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Predictors of visitors' climate-related coping behaviors in a nature-based tourism destination

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ABSTRACT:

Climate change affects the supply of nature-based tourism opportunities as well as the demand visitors place on those opportunities. Climate-induced changes in visitor demand, specifically climate-related coping behaviors (e.g., seeking safer recreation sites, changing trip timing, using weather forecasts to plan trips), are influenced by multiple factors such as season of visit, specific visitor attributes, and general climate change beliefs and concern. Understanding the relationships between visitor characteristics and coping behaviors within the context of a changing climate will help recreation managers and tourism providers anticipate shifts in demand and adapt strategically. In this study, we present results from a series of binary logistic regression models of summer and winter visitor survey data to examine climate-related coping behaviors within a regional nature-based tourism area (the North Shore region of Lake Superior in Minnesota). Findings reveal that winter recreationists, younger visitors, and visitors who are concerned about climate change, are most inclined to use behavioral coping in response to changing climate and environmental conditions. Specifically, we found that winter season recreationists are much more likely to report having experienced a past climate-related impact, and that weather information, alternative gear, and flexibility in timing their trips are important in overcoming these constraints. Further, younger visitors were more likely to use informational (weather forecast) coping, site substitution, and activity substitution to respond to climate-related impacts. This study expands upon climate-related recreation and tourism research by documenting how recreationists' informational, spatial, and temporal coping behaviors vary across visitor characteristics. Further research is needed to determine if the behavioral coping preferences and patterns found in this study emerge across diverse contexts. However, our findings here can help managers begin to strategically plan and collaborate to maintain destination-level attractiveness to visitors despite changing environmental conditions.

Management implications: Understanding how visitors respond to environmental changes is important in sustaining 'weather-resistant' visitor flows. In anticipation of on-site disruptions and future demand shifts, regional partnerships within nature-based destinations may mitigate reductions in visitor demand and accommodate shifting patterns in visitor flows. For example, recreation managers and tourism providers could identify and jointly market alternative recreation opportunities when conditions are not conducive to participating in desired activities, as well as develop a networked approach for communicating weather and site safety information.

1. Introduction

Tourism, as a global industry, is projected to be impacted by climate change, with specific impacts dependent on the nature of the tourism activity itself (e.g., winter or summer tourism, water or land-based recreation; Lise & Tol, 2002; McCarthy, Canziani, Leary, Dokken, David, & White, 2001; Nicholls, 2006; Scott, McBoyle, & Schwartzentruber, 2004; Scott & Lemieux, 2010). Climate change impacts nature-based tourism and outdoor recreation by altering both the supply of outdoor recreation opportunities (e.g., Gossling & Hall, 2006; Scott et al., 2004) and the demand visitors place on those opportunities (e.g., Dawson, Scott, & Havitz, 2013). Weather also impacts visitors' recreational

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experiences (Hendrik & Jeuring, 2017; Hipp & Ogunseitan, 2011).

Climate and weather are closely related concepts, especially to the general public, as climate is the long-term average of weather conditions (Forland et al., 2012; Scott, Jones, & Konopek, 2007). Climate is defined as the average weather (temperature, precipitation, etc.) over a period of thirty years (IPCC, 2007) and weather is the actual (rather than average) conditions (temperature, precipitation, etc.) encountered on any given day. Climate, weather, and climate change are capable of enhancing or constraining recreation experiences, particularly in nature-based tourism destinations that rely on environmental conditions to attract visitors and as settings for specific recreation opportunities (Beaudin & Huang, 2014; Dawson & Scott, 2013; Forland, Denstadli, & Jacobsen, 2012; Gossling & Hall, 2006; Hendrik & Jeuring, 2017; Scott & Lemieux, 2010). Ideal weather or climate is highly subjective, shaped by individuals' preferences for, and responses to, environmental conditions. However, impacts sustained from adverse weather or climatic conditions (flooding, extreme temperatures, fire, etc. hereafter, *climate-related impacts*) are generally perceived negatively by nature-based recreationists (Forland et al., 2012).

In response to conditions that are perceived as adverse, nature-based recreationists find ways to cope, including behavioral responses (Miller & McCool, 2003) such as temporal, spatial, activity, and strategic substitution (e.g., Aas & Onstad, 2013; Dawson et al., 2013). Existing literature regarding this phenomenon suggests a relationship between visitor attributes (e.g., age and gender) and responses to climate change (e.g., concern, risk perceptions, perceptions of impacts; De Urioste-Stone, Le, Scaccia, & Wilkins, 2015; Maibach, Bloodhart, & Zhao, 2013). For example, visitors to Acadia National Park were surveyed on their perceptions of climate change risks to the park; older visitors tended to be skeptical of, and perceive low risk of, climate change impacts to the park, while younger visitors were likely to agree that climate change would threaten local outdoor recreation and tourism experiences (De Urioste-Stone et al., 2015).

While most of the existing literature explores behavioral coping responses by asking how visitors would behave given a hypothetical constraint, our study explores reported behaviors, or how visitors have responded to experienced climate-related impacts. For example, in studies such as Ditton and Sutton (2004), Hammit, Backland, and Bixler (2004), and Rutty et al. (2015), researchers ask *if this happens* … how might visitors respond? In this study, we explore *because this happened* …. how did visitors respond. We assess how visitors to a nature-based tourism destination are coping with climate-related impacts through site, activity, temporal, strategic, and information coping mechanisms. Specifically, this study posits three research questions:

1. What are general trends in recreationists' coping behaviors in response to climate change?
2. Is climate-related behavioral coping in a nature-base tourism area related to visitors' season of visit?
3. How do visitors' personal attributes (age, income, gender, use history) and climate change perceptions (belief, concern, and worry) influence their coping behavior?

Results from this study can inform how tourism providers plan, manage, and adapt opportunities for tourism experiences within the context and uncertainty of climate change. Theoretically, this study enhances the understanding of relationships between personal factors, values, beliefs, and behaviors by identifying the most significant predictors of visitors' past behavioral coping responses to climate-related impacts.

2. Behavioral responses to climate change

Coping in outdoor recreation occurs in response to recreation conflict, goal interference, or constraints (e.g., Manning, 2010; Miller & McCool, 2003; Schneider & Wynveen, 2015). Miller and McCool explain that coping occurs when outdoor recreationists "either change their behavior, attempt to change their environment, or change the way they evaluate the situation" in response to undesirable conditions that inhibit them from achieving their goal of obtaining a desirable recreational experience (p. 261). There are various reactions to goal interference, such as cognitive coping through rationalization (e.g., justifying the problem), product shift (e.g., shifting perceptions of acceptable conditions), and direct action (e.g., talking through solutions to the issues with others) (Schneider & Wynveen, 2015). Outdoor recreationists may also react to goal interference through behavioral coping mechanisms, such as changing when or where they engage in outdoor recreation (i.e., temporal or spatial recreation substitution) (Aas & Onstad, 2013; Miller & McCool, 2003; Schneider & Wynveen, 2015). It is presumed that recreationists will make the smallest or most similar changes to their cognitive processes or behaviors to cope with a conflict or constraint (Aas & Onstad, 2013). However, as recreation resources are impacted by climate change, coping alternatives may become uncertain or reduced (IPCC, 2014).

