

“It’s Just a Matter of Time:” Lessons from Agency and Community Responses to Polar Bear-inflicted Human Injury

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Abstract

Bear-inflicted human injuries or deaths are often widely publicised, controversial, and evoke substantial social responses that articulate public expectations about bear management. In this paper, we examine how local people and management agencies (i.e. Manitoba Conservation, Parks Canada, and the Town of Churchill) responded to a polar bear-inflicted human injury in Churchill, Manitoba, Canada. On November 1st, 2013, two people in Churchill were badly mauled by a polar bear. The incident shocked the community, highlighted problems such as a lack of bear safety education, and led to reviews of institutional policies for preventing polar bear-human conflicts. We used qualitative analysis methods to describe what is said (about polar bears, about people, and about management) and what is done (changes in behaviours and changes in policies/practices) when someone is attacked by a polar bear in Churchill. Results show that polar bear management agencies in Churchill respond remarkably well to errors in procedure, but are often unable to address the many underlying systematic drivers of polar bear-human conflict. Hence, managerial reactions to bear-human conflicts are successful at addressing the proximate cause of the problem, but offer few long-term solutions.

Keywords: polar bear-human conflicts, management responses, community responses, Churchill, Manitoba, Canada

INTRODUCTION

Polar bear-human interactions and conflicts are increasing throughout the Arctic (Dowsley and Wenzel 2008; Tyrrell 2009; Lemelin et al. 2010; Boisen 2014). Although the exact impacts of climate change on polar bears remain disputed, temporal trends in sea ice decline suggest increasing overlap with people so conflict with humans will continue to occur (Stirling and Parkinson 2006; Peacock et al. 2011; Stirling and Derocher 2012). In 2013, Canada experienced a record number of polar bear-inflicted human injuries – with three out of four of

these attacks occurring in Churchill, Manitoba. Nevertheless, such injuries or fatalities remain relatively rare (Fleck and Herrero 1988; Clark et al. 2012). Herrero and Fleck (1990) found that polar bears were responsible for only 6% of human injuries or deaths by all bear species across North America. However, published studies of trends in polar bear-human conflicts are dated (e.g. Gjertz 1987; Fleck and Herrero 1988; Clark 2003). Furthermore, many of these conflicts have not been well documented making it difficult to draw conclusions from these trends.

That said, bear-inflicted human injuries or deaths are often widely publicised, controversial, and evoke substantial social responses that articulate public expectations about management responses (Don Carlos et al. 2009; Clark and Slocombe 2011). Bear-human conflicts are often focal points for social conflict over bear management since different groups of people have diverse views on what caused the problem and on how it should be solved (Cromley 2000; Wilson and Clark 2007). Historically, bear-human conflicts have served as catalysts for significant changes in institutional behaviour and policies

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(Mattson and Craighead 1994; Herrero and Herrero 1997; Wondrack-Biel 2006; Clark and Slocombe 2011). However, institutional changes following specific incidents in natural resource management do not necessarily rectify problems in a useful manner (Ascher 2001; Yaffee 1997). As Ascher (2001) and Yaffee (1997) have pointed out, the lessons that agencies draw from these situations are conditioned by a number of behavioural biases that affect decision-making. These include: focusing on short-term outcomes, oversimplifying problems, favoring status quo arrangements, and fragmenting responsibility between agencies, among others. While these biases are not always obvious, they have a profound effect on whether the actions agencies take successfully prevent incidents from reoccurring (Ascher 2000; Yaffee 1997).

In this manuscript, we examine events leading to the November 1st 2013 mauling of two people, and the reactions that followed, to better understand how involved agencies and community members respond when someone is attacked by a polar bear in Churchill, MB. Here, we use the term “agency” broadly to describe the key institutions responsible for managing polar bear-human conflicts: Manitoba Conservation, Parks Canada, and the Town of Churchill. We document community and agency responses to bear-related crisis in Churchill: describing what is said (about polar bears, about people, about the incidents) and what is done (changes in behaviours, changes in policies/practices). Our research addressed the following questions—1) How do agencies respond to polar bear-human conflicts? how do they respond to polar bear-inflicted human injury? 2) How do Churchill residents respond to bear-human conflicts? how do they respond to polar bear-inflicted human injury? 3) What patterns or trends exist in responses to polar bear-inflicted human injuries? what are the implications of these trends for preventing future conflicts?

Although our study is place and species-specific, these questions, and their answers, are globally applicable. Conflicts between people and large carnivores are a worldwide issue with real impacts on human lives, livelihoods, and animal conservation efforts across a wide range of social and ecological contexts in both developing and developed nations (Treves and Karanth 2003; Thirgood et al. 2005; Packer et al. 2011; Barua et al. 2013; Penteriani et al. 2016). However, investigations of how agencies respond to such conflicts are sparse (Clark and Rutherford 2005) and few compare agency and community responses to the same incidents (Cromley 2000; Clark and Slocombe, 2011; Clark et al. 2014). This knowledge gap is important because the field of wildlife-human conflict management is rapidly evolving and sharing best practices — particularly regarding institutions and governance, remains an urgent need (Treves and Karanth 2003; Dickman 2010; Clark et al. 2016). Our paper aims to make a specific contribution to meeting that need by exploring the differences between agency and community responses both before and after a specific high-profile incident.

