EXAMINING THE DYNAMIC RELATIONSHIP BETWEEN CLIMATE CHANGE AND TOURISM: A CASE STUDY OF CHURCHILL'S POLAR BEAR VIEWING INDUSTRY

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Abstract

The purpose of this thesis research was to examine the dynamic relationship between climate change and tourism, with a direct focus on Churchill, Manitoba's polar bear viewing industry. This unique tourism industry and the polar bears it depends on, are experiencing the negative effects of climate change due to warmer temperatures and melting sea ice, which significantly impacts the health, appearance, and prevalence of polar bears on display for tourists. Not only is this tourism industry affected by climate change, it also contributes to the ongoing changes of climatic conditions. This is due to the dependence of fossil fuel energy used for transportation, accommodation, and activities which directly contributes to the release of greenhouse gas emissions and thus to global climate change. Emissions from tourism has increased by 3% over the last 10 years, largely as a result of the accessibility and affordability of air travel, the most energy intensive form of transportation (Lenzen et al., 2018; UNWTO-UNEP-WMO, 2008). It has been suggested that in response to the increase in the demand to travel, the tourism industry should take a leadership role to reduce their total greenhouse gas emissions in an effort to decrease the impact of climate change. In this study, a visitor survey was conducted during four weeks of Churchill's 2018 polar bear viewing season (October 16 to November 16). The aim of the survey was to: 1) estimate greenhouse gas emissions from polar bear viewing tourists and the polar bear viewing industry; 2) identify tourists' awareness of the impacts of climate change (to and from tourism activities); 3) understand tourist's climate-related travel motivations, and 4) identify tourists' opinions on climate change mitigation strategies. Visitor surveys were hand-distributed at the Churchill Northern Studies Centre and at the Churchill Airport to tourists who had participated on a polar bear viewing tour. Surveys were analyzed and compared with the results from similar studies (Dawson et al., 2010 and Groulx, 2015) to identify the changing trends in greenhouse gas emissions, travel motivations, tourists' knowledge of climate change, and acceptance of climate change mitigation strategies. Similar to trends observed 10 years ago, emissions from polar bear viewing tourists are 3-34 times higher than the average global tourist experience. Tourists' awareness about climate change has stayed relatively consistent, despite the topic of climate change having received increased attention globally. Tourists recognize that climate change is happening and that it is human induced however, there is still a lack of understanding of how air travel is a contributor to climatic change. Although briefly mentioned

in some participant's responses, the main motivation was not to see a polar bear before it disappeared from the wild. The majority of tourists identified they were traveling to Churchill simply for the opportunity to see a polar bear. Additional motivators were photography, the Northern Lights, and for the opportunity to see other Arctic animals. The climate change mitigation strategies that tourists believed to be the most effective to reduce emissions were educational programs and transportation alternatives (such as taking the train- which was not an option at the time of study due to a rail line shutdown). This research contributes to the existing knowledge about tourism and climate change and provides a current analysis of Churchill's polar bear viewing industry, enabling a comparison between findings from another study conducted over ten years ago. This research also makes conclusions about climate change mitigation strategies that might be effective for Churchill's tourism industry to reduce their impact on the environment.

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Preface

This thesis is an article-based thesis and consists of an introductory chapter (Chapter 1), a literature review (Chapter 2), two research papers (Chapter 3 & 4) and a concluding chapter (Chapter 5). The introductory chapter (Chapter 1), outlines the project overview and objectives. Chapter 2 includes a literature review and describes the research gaps. Chapter 3 outlines the dynamic relationship between climate change and polar bear viewing in Churchill. The results from this study highlight the greenhouse gas emissions from the tourism industry, tourist's understanding of climate change, and their motivations for travel. The results from this study are also compared with findings from the original study conducted in 2007. Chapter 4 outlines the importance of understanding tourists' opinions of climate change mitigation strategies. The results from this study highlight which climate change mitigation strategies tourists believed to be the most effective for reducing greenhouse gas emissions from Churchill's polar bear viewing industry. Chapter 5 provides a summary of the overarching research findings, outlines limitations of the study, and provides some suggestions for future research. The visitor survey, recruitment letter and research ethics approval are all included as Appendices (see Appendix A, B, & C).

As a master student, I took on the primary responsibility for the entire research project. With the help of my advisor, I created this project, developed the survey questions (although many were taken directly from similar studies to allow for a comparative analysis), collected and analyzed the quantitative and qualitative data, and wrote the research papers. The thesis project received approval from the University of Ottawa's Research Ethic Board (File number #S-06-18-711, Appendix C). The research was funded by the Northern Scientific Training Program (NSTP), the Northern Research Fund (NRF), and funds from the Environment, Society, and Policy Research Group at the University of Ottawa (Canada Research Chairs program).

CHAPTER ONE: Introduction

1.1 Project Overview and Objectives

This study explores the dynamic relationship between climate change and the polar bear viewing tourism industry in Churchill, Manitoba Canada. Churchill's tourism industry relies on an iconic wildlife species, the polar bear, that is highly impacted by a changing climate. Warming temperatures, as a consequence of climate change, are causing the melting of sea ice and has created a situation where the Western Hudson Bay polar bear subpopulation, who are found in and around the Churchill region, is less able to feed and breed because of the changing sea ice conditions (Gagnon & Gough, 2005; Regehr et al., 2007; Stirling & Parkinson, 2006). Greenhouse gas emissions are known to be the primary cause of anthropogenic climate change, largely due to dependence on fossil fuel energy (IPCC, 2018). Tourism industries, much like Churchill's, is dependent on energy intensive modes of transportation, accommodations, and activities, which can influence the effects of climate change (Dawson et al., 2010). Studies have shown that in response to warmer temperatures which are negatively influencing polar bear populations, there tends to be an increase in the demand to travel 'before these animals disappear' (Dawson et al., 2010; Dawson et al., 2011; Eijgelaar et al., 2010; Lemelin et al., 2010; Lemieux & Eagles, 2012). This has been identified as a tourism trend termed "last chance tourism" (Dawson et al., 2010; Eijgelaar et al., 2010; Lemelin et al., 2010; Lemieux & Eagles, 2012). This situation causes an ongoing trend where more and more demand increases the use of fossil fuel energy, which can influence climate change and demise of the very species people are traveling to view and experience (Figure 1.1).

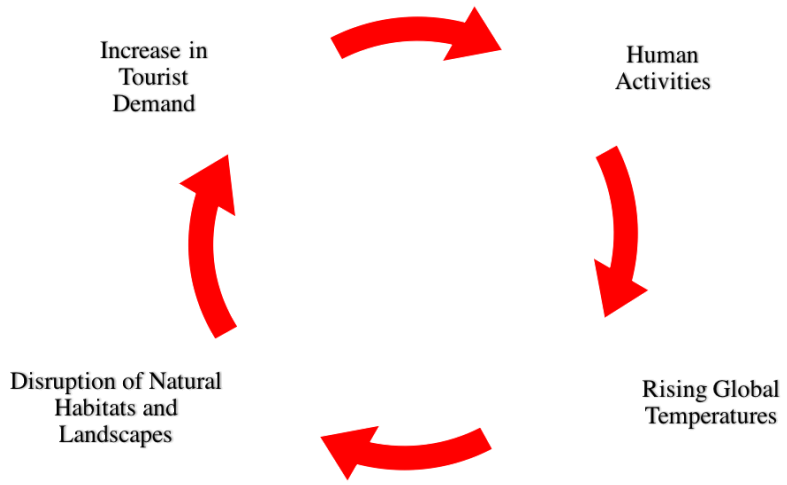


Figure 1.1: The Relationship of Climate Change and Tourism (Adapted from Dawson et al., 2010; Dawson et al., 2011; Lemelin et al., 2010)

Previous studies (see Dawson et al. 2010 and Groulx, 2015) have explored these tourism trends and have identified Churchill as a carbon intensive tourism industry, a last chance tourism destination and an industry at risk if emissions are not reduced. The overall aim of this study is to examine Churchill's polar bear viewing industry to better understand some of the dynamics that exist between climate change and polar bear viewing tourism. The specific objectives of this study are to:

1- Estimate greenhouse gas emissions from polar bear viewing tourists and the polar bear viewing industry;
2- Identify tourists' awareness of the impacts of climate change (to and from tourism activities);
3- Understand tourist's motivation for traveling to Churchill;
4- Compares results of objectives 1-3 with a similar study conducted a decade ago to understand if and how polar bear viewing tourists (including their behaviour and motivation) have changed over time; and
5- Identify tourists' opinions on potential climate change mitigation strategies.

1.2 Study Area and Approach

Churchill, Manitoba is a small Canadian sub-arctic town, located on the edge of the Hudson Bay, at the junction of the boreal forest and the Arctic tundra (Distasio et al., 2011) (Figure 1.2). Churchill is home to less than 900 people and is dependent on its health services, international shipping, scientific research and tourism industry (Distasio et al., 2011; Statistics Canada, 2016). The tourism industry, which includes migratory bird and beluga whale watching, Aurora Borealis gazing, and polar bear viewing, is a major driver for Churchill's economy (Distasio et al., 2011). Churchill's polar bear viewing industry alone attracts 10 000 to 14 000 tourists annually and generates $7.2 million in annual revenue (EcoRessources Consultants, 2011; Struzik, 2014)[1]. Polar bear viewing tours occur in two areas in Churchill: the Churchill Wildlife Management Area (CWMA, the most popular area for viewing tours) and the Wapusk National Park. The CWMA is managed by the provincial conservation authority and the Wapusk National Park is collectively managed by the national and provincial government members, the town of Churchill, and York Factory and Fox Lee Cree First Nations (Dawson et al., 2010b; Parks Canada, 2007). Viewing tours are operated by two main tour operators: Frontiers North Adventures and Great White Bear, who have permits to conduct tours along the trails of the CWMA. Accommodation and activities are provided by the main tour operators along with external tour operators including Churchill Nature Tours, Churchill Northern Studies Centre, Churchill Wild, Heartland International Travel & Tours, Great Canadian Travel Company Ltd., Lazy Bear Expeditions, and Natural Habitat Adventures (Dawson et al., 2010b; everythingchurchill.com; Groulx, 2015). Depending on the tour operator, tourists have the option of booking one-day viewing tours, with roundtrip transportation from Winnipeg to Churchill or a multi-day package which includes two viewing tours, activities (dog sledding, helicopter tours, museum and town visits) and accommodation in town, at the Churchill Northern Studies Centre or in lodges directly on the tundra.

[1] Little statistical data is available about this small community's tourism industry, therefore the numbers provided are estimates (Western Management Consultants & Econometric Research Limited, 2018).

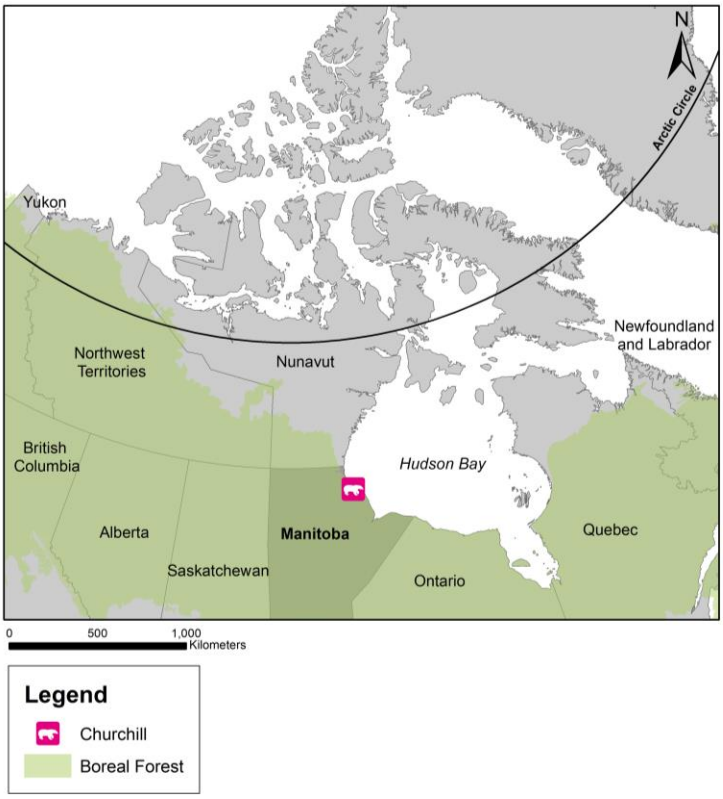


Figure 1.2: Map of Churchill, Manitoba

This study draws on a mixed method approach which is the combination of both qualitative and quantitative methods. The core assumption of this approach is that it will support a comprehensive understanding of the research question than either method would have on its own (Creswell, 2014). Similar to previous studies about motivation to travel and knowledge about climate change, quantitative and qualitative data was collected through the administration of a visitor survey (see Becken 2004 & 2007, Dawson et al., 2010b, Groulx, 2015; McKercher et al., 2010). Surveys have been chosen for this research as the answers provided by participants allow the researcher to examine relationships, and to distinguish patterns and features from Churchill's polar bear viewing tourists (Bradshaw & Stratford, 2010; Creswell, 2014). Quantitative methods were implemented through the use of closed-ended questions in the visitor surveys. This allowed for a direct and succinct analysis of the responses provided by participants. The use of closed-ended questions was important for the comparison of this study and Dawson et al. (2010) (see Objective 4) as many of the same questions from the previous study were asked in this visitor

survey. Quantitative methods were also used through the use of the online carbon calculators which were an essential component for calculating the greenhouse gas emissions from transportation and comparing these emissions with those from the previous study (see Objectives 1 and 4). Qualitative methods were implemented through open-ended questions which allowed participants the opportunity to express themselves in their own words (McKercher et al., 2010). The use of open-ended questions was important in analyzing tourists' motivation for traveling to Churchill (see Objective 3). In this question, tourists were invited to share their motivations to travel, without being prompted by possible answers, which had been done in previous studies (see Groulx, 2015). The use of an open-ended question was especially important to determine if tourists were traveling to Churchill in response to the last chance tourism trend – to see it before its gone.

1.3 Research Contributions

This study contributes to the existing literature on climate change and tourism and provides additional knowledge on tourists' understanding of climate change, their motivation to travel and their opinions on climate change mitigation strategies (see Becken, 2007; Dawson et al., 2010; Groulx, 2015; Mair, 2011; McKercher et al., 2010). It fills in the gaps from existing research that fail to analyze tourists' opinions on these mitigation strategies and initiatives designed to reduce greenhouse gas emissions (see Becken, 2004; Gössling, 2011; Gössling et al., 2012; McKercher et al., 2010). This study also provides an up-to-date analysis of the greenhouse gas emissions from Churchill's polar bear viewing industry since the first study in 2007 (Dawson et al., 2010). The 10-year comparison will be useful for policy makers to understand how the polar bear viewing industry may have evolved in response to climate change, which will allow them to make the necessary changes to existing policies. The results obtained from this research project can also help Churchill's policy makers and stakeholders understand the polar bear viewing tourists' understanding of climate change and their willingness to modify their travel behaviour.

1.4 References

Becken, S. (2004). How tourists and tourism experts perceive climate change and carbon-offsetting schemes. *Journal of Sustainable Tourism 12:*4. 332-345. DOI: 10.1080/09669580408667241.

Becken, S. (2007). Tourists' perception of international air travel's impact on the global climate and potential climate change policies. *Journal of Sustainable Tourism 15*:4. 351-368. DOI: 10.2167/jost710.0.

Bradshaw, M., & Stratford, E. (2010). Qualitative research design and rigour. In Hay, I [Ed], *Qualitative research methods in human geography* (69-80). Don Mills, Ontario: Oxford University Press.

Creswell, J.W. (2014). *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches.* United States of America: Library of Congress Cataloguing-in-Publication Data.

Dawson, J., Stewart, E., & Scott, D. (2010a). Climate change and polar bear viewing: A case study of visitor demand, carbon emissions and mitigation in Churchill, Canada. In Hall, C.M., & Saarinen, J. (Eds.), *Tourism and Change in Polar Regions: Climate, environment and experience* (89-103). Abingdon, Oxon: Routledge.

Dawson, J., Stewart, E.J., Lemelin, H., & Scott, D. (2010b). The carbon cost of polar bear viewing tourism in Churchill, Canada. *Journal of Sustainable Tourism 18*(3). 319-336. DOI: 10.1080/09669580903215147.

Dawson, J., Johnston, M.J., Stewart, E.J., Lemieux, C.J., Lemelin, R.H., Maher, P.T., & Grimwood, B.S.R. (2011). Ethical considerations of last chance tourism. *Journal of Ecotourism 10*(3). 250-265. http://dx.doi.org/10.1080/14724049.2011.617449.

Distasio, J., Dudley, M., & Moradzadeh, F. (2011). *Churchill Sustainability Planning Framework (CSPF).* Retrieved from http://winnspace.uwinnipeg.ca/handle/10680/806.

Eijgelaar, E., Thaper, C., & Peeters, P. (2010). Antarctic cruise tourism: The paradoxes of ambassadorship, "last chance tourism" and greenhouse gas emissions. *Journal of Sustainable Tourism 18* (3). 337-354. doi: 10.1080/09669581003653534

Gagnon, A.S. and Gough, W.A. (2005). Trends in the dates of ice freeze-up and breakup over Hudson Bay, Canada. *Arctic 58* (4). 370-382. Retrieved from https://search.proquest.com/docview/197729777?rfr_id=info%3Axri%2Fsid%3Aprimo.

Gössling, S. (2011). *Carbon Management in Tourism: Mitigating the Impacts on Climate Change.* Abingdon, Oxon: Routledge.

Gössling, S., Scott, D., Hall, C.M., Ceron, J-P., & Dubois, G. (2012). Consumer behaviour and demand response of tourists to climate change. *Annals of Tourism Research 39*(1). 36-58. doi: 10.1016/j.annals.2011.11.002.

Groulx, M.W. (2015). *Prospects for place-based climate change adaptation: An exploration of place, vulnerability and collaborative planning in Churchill, Manitoba* (Doctoral dissertation). Retrieved from Waterloo's Institutional Repository. *http://hdl.handle.net/10012/9606.*

IPCC. (2018). Summary for Policymakers. In Masson-Delmotte, V., P. Zhai, H.-O. Pörtner, D. Roberts, J. Skea, P.R. Shukla, A. Pirani, W. Moufouma-Okia, C. Péan, R. Pidcock, S. Connors, J.B.R. Matthews, Y. Chen, X. Zhou, M.I. Gomis, E. Lonnoy, T. Maycock, M. Tignor, and T. Waterfield (Eds.). Global Warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty. In Press.

Lemieux, C., & Eagles, P. (2012). Last chance tourism in Canada's protected areas: Management implications and emerging ethical considerations. In Lemelin, R.H., Dawson, J., & Stewart, E.J. (Eds.), *Last chance tourism. Adapting tourism opportunities in a changing world* (195-217). Abingdon, Oxon: Routledge.

Lemelin, R.H. (2006). The gawk, the glance, and the gaze: Ocular consumption and polar bear tourism in Churchill, Manitoba, Canada. *Current Issues in Tourism 9* (6). 516-534. doi: 10.2167/cit294.0.

Lemelin, R.H., Bay, T, & Fennell, D. (2008). Polar bear viewers as deep ecotourists: How specialized, are they? *Journal of Sustainable Tourism 16*(1). 42-62. doi :10.2167/jost702.0.

Lemelin, H., Dawson, J., Stewart, E.J., Maher, P., & Lueck, M. (2010). Last-chance tourism: The boom, doom, and gloom of visiting vanishing destinations. *Current Issues in Tourism 13*(5). 477-493. DOI: 10.1080/13683500903406367.

Mair, J. (2011). Exploring air traveler's voluntary carbon-offsetting behavior. *Journal of Sustainable Tourism 19.* 215-230. https://doi.org/10.1080/09669582.2010.517317.

McKercher, B., Prideaux, B., Cheung, C., & Law, R. (2010). Achieving voluntary reductions in the carbon footprint of tourism and climate change. *Journal of Sustainable Tourism 18* (3). 297-317. https://doi.org/10.1080/09669580903395022.

Peacock, E., Derocher, A.E., Lunn, N.J., & Obbard, M.E. (2010). Polar bear ecology and management in Hudson Bay in the face of climate change. In Ferguson, S.H., Loseto, L.L., & Mallory, M.L. (Eds.), *A little less Arctic: Top predators in the world's largest northern inland sea, Hudson Bay* (93-115). Netherlands, Springer.

Regehr, E.V., Lunn, N., Amstrup, S., & Stirling, I. (2007). Effects of earlier sea ice breakup on survival and population size in polar bears in western Hudson Bay. *Journal of Wildlife Management 71* (8). 2673-2683. DOI: 10.2193/2006-180.

Stirling, I. and Parkinson, C. (2006). Possible effects of climate warming on selected populations of polar bears (Ursus maritimus) in the Canadian Arctic. *Arctic 59* (3). 261-275. Retrieved from https://search.proquest.com/docview/197731018/fulltextPDF/C03909F08D9F40DEPQ/1?accountid=14701.

Struzik, E. (2014). *Arctic icons: How the town of Churchill learned to love its polar bears.* Markham, Ontario: Fitzhenry & Whiteside.

CHAPTER TWO: Literature Review

2.1 Climate Change and the Arctic

The atmospheric concentrations of greenhouse gas emissions, which include carbon dioxide, methane and nitrous oxide, have increased globally since 1750 due to human activity (IPCC, 2014;2018). Greenhouse gas emissions, together with clouds, absorb thermal infrared radiation emitted from the earth's surface (IPCC, 2007). Heat is then trapped by the greenhouse gas emissions at the earth's surface and in the troposphere (the lowest atmospheric layer), leading to an increase in the earth's average temperature (IPCC, 2007). In response to the increase in greenhouse gas emissions, the Arctic's average temperature has risen at twice the rate and magnitude compared to temperate and tropical regions (ACIA, 2004; AMAP, 2017; IPCC, 2014). This is because the depth of the atmospheric layer that influences warming of near surface air is much shallower in the Arctic, resulting in a larger temperature increase (ACIA, 2004; IPCC 2014). The rise in temperatures is also a response to the Arctic's albedo. Albedo is defined as the fraction of solar radiation that is reflected off an object or surface (IPCC, 2014). The lighter the colour of the object or surface (i.e. the ice and snow) will influence the amount of solar radiation that is reflected (IPCC, 2014). As a consequence of a warming Arctic, the annual area and duration of snow cover has decreased by 2-4 days per decade, precipitation and humidity has increased, and permafrost has warmed by more than 0.5°C since 2009, increasing the depth of the layer that thaws each year (AMAP, 2017). Sea ice, which plays an important role in regulating Arctic temperatures, and supporting life in the Arctic marine environment, is projected to continue to decline by 3% per decade in response to climate change (IPCC, 2014).

2.1.1 Sea ice decline

One of the most significant impacts of climate change in the Arctic region is sea ice reduction. The two types of sea ice found in the Arctic Ocean are multiyear ice and annual ice. Multiyear sea ice can be found near the coastlines of the northern Canadian Arctic Islands, northern Greenland, and offshore in the central Arctic Ocean. Multiyear ice partially melts in the summer and refreezes over the melted portion in the winter (Meier et al., 2014; Stirling, 2011). It is

typically between 2 and 5m thick and can be decades old (Comiso, 2012; Stirling, 2011). Annual ice is found in the channels between the islands of various Arctic archipelagos, along the southern coasts of the Arctic Ocean and in the Hudson Bay Complex (Stirling, 2011; Wadhams, 2003). Annual ice completely melts in summer months and rarely exceeds 2m in thickness. Both multiyear and annual ice have a high albedo which helps insulate the ocean from heat loss and moisture, regulates surface temperatures, and protects the oceans from winds and harmful gases initiated from the atmosphere (AMAP, 2017).

In response to anthropogenic influences, there is high confidence that from 1979 (when satellite observations began) to 2012, the annual mean of the Arctic's sea ice extent, volume and thickness has decreased by almost 65% (ACIA, 2004; IPCC, 2014). As a result, the extent of open ocean waters has increased and is absorbing more solar radiation, thus contributing to the warming temperatures being experienced in the Arctic (IPCC, 2014).

The most significant trend in sea ice decline has been found in annual ice, where ice is estimated to decline at more than 10 days per decade (IPCC, 2014). Typically, annual sea ice in the Hudson Bay completely freezes by December and is ice-free from mid-August to late October (Gagnon & Gough, 2005). The anthropogenic signal was detected in individual months from May to December which suggests that human influence is strongest in late summer extending warmer temperatures into the colder seasons (IPCC, 2014). Studies have shown that annual sea ice in the Hudson Bay is breaking up 3 weeks earlier than it did 30 years ago and is experiencing later freeze-up periods associated with warmer temperatures (Gagnon & Gagnon, 2005). The increase in Arctic temperatures and decrease in sea ice extent and duration is threatening the long-term survival of marine wildlife, particularly polar bears, who depend on the formation of sea ice to hunt (Stirling, 2011).

2.1.2 Sea ice and polar bear dependence

All polar bear populations require sea ice as a platform to catch their main source of food, ringed seals (Derocher et al., 2004; Stirling, 2011). Ringed seals are abundant, easy to hunt, and represent a high caloric return per unit of energy needed to sustain these large mammals (Stirling et al., 1999). The best time for a polar bear to hunt is during spring and early summer months,

prior to ice break-up (Stirling et al., 1999). This coincides with the seal pup breeding season. During this time, seal pups represent 50% of their weight and are unaware of their predators, making them relatively easy for a polar bear to catch (Stirling et al., 1999). To hunt, a polar bear will position itself on the sea ice, near breathing holes that have been carved into the ice by seals. The polar bear will wait hours and even days on the sea ice for a seal to emerge from the water to take a breath (Derocher et al., 2004; Stirling, 2004). Once the seal's head is visible, the polar bear will launch itself onto its prey, killing it before it has a chance to return into the water (Stirling, 2011). Polar bears prefer annual sea ice for hunting because it lies over shallower and biologically productive waters where seal densities are the highest (Stirling, 2011; Stirling & Derocher, 2012). Seals tend to avoid ocean areas with multiyear ice as the thickness creates difficulty to carve breathing holes (Stirling, 2011). The disadvantages of annual sea ice for polar bears is, because the ice melts completely during summer months, the bears are forced onto land where they must rely on their energy reserves until freeze-up in mid- October (Regehr et al., 2007; Stirling, 2011). Polar bears will typically avoid hunting on floe edges as they do not want to risk using the energy needed to swim back to shore or walk along the coast to their refuge areas if they were carried away on a drifting ice pack (McCall et al., 2016; Stirling et al., 1999).

Canada is home to 13 of the 19 polar bear subpopulations, and are found in regions in Quebec, Ontario, Manitoba, and Nunavut (Government of Canada, 2018; Stewart et al., 2012). The Western Hudson Bay (WHB) polar bear subpopulation is found along the western shore of the Hudson Bay, north from the Manitoba and Ontario border (Government of Canada, 2018; Stewart et al., 2012) (Figure 2.1). Prior to the spring ice break-up, the WHB polar bears will typically spend four months along the shore (Regehr et al., 2007; Stirling & Derocher, 2012). During this time, some polar bears may travel further north, towards Chesterfield Inlet-Nunavut, to try and hunt year-long (Peacock et al.,2010; Stirling 1988; 2011). From mid- October to mid-November, the WHB will travel towards coastal locations and wait, in anticipation, for the sea ice to form (Regehr et al., 2007; Stirling, 2011). During this time, female bears must spend most of their time hunting and storing energy reserves in preparation for winter months. In the winter, female bears will build their maternity den, give birth, and nurse their cubs until spring (McCall et al., 2016; Stirling, 2011). This is a period of approximately 8 months where a female will go without food (Stirling & Derocher, 2012).

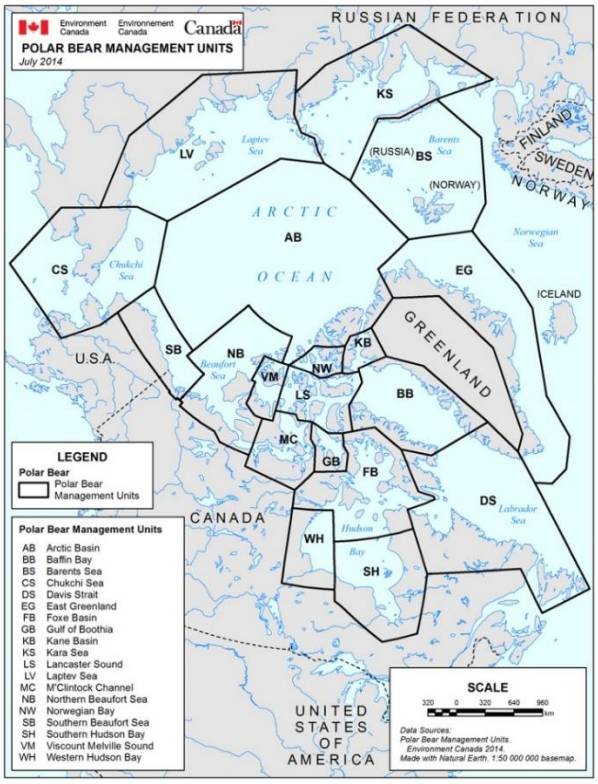


Figure 2.1: Circumpolar Polar Bear Sub- Population Map (source: Government of Canada, 2018)

Sport harvesting and hunting, contaminant accumulation, increase in shipping and development, and the impacts of climate change have been identified as the main anthropogenic influences on polar bears (Peacock et al., 2010). With rising temperatures, as a response to climate change, the WHB polar bears are experiencing longer waiting periods before they can access food due to later sea ice freeze-ups and shorter hunting times due to earlier sea ice break-up. These effects are causing nutritional stresses on the bears which is negatively impacting their health and population sizes (Peacock et al., 2010; Regehr et al., 2007; Stirling et al., 1999; Towns et al., 2009). Between 1988 and 2004, polar bear experts saw a 22% decline in WHB polar bear populations as a direct result to earlier sea ice break-up (Regehr et al., 2007; Stirling & Parkinson, 2006). Furthermore, the less time a female polar bear spends hunting during the fall, the higher the risk of survival and malnutrition, not only for themselves but for their cubs (Derocher et al., 2004; Stirling, 2011; Stirling et al.,1999). If pregnant females continue to arrive ashore two months earlier, females will lose approximately 22kg of body mass per breeding

season causing litter sizes to decline by 44-100% and almost 55-100% of polar bears who will fail to reproduce (Castro de la Guardia et al., 2012; Stirling & Derocher, 1993).

Towns et al. (2009) suggest that if freeze-up continues to be delayed and energy stores continue to deplete, the WHB polar bears will make their way into towns, such as Churchill, in search of food which will increase the probability of interacting with humans. It has also been suggested that polar bears will try to adapt to warming temperatures by traveling further north from their traditional habitats in search of ice and food (Stirling et al., 1999). However, as climate change intensifies due to greenhouse gas accumulation, and the sea ice continues to melt, the long-term survival of polar bear populations is uncertain (Amstrup et al., 2010; Derocher et al., 2004; Lunn et al., 2016; Stirling, 2011; Stirling & Derocher, 2012).

2.2 Arctic Tourism

Sea ice and polar bear population decline are not the only features of the Arctic that have experienced changes in response to climate change. Arctic tourism and travel have evolved significantly over time, with climate change influencing the accessibility and attractiveness to Arctic regions (Hall, 2010). Arctic tourism dates back to the mid-1800s when hunters, hikers, and adventurers braved the high risk and danger of the north to explore the vast areas of ice and snow, to discover the diverse wildlife populations, and to benefit from the abundant fisheries (Hall & Saarinen, 2010; UNEP, 2007). Due to the physical barriers of ice and snow that caused inaccessibility, the insufficient geographic knowledge of the travelers and the inadequate or inappropriate modes of transportation, visitor counts were low, making the Arctic one of the last global regions to be explored (Snyder & Stonehouse, 2007). With the invention of transportation technologies ranging from rail, ship, and air, an expansion of socio-economic development opportunities for tourism, a shift in cultural trends (an increase in wealth and leisure times), and a rise in temperature, the Arctic became more accessible and the number of visitors increased (Scott et al., 2012; UNEP, 2007). Hall & Johnston (1995) suggest that the motivation to travel to the Arctic during this evolution was to seek this northern region's historic and cultural features.

With the expansion of the tourism industry, development was planned around the long-term sustainability of the industry and the potential for economic development (Milne et al.,

1995; Snyder, 2007). Management was focused on the Arctic's natural resources, environments and local communities to address the concerns of the impacts of the increasing number of tourists, their activities and their experiences with the land and cultures (Dressler et al., 2001; Grimwood & Doubleday, 2013; Stewart & Draper, 2006; Stewart, et al., 2017). Climate change began to play an active role in the Arctic's planning decisions especially as the decreased ice cover increased the marine tourism activity (Dawson et al., 2007). In response to these changes, the development of effective governance strategies, policies and regulations have been implemented to reduce community vulnerability and to ensure the continuation of the expanding tourism industry (Pashkevich et al., 2015; Stewart et al., 2011).

