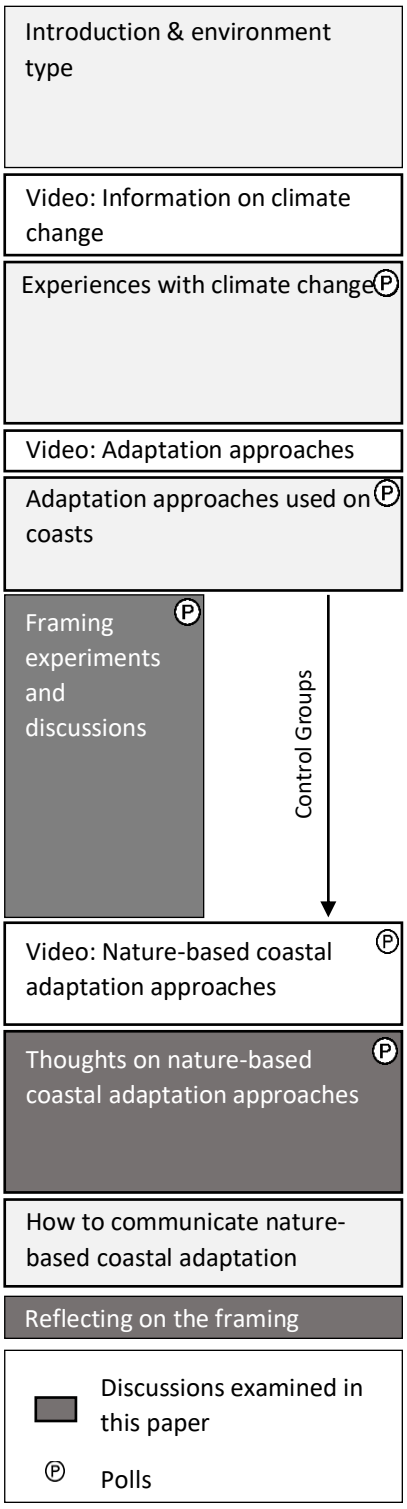

Figure 4. **Framing discussions in focus group design**

3.3.3 Focus group design

We separated participants by the coasts they live on and divided them into three experimental framing treatments (Past, Future, and Meaning) and a control per coast (the exception being the Bay of Fundy coast where extra Future and Meaning focus groups were held). Each focus group had between five and eight participants, ran between 75 minutes and 2 hours long and were separated into four main sections using a mix of polls and discussions. This did not allow time for every participant to answer every question in the facilitated conversations. In the first section participants were introduced to coastal climate change and the myriad ways it can impact the coast in a short video. From there we asked participants whether they had experienced any coastal changes and to provide us with examples of the coastal changes they experienced. In the next section participants were introduced to the most common coastal adaptation approaches and encouraged them to assess how they and their communities have responded to these changes and whether they felt the approaches being used were still effective. In these sections, participants were prompted with questions by the facilitator meant to encourage participants to respond and talk amongst themselves about these issues.

For the groups that included a framing treatment, the discussion then moved away from coastal climate changes. Here, we used question prompts to invite participants to collectively frame the impacts of climate change that they were seeing according to the designed framing treatments. Each was designed with a dimension of climax thinking in mind (Table 4). We avoided designing detailed framing scenarios for them to ensure authenticity and saliency of the content; none of the researchers are from NS, and in the process of developing the focus groups we learned that rural residents have very fine-grained sense of history and place. Instead, we let them do the framing for one another.

Table 4. Focus group framing question prompts informed by climax thinking dimensions adapted from Sherren (2020)

Dimensions:	Past	Future	Space/Place (Meaning)
Framing:	**This change is just one in a series of changes your coast has faced over time**	**The things you love about being on the coast will persist under adaptation.**	**We have faced big challenges together before and can do so again.**
Topics:	How has your coast changed for reasons other than climate change (e.g. infrastructure, economy) and how did that affect your community?	What do you love about this coast that you hope future generations will get to experience, and what is your duty to those future residents?	How did the residents of your community face wartime mobilization and what do you think made it possible for them to do so?

In the past framing, we asked participants to discuss whether their reasons for living on the coast had changed since they moved there and if so, why. Participants were also encouraged to talk about the ways in which their communities, the buildings, and infrastructure have changed and then prompted to discuss whether it is important to keep buildings and infrastructure where they currently are on the coast. In the future framing, participants were prompted to discuss what they like about living on the coast and the aspects of coastal living that they would like future generations on the coast to experience. They were then queried on whether they thought that current coastal infrastructure would continue to work for future generations. As a follow up to their responses, participants were asked if we should be making changes to our current coastal infrastructure for future generations or if we should adapt it for the current coastal residents. In the meaning framing, participants were asked to consider the ways in which their communities or families made sacrifices and changes for the early 20th century war efforts in Europe and what made it possible for those kinds of sacrifices and collaboration to occur even with the distance of the threat. We also asked if participants thought their communities were still capable of making similar sacrifices and changes today. Participants were encouraged to imagine whether they would expect their community to come together to help an individual who was affected by someone else's coastal decisions. The meaning frame concluded after participants were asked who they

felt should be responsible for paying for changes to coastal infrastructure and coastal protection.

After the framing or direct from discussions of categories of adaptation approaches for those in the control group (see Figure 4), participants viewed a short video about each of the nature-based approaches that can be applied in Nova Scotia's coastal environments and were given the opportunity to discuss their thoughts and concerns about them. Participants were polled after each nature-based approach was presented and then in a facilitated discussion after the video, were provided the chance to talk about which approach they most preferred or least preferred as well as why they thought that way. Next, we asked participants about what information they would need before implementing such nature-based approaches, and what they thought was the best way to introduce these approaches and the topic of coastal climate change to their communities. Finally, focus groups participants in framing treatments were asked what they thought about the framing discussions and whether they felt it was helpful to think about coastal changes in the given contexts in terms of the past trajectory, future needs, and meaning in sacrifice.

3.3.4 Analysis

The focus groups were transcribed using InqScribe and then coded using NVivo 12 software. We drew on the general inductive approach for our analysis (Thomas, 2006). The focus group transcripts were first coded deductively to the questions posed during the framing discussions, and to the nature-based coastal adaptation options being discussed and then inductively to participants' responses to the framing and perceptions about the nature-based coastal adaptation approaches. The responses to the framing questions were inductively coded into themes and sentiment where applicable. We compared the codes by gender, coast, and framing treatment using crosstabulations. We also deductively coded based in part on recruitment data. Matrix queries were also used to compare perceptions of each nature-based adaptation, and rationales for those perceptions, by framing treatment. As there was no evident difference in the effects

the framing had on preferences within nature-based coastal adaptation approaches—living shorelines options were overwhelmingly preferred—we focus here on the framing experience and how it seemed to influence overall openness to adaptation.