The theoretical framework we used to understand responses to the November 1st attack was incident analysis

(Reisman 1988). Incidents are important phenomena that can shape responses to political wildlife management issues (Cromley 2000; Mattson and Clark 2012; Vernon et al. 2015). Incident analysis involves examining normative expectations articulated in response to a specific event, to understand how they shape management actions and policy outcomes (Reisman and Willard 1988). This meta-approach focuses on a specific situation and has scope for the application of a variety of qualitative methods including interviews (see Cromley 2000; Vernon et al. 2015) and content analysis of media (see Mattson and Clark 2012). Incidents function to clarify people’s perspectives and expectations about management actions and have the power to shape management policy and practice (Reisman 1984; Clark and Rutherford 2005; Mattson and Clark 2012). Incidents can be identified by changes in the frequency of references to focal issues made by stakeholders, and are characterised by an amplified attention to defining problems, and promoting specific solutions (Birkland 1998; Reisman 1988). As Mattson and Clark (2012: 333) point out, “incidents became opportunities for redefining problems and debating and contesting the merits of management methods, decision-making processes, and other status quo arrangements.”

Social, Ecological, and Institutional Context

Situated at the mouth of the Churchill River, on the southwest coast of the Hudson Bay, Churchill, Manitoba is home to approximately 810 people (Statistics Canada 2013). The resident population is a mixture of long-term residents (some of whom have lived in the community for generations) and transients who are usually employed in temporary or seasonal positions. Here, we define transient resident as anyone who has lived in the community for less than two years and is not employed in a permanent position. Churchill experiences high rates of polar bear-human interactions since polar bears aggregate along the shores of the Hudson Bay near the community during the ice-free period (Lemelin 2006). Polar bear-viewing has made Churchill an international tourist destination with 6,000–10,000 tourists travelling to the community each year (Dawson et al. 2010).

Since 1965, twelve people have been injured and two have been fatally mauled by polar bears in the Churchill region (Jonkel 1970; Stirling et al. 1977; Kearney 1989; Lemelin 2007; Herrero and Herrero 1997; Struzik, 2014). Research participants also reported countless other close encounters that remain largely undocumented, largely because they did not result in a human injury or death.

In the past, polar bear-human conflicts resulting in human injury or death have triggered significant changes to management strategies and policies in Churchill (Kearney 1989; Struzik 2014). In particular, human fatalities have triggered the most notable revisions to policy and procedures. For example, the 1968 death of a teenage boy prompted a collaborative effort between the local, provincial, and federal government that led to development of the provincially-run Polar Bear Alert (PBA) Programme (Kearney 1989). Similarly,

a death in 1983 led to significant reviews of the PBA program's operating procedures – largely in response to widespread public dissatisfaction.

In its present form, the PBA Programme consists of patrols that seek to deter, capture, or occasionally kill polar bears who venture near inhabited areas around Churchill (Manitoba Conservation and Water Stewardship 2014). Struzik (2014) provides a comprehensive overview of the origins and day-to-day operations of the PBA Programme. In addition to the PBA programme, several other institutions contribute to the management of polar bear-human conflicts in the Churchill area. The Town of Churchill is the municipal governing body responsible for garbage disposal and attractant management. Safety measures requiring changes to town infrastructure (e.g. better street lighting, removal of brush or rocks, or bear-proof garbage containers) must be approved and implemented by the Town of Churchill. Neither Manitoba Conservation nor the Town of Churchill have authority to deter polar bears, or manage attractants on OmniTrax property, despite its proximity to the community. Nevertheless, OmniTrax cooperates with Manitoba Conservation by allowing PBA officers to deter bears on the 'Port of Churchill' property – a strip of privately owned land immediately adjacent to the town site. Finally, Parks Canada manages polar bear-human interactions in the nearby Wapusk National Park and at various national historical sites in the Churchill vicinity (Cape Merry and Prince of Wales Fort). Due to the significant overlap between jurisdictions, the management of polar bear-human conflicts in Churchill requires constant negotiation and cooperation between agencies.

Incident Details

At 5am on November 1st 2013, transient resident Erin Greene was walking home from a Halloween party in Churchill, Manitoba, accompanied by three other people. The group took a short-cut, down an alley between two apartment buildings, and Greene was attacked by a polar bear. The attack occurred outside the residence of Billy Ayotte, a long-time Churchill resident. Awakened by her screams, Ayotte came to Greene's aid, attempting to distract the polar bear by hitting it with a shovel. The polar bear, however, turned on Ayotte and began to maul him instead. Other residents attempted to scare the bear off by firing shots and shouting but the bear was only deterred when a local man rammed it with his truck. Both Greene and Ayotte suffered severe lacerations but survived. Conservation officers tracked down and shot the bear. However, a female bear in the general vicinity was mistakenly killed as well and her orphaned cub was later sent to a zoo.

METHODS

Data Collection

Data was collected under the authorisation of the University of Saskatchewan Behavioural Research Ethics Board,

protocol number: BEH 13-143. Since this research focused on a sensitive topic in a small northern community, and some interviewees worked in positions of responsibility, we applied appropriate standards of confidentiality (ACUNS 2003).