2.1. Site substitution

Research demonstrates that site (i.e., spatial or resource) substitution is the most common among recreationists who are highly involved (e.g., skilled, committed) in an activity, and care less about where (the resource or spatial context) they recreate (Aas & Onstad, 2013; Hammit et al., 2004). While site substitution was originally conceptualized as a response when demand outstrips the supply of a resource (Cordell, 1976), the construct is now considered more broadly, such as in contexts where the environmental conditions are not ideal for recreationists, regardless of user density (Aas & Onstad, 2013). Climate change may influence site selection, and substitution, due to variations in precipitation at specific sites. For example, inadequate snow depth for skiing may displace visitors to higher altitude ski destinations or ski operations capable of snowmaking.

2.2. Activity substitution

Activity substitution was conceptualized by early researchers from the fields of outdoor recreation management (Hendee & Burdge, 1974) and leisure sciences (Iso-Ahola, 1986). Activity substitution is the concept of outdoor recreationists swapping activity choices rather than the location of their recreational experience, allowing visitors to avoid unwanted conditions or situations (Miller & McCool, 2003). Studies of activity substitution demonstrate that recreationists do not perceive that they receive the same benefit or satisfaction from 'substitute activities' as they would from their original endeavor. For example, Shelby and Vaske (1991) found that 38% of salmon anglers agree that 'no other fishing is a substitute for salmon fishing'. Alternatively, some recreationists are seeking an *experience* that can be substituted as closely as possible to their original endeavor. For example, challenge-oriented activities (hunting and golf) may be swapped with another competition-oriented opportunity or non-challenge activities (camping and swimming) may be interchanged by visitors seeking calmer recreation experiences (Ditton & Sutton, 2004). Climate change will indirectly impact recreation activities by limiting, or enhancing, the opportunity for those activities. For example, precipitation will impact lake levels and determine whether boating access is feasible from launch facilities that may be inaccessible during low and high water events.

2.3. Temporal substitution

Temporal substitution refers to changing the timing of recreational pursuits to overcome conflicts or constraints, such as crowding (Dawson et al., 2013; Manning, 2010) or adverse environmental conditions (Rutty et al., 2014). For example, whitewater kayakers might change

the timing of their boating trips to adapt to hydro-peaking associated with dam releases (Aas & Onstad, 2013). Temporal substitution makes managing displaced visitors complex, as an isolated event does not only cause a loss in the number of visitors tourism providers would receive on a given day, but also (potentially) redistributes those visitors over any number of given days in the future (Deacon & Kolstad, 2000). Climate change will likely impact trends in outdoor recreation on an annual scale, as seasons favorable for hiking and camping change in response to long-term weather trends (e.g., favorable temperatures) and storm seasons.

2.4. Strategic substitution

Strategic (or tactical) substitution has recently received more attention from tourism researchers and managers and is used to describe a variety of behaviors (not related to spatial, temporal, or activity substitution) that allow recreationists to overcome uncertain environmental conditions or climate-related constraints (e.g., Aas & Onstad, 2013; Stensland, Aas, & Mehmetoglu, 2017; Zweifel & Haegeli, 2014). Strategic substitution refers to using different gear, equipment, or methods (e.g., bow hunting and rifle hunting, tent camping and using back-country shelters) to overcome constraints or goal interference (Aas & Onstad, 2013). Climate change in the form of increasingly frequent and/or unpredictable severe weather events may influence backpackers to purchase and carry more sophisticated wind and waterproof gear during backcountry trips. Strategic substitution is considered a negotiation tactic in the constraints-effects-mitigation model, where constraints (adverse conditions) trigger effects such as negotiation or coping behaviors, resulting in modified or mitigated (rather than simply reduced) use (Hubbard & Mannell, 2001). One study found that strategically negotiating constraints most often included putting away additional money for recreational interests and improving one's skill and knowledge to overcome limitations (Stensland et al., 2017). Other studies have focused on strategic mechanisms related to travel party size and interpersonal dynamics in helping recreationists overcome challenges (e.g., Zweifel & Haegeli, 2014).

2.5. Informational coping

Information, particularly weather forecasts, are also a more recent consideration of managers and researchers exploring how visitors overcome climate-related constraints (e.g., (Hendrik & Jeuring, 2017; Rutty & Andrey, 2014; Savelli & Joslyn, 2012). Recent studies document that one-third (Hamilton & Safford, 2015) to nearly all (Rutty & Andrey, 2014) of recreationists check the weather of a destination before their trip. Winter recreationists often consult a national weather website, a website associated with their destination, or social media. These sources of information have differential impacts on subsequent coping behaviors; in suboptimal conditions, skiers are likely to reschedule their visits or select different gear (clothing) while snowmobilers are more likely to select a different site to visit (Rutty & Andrey, 2014). Studies also demonstrate that conditions within the forecast are uniquely important; for example, winter recreationists often focus on freezing rain (Rutty & Andrey, 2014); conversely, beach visitors focus more specifically on temperatures and UV exposure (Moreno, Amelung, & Santamarta, 2008). Additionally, favorable forecasts have even been shown to alter tourists' behaviors once they arrive at a destination, such as increased tipping rates for restaurant wait staff (Rind & Strohmetz, 1996).

Although research shows that recreationists understand there is uncertainty in the accuracy of weather forecasts, forecasts remain the core tool used by individuals planning visits to nature-based tourism sites (Savelli & Joslyn, 2012). While checking site and time specific conditions is important for visitors making near-term decisions, literature also suggests that tourists are considering long-term trends in regional climates when determining destination attractiveness (Hendrik & Jeuring, 2017). Visitors often perceive extreme weather events as the most likely impacts of climate change on their future recreational visits (De Urioste-Stone et al., 2015). Climate changes and extreme weather events (and the media coverage of this) will likely influence information-seeking behavior by outdoor recreationists and, consequently, other behavioral coping strategies such as where visitors go, when they make their visit, and what type of gear they pack. This could impact small-scale decisions (e.g., whether recreationists carry weather radios while hiking, paddling, or camping) and system-scale outcomes (e.g., reduced visitation to a destination following a particularly extreme event such as a severe hurricane season).

2.6. Other influences of behavioral coping

Behavioral coping responses are inherently related to the individual visitor (and the group with whom they travel), the planned activities for their visit, the site itself, and the timing—particularly the season—of the visit. As climate change alters site conditions and the favorability of specific activities, tourism seasons are predicted to change. In North America, it is expected that more destinations will become ideal for winter tourism, reducing the competitiveness of mid-latitude terminuses (Scott et al., 2004). Warming trends are shown to result in increased visitation to parks and protected areas (e.g., Fisichelli, Nicholas, Schuurman, Monahan, & Ziesler, 2015; Scott et al., 2007). However, climate change will have distinct impacts at a regional level and case studies document anomalies to these trends; for example, in the Great Lakes region winter tourism may decline while summer tourism increases (Dawson & Scott, 2013). Therefore, seasons have distinct impacts on if, and how, recreationists will overcome climate-related constraints. For the summer season, increasing temperatures pose a risk to human health, and while high temperatures motivate visitation to beaches, sea level rise may curb beach capacity. For the winter season, reduced snow depth will motivate tourism providers to create alternate recreational opportunities (Arent et al., 2014).