3.4 **Results**

3.4.1 What did the framing treatments comprise?

Here we discuss the results of the framing questions as participants answered them, as a way of understanding the experiences participants had and how consistent each framing treatment was between focus groups that used them. Later, we address how these frames influenced perceptions of climate adaptation urgency and nature-based approaches.

3.4.1.1 Framing coastal change in the past trajectory

Within the past framing focus groups, participants were typically initially a little confused by our question, "have there been any changes to buildings or infrastructure for any reason in the time you have lived on the coast?". Once we clarified that we were looking for them to identify changes other than those related to climate change, dialogue flowed better. Participants identified shifts in both population demographics and in seasonal population due to tourism. For instance, participants felt more "come from aways", that is, people not from the area or from Nova Scotia, and older individuals were moving in even as local youth were leaving in larger numbers than before. They also noted a change in industry and the economy in their communities. For some participants, abandoned wharves and buildings were a sign that their communities had migrated away from the fishing industry to another economic source though not necessarily a more profitable one. One participant mentioned the fact that traffic used to flow through their small town on the main road until traffic was redirected when the highway was built 16 years ago, affecting the stores and travel to the area. When asked if their own reasons for living on the coast had changed since they moved to the coast, none of the participants felt that their reasons had changed.

When asked about the importance of preserving the existing infrastructure and buildings on their coastline four main themes emerged (Table 5). Some participants felt that it was important for things to remain where they are for economic, cultural, and/or social reasons. A fourth theme of resignation or futility appeared as a contradiction to the other three. The economic reasons were that participants felt their communities rely on fishing infrastructure and wharves, coastal buildings and shops for tourism, and waterfront development to bring in business and encourage tourism growth. Culturally, participants were against moving existing coastal infrastructure because the buildings and houses are a large part of what Nova Scotia is known for and proud of. As one female participant on the Atlantic coast put it:

> I think Nova Scotia is you know hallowed ground. It's supposed to be the Ocean Playground [once written on NS license plates] and we don't want it the Ocean Wasteland and I think it's a big part of tourism and it's pretty along the coastlines and I think it would be terrible if we lost that… it's extremely important to generations too.

Table 5. Participant identified themes for the importance of preserving existing infrastructure and buildings on their coastline

Themes:	Important			Not Important
	Economics	Cultural	Social	Resignation/Futility
How important is it to preserve the existing buildings and infrastructure along your coastline?	Fishing infrastructure and wharves are livelihood	Buildings and houses are the pride of Nova Scotia	Provides a sense of community	Waste of money to preserve infrastructure
	Buildings bring in tourism	Moving heritage houses would impact families	Coastal infrastructure defines the community	Losing battle with nature
	Waterfront development attracts tourism	Houses on coast tell history of NS	Community history	Coast is always changing

Others were opposed to the idea of moving houses that have been there for generations due to the negative impacts it would have on the families that live there. The knowledge that some of the houses on the coast are very old and tell a part of Nova Scotia's history also made some of them feel like it is important to preserve the coastal infrastructure as it is. The social aspect of maintaining the infrastructure where it stands

is that it brings with it a sense of community. Many participants felt that the coastal infrastructure defines their community and tells the history of the community:

> …you know a lot of them are what you grew up with however I guess times change and it's somewhat important but I guess you know times do change and evolve and so that's kind of what you have to live with sometimes, that's the reality here, but — But, it'd be good to see some of those historic houses and that still remain. If you could find a use for them… Like any community it defines; this place goes here, you know. I can trace my ancestry back almost 250 [years] here so you're going back a long, long time, and your ancestors built this place up and now you see it kind of deteriorating and regressing in some ways so that's kind of sad. (Male Bay of Fundy participant)

Such responses were not uncommon among participants and closely ties the social importance of infrastructure on the coast to the cultural aspects. It is indicative of the predominant attitude within the past framing towards maintaining the coastal landscape.

A very small subset of participants did not oppose moving existing buildings as they felt that it was either naïve to believe things will stay where they are or a waste of money to try and keep things where they are because the coast is always changing and fighting nature is a losing battle:

> …I don't think that we should be putting money- or government money in particular into trying to save buildings from natural forces that we will never be able to defeat. In the case of infrastructure, a road might be changed to a bridge for example, if there was a significant amount of erosion, but in terms of buildings, if it's not sustainable for a building to be in an area then you know I would have a hard time saying well we should be sinking a lot of money into keeping that building there when there's so many other places where we should be putting money. And you can't fight nature, Nature's coming down on you, you need to get out of the way. (Female Atlantic Ocean participant)

3.4.1.2 Looking towards a future coastline

In the future framing, when we asked, "what aspects of living on the coast do you hope future residents will be able to experience?", participants needed to be reminded that we were not looking for them to think about future residents in terms of the potential effects of climate change as we had previously described to them, but just based on the aspects of coastal living they enjoyed as they do now. When asked what they enjoyed or

hoped future residents will enjoy about the coast, responses could be broken down into three categories: atmosphere, activities, and belonging. For atmosphere, participants talked about the sights and sounds, the breeze, and the general ambiance on the coast as something they hoped future generations would also get to enjoy. Activities consisted of hiking, walking on the beach, gardening, fishing, clamming, and other marine activities. These activities were things that participants enjoyed doing themselves but were also things that they considered to be part of the coastal living experience:

> … the quality of life of living in a small community, just being able to- the cleanness of the air and the sound of the waves and just being able to get out and walk on the beach. And I think it's just a quality of life but not, it's not for everyone but for people who enjoy it, it's priceless. So, I think there is a certain connection there with people who have been in a certain area or their families have been there for many, many years. And just the contentment that you know of living in a place where you just feel you belong (Female Bay of Fundy participant).

Participants often described that they would like the sense of belonging and community connectedness that comes with living on the coast to continue to exist for future residents.

As we moved participants along in this framing section, we wanted to know if participants thought their current coastal adaptation would work for future residents. In this, participants were unsure; many felt that over time their current coastal adaptation would cost too much money to keep up with climate change. This was connected to expressions that climate change is something that we cannot stop, only manage. There was also a sense from some participants that currently employed adaptation approaches were short-lived and would only delay coastal changes.