Interviews

Over two field seasons, the first author conducted 37 semi-structured interviews with field personnel (Manitoba Conservation and Parks Canada), managers (Manitoba Conservation, Parks Canada and the Town of Churchill), and residents. In 2013, three field personnel, one manager, and 16 residents were interviewed. In 2014, four field personnel, six managers, and twelve residents were interviewed. Interviews were informal, conversational, and adjusted to each unique interaction (Huntington 1998). Interview guides provided a list of topics and probes that allowed interviewees to guide the direction and scope. Interviews lasted on average one hour and covered a range of topics including participants' experiences with and perceptions of polar bears, the history of bear management in the community, and perceived challenges to management. Sampling measures for interviews involved a combination of snowball and heterogeneity sampling techniques (Palinkas et al. 2013).

Focus groups

In 2014, three focus groups were carried out with three different stakeholders: tourism operators, managers, and long-time Churchill residents. Focus groups allowed for direct comparisons between the perceptions and knowledge of polar bears held by different stakeholders and helped clarify findings from the interview data (Morgan 1997). Homogeneity sampling ensured that participants who shared similar perspectives and experiences were grouped together (Palinkas et al. 2013). Each focus group lasted an average of 90 minutes and a total of 10 people participated (two tourism operators, five managers, and three long-term residents).

Problem solving workshop

We organised and facilitated a problem-solving workshop (Edwards and Gibeau 2013) in Churchill, in October 2015. Problem-solving workshops have been used to build trust and establish common ground between stakeholders in other contexts involving bear-human conflicts (Mattson et al. 2006; Rutherford et al. 2009; Clark et al. 2010). This workshop was similar to the Clark et al. (2010) workshop, with participants focused on defining problems and identifying corresponding solutions. Twelve participants attended (five managers and seven residents), including representatives of Manitoba Conservation, Parks Canada, and the Town of Churchill. The workshop consisted of a series of facilitated exercises that encouraged participants to identify common ground about polar bear-human conflicts in Churchill. Workshop participants worked together to describe what they thought was needed to address the problems and reach these goals. In addition, since eight out of the 12 workshop participants had participated in prior data collection activities (interviews and focus groups),

the workshop included a ‘validation of results’ component. This allowed participants to provide feedback on study findings and ensured that their perspectives have been precisely documented. This type of validation is a critical step in establishing the accuracy and credibility of qualitative research findings (Creswell and Miller 2000; Miles and Huberman 2013).

Data Analysis

The use of multiple methods allowed for the corroboration and synthesis of data through triangulation (Miles and Huberman 2013). Triangulation refers to the systematic process of finding common themes across data collected through various methods (Miles and Huberman 2013). The first author organised, processed, and coded data according to themes or categories that emerged from the data (Braun and Clarke 2006) using NVIVO Mac v.10. An initial round of inductive coding revealed patterns consistent with the categories identified by Mattson and Clark (2012). A second round of deductive coding, organised statements according to problems (discrepancies between actual and desired states of affairs) and solutions (alternatives to address an identified problem). Each statement of a problem was then organised into distinct categories and the number of participants who made these statements was counted (2). Each participant was given an identifying alphanumeric code to preserve anonymity. Codes were assigned based on the year of the interview (“A” for 2013 and “B” for 2014) and chronologically within each year.

RESULTS

Events leading up to the November 1st incident, and the managerial responses that followed, are presented in the following timeline (Table 1), which draws on information from a variety of sources (interviews, focus groups, informal discussions with participants and other community members, and newspaper articles).

Defining Problems

This analysis focused how participants defined problems that caused polar bear-human conflicts (Table 2). Problem statements were defined as “discrepancies between the actual and desired states of affairs” (Vernon et al. 2015: 68).

Improper garbage/attractant management

Improper garbage or attractant management was identified as a problem once in 2013, and nine times (by four managers, and five residents) after the attack. This problem focused primarily on the practice of creating attractants by setting garbage on the street the night before pick-up. Participants also highlighted the lack of bear-proof garbage containers, noting that bears frequently broke into the wooden or wire mesh garbage containers widely used around the community at this time. Restaurants were seen as a chief source of attraction and

participants noted that proper garbage disposal did not appear to be a priority of most restaurants or businesses. Finally, one manager noted that the Port of Churchill had begun disposing of wheat screenings closer to the Churchill community, creating a bear attractant.

Risk-taking by outsiders

Risk taking by outsiders (tourists or transient workers) was the most frequently identified problem both before and after the incident (by four managers, four field personnel, eight residents). Both managers and residents noted that outsiders often get dangerously close to polar bears or fail to take precautions against encountering them. As one participant in 2013 predicted: “there will be another incident in Churchill with a bear and a person. It’s just a matter of time. Might be this year, might be in 20 years but it’s inevitable. It will happen.