Climate change concerns and beliefs also influence climate-related coping behaviors. For example, “climate change impacts that pose potential personal risks/threats to visitors may be important factors influencing travel behavior, such as the selection of a tourism destination” (De Urioste-Stone et al., 2015, p. 62). Tourism is dependent on individuals' perceptions of climate and weather, as destinations often market themselves in terms of the environmental conditions meant to attract new visitors (e.g., a cool escape from urban heat islands or a warm getaway during winter snow and ice; Gossling & Hall, 2006). While visitors make decisions based on climate perceptions and experiences, most visitors have substantial flexibility in responding to climate change (Dawson et al., 2013; Gossling, Scott, Hall, Ceron, & Dubois, 2012).

Visitors' response to a constraint can also depend on individual attributes (Miller & McCool, 2003). To date, research has predominately focused on linking individuals' sociodemographic traits to specific recreational activities. For example, income has been found to be influential when substitution is viewed as an economically-driven response (Cordell, 1976). Use history also influences recreation behavior, as “past use of a selected recreation and tourism area leads to preferred habitual use patterns that are difficult for very experienced users to alter” (Oh & Hammitt, 2011, p. 1322). Age and gender have also been found to influence coping behavior. For example, Propst and Koesler (1998) found that men spend less time considering risks and, as such, report less recreational coping than women. More recently, Ditton and Sutton (2004) found that males are more likely to cope through activity substitution and that substitution increases with age, as older (i.e., more experienced) recreationists might have a broader knowledge and capacity to swap recreation experiences. However, age may act as a physical constraint on the suite of substitution behaviors visitors are able to employ. These variables have been illustrated in Fig. 1, a model of how the predictors we hypothesize influence climate-related coping

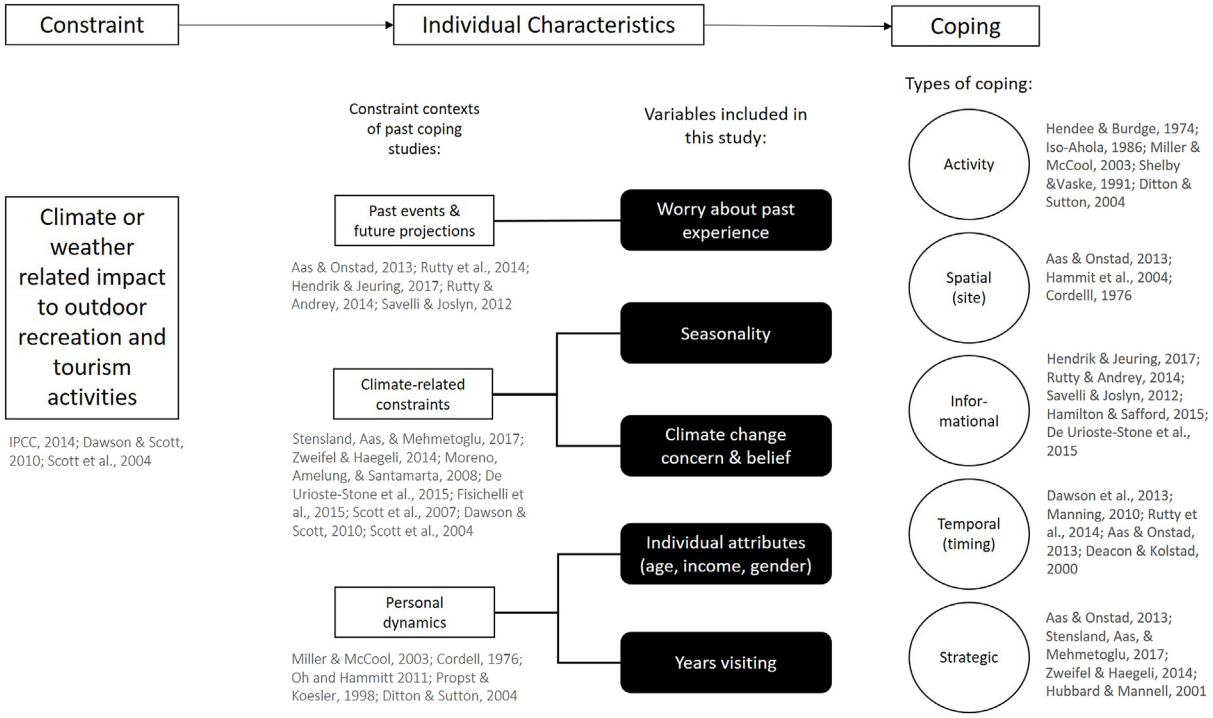

Fig. 1. A model of the predictors hypothesized to influence climate-related coping in relation to past studies.

relate to past studies.

3. Methods

3.1. Study area

The study area for this research is the "North Shore" nature-based tourism region located in Minnesota (USA) along the northwestern shore of Lake Superior (Fig. 2). The North Shore is characterized by public land ownership; a majority of the region is owned and managed by federal and state agencies (USDA Forest Service, Minnesota Department of Natural Resources) for public recreational access. The dominant recreation settings are forests (mixed aspen-birch-conifers) and open water (Lake Superior and inland lakes, river and streams). Small communities are concentrated along the coastline and provide predominantly locally-owned lodging options, restaurants, and outfitting and guiding services to facilitate tourism opportunities for visitors. Popular recreation activities for the region include hiking, swimming, fishing, boating, skiing, snowmobiling, and hunting (Davenport, Schneider, Date, & Filter, 2011).

Climate models project changes to environmental conditions on the North Shore, within the next 50 years, may alter forest composition and precipitation patterns (Pryor et al., 2015). Specifically, the Third National Climate Assessment (Pryor et al., 2015) projects that forest