2.2.1. Canadian Arctic Tourism

The tourism sector in the Canadian Arctic, has seen a significant rise in visitor counts and spending in response to climate change, accessibility, and the growth of Northern governments (Dawson et al., 2010b; IPCC, 2007; Johnston, 2006; Maher et al., 2014). The Canadian Arctic is made up of the three territories: Yukon, Northwest Territories (NWT) and Nunavut and parts of Manitoba, Quebec, and Labrador (Dawson et al., 2007) (Figure 2.1). These northern regions employ a mixed economy whereby some destinations (i.e. the Yukon), depend on service sector jobs and wage employment while other destinations (i.e. Nunavut), depend on the traditional sector which is based on land and resources (Dressler et al., 2001). Tourism, alongside mineral extraction and fisheries is one of the Canadian Arctic's most substantial economic drivers (Hall & Saarinen, 2010). Tourism in these northern locations, attracts approximately 530, 000 visitors and generates more than $390 million in annual visitor spending (Maher et al., 2014) (Table 2.1). People travel to the Canadian Arctic for business, wildlife viewing, hunting, recreational opportunities, and for cultural resources and activities (Dawson et al., 2007; Hall & Saarinen, 2010) (Table 2.1). The Yukon has the highest visitor count compared to the other Canadian Arctic destinations due to the accessibility by roads, the benefits received from Alaska, and inexpensive airfare costs (Dawson et al., 2007; Maher et al., 2014).

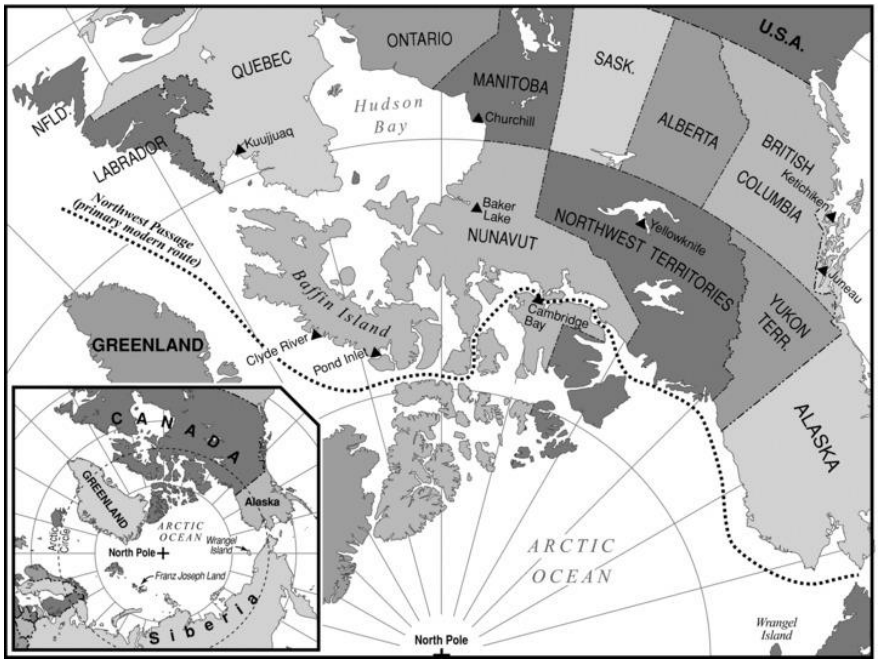


Figure 2.2: Map of Canadian Arctic (source: Stewart & Draper, 2006)

Table 2.1: Canadian Arctic Tourism Facts

Destination	Visitors	Accessibility	Activities
Yukon	314, 450	Air, road, ship	Leisure, business, nature-based activities
Northwest Territories	64, 380	Air, road	Leisure and business
Nunavut	30,525	Air, ship	Leisure, business and culture- based activities
Manitoba	20, 747	Air, ship (emerging trend), rail	Leisure, nature and culture- based activities
Quebec	88, 000	Air, ship (emerging trend)	Culture-based activities
Labrador	10, 394	Air, ship (emerging trend)	Cultural-based activities

Sources: Dawson et al., 2007; Hall & Saarinen; Maher et al., 2014

In response to climate change, the expansion of expedition cruise ships is a growing source of tourism and economic growth in for Nunavut and other Canadian Arctic destinations (Dawson et al., 2007; Hall & Saarinen, 2010). The attractiveness of the Canadian Arctic has

changed as well. Traditionally, the tourism periods for the Canadian Arctic have been summer months, however with the increase in temperatures, the tourism season has extended into spring and autumn (Hall & Saarinen, 2010; Johnston, 2006; UNEP, 2007). Tourists can now participate in a new range of activities including going for walks on the frozen land, kayaking, and observing immediate wildlife, especially as new species of flora and fauna begin to appear in response to climate change (Hall et al., 2010). One tourism destination in the Canadian Arctic has experienced in influx of tourists in response to climate change. Churchill, Manitoba has been estimated to attract over 10,000 to 14,000 tourists annually who travel to this northern region to see the polar bears in their natural environment (Struzik, 2014). As climate change influences the polar bears' health, population sizes and appearance, studies have shown that tourists are "rushing" to the Arctic to see these animals 'before they disappear' (Dawson et al., 2010; Groulx, 2015). This recent tourism trend has been termed "last chance tourism".

2.2.2. Last Chance Tourism

"Last chance tourism (LCT)", is a phenomenon whereby tourists are drawn to locations whose landscapes, natural systems or cultures are vulnerable to changes caused by global warming and amplifying anthropogenic factors, such as globalization and modernization (Dawson et al., 2010b; Lemelin et al., 2010). This LCT phenomenon has been studied in many areas across the world including Antarctica where cruise ship tourism has increased due the accessibility of the areas as well as changing landscapes and vegetation (see Eijegelaar et al., 2010), in Australia where coral bleaching, caused by the rise of sea temperatures, is influencing people to see the Great Barrier Reef "before it is too late" (see Coghlan, 2012), in Jasper National Park where the increase in melting glaciers is motivating tourists to see it 'one last time' (see Lemieux et al., 2017), and others. Although these locations have been influenced by the effects of climate change it is important to note that studies show little to no evidence that tour operators themselves are supporting the concept of LCT, nor are they marketing their industry as such (Gössling et al., 2012; Stewart et al., 2013; Lemieux et al., 2017). Promoting the vulnerability and potential disappearance of their attractions would seem contradictory for these industries (Dawson et al., 2011). The images, texts, and verbal communication of LCT destinations are often transmitted

by uncontrollable media sources which include newspaper articles, word of mouth, social media, and television programs (Dawson et al., 2012; Gössling et al., 2012; Scott et al., 2012). These media sources have alerted the viewing public about disappearing locations and ecosystems to "see it before it is gone" and the congestion of these locations to "visit before it becomes too crowded" (Lamers et al., 2012; Lemelin et al., 2012). These sources tend to glamorize destinations and animal species at risk and fail to acknowledge and educate viewers about the impacts and implications of climate change and how tourists themselves can be involved in making a positive change (Burns & Bibbings, 2009; Lemieux et al., 2017). As tourists become aware of the decline of the Arctic's most iconic animal, the polar bear, research has shown that tourists from all over the world are "rushing" to Churchill, Manitoba to see them in their natural environment (Dawson et al., 2010b; Lemelin et al., 2010).

2.2.3. Opportunities for Last Chance Tourism

Dawson et al. (2010), identified one motivation tourists had to travel to Churchill was to see the polar bears before they disappeared. This is a reaction to the perceived irreversible changes of a destination which allows a tourist the opportunity to see the transformation of ecosystems and extinction of entire species firsthand (Groulx et al., 2016). Individual tourists will perceive the effects of LCT differently (Johnston et al., 2012; Scott et al., 2012; Stewart et al., 2012). Tourists' perceptions about LCT are value-dependent and are likely to vary among people (Johnston et al., 2012; Scott et al., 2012; Stewart et al., 2012). Perceptions are influenced by their education levels and how LCT is represented and communicated to them (Becken, 2007; Johnston et al., 2012). Many tourists embark on LCT experiences to support their strong ethical and environmental values and willingness to learn about wildlife firsthand (Groulx et al., 2016; Lemelin, 2006; Lemelin, et al., 2008). Other tourists embarking on LCT experiences may be motivated to travel to experience the vulnerability and rarity of the polar bears in this location (Dawson et al., 2011; Dawson et al., 2012). For these tourists, LCT is seen as a prestigious experience in comparison to a life changing or empowering one (Groulx et al., 2016; Lemelin et al., 2010). These tourists believe that because they are fortunate enough to visit a vulnerable location which contains a rare product (the polar bears), they will be "awarded" with an elite travel status and social prestige (Lemelin et al., 2012). Most tourists participating on LCT

experiences already have an understanding about climate change and may participate in sustainable practices at home (Gunter Jr., 2018). However, this "sense of urgency" and motivation to see animals or destinations that may disappear due to climate change tend to outweigh these values as tourists believe they won't have another opportunity to see it again (Hindley & Font, 2018). Last chance tourism studies have shown an inconsistency between tourists' values towards environmental issues and behaviours as tourists are traveling long distances on energy intensive mode of transportation (i.e. plane or cruise) which contribute to the effects of climate change (Dawson et al., 2010; Eijelaar & Peeters, 2010; Piggott- McKeller & McNamara, 2017).These tourists are likely to employ the same travel patterns on their future travels (Eijelaar & Peeters, 2010).

Dawson et al. (2011) emphasize that by visiting LCT destinations, there is an opportunity for tourists to become ambassadors for change. Through exposure of these vulnerable destinations, in association with education and informative processes, it is presumed that tourists will create an emotional bond with the environment and in turn they will be encouraged to make positive changes to their lifestyles and behaviours (Lemelin et al., 2010; Lemelin et al., 2012). This has been a common recommended strategy in last chance tourism studies (Groulx et al., 2016; Lemieux et al., 2017; Piggott- McKeller & McNamara, 2017). After participating on a polar bear viewing tour in Churchill, almost half (48%) of tourists were encouraged to reduce their greenhouse gas emissions (Dawson et al., 2010b). Polar bear expert Ian Stirling (1988; 2011) believes that the increase in public interest and awareness and the ease of seeing polar bears in their natural environment will encourage tourists to be part of the conversation to the protect the polar bears from disappearing. This can help LCT destinations become places of connection and for people to collectively motivate climate action (Groulx et al., 2016).

The increase in the demand to travel as a response to LCT, alongside the extension of the tourism season and the willingness to pay to see the polar bears, can provide tour operators with an economic benefit over the short-medium term (Lemelin et al., 2010). However, the long-term development of an LCT economy which relies primarily on one attraction that is projected to disappear, is extremely risky (Dawson et al., 2011). As climate change continues to alter visitor attractions and the overall quality of visitor experiences, tourists may be faced with the disappointment of experiencing environments and biodiversity in a state of devastation (Lemieux

& Eagles, 2012; Gössling et al., 2012). Tourists might experience a disconnect between what the tourist expects to see and what the destination can sustainably offer (Lemieux et al., 2017). They might perceive the attraction to be lost and choose other travel destinations to visit (Dawson et al., 2011; Hall, 2014).

Consequently, tourists may be resilient to change and may find other activities in the same area to participate on (Gössling et al., 2012). Over 82% of polar bear viewing tourists in Churchill indicated that even if the polar bear population continued to decrease, they would still travel to this Arctic location in the future (Dawson et al., 2010a). The paradox of LCT on polar bear viewing and other LCT destinations, whether there are bears to see or not, is that these tourists are disproportionately responsible for the harmful greenhouse gas emissions contributing to climate change (Dawson et al., 2010b). This is largely a result of the dependence on air travel.

2.3 Tourism as a Contributor to Climate Change

Arctic tourism is responsible for the production of very high amounts of greenhouse gas emissions due to the strong dependence on air travel in a region that is often only accessible by plane or ship (Hall, 2010). Dawson et al. (2010b), reported that emissions from Churchill's polar bear viewing industry were primarily generated from local transportation between activities, diesel powered tundra vehicles, scenic tours via helicopters and air travel, making this a carbon intensive industry. Because of the high costs and extreme difficulties associated with building roads on areas covered in permafrost, Churchill is not accessible by a personal vehicle (Distasio et al., 2011). Additionally, because cruise ship tourism is seasonal, and the rail line frequently experiences infrastructure problems and delays, Churchill is only reliably accessible by plane (Dawson et al., 2010b; Johnston et al., 2012). Accounting for the dependence on air travel in addition to the energy intensive accommodation and activities, Churchill's polar bear viewing industry was estimated to emit greenhouse gas emissions that were 6-34 times higher than an average tourist experience[2] (Dawson et al., 2010a).

[2] According the UNWTO-UNEP-WMO (2008) report and in-depth analysis of tourism emissions on a global scale, an average global tourist experience is estimated to emit 0.25t/CO_2

Compared to national tourists who will take shorter flights, international tourists traveling to Churchill by plane expel larger amounts of carbon emissions as their long flights require extra engine thrusts that need more fuel consumption (Becken & Hay, 2007; Gössling & Peeters, 2007). A single roundtrip journey from Europe to Australia, for example, will result in 4 tons of CO_2 emissions which is equivalent to the average amount of CO_2 that a person will generate in one year (Peeters et al., 2009). It was estimated that although international tourists represented only 14% of polar bear viewing tourists traveling to Churchill, these tourists had the highest amount of emissions per person due to their long-haul flights (Dawson et al., 2010b). As international tourism evolves and becomes more accessible and affordable, air travel is expected to continue to grow by 2035 which will continue to influence greenhouse gas emissions (Gössling et al., 2013).

Surges in the number of people traveling to remote locations and using energy intensive modes of transport will further contribute to the build-up of greenhouse gas emissions (Gössling, 2011; Hall, 2010). As climate change worsens in the north, traditional Arctic attractions, activities, and ways of life are also changing (Johnston, 2006). Scenic attractions such as snow and ice are melting, making traditional activities such as dog sledding and skiing harder to participate in (Scott et al., 2012). Indigenous people, who rely on local and natural resources, must keep up with the demand and changes that are affecting their traditional life (Johnston et al., 2012; Snyder, 2007). Increasing counts of invasive species, disruption of marine mammals and migratory patterns, noise produced from marine shipping activity, along with the rise in the numbers of tourists who are occupying a small area of traditional land, create difficultly for indigenous cultures to hunt and maintain their traditional lifestyles (Hall & Saarinen, 2010; Pashkevich et al., 2015). Consequently, this northern land is now seen as a fragile environment that is dependent on the management of resources and the protection of land and wildlife species to withstand the impacts caused by climate change (Hall & Saarinen, 2010; UNEP, 2007). The implementation of climate change mitigation strategies from tourism stakeholders will be important in an effort to reduce the impacts of climate change for and from Arctic tourism to help preserve the traditional wildlife, activities and landscapes of this northern land.

2.4 Climate Change Mitigation for the Tourism Industry

The IPCC (2014) defines mitigation as a human intervention intended to reduce the sources of greenhouse gas emissions (i.e. CO_2 emissions from air travel) and enhance greenhouse gas sinks (i.e. forests and oceans). Responses to reduce climate-related risks in the tourism industry can be addressed by implementing climate change mitigation strategies (Becken & Hay, 2007; IPCC, 2014). The objectives of these strategies are, by eliminating anthropogenic interference with the climate system, natural environments can adapt, food production will not be threatened, and economic development can continue (IPCC, 2014).

Climate change mitigation involves a large number of stakeholders which include different levels of government, tour operators, transportation companies and manufacturers, and tourists (IPCC, 2014; UNEP-UNWTO-WMO, 2008). The implementation of climate change mitigation initiatives from stakeholders will reflect technological advancements, environmental management, behavioural change, and economic measures aimed at reducing energy use, improving energy efficiency, and increasing the use of renewable energy to reduce fossil fuel consumption (IPCC, 2014; UNEP-UNWTO-WMO, 2008; World Tourism Organization, 2009).

2.4.1. Climate change mitigation strategies

Table 2.2 provides some examples of climate change mitigation strategies that governments, tour operators and tourists can implement to reduce their greenhouse gas emissions. These strategies range from tax and market- based instruments and regulations, carbon offsets, education, providing tourists with information about their emissions prior to their trip, and choosing more environmentally friendly modes of travel (Dawson et al., 2010b; Gössling, 2011; Gössling et al., 2012; Lemieux & Eagles, 2009; McKercher et al., 2010; Peeters et al., 2009; Scott et al., 2012; UNWTO-UNEP-WMO, 2008; Winfield, 2009).

Table 2.2: Climate Change Mitigation Strategies

Governments	Tour Operators	Tourists
• Environmental taxes • Mandatory carbon auditing • Investment in energy efficient modes of transportations	• Voluntary offsetting- carbon offsets • Educational programs/ tours • Providing information on emissions from transportation, accommodation and activities on airline tickets or brochures	• Choosing to travel closer to home • Choosing to travel for longer periods • Opting for environmentally friendly and energy efficient modes of transportation, accommodation and activities

Sources: Dawson et al., 2010b; Gössling, 2011; Gössling et al., 2012; Lemieux & Eagles, 2009; McKercher et al., 2010; Peeters et al., 2009; Scott et al., 2012; UNWTO-UNEP-WMO, 2008; Winfield, 2009.

2.4.2 Challenges

As previously mentioned, Churchill's polar bear viewing industry attracts a wide variety of tourists, ranging from pro-environmentalists to tourists who are not concerned about the environment or the future of the environment. As a result, tourists will perceive climate change mitigation strategies in different ways. Furthermore, because a tourist's adaptive capacity is high as their decisions to travel depend on money, knowledge, and time (UNWTO-UNEP-WMO, 2008), tour operators need to be cautious about acknowledging their concerns about climate change as it may invite negative reactions from tourists and investors (Scott et al., 2012). Increasing prices on airline tickets or implementing a carbon tax, for example, may reduce demand to travel to these destinations, which will negatively impact the survival of certain tourism industries at risk (Winfield, 2009). Moreover, tourists may also believe that their "right to be mobile" and their connectivity to other cultures, which depends on air travel, should not be compromised by restrictions or an increase in travel costs (Becken, 2007). These tourists may not see or understand that they are responsible for the impacts of climate change from tourism and may blame governments and airlines to act and address the costs themselves (Gössling, 2011).

The limited knowledge and awareness about the effects of climate change create significant challenges for tourism stakeholders to implement climate change mitigation

strategies. Tourists may have a perception that holidays and vacations are activities where caution about environmental risks could be relaxed and may ignore, underestimate or even deny the impacts associated with travel (Becken, 2004; Becken and Hay, 2007; Lane, 2009). Consumers who may exert pro-environmental behaviour in their everyday lives may suspend these attitudes during times of travel (Weaver, 2009). This would make climate change mitigation initiatives highly ineffective. Dawson et al. (2010) state that polar bear viewing tourists do not understand how their behaviour contributes to climate change. Moreover, these tourists did not understand the purpose of climate change mitigation initiatives, how it is used and who is responsible for implementing them (Dawson et al., 2010b; Mair, 2011). Because the effects from air travel take time to trigger temperature and climatic changes, a tourist may not be able to recognize the impacts of change on their single trip (Becken, 2004; Gössling & Peeters, 2007; Hall, 2010). Thus, the lack of conceptual clarity makes it difficult for many consumers to understand what climate change really means (McKercher et al., 2010). Tourist may also feel that it is easier and more effective to take personal actions at a local level than a global one because the effects of climate change might be more noticeable on a day-to-day basis (Becken, 2007). Although these challenges exist, Churchill has an opportunity to lead by example to implement these strategies and reduce their impact on the environment.

2.5 Research Gaps in the Literature

Although countless of studies have explored the relationship between climate change and tourism, there still exist many research gaps pertaining to polar bear viewing tourism, mitigation and tourists understanding of climate change and willingness to participate climate change mitigation strategies. Some of these gaps were explored in this thesis research.

Existing literature suggests that although there is a growing number of tourists who are aware that climate change is happening, there is a reluctance for tourists to be environmentally active, to change consumption patterns and to mitigate the effects from the accumulation of greenhouse gas emissions (Becken, 2004; McKercher et al., 2010). Furthermore, tourists are likely to engage in mitigation strategies in their everyday lives but are reluctant to make changes while on vacation (Becken, 2007). This may be because they are unaware about the effect's climate change has on tourism mainly because they can't see it. Tourists' commitment to the

environment as well as their knowledge and attitude towards becoming a green consumer in the context of travel has not been explored thoroughly (Garma, 2014).

Much of the research involving mitigation initiatives has been centered around what industries, tour operators, and policy makers believe to be effective, such as the implementation of environmental or carbon taxes (Winfield, 2009). Little is known about the demand side- i.e. tourist's perspectives, willingness to pay and their opinions on effective mitigation strategies including which options are preferred by tourists and why (Becken & Hay, 2012; Garma, 2014; UNWTO-UNEP-WMO, 2008).

2007 and 2008 were important years in assessing the relationship between tourism and climate change. It was first recognized by the United Nations World Tourism Organization (UNWTO) who began to analyze how tourism industries worldwide were not only being affected by climate change but how they were contributing to the effects of climate change. This stemmed from the Davos Declaration in 2007, which highlighted these issues and proposed actions towards mitigating greenhouse gas emissions from the tourism industry, specifically from transportation, accommodation and activities, adapting these industries to the on-going changes, creating innovative technologies and activities, ensuring a pro-poor model by providing financial aid to destinations in need. The "Climate Change and Tourism: Responding to Global Challenges" report, created by the UNWTO alongside the United Nations Environmental Program (UNEP) and the World Meteorological Organization (WMO), highlighted both the effects caused by climate change for tourism (i.e. changes in tourism seasons, shifts in tourism demand, availability of tourism products and attractions) and the contributors to climate change (dependence of on air travel, energy use from accommodations and activities). Many tourism studies have stemmed from this report during this time (see Dawson et al., 2010; Eijgelaar et al., 2010; Lemelin et al., 2010). However, very little recent research on tourism and climate change in Churchill which specifically highlight the knowledge of tourists and the emissions of the industry has been done.

2.6 References

ACIA. (2004). Arctic climate impact report: Impacts of a warming Arctic. Cambridge: Cambridge University Press.

Amstrup, S.C., DeWeaver, E.T., Douglas, D.C., Marcot, B.G., Durner, G.M., Bitz, C.M., & Bailey, D.M. (2010). Greenhouse gas mitigation can reduce sea-ice loss and increase in polar bear persistence. *Nature 10.* 955-958. DOI: 10.1038/nature09653.

Arctic Monitoring Assessment Programme. (2017). *Snow, Water, Ice and Permafrost in the Arctic (SWIPA) 2017.* Oslo, Norway: Arctic Monitoring Assessment Programme (AMAP).

Armitage, D. (2015). Resource and Environmental Management in Northern Canada. In Mitchell, B. (Ed). *Resource and Environmental Management in Canada* (450-473). Don Mills, Ontario: Oxford University Press.

Becken, S. (2004). How tourists and tourism experts perceive climate change and carbon-offsetting schemes. *Journal of Sustainable Tourism 12:*4. 332-345. DOI: 10.1080/09669580408667241.

Becken, S. (2007). Tourists' perception of international air travel's impact on the global climate and potential climate change policies. *Journal of Sustainable Tourism 15*:4. 351-368. DOI: 10.2167/jost710.0.

Becken, S. & Hay, J.E. (2007). *Tourism and climate change: Risk and opportunities.* North York, Ontario: Channel View Publications.

Becken, S. & Hay, J.E. (2012). *Climate Change and Tourism. From policy to practice*. New York, New York: Routledge.

Burns, P., & Bibbings, L. (2009). The end of tourism? Climate change and societal challenges. *Twenty-First Century Society 4*(1). 31-51. DOI: 10.1080/17450140802642424.

Castro de la Guardia, L., Derocher, A.E., Myers, P.G., Terwisscha Van Sheltinga, A.D. & Lunn, N.J. (2013). Future sea ice conditions in Western Hudson Bay and consequences for polar bears in the 21st century. *Global Change Biology 19* (9). 2675-2687. DOI: 10.1111/gcb.12272.

CBC News. (8 January 2018). Omnitrax to argue federal lawsuit over northern Manitoba rail line should be tossed. Retrieved from http://www.cbc.ca/news/canada/manitoba/omnitrax-and-ottawat-court-1.4476974.

Coghlan, A. (2012). Last chance tourism on the Great Barrier Reef. In Lemelin, R.H., Dawson, J., & Stewart, E.J. (Eds.), *Last chance tourism. Adapting tourism opportunities in a changing world* (133-149). Abingdon, Oxon: Routledge.

Comiso, J.C. (2012). Large decadal decline of the Arctic multiyear ice cover. *Journal of Climate 25.* 1176-1193. DOI: 10.1175/JCLI-D-11-00113.1.

Dawson, J., Maher, P.T., & Slocombe, D.S. (2007). Climate change, marine tourism, and sustainability in the Canadian Arctic: Contributions from systems and complexity approaches. *Tourism in Marine Environments 4* (2-3). 69-83. DOI: https://doi.org/10.3727/154427307784772057.

Dawson, J., Stewart, E., & Scott, D. (2010a). Climate change and polar bear viewing: A case study of visitor demand, carbon emissions and mitigation in Churchill, Canada. In Hall, C.M., & Saarinen, J. (Eds.), *Tourism and Change in Polar Regions: Climate, environment and experience* (89-103). Abingdon, Oxon: Routledge.

Dawson, J., Stewart, E.J., Lemelin, H., & Scott, D. (2010b). The carbon cost of polar bear viewing tourism in Churchill, Canada. *Journal of Sustainable Tourism 18*(3). 319-336. DOI: 10.1080/09669580903215147.

Dawson, J., Johnston, M.J., Stewart, E.J., Lemieux, C.J., Lemelin, R.H., Maher, P.T., & Grimwood, B.S.R. (2011). Ethical considerations of last chance tourism. *Journal of Ecotourism 10*(3). 250-265. http://dx.doi.org/10.1080/14724049.2011.617449.

Dawson, J., Stewart, E., & Lemelin, R.H. (2012). Last chance tourism: conclusion. In Lemelin, R.H., Dawson, J., & Stewart, E.J. (Eds.), *Last chance tourism. Adapting tourism opportunities in a changing world* (218-228). Abingdon, Oxon: Routledge.

Derocher, A.E., Lunn, N.J., & Stirling, I. (2004). Polar bears in a warming climate. *Integrative and Comparative Biology 44* (2). 163-176. DOI: 10.1093/icb/44.2.163.

Distasio, J., Dudley, M., & Moradzadeh, F. (2011). *Churchill Sustainability Planning Framework (CSPF).* Retrieved from http://winnspace.uwinnipeg.ca/handle/10680/806.

Dressler, W.H., Berkes, F., & Mathias, J. (2001). Beluga hunters in a mixed economy: Managing the impacts of nature-based tourism in the Canadian western Arctic. *Polar Record 37* (200). 35-48. DOI: 10.1017/S0032247400026735.

EcoRessources Consultants. (2011). *Evidence of the socio-economic importance of polar bears for Canada*. Retrieved from the Government of Canada website: http://publications.gc.ca/site/eng/397569/publication.html.

Eijgelaar, E., Thaper, C., & Peeters, P. (2010). Antarctic cruise tourism: The paradoxes of ambassadorship, "last chance tourism" and greenhouse gas emissions. *Journal of Sustainable Tourism 18* (3). 337-354. doi: 10.1080/09669581003653534.

Eijgelaar, E., Peeters, P., de Bruijn, K., & Dirven, R. (2017) Travelling large in 2016: The carbon footprint of Dutch holidaymakers in 2016 and the development since 2002. Breda, The Netherlands: NHTV Breda University of Applied Sciences.

Fleming, M. (1988). *Churchill Polar Bears Capital of the World.* Winnipeg, Manitoba: Hyperion Press Limited.

Folwer, F. (2009). *Survey Research Methods.* Thousand Oaks, California: Library of Congress Cataloging- in- Publication Data.

Gagnon, A.S. and Gough, W.A. (2005). Trends in the dates of ice freeze-up and breakup over Hudson Bay, Canada. *Arctic 58* (4). 370-382. Retrieved from https://search.proquest.com/docview/197729777?rfr_id=info%3Axri%2Fsid%3Aprimo.

Gössling, S. (2011). *Carbon Management in Tourism: Mitigating the Impacts on Climate Change.* Abingdon, Oxon: Routledge.

Gössling, S., & Peeters, P. (2007). 'It does not harm the environment!' An analysis of industry discourses on tourism, air travel and the environment. *Journal of Sustainable Tourism 15*(4). 402-417. doi: 10.2167/jost672.0.

Gössling, S., Scott, D., & Hall, M.C. (2013). Challenges of tourism in a low-carbon economy. *Wiley Interdisciplinary Reviews: Climate Change 4:*6. 525-538. doi: 10.1002/wcc.243.

Gössling, S., Scott, D., Hall, C.M., Ceron, J-P., & Dubois, G. (2012). Consumer behaviour and demand response of tourists to climate change. *Annals of Tourism Research 39*(1). 36-58. doi: 10.1016/j.annals.2011.11.002.

Gössling, S., Broderick, J., Upham, P, Ceron, J-P., Dubois, G., Peeters, P., & Strasdas, W. (2007). Voluntary carbon offsetting schemes for aviation: Efficiency, credibility and sustainable tourism. *Journal of Sustainable Tourism 15:* 3. 223-248DOI: 10.2167/jost758.0.

Government of Canada. (2018). Polar bear: non-detriment finding. Retrieved from https://www.canada.ca/en/environment-climate-change/services/convention-international-trade-endangered-species/non-detriment-findings/polar-bear.html?_ga=2.47910695.1829174673.1520434768-1869394333.1520434768.

Government of Canada. (2018). Maps of sub-populations of polar bears and protected areas. Retrieved from https://www.canada.ca/en/environment-climate-change/services/biodiversity/maps-sub-populations-polar-bears-protected.html.

Great White Bear Tours. (2017). Polar Rovers. Retrieved from https://www.greatwhitebeartours.com/about/polar-rovers.

Grimwood, B.S.R., & Doubleday, N.C. (2013). Illuminating traces: Enactments of responsibility in practices of Arctic river tourists and inhabitants. *Journal of Ecotourism 12* (2). 53-74. DOI: 10.1080/14724049.2013.797427.

Groulx, M.W. (2015). *Prospects for place-based climate change adaptation: An exploration of place, vulnerability and collaborative planning in Churchill, Manitoba* (Doctoral dissertation). Retrieved from Waterloo's Institutional Repository. *http://hdl.handle.net/10012/9606.*

Groulx, M., Lemieux, C., Dawson, J., Stewart, E., & Yudina, O. (2016). Motivations to engage in last chance tourism in the Churchill Wildlife Management Area and Wapusk National Park: The role of place identity and nature relatedness. *Journal of Sustainable Tourism 24*(11). 1523-1540. http://dx.doi.org/10.1080/09669582.2015.1134556.

Hall, M.C. (2010). Tourism and environmental change in polar regions: Impacts, climate change and biological invasion. In Hall, C.M., & Saarinen, J. (Eds.), *Tourism and Change in Polar Regions: Climate, environment and experience* (42-70). Abingdon, Oxon: Routledge.

Hall, C.M. (2014). Will climate change kill Santa Claus? Climate change and high latitude Christmas place branding. *Scandinavian Journal of Hospitality and Tourism 14* (1). 23-40. DOI: http://dx.doi.org/10.1080/15022250.2014.886101.

Hall, C.M., & Johnston, M.E. (1995). *Polar tourism: Tourism in the Arctic and Antarctic regions.* Chichester: John Wiley.

Hall, M.C., & Saarinen, J. (2010). Tourism and change in polar regions: Introduction-definitions, locations, places and dimensions. In Hall, C.M., & Saarinen, J. (Eds.), *Tourism and Change in Polar Regions: Climate, environment and experience* (1-41). Abingdon, Oxon: Routledge.

Hall, M.C., James, M., & Wilson, S. (2010). 'Biodiversity, biosecurity, and cruising in the Arctic and sub-Arctic'. *Journal of Heritage Tourism, 5*(4). 351-364. DOI: 10.1080/1743873X.2010.517845.

Hindley, A., & Font, X. (2018). Value and motivations in tourists perceptions of last chance tourism. *Tourism and Hospitality Research 18* (1). 3-14. DOI: 10.1177/1467358415619674.

IPCC. (2007). Summary for policymakers. In M.L. Parry, O.F. Canziani, J.P. Palutikof, P.J., vander Linden, & C.E. Hanson (Eds.), Climate change 2007: Impacts, adaptation and vulnerability. Contribution of Working Group II to the fourth assessment report of the intergovernmental panel on climate change (pp. 1–22). Cambridge, UK: Cambridge University Press.

IPCC. (2014). Synthesis report. In Pachauri, R.K and Meyer, L.A. (Eds.) *Climate Change 2014: Synthesis Report.* Contribution of working groups I, II and II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change (pp. 33-112). Geneva, Switzerland, IPCC.

IPCC. (2018). Summary for Policymakers. In Masson-Delmotte, V., P. Zhai, H.-O. Pörtner, D. Roberts, J. Skea, P.R. Shukla, A. Pirani, W. Moufouma-Okia, C. Péan, R. Pidcock, S. Connors, J.B.R. Matthews, Y. Chen, X. Zhou, M.I. Gomis, E. Lonnoy, T. Maycock, M. Tignor, and T. Waterfield (Eds.). Global Warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty. In Press.

Johnston, M.E. (2006). Impacts of global environmental change on tourism in the polar regions. In Gössling, S. and Hall. C.M. (Eds.), *Tourism & global environmental change: Ecological, social, economic and political interrelationships* (37-53). Abingdon, Oxon: Routledge.