Table 1
Incidents Events Timeline

Date	Events
2013 (July 29)	A transient resident walking with his dog and two children on the Complex Beach is confronted by a subadult polar bear. He uses the dog leash to keep the bear at bay, and calls Manitoba Conservation, who deter the bear.
2013 (9 September)	Transient resident walking home from bar at about 1:30 am is bitten by a subadult polar bear near the local bakery. The polar bear is later captured by Manitoba Conservation and sent to the Assiniboine zoo in Winnipeg.
2013 (1 November)	Transient worker Erin Greene, and long-term resident Billy Ayotte are attacked by a subadult polar bear. Two polar bears are shot and an orphaned cub is sent to the zoo.
2013 (November)	The Polar Bear Safety and Awareness Committee is formed, involving Parks Canada, Manitoba Conservation, Chamber of Commerce, the Town of Churchill; the Churchill Emergency Measures Organisation. The focus of this committee is to increase polar bear safety messaging in the community.
2014 (February)	The Local Advisory Committee is formed, made up of 4 long term Churchill residents. The goal of this organisation is greater transparency of PBA decisions. Meets for the first time on 14 May 2014.
2014 (July)	<i>Safety in Polar Bear Country</i> information sessions that are co-hosted by Parks Canada and Manitoba Conservation begin. Overall attendance was poor and did not match up with anticipated interest. <i>Safety in Polar Bear Country</i> pamphlets are printed and distributed around the community
2014 (August)	Manitoba Conservation widens the perimeter in which polar bears are not tolerated and begins hazing more polar bears. Early morning and late evening PBA patrols are increased.
2014 (31 October)	Manitoba Conservation implements the first 24-hour PBA patrol on Halloween night.

Table 2
Summary of problem statements categories made by 2013-2014 interview participants

Category of problem statements	Mentioned by # of participants in 2013	Mentioned by # of participants in 2014
Improper garbage/attractant management	1	9
Risk-taking by outsiders	8	9
Risk-taking by locals	2	6
Risk-taking due to alcohol consumption	0	5
Lack of bear safety education	2	8
Bear behaviours	5	7
Shortcomings of the PBA program	0	5
Too many bears	1	1
Problem bears not removed from the population	0	4
Deferral of responsibility by management agencies	0	3

And I would say it's likely going to be a tourist" (A6, field personnel). Several participants noted the pressure on tourism operators by film crews and photographers to facilitate close interactions with polar bears. Two managers also cited their inability to legally prevent outsiders from engaging in this risk-taking behaviour due to a lack of regulations.

Risk-taking by locals

Participants who identified this as a problem highlighted that local people seemed to have a complacent attitude about the potential risks posed by polar bears. Two managers attributed this to a larger culture of risk-taking in the Churchill community—"I think complacency isn't just about polar bears, it's about jumping in the boat with no life jackets, it's about Royal Canadian Mounted Police [RCMP] enforcing seat belt rules, it just seems like it's a different mentality in Churchill" (B5, manager). Two other participants attributed complacency among locals to the fact that there has not been a polar bear-inflicted human death in Churchill since 1983: "When things kind of go along status quo... you tend to get a bit lazy, I mean that's just human nature" (B4, manager). Other participants pointed out that the presence of the PBA programme created a false sense of security for people, as did efforts to develop beach areas (by putting fire pits and picnic tables on them) subject to frequent polar bear visitation. Finally, children playing outside unsupervised after dark was also identified as a problem.

Risk-taking due to alcohol consumption

Participants who articulated risk-taking as a problem, also emphasised poor decision-making by people under the influence of alcohol – specifically choosing to walk home after dark while intoxicated. Unlike the two previous problem statements about risk-taking this one did not distinguish between insiders or outsiders to the community. Alcohol consumption was one of the only problems not discussed by managers in the interviews (identified by five residents), although it was briefly touched on in the managerial focus group. Most participants who identified this problem noted that they had engaged in this type of behaviour themselves at some point in the past: "I know, people shouldn't be walking home at that time of night but,

you know, everyone who judges Erin for that night, did it themselves" (B15, resident).

Lack of bear safety education

Two participants noted this problem prior to the incident and it gained considerable traction after the incident. In addition to eight interview participants who cited lack of education as a problem in 2014, this problem was also prevalent in two focus groups and was the dominant problem definition in the 2015 workshop. Participants felt more education was necessary to increase people's awareness of the danger posed by polar bears, and to teach people how to avoid polar bear-human conflicts. Participants who identified this solution felt that education should be geared towards outsiders, noting that local people were already sufficiently bear aware: "as of late most of the incidences are happening with the tourism people that aren't educated among the bears and... the local people they... are probably a little more educated than the average person that comes up from the city" (B10, resident).

Bear behaviours

This category of problem statements focused on the habituation of polar bears (to people or to cracker shells) and on an increase in aggressive behaviours by polar bears. Here, we use the term habituation after Herrero et al. (2005) to refer to bears that show little or no overt reaction to humans. Several participants noted that bears were increasingly losing their fear of humans. One agency staff member pointed out, "they banned the hunt, now all these people take pictures of bears, the bears aren't scared of nothing. They are not scared of man at all" (B16). Several participants noted that increasing habituation to cracker shells made bears more difficult to deter during interactions and therefore more dangerous. In 2014, four participants (two residents, one field personnel, one manager) identified "rogue bears" as the problem, which highlighted the infrequency of bear attacks while also underscoring the unpredictable and potentially unavoidable nature of such incidents.

Too many bears

This problem statement focused on the perception that the polar bear population in the Churchill region was increasing, which in turn, increased the likelihood of polar bear-human conflicts.

