THE BEAR NECESSITIES OF CONSERVATION MESSAGING:

Exploring how to effectively communicate safety information to people visiting bear country

By

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A Thesis submitted to the School of Graduate Studies

In partial fulfillment of the requirements for the degree of

Master of Science Department of Geography

Memorial University of Newfoundland

May 2018

St. John's, Newfoundland and Labrador

Abstract

Reducing human–bear conflict is an ongoing challenge for wildlife managers. Traditional wildlife education involves a variety of text-based educational material of which little evaluation has been done. The overarching goal of this thesis is to examine current bear aware programs found in North America and suggest some of the reasons why they may be ineffective. Analysis of seven 'bear programs' was conducted and a survey (*n*=279) administered at the Alaska Wildlife Conservation Center during the summer of 2014. Findings suggest that the large number of messages found in bear aware programs explain some of the confusion among participants. Additionally, the research examines how a person's risk perception to a hypothetical bear encounter can be influenced by the medium used in the survey. The research concludes that using experiential education techniques may be more effective at increasing knowledge levels and developing effective emotional responses during bear encounters than traditional educational material.

Dedication

To Kuma, Ueli, Hugo, JB and Patron - the best bears.

Figure 1 Kuma and Glacier by E.Spencer

Acknowledgements

I would like to thank the staff and interns at the Alaska Wildlife Conservation Center for their assistance with the project, The Human Dimensions Team at Memorial University for the continued support and Dr. Stephen Stringham for providing the video footage of the bears. Finally, I would like to thank the Alaska Wildlife Conservation Center, Bear Trust International and Memorial University of Newfoundland Geography Department for funding and logistical support.

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1. Introduction

1.1. Human Dimensions of Bears in North America

There is perhaps no wild animal more prominent in the North American psyche than 'the bear' (Schwartz et al., 2003). 'The bear' is frequently the first animal to which we are introduced, in the form of a cuddly, stuffed toy. When we are children, 'the bear' takes on divergent roles as both the hero in stories, such as Yogi, the funny and mischievous bear from Jellystone Park, or the villain, like the aggressive, red-eyed bear in Disney's 'The Fox and the Hound' who attacks and injures the protagonists. When we are adults, 'the bear' becomes a symbol of freedom, the wild, and the last frontier, and at the same time, we know that 'the bear' is dangerous, to carry weapons to defend ourselves, and that we must deter 'the bear' from coming near our family and our property. The relationship that North Americans have with their largest carnivore is complex and is the product of historical, cultural, and geographic factors. As a result, managing bears in North America is as much about managing the public's perception to them as it is about managing the animals themselves.

Three species of bears exist in North America; the most common, with the largest range is the black bear *(Ursus americanus)*, followed by the elusive brown/grizzly (hereafter referred to as brown) bear *(Ursus arctos)* found in the northern and mountainous regions of the continent (Craighead, 2000, p.42-55). Finally, the king of the arctic, the polar bear (*Ursus maritimus)* inhabits the far north.

Human-bear interactions in North America have evolved over time. The First Nations of North America had considerable respect and fear for bears. Bears were worthy

adversaries as primitive spears and bows and arrows were not particularly effective against the animals (Van Tighem, 2009). Bears were not only fearsome, their physiological similarities to humans made them relatable; referred to as “cousin”, “four-legged human” and “chief’s son” by various Nations; there was a belief that when killed, a bear’s soul would enter an afterlife, like their human counterparts (Brunner, 2007, p.4). The bear played an important role in early North American life by blending the line between human and animal.

The arrival of Europeans to the New World, with their superior weapons, changed the dynamics between people and bears in North America. Suddenly people could fight back effectively against what had been a constant threat to daily life. The combination of killing bears for protection, food, and bounties, as well as the seemingly systematic destruction and appropriation of bear habitat resulted in the decimation of brown bears, and to a lesser degree black bears, leaving them in a fraction of their traditional range by the end of the 19th century (Miller, 1989; Schwartz et al., 2003).