Johnston, M., Viken, A., & Dawson, J. (2012). Firsts and lasts in Arctic tourism: last chance tourism and the dialectic of change. In Lemelin, R.H., Dawson, J., & Stewart, E.J. (Eds.), *Last chance tourism. Adapting tourism opportunities in a changing world* (10-24). Abingdon, Oxon: Routledge.

Lamers, M., Eijgelaar, E., & Amelung, B (2012). Last chance tourism in Antarctica. In Lemelin, R.H., Dawson, J., & Stewart, E.J. (Eds.), *Last chance tourism. Adapting tourism opportunities in a changing world* (25-41). Abingdon, Oxon: Routledge.

Lane, B. (2009). Thirty years of sustainable tourism: Drivers, progress, problems and the future. In Gössling, S., Hall. C.M., & Weaver, D.B. (Eds.), *Sustainable tourism futures: Perspectives on systems, restructuring and innovations* (19-32). Abingdon, Oxon: Routledge.

Lemieux, C., & Eagles, P. (2012). Last chance tourism in Canada's protected areas: Management implications and emerging ethical considerations. In Lemelin, R.H., Dawson, J., & Stewart, E.J. (Eds.), *Last chance tourism. Adapting tourism opportunities in a changing world* (195-217). Abingdon, Oxon: Routledge.

Lemieux, C. J., Groulx, M., Halpenny, E., Stager, H., Dawson, J., Stewart, E.J., & Hvenegaard, G.T. (2017). "The end of the Ice Age?": Disappearing world heritage and the climate change communication imperative. *Environmental Communication.* (1-19). Retrieved from https://doi.org/10.1080/17524032.2017.1400454.

Lemelin, R.H. (2006). The gawk, the glance, and the gaze: Ocular consumption and polar bear tourism in Churchill, Manitoba, Canada. *Current Issues in Tourism 9* (6). 516-534. doi: 10.2167/cit294.0.

Lemelin, R.H., Bay, T, & Fennell, D. (2008). Polar bear viewers as deep ecotourists: How specialized, are they? *Journal of Sustainable Tourism 16*(1). 42-62. doi :10.2167/jost702.0.

Lemelin, H., Dawson, J., Stewart, E.J., Maher, P., & Lueck, M. (2010). Last-chance tourism: The boom, doom, and gloom of visiting vanishing destinations. *Current Issues in Tourism 13*(5). 477-493. DOI: 10.1080/13683500903406367.

Lemelin, R.H., Stewart, E., & Dawson, J. (2012). An introduction to last chance tourism. In Lemelin, R.H., Dawson, J., & Stewart, E.J. (Eds.), *Last chance tourism. Adapting tourism opportunities in a changing world* (3-9). Abingdon, Oxon: Routledge.

Lemieux, C. J., Groulx, M., Halpenny, E., Stager, H., Dawson, J., Stewart, E.J., & Hvenegaard, G.T. (2017). "The end of the Ice Age?": Disappearing world heritage and the climate change communication imperative. *Environmental Communication.* (1-19). Retrieved from https://doi.org/10.1080/17524032.2017.1400454.

Maher, P.T. Gelter, H., Hillmer-Pegram, K., Hovgaard, G., Hull, J., Þór Jóhannesson, G., Karlsdóttir, A., Rantala, O., & Pashkevich, A. (2014). Arctic tourism: Realities and possibilities. *Arctic Yearbook 2014.* Retrieved from https://www.researchgate.net/publication/275945995_Arctic_Tourism_Realities_Possibilities?_esc=publicationCoverPdf&el=1_x_2&enrichId=rgreq-533db16e7eb404ff96bb94d8591bc125-XXX&enrichSource=Y292ZXJQYWdlOzI3NTk0NTk5NTtBUzoyNDk3MDgzMTI1MjY4NTNAMTQzNjU0NjUwOTcyMg%3D%3D

Mair, J. (2011). Exploring air traveller's voluntary carbon-offsetting behavior. *Journal of Sustainable Tourism 19.* 215-230. https://doi.org/10.1080/09669582.2010.517317.

McCall, A.G., Pilfold, N.W., Derocher, A.E., & Lunn, N.J. (2016). Seasonal habitat selection by adult female polar bears in western Hudson Bay. *Population Ecology 58* (3). 407-419. DOI: 10.1007/s10144-016-0549-y.

McKercher, B., Prideaux, B., Cheung, C., & Law, R. (2010). Achieving voluntary reductions in the carbon footprint of tourism and climate change. *Journal of Sustainable Tourism 18* (3). 297-317. https://doi.org/10.1080/09669580903395022.

Meier, W.N., Hovelsrud, G.K., van Oort, B.E.H., Key, J.R., Kovacs, K.M., Michel, C., Haas, C., Granskog, M.A., Gerland, S., Perovich, D.K., Makshtas, A., & Reist., J.D. (2014). Arctic sea ice in transformation: A review of recent observed changes and impacts on biology and human activity. *Review of Geophysics 52* (3). 185-217. https://doi.org/10.1002/2013RG000431

Milne, S., Ward, S., & Wenzel, G. (1995). Linking tourism and art in Canada's eastern Arctic: The case of Cape Dorset. *Polar Record 31* (176). 25-36. DOI: 10.1017/S0032247400024839.

Needham, M.D. & Vaske, J.J. (2008). Writing and constructing. In Vaske, J.J. (Ed.), *Survey research and analysis: Applications in parks, recreation and human dimensions.* (121-171). State College, Pennsylvania: Venture Publishing, Inc.

Pashkevich, A., Dawson, J., & Stewart, E.J. (2015). Governance of expedition cruise ship tourism in the Arctic: A comparison of the Canadian and Russian Arctic. *Tourism in Marine Environment 10*(3). 225-240. DOI: http://dx.doi.org/10.3727/154427315X14181438892883.

Peacock, E., Derocher, A.E., Lunn, N.J., & Obbard, M.E. (2010). Polar bear ecology and management in Hudson Bay in the face of climate change. In Ferguson, S.H., Loseto, L.L., & Mallory, M.L. (Eds.), *A little less Arctic: Top predators in the world's largest northern inland sea, Hudson Bay* (93-115). Netherlands, Springer.

Peeters, P., Gössling, S., & Lane, B. (2009). Moving towards low-carbon tourism: New opportunities for destinations and tour operators. In Gössling, S., Hall. C.M., & Weaver, D.B. (Eds.), *Sustainable tourism futures: Perspectives on systems, restructuring and innovations* (240-257). Abingdon, Oxon: Routledge.

Regehr, E.V., Lunn, N., Amstrup, S., & Stirling, I. (2007). Effects of earlier sea ice breakup on survival and population size in polar bears in western Hudson Bay. *Journal of Wildlife Management 71* (8). 2673-2683. DOI: 10.2193/2006-180.

Scott, D., Hall, C.M., & Gössling, S. (2012). *Tourism and climate change.* Abingdon, Oxon: Routledge.

Snyder, J.M. & Stonehouse, B. (2007). The growing significance of polar tourism. In Snyder, J.M. & Stonehouse, B. (Eds.). *Prospects for polar tourism.* (3-14). Wallingford, Oxon: CAB International.

Snyder, J.M. (2007). The economic role of Arctic tourism. In Snyder, J.M. & Stonehouse, B. (Eds.). *Prospects for polar tourism.* (102-122). Wallingford, Oxon: CAB International.

Statistics Canada. (2016). Census profile, 2016 Census. Retrieved from http://www12.statcan.gc.ca/census-recensement/2016/dp-pd/prof/details/page.cfm?Lang=E&Geo1=CSD&Code1=4623056&Geo2=PR&Code2=46&Data=Count&SearchText=Churchill&SearchType=Begins&SearchPR=01&B1=All&GeoLevel=PR&GeoCode=4623056&TABID=1.

Stewart, E.J., & Draper, D. (2006). Sustainable cruise tourism in Arctic Canada: An integrated coastal management approach. *Tourism in Marine Environments 3* (2). 77-88. DOI: 10.3727/154427306779435210.

Stewart, E.J., Dawson, J., & Draper, D. (2011). Cruise tourism and residents in Arctic Canada: Development of a resident attitude typology. *Journal of Hospitality and Tourism Management 18* (1). 95–106. DOI 10.1375/jhtm.18.1.95.

Stewart, E.J., Dawson, J., & Lemelin, R.H. (2012). The transformation of polar bear viewing in the Hudson Bay region, Canada. In Lemelin, R.H., Dawson, J., & Stewart, E.J. (Eds.), *Last chance tourism. Adapting tourism opportunities in a changing world* (89-102). Abingdon, Oxon: Routledge.

Stewart, E.J., Draper, D., & Johnston, M.E. (2013). A review of tourism research in the polar region. *Arctic 58* (4). 383-394. Retrieved from https://www.researchgate.net/profile/Emma_Stewart/publication/228351918_Sea_Ice_in_Canada%27s_Arctic_Implications_for_Cruise_Tourism/links/54d26c970cf28e0697241d22/Sea-Ice-in-Canadas-Arctic-Implications-for-Cruise-Tourism.pdf.

Stewart, E.J., Liggett, D., & Dawson, J. (2017): The evolution of polar tourism scholarship: Research themes, networks and agendas. *Polar Geography 40* (1). 59- 84. DOI: 10.1080/1088937X.2016.1274789.

Stirling, I. (1988). *Polar Bears.* Michigan, United States of America: The University of Michigan Press.

Stirling, I. (2011). *Polar Bears. The Natural History of a Threatened Species.* Brighton, Massachusetts: Fitzhenry & Whiteside.

Stirling, I., & Derocher, A.E. (1993). Possible impacts of climatic warming on polar bears. *Arctic 46* (3). 240–245. Retrieved from http://www.jstor.org/stable/pdf/40511411.pdf.

Stirling, I., & Derocher, A. E. (2012). Effects of climate warming on polar bears: A review of the evidence. *Global Change Biology 18* (9). 2694-2706. DOI: 10.1111/j.1365-2486.2012.02753. x.

Stirling, I. and Parkinson, C. (2006). Possible effects of climate warming on selected populations of polar bears (Ursus maritimus) in the Canadian Arctic. *Arctic 59* (3). 261-275. Retrieved from https://search.proquest.com/docview/197731018/fulltextPDF/C03909F08D9F40DEPQ/1?accountid=14701.

Struzik, E. (2014). *Arctic icons: How the town of Churchill learned to love its polar bears.* Markham, Ontario: Fitzhenry & Whiteside.

Towns. L., Derocher, A.E., Stirling, I., Lunn, N.J., & Hedman, D. (2009). Spatial and temporal patterns of problem polar bears in Churchill, Manitoba. *Polar Biology 32* (10). 1529-1537. DOI: 10.1007/s00300-009-0653-y.

United Nations Environmental Program (UNEP). (2007). *Tourism in polar regions: The sustainability challenge.* Paris: UNEP.

United Nations World Tourism Organization (UNWTO)- United Nations Environmental Program (UNEP)- and World Meteorological Organization (WMO). (2008). *Climate change and tourism: Responding to global challenges.* Madrid and Paris: UNWTO and UNEP.

Wadhams, P., (2003). How does Arctic sea ice form and decay? *National Ocean and Atmospheric Administration.* Retrieved from http://sites.fas.harvard.edu/~scia30/2008/SOURCEBOOK/Arctic_sea_ice_Wadhams.pdf.

Weaver, D. (2009). Reflections on sustainable tourism and paradigm change. In Gössling, S., Hall, C.M., & Weaver, D.B. (Eds.), *Sustainable tourism futures: Perspectives on systems, restructuring and innovations* (169-199). Abingdon, Oxon: Routledge.

Winfield, M. (2009). Policy instruments in Canadian environmental policy. In VanNijnatten D.L and Boardman R. (Eds.), *Canadian environmental policy and politics: Prospects for leadership and innovation* (46-63). Don Mills, Ontario: Oxford University Press.

World Tourism Organization. (2009). From Davos to Copenhagen and beyond: Advancing tourism's responses to climate change [UNWTO Background paper]. Retrieved from http://sdt.unwto.org/sites/all/files/docpdf/fromdavostocopenhagenbeyondunwtopaperelectronicversion.pdf.

CHAPTER THREE:

A 10-year comparison of Churchill's polar bear viewing tourism industry

In preparation for submission to: Journal of Sustainable Tourism

Abstract

For over 50 years, Churchill, Manitoba has provided tourists from all over the world with the unique experience of viewing polar bears in their natural environment. However, the rise in Arctic temperatures and changing sea ice conditions is negatively impacting polar bear health and population sizes. As a consequence, studies have shown an increase in the demand to travel to the North to see these animals 'before they are gone', a tourism trend referred to as "last chance tourism." The paradox of this tourism trend is that tourists require energy intensive modes of transportation to reach the Arctic thereby generating greenhouse gas emissions which are primary causes of anthropogenic climate change. This study aims to calculate the polar bear viewing industry's total greenhouse gas contribution, identify tourists' knowledge about climate change and understand their motivation to travel. Furthermore, this study reports any changes that may have occurred in the industry since the first study over 10 years ago. During the 2018 polar bear viewing season, 513 surveys were distributed, completed, and returned by tourists who had participated on a polar bear viewing tour. The results of this study indicate that the greenhouse gas emissions from this industry remained high due to the dependence on energy intensive modes of transportation, accommodations and local activities. The results also indicated that although people believe climate change is happening and that it is influenced by human activity, there remains a lack of understanding of how energy intensive travel is, a similar finding identified 10 years ago. Tourists identified that their main motivation for travel was simply to see a polar bear in its natural environment. Findings of this research are important for Churchill's polar bear viewing industry to understand where effort needs to be made to reduce emissions from the industry and how to further educate tourists about the relationship between climate change and tourism.

Keywords

Climate change, polar bears, last chance tourism, Churchill, greenhouse gas emissions

3.1 Introduction

According to the Intergovernmental Panel on Climate Change (IPCC) Fifth Assessment Report, we now have high confidence that the warming of the climate system is *extremely likely* to be human induced (IPCC, 2014). Globally, every continent has experienced an increase in average temperatures due to climate change (IPCC, 2007). Arctic regions, often defined as north of the tree line or where zones of continuous permafrost are present, have experienced a rise in temperatures at twice the rate and magnitude compared to temperate and tropical regions (ACIA, 2004; AMAP, 2017; Dawson et al., 2007; IPCC, 2014). In response to these rising temperatures, distinctive Arctic features, such as ice and snow, are undergoing significant changes which are having negative impacts on migratory birds, mammals and other Arctic wildlife (Gagnon & Gough, 2005; IPCC, 2007). One of the Arctic's most recognized megafauna, the polar bear, has been impacted by climate change as the increase in Arctic temperatures has decreased the extent and thickness of sea ice. This transformation has limited the accessibility for a polar bear to hunt and breed on the sea ice, which is negatively influencing their health and population sizes (Peacock et al., 2010; Regehr et al., 2007; Stirling et al., 1999; Towns et al., 2009).

In response to impacts of climate change in the Arctic, the polar bear has become a symbol of global climate change and a symbol of the "last chance tourism" phenomenon (Dawson et al., 2010b; Lemelin et al., 2010; Struzik, 2014). Last chance tourism has been categorized as a tourism trend, which assumes tourists are drawn to locations whose landscapes, natural systems, or cultures are vulnerable to changes caused by global warming or other anthropogenic factors, including globalization and modernization (Dawson et al., 2010; Lemelin et al., 2010). Churchill, Manitoba, whose tourism industry is centered around polar bear viewing, has been linked with this last chance tourism trend, as it has been identified that some tourists traveled to Churchill to see a polar bear 'before they no longer exist' (Dawson et al., 2010; Groulx, 2015). The paradox of this demand to travel to see the polar bears lies in the fact that tourists, in most cases, require air transportation to reach this Arctic destination. Air travel is the most energy intensive mode of transportation, responsible for 40% of CO_2 emissions – the principal anthropogenic gas contributing to the increase in temperatures (IPCC, 2014; UNWTO-UNEP-WMO, 2008). Therefore, Churchill's polar bear viewing industry is not only vulnerable

to the effects of climate change, but due to the dependence on fossil fuel energy, it is also an anthropogenic driver influencing change.

Building on the growing research about the implications of climate change for and from tourism, Dawson et al. (2010b) conducted the first study in North America, estimating the greenhouse gas emissions from Churchill's polar bear viewing tourism industry and analyzing tourists' knowledge about climate change. Similarly, Groulx (2015) used Churchill's unique tourism industry to explore motivations for travel, building on the emerging knowledge about "last chance tourism". More than 10-years after the original study by Dawson et al. (2010), this paper provides an up-to-date analysis of Churchill's polar bear viewing industry and allows for a decadal comparison. The study employed a survey-based approach to achieve the following objectives 1) to estimate the greenhouse gas emissions emitted from the polar bear viewing industry; 2) identify tourists' awareness of the impacts of climate change; and 3) to understand the motivations tourists have for traveling to Churchill.

3.2 Literature Review

3.2.1 Climate change and Arctic regions

In response to a warming Arctic, sea ice, which plays an important role in regulating Arctic temperatures and supporting life for the Arctic marine environment, has exhibited significant changes. Studies have shown Arctic sea ice to have decreased every season since 1979 and is projected to continue to decrease by 3% in response to climate change (IPCC, 2014).

The most significant trends in sea ice decline has been identified in annual ice. In response to warming temperatures, annual ice is estimated to decline at more than 10 days per decade (IPCC, 2014). Annual sea ice is found along the southern coasts of the Arctic Ocean, in the channels between the islands of various Arctic archipelagos, and the in the Hudson Bay Complex (Stirling, 2011; Wadhams, 2003). Trends in annual sea ice in the Hudson Bay indicate complete freeze-up by December and an ice-free period from mid-August to late October (Gagnon & Gough, 2005). Anthropogenic influence is *very likely* to have contributed to Arctic sea ice loss (IPCC, 2014). Anthropogenic evidence was detected from May to December which

suggests that the human influence is stronger in the late summer. This has caused a prolonged period of warmer temperatures into the colder seasons (IPCC, 2014). Consequently, these warmer temperatures have caused annual sea ice in the Hudson Bay to break up three weeks earlier than it did 30 years ago and freeze-up later (Gagnon & Gough, 2005). The decrease in sea ice extent and duration, along with the increase in Arctic temperatures, is threatening the long-term survival of marine wildlife, particularly animals, much like the polar bear, who depend on sea ice for hunting (Stirling, 2011).

3.2.2 Sea ice and polar bear dependence

All polar bears use sea ice as a platform to catch ringed seals, their main source of food (Derocher et al., 2004; Stirling, 2011). Polar bears use annual sea ice for hunting because it lies over shallower and biologically productive waters where seal densities are the highest (Stirling, 2011; Stirling & Derocher, 2012). Because annual sea ice melts completely during summer months, polar bears are forced onto land where they must rely on their energy reserves until they can find ice to hunt on or until the freeze-up period in mid-October (Regehr et al., 2007; Stirling, 2011).

An estimate of 842 Western Hudson Bay (WHB) polar bears occupy areas in and around the Western Shore of the Hudson Bay, north from the Manitoba and Ontario board and in areas in Nunavut including Rankin Inlet, Arviat, and Chesterfield Inlet (Dyck et al., 2017; Government of Canada, 2018; Peacock et al., 2010; Stirling 1988; 2011) (Figure 3.1). From October to November, the WHB bears congregate on shore around the Bay and wait for the sea ice to form so they can begin their 8-month hunting period (Regehr et al., 2007; Stirling, 2011). During this time, the bears have low energy levels and are thus relatively inactive and easy to see on the snow-free ground (Stirling, 2011).

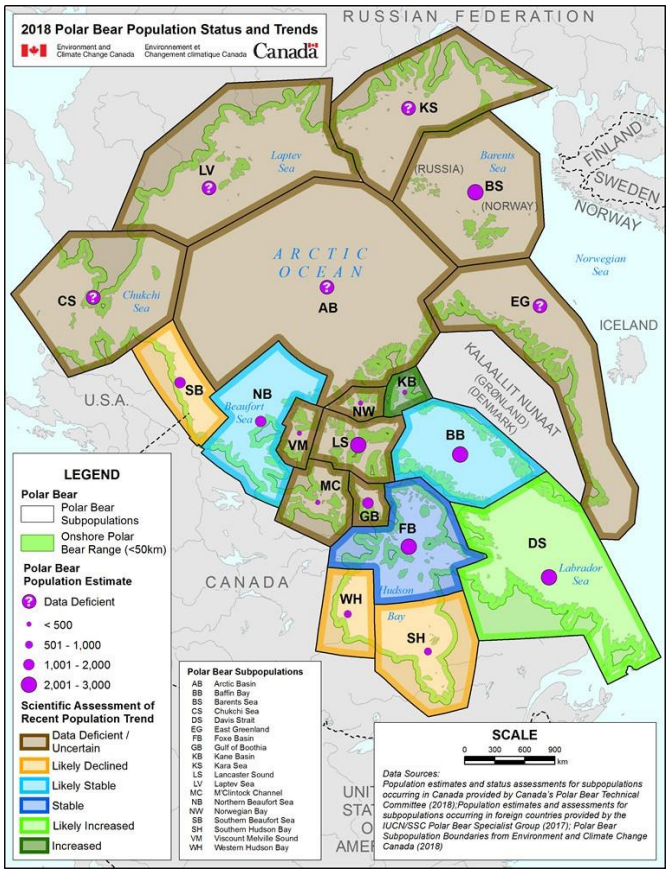


Figure 3.1: Circumpolar Polar Bear Sub- Population and Status Map (source: Government of Canada, 2018)

Because the WHB polar bears are accessible and abundant during the summer, they are easy to study. There has been more than 40 years of research on this subpopulation, with studies analyzing the animal's health, population and threats to the bears (Peacock et al., 2010). Studies have shown threats to the polar bears to be linked with anthropogenic influences which include sport harvesting and hunting, contaminant accumulation, increase in shipping and climate change (Peacock et al., 2010). Because of rising temperatures, the WHB polar bears are experiencing longer waiting periods before they can begin hunting due to later ice freeze-ups, and shorter hunting times in response to earlier ice break ups. Between 1988 and 2004, polar bear experts saw a 22% decline in the WHB polar bears in response to the changes in sea ice patterns (Regehr et al., 2007; Stirling & Parkinson, 2006). Furthermore, the less time a female bear spends hunting during the freeze-up period, the higher the risk of survival and malnutrition for themselves and for their cubs (Derocher et al., 2004; Stirling, 2011; Stirling et al., 1999). It has been estimated

that if pregnant females continue to arrive ashore two months earlier, they will lose approximately 22kg of body mass per breeding season (Castro de la Guardia et al., 2012; Stirlling & Derocher, 1993).

Lunn et al., (2016) suggests that the survival of the WHB polar bears will fluctuate over time as the climate continues to change. However, because this subpopulation depends largely on the productivity of female bears and sea ice freeze-up periods, the long-term trend of this population is likely to be negative.

3.2.3 The implications of climate change for tourism

Tourism destinations whose services and products are dependent on natural resources and environmental systems are being impacted by the effects of climate change (Dawson et al., 2007). Becken & Hay (2012) identified ski and beach resorts as the tourism destinations experiencing the worst effects of climate change, whereby unseasonable temperatures and extreme weather events are altering the products, service, and infrastructure. This in turn is causing destructive, expensive and potentially irreversible changes to the industry (Becken & Hay, 2007). Furthermore, these destinations are experiencing a loss of biodiversity, a redistribution of animal species and a transformation of natural landscapes (IPCC, 2014; Scott et al., 2012).

In Canada, tourism is one of the leading growth sectors and one of its main attractions is its natural resources (Dodds & Graci, 2009). The Canadian Arctic is made up of three territories: Yukon, Northwest Territories, and Nunavut and northern parts of Manitoba, Quebec, and Labrador (Dawson et al., 2007) (Figure 3.2). Along with mineral extraction and fisheries, tourism is one of the most substantial economic drivers in these northern regions attracting on average 530 000 visitors and generating more than $390 million in annual visitor spending (Hall & Saarinen, 2010; Maher et al., 2014). Motivations for traveling to the Canadian Arctic typically reflects wildlife viewing, hunting and fishing, recreational opportunities, cultural activities and business activities (Dawson et al., 2007; Hall & Saarinen, 2010).

Figure 3.2: Map of Canadian Arctic (Source: Oceans North Conservation Society, World Wildlife Fund Canada, and Ducks Unlimited Canada, 2018)

The effects of climate change are altering Arctic tourism resources including scenery and wildlife (Dawson et al., 2007). Warmer temperatures have extended traditional tourism seasons (summer) into spring and autumn, and in turn have extended summer activities such as whale watching (Hall & Saarinen, 2010; Johnston, 2006; UNEP, 2007). The decline in sea ice has extended the shipping season and expanded cruise ship tourism which has increased economic growth and accessibility for Nunavut and other Canadian destinations (Dawson et al., 2007; Hall & Saarinen, 2010). Moreover, the implications of climate change in Arctic regions has allowed tourists to participate in a new range of activities which include taking walks on the frozen land, kayaking, and observing immediate wildlife, especially as new species of flora and fauna emerge in response to warmer temperatures (Hall et al., 2010). Consequently, these warmer temperatures are creating seasonal challenges for winter activities and is causing structural damage and infrastructure problems due to permafrost melting and land instability (Dawson et al., 2007;

Dawson et al., 2010). Scenic attractions, such as snow and ice are melting making traditional activities such as dog sledding increasingly difficult to participate in (Dawson et al., 2007). Wildlife viewing such as polar bear viewing tourism in Churchill, Manitoba is experiencing both the negative and positive implications from climate change, caused by warmer Arctic temperatures (Dawson et al., 2010).

3.2.4 Polar bear viewing and last chance tourism in Churchill, Manitoba

Churchill, Manitoba has built a global reputation as the best place for polar bear viewing, self-declaring themselves as the "polar bear capital of the world" (Lemelin et al., 2010; Stewart et al., 2012) (Figure 3.3). Since the 1960s, Churchill's tourism industry has capitalized on the WHB polar bears' October and November waiting period by providing thousands of tourists with a unique experience to see a polar bear in its natural habitat (Struzik, 2014). Traveling in large tundra vehicles along 33 km of trails in the Churchill Wildlife Management Area (CWMA), tourists spend six hours a day trying to spot a polar bear or other Arctic wildlife (Dawson et al., 2010b). These vehicles are built high off the ground, have open area viewing platforms which provide tourists with adequate viewing opportunities and are the ideal way to safely and comfortably take pictures and enjoy the unique viewing experience (Dawson et al., 2010b) (Figure 3.4).

Figure 3.3: Town of Churchill Welcome Sign

Figure 3.4: Tundra Vehicle and Polar Bear in the CWMA

Some animals, much like the polar bear, attract more interest from the general public because if its size appeal, the difficulty and accessibility of being found in the wild, and even its portrayal in the media (Fennell, 2012). With the rise of Arctic temperatures and the decline in polar bear populations, people have become increasingly aware of the state of these animals. It has been suggested that tourists are "rushing" to Churchill to see the polar bears while they still exist in the wild (Dawson et al., 2010b; Groulx, 2015; Lemieux et al., 2017). It is important to note that studies show no existing evidence of tour operators marketing their industries as "last chance tourism" (LCT) destinations (Gössling et al., 2012; Lemieux et al., 2017; Stewart et al., 2013). Promoting the vulnerability and potential disappearance of their attractions would portray a negative image for these tourism destinations (Dawson et al., 2011). The images of LCT destinations are influenced by uncontrollable media sources which can include social media, word of mouth, and television programs (Dawson et al., 2012; Gössling et al., 2012; Scott et al., 2012). These media sources tend to alert the viewing public about disappearing locations and ecosystems and the congestion of these locations to encourage viewers to "see it before it is gone" or to "visit before it becomes too crowded" (Lamers et al., 2012; Lemelin et al., 2012). Furthermore, the coverage by the media tends to be glamourized and fails to educate viewers about the impacts of climate change and what it means for these destinations at risk (Burns & Bibbings, 2009; Lemieux et al., 2017).

3.2.5 Advantages and disadvantage of last chance tourism for polar bear viewing

The motivation to travel to see the polar bears "before they disappear" is a reaction to the perceived changes of a destination which allows tourists the opportunity to see the transformation of an ecosystem and extinction of a species firsthand (Groulx et al., 2016; Lemelin et al., 2012). Tourists' perceptions about these destinations are influenced by education levels, age, culture, and how LCT is represented and communicated to them (Becken, 2007; Johnston et al., 2012; Scott et al., 2012). Table 3.1 highlights some of the advantages and disadvantaged that can be experienced by tourism industries influenced by the last chance tourism trend.

Table 3.1: Advantage and Disadvantages of Last Chance Tourism

Advantages	Disadvantages
• Tourists traveling to LCT destinations generally have an understanding about the implications of climate change and have expressed concern and a desire to learn more; • LCT experiences can motivate and encourage behavioural and lifestyle change for tourists; • LCT destinations can be places to collectively motivate climate action which will influence the protection of polar bear populations; • Economic benefit to tour operators over the short-medium term due to the extension of the tourism season and the willingness to pay to see a polar bear; • Increase in employment opportunities; and • Improvement in the recovery rates for threatened species due to increase in the demand to travel.	• Tourists may be faced with the disappointment of experiencing environments and biodiversity in the state of devastation; • Tourists might experience a disconnect between what they may expect to see and what the destination can sustainably offer; and • Tourists might perceive the attraction to be lost, which may lead to them to travel to other tourism destinations entirely.

Sources: Dawson et al., 2007; Dawson et al., 2010; Dawson et al., 2011; Gössling et al., 2012; Groulx, 2015; Groulx et al., 2016; Gunter Jr., 2018, Hall, 2014; Lemelin et al., 2010; Lemieux & Eagles, 2012; Lemieux et al., 2017; Shelton, 2012.

3.2.6. Implications of travel for climate change

As more tourists travel to see the polar bears before they disappear, these tourists become disproportionately responsible for the greenhouse gas emissions which are contributing to climate change (Dawson et al., 2010b). Dawson et al. (2010b) stated that emissions from Churchill's polar bear viewing industry were primarily generated from local transportation between activities, diesel powered tundra vehicles, scenic tours via helicopters and air travel. Due to the high costs and extreme difficulties associated with building roads on areas covered by permafrost this region is inaccessible by vehicle (Distasio et al., 2011). Furthermore, cruise ship tourism is seasonal due to the freeze-up periods and the rail line running from Winnipeg to Churchill experiences frequent infrastructure problems and delays. (CTVNews, 2018; Dawson et al., 2010b; Johnston et al., 2012). Churchill is therefore only reliable by plane. Due to this dependence on air travel, a polar bear viewing tourist was estimated to emit greenhouse gas emissions which were 6-34 times higher than an average global tourist (Dawson et al., 2010a)[3]. Over 75% of the global tourism industry emissions are emitted by transportation. Accommodation and tourist activities influence 21% and 4% respectively of the tourism industry's emissions (UNWTO-UNEP-WMO, 2008). As the tourism industry expands in response to international tourism development, the demand and reliance on air travel is expected to grow, further influencing greenhouse gas emissions (Gössling & Peeters, 2007; Gössling et al., 2013).

3.3 Methodology

3.3.1 Study area

Churchill, Manitoba is located on the edge of the Hudson Bay, at the junction of the boreal forest (an important site for polar bear denning) and the Arctic tundra (an important site for polar bear viewing) (Distasio et al., 2011) (Figure 3.5). Churchill's population of approximately 900 people fluctuates on a seasonal basis as many of its residents work in health services, international

[3] According the UNWTO-UNEP-WMO (2008) report who conducted an in-depth analysis of tourism emissions, an average global tourist experience is estimated to emit 0.25t/CO_2

shipping, scientific research, and the tourism industry (Distasio et al., 2011; Statistics Canada, 2016). The tourism industry is a major driver for Churchill's economy. Throughout the year, this subarctic town offers a wide variety of attractions which include migratory bird spotting, beluga whale watching, Aurora Borealis gazing, and polar bear viewing (Distasio et al., 2011) (Figure 3.3). Polar bear viewing, which occurs every October to November, attracts an average of 12 000 tourists annually and generates $7.2 million to Churchill local economy (EcoRessources Consultants, 2011; Struzik, 2014)[4].

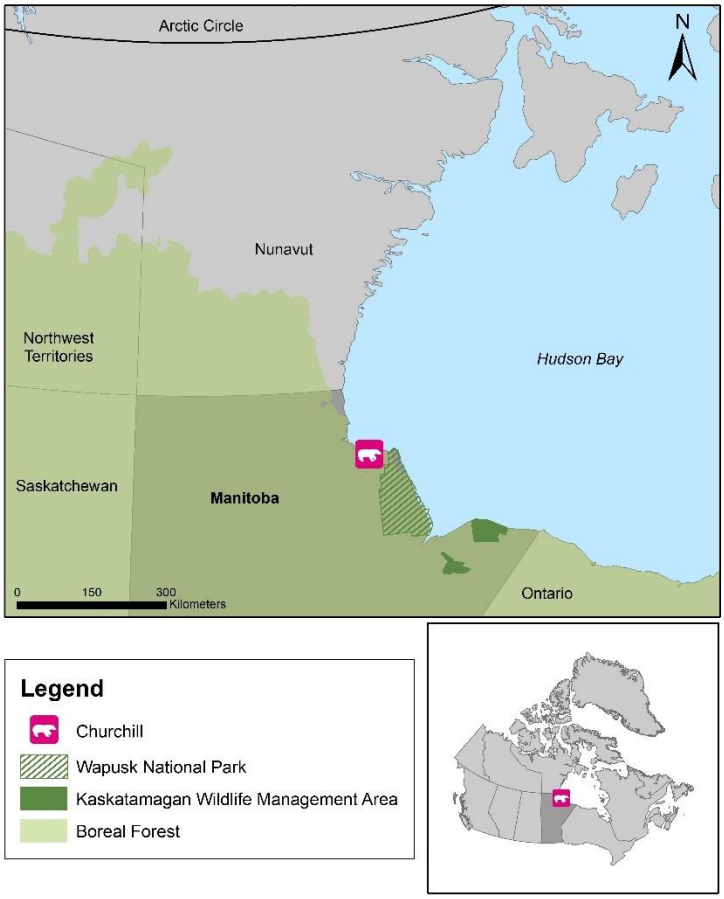


Figure 3.5: Map of Churchill, Manitoba

[4] Little statistical data is available about this small community's tourism industry, therefore the numbers provided are estimates (Western Management Consultants & Econometric Research Limited, 2018).