In this treatment a brief poll was implemented, asking: “Which is more important? Extending the life of current coastal protections and infrastructure locations for current residents, even if it increases vulnerability for future residents or adapting coastal protection and infrastructure now to reduce the vulnerability of future residents, even if it means change for current residents?”. In the subsequent discussion many participants

voiced skepticism that there could be effective coastal adaptation though they were somewhat hopeful a solution could be found. As a male participant in the second Bay of Fundy focus group explained:

> I said adapting for the future [was more important in the poll]. I mean it's kind of a hard question really but a lot of what we do seems to be only temporary, you know with the hard walls and all the stuff we were discussing before. And you know if we could somehow slow it down in the future you know I think that would be the best option.

Nevertheless, the majority believed that we do in fact need to adapt now to extend coastal living for the future, with a smaller number going even further than that, stating that if we do not start adapting for the future now it will be too late. But there were other minority opinions. A few participants were of the mind that we should focus on current residents, but they were generally agreeable with the idea that future generations should be considered as well. There was also a subset of participants who believed that it is expensive to try and stop coastal climate change and as such there is no point in talking about adapting. Another small group of participants believed that we already should have started to adapt for the future (i.e., it is too late).

3.4.1.3 Finding meaning in collective sacrifices

Unlike the other framing treatments, this framing did not speak to landscape changes; instead, the framing asked participants to consider the kinds of sacrifices their communities had made in the past for the greater good and think about whether the same could be said about the present. When prompted to talk about the kinds of war efforts and sacrifices their communities made during World War I and II, participants across all meaning focus groups initially hesitated before talking about their knowledge that many in their communities served in the war, did whatever needed to be done in their communities, rationed food and cared for others, worked in the coal mines, made supplies, fed people, or built homes for shipbuilders as their contribution to the war efforts.

When asked, "What made it possible for that kind of collaboration?", participants intimated that their communities were able to make these sacrifices because they were

small communities that had a strong bond. The majority also said it was because everyone in the community knew of someone who fought overseas. Many felt that there was a different mindset in communities during the World Wars, unlike today, which made it more automatic for people to collaborate and help their neighbours out of self-reliance rather than a reliance on the government. These participants likewise felt that the way people collaborated then was because the wars were a threat to life and country, and a call to arms greater than anything we have now.

Such responses presaged our subsequent question, “Do you think we would be capable of accepting similar sacrifices and changes today?”, with which a large majority of participants said yes. Their reasoning was that it is human nature to make sacrifices for others and that their communities are “all for one” communities with many examples of coming together to support individuals who are sick or in need, fundraising even by those who don’t have much to give, and volunteering for those in the community who need help. A minority felt that it is not possible for people to make sacrifices like they did for the World Wars if it was for something they cannot relate to. These participants gave examples of events happening on the other side of the world, people who “come from away” and move into their communities but choose not to get involved in community events, and the fact that in the media non-tragedies do not get the same sort of action that tragedies do. These answers suggest that it is where an ongoing sense of altruism and connectedness in these communities exists that also does a willingness to make sacrifices and changes for a good cause.

Another prompt asked, “Imagine one person’s or company’s property or infrastructure worsened coastal erosion for their neighbours. Would you expect to respond as a community in that case?”. Overall, participants felt that they would respond to coastal erosion on one person’s property as a community, especially if that person was not responsible for creating the problem. A female participant from the first Bay of Fundy focus group demonstrated, however, that you cannot rely on just your neighbours for support:

> I think that if it was affecting your property or something and the person that put it in didn't seem to be all that interested in doing something about the problem and that yes, I think others would come to your assistance. But again, it would be a matter of if the community is not going to be able to do anything for you because in a case like that what can they do really? It would just be a matter of getting through to your MLAs or whoever is in charge of your roads, the shoreline stuff, stuff like that anyways, getting hold of them and telling them what the problem is.

Others, like this male participant on the Atlantic coast, indicated that depending on the situation they would respond as a community. For these participants responding as a community was also contingent on whether the individual causing the worsening erosion took responsibility for their actions and made changes to rectify the problem:

> … I think it depends on the situation. I think if an individual is doing something to purposefully and wilfully – that is affecting the coastline – I think people are going to be not hesitant in the time of his need, like if something does happen people are still going to pitch in and help and try to get him back on his feet. But they're going to expect him to make changes to what he's doing, not continue on the way that he is. I think they'll still pitch in.

Even as our participants were mostly willing to respond as a community to coastal erosion on one's property, they made it clear that there is an expectation of taking responsibility and ownership when it comes to the source of the problem.

When asked whose responsibility it is to pay for changes to coastal protection and infrastructure due to sea-level rise, the predominant response was that the responsibility lies with all levels of government. Participants emphasized the fact that in some cases municipal governments must rely on provincial and federal governments for the funds to adapt to coastal changes. There was a consensus among participants that we ought to have included the private sector and companies as a group they could have chosen. They felt that those in the private sector that have a hand in adding to climate change should be responsible for dealing with the coastal changes that result. For example, a male participant on the Northumberland group said:

> Well, they [companies] can be [responsible], yes. It is the case in our area that's for sure. And I know in the south shore mining companies and so forth are causing quite a few problems, so yes, if they are causing the issue, whether it's land-based or whatever they should be part of the solution as well.

There were those who believed that it should be a group effort including individuals from all suggested groups: government, NGOs, affected residents, community groups, and owners of future builds. They felt that in some cases the responsibility starts with the government allowing people to build in at-risk areas and those people not taking precautions on the coast. As coastal changes affect both public and private property their belief was that involving everyone and holding them responsible would help in finding a solution that works.

The final question we asked meaning-framing participants was about how coastal residents could take responsibility for responding to coastal changes. Participants suggested that coastal residents "spark awareness" of the effects of coastal changes in their communities and pay attention to the changes. They also felt that by avoiding building in problematic areas residents could take responsibility.