Problem bears are not removed from the population

This problem statement highlighted that PBA officers no longer routinely remove polar bears with a history of conflict with humans from the population. Articulated by two managers, one field personnel and one resident in the interviews, this problem statement was also reiterated in one focus group by a resident— “let’s face it, some bears need to get dead.” (A8, resident, 2014 Focus Group). Exactly what information or event compelled this problem statement was unclear since all the polar bears involved in the 2013 incidents (Table 1) were sub-adults and none had a history of prior conflicts with humans. This problem statement may have been motivated by a desire for retribution against polar bears because it was not present in the 2013 data set (prior to the incident) and was the only problem statement that openly supported lethal action against bears.

Deferral of responsibility by management agencies

Two managers and one resident identified this as a problem. Both managers highlighted difficulties in implementing change when agencies failed to follow through on their responsibilities, noting a tendency to “pass the buck” when it came to responsibility for specific tasks. The resident felt that the Town of Churchill in particular was not doing its part in working together with other management agencies to reduce polar bear-human conflicts – specifically through effective garbage management.

Shortcomings of the PBA programme

This category of problem statements identified two shortcomings of the PBA programme that were perceived to have contributed to the incident in 2013— 1) the lack of a 24-hour patrol by PBA officers (by two residents) and 2) PBA officers had become too tolerant of polar bears in the community’s vicinity (by two managers, one field personnel, one resident). Although not present prior to the 2013 incident, relatively few residents articulated this problem statement. This indicates that the Churchill residents were still relatively satisfied with the PBA program even after the 2013 bear attack.

Table 3
Problem definitions and corresponding solutions implemented by management agencies

Problem	Implemented solution
Improper garbage/attractant management	New garbage bins
Risk-taking by outsiders	Education
Risk taking by locals	None
Risk taking due to alcohol consumption	None
Lack of bear safety education	Education
Bear Behaviours	Increased hazing/patrols
Too many bears	None
Shortcomings of the PBA program	Increased hazing/patrols
Deferral of responsibility by management agencies	None
Problem bears are not removed from the population	None

Implemented Solutions

In this section, we describe which problem definitions apparently gained traction and resulted in the implementation of specific solutions by management agencies and which did not (Table 3).

New garbage bins

In November 2014, the Town of Churchill installed five bear-proof garbage containers around the community, replacing older wooden and wire mesh garbage containers located behind restaurants, hotels, and the Complex building. It is worth noting that the Town of Churchill had already started implementing this solution prior to the incident; two garbage bins were installed in 2013, and the rest were slated for installation in November 2014 (Town of Churchill representative, pers. com). This solution addressed some of the long-standing issues with polar bears breaking into garbage bins and accessing restaurant scraps and other garbage. Nevertheless, it was only a partial solution given that only a few bear-proof containers were installed, and numerous smaller garbage cans that are not bear-proof remain scattered. Furthermore, although participants identified the existing garbage pick-up system as a problem, to our knowledge no steps have been taken to improve it.

Education

Unsurprisingly, perhaps, people who raised education as a solution also define the problems as risk-taking by outsiders and a lack of bear safety education. The lack of polar bear safety education was identified as a solution almost immediately following the incident. The Polar Bear Safety and Awareness Committee formed within a week of the incident and focused on increasing the availability of polar bear safety messaging in Churchill (Table 1). Educational efforts specifically targeted outsiders to the community, and were designed to reach seasonal workers specifically. One manager involved in forming the committee described the rationale— “what we found was that long-term residents of Churchill have good knowledge, are bear aware, and you really don’t need to worry about them too much, the tourists are well informed, well managed, you don’t have to worry about them too much, it’s the seasonal worker, they were falling between the cracks” (B17). The committee also implemented bear safety information sessions (co-hosted by Manitoba Conservation and Parks Canada) that are now held bi-weekly from July to October. Five sessions were held in 2014 and six in 2015. Finally, the Polar Bear Safety and Awareness Committee also updated and distributed an existing brochure on polar bear safety.

Increased Hazing and Patrols

In 2014, Manitoba Conservation made several changes to the PBA Programme’s operating procedures. These included more frequent hazing and handling of polar bears near the community; more patrols in the mornings and evenings; and

larger numbers of field personnel available during the bear season. These solutions corresponded to problem definitions that blamed polar bear behaviours and identified shortcomings in the PBA programme. Increased hazing of polar bears was the solution that was most promoted by Manitoba Conservation employees, with three out of four participants identifying this as a problem working in the PBA programme. One manager described the changes to hazing procedures—“we are going to be more assertive or quicker to immobilise and lodge bears that are hanging around... whereas last year and a few previous years we would tolerate them longer until we were sure that bear was one of the bears that was coming into town” (B2). Manitoba Conservation also increased PBA patrols (adding a 7 am patrol, 9 pm and 10 pm patrol), and commenced a 24-hour patrol on Halloween night (the night of the 2013 incident). However, Manitoba Conservation did not begin to conduct 24-hour patrols on a nightly basis throughout polar bear season – a solution that was advocated for by a number of Churchill residents.

Solutions that were not implemented

Interview, focus group, and workshop participants identified other solutions that were not acted on by management agencies. These included reinstating hunting of polar bears to instil fear of humans; installing a bait station to divert polar bears away from the community; fining people who engage in risk-taking behaviour around polar bears; implementing an all-night taxi or bus system to prevent people from walking home from bars; implementing a 24-hour PBA patrol during bear season; and taxing visitors to the community to fund improvements to garbage management.