During the polar bear viewing season, tours are conducted in the CWMA. This area is managed by the provincial conservation authority and only two tour operators (Frontiers North Adventures and Great White Bear) hold permits to conduct tours along the trails (Dawson et al., 2010b). While Frontiers North Adventures and Great White Bear monopolize the viewing tours, accommodations and activities can be provided by external tour operators. These tour operators include Churchill Nature Tours, Churchill Northern Studies Centre, Churchill Wild, Heartland International Travel & Tours, Great Canadian Travel Company Ltd., Lazy Bear Expeditions, Natural Habitat Adventures (Dawson et al., 2010b; everythingchurchill.com; Groulx, 2015). Accommodation can be found in town, at the Churchill Northern Studies Centre or in lodges directly on the tundra. Tourists have the option of booking one-day viewing tours, with roundtrip transportation from Winnipeg to Churchill or a multi-day package where accommodation is included along with dog sledding, helicopter tours and visits into the town.

3.3.2 Survey distribution and design

During the 2018 polar bear viewing season (October 16 to November 16), qualitative and quantitative data was collected using a visitor survey. Paper and electronic surveys (via tablets and iPads) were distributed to tourists who participated on a polar bear viewing tour on their current visit to Churchill. Survey participants were selected using convenience sampling which is a non-probability sample where participants (in this case tourists) are chosen based on convenience and availability (Creswell, 2014). Sampling occurred in two areas in Churchill: the Churchill Northern Studies Centre (a field station catered to research and education), and at the Churchill Airport. Rationale for these two locations was based on Dawson et al. (2010) and Groulx (2015) who used these two places to conduct surveys. Surveys were not conducted at the train station or at the adjoining Parks Canada visitor centre as was done in the previous studies as the train was not operational at the time during the time of study. At the Churchill Northern Studies Centre, surveys were distributed methodically 1-2 times a week to tourists who were staying at the Centre and who were participating on multi-day tours. At the Churchill airport, surveys were distributed to participants during regularly scheduled departures times, twice a day, three times a week. The survey was designed to be self-completed by the participants to allow them to express themselves as honestly as possible, without feeling compelled to give the “right”

answer (Fowler, 2009; McKercher et al., 2010). Similarly, it also allowed the respondents to immediately read and respond to the questions themselves (Needham & Vaske, 2008). Survey questions consisted of closed-ended questions to allow for a comparison between results from former studies as well as open-ended questions to allow tourists to elaborate their thoughts. Following the completion of the survey, tourists were invited to be entered to win a signed copy of "Arctic Icons: How the town of Churchill learned to love its polar bears" by Edward Struzik. Of 662 tourists who were approached, 513 surveys were completed and returned, representing a 77% response rate. Reasons tourists chose not to complete the surveys were because they were tired, uninterested, or because they wanted to do one survey among two people.

The survey was divided into five sections: trip characteristics, motivation to travel, knowledge about climate change, opinions on strategies to reduce greenhouse gas emissions, and demographics. Several survey questions were replicated from Dawson et al. (2010) and Groulx (2015) to allow for a comparison of tourists' knowledge and awareness about climate change, motivation to travel and the greenhouse gas emissions from this industry. Trip characteristics were used to conduct a bottom-up approach, which estimates energy use and emissions based on a tourist's choice of activities, accommodation and mode of transportation (Becken & Hay, 2007). The same approach that was used by Dawson et al. (2010) was employed. This involved using this data to calculate the greenhouse gas emissions from the polar bear viewing industry. Emission estimates were calculated to identify if Churchill's emissions had fluctuated since the original study in 2007. Tourism emissions have risen globally from 5% in 2007 to 7% in 2018, due to the increase in transportation, thus it was expected that emissions from the polar bear viewing industry on average will also have risen accordingly (Lenzen, 2018; UNWTO-UNEP-WMO, 2008).

At the time of this study, air travel was the only mode of transportation available to tourists to reach Churchill due to the closure of the local train line. Air travel is therefore the only mode of transportation considered in the greenhouse gas emission analysis. This is a limitation of the study as train travel emits lower emissions compared with air travel (UNWTO-UNEP-WMO, 2008). According to calculations made by Via Rail, train travel from Winnipeg to Churchill is approximately 0.058 tonnes/ CO_2, while taking the plane is approximately 0.41 tonnes/ CO_2 (viarail.com). Dawson et al. (2010) found that only 14% of survey participants traveled to and

from Churchill by train and did not consider their emissions from train travel in their calculations. It is uncertain how many tourists will take the train again in the future now that service has become increasingly inconsistent and even ceased operations completely for the past two years. Although the rail line has reopened, the round-trip journey between Winnipeg and Churchill is four days (viarail.com) and may be unappealing to tourists due to the time constraints of their vacations.

Using information about respondent's trip characteristics (i.e. mode of travel, length of travel, etc.), the amount of greenhouse gas emissions from transportation were calculated using online carbon calculators. Online carbon calculators are openly available to the public and are used by governments for international emissions reports, by businesses to determine their carbon emissions, and by individuals who wish to reduce their environmental impacts either at home or from travel (Jardine, 2009). Carbon calculators employ a basic technique which uses travel distances and standard emission factors (ranging from 1-5) to estimate CO_2 emissions (Dawson et al., 2010b). An estimate of total travel emissions from an individual tourist based on their travel routes was calculated using three online calculators: Carbon Zero, Atmosfair, and Climate Care (Becken & Hay, 2007; Dawson et al., 2010; Jardine, 2005). The Carbon Zero online carbon calculator has been previously used in studies which analyzed tourists' understanding of online carbon calculators (see Juvan et al., 2014). The Climate Care online calculator has been used in studies which analyzed the carbon emissions from flights (see Jardine, 2009). Atmosfair has been used to calculate the emissions from Churchill's polar bear viewing industry (see Dawson et al., 2010b). Additionally, these three calculators were chosen because they required the same information to be inputted (route specific information, passenger load and cabin class). The two other carbon calculators used by Dawson et al. (2010b), Zerofootprint and Carbonnneutral, are no longer available and could not be used for this analysis.

Different calculators will provide varying results for the same flights due to underlying assumptions (i.e. climatic conditions, flight distances due to detours, flight mass, etc.) made in the calculator methodology (Jardine, 2009). Therefore, an average of emissions calculated from the selected online calculators was used to provide a best estimate of the greenhouse gas emissions from air travel. Accommodation and activity estimates were taken directly from Dawson et al. (2010) and the UNWTO-UNEP-WMO (2008) report as these emission estimates

have been previously validated and no new relevant carbon factors that relate to the tourism industry were available at the time of this study.

3.4 Results

3.4.1. Tourist profile/ demographics

In this study, a typical polar bear viewing tourist is female (63%) who is, on average, 64 years of ages and holds either a bachelor or graduate degree (76%) (Table 3.2). This demographic profile very closed matched the profiles found by Dawson et al. (2010) and Groulx (2015) who also identified that the typical polar bear viewing tourist was an older (average age of 61 years old), female (67%) with higher levels of education (74%) (Table 3.2). Similarly, these demographics also mirror the profiles found in studies which have focused on other last chance tourism and ecotourism destinations (see Eijgelaar et al., 2010; Gunter Jr., 2018).

Table 3.2: A Comparison of Churchill's Polar Pear Viewing Tourists' Demographics

	Dawson et al. (2010)	**Groulx (2015)**	**D'Souza (2018)**
Average Age	61	63	64
Gender	Female (66%)	Female (67%)	Female (63%)
Level of Education	Higher than average levels of education (72% post-secondary)	Bachelor's degree (76%)	Bachelor or Graduate degree (76%)
Country of Residence	• Canada (44%) • United States (42%) • United Kingdom (18%) • Europe (3%) • Australia (3%)	• Non-Canadian citizens (76.5%) • Canadian citizens (23.5%)	• United States (68%) • Canada (17%) • United Kingdom (6%) • Australia (5%) • Europe (3%) • Asia (1%)

The majority of respondents were from the United States (68%) followed by Canada (17%), the United Kingdom (6%), Australia (5%), Europe (3%) and Asia (1%). Groulx (2015) also indicated that a small percentage (23.5%) of survey respondents were Canadian citizens (Table 3.2). These results differ from Dawson et al. (2010) which indicated an almost equal divide between Canadian tourists (44%) and American tourists (42%) (Table 3.2). The high volume of tourists from the United States from 2015-2018 may be a response to the low Canadian dollar which has increased visitation from US residents since 2014 (TIAC, 2016). Another explanation for the high volume of tourists from the United States in more recent years may also be due to the increased target marketing in many US states, which has influenced more people to travel to Manitoba (Travel Manitoba, 2018).

Polar bear viewing experiences in Churchill are an average of 5-days in length. During this time, tourists will go on two day-long polar bear viewing tours inside an elevated vehicle, one helicopter ride (weather permitted), dog sledding, and will take one or more trips into town for visits to the Parks Canada visitor centre, the Eskimo/Itsanitaq Museum, souvenir shopping, and dining at the town's local restaurants. These activities are the same as those indicated by Dawson et al. (2010) and Groulx (2015). When asked if their tours included an educational component, 93% of respondents identified that there was. They indicated that their tour operators discussed climate change, polar bear health, environmental issues, sea ice and general polar bear information. Churchill Northern Studies Centre, Frontiers North Adventures, and Natural Habitat Adventures all advertise an educational component to their tours which are often led by polar bear experts (churchillscience.ca; frontiersnorth.com; nathab.com). This is something that has evolved over the last 10 years as Dawson et al. (2010a) indicated that very little environmental information was provided to tourists during the viewing tours.

3.4.2 Greenhouse gas emission estimates from Churchill's polar bear viewing industry

The first objective of this study was to estimate the greenhouse gas emissions from Churchill's polar bear viewing industry. To calculate the greenhouse gas emissions from transportation (primarily from air travel), survey respondents were asked to describe their travel routes from their original destination to their arrival destination (Churchill, Manitoba). Almost all the

respondents travelled to Winnipeg, Manitoba (the gateway city to Churchill) by plane. No specific addresses were provided by respondents to allow for an accurate calculation of travel emissions by other modes of transportation (i.e. car) used to travel to Winnipeg. Therefore, any greenhouse gas estimates for travel only considered travel routes by plane. The estimated greenhouse gas emissions for a personal journey to Churchill via plane from Denver, Minneapolis, New York City, Toronto, Vancouver, London, Adelaide, Munich, and Tokyo ranged from an average of 0.53 t/CO_2^{-e} (origin: Minneapolis, Minnesota) to an average of 8.08 t/CO_2^{-e} (origin: Adelaide, Australia)[5] (Table 3.3).

Table 3.3: Estimated CO_2 Emissions from Air Travel Routes to Churchill, Manitoba

	CarbonZero	Atmosfair	Carbon Care	Average ($t/CO2^{-e}$)
Minneapolis, USA (via Winnipeg)	0.54	0.65	0.41	**0.53**
Denver, USA (via St Paul)	1.06	1.24	0.77	**1.02**
Toronto, Canada (via Winnipeg)	1.15	1.14	0.83	**1.04**
Vancouver, Canada (via Winnipeg)	1.33	1.49	0.95	**1.26**
New York, USA (via St Paul or Toronto)	1.39	1.45	1.02	**1.29**
London, England (via Toronto)	4.27	3.90	2.57	**3.58**
Munich, Germany (via Toronto)	4.46	3.84	2.75	**3.68**
Tokyo, Japan (via St Paul)	6.2	6.79	3.98	**5.66**
Adelaide, Australia (via Los Angeles)	9.16	9.77	5.3	**8.08**

Note: These cities listed above represent the major cities tourists traveled from to reach Winnipeg

[5] Emission estimates are expressed as CO_2 equivalents (CO_2^{-e}) as a way of comparing emissions from all greenhouse gases which are trapped in different amounts of heat, not just carbon dioxide (Hausfather, 2017)

Accommodation and activities were calculated using emission factors from Dawson et al. (2010b) and the UNWTO-UNEP-WMO (2008) report (Table 3.4). These calculations consider emissions from commercial accommodation in a developed country, emissions used to travel to and from the tundra vehicle launch, the tundra vehicle trips, helicopter tours, travel to the dog sledding location, and a tour of the town.

Table 3.4: Estimated CO_2 Emissions for Churchill's Accommodations and Polar Bear Tour Activities

Accommodation/land-based transportation/ activities	**Distance/time**	**CO_2 factor**	**Total CO_2 emissions (in tons)**
Accommodation	5 nights	19 kg/ hotel night	0.095
Travel to tundra vehicle launch- return	104 km	0.022 kg/km	0.002
Tundra vehicle trip (2 trips)	30-gal diesel/ vehicle/ day	10.1 kg/gallon	0.034
Helicopter scenic flight	15-20 minutes	27.7 kg/ trip	0.028
Travel to dog sledding location	26 km	0.22 kg/km	0.006
Tour of town	15 km	0.22 kg/km	0.003
Total			**0.168**

See Dawson et al. (2010b) for a complete discussion of the emission breakdown and calculations.

Based on these calculations, a polar bear viewing tourist will emit, on average, 0.7 t/CO_2^{-e} (origin: Minneapolis, Minnesota) to 8.25 t/ CO_2^{-e} (origin: Adelaide, Australia) during their 5-day trip to Churchill, Manitoba. Compared to Dawson et al. (2010), who estimated greenhouse gas emissions to range from 1.54 t/ CO_2^{-e} (origin: Toronto, Canada) to 8.61 t/ CO_2^{-e} (origin city: Sydney, Australia). The difference of the greenhouse gas estimates for individual tourists from the two studies is negligible, indicating that there has been very little shift in emissions over 10 years. The polar bear viewing industry is therefore 3-34 times higher than a global average tourist experience of 0.25 t/CO_2, depending on the departure destination. Dawson et al. (2010)

indicated that following cruise ship tourism in Antarctica, which emits 15 t/CO_2-e per tourist, polar bear viewing has the second highest greenhouse gas emissions (Eijgelaar et al., 2010).

The total industry emissions for the 2018 polar bear viewing season is estimated to be 23,017 t/CO_2 (Table 3.5). This is higher than the 2007 estimates which were estimated to be 20,892 t/CO_2. The increase in the total industry emissions is related to the estimated increase in tourists in 2018 (n= 12 000) compared to estimated numbers for 2007 (n=8000). Furthermore, there was an increase in tourists traveling further distances (i.e. increased from the United States and a decrease in visitors from Canada) in 2018.

Table 3.5: Estimated Total Polar Bear Viewing Industry Emissions for Churchill, Manitoba

Transportation, accommodation, and activities	**Emissions (t/CO2 -e)**	**Total number of tourists/year (n=12 000)**	**Total emissions per scenario (t/CO2 -e)**
Minneapolis, USA (30%)	0.7	3600	2520
Denver, USA (19%)	1.19	2280	2713
New York, USA (19%)	1.46	2280	3329
Toronto, Canada (9%)	1.21	1080	1307
Vancouver, Canada (8%)	1.43	960	1373
London, England (6%)	3.75	720	2700
Adelaide, Australia (5%)	8.25	600	4950
Munich, Germany (3%)	3.85	360	1386
Tokyo, Japan (1%)	5.83	120	700
Activities/ accommodations (100%)	0.17 per person	12000	2040
Total			**23,017 t/CO2**

3.4.3 Tourists' awareness about the impacts of climate change

The second objective of this study was to identify tourists' awareness of the impacts of climate change. Based on the responses shown in Table 3.6, there appears to be a negligible difference in responses when the same questions were asked to tourists more than 10 years later. The majority of polar bear viewing tourists (92%) were very sure or somewhat sure climate change is happening and that human activities contribute to the effects of the changes being experienced today. Like the responses from 2015, 84% of respondents were extremely or somewhat concerned about climate change. Fewer respondents (73%), strongly agreed or agreed with the statement "air travel is a contributor to climate change". Dawson et al. (2010) concluded that this lack of understanding of how travel contributes to climate change may be because tourists cannot necessarily see the environmental impacts (i.e. the decrease in polar bear populations) from their single visit to Churchill (Gunter Jr., 2018). Because the effects from air travel take time to trigger temperature climatic changes, a tourist may not be able to recognize the impacts of change on their single trip (Becken, 2004; Gössling & Peeters, 2007; Hall, 2010). Only 59% of respondents agreed or strongly agreed that polar bears would disappear from the Churchill region due to change in the global climate. Moreover, tourists might not be aware of these impacts from travel because it is not frequently discussed (Hall, 2010). There was no mention from respondents that their tour operators discussed the effects of climate change from tourism during their tours.

Table 3.6 Tourists' Knowledge and Attitudes about Climate Change

	Dawson et al. (2010)	Groulx (2015)	D'Souza (2018)
Do you think climate change is happening?		89.2% agree	92% agree or strongly agree
If you think climate change is happening, do you think it is • *Caused mostly by human activities* • *Caused mostly by natural changes in the environment* • *Caused by both human activities and natural changes*	88% agree or strongly agree **humans** are contributing to the changes in the global climate	74.6% believe climate change is caused primarily by human influences	47% believe climate change is caused by both **human** activities and natural changes 45% mostly by **human** activities Total agreeing or strongly agreeing a human influence = 92%
Air travel is a contributor to climate change	69% agree or strongly agree		73% agree or strongly agree
Polar bears will disappear from the Churchill region due to changes in the global climate	60% agree or strongly agree 7% disagree 28% unsure		59% strongly agree/ agree 23% neutral
Would you still have visited Churchill if the polar bears appeared to be unhealthy (i.e. noticeably skinny)	60% definitely		56% definitely/ probably
If you were not able to see polar bears in Churchill, would you be willing to go elsewhere to view the bears?	72% definitely		78% definitely/ probably
"After seeing the polar bears, I plan on making some changes to my lifestyle at home to reduce my greenhouse gas emissions"	48% strongly agree		57% strongly agree or agree
Did you purchase an offset?	7%		8%
What is the reason you did not purchase an offset	• I don't know what the money is for (21%) • I don't know what a carbon tax is (12%) • I don't know what company to trust (12%)		• I don't know what a carbon offset is (22%) • I don't know what the money is used for (18%) • It was not offered (11%) • I don't think it is necessary or effective (6%) • It was not made available (5%)

When respondents were asked if they would make lifestyle changes at home to reduce their greenhouse gas emissions, 57% strongly agreed or agreed which indicates a 9% increase from the 2007 results. These respondents stated they would try to reduce packaging, invest in solar energy, recycle more, drive less, and purchase an electric or hybrid car. 62 respondents strongly disagreed or disagreed with this statement and 64 respondents left this question blank. These respondents stated that they already did enough to reduce their emissions at home and they did not know what else they could or should be doing. McKercher et al. (2010) argue that there is a growing number of people who are becoming aware of the implications of climate change, but they are unwilling to translate these concerns into actions by changing their consumption patterns. Although more than half of respondents indicated they would make lifestyle changes, more information needs to be provided to tourists about what sort of changes they can make especially relating to travel.

When asked if respondents purchased a carbon offset[6] only 8% indicated they had purchased one. Only one of the tour operators (Natural Habitat Adventures) offer a carbon offset as part of their tour packages, and although 36% of respondents traveled with this operator, the number of people who purchased an offset remains significantly low. Similar to studies which have analyzed carbon offsetting (Becken, 2004; Dawson et al., 2010; UNWTO-UNEP-WMO, 2008), tourists are unsure about what a carbon offset is. The U.S. Department of Energy 2011 survey of US consumers have also indicated a very low public awareness (36%) about carbon offsetting (Kim et al., 2016). Recent studies have highlighted a stable carbon offsetting market that shares several key characteristics with the LCT market (e.g. nature-based tourists, experience seekers, etc.) (Groulx et al., 2016; McLennan et al., 2014). However, this study indicates that tourists may need more information about what a carbon offset is and what the money used is for in order to make the decision to participate in an offsetting program (Table 3.6).

[6] A carbon offset is a voluntary, monetary donation equal to the emission of a certain activity (i.e. flights). This donation is intended to reduce greenhouse gas emission through other activities such as planting trees or educational investments (UNWTO-UNEP-WMO, 2008).

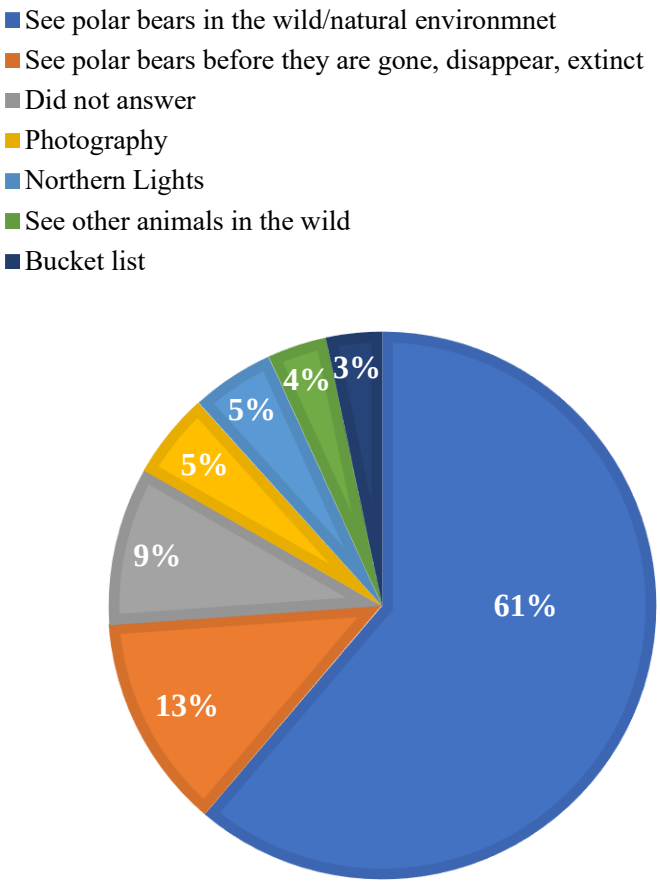
3.4.4 Motivations for travel

The main motivations for tourists traveling to Churchill was to see a polar bear in the wild/ in their natural environment (61%) (Figure 3.6). Of these responses, there was no indication as to whether these respondents wanted to learn more about the polar bears or climate change. Tourists indicated other motivations which included to see other Arctic animals in the wild, to see the Northern Lights and for photography (Figure 3.6). Furthermore, 56% of respondents definitely or probably would still have visited Churchill if the polar bears appeared to be unhealthy (i.e. noticeably skinny). This demonstrates a certain loyalty to this destination, indicating that tourists are traveling/ would be traveling to Churchill for other reasons than seeing a polar bear (Scott et al., 2012).

Of the responses that included a "see it before its gone" response, 13% of respondents identified they wanted to see the polar bears before they are gone, go extinct or disappear. These respondents also indicated they were motivated to learn about climate change and environmental issues and to understand the situation the polar bears currently face. This is a trend that has increased over time. In some of the first studies examining tourists' motivations for traveling to Churchill, tourists visited this subarctic town because of their love of bears and for photography (Lemelin, 2006). The 2018 responses are similar to other last chance tourism studies which have also indicated an increase in the demand to see it before it's gone over the past 10 years (Piggott-McKellar & McNamara, 2017). Groulx (2015), identified the motivation to travel to Churchill was primarily to consume aspects of Churchill's vulnerable landscape as part of the last chance experience. Additionally, other motivations to travel indicated by the 2015 respondents were nature reflection and to learn about society's role on climate change and the impact on Churchill's polar bear. Gunter Jr. (2018) argues that the very nature of this type of travel is for tourists to learn while on vacation and to be inspired to share this information with people in their own spaces. Tour operators would need to continue to provide information to tourists post-visit to encourage and motivate them to change behaviours and attitudes about climate change (Ballantyne & Packer, 2011). There is not enough evidence however, to suggest that this would have a direct impact on climate change and polar bears (Dawson et al., 2011). Groulx et al., (2016) also identified motivation to travel which includes a social interaction component, whereby visitors are traveling to Churchill to engage with individuals who relate to nature in a

similar way. In the responses from the 2018 study, there was no mention of wanting to engage with other visitors and to share this experience with others.

Figure 3.6: Churchill's Tourists' Motivation to Travel



3.5 Discussion

Based on the emissions calculated from transportation, accommodation, and activities, Churchill's polar bear viewing industry remains an energy intensive tourism industry, mainly due to the dependence on air travel. However, using the estimates for accommodations and activities from 2008 might provide some inconsistencies with the emission calculations and is a limitation of this study. Natural Habitat Adventures state that they are 100 percent carbon neutral and the Churchill Northern Studies Centre holds a LEED Silver certification for its building

(churchillscience.ca; nathab.com). Therefore, greenhouse gas emissions from accommodations may be lower. Furthermore, most of the emissions that are influenced by Churchill's polar bear viewing industry are from air travel (0.53 – 8.08 t/CO_2-^{e}). Had the train been running during the time of study, emissions may have been slightly lower – but not by much. As indicated, it is uncertain how many tourists would have taken the train from Winnipeg to Churchill. If tour operators promote train travel, the greenhouse gas emissions from transportation for this industry may decrease (Dawson et al.,2010b; UNWTO-UNEP-WMO, 2008). Should air travel continue to increase as is projected, operational, infrastructural and technology driven improvements will be required to reduce emissions and potentially improve travel times (Gössling & Peeters, 2007; Gössling et al., 2013; Vorster & Lyle, 2014).

As observed by Dawson et al. (2010), tourists have an understanding that climate change is happening however, there is a still limited awareness about how air travel contributes to climate change and how these impacts may affect the survival of polar bears. Although tourists are receiving educational information on their tours, it is uncertain (as it was not specified) about the depth of the information received and there was no mention if tour operators were discussing the impacts travel and tourism have on the environment. Because tourists are mostly unaware of these climate change impacts, it can help to explain the low number of tourists who purchased a carbon offset (8%) to reduce the emissions from their polar bear viewing trip. Tour operators should develop innovative experiences that have a greater meaning to tourists, rather than having them pay a carbon offset for example, which as indicated, tourists don't know what it is (Garma, 2014). For these strategies to be effective, more information is required by the tour operators or at the point of purchase (i.e. travel agents) to provide tourists with the information they need to make their trip more sustainable (Gössling et al., 2012; UNWTO-UNEP-WMO,2008). Without knowing the implications or the potential solutions to reduce emissions, there is no "incentive" for tourists to do so. Studies have indicated that tourists feel it is easier and more effective to take personal actions at a local level than a global one, as the effects of climate change might be more noticeable on a day-to-day basis (Becken, 2007). Half of the respondents (57%) identified they would be making lifestyle changes at home, representing a 9% increase since 2007. This is in line with the current awareness people have about climate change and that they believe it is primarily human induced and that action is needed (Gössling, 2011). A follow-up study would be

necessary to help indicate if these tourists actually made these changes and how significant they were in comparison to the emissions from their trip to Churchill.

Groulx (2015) identified that there was evidence that tourists were engaging in the "last chance tourism" trend, however it was not the only motivation as tourists travelled to Churchill to engage in nature reflection as well as to become part of Churchill's story. Although the majority of respondents (67%) from the 2018 study indicated they were traveling to Churchill to see a polar bear in its natural environment, many tourists (13%) included a to "see it before it is gone" response. It should be noted that because this question was open-ended, allowing respondents to express themselves, tourists were not prompted to give this type of response, as might have been the case in the 2015 study. Due to the increase in awareness about climate change and the impacts on animal species, this type of response may be higher than it was in 2007 when the topic of climate change and the relationship with tourism was fairly new. This is a trend that has also been identified in other last chance tourism studies (Piggott-McKellar & McNamara, 2017). Furthermore, because this was an open-ended question, which allowed tourists to express themselves, it might be assumed that more tourists did not include a response which included a "last chance tourism" aspect as they did not want to feel judged by the researcher, especially since they indicated climate change was happening and that it is human induced. Tourists identified other motivations to travel to Churchill including photography, wanting to see the Northern Lights, and wanting to see other Arctic animals. 56% of respondents indicated they would still travel to Churchill, despite the poor conditions of the polar bears, which represents a degree of loyalty to this destination (Scott et al., 2012). Tourists in the 2007 study also indicated they would continue to travel to Churchill if the polar bears disappeared. By having tourists be motivated to travel to Churchill for other reasons, besides seeing a polar bear, can be an advantage for Churchill, who may be able to provide other experiences or advertise the other tourism seasons and activities they offer (Gössling et al., 2012). This is another tourism trend identified as "first chance tourism" – finding new alternatives to attract tourists based on new conditions (i.e. climate change) (Johnston et al., 2012).

3.6 Conclusion

Although the long-term survival of the WHB polar bears is likely to be negative, traveling to Churchill for an opportunity to see a polar bear in its natural environment is likely to continue to increase. The results of this study indicate that after more than 10 years, the overall emissions from the polar bear viewing industry have increased (from 20, 892 t/CO_2 in 2007 to 23,017 t/CO_2 in 2018), due to the increase in travel, a trend that is expected to continue (Scott et al., 2012). Individual emissions from tourists ranged from an average of 0.7 t/CO_2-^{e} (origin: Minneapolis, Minnesota) to 8.25 t/ CO_2-^{e} (origin: Adelaide, Australia) during their 5-day trip to Churchill, Manitoba. These estimates are similar to those reported by Dawson et al. (2010), indicating that little to no efforts have been made to reduce emissions from the industry over 10 years. Moreover, the awareness that tourists have about climate change has remained unchanged. Although 92% of respondents believe that climate change is primarily induced, there is still a lack of knowledge about how air travel contributes to these changes and how polar bears are influenced by climate change. It is an important step that tour operators are talking to tourists about climate change and emphasizing how it influences the polar bears, something that has evolved over ten years; however, more information and education is needed. Furthermore, as the results of this study indicate, if tourists are not traveling to Churchill to see a polar bear, they will be traveling for other reasons (i.e. to see the Northern Lights, to see other Arctic wildlife, etc.). However, as indicated in the results, more tourists are motivated to see a polar bear "before it's gone", compared to 2007, and this trend is expected to rise as climate change continues to influence the polar bear populations. As tourism continues to expand, more tourists continue to travel to Churchill, the polar bear viewing industry has an opportunity to play their part in reducing emissions to make their tourism experiences less carbon intensive.

3.7 References

ACIA. (2004). Arctic climate impact report: Impacts of a warming Arctic. Cambridge: Cambridge University Press.

Atmosfair. (2018). *Calculate Flight Emissions.* Retrieved November 20, 2018. https://www.atmosfair.de/en/offset/flight.

Ballantyne, R. & Packer, J. (2011). Using tourism free-choice learning experience to promote environmentally sustainable behavior: the role of post-visit 'action resources'. *Environmental Education Research 17* (2). 201-215. DOI: 10.1080/13504622.2010.530645

Becken, S. (2004). How tourists and tourism experts perceive climate change and carbon-offsetting schemes. *Journal of Sustainable Tourism 12:*4. 332-345. DOI: 10.1080/09669580408667241.

Becken, S. (2007). Tourists' perception of international air travel's impact on the global climate and potential climate change policies. *Journal of Sustainable Tourism 15*:4. 351-368. DOI: 10.2167/jost710.0.

Becken, S. & Hay, J.E. (2007). *Tourism and climate change: Risk and opportunities.* North York, Ontario: Channel View Publications.

Becken, S. & Hay, J.E. (2012). *Climate Change and Tourism. From policy to practice*. New York, New York: Routledge.

Bradshaw, M., & Stratford, E. (2010). Qualitative research design and rigour. In Hay, I [Ed], *Qualitative research methods in human geography* (69-80). Don Mills, Ontario: Oxford University Press.

Burns, P., & Bibbings, L. (2009). The end of tourism? Climate change and societal challenges. *Twenty-First Century Society 4*(1). 31-51. DOI: 10.1080/17450140802642424.

Carbonzero. (2018). *Carbon Emissions Calculator.* Retrieved November 20, 2018. http://www.carbonzero.ca/calculate

Castro de la Guardia, L., Derocher, A.E., Myers, P.G., Terwisscha Van Sheltinga, A.D. & Lunn, N.J. (2013). Future sea ice conditions in Western Hudson Bay and consequences for polar bears in the 21st century. *Global Change Biology 19* (9). 2675-2687. DOI: 10.1111/gcb.12272.

ClimateCare (2018). *ClimateCare Carbon Calculator.* Retrieved November 20, 2018. https://climatecare.org/calculator/

Creswell, J.W. (2014). *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches.* United States of America: Library of Congress Cataloguing-in-Publication Data.