3.4.2 Consistency of stories across frames and coasts

Allowing the focus group participants to shape the framing in response to prompts means that, as researchers, we lose control of consistency. We acquire authenticity, but at what cost? The stories elicited by the facilitated framing varied somewhat across instances with some coasts focusing on different parts of the discourse and having different reasons for their responses. Within the past framing, for instance, the Northumberland group stands out from the other two coasts in that the stories elicited from the framing were different. Participants in this focus group were very concerned about the tourism and economic effects of coastal adaptation rather than the effects of climate change, which is perhaps caused by the relatively recent subdivision of coastal farm lots there for cottage use. From the tone of the focus group one could sense that they were not very interested in adapting to climate change before they had to. Apart from the focus on tourism and economics in the Northumberland group, the past-framed focus groups all told much the same kinds of stories.

There were a few differences in the future framing, with the second Bay of Fundy future-framed focus group being more concerned with how different the coast would

look if it was adapted for the future generation and less concerned about impact on future generations as a whole. Despite that, they still felt that adapting to coastal changes is something owed to future generations. There was one prominent participant in this Bay of Fundy group who disagreed with the others because he was thinking about how it would directly affect his children and grandchildren:

> You know, a lot of people and I think that's what they're doing, they're saying 'hey well you know what I'm 60 years old, 50-60, it ain't going to affect me in 20 years, I won't be here, so. A lot of people have different thoughts but for me you know I have children I'd like to see them enjoy the ocean, the coast and you know have a safe place to live in the future so I'm optimistic that hopefully we can find something. And we should try instead of, you know, not trying, so that's my opinion.

The first Bay of Fundy future focus group was more concerned about future generations and how they would support themselves if they stayed, citing many generations of living on the coast and feeling like it was important to be able to pass that on. Conversation within the framing for this group was influenced by two of the participants recognizing each other's voices and telling stories from their own community. By contrast, the Northumberland and Atlantic future focus groups had very similar discourse throughout the framing section. This would suggest that the future framing was successful in eliciting similar perspectives across coasts.

In the meaning framing, stories were consistent between focus groups as participants shared stories of how their communities had come together in war efforts and gave similar examples for how they come together now. There were differences in how they thought their community should react today, with a strong justice and responsibility story appearing in all groups but quite prominently in the first Bay of Fundy focus group and the Atlantic focus group, while a sense of community/collaborative response still appeared in the other two focus groups. The Northumberland and Atlantic Focus groups believed the wartime mobilization framing to be "apples to oranges" (this was a response elicited outside of the 'treatment' section when we asked people what they thought about the frame) in comparison with climate change while the first Bay of Fundy group found aspects of it to be useful. Despite these differences in opinion about

the meaning frame, the majority of participants were understood the framing and responded positively to it.

3.4.3 How did framing influence discussions around the need for changed approaches on the coast?

The discourse around adapting to coastal changes intimates that the majority of participants did not yet feel the issue was urgent, but this did vary somewhat by treatment. Participants in the past-framed focus groups talked about change as something that is inevitable and part of coastal living. They were not overly concerned about the impacts of climate change on their coasts, in one focus group even going as far as to refer to coastal Nova Scotians as "resilient". There was also a sense that talking about past changes reminded participants that past attempts at protecting the shore have not always been successful and, as such, it may be futile: i.e. there is no point in worrying about the future because adaptation measures will not make a difference.

When the majority of past-framed focus group participants were concerned about the coastal changes underway, heritage and tourism were usually the rationale, but these concerns were again tempered by the expressed idea that we are already doing everything we can. A subset of these participants seemed to feel they should not be concerned because the major effects of climate change will not have an impact on them. For instance, a highly vulnerable male participant in the Bay of Fundy past-framed focus group said:

> … I know that if, you know, if the tide rises, well not much we can do about it but if the tide rises a metre, I'd have 2 ft of water in my living room but, I have good faith in what we have so far, I think we're protected... I also chose to live this close to the water, and it's been here for, well, not my house but the property itself has been there for a long while. I'm hoping to get a, you know, a couple hundred years more out of it… Well, I can walk off my front deck, take 3 steps and jump in the Bay of Fundy. Also, on a real high tide, the tide is actually probably a little higher than my main floor, so I rely on the walls, the wall that I have out in front and all around property to protect it.

Counter to those participants, there were participants particularly in the Northumberland past-framed focus group who were in fact concerned about the

impacts of climate change and believed that change needs to be made, but these participants felt that the next generation should be the group to champion it.

In the meaning-framed focus groups it was evident that participants were aware of the need to change and adapt and were mostly willing to make that change. Participants used language like “come together” when describing ways in which their communities have worked together towards a common goal, with examples about fighting wastewater and fish farms. There was a sense from participants that in moments of clear need people could be spurred into action. The ways in which participants referred to the nature-based approaches suggested that they were concerned about making responsible and positive change as opposed to making change simply to protect what they currently have. They made references to being optimistic about the potential to adapt to climate change with phrases like “if we could do it collectively” referencing their belief that as a community they could make a difference and work towards a solution for coastal climate change. On the other hand, the majority in these meaning-framed focus groups felt that the threat of climate change was not imminent enough to the majority to “rally the troops” for a mostly unacknowledged, and distant threat. The echoing of military language suggests that the framing discourse may have been more relevant to participants than they realized.

The future-framed focus groups also featured more urgent language around the need for change, with the majority of rationales echoing the treatment. A male Northumberland Strait participant said, “I think there's an old saying that says, this is not our land, we don’t own it, we’re just borrowed it and we should leave it how we found it”. This quote is characteristic of many participants in the Northumberland Strait future-framed focus group as they appeared to be conscious of the trajectory of coastal risk and the need for change. The Northumberland future-framed group conveyed an understanding of the urgency of adapting but aligned strongly against the idea of wasting time on measures that may not last. This strong response against time-wasting measures did not consequently mean that they advocated for adapting as soon as possible. The two Bay of Fundy future-framed groups responded similarly to the urgency

question. While many participants did not necessarily see changes in the handling of climate as urgent, they did see it as something we do need to try and work towards solving for future generations even if their coast ends up looking different than the present coastal landscape. In the first Bay of Fundy future-framed group the majority of participants were of the mind that we have to make changes so that future generations can live like the current generation does, with one female participant saying:

> … in order to allow people to continue to live the way that we do… it's going to be a huge expense but if we don't make those adaptations and protect that infrastructure now, then that just means that in the future those communities are going to begin to disappear because people won't be able to have a livelihood there… But if we don't act now, we're going to be faced with a much bigger problem in the future.