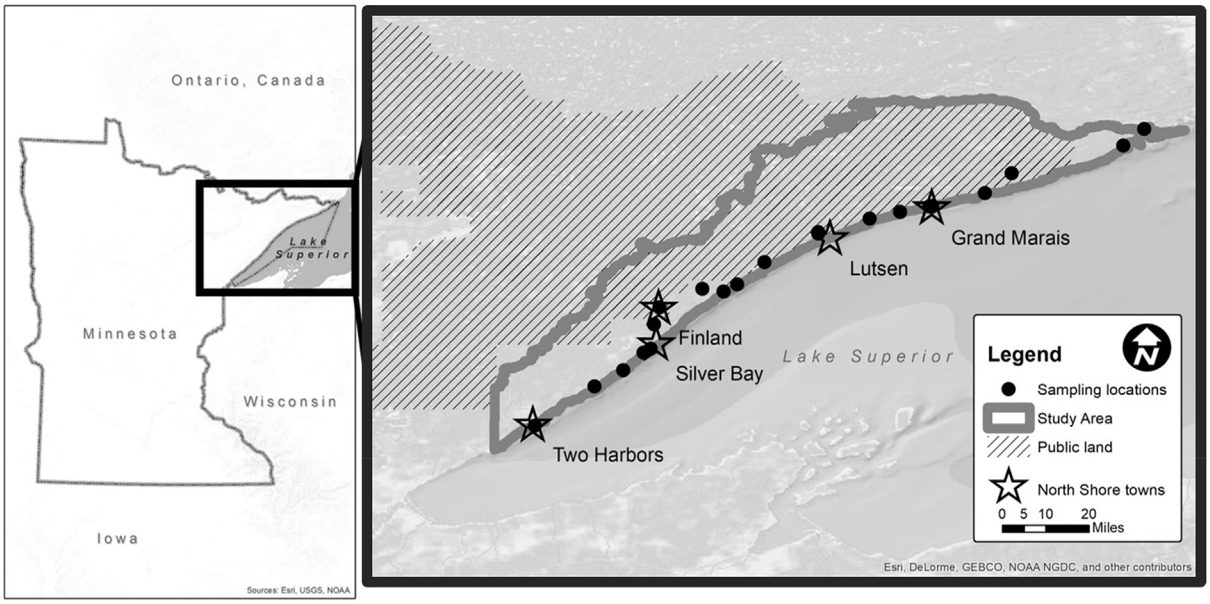

Fig. 2. Study area: The North Shore of Lake Superior, Minnesota, USA.

composition is likely to transition from spruce/fir to maple/beach/birch (under a low emissions scenario) or oak/hickory (under a moderate emissions scenario) by 2070. Concurrently, precipitation is predicted to become more sporadic and severe (i.e., greater number of heavy precipitation days *and* an increase in number of consecutive dry days are projected) for that same time period. While national trends indicate a "potential poleward shift in visitation due to warming" (Fisichelli et al., 2015, p. 9), local reports establish that increasing temperatures, changes in precipitation, and risks to the Great Lakes may impact recreation and tourism in northeastern Minnesota (IPCC, 2014). The State of Minnesota has identified potential impacts of climate change to recreational fisheries and opportunities for water-based recreation, as well as increases in temperature that could impact nature-based tourism communities and recreationists (IPCCCore Writing Team, Pachauri, Meyer, & IPCC, 2014).

3.2. Procedure and sample

The unit of analysis for this study was visitors to the North Shore during the winter and summer tourism seasons (defined as November 28 through February 28 and June 1 through August 31, respectively). To participate in the survey, individuals had to reside outside of the North Shore region for at least 10 months of the year, be 18 years of age or older, and voluntarily participate. Visitors completed survey questionnaires on-site at recreation areas along the North Shore between January 8 and January 19 and February 13 and 26, 2015 (winter season) and July 15 and August 3, 2015 (summer season). Project personnel determined sampling sites in consultation with North Shore recreation and tourism providers, considering geographic consistency (i.e., locations along all portions of the region) as well as diversity in the type of tourist likely to be intercepted (i.e., sites were selected where visitors engaging in a variety of different activities were likely to stop). Sampling was semi-random, with sites assigned to either the northern or southern end of the region and then randomly assigned three to four weekday sampling blocks and two weekend sampling block within the sampling time frames (Vaske, 2008). For those visitors traveling in groups, the individual with the most recent birthday was asked to complete the survey questionnaire. By randomly assigning sampling locations to date and time blocks and by selecting visitors to participate at random, the likelihood of obtaining a sample population representative of the true population increases (Babbie, 2013; Creswell, 2013). Visitors who were eligible but declined participation were asked five items from the questionnaire as a non-response bias check (Vaske, 2008).

3.3. Instrument

Survey items were constructed and refined using existing literature, expert review, and an on-site pilot testing session (Fink, 2012; Vaske, 2008) conducted in fall 2014; the pilot testing resulted in small changes to the language and flow of measurement items and sampling procedures to maximize visitors' time and engagement with the questionnaire. Full sampling occurred during both the 2015 winter and summer tourism seasons.

To explore visitors' past climate-related coping behaviors, a matrix type measurement item was included in both the winter and summer visitor questionnaire. Visitors were first asked if they had experienced a past climate-related impact (operationalized by ice thickness, snow depth and extreme cold temperature for the winter season, and rainfall/flooding, extreme high and low temperature, forest fire, and forest blowdowns for the summer season). If visitors indicated that they had been impacted, they were prompted to then select which behaviors (from a pre-defined list of options that were modified from response options used by Dawson, Havitz, & Scott, 2011) they had utilized in response to that (those) impact(s). Therefore, we assumed that visitors were considering the prior impact (question prompt) when selecting the substitution behaviors they had utilized (e.g., site substitution was selected in relation to the prior impact and not for some other reason; therefore, this response option was framed as selecting 'safer' sites). Behavior response options reflected five coping behaviors: (1) site substitution (seeking lodging options that enhance safety and recreation sites that reduce risk); (2) activity substitution (participation in recreation activities that reduce risk); (3) temporal substitution (planning trips for other times of the year); (4) strategic substitution (purchasing new or better equipment or gear); and (5) informational coping (paying closer attention to weather forecast prior to or during visits). Respondents could respond yes (i.e., check) for any (or none) of the behavioral coping response options. The five coping mechanisms outlined above were used as the dependent variables in this study. However, a sixth response option was also measured: whether visitors worried more as a result of the past climate-related impact. The worry construct was used as an independent variable in this study to explore how visitors' cognitive coping (i.e., worry) may be related to climate-related behavioral coping. As with the other coping mechanism measures, respondents could respond yes or no.

One item was used to assess climate change concern, with responses measured on a Likert-type scale including options: *Not at All Concerned, Slightly-Moderately Concerned, Very-Extremely Concerned*. One item was used to measure climate change beliefs: *Do you think climate change is happening?* (yes/no). Both climate change belief and concern measures were adapted from previous research in this realm (i.e., Leiserowitz, 2006; Yang, Kahlor, & Griffin, 2014) Personal attributes included a single continuous-response item to capture how many years respondents had been making recreational visits to the North Shore, as well as categorical measures of visitors' sociodemographic characteristics (age, income, and gender). Low cell counts for some response options affiliated with some variables inhibited the regression analyses; specifically, age, income, and climate change concern response categories were collapsed in order to retain these variables in the model and allow the model to run.

3.4. Data analysis

A series of binary logistic regression analyses were conducted to identify variables predicting predicted coping behaviors. All analyses were completed using SPSS, v. 24. Binary logistic regression was selected because the dependent variables (climate-related coping behaviors) were measured on a binary (yes/no) scale. Further, binary logistic regression does not assume a linear relationship between the dependent and independent variables (the data used here were not linearly correlated) and the independent variables do not need to be normally distributed (our independent variables were not) or have equal variance within each group (our independent variables did not) (Field, 2013). For each analysis, the use or non-use of a coping behavior was mutually exclusive (i.e., each visitor was either a 'yes' or 'no' for each of the five coping behaviors), even though visitors could have participated in more than one coping behavior.