CTV News. (December 2, 2018). All aboard: First passenger train in 18 months depart for Churchill, Man. Retrieved from https://www.ctvnews.ca/canada/all-aboard-first-passenger-train-in-18-months-departs-for-churchill-man-1.4201440

Dawson, J., Maher, P.T., & Slocombe, D.S. (2007). Climate change, marine tourism, and sustainability in the Canadian Arctic: Contributions from systems and complexity approaches. *Tourism in Marine Environments 4* (2-3). 69-83. DOI: https://doi.org/10.3727/154427307784772057.

Dawson, J., Stewart, E., & Scott, D. (2010a). Climate change and polar bear viewing: A case study of visitor demand, carbon emissions and mitigation in Churchill, Canada. In Hall, C.M., & Saarinen, J. (Eds.), *Tourism and Change in Polar Regions: Climate, environment and experience* (89-103). Abingdon, Oxon: Routledge.

Dawson, J., Stewart, E.J., Lemelin, H., & Scott, D. (2010b). The carbon cost of polar bear viewing tourism in Churchill, Canada. *Journal of Sustainable Tourism 18*(3). 319-336. DOI: 10.1080/09669580903215147.

Dawson, J., Johnston, M.J., Stewart, E.J., Lemieux, C.J., Lemelin, R.H., Maher, P.T., & Grimwood, B.S.R. (2011). Ethical considerations of last chance tourism. *Journal of Ecotourism 10*(3). 250-265. http://dx.doi.org/10.1080/14724049.2011.617449.

Dawson, J., Stewart, E., & Lemelin, R.H. (2012). Last chance tourism: conclusion. In Lemelin, R.H., Dawson, J., & Stewart, E.J. (Eds.), *Last chance tourism. Adapting tourism opportunities in a changing world* (218-228). Abingdon, Oxon: Routledge.

Derocher, A.E., Lunn, N.J., & Stirling, I. (2004). Polar bears in a warming climate. *Integrative and Comparative Biology 44* (2). 163-176. DOI: 10.1093/icb/44.2.163.

Distasio, J., Dudley, M., & Moradzadeh, F. (2011). *Churchill Sustainability Planning Framework (CSPF).* Retrieved from http://winnspace.uwinnipeg.ca/handle/10680/806.

Dodds, R., & Graci, S. (2009). Canada's tourism industry- mitigating the effects of climate change: A lot of concern but little action. *Tourism and Hospitality Planning & Development 6.* 39-51. https://doi.org/10.1080/14790530902847046

Dyck, M., Campbell, M., Lee, D., Boulanger, J., & Hedman, D. (2017). 2016 Aerial survey of the Western Hudson Bay polar bear subpopulation [Final Report]. Retrieved from https://www.gov.nu.ca/sites/default/files/pb_wh_2016_population_assessment_gn_report_27_june_2017.pdf.

EcoRessources Consultants. (2011). *Evidence of the socio-economic importance of polar bears for Canada*. Retrieved from the Government of Canada website: http://publications.gc.ca/site/eng/397569/publication.html.

Eijgelaar, E., Thaper, C., & Peeters, P. (2010). Antarctic cruise tourism: The paradoxes of ambassadorship, "last chance tourism" and greenhouse gas emissions. *Journal of Sustainable Tourism 18* (3). 337-354. doi: 10.1080/09669581003653534

Fennell, D.A. (2012). *Tourism and Animal Ethics* Abingdon, Oxon: Routledge.

Folwer, F. (2009). *Survey Research Methods.* Thousand Oaks, California: Library of Congress Cataloging- in- Publication Data.

Gagnon, A.S. and Gough, W.A. (2005). Trends in the dates of ice freeze-up and breakup over Hudson Bay, Canada. *Arctic 58* (4). 370-382. Retrieved from https://search.proquest.com/docview/197729777?rfr_id=info%3Axri%2Fsid%3Aprimo.

Garma, R. (2014). Greening Consumers. In DeLacy, T., Jiang, M., Lipman, G., & Vorster, S. (Eds.), *Green grown and travelism: Concept, policy and practice for sustainable tourism (*97-111). Abingdon, Oxon: Routledge.

Gössling, S., & Peeters, P. (2007). 'It does not harm the environment!' An analysis of industry discourses on tourism, air travel and the environment. *Journal of Sustainable Tourism 15*(4). 402-417. doi: 10.2167/jost672.0.

Gössling, S., Scott, D., Hall, C.M., Ceron, J-P., & Dubois, G. (2012). Consumer behaviour and demand response of tourists to climate change. *Annals of Tourism Research 39*(1). 36-58. doi: 10.1016/j.annals.2011.11.002.

Gössling, S., Scott, D., & Hall, M.C. (2013). Challenges of tourism in a low-carbon economy. *Wiley Interdisciplinary Reviews: Climate Change 4:*6. 525-538. doi: 10.1002/wcc.243.

Government of Canada. (2018). Maps of sub-populations of polar bears and protected areas. Retrieved from https://www.canada.ca/en/environment-climate-change/services/biodiversity/maps-sub-populations-polar-bears-protected.html.

Groulx, M.W. (2015). *Prospects for place-based climate change adaptation: An exploration of place, vulnerability and collaborative planning in Churchill, Manitoba* (Doctoral dissertation). Retrieved from Waterloo's Institutional Repository. *http://hdl.handle.net/10012/9606.*

Groulx, M., Lemieux, C., Dawson, J., Stewart, E., & Yudina, O. (2016). Motivations to engage in last chance tourism in the Churchill Wildlife Management Area and Wapusk National Park: The role of place identity and nature relatedness. *Journal of Sustainable Tourism 24*(11). 1523-1540. http://dx.doi.org/10.1080/09669582.2015.1134556.

Gunter, M.Jr. (2018). *Tales of an Ecotourist: What travel to wild places can teach us about climate change.* Albany, New York: State University of New York.

Hall, M.C. (2010). Tourism and environmental change in polar regions: Impacts, climate change and biological invasion. In Hall, C.M., & Saarinen, J. (Eds.), *Tourism and Change in Polar Regions: Climate, environment and experience* (42-70). Abingdon, Oxon: Routledge.

Hall, C.M. (2014). Will climate change kill Santa Claus? Climate change and high latitude Christmas place branding. *Scandinavian Journal of Hospitality and Tourism 14* (1). 23-40. DOI: http://dx.doi.org/10.1080/15022250.2014.886101.

Hall, M.C., & Saarinen, J. (2010). Tourism and change in polar regions: Introduction-definitions, locations, places and dimensions. In Hall, C.M., & Saarinen, J. (Eds.), *Tourism and Change in Polar Regions: Climate, environment and experience* (1-41). Abingdon, Oxon: Routledge.

Hausfather, K. (2017). UNEP: Six crucial actions to help close the world's 'emission gaps. Retrieved from https://www.carbonbrief.org/unep-six-crucial-actions-help-close-worlds-emissions-gaps.

IPCC. (2007). Summary for policymakers. In M.L. Parry, O.F. Canziani, J.P. Palutikof, P.J., vander Linden, & C.E. Hanson (Eds.), Climate change 2007: Impacts, adaptation and vulnerability. Contribution of Working Group II to the fourth assessment report of the intergovernmental panel on climate change (pp. 1–22). Cambridge, UK: Cambridge University Press.

IPCC. (2014). Synthesis report. In Pachauri, R.K and Meyer, L.A. (Eds.) *Climate Change 2014: Synthesis Report.* Contribution of working groups I, II and II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change (pp. 33-112). Geneva, Switzerland, IPCC.

Jardine, C.N. (2005). Part 1: Calculating the environmental impact of aviation emissions [Climate Care Report]. *Environmental Change Institute.*

Jardine, C.N. (2009). Calculating the carbon dioxide emissions of flights [Final Report]. *Environmental Change Institute.*

Johnston, M.E. (2006). Impacts of global environmental change on tourism in the polar regions. In Gössling, S. and Hall. C.M. (Eds.), *Tourism & global environmental change: Ecological, social, economic and political interrelationships* (37-53). Abingdon, Oxon: Routledge.

Johnston, M., Viken, A., & Dawson, J. (2012). Firsts and lasts in Arctic tourism: last chance tourism and the dialectic of change. In Lemelin, R.H., Dawson, J., & Stewart, E.J. (Eds.), *Last chance tourism. Adapting tourism opportunities in a changing world* (10-24). Abingdon, Oxon: Routledge.

Juvan, E., & Dolnicar, S. (2014). Can tourists easily choose a low carbon footprint vacation? *Journal of Sustainable Tourism 22* (2). 175-194. http://dx.doi.org/10.1080/09669582.2013.826230

Kim, Y., Yun, S., Lee, J., & Ko, E. (2016). How consumer knowledge shapes green consumption: An empirical study on voluntary carbon offsetting. *International Journal of Advertising 35* (1). 23-41. http://dx.doi.org/10.1080/02650487.2015.1096102

Lamers, M., Eijgelaar, E., & Amelung, B (2012). Last chance tourism in Antarctica. In Lemelin, R.H., Dawson, J., & Stewart, E.J. (Eds.), *Last chance tourism. Adapting tourism opportunities in a changing world* (25-41). Abingdon, Oxon: Routledge.

Lemelin, R.H. (2006). The gawk, the glance, and the gaze: Ocular consumption and polar bear tourism in Churchill, Manitoba, Canada. *Current Issues in Tourism 9* (6). 516-534. doi: 10.2167/cit294.0.

Lemelin, H., Dawson, J., Stewart, E.J., Maher, P., & Lueck, M. (2010). Last-chance tourism: The boom, doom, and gloom of visiting vanishing destinations. *Current Issues in Tourism 13*(5). 477-493. DOI: 10.1080/13683500903406367.

Lemelin, R.H., Stewart, E., & Dawson, J. (2012). An introduction to last chance tourism. In Lemelin, R.H., Dawson, J., & Stewart, E.J. (Eds.), *Last chance tourism. Adapting tourism opportunities in a changing world* (3-9). Abingdon, Oxon: Routledge.

Lemieux, C., & Eagles, P. (2012). Last chance tourism in Canada's protected areas: Management implications and emerging ethical considerations. In Lemelin, R.H., Dawson, J., & Stewart, E.J. (Eds.), *Last chance tourism. Adapting tourism opportunities in a changing world* (195-217). Abingdon, Oxon: Routledge.

Lemieux, C. J., Groulx, M., Halpenny, E., Stager, H., Dawson, J., Stewart, E.J., & Hvenegaard, G.T. (2017). "The end of the Ice Age?": Disappearing world heritage and the climate change communication imperative. *Environmental Communication.* (1-19). Retrieved from https://doi.org/10.1080/17524032.2017.1400454.

Lenzen, M., Sun, Y-Y., Faturay, F., Ting, Y-P., Geschke, A., & Malik, A. (2018). The carbon footprint of global tourism. *Nature Climate Change 8.* 522-528. https://doi.org/10.1038/s41558-018-0141-x

Lunn, N.J., Servanty, S., Regehr, E.V., Converse, S.J., Richardson, E., & Stirling, I. (2016). Demography of an apex predator at the edge of its range: Impacts of changing sea ice on polar bears in Hudson Bay. *Ecological Applications 26* (5). 1302-1320. https://doi.org/10.1890/15-1256

Maher, P.T. Gelter, H., Hillmer-Pegram, K., Hovgaard, G., Hull, J., Þór Jóhannesson, G., Karlsdóttir, A., Rantala, O., & Pashkevich, A. (2014). Arctic tourism: Realities and possibilities. *Arctic Yearbook 2014.* Retrieved from https://www.researchgate.net/publication/275945995_Arctic_Tourism_Realities_Possibilities? _esc=publicationCoverPdf&el=1_x_2&enrichId=rgreq 533db16e7eb404ff96bb94d8591bc125-XXX&enrichSource=Y292ZXJQYWdlOzI3NTk0NTk5NTtBUzoyNDk3MDgzMTI1MjY4NTNAMTQzNjU0NjUwOTcyMg%3D%3D

McKercher, B., Prideaux, B., Cheung, C., & Law, R. (2010). Achieving voluntary reductions in the carbon footprint of tourism and climate change. *Journal of Sustainable Tourism 18* (3). 297-317. https://doi.org/10.1080/09669580903395022.

McLennan, C.J., Becken, S., Battye, R., Kam Fung So, K. (2014). Voluntary carbon offsetting: Who does it? *Tourism Management 45.* 194-198. DOI: 10.1016/j.tourman.2014.04.009

Needham, M.D. & Vaske, J.J. (2008). Writing and constructing. In Vaske, J.J. (Ed.), *Survey research and analysis: Applications in parks, recreation and human dimensions.* (121-171). State College, Pennsylvania: Venture Publishing, Inc.

Oceans North Conservation Society, World Wildlife Fund Canada, and Ducks Unlimited Canada. (2018). Canada's Arctic Marine Atlas. Ottawa, Ontario: Oceans North Conservation Society.

Peacock, E., Derocher, A.E., Lunn, N.J., & Obbard, M.E. (2010). Polar bear ecology and management in Hudson Bay in the face of climate change. In Ferguson, S.H., Loseto, L.L., & Mallory, M.L. (Eds.), *A little less Arctic: Top predators in the world's largest northern inland sea, Hudson Bay* (93-115). Netherlands, Springer.

Peeters, P., Gössling, S., & Lane, B. (2009). Moving towards low-carbon tourism: New opportunities for destinations and tour operators. In Gössling, S., Hall. C.M., & Weaver, D.B. (Eds.), *Sustainable tourism futures: Perspectives on systems, restructuring and innovations* (240-257). Abingdon, Oxon: Routledge.

Piggott-McKellar, A.E., & McNamara, K.E. (2017) Last chance tourism and the Great Barrier Reef. *Journal of Sustainable Tourism 25* (3). 397-415. DOI: 10.1080/09669582.2016.1213849.

Regehr, E.V., Lunn, N., Amstrup, S., & Stirling, I. (2007). Effects of earlier sea ice breakup on survival and population size in polar bears in western Hudson Bay. *Journal of Wildlife Management 71* (8). 2673-2683. DOI: 10.2193/2006-180.

Scott, D., Hall, C.M., & Gössling, S. (2012). *Tourism and climate change.* Abingdon, Oxon: Routledge.

Shelton, E. (2012). Seeing it off: Last chance tourism opportunity shagged by a rare parrot. In R. H. Lemelin, J. Dawson, & E. J. Stewart (Eds.), *Last chance tourism: Adapting tourism opportunities in a changing world* (182-194). Abingdon: Routledge

Statistics Canada. (2016). Census profile, 2016 Census. Retrieved from http://www12.statcan.gc.ca/census-recensement/2016/dp-pd/prof/details/page.cfm?Lang=E&Geo1=CSD&Code1=4623056&Geo2=PR&Code2=46&Data=Count&SearchText=Churchill&SearchType=Begins&SearchPR=01&B1=All&GeoLevel=PR&GeoCode=4623056&TABID=1.

Stewart, E.J., Dawson, J., & Lemelin, R.H. (2012). The transformation of polar bear viewing in the Hudson Bay region, Canada. In Lemelin, R.H., Dawson, J., & Stewart, E.J. (Eds.), *Last chance tourism. Adapting tourism opportunities in a changing world* (89-102). Abingdon, Oxon: Routledge.

Stewart, E.J., Draper, D., & Johnston, M.E. (2013). A review of tourism research in the polar region. *Arctic 58* (4). 383-394. Retrieved from https://www.researchgate.net/profile/Emma_Stewart/publication/228351918_Sea_Ice_in_Canada%27s_Arctic_Implications_for_Cruise_Tourism/links/54d26c970cf28e0697241d22/Sea-Ice-in-Canadas-Arctic-Implications-for-Cruise-Tourism.pdf.

Stirling, I. (1988). *Polar Bears.* Michigan, United States of America: The University of Michigan Press.

Stirling, I. (2011). *Polar Bears. The Natural History of a Threatened Species.* Brighton, Massachusetts: Fitzhenry & Whiteside.

Stirling, I., & Derocher, A.E. (1993). Possible impacts of climatic warming on polar bears. *Arctic 46* (3). 240–245. Retrieved from http://www.jstor.org/stable/pdf/40511411.pdf.

Stirling, I., & Derocher, A. E. (2012). Effects of climate warming on polar bears: A review of the evidence. *Global Change Biology 18* (9). 2694-2706. DOI: 10.1111/j.1365-2486.2012.02753.x.

Stirling, I. and Parkinson, C. (2006). Possible effects of climate warming on selected populations of polar bears (Ursus maritimus) in the Canadian Arctic. *Arctic 59* (3). 261-275. Retrieved from https://search.proquest.com/docview/197731018/fulltextPDF/C03909F08D9F40DEPQ/1?accountid=14701.

Stirling, I., Lunn, N.J., & Iacozza, J. (1999). Long-term trends in the population ecology of polar bears in Western Hudson Bay in relation to climate change. *Arctic 52* (3). 294-306. http://www.jstor.org/stable/40511782.

Struzik, E. (2014). *Arctic icons: How the town of Churchill learned to love its polar bears.* Markham, Ontario: Fitzhenry & Whiteside.

TIAC. (2016). Annual Report on Canadian Tourism. Retrieved from https://tiac-aitc.ca/_Library/TIAC_Publications/TIAC_Annual_Report_2016_EN.pdf

Towns. L., Derocher, A.E., Stirling, I., Lunn, N.J., & Hedman, D. (2009). Spatial and temporal patterns of problem polar bears in Churchill, Manitoba. *Polar Biology 32* (10). 1529-1537. DOI: 10.1007/s00300-009-0653-y.

Travel Manitoba.com. (2018). Real Growth Real Results [2017/2018 Annual Report]. Retrieved from https://assets.simpleviewinc.com/simpleview/image/upload/v1/clients/manitoba/2017_18_ANNUAL_REPORT_TMB_FNL_SP_LR_R_94cd31bf-d41b-4a57-8711-a3bb764ec193.pdf

United Nations Environmental Program (UNEP). (2007). *Tourism in polar regions: The sustainability challenge.* Paris: UNEP.

United Nations World Tourism Organization (UNWTO)- United Nations Environmental Program (UNEP)- and World Meteorological Organization (WMO). (2008). *Climate change and tourism: Responding to global challenges.* Madrid and Paris: UNWTO and UNEP.

Vorster, S. & Lyle, C. (2014). Lower-carbon aviation in the green economy. In DeLacy, T., Jiang, M., Lipman, G., & Vorster, S. (Eds.), *Green grown and travelism: Concept, policy and practice for sustainable tourism (*41-58). Abingdon, Oxon: Routledge.

Wadhams, P., (2003). How does Arctic sea ice form and decay? *National Ocean and Atmospheric Administration.* Retrieved from http://sites.fas.harvard.edu/~scia30/2008/SOURCEBOOK/Arctic_sea_ice_Wadhams.pdf

Western Management Consultants & Econometric Research Limited. (2018). The economic impact of tourism in Churchill, Manitoba in 2017 [Draft Report].

CHAPTER FOUR

Tourists' perspectives of climate change mitigation strategies aimed at reducing greenhouse gas emissions related to Churchill, Canada's polar bear viewing industry

In preparation for submission to: Polar Geography

Abstract

Over 14 000 tourists travel to Churchill, Manitoba annually for the unique opportunity to see a polar bear in their natural habitat, relying on air travel and energy intensive accommodation and activities. More than 8% of the global carbon dioxide emissions which influence climate change are attributable by the tourism sector. These emissions are expected to increase in response to rising tourism trends. It has been suggested that the tourism industry take leadership to implement climate change mitigation strategies to reduce their emissions and impact on the environment. Strategies include taxation schemes, voluntary offsets, and education programs. Using the perspectives from polar bear viewing tourists, the objective of this study is to gain greater insights into consumer (tourists) responses to initiatives intended to mitigate climate change. A vast majority of respondents support Churchill's tourism industry to become a carbon neutral destination. They indicated the most effective ways to do so would be through education programs and transportation alternatives (i.e. taking the train). Tourists also identified that policy makers, tour operators and tourists themselves are all responsible for implementing positive change to reduce emissions, thus highlighting the importance of including tourists in decision making process focused on climate change mitigation strategies. Findings of this research are important for Churchill's polar bear viewing industry to understand which strategies would be the most effective to implement and how to continue to develop their successful tourism industry in a more sustainable manner.

Keywords: Churchill, polar bears, climate change, tourism, mitigation

4.1 Introduction

In the Canadian Arctic, tourism is one of the most substantial economic drivers of the region, in addition to mineral extraction and fisheries (Hall & Saarinen, 2010). On average, the Canadian Arctic attracts 530 000 visitors and generates more than $390 million in annual visitor spending (Hall & Saarinen, 2010; Maher et al., 2014). Due to the reliance of fossil fuel energy, tourism is a very energy intensive industry. Over eight percent of the total global carbon dioxide (CO_2) emissions are attributable to the tourism sector (Lenzen et al., 2018). The tourism industry uses energy for transportation (to and from the destination as well as within the tourism location), accommodations, and for a range of tourist activities such as visitation of sites and attractions, visits to restaurants or bars and events such as festivals or concerts (Burns & Bibbings, 2013; Gössling, 2010; Scott et al., 2012). Transportation alone contributes over 75% of the tourism industry's emissions, with 21% attributed from accommodation and 4% from activities (UNWTO-UNEP-WMO, 2008). Arctic tourism experiences the highest amount of greenhouse gas emissions due to the dependence on air travel and long travel distances (Hall, 2010).

Important tourism destinations whose services and products are dependent on natural resources and environmental systems, are being impacted by the magnitude of effects from climate change, whereby unseasonable temperatures and extreme weather events are altering the products, services, and infrastructure (Becken & Hay, 2012; Dawson et al., 2007). It has been suggested that as greenhouse gas emissions continue to rise, individual destinations should take leadership to implement climate change mitigation strategies to reduce the impact they have on global climate change (Dawson et al., 2010b; Gössling, 2011). Mitigation, defined as human intervention intended to reduce the sources of greenhouse gas emissions (i.e. CO_2 emissions from air travel) and enhance greenhouse gas sinks (i.e. forests and oceans), is often used as a strategy for reducing emissions (Becken & Hay, 2012; Dawson et al., 2010; Gössling, 2011; IPCC, 2014; UNWTO-UNEP-WMO, 2008). Climate change mitigation strategies entail technological advancements, environmental management, behavioural change, and economic measures to reduce energy use, improve energy efficiency, and increase the use of renewable energy to reduce fossil fuel consumption (IPCC, 2014; UNWTO-UNEP-WMO, 2008; World Tourism Organization, 2009). Mitigation policies contribute to greater environmental awareness of emissions related to travel, which may foster changes in travel patterns (Scott et al., 2012). The

existing research about climate change mitigation initiatives tends to focus on what policy makers, industries and tour operators believe will be effective for reducing emissions (Garma, 2014; UNWTO-UNEP-WMO, 2008). Little is known about tourist's perspectives, willingness to pay and their opinions on effective mitigation strategies (Garma, 2014). Therefore, this paper addresses a critical need and aims to gain greater insights into tourists' responses to initiatives intended to mitigate climate change, especially to identify the behavioural effects of these initiatives (Becken & Hay, 2012; Scott et al., 2012). Using a survey-based approach to identify tourists' opinions on potential climate change mitigation initiatives, this paper provides an analysis of Churchill's polar bear viewing industry and makes recommendations about which mitigation strategies this industry could implement.

4.2 Literature Review

4.2.1 Greenhouse gas emissions and the polar bear viewing industry

For over 50 years, the small town of Churchill, Manitoba, has attracted thousands of tourists to see polar bears in their natural habitat (Distasio et al., 2011). For six hours a day, tourists are transported in large tundra vehicles and travel along 33 km of trails in the Churchill Wildlife Management Area (CWMA), trying to spot a polar bear as well as other Arctic wildlife (Dawson et al., 2010b) (Figure 4.1).

Figure 4.1: Polar Bear Viewing in the Churchill Wildlife Management Area

It was identified by Dawson et al. (2010) that Churchill's polar bear viewing tourism industry was the second highest carbon intensive tourism destination, after cruise ship tourism in Antarctica. Emissions from Churchill's polar bear viewing industry were primarily generated from local transportation between activities, diesel powered tundra vehicles, scenic tours via helicopter and air travel. Because of the high costs and extreme difficulties associated with building roads on areas covered by permafrost, Churchill is not accessible by personal vehicle (Distasio et al., 2011). Additionally, because cruise ship tourism is seasonal and the rail line had been out of service for almost two years, Churchill is only consistently accessible by plane; which is one of the most energy intensive modes of transportation (CTVNews, 2018; Dawson et al., 2010b; Johnston et al., 2012). Compared to domestic tourists who will take shorter flights, international tourists traveling to Churchill by plane expel larger amounts of carbon emissions as their long flights require extra engine thrusts that need more fuel consumption (Becken & Hay, 2007; Gössling & Peeters, 2007). It was estimated that although international tourists represented only 14% of polar bear viewing tourists traveling to Churchill, these tourists had the highest amount of emissions per person due to their long-haul flights (Dawson et al., 2010b). Air travel is expected to continue to grow in response to international tourism development and an increase in accessibility and affordability among tourists which will continue to increase emissions as a consequence (Gössling & Peeters, 2007; Gössling et al., 2013; Lenzen et al., 2018). Although the

tourism industry is a contributor to the rise of greenhouse gas emissions, if these emissions are controlled, managed properly, and ultimately reduced, this industry has an opportunity to operate on a sustainable basis (Butler, 2010).

4.2.2 Mitigation and the role of the tourism industry

Dawson et al. (2010) identified that it is possible for Churchill's polar bear viewing industry to become one of the first carbon neutral destinations in North America. Reducing greenhouse gas emissions over the next couple of decades, through mitigation initiatives, will reduce the risks of climate change, while limiting warming in the second half of the 21st century (IPCC, 2014). Emissions can be substantially reduced through technological and structural changes which are aimed at changing consumption patterns, adopting measures to save and reduce energy usage, dietary changes, and food waste reduction (IPCC, 2014). The tourism industry itself has a responsibility to minimize harmful emissions by encouraging carbon neutral transportation options and alternatives and improving the effectiveness of the use of natural resources which many tourism destinations depend on (Burns & Bibbings, 2013).

To be effective, mitigation initiatives should involve all actors of the tourism industry which include policy makers, governments, tour operators and tourists themselves. Table 4.1 provides examples of climate change mitigation strategies that each actor can implement to reduce greenhouse gas emissions.

Table 4.1 Climate Change Mitigation Strategies

Governments	• Environmental taxes • Mandatory carbon audits • Investment in energy efficient modes of transportation • Educational programs and information sessions provided to tour operators
Tour Operators	• Voluntary offsetting (i.e. carbon offset programs) • Educational programs • Carbon labeling (including emission information on airline tickets or in destination brochures) • Marketing adjustments to promote eco-friendly tourism products and services • De-marketing (marketing their tours to closer destinations)
Tourists	• Traveling closer to home • Extending length of stay • Opting for environmentally friendly and energy efficient modes of transportation, accommodation and activities.

Sources: Dawson et al., 2010b; Gössling, 2011; Gössling et al., 2012; Lemieux & Eagles, 2009; McKercher et al., 2010; Peeters et al., 2009; Scott et al., 2012; UNWTO-UNEP-WMO, 2008; Winfield, 2009

4.2.3 Climate change mitigation strategies aimed at tourists

One of the main actors in the tourism industry are tourists themselves because they hold considerable market power and ultimately make the decision to travel (Becken, 2004; Garma, 2014). How tourists respond to the impacts of climate change will reshape consumer demand patterns and will play an important role towards the future of tourism destinations (Scott & Lemieux, 2013; UNWTO-UNEP-WMO, 2008). Allowing travel to continue to happen, and having tourists physically be on site where change is occurring can help put into perspective the issues of climate change which may promote conservation efforts (Gunter Jr., 2018; Lemelin et al., 2010).

Climate change mitigation strategies aimed at tourists can be implemented by different tourism stakeholders. Governments and nongovernment organizations can work closely with consumers to educate and empower them to be part of the efforts towards greenhouse gas reductions (Garma, 2014). Hotel owners, tour operators and transportation services play a key role in influencing tourists to make sustainable choices, both prior, during, and following the tourism experience (UNWTO & WTO, 2011). Tour operators can use direct advertising or direct mail to push the information onto tourists, which can create awareness about the work and efforts being made by the tourism destinations (Garma, 2014). Having these learning materials be available to tourists following their trip is also important to continue to support and encourage tourists to take action to reduce their emissions (Ballantyne & Packer, 2011). Because tourists spend a great deal of time in airports before they reach their destinations, there is an opportunity to provide information about the impacts of travel as well as alternatives and solutions for how tourists can reduce their travel emissions (Gössling, 2018). Improving consumer awareness by indicating emissions on transportation tickets and product brochures can also make tourists more aware about their impacts (UNWTO-UNEP-WMO, 2008).

One of the most recommended climate change mitigation solution, aimed at tourists is, visitor education programming which allow tourists to learn about climate change and their impacts (Dawson et al., 2010b; Groulx et al., 2016; Lemelin et al., 2009). These education programs must include environmental and climate specific subjects aimed at promoting and encouraging tourists to act and think in a climate conscious manner (Lemieux et al., 2018; UNWTO-UNEP-WMO, 2008). Existing literature suggests the concept of tourists as ambassadors which means that through exposure of vulnerable destinations, along with education and informative processes, it is presumed that tourists will create an emotional bond with the environment and will be encouraged to share the information and experiences learned with others upon their return home (Dawson et al., 2011; Gunter Jr., 2018; Lemelin et al., 2010; Lemelin et al., 2012). Tour operators play a significant role in providing tourists with this information through printed materials and informational sessions on the tours and additional materials (i.e. via social media, email, internet forums etc.) they can access when they go home (Ballantyne & Packer, 2011).

Providing tourists with environmentally friendly travel alternatives is also highly recommended for reducing emissions. Tour operators can help influence demand for less carbon intensive packages by offering tourists environmentally friendly products and options such as promoting alternative modes of transportation (i.e. taking the train) (Dawson et al., 2010; UNWTO-UNEP-WMO, 2008). Dawson et al., (2010) also proposed a carbon offset[7] program where tourists would have the opportunity to donate money towards renewable energy generation projects, which would offset their travel emissions. Furthermore, tour operators could provide incentives (souvenirs, tour discounts, etc.) to encourage tourists to offset their travel emissions (Dawson et al., 2010b). For these mitigation strategies to be effective, it is important that tourists are involved at the beginning of the planning process to the decision-making phase (Becken & Hay, 2007).

4.2.4 Challenges of implementing mitigation strategies

Many challenges arise with the effort to implement climate change mitigation strategies, especially those directed at tourists. One main challenge identified by Dawson et al. (2010b) is tourists' lack of understanding about how travel contributes to climate change and how these changes influence the tourism resources they depend on or value. Because the effects from air travel take time to trigger climatic change, a tourist may not be able to recognize the impacts or understand the potential implications for change on their single trip (Becken, 2004; Gössling & Peeters, 2007; Hall, 2010). Thus, the lack of conceptual clarity makes it difficult for many tourists to understand what climate change really means (McKercher et al., 2010). Tourists generally do not have information about their energy use or emissions from tourist attractions or activities readily available to them, meaning they may not understand how much of an impact their holiday has on the environment (Becken & Hay, 2007). Moreover, tourists do not like to be overwhelmed with information concerning their vacations, especially if it involves an additional factor that they have to consider in their decision-making process (Weeden, 2014). They are likely to prioritize price, convenience and quality over environmental alternatives when making

[7] A carbon offset is a voluntary, monetary donation equal to the emission of a certain activity (i.e. flights). This donation is intended to reduce greenhouse gas emission through other activities such as planting trees or educational investments (UNWTO-UNEP-WMO, 2008).

travel decisions (Weeden, 2014). Tourists typically travel to achieve personal benefits (i.e. to see a polar bear) and to satisfy their own needs and desires (Caton, 2014). It could be assumed that the environmental impacts associated with travel may be underestimated or ignored by tourists and therefore their behaviours are less likely to change (Becken, 2004). Consumers who may exert pro-environmental behaviour in their everyday lives may suspend these attitudes during times of travel (Weaver, 2009). Tourists may also feel that it is easier and more effective to take personal actions at a local level than a global one as the effects of climate change might be more noticeable on a day-to-day basis (Becken, 2007)

There is a growing number of people who are aware of climate change however, these concerns are generally not translated into actions (McKercher et al., 2010). This may make climate change mitigation initiatives highly ineffective. Dawson et al., (2010) indicated that polar bear viewing tourists do not understand how their behaviour contributes to climate change. Furthermore, tourists typically do not understand the purpose of mitigation initiatives, how they are used, and who is responsible for implementing them (Dawson et al., 2010b; Mair, 2011). Tourists may even be in denial about their environmental impacts when traveling, especially if they can justify that their vacation includes an educational component and no other actions are necessary (Gunter Jr., 2018; Lane, 2009). These challenges indicate an opportunity for tour operators, much like Churchill's, to develop solutions that are accessible and attractive to tourists which allow them to think about the relationship between tourism and climate change.