The Atlantic future-framed focus group participants were the most concerned with the need to adapt soon. One of the female participants in the group put it this way: "I definitely think we have to do something now because we can see the changes and they're coming fast. And if we don't do something now it's going to be too late." The commonly repeated reactions of future-framing participants suggest that we were able to emphasize the time-sensitivity of adapting to climate change

We could not find a tone of urgency in our control groups even though participants talked about major infrastructure, like main roads, being impacted. Recall that the control groups received only factual information about climate change, its impacts, and adaptation options. The exception was in our Northumberland Strait control group where one individual felt like it was already too late to be responding to coastal climate change and that we should start making changes immediately. Overall, the control groups were not evidently interested in coastal adaptation except to protect existing coastal infrastructure and shoreline locations.

3.4.4 Participants thoughts about the use of these framing approaches

At the end of the focus groups we asked participants what they thought about the usefulness of the framing they had received for talking about coastal changes. In the past framing, participants felt that talking about future coastal changes in relation to

past changes was important because the history of the community and its changes are relevant. Those who answered the question also felt that the past shows the resilience of the community and is important for avoiding past mistakes in future development. The future focus group participants felt that thinking about climate change in relation to the future and future coastal changes was particularly important for the next generation emphasizing that we "owe it" to future generations and should not shortchange them. The meaning-framed focus group participants did not believe that it was helpful to think about coastal changes in the context of sacrifices from the World Wars. Several described the comparison as "apples to oranges" because of the scale of war and said they would not be willing to equate war to climate change. One participant did feel that coastal changes and the risks they bring need to be equated to something as drastic as war to spark action, and a few others described the violence of storms they had experienced like the Groundhog Day storm of 1976. As noted above, some participants in the meaning framing did unconsciously echo the language around 'rallying troops' in a way that suggests that there was some efficacy in the treatment.

3.5 **Discussion**

The outcomes of having participants talk amongst themselves within the facilitated framing discussion elements suggests that it is possible to collectively generate a useful and reliable framing experience. The contents of the framing discussions were relatively consistent, recognizing the inevitable variations of personality. Participants responded to the framing used in the focus groups and demonstrated differences in how they subsequently responded and reflected on the need for coastal adaptation as a result. While the conversations during the later parts of the focus groups seemed to vary by framing treatment, not all treatments increased the sense of urgency for change and little difference was evident in the specific coastal adaptations preferred between treatments. These differences are described further below.

The meaning framing appeared to be a little harder to self-apply and participants took longer to immerse themselves in it possibly due to how removed an event like World War II is from the present day; this suggests that there was potentially a saliency issue.

In Canada, it is not common that climate changes are talked about using such militarized or warlike terms, unlike in the United Kingdom where these kinds of descriptions have been a frequent part of how the media talks about urgency related to climate change since the 1980s (M. J. Cohen, 2011). This aligns with Kester and Sovacool's (2017) stance that using war to mobilize against the threat of climate change is polarizing and as a frame may be interpreted negatively due to its militarization regardless of whether one considers climate change to be a threat. Using wartime language may bring to mind images of World War II and the extreme lengths countries went to fight it, as well as a stark sense of urgency that Bartels (2001) suggests is precisely what is needed for climate change to bring its effects into the spotlight. Delina and Diesendorf (2013) argue that wartime mobilization may work as a policy model for complexity of climate mitigation however the efforts associated with it (e.g. conscription) may also be seen as a threat to democracy and should only be taken as a suggestion of how to bring about change.

Participants in the past framing focus groups reacted to the nature-based options presented by considering the expense of the approaches as well as their success as reasons to protect and defend the life of their current coastal infrastructure. They sought to resist change through the most effective means and their tone was hesitant about newer approaches to adapt to coastal climate changes, even changes that they felt were inevitable. Their reasons for resisting change carry a lot of weight as coastal adaptation has the potential to disrupt the economic and cultural stability of their communities. It is understandable that some might be reluctant to adopt newer approaches to coastal adaptation as the decision to adapt can be complicated for those who live on the coast. This resistance to change suggests that the framing may have encouraged an aversion to change and adapting by reminding people of what they have already lost on the coast; in other words, it is possible that past-framing reinforced the status-quo bias that we were hoping to challenge. It has been argued by Gal (2006) that such *status quo* bias is a naturally occurring inertia whereby one's initial preference is to avoid change unless necessary or provided with reason enough to change. Morton,

Rabinovich, Marshall, & Bretschneider (2011) argue, consistent with this, that focussing on losses in a framing will increase uncertainty and decrease an individual's likelihood to engage in pro-environmental behaviours. While our participants in the past framing were less likely than the other framings to engage in discussion of the potential of nature-based approaches for adaptation purposes, they were also less concerned than other framings with the potential long-term success of the approaches. Our past-framed focus group participants felt a sense of duty toward past landscape use and expectations of maintaining the coastal heritage which Eaton, Hinrichs, and Burnham (2020) refer to as a "moral obligation" to previous generations regardless of current landscape needs.

A key theme in the discussions prompted by future framing was thinking about the long-term effects of adapting. These participants were more open to thinking about the future and making changes to prepare for the future they envisioned, even if they would not be the beneficiaries. This fits with Beaulieu et al.'s (2016) findings that asking participants to describe what they want the future to look like may increase support for action towards it. It also suggests that thinking about long-term effects is something that is tied into intergenerational equity, and the responsibility to the next generation: our participants' statements about the long-term were mostly regarding their children and future generations. In asking participants to think about what they wanted future generations to experience or enjoy about the coast, intergenerational equity can be conceived of as a legacy passed on by the current generation for the well-being of those to come (Hurlstone, Price, Wang, Leviston, & Walker, 2020; The Long Time Project, 2020). The sentiment expressed in the future-framed focus groups that change needs to happen quickly to secure the coastal lifestyle for future generations suggests that there is willingness to take responsibility or compromise for the benefit of those to come (Wood, 1996). Cooper and McKenna (2008) similarly caution against focusing solely on solving the effects of coastal climate change for the current generation as it disregards the consequences of unsustainable actions on future generations who are left to carry the burden. We saw this demonstrated in our own focus groups where our participants

in the past framing were more inclined to discuss the more immediate benefits of nature-based adaptation on their coasts whereas our future framing participants were able to consider the possibilities of adapting to reduce climate vulnerability for themselves and for future generations who cannot voice their opinion at this moment.