4. Results

4.1. Response rate and non-response bias statistics

Survey sampling resulted in a total of 2250 useable responses. For the winter sampling period, 852 visitors completed the questionnaire (68 answered the non-response bias questions and 280 refused, resulting in a 71% response rate). For the summer sampling period, 1398 visitors completed the survey (169 participated in the non-response bias check and 886 refused, resulting in a 57% response rate).

Non-response bias testing for the winter season revealed statistically significant differences between winter participants and nonparticipants in regards to their average number of trips (participants $\bar{x} = 2$, nonparticipants $\bar{x} = 4$, $t = 4.28$, $p < .001$) and age (participants were

significantly younger, particularly in the age 18 to 24 category, and nonparticipants tended to be older, particularly in the age 65-plus category, $\chi^2 = 24.63$, $p < .001$). Non-response bias testing for the summer season revealed that there were differences between summer season participants and non-participants based on age (summer participants were younger, overall, than non-participants, $\chi^2 = 32.33$, $p < .001$) and trip purpose (participants, overall, had a primary purpose to recreate at the site at which they were intercepted, non-participants were more likely to recreate at multiple sites or to be on a business trip, $\chi^2 = 23.06$, $p < .001$). For reference, an inventory of recreation experience opportunities for the state of Minnesota (Davenport et al., 2011) shows that annual visitation to the study region is primarily made by Minnesota residents (66% of the visitors population) and the most common recreation activities are hiking, swimming, and fishing motivated by a desire to be close to nature. The National Visitor Use Monitoring (NVUM) report for the Superior National Forest, adjacent to the study area, (*Visitor Use Report Superior National Forest*, 2012) documents that 48.6% of visitors are marking between one to five trips per year, which is consistent with both our participant and non-participants profiles (i.e., two and four trips per season, respectively). The NVUM report shows that nearly 60% of national forest visitors are over the age of 40, older than our samples. The NVUM did not discriminate between visitors recreating at one or multiple sites, although data reveal that 76% of participants in the NVUM had a trip purpose of recreation (in general, rather than working, passing through the area). Although many attributes of North Shore visitors in our sample reflect those in other studies, some differences between respondents, non-respondents, and other regional samples for variables, such as age and trip purpose, suggest some degree of caution may be needed when interpreting our results.

4.2. Sample population profiles

Descriptive statistics (Table 1) illustrate the sample populations for the winter and summer seasons, and total sample (combined winter and summer). About one-third (29%) of the total sample could be described as young adult (18–34), the majority (43%) as middle aged (35–54), and more than one-quarter (28%) as older adult (55 and older), with winter participants tending to be younger (under 35) and summer participants tending to be older (over 55). Gender was nearly evenly split, with slightly more males than females participating in the winter survey and slightly more females than males participating in the summer survey. Income was negatively skewed, using response categories previously established in the recreation literature (e.g., De Urioste-Stone et al., 2015), with about a third of the sample populations for both season and combined reporting an annual income of $100,000 or more. Visitors in our sample had been typically making trips to the North Shore for the past 16 (overall and summer samples) to 17 years (winter sample). More than three-quarters (77%) of participants (for both seasons and overall) believed that climate change is occurring (this proportion is higher than that documented in studies regarding public belief in climate change [e.g., 54% of men and 59% of women believe the effects of global happening are already beginning to happen (McCright, 2010)] and related concepts [e.g., 66% of Desert Island, Maine visitors perceive sea level rise will occur in the 10 years and 75% perceive that extreme weather events will increase (De Urioste-Stone et al., 2015)]). On average, visitors reported moderate concern about climate change. The greatest disparity between samples is in regards to past impacts and worry. The majority (87%) of winter visitors worried about their current or future recreational visits as a result of past climate-related impact(s). Conversely, the minority (17%) of summer participants worried in response to past climate-related impacts.

Related to research question 1 (*what are general trends in recreationists' use of these coping behaviors in response to climate change?*), descriptive statistics illustrate that the most common behavioral coping strategy was increased attentiveness to weather forecasts prior to and during recreational visits (60% of the total sample, 98% of winter respondents, and 50% of summer respondents). In general, winter visitors reported more coping behaviors—particularly related to timing of their trips (94%) and using new equipment, gear or technology (88%) during their visit—than summer visitors. Selecting safer sites (83%) and substituting recreation activities (78%) were also common within the winter sample. Summer visitors were most likely to select safer sites (48%) as a behavioral coping mechanism, as strategic (new gear/technology, 20%), activity (21%), and temporal (26%) substitution were infrequently reported within the summer sample.

Table 1
Descriptive statistics of the sample North Shore visitor populations.

Variable	Winter (n = 852, 38% of total sample)	Summer (n = 1,398, 62% of total sample)	Total Sample (n = 2250)
Age (%)			
< 35	36%	24%	29%
35-54	42%	43%	43%
55 +	22%	32%	28%
Gender (female %)	48%	56%	53%
Income [a] (%)			
< $20,000	9%	6%	7%
$20,000–39,000	10%	10%	9%
$40,000–59,000	13%	14%	12%
$60,000–79,000	11%	18%	14%
$80,000–99,000	15%	18%	15%
= / > $100,000	33%	34%	30%
Years visiting (mean, SD)	17 years (15)	16 years (16)	16 years (16)
Climate change belief (yes %)	77%	77%	77%
Climate change concern[b] (mean, SD)	2.26 (0.67)	2.27 (0.67)	2.27 (0.67)
Worry more after past impact (yes %)	87%	17%	30%
Past coping behaviors include (yes %)			
New gear or equipment/technology	88%	20%	33%
Timing of trips	94%	26%	40%
Attentiveness to weather forecasts	98%	50%	60%
Selection of 'safer' sites	83%	48%	55%
Selection of other activity	78%	21%	33%

[a] Percentages will not add to zero when participants elected not to self-report their annual income.
[b] Climate concern responses recorded using the following scale: (1) not at all concerned, (2) slightly/moderately concerned, (3) very/extremely concerned.

Table 2
Binary logistic regression results of relationships between season of visit, visitor attributes, visitors' climate change perceptions, and climate-related coping behaviors.