In the mid-20th century, attitudes towards bears once again shifted. The reduction in their population meant that their rareness made them sporting game rather than an inconvenience or threat (Miller, 1989), and the start of the environmental movement created a shift in attitude away from their outright destruction towards a need to conserve the few bears that were left. A 1994 study by Kellert demonstrates this shift in attitude. He asserts “that most wildlife managers have been far too conservative in acknowledging the public’s highly favorable attitudes towards bears”. While some resource-dependent groups such as loggers, livestock producers and miners largely harbor unfavorable views of bears, by 1994 much of the public saw bears as relatable, culturally significant and

intelligent and therefore ascribed to them a high level of value (Kellert, 1994). However, by the time this shift in attitude occurred, brown bears had been extirpated from most of the lower 48 states, as well as eastern and central Canada (Herrero, 2003, pg. 2-4).

The shift in attitudes seen in the mid-20th century created the dual identities of the bear that we see today. Bears became the symbol of wilderness, with many people visiting places such as Yellowstone and Alaska with the hopes of seeing the elusive bear. They also remain an animal to be feared; especially because the number of people using bear habitat for recreation is increasing and with it the number of negative human-bear interactions (Penteriani et al., 2016).

Throughout the evolution of the significance of 'the bear' to North America's people, the process of managing bears has also evolved. Up until the 1950's brown bears were little more than considered dangerous animals that should be removed by the government (Schwartz et al., 2003). A double fatality in Glacier National Park in 1967 and an increase in the number of negative human-bear interactions occurring in national parks meant that by the 1970's bear biologists and wildlife managers feared it would be impossible for bears and humans to peacefully co-exist. It was not until wildlife managers realized that most of these negative encounters were the result of bears who had become food conditioned, that is they associated humans with garbage and food (Herrero et al., 2005), that management styles changed from a reactionary approach of 'deal with problem bears on a case by case basis' (i.e. shoot the bear) to a pro-active approach of 'if we can stop bears from becoming food-conditioned, we can prevent future human-bear conflict'.

The changes in cultural attitudes and the shift in management policies meant that bear populations in North America have stabilized and in some areas, and have started to recover in others. For example, in the 1980's, sightings and encounters with black bears in Nevada were so rare it was believed that there were no black bears residing in the state. However, a study published in 2013 suggests that there is now a bear population numbering in the hundreds, which has returned to its more traditional range (Lackey et al., 2013).

While these are positive signs for future bear populations in North America, there is an additional problem. As bear populations stabilize, or increase, and as humans increasingly recreate in the backcountry, the number of human-bear interactions will likely increase. If the goal of wildlife managers is to manage a stable healthy population of bears, it is essential that public attitudes towards bears remain positive. This can be achieved by reducing negative human-bear interactions. The overarching purpose of this research is to reduce negative human-bear interactions by exploring how emotions and education affect people's reactions towards bear encounters. Understanding the effect of emotions on bear encounters and the effectiveness of education can guide the development of future education tools to prevent negative human-wildlife interactions.

1.2. The Human Dimensions Perspective

The field of human dimensions in wildlife management (HDWM) is focused on reducing human-wildlife conflict by implementing practices which influence the interactions between people and wildlife to produce a preferred outcome (Decker et al., 2012). Throughout the late 20th and early 21st century HDWM research has focused on

how beliefs and attitudes have affected a person's behaviour. Theories such as Vaske's Cognitive Hierarchy (Vaske and Donnelly, 1999) and tools for measurement such as Purdy and Decker's Wildlife Attitude and Value Scale (Purdy and Decker, 1989) have been developed and used to measure participants' attitudes towards wildlife and their level of support for certain wildlife management policies. These theories, such as Vaske's theory of cognitive hierarchy, examine how people's behavior is the result of their values, attitude, beliefs, behavioral intentions, and behaviors. In relation to Vaske's work, other studies examine the relationship between a person's beliefs, attitudes, and their behaviour towards wildlife. These studies are frequently applicable to the real-world because they analyze the support, or lack thereof, of specific management actions and policies. For example, Aipanjiguly, Jacobson and Flamm examined the attitudes of boaters in Florida relating to manatee (Trichechus spp.) conservation (Aipanjiguly et al., 2003). Ericson and Herberlein explored the relationship between experience, knowledge and attitude and the public's reaction to the return of wolves in Sweden (Ericson & Herberlein, 2003). A Miller, Miller and McCollum study conducted in 1992 on Alaskan's attitudes towards hunting, examined a range of attitudinal and belief based variables around bear hunting in Alaska (Miller et al., 1998). Using data from studies like these in the development of wildlife management policies and actions may increase support for those policies from the interest groups involved, or can highlight potential problems with those policies before they arise.