In the future-framed focus groups, there was also evidence in the discourse of environmental and social systems thinking. Rather than thinking just about how adaptation can protect the shoreline as the control group did, they expressed questions about "'what is' and what 'ought to be'" in relation to the environmental impacts of coastal climate change as it stands, and as it has been projected for 2050 and 2100, which are key questions in the heuristics of systems thinking (Eelderink, Vervoort, & van Laerhoven, 2020, p. 16). In considering the economic aspects of their communities alongside the physical and social, participants of the future-framing often identified potential problems to successful long-term adaptation and determined that they all need to be addressed holistically. This type of systems thinking, in which participants thought about the whole, is necessary to developing appropriate and effective communication and adaptation strategies (Eelderink et al., 2020).

The meaning framing focus groups revealed that participants were aware of the barriers to adaptation that others in their community may have and predominantly looked at adapting to coastal climate change from the lens of how each approach would affect the whole community. Unlike the future-framed focus groups, the meaning-framed groups focused primarily on the socio-economic aspects rather than the long-term impacts to the environment. This suggests that the framing evoked a deep sense of empathy, responsibility, and intragenerational equity. Our findings contrast with Davydova, Pearson, Ballew, & Schuldt (2018), who found that there is a greater sense of collective control (or belief that something can be done collectively to mitigate a threat), and perception of a threat from climate change, when emphasis is placed on the responsibility of government in both contributing to and mitigating climate change effects. Our meaning-framing participants tended instead to believe that all groups should be responsible for adapting to climate change, mirroring Berke and Lyles' (2013)

categorization of climate change as a risk that is distributed amongst the public. Recognizing that not everyone has the ability to adapt, or the same capacity to adapt as our participants did, is an important part of garnering acceptance and support for shared climate adaptation (Hamilton & Mallon, 2015). There are those in coastal communities who simply cannot afford to adapt and who may not be given a choice either due to the impacts of climate change or due to a lack of consideration in the adaptation process (Padilla, 2002). Intragenerational equity is closely tied into social and ecological justice. Nova Scotia has an income gap between rural and urban areas and those who live in rural areas have a greater chance of living in an older or poorly maintained home (Saulnier, 2009). For these individuals to be able to adapt, services must first be put in place to address the equity concerns while also being sure to address the environmental concerns associated with climate change. Our participants' responses to fellowship in wartime mobilization efforts, and references to being close-knit communities, suggest that from within their sense of responsibility and empathy they have found ways to bridge the gap for each other as a community where services are lacking.

Of the three framing treatments, framing coastal climate adaptation in terms of the future worked best. It seemed to instill a sense of urgency for coastal adaptation the other two frames did not. It was also better received by participants than the meaning frame while having rather similar results. The future frame also appeared to be more salient than the meaning frame for climate change due to its personal relevance for our participants, the majority of whom identified as parents. In examining the effectiveness of the climax thinking dimensions as frames, it is necessary to note that two of the three frames performed as the framework intended by successfully instilling a change in the way landscape changes were understood, and a willingness to adapt. This suggests that there are benefits to encouraging the use of this framework within climate adaptation communication and as communicative frames; however, the framework needs to be adapted for such use since the past framing worked counter to intentions.

3.6 **Conclusion**

We tested three experimental framing treatments that examined the effectiveness of specific frames on discussions of coastal adaptation using 14 online focus groups. The framing treatments were intended to improve public saliency of climate adaptation and landscape change discourse. In facilitated discussions we encouraged participants to collectively generate a framing experience determined by the dimensions of climax thinking: past trajectory, future responsibility, and meaning in sacrifice. Understanding the most effective framing for encouraging support of nature-based coastal adaptation is important for anyone seeking to implement these kinds of approaches as a response to coastal climate changes. Results indicate that a future-framed approach may effectively promote a sense of urgency, understanding, acceptance, and support for coastal climate change adaptation when compared to the meaning and past framings. Past framing encourages adaptive measures to maintain the present landscape settings as opposed to a more flexible approach, and the meaning framing lacked a sense of personal relevance for participants due to how long ago the World Wars took place. Our results suggest that consideration of inter/intragenerational equity highlighted in the dimensions of climax thinking should be encouraged in effective framing as it may prove to be a successful way to communicate the necessity of coastal climate adaptation within a community. Highlighting past changes is likely to increase resistance to move.

Municipalities and governments should consider introducing plans for coastal adaptation within a future-framed approach in order to encourage support and acceptance from community members and residents. Municipal planners can incorporate community members' opinions on climate adaptation and the kind of legacy they want to leave for future generations into plans for adapting to coastal climate changes. Including coastal residents in the decision-making process is a management strategy that will allow planners to identify areas of concern for the community that may otherwise go unaddressed and adopt a more holistic approach to climate adaptation initiatives that will encourage future support for similar initiatives. For policy

such as Nova Scotia's Coastal Protection Act the knowledge that a future-framed approach promotes a sense of urgency and inter/intragenerational equity would allow for the act to provide effective information and directives for actions that coastal communities can make toward coastal adaptation.

One limitation of this study is that we may have primed our participants to prefer the living shorelines approach by dedicating the most time to that group of approaches which in part limited our ability to identify the effects of the framing on the perceptions of the approaches. Our study is also not a representative sample of Nova Scotians due in part to the requirement that participants be homeowners, and the phone recruitment. Likewise, as our participants predominately identified as middle to upper class individuals, they are not representative of rural Nova Scotia or vulnerable coastal populations. As the impacts of coastal adaptation affect more than just coastal homeowners it is important to gain a more representative perspective so as to address the issues of equity that our participants noted and is supported by Dow et al. (2006). It is equally as important to consider the perspectives of younger individuals who may feel more invested in the outcomes due to their age and the potential long-term impacts of adaptation decisions on their lives. Social media may be a viable way to engage such demographics. We were also not able to follow up on participants to determine if the framing effects were long-lasting.

It would be useful to do a larger framing study looking at Atlantic Canada rather than just Nova Scotian coasts to understand whether the perspectives elicited from the focus groups are due to cultural/social factors in Nova Scotia or as a result of the framing prompts. A longitudinal set of focus groups or survey in the region would serve to provide policy makers and planners with a reference for future adaptation projects to understand how perspectives change with the framing throughout the adaptation process.

Chapter 4: Conclusion

Effectively communicating the need for coastal climate adaptation is a crucial part of responding to climate change risks. As increasing coastal risk in Atlantic Canada threatens the economic, social, and physical structure of the coast, it is necessary to understand how communities understand coastal climate change and what they perceive as the best way to adapt (Lieske et al., 2014). Since framing is a commonly used facet of climate communication, understanding the most effective frame is important for encouraging action as opposed to reaction. Successfully framing climate change communication for coastal residents in Nova Scotia provides an example for other provinces in Atlantic Canada on how to make coastal adaptation a salient, and relevant concern for coastal communities. This study aimed to understand perceptions of coastal climate change and nature-based adaptation, testing three communicative framings to understand how to increase support and acceptance of coastal adaptation and prompt action.