	BEHVIORAL COPING MECHANISMS:														
	STRATEGIC			TEMPORAL			INFORMATIONAL			SITE			ACTIVITY		
	β	SE	OR	β	SE	OR	β	SE	OR	β	SE	OR	β	SE	OR
Season (winter[a])	−2.89	0.24	0.06***	−3.24	0.31	0.04***	−3.29	0.59	0.04***	−0.67	0.22	0.51*	−1.83	0.20	0.16***
Age (55+ [a])															
< 35	0.97	0.23	2.63***	0.24	0.22	1.27	0.35	0.20	1.42	0.29	0.19	1.34	−0.13	0.22	0.88
35-54	0.57	0.19	1.87**	−0.16	0.18	0.85	0.07	0.16	1.07	0.09	0.16	1.10	−0.31	0.18	0.74
Income (> / = $100,000[a])															
< $20,000	−0.73	0.36	0.48*	0.06	0.35	1.06	−0.31	0.34	0.73	0.38	0.32	1.46	0.08	0.33	1.09
$20,000–39,999	−0.14	0.27	0.87	−0.09	0.27	0.91	−0.11	0.18	0.90	−0.12	0.24	0.89	−0.23	0.27	0.79
$40,000–59,999	0.03	0.24	1.03	0.26	0.23	1.29	−0.36	0.22	0.70	0.19	0.21	1.22	0.19	0.24	1.20
$60,000–79,999	−0.06	0.22	0.94	−0.08	0.22	0.93	0.03	0.19	1.04	0.30	0.19	1.34	0.28	0.21	1.32
$80,000–99,999	−0.16	0.22	0.85	−0.15	0.22	0.86	−0/38	0.19	0.69	0.12	0.19	1.13	0.01	0.21	1.00
Gender (male[a])	−0.32	0.15	0.73*	−0.22	0.15	0.80	−0.16	0.14	0.85	0.04	0.13	1.04	0.15	0.15	1.16
Years visiting	0.01	0.01	1.01*	−0.01	0.01	0.99	0.01	0.01	1.01**	−0.01	0.01	1.00	0.01	0.01	1.00
Belief (no[a])	−0.55	0.31	0.58	−1.01	0.29	0.37**	−0.74	0.29	0.48*	−0.27	0.27	0.76	−0.61	0.30	0.55*
Concern (Very/Extreme[a])															
Not at all	−0.97	0.33	0.38***	−0.82	0.35	0.44*	−0.89	0.33	0.41*	−0.62	0.29	0.54*	−0.86	0.34	0.42*
Slight/Mod.	−0.43	0.15	0.65***	−0.21	0.16	0.82	−0.07	0.15	0.93	−0.13	0.14	0.88	0.01	0.16	1.00
Worry (yes/no[a])	0.78	0.17	2.18***	1.25	0.17	3.50***	1.83	0.21	6.21***	1.54	0.18	4.65***	1.35	0.17	3.85***
Classification	81.2			79.4			70.3			64.8			78.9		
Nagelkerke R^2	0.44			0.46			0.37			0.22			0.36		

*, **, and *** denote significance of odds ratios at α = 0.05, 0.01, and 0.001, respectively.
[a] Indicates reference category.

4.3. Regression results

Results of the binary logistic regressions (Table 2, Fig. 3) reveal that the models explained between 22 and 46 percent of the variance in past coping behaviors (i.e., Nagelkerke R^2) and correctly classified between 65 and 81 percent of the cases. Related to research question 2 (*is climate-related behavioral coping in nature-base tourism areas related to visitors' season of visit?*), regression results show that season of visit was influential across all five of the coping behaviors examined by this study. Summer visitors were significantly less likely to report using any of the coping behaviors in response to climate-related impacts than were winter visitors.

We found mixed results regarding question 3 (*how do personal attributes and climate change perceptions influence visitors' coping behavior?*). Age, gender, and income were only statistically significant in relation to strategic coping. Visitors under 55 years of age were more likely to cope strategically (using gear or technology) than the oldest visitors (55+), females were less likely than males to cope using gear or strategy, and

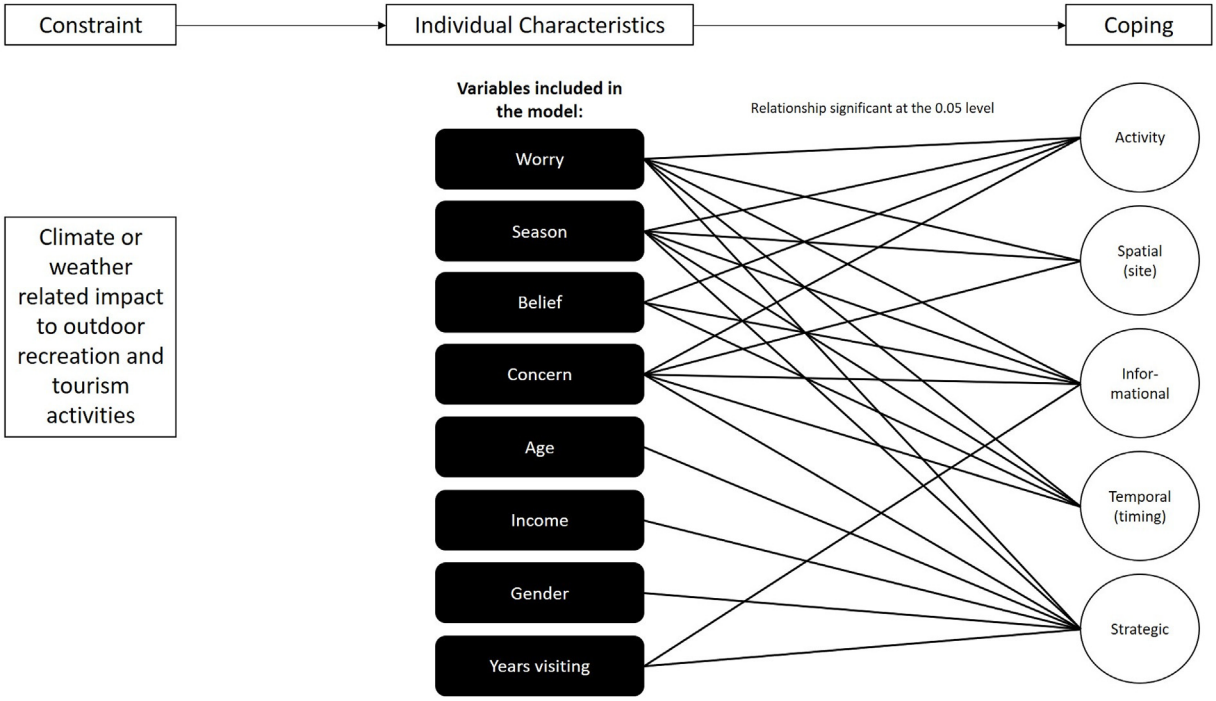

Fig. 3. Illustrating the results of the binary logistic regression: influential variables on each of the six coping mechanisms explored by this study.

visitors reporting the lowest income were less likely than visitors reporting the highest level of income to use gear to strategically cope with climate-related constraints. Use history (the number of years participants had been making visits to the North Shore) was significantly related to strategic and informational coping responses. For each increase in years visiting the North Shore, visitors were significantly more likely to cope with climate-related impacts through gear/technology or weather information.

Although individuals who believed climate change was happening were less likely to use temporal, informational, or activity substitution, visitors who were concerned about climate change were more likely to engage in all types of coping behavior. Visitors who are not at all concerned about climate change are less likely to report using any of the five coping behaviors than visitors who are very to extremely concerned about climate change. Finally, worry in response to past climate-related impacts was significantly related all five coping behaviors: visitors who worry as a type of cognitive coping response are also more likely to report behavioral coping responses.

5. Discussion

The objectives of this research were to assess general trends in recreationists' climate-related coping behaviors and evaluate the relationships between climate-related coping behaviors and tourism season, visitor attributes, and visitors' climate change perceptions. By assessing how visitors have actually responded to past climate-related impacts, we contribute to previous literature that has examined hypothetical coping/substitution scenarios. Specifically, we posit four key findings and suggest strategies researchers and managers can implement to build understanding of, and capacity for, altered nature-based tourism demand in response to changing climate.