DISCUSSION

The increase in how frequently participants discuss problem statements from 2013 to 2014 is consistent with findings from other incident analysis research (Mattson and Clark 2012; Vernon et al. 2015; see also Birkland 1998). Following an incident, participants spent more interview time defining problems and proposing potential solutions to prevent future attacks. No clear distinction was found between how managers and residents talked about problems, although this may be due to limitations in the data set since only one manager was interviewed in 2013 vs. six in 2014. Although stakeholders put forth multiple problem definitions (ten) only a select array had corresponding solutions that were implemented by management (five) following the Nov 1st incident. In his research on how problems are defined, Dery (1984) found that the most prominent problem definitions tend to dictate which solutions are enacted (see also Weiss 1989). This trend was evident in our findings since problem definitions with the highest incidence before the incident (i.e. risk-taking by outsiders and bear behaviours) correlated with the actions taken and solutions implemented afterwards: educational efforts deliberately targeted outsiders, and increases in hazing/patrols were directed at problematic polar bear behaviours.

Managerial Responses

Trends in managerial responses to the incident reflected a number of documented behavioural biases that characterise decision-making processes in North American natural resource management agencies (Yaffee 1997; Ascher 2001; Clark et al. 2014). These responses focus on short-term results that have immediate rewards but fail to resolve the actual problem; a tendency to oversimplify problems or favour responses that fit within existing modes of operation; and fragmented responsibility between agencies that allowed important decisions to fall through the cracks (Yaffee 1997; Ascher 2001). Responses to the 2013 incident included educational efforts that primarily targeted outsiders and increased hazing and patrols. Higher-cost solutions such as better garbage management did not translate into managerial responses. Overall, managerial responses favoured status quo arrangements and defended the legitimacy and structure of existing agency arrangements in a manner indicating problems with the underlying constitutive decision-making process (Clark et al. 2014; Oppenheimer and Richie 2014). As Clark et al. (2014) note, the constitutive process is the collective set of higher-order decisions in an institution that determines how ordinary ‘technical’ decisions should be made and who should be involved. Although not widely acknowledged, and not always visible from the outside, the constitutive process plays a fundamental role in carnivore conservation decisions and has real consequences for both the people and wildlife involved.

Education

Within one week of the incident, management agencies had identified the lack of polar bear safety education as a problem and formed a Polar Bear Safety and Awareness Committee in response (Table 1). One reason education gained traction so quickly was at least partly because the incident reinforced pre-existing problem definitions about the behaviours of outsiders to the community. Over time, both agencies and community members came to view increased polar bear safety education as the preferred solution. This was particularly evident in the 2015 problem-solving workshop, in which participants were adamant that more education was the best way to resolve a wide array of human risk-taking behaviours. The workshop demonstrated the extent to which education had been accepted as the most logical and desirable solution to prevent future bear attacks.

Education was the favoured solution in the workshop because it was the solution over which participants found the most common ground. The focus on this particular solution may have been a by-product of Churchill residents’ pervasive low trust in management agencies. Lankshear (2013) found that many Churchill residents felt excluded from decision-making about natural resources and frustrated with the inability of management agencies to address their concerns. Because increased education was a common goal of both agencies and residents, managers may have been motivated to advance this solution in hopes of leveraging support for their respective

institutions. Furthermore, educating the public may have been a particularly attractive solution to them because it was low-risk to implement and appeared to address the entire array of problem definitions relating to human behaviour around polar bears (including risk-taking by outsiders and locals, risk-taking due to alcohol, and of course the lack of bear safety education). By supporting education as the solution, agencies achieved a short-term goal (the recognition that managers were working to prevent future incidents) while also protecting on-going organisational procedures (Yaffee 1997; Ascher 2001). That said, securing public support for management actions is a perfectly valid goal, particularly since public backlash can have significant negative consequences for both the agency and its individual employees.

However, for several reasons education did not adequately address all the problem definitions that interviewees noted as being related to risk-taking by humans. First, the educational efforts resulting from the 2013 incident focused on transient residents and outsiders rather than targeting the behaviour of locals despite a number of participants (both residents and managers) identifying the complacency of long-term residents as problematic. One manager summarised his dissatisfaction with the educational efforts implemented in 2014, commenting: “I don’t think that we have really hit the nail on the head and really gone all the way because you still do see, not only tourists, but local people doing some questionable things and it makes you wonder if we are actually effective, the way that we are getting the message out? (B5). Managerial focus group participants also acknowledged the need for education targeted specifically at long-term residents, but, to date, we are not aware that any such efforts have been made.

Second, educational efforts failed to directly address risk-taking behaviours that resulted from alcohol consumption. Perhaps because substance abuse in northern communities is a sensitive issue, this problem was not widely discussed by managers, despite that the 2013 incident could be directly attributed to alcohol consumption (Canadian Centre on Substance Abuse 2005). While residents felt comfortable openly discussing the issue of alcohol consumption, the controversial nature of alcohol abuse likely prevented managers from discussing this risk factor in more detail. The failure to address this issue likely results from no single agency being accountable for resolving it, thus making it easy to dismiss or ignore (Yaffee 1997). Some solutions aimed at preventing people from walking after dark while intoxicated – such as a 24-hour PBA patrol or taxi that ran all night – could be implemented if sufficient support existed. However, these solutions would require significant buy-in by multiple agencies, not to mention resource allocation.