Fourteen focus groups were held with 86 participants across Nova Scotia's three coasts. These focus groups were divided into 4 groups: control, past framing, future framing, and meaning framing. Participants' personal experiences with the effects of coastal climate change and their descriptions of the effects indicate that the existence of coastal climate change is generally agreed upon. Results suggested that participants and their communities are aware that current adaptive measures on their coast are not as effective as they once were or are simply nonexistent. Recognizing this, participants were more inclined to perceive the nature-based approaches presented to them as a potential solution to their coastal risk problems so long as they could be proven viable and cost-effective.

The stories participants shared with each other during the framing discussions were similar across like-framed focus groups and between coasts. We determined that as there were no significant differences between focus group participants' responses within each framing experiment that participants were able to collectively frame for one another given facilitation. Results suggest that the framing experiments did not affect

participants' perception of which nature-based approaches was most preferred: across all focus groups that was living shorelines. The framing narratives were determined to have had an influence on how open participants were to the need to adapt. The future frame and meaning frame narratives prompted more urgent language from participants around adapting and were more open to the idea of that adapting to climate change is an urgent matter than the past frame and the control group. On the other hand, the past framed groups were more inclined to choose approaches and an adaptation pace that allowed them to maintain the *status quo* on their coasts.

This study has several limitations that stem from the recruitment method and requirements. As Narrative Research recruited our participants through their omnibus landline phone survey, very few participants recruited were under the age of 35. We supposed this is because younger individuals are less likely to pick up their phones for unknown callers. This age range may have also been affected by the coastal homeowner requirement as younger individuals are more likely to rent their residence as opposed to own it. A result of the homeowner requirement is that this study is not a representative sample of coastal or rural Nova Scotian residents and, as brought up by our participants, it is important not to generalize their thoughts on nature-based approaches to the rest of the province. It is important to consider the differences between age categories and how differently they might have perceived the need to adapt. Older individuals may be more willing to make more ecological changes than younger individuals as a result of having more experience and knowledge (Otto & Kaiser, 2014). They may also, however, be more attached to their home places as a result of long occupation. We could not differentiate between the perceptions of year-round residents and those of summer residents when seeking to understand how they perceived coastal climate change and the efficacy of coastal adaptation; a small minority of participants identified as summer residents and did not speak to this issue. This study did not directly recruit Indigenous participants, though it is possible that some of our participants may have personally identified as such. We acknowledge that by not purposefully including these important groups, there are different perceptions that are not included that likely would have

changed the results of the study. Likewise, this study did a surface level analysis of participants' perceptions of nature-based approaches focusing on their perceived feasibility as opposed to an in-depth analysis of their understanding/assessment of the approaches. There are also limitations to using focus groups as opposed to in-depth interviews in that not every participant was able to answer each question and we were not always able to provide clarification for participants due to the use of a focus group facilitator. Our participants did not always have the opportunity to provide their opinion for each question due to the group setting and time constraints; however, this limitation is offset by the potential challenge of testing these communication framings in an interview setting.

Coastal climate adaptation must take a more nuanced approach that takes care to recognize the constraints that coastal residents may experience when trying to address coastal risks. It is important to consult a diverse group of community members, ensuring that the need for coastal adaptation and the various adaptation approaches is communicated in a manner that leaves room for questions, alternative perspectives, and is sensitive to the cultural and social aspects of coastal communities. Research needs to be done into the utility of these framings in other parts of Atlantic Canada and beyond. This will determine how effective the future and meaning frames can be when used for a larger geographical area and whether there is an aspect of place that impacts how such devices are perceived. Effective framing will allow researchers, municipalities, and planners to fine-tune coastal adaptation communication so that it works towards their goals, increases acceptance and support, and helps to mitigate coastal risk. As climate risks increase, finding the most efficient way to communicate the need for adaptation will be vital to effecting positive and preemptive climate action in these communities.

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Appendix A Focus Group Guide

2019 NRCAN Coastal Adaption Focus Groups

Moderator's Guide

DATE: GROUP NUMBER: REGION:

FRAMING OPTIONS:	ATLANTIC	NORTHUMBERLAND	BAY OF FUNDY	
A. PAST LANDSCAPE CHANGE	GROUP 1	GROUP 5	GROUP 9	
B. FUTURE LANDSCAPE	GROUP 2	GROUP 6	GROUP 10	GROUP 13
C. MEANING IN CHANGE	GROUP 3	GROUP 7	GROUP 11	GROUP 14
D. CONTROL (NO FRAMING)	GROUP 4	GROUP 8	GROUP 12	

NBCA OPTIONS:	ATLANTIC	NORTHUMBERLAND	BAY OF FUNDY
OVERLAND FLOW MANAGEMENT	X	X	X
LIVING SHORELINES	X	X	X
DYKE REALIGNMENT			X
ACCOMMODATION	X	X	X
RETREAT (PRECAUTIONARY)	X	X	X

Introduction 5 minutes

SLIDE 1

- Welcome: Introduce self and function of a moderator

- Topic: Today I'd like to explore your thoughts on some ideas for coastal adaptation methods due to rising sea levels.

- Length: Discussion will last about 75 minutes.

- Explain process: Net*focus* group (online, real-time); observation (if applicable); audio taping; all opinions are important; no right/wrong answers; need to understand agreement/disagreement; talk one at a time; please state first name before you talk so I know who I'm hearing from and to help when we review the recording.

- Confidentiality: Individual comments are confidential/anonymous; no names in report; please refrain from stating or typing your full name

SLIDE 2

- Participant Introduction: First name, which type of coastal environment you live in, and how long you've personally lived on the coast. SCREEN TO SHOW IMAGES OF COASTAL ENVIRONMENT TYPES WITH LABELS.

Context 10 minutes

SLIDE 3

To start things off, I'd like to show you a short video that outlines some information about climate change and the issues we're facing here in Nova Scotia. Please hold your thoughts as you watch the video. At the end, I'm going to display a poll on screen for you to complete individually. After everyone has submitted their answers, we'll discuss as a group, so please hold your thoughts until then.