5.1. Informational coping was the most frequently reported behavioral response to past climate-related impacts

Our finding that visitors who have experienced climate-related impacts increase their attentiveness to weather forecasts prior to and during trips confirms previous research that weather information is valuable to a majority of visitors (e.g., Rutty & Andrey, 2014). As climate change causes greater uncertainty in environmental conditions, visitors will seek the information necessary to make decisions that ensure their safety and enjoyment during recreational visits. This contributes to our theoretical understanding of behavioral coping, particularly in response to climate-related constraints.

Additionally, use history was significantly related to two coping mechanisms: strategic and informational coping. Repeat visitation may afford visitors the agency, capacity, and/or knowledge of the region to find strategic and informational ways of coping with climate change impacts. Younger visitors were also more likely to engage in these coping mechanisms (rather than temporal or activity substitution). This leaves a niche population of tourists—specifically, older, first time visitors—who may not be inclined towards informational coping. Recreation managers should be aware of this population and possibly target informational and/or strategic coping awareness campaigns towards this group in an effort to retain (temporally, spatially, and/or activity-wise) these visitors.

Information, as the mostly frequently reported behavioral strategy found in this study, has also previously been shown to impact other coping behaviors, such as strategic (what gear to bring) and spatial (which site to visit) coping (Rutty & Andrey, 2014). Therefore, managers should provide this weather information through widely recognized sources (see Rutty & Andrey, 2014), such as providing links to national weather reports on their webpage or having a feature on their website devoted to real-time and near-term local or site conditions. In addition to near-term forecasts, tourism providers may consider including longer-term seasonal projections for their destination, as this study and others (De Urioste-Stone et al., 2015; Hendrik & Jeuring, 2017) demonstrate that many visitors are proactively thinking about climate change impacts that manifest as extreme weather events.

Managers can include supplemental information along with the weather data, such as near-term reports of which sites or times pose the lowest risk or which gear is most adapatable for a range of environmental conditions and/or recreational opportunties (e.g., recommending higher elevation trails during likely flooding periods). From the managerial perspective, recreation service providers may also strategically consider the type and volume of information they are communicating to visitors. Recreationists understand there is uncertainty with weather information (Savelli & Joslyn, 2012); however, this uncertainty should not deter tourism professionals or recreation managers from providing weather forecasts, as it is perceived by visitors as a valuable coping tool. Partnerships between recreation providers at the destination-level could enhance consistency in the provision of such information, given the multiple pathways of weather and climate information-seeking (Nalau, Becken, Noakes, & Mackey, 2017) and the need to link tourism with disaster risk reduction systems (Becken & Hughey, 2013).

5.2. Behavioral coping in response to climate-related impacts is greater during the winter tourism season

While studies of North American tourism resources state that generally the winter season will become more favorable under projected climate change conditions (e.g., Scott et al., 2007), our study adds to the growing evidence that climate change impacts and responses are highly variable on a regional scale (e.g., Dawson et al., 2011). Our results suggest that in the Great Lakes region, winter tourism may be constrained as temperatures increase. For example, popular winter activities such as skiing, snowmobiling, and ice fishing may be more wholly dependent on certain environmental conditions (ice thickness, snow depth) that are negatively impacted by warming trends. Conversely, popular summer activities such as swimming, hiking, and fishing (except for cold-water dependent species) may benefit from these same warming trends. In response to past climate-related impacts, winter recreationists were three times more likely to engage in strategic, temporal, and information coping (and one to two times more likely to engage in site or activity substitution, respectively) than summer visitors. To more fully understand this relationship, future research may explore whether winter poses more risks, if winter risks are less familiar to visitors, if there are fewer suitable winter-season substitute activities or sites, or the extent to which winter visitors are aware of the substitute activities and sites that exist.

Arent and others (2014) suggest that managers should consider alternate recreational opportunities they may be able to provide visitors. Winter tourism providers in particular should be considering the technology or gear that could enhance winter visitors' capacity to overcome climate-related winter impacts. Recommendations for substitute activities or the provision of alternate programming when snow depth is not feasible for snowmobiling or snowshoeing may serve as valid substitutes for traditional winter recreation experiences (Ditton & Sutton, 2004).

Our study builds on previous research exploring climate-related impacts for the summer season (Arent et al., 2014; Fisichelli et al., 2015; Perry, Manning, Xiao, & Vallerie, 2018) by finding that summer recreationists were much less likely to report behavioral coping in response to a past impact. For example, Perry et al. (2018) found that daily high and low temperatures would not affect visitation to Vermont state parks for the summer season. However, because consideration of safer substitute sites is among the most prominent recreation coping strategy among summer visitors in this study, recreation mangers may still consider climate-related site safety during summer recreation (e.g., assessing what may go wrong, which risks can be controlled, and how risk mitigation will be financed; Eagles, McCool, & Haynes, 2002). For

example, risk management in campgrounds should be a top priority and would include such actions as removing hazardous trees and providing evacuation procedures in case of flooding or storm-induced tree blowdowns. Additionally, preventative fire management activities (e.g., mechanical thinning and removal of downed trees, prescribed fire) will be important, as seasonal patterns of fire hazard conditions shift and subsequently affect visitation patterns (Kanazawa, Wilson, & Holmberg, 2018).

5.3. Younger visitors are most likely to report strategic coping

Age was a significant predictor of strategic coping, with those visitors under the age of 35 more likely to engage in strategic coping strategies than older visitors. Additionally, income was the only variable significantly related to strategic coping, demonstrating an interesting intersection of wealth and age that influences the likelihood of recreationists coping strategically through gear or technology. This finding related to income reveals a potential environmental justice implication, particularly in regards to the notion of environmental equity which has previously been conceptualized as "persons most likely to live in areas adjacent to environmental hazards are individuals and groups who do not possess the economic means to locate to more environmentally desirable areas" (Floyd & Johnson, 2002, p. 63) and could be extended to include individuals and groups who do not possess the economic means to cope with climate-related recreation constraints. While our study confirms the relationship between higher income levels and the likelihood of coping (e.g., Cordell, 1976), at least in terms of strategic coping, it contradicts other studies which found that substitution likelihood increases with age (e.g., Ditton & Sutton, 2004). Our study found that, in response to climate-related impacts, younger visitors are more likely to utilize strategic coping mechanisms. However, the bias in our samples (i.e., respondents were younger than non-respondents) necessitates that additional research is needed to confirm this finding. Without such research, we hypothesize that this finding could be explained by climate-related coping and substitution as being unique, particularly in relation to age.

Supporting this hypothesis is the Six Americas report, which defines six types of relationships the American public has with climate change information (Maibach, Roser-Renouf, & Leiserowitz, 2009). One group dubbed the "cautious" are affiliated with individuals who are younger, while the "disengaged" and "doubtful" groups tend to be older (65 + and 75 + respectively). Cautious individuals are characterized as having a moderate amount of knowledge regarding climate change sources and impacts and a feeling that climate change will impact the next generation of Americans. Disengaged individuals are those who know little about climate change and are not particularly interested in understanding the sources and impacts of shifting environmental conditions, and while doubtful individuals have a minimal understanding of climate change, they believe that it is cause by natural cycles and will pose minimal harm in the distant (30 year) future. Younger Americans and younger American recreationists may be more knowledgeable and cautious in terms of climate change and, consequently, more likely to change their behaviors in response to past impacts. Longitudinal studies are needed to determine if younger visitors "outgrow" their caution and concern about climate change or if this characteristic follows this generation of visitors through older adulthood.