The prominence of education as the preferred management solution is not unique to the Churchill polar bear management context. In their global survey of bear-human conflicts and management, Can et al. (2014) found that education was the most commonly emphasised tool for conflict prevention by managers (see also Gore et al. 2006). Faith in education as a panacea is apparent in broader literature on the management

of environmental risks (Thompson et al. 2003; Amick et al. 2015). However, not all educational efforts succeed (Gore et al. 2006; Gore et al. 2008; Baruch-Mordo et al. 2011) as several studies have highlighted (Spencer et al. 2007; Gore et al. 2008; Baruch-Mordo et al. 2011). Evaluation of the effectiveness of bear safety education in Churchill is particularly pertinent given that the 2015 workshop showed few changes in human behaviour since the efforts to increase education were undertaken. In addition, the Polar Bear Safety and Awareness sessions – the most decisive educational efforts – had chronically poor attendance, which suggests that these sessions are likely falling short of their intended goals.

Increased hazing and patrols

Wildlife management agencies often choose to implement the least politically costly management actions (Mattson and Craighead 1994; Clark and Slocombe 2011; Clark et al. 2014). For Manitoba Conservation, this meant increased hazing and patrols – merely changing the intensity of routine procedures that were already standard practice within the daily operations of the PBA programme. This solution was convenient, required minimal energy to implement, and maximised agency control over the situation (Yaffee 1997). Moreover, these management actions had already proven effective and did not require taking action against people or cooperation from other management agencies. Thus, Manitoba Conservation was able to implement this solution quickly and with minimal effort.

Manitoba Conservation’s decision to increase hazing and patrols also reinforced the legitimacy of the PBA programme. Since Manitoba Conservation is responsible for protecting Churchill’s human residents, a response that targeted polar bears rather than humans was the least likely to be controversial. In the managerial focus group, participants noted that they felt pressured to “get ahead of the rumours” in order to meet perceived public expectations. Mattson and Clark (2012) found that solutions promoting increased agency control also supported agency authority and responsibility, a finding that appears to be true in this situation as well. Hence, the decision to increase hazing and patrols was driven equally by the desire to actually prevent future incidents and maintain the credibility of the PBA programme.

This analysis does not imply that increased hazing and patrols were ineffective. One manager described the rationale for increased hazing— “I had observed for the last couple years that we are getting as many – or more calls – in town as we ever have, yet we are handling fewer bears” (B2). Managers felt that because they had been deterring fewer polar bears on the outskirts of town, more bears were able to enter the community. Increased efforts to keep people and polar bears apart are likely to help reduce the risk of future incidents especially because PBA personnel are committed to their jobs and take the PBA mandate (to keep people safe from polar bears), seriously. However, the control focused and reactive nature of this management response offers few long-term solutions. Furthermore, these efforts rely on available funding and on supervisors who view them as a necessary and so are vulnerable to institutional pressures and

constraints, no matter the intentions of local personnel (Yaffee 1997; Ascher 2001). It remains to be seen if this management response is the outcome of what Ascher (2001) describes as “perverse learning” that occurs when management actions are more convenient than valid.

High-risk solutions

A number of solutions suggested by participants did not translate into managerial responses. All of these solutions had one thing in common – they all involved controversial topics, or those that would be difficult to carry out due to jurisdictional barriers and/or a lack of resources. For example, improper garbage management was a prominent problem definition (identified by nine interview participants in 2014), but how garbage was managed remained unchanged after the incident. One reason for this may be that since garbage management is primarily the responsibility of the Town of Churchill, managers from other agencies may have been hesitant to criticize the existing system out of concern that doing so might jeopardize working relationships between managers. As one manager noted, garbage management was clearly a sensitive issue: “when it comes to garbage there's more finger-pointing than there is action on the ground and that's frustrating” (B5). Similarly, problems such as fragmented management responsibilities (i.e. lack of coordination between agencies) would have required significant changes in existing management arrangements to address.

Community Responses

Although community members' responses varied, risk-taking by outsiders was the most widely accepted problem definition. The focus on outsiders as the problem was consistent with the strong insider/outsider dynamic that characterises social relationships in the Churchill community and remote northern communities in general. Attributing polar bear-human conflicts to outsiders functioned to affirm local knowledge about and savvy for coping with polar bears. At the same time, blaming outsiders also disassociated locals from the problem and thus allowed them to continue to behave as they had prior to the incident. Participants in the 2015 workshop noted that residents' risk perceptions were only temporarily heightened following the incident, and two years after the incident, most residents had reverted back to routine behaviours. This cyclical pattern of heightened risk followed by a complacent attitude is not new (Kearney 1989; Struzik 2014). As Kearney (1989: 85) pointed out: “unfortunately it seems to require a serious incident for residents to recognise or remember the dangers of polar bears...”

Overall, most community members showed a relatively high level of support for management responses – particularly with regard to efforts to implement better polar bear safety education. This suggests that management agencies' swift responses successfully reaffirmed stakeholders' trust in agency responsiveness (Siemer et al. 2010). Despite overall satisfaction with the efforts of the PBA programme, some participants were critical of the reactive nature of management solutions. One long-term resident pointed out that solutions

such as increased hazing focused on polar bears who had already entered the community rather than on preventing them from entering in the first place: “Well I just laugh at Resources [Manitoba Conservation], because they are.... running around with their heads cut off but they are not doing anything to implement anything to make it safer!” (B9).