MODERATOR TO SHOW 5 MINUTE VIDEO (CONTEXT WITH NARRATION.MP4)

SLIDE 4

1. POLL: Have you noticed any changes to sea levels and storms on your coast since you've been there? Yes/No

- IF MANY YESES: What changes have you noticed over the years?
- IF MANY NOS: What have you heard from others in your community about changes to your coast?
    - If applicable: What do you think is causing those changes?

Initial Thoughts on Options 15 minutes

SLIDE 5

I'd now like to talk about broad categories of coastal adaption options to give you some background.

MODERATOR TO SHOW 5 MINUTE VIDEO ON OPTIONS (PRE-CONTEXT APPROACHES.MP4)

SLIDE 6 & 7

2. POLL: Which of these options is currently being used on your part of the coast? (Choose all that apply)

- Which of these options is currently being used on your part of the coast?
- Have you noticed places where existing protection on your coast is no longer being effective?
    - What gives you that impression?
- Do you feel that your coastal property is at increased risk compared to ten years ago because of coastal changes like these?
- What do you think your part of the coast would look like if the sea-level rose by 1 meter?
    - How, if at all, would your property be impacted?
        - Would you need to make any changes to your property?
        - What about your neighbours?
    - Can you think of any properties in your area that would be impacted?
        - What about your neighbours/friends/ family?

OPTION A. Framing - PAST 10 minutes

SLIDE 8

Looking to the past, I'd like to talk a bit more about your experience living on the coast.

- Have your reasons for being on the coast changed over time?
    - If so – how?
- How have the buildings and roads along the coast in your community changed over time for any reason, not just sea-level rise? *(Probe for: infrastructure, local economy, tourism, cottages, depopulation, etc.)*
    - How, if at all, has your community changed because of coastal threats over the years? *(Probe for storms)*
- What have you heard from older people in your community about changes over time along the coast?
    - What is your reaction to hearing those stories?

SLIDE 9

3. POLL: How important is it to preserve the existing buildings and infrastructure along your coastline? *(LIKERT SCALE)*

- How important is it to keep things the same along the coastlines for those who live and work there currently? Why/Why not?

OPTION B. Framing - FUTURE 10 minutes

SLIDE 8

Looking forward, I'd like to talk about your expectations for how things might change in the future.

- What aspects of living on the coast do you hope future residents will be able to experience?
    - Do coastal threats like sea-level rise pose a threat to those aspects of coastal living? How so?
- Do you think our current approaches for dealing with coastal threats will work well for future residents? Why/Why not?
- What should we do if we learn that our current protective measures will not be effective for the long-term?
- Do you hope future generations of your family settle in your coastal area? Why/Why not?

SLIDE 9

3. POLL: Which is more important – choose one of the following:

a. Extending the life of current coastal protections and infrastructure locations for current residents, even if it increases vulnerability for future residents
b. Adapting coastal protection and infrastructure now to reduce the vulnerability of future residents, even if it means change for current residents?
c. Don't know

- Do we need to change how we manage coastal threats today to reduce the impact of rising water levels on future residents? Why/Why not?

OPTION C. Framing - MEANING 10 minutes

SLIDE 8

I'd now like to shift gears a little bit and talk about some instances in the past where people have had to make major changes to deal with significant events.

- As you may know, many rural communities in Nova Scotia made sacrifices to support the war efforts in Europe. What, if anything, have you heard of that your own community or family has done?
- What do you think made it possible for such sacrifice and collaboration to occur, given the distant threat?
- Do you think we would be capable of accepting similar sacrifices and changes today? Why/Why not?
- In what ways, if any, does your community work together to achieve common goals today?

Now turning back to the concept of sea-level rise…

- Imagine one person's or company's property or infrastructure worsened coastal erosion for their neighbours. Would you expect to respond as a community in that case? Why/Why not?
    - Should we respond as a community in such cases to support those who are more affected or vulnerable?

SLIDE 9

3. POLL: Who should pay for the coastal protection and infrastructure changes required due to sea-level rise? *(Multiple response options: Government, current taxpayers, future taxpayers, community groups, affected residents, non-government organizations, future residents).*

- Whose responsibility is it to respond to coastal changes due to sea-level rise? *Probe for: Government (which?), taxpayers, everyone.*
    - Who else?
- In what ways could coastal residents take responsibility for responding to coastal changes?

Regional NBCA Options 30 minutes

SLIDE 10

Now moving to some nature-based options for dealing with coastal changes. I'm going to present a few different nature-based methods for your particular coast and I'll get your feedback in a quick poll after we review each. Please hold your thoughts while we're reviewing the options, as we'll discuss altogether as a group afterwards.

MODERATOR TO SHOW 5 MINUTE VIDEO ON OPTIONS (OPTIONS_ATLANTIC/NORTHUMBERLAND COAST.MP4)

SLIDE 11

4_1; 4_2; 4_3; 4_4 POLL – TO BE ASKED AFTER EACH OPTION: To what extent do you support or oppose this coastal adaption option for your coast? (5-pt. scale)

SLIDE 12 & 13

5. POLL – TO BE ASKED AFTER ALL OPTIONS SHOWN: Which option would you most like to see for your coast?

SLIDE 14

- Do you think any of these options could work in your coastal area? Why or why not?
    - Which would you most like to see?
    - Why is this option most acceptable to you?
- Which would you least like to see?
    - What, if anything, would make you open to using them?
- What information would your community need before implementing such changes?
- How does it feel, as a coastal resident, to be having conversations about sea level rise?
- Did you hear anything that bothered you?
- What do you think are the best ways to talk to citizens about the more dramatic options, such as retreat?
- DO NOT ASK IF CONTROL GROUP: Before these specific options were presented, we asked you questions that may have seemed unrelated to sea level rise. Do you think it's helpful to think about possible future coastal changes in the context of [SELECT ONE, AS APPLICABLE]?
    a. past changes already experienced on the coast

b. responsibilities we have to future generations
c. previous ways that society faced big challenges, like wartime

Thanks & Direction to Post-Survey: 5 minutes

SLIDE 15

That's all my questions. To finish up, I'm going to send you a link to complete a 5-minute survey now. Once you submit the survey we'll receive a notification that you've completed it and we will process your incentive.

MODERATOR TO SHARE SURVEY LINK IN CHAT BOX WITH PARTICIPANTS

Thank you for taking part in our discussion. You'll be receiving your incentive within the next 2 weeks.