5.4. Climate change perceptions are a key driver of recreational coping

Belief in climate change was correlated with a decreased likelihood to use temporal substitution or informational coping. Moreover, we found that concern about climate change and worrying in response to impacts are significantly related to all five behavioral coping mechanisms. These findings support other literature that links climate concern, or worry regarding climate-related risks, to travel behavior (De Urioste-Stone et al., 2015).

Concern and worry, which indicate negative affect (e.g., anxiety and alarm), have been linked to stress (Miller & McCool, 2003) and the need to cope. Climate change beliefs, on the other hand, is not perceived as explicitly negative, or positive. Individuals who believe climate change is happening may perceive positive (warmer, more comfortable temperatures for hiking) and/or negative (decreased snow depth for snowshoeing) consequences. This would explain why climate concern and worry are more strongly related to behavioral coping responses than climate change beliefs. As noted above, tourism managers should provide visitors with the information necessary to cope with perceived concern and worries. A separate study in the North Shore region demonstrated that summer visitation to state parks is constrained by heat waves and fire risks, but cautions that official warnings may not effectively discourage engagement in risky outdoor activities (Kanazawa et al., 2018). Thus, in addition to weather information, recommendations for sites and gear, as well as trip planning and timing information, may ensure sustained tourism flows to a destination impacted by adverse conditions. Further, managers may leverage visitors' climate concern as a call to action. In a study of visitors' willingness to pay for destination-specific climate change adaptation planning, McCreary et al. (2018) found that heightened risk perceptions (concern that climate change impacts would negatively affect a destination) were associated with recreationists' willingness to contribute more than $30 (USD) annually to destination-specific climate adaptation planning.

5.5. Limitations and future research

Results of this study highlight key connections between visitor attributes, climate change perceptions, and climate-related recreational coping behaviors. However, because these findings are specific to the recreation opportunities and constraints of the North Shore, it is not clear if/how they would extend to other nature-based tourism destinations. For example, visitors to an equatorial destination may experience increased rates of coping behavior during the summer months due to increasing heat indices, with limited coping during winter months. Oceanic destinations, in general, may be correlated with visitors reporting greater coping behavior during the autumn months due to increased storm-related damage and disruptions. Replication of our study in other nature-based tourism destinations will help advance the theoretical understanding of climate-related recreational coping, as well as provide recreation and tourism system managers with strategies to enhance the adaptive capacity of their destination and the individuals who visit those destinations.

As already discussed, the generalizability of our findings are constrained due to the non-response bias testing results. Our winter sample made fewer trips per winter season and were younger than non-respondents. Their coping behaviors, particularly results regarding temporal substitution and age, could be biased. Our summer sample was also younger than non-respondents and more likely to be recreating at one site. Again, this could have biased results, particularly regarding spatial substitution and the relationships we found between age and climate-related coping. Future research is needed to confirm the relationships found in this study.

Additionally, the findings of this study are limited as visitors who have already been spatially displaced to locations outside of the study region due to past climate-related impacts were not represented in the sample. These visitors present a potentially important group to study through future research. Another important consideration may be delving deeper into the relationship between information and recreation coping behaviors. For example, what kind of information sources are currently utilized? What types of information and delivery styles are desired by recreationists? And (how) does informational coping have cascading effects on other types of substitution (e.g., activity swaps or strategic coping)?

6. Conclusion

Research on the biophysical impacts of climate change in nature-based tourism areas provides important insights into when and where climate change may occur (Adger, Barnett, Brown, Marshall, & O'Brien, 2013; Nicholls, 2006; Scott et al., 2004; Shaw et al., 2009). Understanding visitors' behavioral responses to climate change provides recreation and tourism managers with complementary information needed to cope with climate-related impacts to visitor flows (e.g., Scott et al., 2007, Beaudin and Huang 2014; Adger et al., 2013). For example, when conditions are not conducive for visitors' desired activities, recreation managers and tourism providers could collaboratively identify, market, and provide alternative recreation opportunities. This study demonstrates the importance of understanding how visitors have responded to past climate-related impacts for informing future recreation and tourism planning. Moreover, this study builds on previous studies (e.g., Rutty & Andrey, 2014; Stensland et al., 2017; Zweifel & Haegeli, 2014) and documents that information and gear are currently the most frequently reported mechanisms of behavioral coping.

Climate change presents individuals with more uncertainty in the environmental conditions they will encounter at nature-based tourism destinations. Managers may focus on coordination across destinations to enhance visitors' ability to cope with conditions encountered on-site. Recreation and tourism service providers can develop a networked approach for communicating weather and site safety that is consistent across sites, providing recreationists with readily available options and strategies to cope with climate-related impacts and environmental change. Collaboratively identifying the potential challenges and opportunities of climate change—and forming regional partnerships to address both—may become increasingly necessary to address more complex management problems that climate change poses, such as campground concessionaires coordinating flooding evacuation procedures with emergency management personnel (De Bruin et al., 2009).

"Coopetition," that is, cooperation among recreation providers at the destination-level to remain competitive (for tourism attractiveness), on a regional level is appropriate as visitors experience a destination seamlessly (Kylanen & Mariani, 2012). As such, planning for climate change collaboratively will ensure that the destination continues to offer 'weather resistant' recreation opportunities and reap the benefits of a nature-based tourism economy. For nature-based tourism destinations, weather-resistant programing may include keeping hiking trails maintained in the case of low snowfall (for hiking or snowshoeing when skiing, snowboarding, or snowmobiling are not available opportunities), being prepared, simultaneously, to offer either open water or ice fishing opportunities for visitors (depending on ice thickness in various locales), or creating events that interpret the cultural history and traditions (e.g., American Indian, Nordic immigration, populations etc.) or the natural history (including present-day environmental changes influencing the region) of the region in either indoor and/or outdoor spaces.

Building on the theoretical knowledge of recreational constraints and coping, we find that climate-related impacts influence visitor behavior, specifically behavioral coping responses to negatively perceived impacts. In particular, we found that in response to climate-related constraints on the North Shore of Lake Superior: 1) overall, visitors were more likely to engage in informational coping relative to activity, spatial, temporal, or strategic coping; 2) winter tourists more frequently employed behavioral coping responses than summer tourists; 3) younger visitors were most likely to report behavioral coping; and 4) climate change perceptions were a driver of all recreational coping behaviors. These findings advance the theoretical understanding of constraints and coping by extending them to the context of climate change. The findings can also enhance the sustainability of outdoor recreation and tourism destinations by reducing climate-related risks within managers' control, such as providing timely, relevant and consistent information across sites, including weather forecasts and alternative activities when conditions are not ideal.

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