4.3 Methods

4.3.1 Study Area

Churchill, Manitoba is a small Canadian sub-arctic town of less than 900 people, located on the edge of the Hudson Bay, at the junction of the boreal forest and the Arctic tundra (Distasio et al., 2011; Statistics Canada, 2016) (Figure 4.2). Churchill's local economy is dependent on its health services, international shipping, scientific research and tourism industry (Distasio et al., 2011; Statistics Canada, 2016). Tourism is a major driver for Churchill's economy. Different attractions and activities which include migratory bird and beluga watching, Aurora Borealis gazing, and polar bear viewing are offered to tourists at multiple times during the year (Distasio

et al., 2011). Annually, from October to November, Churchill's polar bear viewing industry is in full effect, as tourists travel from all over the world to see the Western Hudson Bay polar bear subpopulation that lives in and around Churchill (Dawson et al., 2010). During this time, this small town attracts 10 000 to 14 000 tourists and generates over $7.2 million in annual revenue (EcoRessources Consultants, 2011; Struzik, 2014).

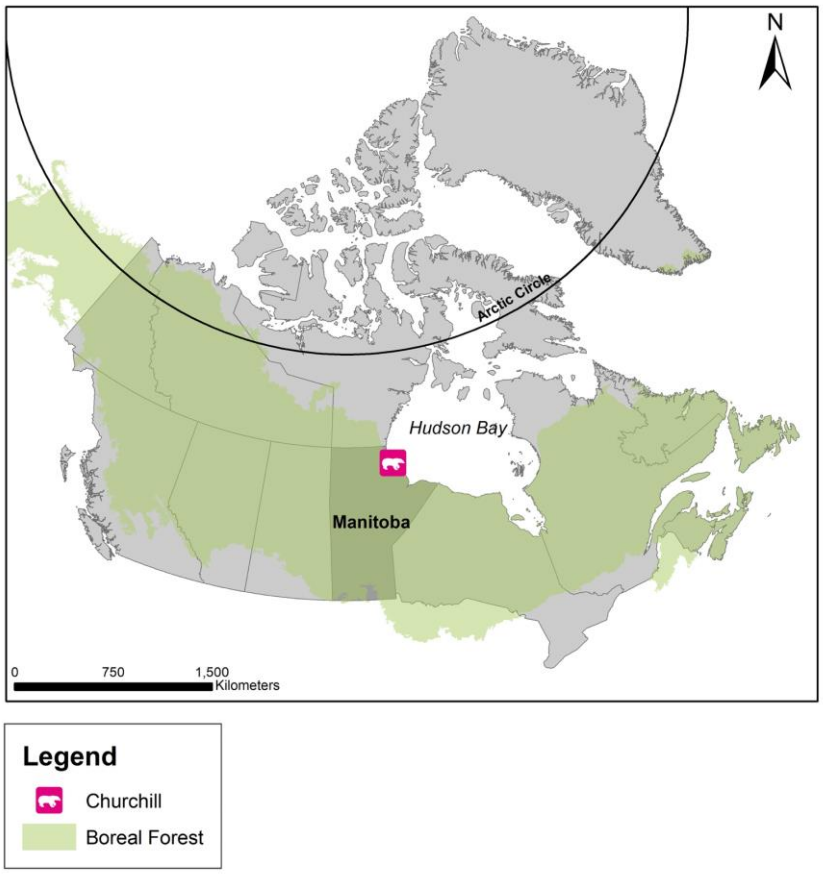


Figure 4.2: Map of Churchill, Manitoba

A typical polar bear viewing tour includes two polar bear viewing tours, accommodation either in town, at the Churchill Northern Studies Centre, or in lodges located directly on the tundra, and activities including dog sledding, helicopter tours (weather permitted), and visits into town (Dawson et al., 2010). Tourists also have the option of booking a one-day viewing polar bear viewing tour which includes round-trip transportation from Winnipeg to Churchill. On the polar bear viewing tours, tourists are transported on large tundra vehicles, which are built high off the

ground and travel along designated routes far out along the coast from Churchill (Dawson et al., 2010b; Lemelin 2006; 2008). These large vehicles can hold approximately 15-20 people, are heated, have open air viewing platforms, easy slide windows, and are the ideal way for tourists to safely and comfortably take pictures and enjoy the unique viewing experience (Dawson et al., 2010b). During and following the viewing tours, tour operators typically provide informational and educational sessions about polar bears. Furthermore, the tour operators offer evening presentations which are given by polar bear experts to provide tourists with additional information about polar bears and climate change.

4.3.2 Survey distribution and design

Due to the nature of this research which looks at tourists' opinions on climate change mitigation strategies, visitor surveys were chosen for data collection. Similar studies examining the relationships between tourism, tourists, and climate change have also used visitor surveys (see Becken 2004; 2007; Dawson et al., 2010b; Groulx, 2015; McKercher et al., 2010). The answers provided in the visitor surveys allowed the researcher to examine relationships and distinguish patterns (Bradshaw & Stratford, 2010; Creswell, 2014). During the 2018 polar bear viewing season (from October 16 to November 16), visitor surveys (both paper and electronic versions via iPad) were hand distributed to Churchill's polar bear viewing tourists. Participants were selected using convenience sampling, whereby respondents are chosen based on convenience and availability (Creswell, 2014). Survey distribution occurred in two areas in Churchill: the Churchill Northern Studies Centre (a field station catered to research and education) and at the Churchill Airport. On-site surveys typically yield a high response rate because the researcher can explain, in person, the rational and importance of the survey to their participants (Needham & Vaske, 2008). Surveys were distributed methodically once a week at the Churchill Northern Studies Centre with tourists who were staying at the centre and participating on learning vacations. Surveys were distributed three times a week, twice a day at the Churchill Airport during departure times. These locations were chosen based on previous studies where visitor surveys were used and conducted in Churchill (see Dawson et al., 2010 and Groulx, 2015). In order to be chosen as a survey participant, tourists had to have participated on

a polar bear viewing tour on their current trip to Churchill as many questions were related to their viewing tours. The survey took participants approximately 20 minutes to complete, which was enough time for tourists to complete all 25 questions given potential time constraints (especially to those being surveyed at the airport). Following the completion and the return of the surveys, tourists were invited to enter a contest arranged by the researcher. By entering their name and contact information, tourists had a chance to win a signed copy of "Arctic Icons: How the town of Churchill learned to love its polar bears" by Edward Struzik. Of 662 polar bear viewing tourists who were approached, 513 surveys were completed and returned, representing a 77% response rate. Reasons tourists chose not to participate in the survey was because they were tired, language barriers, they were uninterested, and they wanted to do one survey between two people.

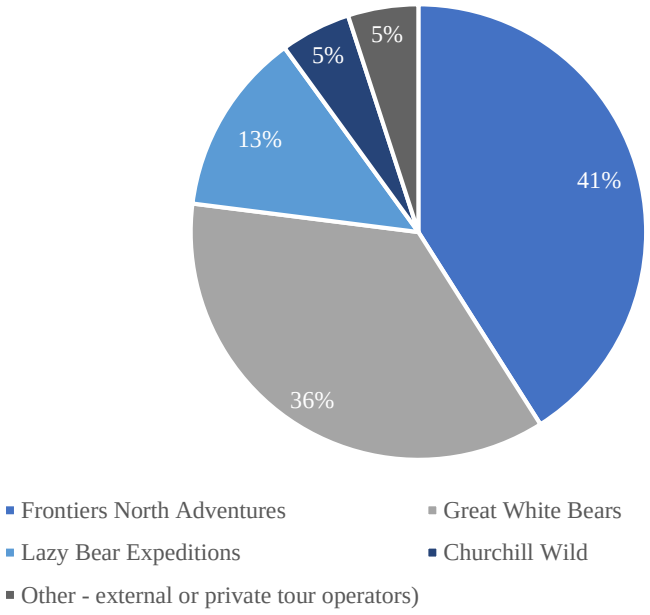
The survey was designed to be self-completed by the participants to allow them to express themselves as honestly as possible, without feeling compelled to give the "right" answer (Fowler, 2009; McKercher et al., 2010). Similarly, it also allowed the respondents to immediately read and respond to the questions themselves (Needham & Vaske, 2008). The survey consisted of both open and ended questions. Closed ended questions allowed for a succinct comparison and analysis of the responses while open-ended questions allowed the participants an opportunity to explain their answer in their own words (McKercher et al., 2010). Questions focused on tourists' knowledge about climate change and their opinions on positive environmental change to allow the researcher to identify how the relationship between tourism and climate change is perceived, what kind of tourists are traveling, and what they believe to be the most effective climate change mitigation strategies for Churchill to implement and reduce emissions.

4.4 Results

4.4.1 Polar bear viewing tourists and tour operators

The demographic profile of a polar bear viewing tourist in this study closely resembles the profiles found in eco-tourism or wildlife viewing research (see Dawson et al., 2010; Eijgelaar et al., 2010; Groulx, 2015; Gunter Jr., 2018). A polar bear viewing tourist in this study typically includes an older (average age of 61), female (64%) with a bachelor or graduate degree (74%). Most respondents (85%) identified they were from either Canada or the United States, while the remaining (14%) travelled from the United Kingdom, Europe, Asia, and Australia.

Figure 4.3 illustrates which tour operators tourists chose for their polar bear viewing tours. The main reasons influencing the choices of tour operators were online reviews, recommendations from friends and family, because these operators were chosen for them by their travel agents, and the price of the experience. On average, tourists identified that their polar bear viewing experience was a 5-day stay in Churchill which included two polar bear viewing tours, one helicopter ride (weather permitted), dog sledding, and one or more trips into town to visit the Parks Canada visitor centre, the Eskimo museum, souvenir shopping, and dining at the town's local restaurants. During their stay in Churchill, respondents identified that their polar bear viewing tour included information about environmental issues, climate change, and polar bear health.



Frontiers North Adventures include survey respondents who organized their trips with Heartland Tours, Churchill Northern Studies Centre, CAA, Road Scholar, and Lords of the Arctic. Great White Bears include tourists who organized their trips with Natural Habitat Adventure

Figure 4.3. Polar Bear Viewing Tourists' Choice of Tour Operators

4.4.1 Tourists knowledge and awareness about climate change

The majority of the polar bear viewing tourists (92%) indicated they believed climate change was happening and that it is influenced by human activity. Of the respondents who strongly believed climate change was happening, only 66% strongly agreed or agreed air travel was a contributor to these changes. As previous research suggests, although there is an increased awareness about the impacts of climate change, tourists do not necessarily understand how this process occurs, especially in regard to travel (Gössling, 2011). Furthermore, respondents who strongly agreed or agreed that air travel is a contributor of climate change also stated that they would probably travel elsewhere to see polar bears if they could not see them in Churchill. This is a similar response indicated by tourists who visited glacier sites that were negatively influenced by climate change (Lemieux et al., 2017). Tourists would have to travel further north in Canada or to further northern destinations worldwide (i.e. Norway or Russia) to see the bears, which would generate more carbon emissions into the atmosphere (Government of Canada, 2018). Dawson et al. (2010) indicated emissions from air travel for polar bear viewing tourists ranged from an average of 1.54 t/CO_2^{-e} (city of origin: Toronto, Canada) to an average of 8.61

t/CO_2-e (city of origin: Sydney, Australia). Emissions to travel to other popular polar bear viewing destinations, such as Svalbard, Norway, would range from an average of 3.35 t/ CO_2-e (origin: Toronto, Canada) to an average of 7.86 t/CO_2-e (origin: Sydney, Australia)[8]. Similarly, many respondents (n=42) were intrigued by the option to travel Churchill for one day only. This is a tourism trend that is expected to continue. It has been estimated that on a per day basis, domestic travel is more carbon intensive compared to international travel due to the shorter stays (Becken & Hay, 2012). People traveling to Churchill will continue to depend on energy intensive modes of transportation (i.e. air travel). This will mean an increase in greenhouse gas emissions, unless attitudes and behaviours are changed (Holden, 2014; Scott et al., 2012).

Even though the polar bear viewing tours provide tourists with information about polar bears (including polar bear heath, sea ice, and general polar bear information), only 52% of respondents strongly agreed or agree with the statement "polar bears will disappear from the Churchill region due to changes in the global climate." Reasons for this may reflect the lack of conceptual clarity of how the rise in temperatures is influencing the polar bears' health and population sizes. If a tourist sees more than one bear on their viewing tour, they might not understand these effects as well compared to a tourist who doesn't see any bears during their polar bear viewing tour. This lack of understanding creates an opportunity for Churchill's tour operators to teach tourists about the relationship between tourism and travel and climate change to give them a better understanding about what it means and what tourists can do to play a part in reducing the impact.

4.4.2 Tourist's opinions on climate mitigation strategies

A vast majority of Churchill's polar bear viewing tourists (89%) would support Churchill's tourism industry becoming a carbon neutral destination which would require the industry to switch their energy consumption, implement carbon offsetting and improve efficiency gains (Dawson et al., 2010). Figure 4.4 shows respondents' opinions on the approaches they believe to

[8] Emissions estimates from air travel are calculated using an average of three carbon calculators. See Dawson et al., (2010) for a complete discussion

be the most effective for reducing carbon emissions for Churchill to reach this carbon neutral status.

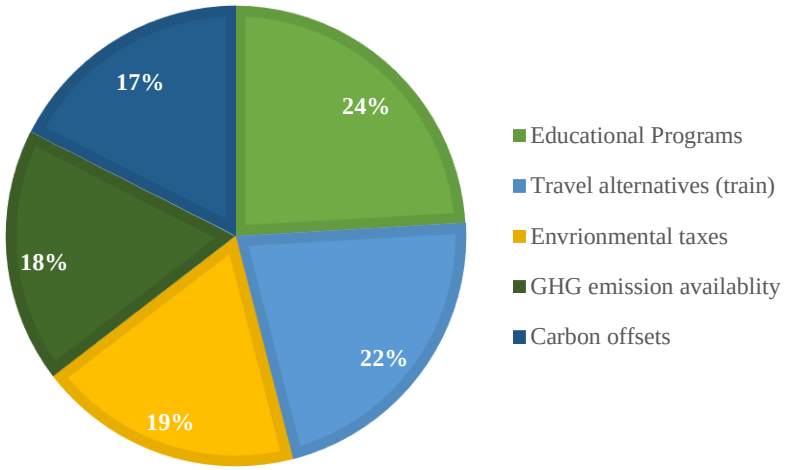


Figure 4.4. Polar Bear Viewing Tourists' Opinions on the Most Effective Approaches to Reduce Carbon Emissions

The most effective strategies identified by tourists were educational programs and travel alternatives (e.g. train). Respondents had indicated that they would have preferred to take the train to Churchill instead of taking the plane, had that option been available. Of the respondents who believed train travel was effective or very effective, 42% indicated they would recommend to others to travel to Churchill. These tourists may encourage their friends and families to take the train which would reduce the dependence on air travel therefore reducing emissions from the polar bear viewing industry. Knowing that tourists are interested in taking the train is an opportunity for Churchill's local government to invest in improving low-emission forms of transportation. This would involve fixing the tracks, and improving schedules, times, and services (Dawson et al., 2010b). Tourists also believe educational programs are an effective strategy for reducing emissions. More than half of survey respondents (68%) always consider ecologically friendly travel options and alternatives if they are made available to them. This may be a good marketing opportunity for the tour operators to promote to tourists the types of education they will receive, and even direct their educational programs to include information about the impacts of travel on climate change and the opportunities or alternatives available for

tourists to reduce their emissions. In addition to educational programs on-site, during tours, in order for tourists to successfully make these decisions, they need to be supported and encouraged following their travels (Ballentyne & Packer, 2011). Tourists believed that the best way to receive information about the environmental and ecofriendly travel alternatives/ options is by email and the internet. Tour operators can use a direct approach prior, during, and following the trips to teach tourists about climate change and to provide them with the solutions they need to make changes (Garma, 2014).

Studies have shown that implementing carbon or environmental taxes are a way to generate awareness about climate change (Gössling, 2013). Polar bear viewing tourists however, did not believe it to be the most effective solution for reducing Churchill's emissions. Respondents indicated they would be willing to pay between $50 to $100 to offset the greenhouse gas emissions generated from their visit to Churchill. Dawson et al. (2010) indicated that tourists would only pay 10% of the cost of the flight to offset their greenhouse gas emissions from travel. Tourists also stated that the trip to Churchill is already very expensive and that including additionally taxes or fees was not a very attractive/ effective option as indicated in Figure 4.4. Furthermore, the majority of respondents (85%) did not purchase a carbon offset because they don't know what it is and because they don't know what the money is used for. Similar studies have analyzed carbon offsetting (Becken, 2004; Dawson et al., 2010; UNWTO-UNEP-WMO, 2008), have also found tourists to be unsure about what a carbon offset is, which may explain why the polar bear viewing tourists do not believe this strategy is effective for reducing emissions.

Contrary to previous studies which identified that tourists may not feel responsible for the impacts of climate change and may blame governments and airlines to act and address the costs themselves (Gössling, 2011), 70% of polar bear viewing tourists believe that it is the role of individuals, tour operators, and policy makers to implement positive environmental change for the tourism industry. This highlights the importance of including tourists in decision making processes focused on climate change mitigation strategies and providing them with the necessary tools to reduce their emissions. More than half (59%) of the polar bear tourists indicated that when they arrived home, they would be making lifestyle changes to reduce their emissions. Efforts to reduce emissions included buying an electric/hybrid car, drive less, recycle, invest in

solar energy, and reduce packaging (mainly from plastic). There was little to no indication about reducing emissions from travel, which provides a good opportunity for tour operators to talk to tourists about the alternatives that exist and to provide them with the necessary knowledge so that they can make environmentally friendly decisions for their trip.

4.5 Discussion

As previous studies suggest, the tourism industry is likely to expand in the years ahead, increasing the demand for air travel and intensifying the emissions emitted from this carbon intensive industry (Lenzen et al., 2018). It is important for tourism industries, much like Churchill's, to address the needs of their tourists to encourage and enforce more environmentally sustainable travel. Churchill's polar bear viewing industry does make an effort to be environmentally friendly -- Natural Habitat Adventures state that they are 100 percent carbon neutral, the Churchill Northern Studies Centre holds a LEED Silver certification for its building, and Frontiers North Adventures promotes sustainability in their sustainability reports (churchillscience.ca; frontiersnorthadventure.com; nathab.com). Furthermore, the education about environmental issues, polar bear health, and climate change provided to tourists on their polar bear viewing tour is something that has been recently implemented within the last ten years (Dawson et al., 2010b). Studies have shown that there is a growing number of consumers who are interested in choosing tours where the industry and the tour operators demonstrate sustainable tourism practices and this is a trend that is expected to grow especially as the awareness of climate change and the understanding that action is necessary to reduce these negative impacts continues to evolve (Gössling, 2011; Frew, 2012). One thing that should be noted is Churchill's polar bear viewing industry is quite small and available tour operators and accommodations are limited. More than half of the polar bear viewing tourists (68%) identified they consider ecologically friendly transportation and accommodation options and alternatives if they are made available to them. These people are likely to consider these factors in their future travel. Churchill's tour operators have an opportunity to promote their environmental initiatives while continuing to educate tourists about other environmental travel alternatives and options. More research is needed to further identify how marketing environmental features and aspects influences a tourist's decision to choose their tour operator.

This study indicated that polar bear viewing tourists believed the most effective strategies for reducing emissions was educational programs and travel alternatives. By knowing what sort of solutions polar bear viewing tourists believe to be the most effective, will help tour operators understand where they could make changes to their industry and tours and that these solutions will have a positive influence on tourists themselves (Chen, 2015). In providing these educational programs, studies have shown that tour operators themselves require specific information and education that highlights consumer trends, motivations and information on how to market their industries as green destinations (Dodds & Graci, 2009; Gössling, 2013). Accessibility to this information should come from governments who include this information about environmental and climate specific subjects into tourism training programs (Becken & Hay, 2012; UNWTO-UNEP-WMO, 2010). While education programs may not be a mitigation strategy that directly reduce greenhouse gas emissions, compared to switching to low-carbon forms of transportation, it is a strategy that allows people to reflect on their decisions, and begin thinking about the solutions and alternatives that exist, so that in their next trip, they may be encouraged to purchase a carbon offset or choose a hotel that is less carbon intensive compared to others. Furthermore, because tourists identified that policy makers, tour operators, and tourists all play a role towards implementing positive change, it is important to note that they would be willing to take action for their behaviour in order to reduce emissions, whether it be when they return home or on their next trip, instead of placing the blame elsewhere. Existing studies show an inconsistency between environmental awareness and actual behaviour (Budeanu & Emrarah, 2014). One of the major limitations of this study is not being able to know if tourists will actually make environmental lifestyle changes when they go home, even though 59% of respondents indicated they would. It is also difficult to know if tourists who are traveling to other tourism destinations that are not affected by climate change in the same way that Churchill is, will be influenced to make lifestyle changes. This will come down to tour operators educating tourists prior, during and following tours, to make sure they have the information they need to make environmental decisions whether it be at home or while traveling (Ballentyine & Packer, 2011).

Although the 2018 polar bear viewing tourists were only able to take the plane to reach Churchill, many tourists mentioned they would have taken the train if the option was available. Taking the train is significantly less carbon intensive than taking the plane. It is estimated that train travel from Winnipeg to Churchill will emit approximately 0.058 tonnes/ CO_2, while taking

the plane from is approximately 0.41 tonnes/ CO_2 (viarail.com). The downside is that it would take approximately four days of round-trip travel from Winnipeg to Churchill. This may be unappealing to certain tourists due to potential time constraints of their vacation. Promoting this form of travel will be important nonetheless for tour operators and travel agents to encourage modes of travel that are less carbon intensive. Now that the train is functioning again, it will be important to know how many people used this as an alternative for sustainable travel.

Upon the reopening of the train in October 2018, the University of Manitoba created *Expedition Churchill: A Gateway to Arctic Research* which is an interactive e-book providing people with information about research being done in Churchill. On the train to Churchill, there is a research-themed dining car which will sometimes feature researchers to educate passengers. The e-book is also accessible on the train (Billeck, 2018). This is a great opportunity to educate tourists about climate change and tourism, using the two mitigation strategies (education and travel alternatives) that tourists believe would be the most effective to reduce emissions.

4.6 Conclusion

Studies have shown that the tourism industry is becoming increasingly carbon intensive due to the desire to travel to exotic destinations which have increased travel distances and the reliance on air travel (Lenzen et al., 2018). Climate change mitigation has been a solution to reduce fossil fuel dependent energy use through technological advancements, economic measures, environmental management and behavioural change (UNWTO-UNEP-WMO, 2008). This study emphasized the need to involve tourists in the decision-making processes to reduce greenhouse gas emissions from travel. This study also highlighted what tourists know about climate change and what sort of climate change mitigation strategies they believed to be the most effective for Churchill's polar bear viewing industry to reduce emissions. These strategies will help increase awareness, foster new attitudes in the hopes of leading tourists to change their travel patterns and behaviour in the future (Scott et al., 2012). Future research is needed to determine how effective these strategies will be in the long-term in relation to behavioural change and emission reductions. Tourists commitment to the environment is a concept that is continued to be explored to understand the knowledge and attitude about climate change and tourism and their willingness

to implement change (Garma, 2014). Popularizing sustainable tourism will take significant efforts from all levels of the tourism industry to effectively implement mitigation strategies and to change the ways in which they think about the relationships between tourism and climate change (Lane, 2009). Implementing climate change mitigation strategies (which include educational programs and travel alternatives) will allow Churchill, Manitoba's polar bear viewing industry, to be not only the best place for polar bear viewing but best tourism industry for promoting, encouraging, and initiating sustainable tourism.

4.7 References

Ballantyne, R. & Packer, J. (2011). Using tourism free-choice learning experience to promote environmentally sustainable behavior: the role of post-visit 'action resources'. *Environmental Education Research 17* (2). 201-215. DOI: 10.1080/13504622.2010.530645

Becken, S. (2004). How tourists and tourism experts perceive climate change and carbon-offsetting schemes. *Journal of Sustainable Tourism 12:*4. 332-345. DOI: 10.1080/09669580408667241.

Becken, S. (2007). Tourists' perception of international air travel's impact on the global climate and potential climate change policies. *Journal of Sustainable Tourism 15*:4. 351-368. DOI: 10.2167/jost710.0.

Becken, S. & Hay, J.E. (2007). *Tourism and climate change: Risk and opportunities.* North York, Ontario: Channel View Publications.

Becken, S. & Hay, J.E. (2012). *Climate Change and Tourism. From policy to practice*. New York, New York: Routledge.

Billeck, S. (November 30, 2018). Interactive e-book hopes to put spotlight on Churchill. Retrieved from https://winnipegsun.com/news/news-news/interactive-e-book-hopes-to-put-spotlight-on-churchill.

Bradshaw, M., & Stratford, E. (2010). Qualitative research design and rigour. In Hay, I [Ed], *Qualitative research methods in human geography* (69-80). Don Mills, Ontario: Oxford University Press

Budeanu, A., & Emtairah, T. (2014). Is there hope for sustainability? An empirical study of Swedish tourist. In Weeden, C. & Boluk, K. (Eds.), *Managing Ethnical Consumption in Tourism* (83-103). Abingdon, Oxford: Routledge.

Burns, P., & Bibbings, L. (2009). The end of tourism? Climate change and societal challenges. *Twenty-First Century Society 4*(1). 31-51. DOI: 10.1080/17450140802642424.

Burns, P. & Bibbings, L., (2013). Climate change and tourism. In Holden, A., & Fennell, D. [Eds.], *The Routledge Handbook of Tourism and the Environment* (406-420). Abingdon, Oxon: Routledge.

Butler, R. (1992). Alternative tourism: The thin edge of the wedge. In Smith, V. & Eadington, W. [Eds.], *Tourism Alternatives* (31-46). Philadelphia, Pennsylvania: University of Pennsylvania.

Campos, A.C., Mendes, J., Oom do Valle, P., & Scott, N. (2018). Co-creation of tourist experiences: a literature review. *Current Issues in Tourism 21* (4). 369-400. https://doi.org/10.1080/13683500.2015.1081158

Caton, K. (2014). What does it mean to good in tourism? In Weeden, C. & Boluk, K. (Eds.), *Managing Ethnical Consumption in Tourism* (19-31). Abingdon, Oxford: Routledge.

Chen, J.S. (2015). Tourism stakeholders' attitudes toward sustainable development: A case in the Arctic. *Journal of Retailing Consumer Services 22*. 225-230. https://doi.org/10.1016/j.jretconser.2014.08.003

Comiso, J.C. (2012). Large decadal decline of the Arctic multiyear ice cover. *Journal of Climate 25.* 1176-1193. DOI: 10.1175/JCLI-D-11-00113.1

Creswell, J.W. (2014). *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches.* United States of America: Library of Congress Cataloguing-in-Publication Data.

CTV News. (December 2, 2018). All aboard: First passenger train in 18 months depart for Churchill, Man. Retrieved from https://www.ctvnews.ca/canada/all-aboard-first-passenger-train-in-18-months-departs-for-churchill-man-1.4201440

Dawson, J., Maher, P.T., & Slocombe, D.S. (2007). Climate change, marine tourism, and sustainability in the Canadian Arctic: Contributions from systems and complexity approaches. *Tourism in Marine Environments 4* (2-3). 69-83. DOI: https://doi.org/10.3727/154427307784772057.

Dawson, J., Stewart, E., & Scott, D. (2010a). Climate change and polar bear viewing: A case study of visitor demand, carbon emissions and mitigation in Churchill, Canada. In Hall, C.M., & Saarinen, J. (Eds.), *Tourism and Change in Polar Regions: Climate, environment and experience* (89-103). Abingdon, Oxon: Routledge.

Dawson, J., Stewart, E.J., Lemelin, H., & Scott, D. (2010b). The carbon cost of polar bear viewing tourism in Churchill, Canada. *Journal of Sustainable Tourism 18*(3). 319-336. DOI: 10.1080/09669580903215147.

Dawson, J., Johnston, M.J., Stewart, E.J., Lemieux, C.J., Lemelin, R.H., Maher, P.T., & Grimwood, B.S.R. (2011). Ethical considerations of last chance tourism. *Journal of Ecotourism 10*(3). 250-265. http://dx.doi.org/10.1080/14724049.2011.617449.

Distasio, J., Dudley, M., & Moradzadeh, F. (2011). *Churchill Sustainability Planning Framework (CSPF).* Retrieved from http://winnspace.uwinnipeg.ca/handle/10680/806.

Dodds, R., & Graci, S. (2009). Canada's tourism industry- mitigating the effects of climate change: A lot of concern but little action. *Tourism and Hospitality Planning & Development 6.* 39-51. https://doi.org/10.1080/14790530902847046

Dyck, M., Campbell, M., Lee, D., Boulanger, J., & Hedman, D. (2017). 2016 Aerial survey of the Western Hudson Bay polar bear subpopulation [Final Report]. Retrieved from https://www.gov.nu.ca/sites/default/files/pb_wh_2016_population_assessment_gn_report_27_june_2017.pdf.

EcoRessources Consultants. (2011). *Evidence of the socio-economic importance of polar bears for Canada*. Retrieved from the Government of Canada website: http://publications.gc.ca/site/eng/397569/publication.html.

Eijgelaar, E., Thaper, C., & Peeters, P. (2010). Antarctic cruise tourism: The paradoxes of ambassadorship, "last chance tourism" and greenhouse gas emissions. *Journal of Sustainable Tourims 18* (3). 337-354. doi: 10.1080/09669581003653534

Folwer, F. (2009). *Survey Research Methods.* Thousand Oaks, California: Library of Congress Cataloging- in- Publication Data.

Garma, R. (2014). Greening Consumers. In DeLacy, T., Jiang, M., Lipman, G., & Vorster, S. (Eds.), *Green grown and travelism: Concept, policy and practice for sustainable tourism (*97-111). Abingdon, Oxon: Routledge.

Gössling, S. (2011). *Carbon Management in Tourism: Mitigating the Impacts on Climate Change.* Abingdon, Oxon: Routledge.

Gössling, S. (2013). Climate policy and tourism. In Holden, A. & Fennell, D. (Eds), *The Routledge Handbook of Tourism and the Environment* (421-434). Abingdon, Oxon: Routledge.

Gössling, S. (2018). Tourism, tourist learning and sustainability: an exploratory discussion of complexities, problems and opportunities. *Journal of Sustainable Tourism 26* (2). 292-306. DOI: 10.1080/09669582.2017.1349772

Gössling, S., & Peeters, P. (2007). ‘It does not harm the environment!’ An analysis of industry discourses on tourism, air travel and the environment. *Journal of Sustainable Tourism 15*(4). 402-417. doi: 10.2167/jost672.0.

Gössling, S., Scott, D., & Hall, M.C. (2013). Challenges of tourism in a low-carbon economy. *Wiley Interdisciplinary Reviews: Climate Change 4:*6. 525-538. doi: 10.1002/wcc.243.

Gössling, S., Scott, D., Hall, C.M., Ceron, J-P., & Dubois, G. (2012). Consumer behaviour and demand response of tourists to climate change. *Annals of Tourism Research 39*(1). 36-58. doi: 10.1016/j.annals.2011.11.002.

Gössling, S., Broderick, J., Upham, P, Ceron, J-P., Dubois, G., Peeters, P., & Strasdas, W. (2007). Voluntary carbon offsetting schemes for aviation: Efficiency, credibility and sustainable tourism. *Journal of Sustainable Tourism 15:* 3. 223-248DOI: 10.2167/jost758.0.

Government of Canada. (2018). Maps of sub-populations of polar bears and protected areas. Retrieved from https://www.canada.ca/en/environment-climate-change/services/biodiversity/maps-sub-populations-polar-bears-protected.html.

Groulx, M.W. (2015). *Prospects for place-based climate change adaptation: An exploration of place, vulnerability and collaborative planning in Churchill, Manitoba* (Doctoral dissertation). Retrieved from Waterloo’s Institutional Repository. *http://hdl.handle.net/10012/9606.*

Gunter, M.Jr. (2018). *Tales of an Ecotourist: What travel to wild places can teach us about climate change.* Albany, New York: State University of New York.

Hall, M.C. (2010). Tourism and environmental change in polar regions: Impacts, climate change and biological invasion. In Hall, C.M., & Saarinen, J. (Eds.), *Tourism and Change in Polar Regions: Climate, environment and experience* (42-70). Abingdon, Oxon: Routledge.

Hall, M.C., & Saarinen, J. (2010). Tourism and change in polar regions: Introduction-definitions, locations, places and dimensions. In Hall, C.M., & Saarinen, J. (Eds.), *Tourism and Change in Polar Regions: Climate, environment and experience* (1-41). Abingdon, Oxon: Routledge.

Holden, A. (2014). The evolution of environmental ethics: Reflections on tourism consumption. In Weeden, C. & Boluk, K. (Eds.), *Managing Ethnical Consumption in Tourism* (70- 80). Abingdon, Oxford: Routledge.

IPCC. (2014). Synthesis report. In Pachauri, R.K and Meyer, L.A. (Eds.) *Climate Change 2014: Synthesis Report.* Contribution of working groups I, II and II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change (pp. 33-112). Geneva, Switzerland, IPCC.

Johnston, M., Viken, A., & Dawson, J. (2012). Firsts and lasts in Arctic tourism: last chance tourism and the dialectic of change. In Lemelin, R.H., Dawson, J., & Stewart, E.J. (Eds.), *Last chance tourism. Adapting tourism opportunities in a changing world* (10-24). Abingdon, Oxon: Routledge.