Many participants felt that future bear attacks were inevitable regardless of preventative efforts. While discussing the 2013 attack one resident noted: “Shit happens, no matter what in our life, shit happens. I can walk right outside our door right here and I can get hit by a vehicle.... unfortunately, things happen in our lives. People die, bears die, people get injured, bears get injured – we just have to accept what it is” (A1). This statement is indicative of the fatalistic attitude shared by many Churchill residents – and also by some managers – with regard to polar bear-human conflicts. Kouabenan (1998) defines fatalism as the general belief that events are controlled by external factors and that individual people cannot influence the outcomes of these events. Interestingly, fatalistic comments about the inevitability of a polar bear attack predated the incident – they are equally prominent in both the 2013 and 2014 data sets. This suggested that fatalism was not the result of scepticism over the effectiveness of management responses to the incident, but rather symptomatic of a larger sense of powerlessness felt by Churchill residents. Kouabenan (1998) found that such fatalistic beliefs could incite increases in risk-taking behaviour, which may explain why many Churchill residents seemed unconcerned about the risks posed by polar bears and neglected taking precautions. It is worth noting that fatalistic attitudes are not indicative of a social climate that is proactive in preventing risks (Kouabenan 1998). Hence, management solutions such as bear safety education – which require people to take responsibility for their own safety – might not be effective in the Churchill community.

This observation reveals something important about our assumptions as researchers in this study. In our analysis of this incident, we assume that Churchill residents would want to see the systemic drivers of polar bear-human conflicts addressed. However, what we as researchers interpret as fatalistic attitudes – and therefore as potentially problematic – may be understood differently by Churchill residents. As Kouabenan (1998) points out, cultural values, beliefs and worldviews influence risk perceptions, and Churchill residents may well frame fatalistic responses more positively – as indicative of their ability to accept the risks associated with living around polar bears or as their ability to recognise that some problems are simply unsolvable. Within this framing, Churchill residents may be quite satisfied with existing efforts by management agencies to prevent future polar bear-related incidents. Conversely, Churchill residents may want to see improvements to management actions and fatalistic attitudes may arise from the belief that the magnitude of systemic problems is such that no resolution is possible.

CONCLUSIONS

This research revealed trends in agency and community responses to polar bear-inflicted human injury and examined

which solutions were implemented following an incident of human-wildlife conflict. The Polar Bear Alert Programme is often considered the most intensive and effective program for preventing and mitigating polar bear-human conflicts in the Arctic (Derocher et al. 2013). However, even with such a well-developed bear-human conflict management system the systemic drivers of polar bear-human conflicts in Churchill remain difficult to address – let alone ameliorate. One reason for this is that agency responses to the 2013 incident focused as much on appeasing public expectations and asserting managerial authority and control as they did on actually solving the problem. The problem definitions that gained traction among both residents and managers shaped what management actions were considered acceptable and necessary. Solutions that were implemented addressed proximate drivers of conflicts, focused on immediate concerns, were uncontroversial, and were relatively easy to implement – because they did not require any changes to the existing management system.

Our findings also highlight some barriers to implementing effective solutions to systemic problems that drive conflicts with large carnivores. Specifically, they suggest that agency responses to wildlife related incidents, regardless of whether they align with public expectations, should be carefully evaluated to determine if they actually offer “adequate” solutions. Although other studies have focused on evaluating agency responses to specific human wildlife conflicts (see Cromley 2000; Clark and Rutherford 2005; Mattson and Clark 2014; Clark et al 2014; Vernon et al. 2015) this study differs in its attempt to evaluate whether responses can actually prevent future polar bear-human conflicts from occurring. Although our analysis is context specific, many of the systemic drivers of polar bear-human conflicts (particularly those related to human behaviour), and responses to them discussed here, are widely applicable to the management of human-wildlife conflicts across the globe. For example, risk-taking due to alcohol appeared to be a factor in a publicised polar bear attack caught on video in Chukotka, Russia in 2011 (http://www.huffingtonpost.com/2011/09/09/polar-bear-attack_n_955728.html). Similarly, in Bangladesh, Inskip et al. (2016) found that community members also failed to take precautions against tigers because they held fatalistic beliefs about the risk of being attacked.

Further research is required to determine exactly how adequate solutions for polar bear-human conflicts are defined by the Churchill community – whether this means addressing substantive systemic problems or merely continuing with short-term, proximate responses. Ultimately, Churchill community members are the ones who must be allowed to determine if solutions are deemed adequate/ sufficient or if more needs to be done. That said, it is easy for us as researchers to analyse and identify shortcoming in existing management approaches. We wish to be clear that we are neither critiquing for its’ own sake, nor making moral judgments about any individual or institutional actions. We are both acutely aware of the challenges of coexisting with bears in remote locales and taking responsibility for others’ safety in such circumstances:

the first author has worked for seven seasons as a grizzly bear viewing guide, and the second author was formerly a national park warden who served for three years in Churchill. Given this collective standpoint we offer our findings and conclusions with the explicit intent of assisting the on-going efforts of managers and community members in our study area and elsewhere to improve human safety and conservation outcomes in their daily lives.

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