Lane, B. (2009). Thirty years of sustainable tourism: Drivers, progress, problems and the future. In Gössling, S., Hall. C.M., & Weaver, D.B. (Eds.), *Sustainable tourism futures: Perspectives on systems, restructuring and innovations* (19-32). Abingdon, Oxon: Routledge.

Lemelin, R.H. (2006). The gawk, the glance, and the gaze: Ocular consumption and polar bear tourism in Churchill, Manitoba, Canada. *Current Issues in Tourism 9* (6). 516-534. doi: 10.2167/cit294.0.

Lemelin, R.H., Bay, T, & Fennell, D. (2008). Polar bear viewers as deep ecotourists: How specialized, are they? *Journal of Sustainable Tourism 16*(1). 42-62. doi :10.2167/jost702.0.

Lemelin, H., Dawson, J., Stewart, E.J., Maher, P., & Lueck, M. (2010). Last-chance tourism: The boom, doom, and gloom of visiting vanishing destinations. *Current Issues in Tourism 13*(5). 477-493. DOI: 10.1080/13683500903406367.

Lemelin, R.H., Stewart, E., & Dawson, J. (2012). An introduction to last chance tourism. In Lemelin, R.H., Dawson, J., & Stewart, E.J. (Eds.), *Last chance tourism. Adapting tourism opportunities in a changing world* (3-9). Abingdon, Oxon: Routledge.

Lemieux, C., & Eagles, P. (2012). Last chance tourism in Canada's protected areas: Management implications and emerging ethical considerations. In Lemelin, R.H., Dawson, J., & Stewart, E.J. (Eds.), *Last chance tourism. Adapting tourism opportunities in a changing world* (195-217). Abingdon, Oxon: Routledge.

Lemieux, C. J., Groulx, M., Halpenny, E., Stager, H., Dawson, J., Stewart, E.J., & Hvenegaard, G.T. (2017). "The end of the Ice Age?": Disappearing world heritage and the climate change communication imperative. *Environmental Communication.* (1-19). Retrieved from https://doi.org/10.1080/17524032.2017.1400454.

Lenzen, M., Sun, Y-Y., Faturay, F., Ting, Y-P., Geschke, A., & Malik, A. (2018). The carbon footprint of global tourism. *Nature Climate Change 8.* 522-528. https://doi.org/10.1038/s41558-018-0141-x

Mair, J. (2011). Exploring air traveller's voluntary carbon-offsetting behavior. *Journal of Sustainable Tourism 19.* 215-230. https://doi.org/10.1080/09669582.2010.517317.

McKercher, B., Prideaux, B., Cheung, C., & Law, R. (2010). Achieving voluntary reductions in the carbon footprint of tourism and climate change. *Journal of Sustainable Tourism 18* (3). 297-317. https://doi.org/10.1080/09669580903395022.

Needham, M.D. & Vaske, J.J. (2008). Writing and constructing. In Vaske, J.J. (Ed.), *Survey research and analysis: Applications in parks, recreation and human dimensions.* (121-171). State College, Pennsylvania: Venture Publishing, Inc.

Parks Canada. (2007). *Wapusk National Park of Canada* (R63-350/4-2008E). Ottawa, Ontario: Library and Archives Canada Cataloguing.

Peacock, E., Derocher, A.E., Lunn, N.J., & Obbard, M.E. (2010). Polar bear ecology and management in Hudson Bay in the face of climate change. In Ferguson, S.H., Loseto, L.L., & Mallory, M.L. (Eds.), *A little less Arctic: Top predators in the world's largest northern inland sea, Hudson Bay* (93-115). Netherlands, Springer.

Peeters, P., Gössling, S., & Lane, B. (2009). Moving towards low-carbon tourism: New opportunities for destinations and tour operators. In Gössling, S., Hall. C.M., & Weaver, D.B. (Eds.), *Sustainable tourism futures: Perspectives on systems, restructuring and innovations* (240-257). Abingdon, Oxon: Routledge.

Piggott-McKellar, A.E., & McNamara, K.E. (2017) Last chance tourism and the Great Barrier Reef. *Journal of Sustainable Tourism 25* (3). 397-415. DOI: 10.1080/09669582.2016.1213849.

Regehr, E.V., Lunn, N., Amstrup, S., & Stirling, I. (2007). Effects of earlier sea ice breakup on survival and population size in polar bears in western Hudson Bay. *Journal of Wildlife Management 71* (8). 2673-2683. DOI: 10.2193/2006-180.

Scott, D., & Lemieux, C. (2013). The vulnerability of tourism to climate change. In Holden, A., & Fennell, D. (Eds.), *The Routledge Handbook of Tourism and the Environment* (241-257). Abingdon, Oxon: Routledge.

Scott, D., Hall, C.M., & Gössling, S. (2012). *Tourism and climate change.* Abingdon, Oxon: Routledge.

Scott, D., Gössling, S., Hall, M.C., & Peeters, P. (2016). Can tourism be part of the decarbonized global economy? The costs and risks of alternative carbon reduction policy pathways. *Journal of Sustainable Tourism 24* (1). 52-72. DOI: 10.1080/09669582.2015.1107080

Stirling, I. (1988). *Polar Bears.* Michigan, United States of America: The University of Michigan Press.

Stirling, I. (2011). *Polar Bears. The Natural History of a Threatened Species.* Brighton, Massachusetts: Fitzhenry & Whiteside.

Stirling, I., Lunn, N.J., & Iacozza, J. (1999). Long-term trends in the population ecology of polar bears in Western Hudson Bay in relation to climate change. *Arctic 52* (3). 294-306. http://www.jstor.org/stable/40511782.

Struzik, E. (2014). *Arctic icons: How the town of Churchill learned to love its polar bears.* Markham, Ontario: Fitzhenry & Whiteside.

Towns. L., Derocher, A.E., Stirling, I., Lunn, N.J., & Hedman, D. (2009). Spatial and temporal patterns of problem polar bears in Churchill, Manitoba. *Polar Biology 32* (10). 1529-1537. DOI: 10.1007/s00300-009-0653-y.

United Nations World Tourism Organization (UNWTO) & World Meteorological Organization (WMO). (2011). Tourism: Investing in energy and resource efficiency. *Towards a green economy*. 414-451.

United Nations World Tourism Organization (UNWTO)- United Nations Environmental Program (UNEP)- and World Meteorological Organization (WMO). (2008). *Climate change and tourism: Responding to global challenges.* Madrid and Paris: UNWTO and UNEP.

Weaver, D. (2009). Reflections on sustainable tourism and paradigm change. In Gössling, S., Hall, C.M., & Weaver, D.B. (Eds.), *Sustainable tourism futures: Perspectives on systems, restructuring and innovations* (169-199). Abingdon, Oxon: Routledge.

Weeden, C. (2014). Marking responsible tourism. In Weeden, C. & Boluk, K. (Eds.), *Managing Ethnical Consumption in Tourism* (225-239). Abingdon, Oxford: Routledge.

Winfield, M. (2009). Policy instruments in Canadian environmental policy. In VanNijnatten D.L and Boardman R. (Eds.), *Canadian environmental policy and politics: Prospects for leadership and innovation* (46-63). Don Mills, Ontario: Oxford University Press.

World Tourism Organization. (2009). From Davos to Copenhagen and beyond: Advancing tourism's responses to climate change [UNWTO Background paper]. Retrieved from http://sdt.unwto.org/sites/all/files/docpdf/fromdavostocopenhagenbeyondunwtopaperelectronicversion.pdf.

CHAPTER FIVE: Summary and Conclusion

5.1 Introduction

As tourism continues to expand, relying on energy intensive modes of transportation, greenhouse gas emissions will rise, further intensifying temperatures and negatively impacting the environment and natural resources most tourism industries are dependent on. Understanding the quantity of greenhouse gas emissions emitted, identifying what tourists know about climate change and why they are traveling, and developing strategies and tactics for reducing these emissions is important for tourism industries, much like Churchill's, to address the impacts from climate change. Through the implementation of visitor surveys using both quantitative and qualitative questions, this research analyzed Churchill's polar bear viewing industry in order to attain the following objectives: 1) to estimate the greenhouse gas emissions from polar bear viewing tourists and the polar bear viewing industry, 2) to identify tourists' awareness of the impacts of climate change (to and from tourism activities), 3) to understand tourist's motivation for traveling to Churchill, 4) to compare results of objectives 1-3 with a similar study conducted a decade ago to understand if and how polar bear viewing tourists (including their behaviour and motivation), and 5) to identify tourists' opinions on potential climate change mitigation strategies. This chapter presents the main findings of this research in relation to the objectives, discusses the contributions from this research, and presents the limitations and suggestions for future research.

5.2 Summary of the findings

Objective 1: Estimate greenhouse gas emissions from polar bear viewing tourists and the polar bear viewing industry (Chapter 3)

It was identified by Dawson et al. (2010) that Churchill's polar bear viewing tourism industry was the second highest carbon intensive tourism destination, after cruise ship tourism in Antarctica. Arctic tourism experiences the highest tourist greenhouse emissions due to the

dependence on air travel (Hall, 2010). Globally, tourism emissions have risen from 5% in 2007 to 7% in 2018 and transportation is one of the major contributors (Lenzen, 2018; UNWTO-UNEP-WMO, 2008). In Chapter 3, it was identified that a polar bear viewing tourist will emit, on average, between 0.7 t/CO_2^{-e} (origin: Minneapolis, Minnesota) to 8.25 t/ CO_2^{-e} (origin: Adelaide, Australia) during their 5-day trip to Churchill, Manitoba. This is 3-34 times higher than an average global tourist experience which is estimated at 0.25 t/ CO_2 (UNWTO-UNEP-WMO, 2008). These emissions are largely a factor of all 2018 polar bear viewing tourists having to fly from Winnipeg (the gateway city) to reach Churchill. If the train had been functional and accessible to tourists, greenhouse gas emissions may have been lower. The total greenhouse gas emissions for Churchill's polar bear viewing industry was identified to be 23 017 t/CO_2 (n=12 000 tourists annually). If Churchill continues to depend on polar bear viewing to support their local economy, the tourism industry should be more involved in implementing strategies for reducing these emissions, especially strategies related to transportation, to make their industry more sustainable and less harmful to the environment.

Objective 2: Identify tourists' awareness of the impacts of climate change (to and from tourism activities) (Chapter 3)

Understanding tourists' awareness of the impacts of climate change will help policy makers and tour operators determine what information they need to be sharing with their tourists to educate them and encourage them to change their behaviour. Chapter 3 highlighted that the majority of polar bear viewing tourists (92%) were very sure or somewhat sure climate change is happening and that human activities are a contributor to the effects of the changes being experienced today. Furthermore, tourists identified they would be willing to make lifestyle changes in order to reduce their emissions. Awareness of climate change and the understanding that action is necessary to reduce climate change impacts is a trend that has increased in recent years (Gössling, 2011). However, there is a lack of understanding about how air travel contributes to these changes and that polar bears will disappear in response to rising temperatures. This is a response that has been identified by several scholars (see Becken, 2004; Dawson et al., 2010a&b; Gössling & Peeters, 2007; Hall, 2010). This lack of understanding can be explained by

the fact that because the effects from air travel take time to trigger temperature climatic changes, a tourist may not be able to recognize the impacts of change on their single trip. The tourism industry, particularly tour operators, play a significant role in the way tourists think about climate change and the actions they take to reduce emissions. Tour operators can educate tourists about the impact tourism has on climate change and can lead by example by providing the options and alternatives for tourists to make their trips more environmentally conscious (Forsyth et al.,1995).

Objective 3: Understand tourist's motivation for traveling to Churchill (Chapter 3)

Understanding tourist's motivation to travel helps tour operators plan how to market their industries, offer their services, and how to determine what sort of information to provide to tourists. For this study, it was also important to identify if the 'last chance tourism' trend was a motivator for traveling to Churchill. Chapter 3 identified that the majority of respondents (61%) indicated they wanted to see a polar bear, without any other explanation. Fewer respondents (13%) indicated they wanted to see the polar bear before they are gone, disappear or go extinct. It is important to note that because this was an open-ended question, respondents were not prompted to write this type of response. Motivations to travel to Churchill in previous studies were primarily to see and photography polar bears (Lemelin, 2006). As tourists become increasingly aware about the effects of climate change and the impacts they are having on polar bears, these types of 'last chance tourism' responses may be increased. Other motivations for travel were photography, to see the northern lights (although the best time is February and March), to see other Arctic animals in the wild, and that this trip was part of a bucket list. This indicates that the 'last chance tourism' trend may not be what is attracting all travel to Churchill. These additional motivations may be beneficial for Churchill's tourism industry to be made aware of as it creates an opportunity to market their other tourism seasons, such as the Aurora Borealis season or Beluga season to tourists –should Churchill no longer be able to provide polar bear viewing tours. The additional motivators identified by the survey respondents may also mean that tourists have developed a certain loyalty to this destination, as tourists may think about coming back to Churchill not only for the polar bear viewing season (Scott et al., 2012).

Objective 4: Compare results of objectives 1-3 with a similar study conducted a decade ago to understand if and how polar bear viewing tourists (including their behaviour and motivation) have changed over time (Chapter 3)

Comparing this study with Dawson et al. (2010) and Groulx (2015) who analyzed similar components of Churchill's polar viewing industry is important to understand where improvements can be made to reduce emissions both short and long term. When calculating the greenhouse gas emissions from this industry, the results from this study show that a polar bear viewing tourist will emit, on average, 0.7 t/CO_2^{-e} (origin: Minneapolis, Minnesota) to 8.25 t/ CO_2^{-e} (origin: Adelaide, Australia) during their 5-day trip to Churchill, Manitoba. Compared to Dawson et al. (2010), who estimated greenhouse gas emissions to range from 1.54 t/ CO_2^{-e} (origin: Toronto, Canada) to 8.61 t/ CO_2^{-e} (origin city: Sydney, Australia). The difference of the greenhouse gas estimates between the two studies, is negligible, indicating that there has been very little shift in reducing emissions over the last ten years. Because the total number of tourists has increased from 8000 in 2007 to 12 000 in 2018, the total greenhouse gas emissions for a polar bear viewing season has increased from 20, 892 t/CO_2 to 23, t/CO_2. This increase in tourists is in line with the tourism trends which indicate an increase in accessibility and affordability of tourism, causing an increase in tourism emissions, due to energy intensive modes of transportation (Lenzen, 2018; Scott et al., 2010). Churchill's tourism industry should be focused on reducing emissions especially from air travel, which tourists rely on to reach this subarctic town.

The results from Chapter 3 identified that there were negligible differences in tourists' knowledge of climate change over the past 10 years. Although tourists believe climate change is happening and that it is primarily human induced, there is still a lack of understanding of how air travel contributes to these changes and how it influences polar bear populations. Tourists are still willing to travel elsewhere (this means traveling to farther destinations which will emit higher amounts of greenhouse gas emissions) in order to see a polar bear. The only significant difference between the two studies was a 9% increase of respondents who would make lifestyle changes at home to reduce greenhouse gas emissions. This number may have been higher, however n=64 left this question blank as they thought they were already doing enough to reduce emissions and did not know what else they could be doing. Similar to the 2007 results,

respondents identified to be less likely to make lifestyle changes while on their trip to Churchill to reduce emissions. Tourists who purchased a carbon offset (8%) increased only by 1%. Reasons for not purchasing an offset remained the same over 10 years; respondents did not know what a carbon offset is or what the money is used for. Although tour operators are now providing tourists with information about climate change, polar bear health and environmental impacts (something that was not being done 10 years ago), they are not providing tourists with information about how energy intensive travel is and what tourists can do to reduce their emissions. This can be linked to why the knowledge and awareness about climate change and tourism among tourists is so low.

Groulx (2015) indicated that one of the motivations to travel was to see the polar bears 'before they disappear', as well as to learn about the impacts of climate change and engage with other tourists. Dawson et al. (2010) also indicated that one of the motivations for traveling to Churchill was in response to the last chance tourism trend. Tourists in the 2018 study indicated that they simply wanted to see a polar bear as well as wanting to see other Arctic wildlife, for photography, and to see the Northern Lights. However, compared to Groulx (2015), tourists were not prompted to give a "last chance tourism" response as many (13%) of respondents did. This type of response will continue to increase as climate change intensifies. Groulx et al., (2016) also identified motivation to travel which includes a social interaction component, whereby visitors are traveling to Churchill to engage with individuals who relate to nature in a similar way. In the responses from this study, there was no mention of wanting to engage with other visitors and to share this experience with others. It is also uncertain if tourists will be sharing this experience with others or will be motivated to be ambassadors of change as has been identified in similar studies (Dawson et al., 2011; Groulx et al., 2016; Gunter Jr., 2018). There is an opportunity for Churchill's tour operators to market this idea of tourists becoming ambassadors, the learning components of the tours, and even the interaction with other tourists in their advertising so that motivations are shifted and that tourists are not only traveling just to see a polar bear.

Objective 5: Identify tourists' opinions on potential climate change mitigation strategies (Chapter 4)

Chapter 4 analyzed the climate change mitigation strategies tourists believed to be the most effective and how to deliver the information about tourism and climate change to tourists. This is important as these strategies will also help increase awareness, foster new attitudes in the hopes of leading tourists to change their travel patterns (Scott et al., 2012). Most (89%) of the polar bear viewing tourists support Churchill's tourism industry to become carbon neutral and would be willing to participate in climate change mitigation initiatives if they were made available to them. Respondents indicated they preferred climate change information to be communicated to them by email or on the internet. Tour operators can use a push strategy through these means to create an increased awareness of climate change (Garma, 2014). Respondents indicated that education programs and travel alternatives (i.e. taking the train) were the strategies that would be the most effective for reducing emissions. Many tourists had mentioned they would have preferred to take the train if it was available to them. Although educational programs are being implemented during the polar bear viewing tours, they only focus on climate change, environmental impacts, and polar bear health and do not refer to how energy intensive tourism and travel is. More than half (68%) of respondents always consider ecological friendly travel options and alternatives if they are made available to them. It is therefore the responsibility of tour operators to have these options and information easily available and accessible to them, both prior, during and following the tours, especially as nature-based and eco- tourism continues to rise in popularity (Ballantyne & Packer, 2011; Gunter Jr., 2018). There is a huge opportunity for Churchill's polar bear viewing industry to implement these changes into the polar bear viewing tours and to take advantage of the desire for tourists to want to learn while being in Churchill and wanting to choose alternative modes of transportation such as taking the train in order to do their part in reducing global emissions.

5.3 Contributions of the research

This research contributes to the continuous growing knowledge about the relationship between climate change and tourism. As climate change worsens and greenhouse gas emissions continue to rise, polar bear populations will be negatively impacted. From the calculation of the

greenhouse gas emissions and the analysis of tourist' knowledge about climate change and motivation to travel, this research provides insight to tour operators and future researchers about what tourists know about these changes and what they believe can be done to reduce emissions and to the reduce the implications of climate change for the polar bears.

The first study in North America relating to climate change and tourism occurred in 2007. Since then, no studies have been conducted in Churchill to estimate the greenhouse gas emissions from the polar bear viewing industry. Comparing these results to those of Dawson et al., (2010b), this research provides an updated analysis of the greenhouse gas emissions emitted from Churchill's polar bear viewing industry – which included emissions from transportation, accommodation, and activities. Although these numbers haven't changed over 10 years and remain high to this day, this up-to-date analysis will be important for future studies to emphasize that little change has been made to reduce emissions from this successful tourism industry. This research also provides insight about where emissions should be reduced and what the best ways to do this could be done (i.e. education and travel alternatives).

Much of the research involving mitigation initiatives has been centered around what industries, tour operators, and policy makers believe to be effective, little is known about the demand side- i.e. tourist's perspectives, and their opinions on effective mitigation strategies (Garma, 2014; UNWTO-UNEP-WMO, 2008). This research allows for a greater insight on which climate change mitigation strategies would have the biggest influence on tourists. This information will be important for tour operators to know where to begin when assessing the climate change mitigation strategies necessary to reduce emissions. This understanding of tourists' opinions of climate change mitigation strategies can also expand past Churchill's polar bear viewing industry to provide insight to other tourism industries about the best ways to reduce emissions.

5.4. Limitations of the research

Due to limited funding of this research project, a vehicle necessary to travel from the CNSC to the Churchill Airport could only be rented out three times a week during the afternoon and evening. These were the only times surveys were conducted at the airport. Therefore, only certain groups of tourists may have been targeted. For example, Natural Habitat groups were surveyed frequently as their chartered flights departed at the time of surveying, whereas groups who stayed at the Frontiers North Adventure lodges were not surveyed as their flights left in the mornings. This means that the entire sample of Churchill's polar bear viewing tourists may not have been fully represented.

This study used emission estimates for accommodation, and activities based on estimates from 2007 and 2008 as these were the only numbers available at the time of the study. This might skew the results as many tour operators have stated that their buildings and tours, in general, are sustainable in some way, which may not have been the case 10 years ago. Therefore, the estimates from this study may be higher than they should be. Because the train had been out of service since spring 2017, polar bear viewing tourists did not have the option to take the train from Winnipeg to Churchill. The transportation emissions may appear higher than what it might have been had the train been functional and had tourists chosen this transportation option, which many tourists stated they would have.

The survey itself was 6 pages long which consisted of many open-ended questions. This took time for the tourists to answer, especially for the questions about their journey to Churchill and their motivations for travel. Because many of the surveys were conducted at the airport, tourists had a limited amount of time to complete the survey. This meant that either they didn't complete the entirety of the survey, they rushed through the end of the survey in order to catch their flight, or they did not respond to the long answer questions in detail because of the time constraint. This was especially obvious for the motivation to travel question (Appendix A) as many respondents wrote "to see a bear" without any other explanation of their motivation to travel.

The visitor survey was only targeted to the polar bear viewing tourists to understand their knowledge about climate change and their opinions on mitigation strategies. This study could have been expanded by surveying or interviewing the tour operators to see their perspectives of what information they are providing to their tourists. Surveying or interviewing tour operators would be also beneficial to know what sort of mitigation strategies they are currently implementing to reduce emissions, as this information may not be available on their websites or in their brochures.

5.5. Suggestions for future research

For future research, the surveys should have a bigger focus on tourism and climate change, to determine what sort of changes tourists will make to their travel choices in the future. The surveys should also include more targeted questions about tourists' knowledge of the implications of travel (not only from air travel but from accommodations and activities as well) Future studies should be focused on trying to educate tourists specifically about the implications of travel and climate change, instead of just climate change in general.

If future surveys include questions about what lifestyle changes tourists will make at home or to their travel habits, a follow-up survey should be employed a couple of months later to see if tourists made any of the changes, they said they would. The researcher could also provide them with a calculation of the greenhouse gas emissions that would have been reduced by making these changes.

Because this is an Arctic community that is dependent on the tourism industry to support their local economy, future studies should include community members in the research. Surveys and interviews can be conducted with the community members to understand their perspectives of climate change and tourism and what sort of mitigation strategies they would like to see implemented to reduce emissions and ensure the long-term success of the tourism industry.

As mentioned, the greenhouse gas emissions from accommodations and activities were taken from a study conducted in 2007. Future studies should try to determine more updated

emissions from accommodations and activities to provide a more accurate analysis of the emissions from the polar bear viewing industry.

5.6 References

ACIA. (2004). Arctic climate impact report: Impacts of a warming Arctic. Cambridge: Cambridge University Press.

Amstrup, S.C., DeWeaver, E.T., Douglas, D.C., Marcot, B.G., Durner, G.M., Bitz, C.M., & Bailey, D.M. (2010). Greenhouse gas mitigation can reduce sea-ice loss and increase in polar bear persistence. *Nature 10.* 955-958. DOI: 10.1038/nature09653.

Arctic Monitoring Assessment Programme. (2017). *Snow, Water, Ice and Permafrost in the Arctic (SWIPA) 2017.* Oslo, Norway: Arctic Monitoring Assessment Programme (AMAP).

Armitage, D. (2015). Resource and Environmental Management in Northern Canada. In Mitchell, B. (Ed). *Resource and Environmental Management in Canada* (450-473). Don Mills, Ontario: Oxford University Press.

Atmosfair. (2018). *Calculate Flight Emissions.* Retrieved November 20, 2018. https://www.atmosfair.de/en/offset/flight.

Ballantyne, R. & Packer, J. (2011). Using tourism free-choice learning experience to promote environmentally sustainable behavior: the role of post-visit 'action resources'. *Environmental Education Research 17* (2). 201-215. DOI: 10.1080/13504622.2010.530645

Becken, S. (2004). How tourists and tourism experts perceive climate change and carbon-offsetting schemes. *Journal of Sustainable Tourism 12:*4. 332-345. DOI: 10.1080/09669580408667241.

Becken, S. (2007). Tourists' perception of international air travel's impact on the global climate and potential climate change policies. *Journal of Sustainable Tourism 15*:4. 351-368. DOI: 10.2167/jost710.0.

Becken, S. & Hay, J.E. (2007). *Tourism and climate change: Risk and opportunities.* North York, Ontario: Channel View Publications.

Becken, S. & Hay, J.E. (2012). *Climate Change and Tourism. From policy to practice.* New York, New York: Routledge.

Billeck, S. (November 30, 2018). Interactive e-book hopes to put spotlight on Churchill. Retrieved from https://winnipegsun.com/news/news-news/interactive-e-book-hopes-to-put-spotlight-on-churchill.

Bradshaw, M., & Stratford, E. (2010). Qualitative research design and rigour. In Hay, I [Ed], *Qualitative research methods in human geography* (69-80). Don Mills, Ontario: Oxford University Press.

Budeanu, A., & Emtairah, T. (2014). Is there hope for sustainability? An empirical study of Swedish tourist. In Weeden, C. & Boluk, K. (Eds.), *Managing Ethnical Consumption in Tourism* (83-103). Abingdon, Oxford: Routledge.

Burns, P., & Bibbings, L. (2009). The end of tourism? Climate change and societal challenges. *Twenty-First Century Society 4*(1). 31-51. DOI: 10.1080/17450140802642424.

Burns, P. & Bibbings, L., (2013). Climate change and tourism. In Holden, A., & Fennell, D. [Eds.], *The Routledge Handbook of Tourism and the Environment* (406-420). Abingdon, Oxon: Routledge.

Butler, R. (1992). Alternative tourism: The thin edge of the wedge. In Smith, V. & Eadington, W. [Eds.], *Tourism Alternatives* (31-46). Philadelphia, Pennsylvania: University of Pennsylvania.

Campos, A.C., Mendes, J., Oom do Valle, P., & Scott, N. (2018). Co-creation of tourist experiences: a literature review. *Current Issues in Tourism 21* (4). 369-400. https://doi.org/10.1080/13683500.2015.1081158

Carbonzero. (2018). *Carbon Emissions Calculator.* Retrieved November 20, 2018. http://www.carbonzero.ca/calculate

Castro de la Guardia, L., Derocher, A.E., Myers, P.G., Terwisscha Van Sheltinga, A.D. & Lunn, N.J. (2013). Future sea ice conditions in Western Hudson Bay and consequences for polar bears in the 21st century. *Global Change Biology 19* (9). 2675-2687. DOI: 10.1111/gcb.12272.

Caton, K. (2014). What does it mean to good in tourism? In Weeden, C. & Boluk, K. (Eds.), *Managing Ethnical Consumption in Tourism* (19-31). Abingdon, Oxford: Routledge.

CBC News. (8 January 2018). Omnitrax to argue federal lawsuit over northern Manitoba rail line should be tossed. Retrieved from http://www.cbc.ca/news/canada/manitoba/omnitrax-and-ottawat-court-1.4476974.

Chen, J.S. (2015). Tourism stakeholders' attitudes toward sustainable development: A case in the Arctic. *Journal of Retailing Consumer Services 22*. 225-230. https://doi.org/10.1016/j.jretconser.2014.08.003

ClimateCare (2018). *ClimateCare Carbon Calculator.* Retrieved November 20, 2018. https://climatecare.org/calculator/

Coghlan, A. (2012). Last chance tourism on the Great Barrier Reef. In Lemelin, R.H., Dawson, J., & Stewart, E.J. (Eds.), *Last chance tourism. Adapting tourism opportunities in a changing world* (133-149). Abingdon, Oxon: Routledge.

Creswell, J.W. (2014). *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches.* United States of America: Library of Congress Cataloguing-in-Publication Data.

CTV News. (December 2, 2018). All aboard: First passenger train in 18 months depart for Churchill, Man. Retrieved from https://www.ctvnews.ca/canada/all-aboard-first-passenger-train-in-18-months-departs-for-churchill-man-1.4201440

Dawson, J., Maher, P.T., & Slocombe, D.S. (2007). Climate change, marine tourism, and sustainability in the Canadian Arctic: Contributions from systems and complexity approaches. *Tourism in Marine Environments 4* (2-3). 69-83. DOI: https://doi.org/10.3727/154427307784772057.

Dawson, J., Stewart, E., & Scott, D. (2010a). Climate change and polar bear viewing: A case study of visitor demand, carbon emissions and mitigation in Churchill, Canada. In Hall, C.M., & Saarinen, J. (Eds.), *Tourism and Change in Polar Regions: Climate, environment and experience* (89-103). Abingdon, Oxon: Routledge.

Dawson, J., Stewart, E.J., Lemelin, H., & Scott, D. (2010b). The carbon cost of polar bear viewing tourism in Churchill, Canada. *Journal of Sustainable Tourism 18*(3). 319-336. DOI: 10.1080/09669580903215147.

Dawson, J., Johnston, M.J., Stewart, E.J., Lemieux, C.J., Lemelin, R.H., Maher, P.T., & Grimwood, B.S.R. (2011). Ethical considerations of last chance tourism. *Journal of Ecotourism 10*(3). 250-265. http://dx.doi.org/10.1080/14724049.2011.617449.

Dawson, J., Stewart, E., & Lemelin, R.H. (2012). Last chance tourism: conclusion. In Lemelin, R.H., Dawson, J., & Stewart, E.J. (Eds.), *Last chance tourism. Adapting tourism opportunities in a changing world* (218-228). Abingdon, Oxon: Routledge.

Derocher, A.E., Lunn, N.J., & Stirling, I. (2004). Polar bears in a warming climate. *Integrative and Comparative Biology 44* (2). 163-176. DOI: 10.1093/icb/44.2.163.

Distasio, J., Dudley, M., & Moradzadeh, F. (2011). *Churchill Sustainability Planning Framework (CSPF).* Retrieved from http://winnspace.uwinnipeg.ca/handle/10680/806.

Dodds, R., & Graci, S. (2009). Canada's tourism industry- mitigating the effects of climate change: A lot of concern but little action. *Tourism and Hospitality Planning & Development 6.* 39-51. https://doi.org/10.1080/14790530902847046

Dressler, W.H., Berkes, F., & Mathias, J. (2001). Beluga hunters in a mixed economy: Managing the impacts of nature-based tourism in the Canadian western Arctic. *Polar Record 37* (200). 35-48. DOI: 10.1017/S0032247400026735.

Dyck, M., Campbell, M., Lee, D., Boulanger, J., & Hedman, D. (2017). 2016 Aerial survey of the Western Hudson Bay polar bear subpopulation [Final Report]. Retrieved from https://www.gov.nu.ca/sites/default/files/pb_wh_2016_population_assessment_gn_report_27_june_2017.pdf.

EcoRessources Consultants. (2011). *Evidence of the socio-economic importance of polar bears for Canada*. Retrieved from the Government of Canada website: http://publications.gc.ca/site/eng/397569/publication.html.

Eijgelaar, E., Thaper, C., & Peeters, P. (2010). Antarctic cruise tourism: The paradoxes of ambassadorship, "last chance tourism" and greenhouse gas emissions. *Journal of Sustainable Tourims 18* (3). 337-354. doi: 10.1080/09669581003653534

Fennell, D.A. (2012). *Tourism and Animal Ethics* Abingdon, Oxon: Routledge.

Fleming, M. (1988). *Churchill Polar Bears Capital of the World.* Winnipeg, Manitoba: Hyperion Press Limited.

Folwer, F. (2009). *Survey Research Methods.* Thousand Oaks, California: Library of Congress Cataloging- in- Publication Data.

Forsyth, P., Dwyer, L., & Clarke, H. (1995). Problems in use of economic instruments to reduce adverse environmental impacts on tourism. *Tourism economics: The business and finance of tourism and recreation 1* (3). 265-282.

Gagnon, A.S. and Gough, W.A. (2005). Trends in the dates of ice freeze-up and breakup over Hudson Bay, Canada. *Arctic 58* (4). 370-382. Retrieved from https://search.proquest.com/docview/197729777?rfr_id=info%3Axri%2Fsid%3Aprimo.

Garma, R. (2014). Greening Consumers. In DeLacy, T., Jiang, M., Lipman, G., & Vorster, S. (Eds.), *Green grown and travelism: Concept, policy and practice for sustainable tourism (*97-111). Abingdon, Oxon: Routledge.

Gössling, S. (2011). *Carbon Management in Tourism: Mitigating the Impacts on Climate Change.* Abingdon, Oxon: Routledge.

Gössling, S. (2013). Climate policy and tourism. In Holden, A. & Fennell, D. (Eds), *The Routledge Handbook of Tourism and the Environment* (421-434). Abingdon, Oxon: Routledge.

Gössling, S. (2018). Tourism, tourist learning and sustainability: an exploratory discussion of complexities, problems and opportunities. *Journal of Sustainable Tourism 26* (2). 292-306. DOI: 10.1080/09669582.2017.1349772

Gössling, S., & Peeters, P. (2007). 'It does not harm the environment!' An analysis of industry discourses on tourism, air travel and the environment. *Journal of Sustainable Tourism 15*(4). 402-417. doi: 10.2167/jost672.0.

Gössling, S., Scott, D., & Hall, M.C. (2013). Challenges of tourism in a low-carbon economy. *Wiley Interdisciplinary Reviews: Climate Change 4:*6. 525-538. doi: 10.1002/wcc.243.

Gössling, S., Broderick, J., Upham, P, Ceron, J-P., Dubois, G., Peeters, P., & Strasdas, W. (2007). Voluntary carbon offsetting schemes for aviation: Efficiency, credibility and sustainable tourism. *Journal of Sustainable Tourism 15:* 3. 223-248DOI: 10.2167/jost758.0.

Gössling, S., Scott, D., Hall, C.M., Ceron, J-P., & Dubois, G. (2012). Consumer behaviour and demand response of tourists to climate change. *Annals of Tourism Research 39*(1). 36-58. doi: 10.1016/j.annals.2011.11.002.

Government of Canada. (2018). Polar bear: non-detriment finding. Retrieved from https://www.canada.ca/en/environment-climate-change/services/convention-international-trade-endangered-species/non-detriment-findings/polar-bear.html?_ga=2.47910695.1829174673.1520434768-1869394333.1520434768.

Government of Canada. (2018). Maps of sub-populations of polar bears and protected areas. Retrieved from https://www.canada.ca/en/environment-climate-change/services/biodiversity/maps-sub-populations-polar-bears-protected.html.

Great White Bear Tours. (2017). Polar Rovers. Retrieved from https://www.greatwhitebeartours.com/about/polar-rovers.

Grimwood, B.S.R., & Doubleday, N.C. (2013). Illuminating traces: Enactments of responsibility in practices of Arctic river tourists and inhabitants. *Journal of Ecotourism 12* (2). 53-74. DOI: 10.1080/14724049.2013.797427.

Groulx, M.W. (2015). *Prospects for place-based climate change adaptation: An exploration of place, vulnerability and collaborative planning in Churchill, Manitoba* (Doctoral dissertation). Retrieved from Waterloo's Institutional Repository. *http://hdl.handle.net/10012/9606.*

Groulx, M., Lemieux, C., Dawson, J., Stewart, E., & Yudina, O. (2016). Motivations to engage in last chance tourism in the Churchill Wildlife Management Area and Wapusk National Park: The role of place identity and nature relatedness. *Journal of Sustainable Tourism 24*(11). 1523-1540. http://dx.doi.org/10.1080/09669582.2015.1134556.

Gunter, M.Jr. (2018). *Tales of an Ecotourist: What travel to wild places can teach us about climate change.* Albany, New York: State University of New York.

Hall, M.C. (2010). Tourism and environmental change in polar regions: Impacts, climate change and biological invasion. In Hall, C.M., & Saarinen, J. (Eds.), *Tourism and Change in Polar Regions: Climate, environment and experience* (42-70). Abingdon, Oxon: Routledge.

Hall, C.M. (2014). Will climate change kill Santa Claus? Climate change and high latitude Christmas place branding. *Scandinavian Journal of Hospitality and Tourism 14* (1). 23-40. DOI: http://dx.doi.org/10.1080/15022250.2014.886101.

Hall, C.M., & Johnston, M.E. (1995). *Polar tourism: Tourism in the Arctic and Antarctic regions.* Chichester: John Wiley.

Hall, M.C., & Saarinen, J. (2010). Tourism and change in polar regions: Introduction-definitions, locations, places and dimensions. In Hall, C.M., & Saarinen, J. (Eds.), *Tourism and Change in Polar Regions: Climate, environment and experience* (1-41). Abingdon, Oxon: Routledge.

Hall, M.C., James, M., & Wilson, S. (2010). 'Biodiversity, biosecurity, and cruising in the Arctic and sub-Arctic'. *Journal of Heritage Tourism, 5*(4). 351-364. DOI: 10.1080/1743873X.2010.517845.

Hausfather, K. (2017). UNEP: Six crucial actions to help close the world's 'emission gaps. Retrieved from https://www.carbonbrief.org/unep-six-crucial-actions-help-close-worlds-emissions-gap

Hindley, A., & Font, X. (2018). Value and motivations in tourists perceptions of last chance tourism. *Tourism and Hospitality Research 18* (1). 3-14. DOI: 10.1177/1467358415619674.

Holden, A. (2014). The evolution of environmental ethics: Reflections on tourism consumption. In Weeden, C. & Boluk, K. (Eds.), *Managing Ethnical Consumption in Tourism* (70- 80). Abingdon, Oxford: Routledge.

IPCC. (2007). Summary for policymakers. In M.L. Parry, O.F. Canziani, J.P. Palutikof, P.J., vander Linden, & C.E. Hanson (Eds.), Climate change 2007: Impacts, adaptation and vulnerability. Contribution ofWorking Group II to the fourth assessment report of the intergovernmental panel on climate change (pp. 1–22). Cambridge, UK: Cambridge University Press.

IPCC. (2014). Synthesis report. In Pachauri, R.K and Meyer, L.A. (Eds.) *Climate Change 2014: Synthesis Report.* Contribution of working groups I, II and II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change (pp. 33-112). Geneva, Switzerland, IPCC.

IPCC. (2018). Summary for Policymakers. In Masson-Delmotte, V., P. Zhai, H.-O. Pörtner, D. Roberts, J. Skea, P.R. Shukla, A. Pirani, W. Moufouma-Okia, C. Péan, R. Pidcock, S. Connors, J.B.R. Matthews, Y. Chen, X. Zhou, M.I. Gomis, E. Lonnoy, T. Maycock, M. Tignor, and T. Waterfield (Eds.). Global Warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty. In Press.

Jardine, C.N. (2005). Part 1: Calculating the environmental impact of aviation emissions [Climate Care Report]. *Environmental Change Institute.*

Jardine, C.N. (2009). Calculating the carbon dioxide emissions of flights [Final Report]. *Environmental Change Institute.*

Johnston, M.E. (2006). Impacts of global environmental change on tourism in the polar regions. In Gössling, S. and Hall. C.M. (Eds.), *Tourism & global environmental change: Ecological, social, economic and political interrelationships* (37-53). Abingdon, Oxon: Routledge.

Johnston, M., Viken, A., & Dawson, J. (2012). Firsts and lasts in Arctic tourism: last chance tourism and the dialectic of change. In Lemelin, R.H., Dawson, J., & Stewart, E.J. (Eds.), *Last chance tourism. Adapting tourism opportunities in a changing world* (10-24). Abingdon, Oxon: Routledge.

Juvan, E., & Dolnicar, S. (2014). Can tourists easily choose a low carbon footprint vacation? *Journal of Sustainable Tourism 22* (2). 175-194. http://dx.doi.org/10.1080/09669582.2013.826230

Kim, Y., Yun, S., Lee, J., & Ko, E. (2016). How consumer knowledge shapes green consumption: An empirical study on voluntary carbon offsetting. *International Journal of Advertising 35* (1). 23-41. http://dx.doi.org/10.1080/02650487.2015.1096102

Lamers, M., Eijgelaar, E., & Amelung, B (2012). Last chance tourism in Antarctica. In Lemelin, R.H., Dawson, J., & Stewart, E.J. (Eds.), *Last chance tourism. Adapting tourism opportunities in a changing world* (25-41). Abingdon, Oxon: Routledge.

Lane, B. (2009). Thirty years of sustainable tourism: Drivers, progress, problems and the future. In Gössling, S., Hall. C.M., & Weaver, D.B. (Eds.), *Sustainable tourism futures: Perspectives on systems, restructuring and innovations* (19-32). Abingdon, Oxon: Routledge.

Lemelin, R.H. (2006). The gawk, the glance, and the gaze: Ocular consumption and polar bear tourism in Churchill, Manitoba, Canada. *Current Issues in Tourism 9* (6). 516-534. doi: 10.2167/cit294.0.

Lemelin, R.H., Bay, T, & Fennell, D. (2008). Polar bear viewers as deep ecotourists: How specialized, are they? *Journal of Sustainable Tourism 16*(1). 42-62. doi :10.2167/jost702.0.

Lemelin, R.H., Stewart, E., & Dawson, J. (2012). An introduction to last chance tourism. In Lemelin, R.H., Dawson, J., & Stewart, E.J. (Eds.), *Last chance tourism. Adapting tourism opportunities in a changing world* (3-9). Abingdon, Oxon: Routledge.

Lemelin, H., Dawson, J., Stewart, E.J., Maher, P., & Lueck, M. (2010). Last-chance tourism: The boom, doom, and gloom of visiting vanishing destinations. *Current Issues in Tourism 13*(5). 477-493. DOI: 10.1080/13683500903406367.

Lemieux, C., & Eagles, P. (2012). Last chance tourism in Canada's protected areas: Management implications and emerging ethical considerations. In Lemelin, R.H., Dawson, J., & Stewart, E.J. (Eds.), *Last chance tourism. Adapting tourism opportunities in a changing world* (195-217). Abingdon, Oxon: Routledge.

Lemieux, C. J., Groulx, M., Halpenny, E., Stager, H., Dawson, J., Stewart, E.J., & Hvenegaard, G.T. (2017). "The end of the Ice Age?": Disappearing world heritage and the climate change communication imperative. *Environmental Communication.* (1-19). Retrieved from https://doi.org/10.1080/17524032.2017.1400454.

Lenzen, M., Sun, Y-Y., Faturay, F., Ting, Y-P., Geschke, A., & Malik, A. (2018). The carbon footprint of global tourism. *Nature Climate Change 8.* 522-528. https://doi.org/10.1038/s41558-018-0141-x

Lunn, N.J., Servanty, S., Regehr, E.V., Converse, S.J., Richardson, E., & Stirling, I. (2016). Demography of an apex predator at the edge of its range: Impacts of changing sea ice on polar bears in Hudson Bay. *Ecological Applications 26* (5). 1302-1320. https://doi.org/10.1890/15-1256

Maher, P.T. Gelter, H., Hillmer-Pegram, K., Hovgaard, G., Hull, J., Þór Jóhannesson, G., Karlsdóttir, A., Rantala, O., & Pashkevich, A. (2014). Arctic tourism: Realities and possibilities. *Arctic Yearbook 2014.* Retrieved from https://www.researchgate.net/publication/275945995_Arctic_Tourism_Realities_Possibilities?_esc=publicationCoverPdf&el=1_x_2&enrichId=rgreq-533db16e7eb404ff96bb94d8591bc125-XXX&enrichSource=Y292ZXJQYWdlOzI3NTk0NTk5NTtBUzoyNDk3MDgzMTI1MjY4NTNAMTQzNjU0NjUwOTcyMg%3D%3D

Mair, J. (2011). Exploring air traveller's voluntary carbon-offsetting behavior. *Journal of Sustainable Tourism 19.* 215-230. https://doi.org/10.1080/09669582.2010.517317.

McCall, A.G., Pilfold, N.W., Derocher, A.E., & Lunn, N.J. (2016). Seasonal habitat selection by adult female polar bears in western Hudson Bay. *Population Ecology 58* (3). 407-419. DOI: 10.1007/s10144-016-0549-y.

McGuirk, P.M. & O'Neill, P. (2010). Qualitative research design and rigour. In Hay, I [Ed], *Qualitative research methods in human geography* (191-216). Don Mills, Ontario: Oxford University Press.

McKercher, B., Prideaux, B., Cheung, C., & Law, R. (2010). Achieving voluntary reductions in the carbon footprint of tourism and climate change. *Journal of Sustainable Tourism 18* (3). 297-317. https://doi.org/10.1080/09669580903395022.

McLennan, C.J., Becken, S., Battye, R., Kam Fung So, K. (2014). Voluntary carbon offsetting: Who does it? *Tourism Management 45.* 194-198. DOI: 10.1016/j.tourman.2014.04.009

Meier, W.N., Hovelsrud, G.K., van Oort, B.E.H., Key, J.R., Kovacs, K.M., Michel, C., Haas, C., Granskog, M.A., Gerland, S., Perovich, D.K., Makshtas, A., & Reist., J.D. (2014). Arctic sea ice in transformation: A review of recent observed changes and impacts on biology and human activity. *Review of Geophysics 52* (3). 185-217. https://doi.org/10.1002/2013RG000431

Milne, S., Ward, S., & Wenzel, G. (1995). Linking tourism and art in Canada's eastern Arctic: The case of Cape Dorset. *Polar Record 31* (176). 25-36. DOI: 10.1017/S0032247400024839.

Needham, M.D. & Vaske, J.J. (2008). Writing and constructing. In Vaske, J.J. (Ed.), *Survey research and analysis: Applications in parks, recreation and human dimensions.* (121-171). State College, Pennsylvania: Venture Publishing, Inc.

Oceans North Conservation Society, World Wildlife Fund Canada, and Ducks Unlimited Canada. (2018). Canada's Arctic Marine Atlas. Ottawa, Ontario: Oceans North Conservation Society.

Parks Canada. (2007). *Wapusk National Park of Canada* (R63-350/4-2008E). Ottawa, Ontario: Library and Archives Canada Cataloguing.

Pashkevich, A., Dawson, J., & Stewart, E.J. (2015). Governance of expedition cruise ship tourism in the Arctic: A comparison of the Canadian and Russian Arctic. *Tourism in Marine Environment 10*(3). 225-240. DOI:

Peacock, E., Derocher, A.E., Lunn, N.J., & Obbard, M.E. (2010). Polar bear ecology and management in Hudson Bay in the face of climate change. In Ferguson, S.H., Loseto, L.L., & Mallory, M.L. (Eds.), *A little less Arctic: Top predators in the world's largest northern inland sea, Hudson Bay* (93-115). Netherlands, Springer.

Peeters, P., Gössling, S., & Lane, B. (2009). Moving towards low-carbon tourism: New opportunities for destinations and tour operators. In Gössling, S., Hall. C.M., & Weaver, D.B. (Eds.), *Sustainable tourism futures: Perspectives on systems, restructuring and innovations* (240-257). Abingdon, Oxon: Routledge.

Regehr, E.V., Lunn, N., Amstrup, S., & Stirling, I. (2007). Effects of earlier sea ice breakup on survival and population size in polar bears in western Hudson Bay. *Journal of Wildlife Management 71* (8). 2673-2683. DOI: 10.2193/2006-180.

Scott, D., & Lemieux, C. (2013). The vulnerability of tourism to climate change. In Holden, A., & Fennell, D. (Eds.), *The Routledge Handbook of Tourism and the Environment* (241-257). Abingdon, Oxon: Routledge.

Scott, D., Hall, C.M., & Gössling, S. (2012). *Tourism and climate change.* Abingdon, Oxon: Routledge.

Shelton, E. (2012). Seeing it off: Last chance tourism opportunity shagged by a rare parrot. In R. H. Lemelin, J. Dawson, & E. J. Stewart (Eds.*), Last chance tourism: Adapting tourism opportunities in a changing world* (182-194). Abingdon: Routledge

Snyder, J.M. (2007). The economic role of Arctic tourism. In Snyder, J.M. & Stonehouse, B. (Eds.). *Prospects for polar tourism.* (102-122). Wallingford, Oxon: CAB International.

Snyder, J.M. & Stonehouse, B. (2007). The growing significance of polar tourism. In Snyder, J.M. & Stonehouse, B. (Eds.). *Prospects for polar tourism.* (3-14). Wallingford, Oxon: CAB International.

Statistics Canada. (2016). Census profile, 2016 Census. Retrieved from http://www12.statcan.gc.ca/census-recensement/2016/dp-pd/prof/details/page.cfm?Lang=E&Geo1=CSD&Code1=4623056&Geo2=PR&Code2=46&Data=Count&SearchText=Churchill&SearchType=Begins&SearchPR=01&B1=All&GeoLevel=PR&GeoCode=4623056&TABID=1.

Stewart, E.J., & Draper, D. (2006). Sustainable cruise tourism in Arctic Canada: An integrated coastal management approach. *Tourism in Marine Environments 3* (2). 77-88. DOI: 10.3727/154427306779435210.

Stewart, E.J., Dawson, J., & Draper, D. (2011). Cruise tourism and residents in Arctic Canada: Development of a resident attitude typology. *Journal of Hospitality and Tourism Management 18* (1). 95–106. DOI 10.1375/jhtm.18.1.95.

Stewart, E.J., Dawson, J., & Lemelin, R.H. (2012). The transformation of polar bear viewing in the Hudson Bay region, Canada. In Lemelin, R.H., Dawson, J., & Stewart, E.J. (Eds.), *Last chance tourism. Adapting tourism opportunities in a changing world* (89-102). Abingdon, Oxon: Routledge.

Stewart, E.J., Draper, D., & Johnston, M.E. (2013). A review of tourism research in the polar region. *Arctic 58* (4). 383-394. Retrieved from https://www.researchgate.net/profile/Emma_Stewart/publication/228351918_Sea_Ice_in_Canada%27s_Arctic_Implications_for_Cruise_Tourism/links/54d26c970cf28e0697241d22/Sea-Ice-in-Canadas-Arctic-Implications-for-Cruise-Tourism.pdf.

Stewart, E.J., Liggett, D., & Dawson, J. (2017): The evolution of polar tourism scholarship: Research themes, networks and agendas. *Polar Geography 40* (1). 59- 84. DOI: 10.1080/1088937X.2016.1274789.

Stirling, I. (1988). *Polar Bears.* Michigan, United States of America: The University of Michigan Press.

Stirling, I. (2011). *Polar Bears. The Natural History of a Threatened Species.* Brighton, Massachusetts: Fitzhenry & Whiteside.

Stirling, I., & Derocher, A.E. (1993). Possible impacts of climatic warming on polar bears. *Arctic 46* (3). 240–245. Retrieved from http://www.jstor.org/stable/pdf/40511411.pdf.

Stirling, I., & Derocher, A. E. (2012). Effects of climate warming on polar bears: A review of the evidence. *Global Change Biology 18* (9). 2694-2706. DOI: 10.1111/j.1365-2486.2012.02753. x.

Stirling, I. and Parkinson, C. (2006). Possible effects of climate warming on selected populations of polar bears (Ursus maritimus) in the Canadian Arctic. *Arctic 59* (3). 261-275. Retrieved from https://search.proquest.com/docview/197731018/fulltextPDF/C03909F08D9F40DEPQ/1?accountid=14701.

Stirling, I., Lunn, N.J., & Iacozza, J. (1999). Long-term trends in the population ecology of polar bears in Western Hudson Bay in relation to climate change. *Arctic 52* (3). 294-306. http://www.jstor.org/stable/40511782.

Struzik, E. (2014). *Arctic icons: How the town of Churchill learned to love its polar bears.* Markham, Ontario: Fitzhenry & Whiteside.

TIAC. (2016). Annual Report on Canadian Tourism. Retrieved from https://tiac-aitc.ca/_Library/TIAC_Publications/TIAC_Annual_Report_2016_EN.pdf

Towns. L., Derocher, A.E., Stirling, I., Lunn, N.J., & Hedman, D. (2009). Spatial and temporal patterns of problem polar bears in Churchill, Manitoba. *Polar Biology 32* (10). 1529-1537. DOI: 10.1007/s00300-009-0653-y.

Travel Manitoba.com. (2018). Real Growth Real Results [2017/2018 Annual Report]. Retrieved from https://assets.simpleviewinc.com/simpleview/image/upload/v1/clients/manitoba/2017_18_ANNUAL_REPORT_TMB_FNL_SP_LR_R_94cd31bf-d41b-4a57-8711-a3bb764ec193.pdf

United Nations Environmental Program (UNEP). (2007). *Tourism in polar regions: The sustainability challenge.* Paris: UNEP.

United Nations World Tourism Organization (UNWTO) & World Meteorological Organization (WMO). (2011). Tourism: Investing in energy and resource efficiency. *Towards a green economy*. 414-451.

United Nations World Tourism Organization (UNWTO)- United Nations Environmental Program (UNEP)- and World Meteorological Organization (WMO). (2008). *Climate change and tourism: Responding to global challenges.* Madrid and Paris: UNWTO and UNEP.

Vorster, S. & Lyle, C. (2014). Lower-carbon aviation in the green economy. In DeLacy, T., Jiang, M., Lipman, G., & Vorster, S. (Eds.), *Green grown and travelism: Concept, policy and practice for sustainable tourism (*41-58). Abingdon, Oxon: Routledge.

Wadhams, P., (2003). How does Arctic sea ice form and decay? *National Ocean and Atmospheric Administration.* Retrieved from http://sites.fas.harvard.edu/~scia30/2008/SOURCEBOOK/Arctic_sea_ice_Wadhams.pdf

Weaver, D. (2009). Reflections on sustainable tourism and paradigm change. In Gössling, S., Hall, C.M., & Weaver, D.B. (Eds.), *Sustainable tourism futures: Perspectives on systems, restructuring and innovations* (169-199). Abingdon, Oxon: Routledge.

Weeden, C. (2014). Marking responsible tourism. In Weeden, C. & Boluk, K. (Eds.), *Managing Ethnical Consumption in Tourism* (225-239). Abingdon, Oxford: Routledge.

Winfield, M. (2009). Policy instruments in Canadian environmental policy. In VanNijnatten D.L and Boardman R. (Eds.), *Canadian environmental policy and politics: Prospects for leadership and innovation* (46-63). Don Mills, Ontario: Oxford University Press.

World Tourism Organization. (2009). From Davos to Copenhagen and beyond: Advancing tourism's responses to climate change [UNWTO Background paper]. Retrieved from http://sdt.unwto.org/sites/all/files/docpdf/fromdavostocopenhagenbeyondunwtopaperelectronicversion.pdf.

Western Management Consultants & Econometric Research Limited. (2018). The economic impact of tourism in Churchill, Manitoba in 2017 [Draft Report]

APPENDIX A

Churchill Polar Bear Viewing Visitor Survey 2018

Part One: Your current visit to Churchill

1) Is this your first visit to Churchill? (*please select one option)*

   ☐ Yes ☐ No

   If NO, please indicate how many times you have visited Churchill: _____

2) How many days in total are you staying in Churchill? _____

3) Please indicate how many people are traveling with you (not including yourself): _____

4) What was your travel route from your originating destination (i.e. home) to Churchill? Please include any travel by car, bus, train, airplane, and taxi (etc.) as well as the start to end points of your journey.

   E.g. 1) Taxi to Toronto airport
   2) Plane from Toronto to Winnipeg
   3) Plane from Winnipeg to Churchill
   4) Same on return trip

   1) _____

   2) _____

   3) _____

   4) _____

   5) _____

5) a) Which Churchill tour operator did you join for your polar bear viewing tour?

   _____

   b) Why did you choose this tour operator for your polar bear viewing experience?

   _____

c) Did your polar bear viewing tour include information about environmental issues, climate change, or polar bear health? (*please select one option)*

☐ Yes ☐ No

If YES, what topics were discussed? _____

6) In addition to the polar bear viewing tours, what other activities did you/ will you participate in during your visit to Churchill? *(please select all that apply)*

☐ Parks Canada visitor centre ☐ Eskimo Museum/ Itsanitaq Museum

☐ Dog sledding ☐ Churchill Northern Studies Center

☐ Helicopter tour ☐ Local restaurants

☐ Souvenir shopping ☐ Movie theatre

☐ Other: Please specify _____

7) Where did you get your information about Churchill's polar bear viewing tours? *(please select all that apply)*

☐ Social Media (Facebook, Twitter, Instagram) ☐ Newspaper

☐ Magazine Advertisement ☐ Television

☐ Internet ☐ Travel agent

☐ Family or Friend

☐ Other: Please specify _____

Part Two: Motivation to travel

1) What were your main motivations for traveling to Churchill? *(please be as descriptive as possible)*

_____

_____

_____

_____

Part Three: Perceptions about climate change

1) Do you think climate change is happening? *(please select one option)*

Very sure climate change is **not** happening	Somewhat sure climate change is **not** happening	Unsure	Somewhat sure climate change is happening	Very sure climate change is happening
1	2	3	4	5

2) If you think climate change is happening, do you think it is: *(please select one option)*

- ☐ Caused mostly by human activities
- ☐ Caused mostly by natural changes in the environment
- ☐ Caused by both human activities and natural changes
- ☐ None of the above because climate change is not happening

3) How concerned are you about climate change? *(please select one option)*

Not at all concerned	Slightly concerned	Somewhat concerned	Moderately concerned	Extremely concerned
1	2	3	4	5

4) Please indicate your opinion on the following statement: "Air travel is a contributor to climate change" *(please select one option)*

Strongly disagree	Disagree	Unsure	Agree	Strongly agree
1	2	3	4	5

5) Please indicate your opinion on the following statement: "Polar bears will disappear from the Churchill region due to changes in the global climate" *(please select one option)*

Strongly disagree	Disagree	Unsure	Agree	Strongly agree
1	2	3	4	5

6) Would you still have visited Churchill if the polar bears appeared to be unhealthy (i.e. noticeably skinny)? *(please select one option)*

No	Not likely	Unsure	Probably	Definitely
1	2	3	4	5

7) Would you still have visited Churchill if you were not guaranteed to see polar bears at all (i.e. you might see some, but you might not)? *(please select one option)*

No	Not likely	Unsure	Probably	Definitely
1	2	3	4	5

8) If you were not able to see polar bears in Churchill, would you be willing to go elsewhere to view the bears? *(please select one option)*

No	Not likely	Unsure	Probably	Definitely
1	2	3	4	5

9) If twenty years from now you knew the polar bears were about to become extinct, would you plan another trip to visit the polar bears? *(please select one option)*

No	Not likely	Unsure	Probably	Definitely
1	2	3	4	5

10) Would you recommend that others travel to the north to view the polar bears before they disappear? *(please select one option)*

No	Not likely	Unsure	Probably	Definitely
1	2	3	4	5

Part Four: Positive environmental change

1) Which of the following best describes your attitude towards ecologically friendly transportation and accommodation options and alternatives? *(please select one option)*

I never consider them	I only consider them if they provide me with cost savings	Unsure	I consider them if they are made available to me	I always consider them
1	2	3	4	5

2) Please indicate your opinion on the following statement "After seeing the polar bears, I plan on making some changes to my lifestyle at home to reduce my greenhouse gas emissions" *(please select one option)*

Strongly disagree	Disagree	Unsure	Agree	Strongly agree
1	2	3	4	5

If you strongly agree or agree, what changes do you think you might make in reducing your greenhouse gas emissions?

_____

3) Were carbon offsets available to you to purchase prior to your trip to Churchill? *(please select one option)*

Note: a carbon offset is a reduction in emissions of carbon dioxide or greenhouse gases made in order to compensate for or to offset an emission made elsewhere

☐ Yes ☐ No

4) Did you purchase an offset?

☐ Yes ☐ No

a) If YES, how much did you pay and where did you purchase it from?

_____

b) If NO, what is the reason you did not purchase an offset? *(please check all that apply)*

☐ I don't know what the money is used for

☐ I don't know what a carbon offset is

☐ I don't think it is necessary or effective

☐ It was too expensive

☐ Other: Please specify _____

How much would you be willing to pay to offset the greenhouse gas emissions you generated by visiting Churchill, Manitoba? _____

5) In your opinion, how would you like to receive information about environmental issues and environmental travel and tourism alternatives?

_____

6) By offsetting greenhouse gas emissions, the polar bear viewing industry could become carbon neutral (i.e. using renewable energy, offsetting emissions, improving travel alternatives, etc.). Do you support the industry becoming carbon neutral? *(please select one option)*

☐ Yes ☐ No

7) In your opinion, how effective would the following approaches for Churchill's polar bear viewing industry to implement to reduce their emissions and become carbon neutral?

	Very ineffective	Ineffective	Unsure	Effective	Very Effective
	1	2	3	4	5
Environmental tax or fee					
Carbon offsets					
Educational programs					
Greenhouse gas emission availability (i.e. on brochures or plane tickets)					
Transportation alternatives (i.e. train travel)					

8) In your opinion, which of the following groups play a role in implementing positive environmental change for the tourism industry? *(please select all that apply)*

☐ Individuals (through demanding environmentally friendly alternatives)

☐ Tour operators (through the products and services they offer)

☐ Policy makers (through enforcement and promotion

Part Five: About you

1) Please indicate your gender

☐ Male ☐ Female ☐ Other ☐ Prefer not to answer

2) What year were you born? _____

3) What is the highest level of education you have attained *(please check one box)*

☐ Elementary school ☐ Secondary (High) school

☐ College, CEGEP or non-university ☐ University (Bachelor)

☐ Graduate/ Professional

4) Please indicate your place of residency: Country _____
City _____

Additional Comments

_____

_____

_____

_____

_____

_____

This is the end of the survey. Thank you for your time!

APPENDIX B

Verbal Recruitment Letter

P = Potential Participant; R = Researcher

R = “Hello, my name is Jamie and I am a graduate student from the University of Ottawa. Through the Department of Geography, Environment and Geomatics. I am conducting a study that focuses on the Churchill’s polar bear viewing industry and tourists, and I would like to invite you to complete a survey that will take about 15- 20 minutes of your time. The survey can be completed by hand on a paper copy. This study has been reviewed and received ethical clearance through a University of Ottawa Research Ethics Committee. Have you participated on a polar bear viewing tour on your current visit to Churchill?”

P = “Yes”

R= “Would you be interested in participating in this survey?”

P = “Yes/sure”

R = “Great. Let me show you what to do to get started. Please be sure to read the information letter at the beginning of the survey before you begin. If you have any questions let me know. I will be right over here.”

P= “No”

R= “Unfortunately this research project is directed at tourists who have participated on a polar bear viewing tour during their current trip to Churchill. Thank you for your time and enjoy your enjoy!”

P = “Yes”

R= “Would you be interested in participating in this survey?”

P = “No, thank you.”

R = “Ok, thank you for your time. Have a great day!”

APPENDIX C

Research Ethics Approval

Université d'Ottawa
Bureau d'éthique et d'intégrité de la recherche

University of Ottawa
Office of Research Ethics and Integrity

CERTIFICAT D'APPROBATION ÉTHIQUE | CERTIFICATE OF ETHICS APPROVAL

Numéro du dossier / Ethics File Number	S-06-18-711
Titre du projet / Project Title	The Implications of Climate Change for Polar Bear Viewing Tourism Churchill Canada
Type de projet / Project Type	Thèse de maîtrise / Master's thesis
Statut du projet / Project Status	Approuvé / Approved
Date d'approbation (jj/mm/aaaa) / Approval Date (dd/mm/yyyy)	05/07/2018
Date d'expiration (jj/mm/aaaa) / Expiry Date (dd/mm/yyyy)	04/07/2019

Équipe de recherche / Research Team

Chercheur / Researcher	Affiliation	Role
Jamie D'SOUZA	Département de géographie / Department of Geography	Chercheur Principal / Principal Investigator
Jackie DAWSON	Département de géographie / Department of Geography	Superviseur / Supervisor

Conditions spéciales ou commentaires / Special conditions or comments

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Université d'Ottawa
Bureau d'éthique et d'intégrité de la recherche

University of Ottawa
Office of Research Ethics and Integrity

Le Comité d'éthique de la recherche (CÉR) de l'Université d'Ottawa, opérant conformément à l'*Énoncé de politique des Trois conseils* (2014) et toutes autres lois et tous règlements applicables, a examiné et approuvé la demande d'éthique du projet de recherche ci-nommé.

L'approbation est valide pour la durée indiquée plus haut et est sujette aux conditions énumérées dans la section intitulée "Conditions Spéciales ou Commentaires". Le formulaire « Renouvellement ou Fermeture de Projet » doit être complété quatre semaines avant la date d'échéance indiquée ci-haut afin de demander un renouvellement de cette approbation éthique ou afin de fermer le dossier.

Toutes modifications apportées au projet doivent être approuvées par le CÉR avant leur mise en place, sauf si le participant doit être retiré en raison d'un danger immédiat ou s'il s'agit d'un changement ayant trait à des éléments administratifs ou logistiques du projet. Les chercheurs doivent aviser le CÉR dans les plus brefs délais de tout changement pouvant augmenter le niveau de risque aux participants ou pouvant affecter considérablement le déroulement du projet, rapporter tout évènement imprévu ou indésirable et soumettre toute nouvelle information pouvant nuire à la conduite du projet ou à la sécurité des participants.

The University of Ottawa Research Ethics Board, which operates in accordance with the *Tri-Council Policy Statement* (2014) and other applicable laws and regulations, has examined and approved the ethics application for the above-named research project.

Ethics approval is valid for the period indicated above and is subject to the conditions listed in the section entitled "Special Conditions or Comments". The "Renewal/Project Closure" form must be completedfour weeks before the above-referenced expiry date to request a renewal of this ethics approval or closure of the file.

Any changes made to the project must be approved by the REB before being implemented, except when necessary to remove participants from immediate endangerment or when the modification(s) only pertain to administrative or logistical components of the project. Investigators must also promptly alert the REB of any changes that increase the risk to participant(s), any changes that considerably affect the conduct of the project, all unanticipated and harmful events that occur, and new information that may negatively affect the conduct of the project or the safety of the participant(s).

Kim THOMPSON
Responsable d'éthique en recherche / Protocol Officer
Pour/For **Barbara GRAVES** Président(e) du/ Chair of the **Comité d'éthique de la recherche en sciences sociales et humanités / Social Sciences and Humanities Research Ethics Board**

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