While studying people's beliefs and attitudes towards wildlife has been a focus in HDWM for several decades, understanding the role that emotions play on people's decision making towards wildlife has recently become a new area of examination. A

paper by Jacobs, Vaske and Dubois, published in 2014, examines the relationship between emotions and the support of lethal control of wolves in Sweden and Canada. The study found that emotion accounted for as much as 20% of the variance in answers with regard to lethal control as a management option (Jacobs et al., 2014). A study by Sponarski, Vaske and Bath on people's perceptions of coyotes in Cape Breton examined the role that emotions have on the acceptability of lethal control (Sponarski et al., 2015). They found that as conflicts escalated, emotions towards wildlife became increasingly negative and that the variance in responses regarding lethal control decreased. Wijeratne, Van Dijk, Kirk-Brown and Frost examined how zoo guides use emotions to communicate and educate their visitors about conservation messages. The research touches on the possible problems with emotion based conservation education, such as desensitization to a particular issue if an emotion such as 'guilt' is invoked too frequently during an education program (Wijeratne et al., 2014). A study by Hudenko examines the role that emotion plays in human-wildlife conflict. She argues that factors that lead to rational decision making may be limited or removed during encounters that result in human-wildlife conflict and that additional factors, such as a lack of time, may mean that people rely more heavily on emotions to make decisions during these particular encounters (Hudenko, 2012). Overall these studies show that emotion based research is currently an area of focus in the field of human dimensions of wildlife management.

Most research on emotions has been done through self-report surveys; that is people are asked to describe how they feel about a subject. A paper of particular interest to this study was published in 2012 by Jacobs, Fehres and Campbell. It was a review of methods and tools often used for assessing emotion. Of particular interest to this study

was their assessment of the biases inherent in self-report surveys. These biases include mental fatigue from excess questions, social desirability biases and biases from a participant's inability to verbalize specific emotion. There are also biases created from the recall of past experiences or expectations of future ones. In addition, participants to self-report surveys are also unable to self-report on emotions which remain unconscious and unacknowledged by themselves (Jacobs et al., 2012). This means that self-report surveys may not be able to properly capture emotional responses, especially those that are unexpected and made under stress such as unexpected bear encounter.

1.3. Experiential and Outdoor Education

1.3.1. Traditional Education

Education about nature from institutions, parks, government and advocacy groups frequently comes in the form of publications, websites, videos, brochures, ranger presentations and displays at ranger stations, trailhead signs, and interpretive displays (Gunderson et al., 2000). These educational tools are used to educate people about a variety of topics such as trail information, camping information, weather, and wildlife safety information. While this information is often readily available to visitors of parks and recreational areas, frequently this information is only seen once, received a long time before the knowledge needs to be used, and is provided "in a setting very different from the setting where it will be used" (Zinn et al., 2008). Other factors such as the mental fatigue of having too many safety messages, of processing conflicting messages, of overly complex messages and messages which are out of context (i.e. some bear safety messaging applies to black bears only and some to brown bears only) exacerbates the

ability of people to remember these messages. The long duration before use, the lack of repetition, and the fact that the information is usually taught or seen in a safe setting, such as a visitor information booth, means that retention of the information and the ability to use the information to act quickly in a comparatively dangerous wilderness situation is severely limited.

Much time and money has been spent on the design and application of wildlife safety education. Unfortunately, there has been little evaluation of the effectiveness of these education programs (Gunderson et al., 2000). The few evaluations that have occurred have suggested that they are not an effective method of changing people's behaviour and attitudes toward wildlife. Studies show that overall traditional wildlife educational programs have only a minor influence on people's knowledge, attitudes and behavior toward wildlife (Dunn et al., 2008; Gore et al., 2006; Cole et al., 1997).

In contrast to traditional educational messages using a passive medium (i.e. a brochure or sign), wildlife centres, zoos, and interactive programs in parks, allow people to see and experience wildlife actively. In the past, zoos were a place to view animals for entertainment but changing attitudes towards wildlife and large carnivores (Zimmermann et al., 2001) has meant that there has been a shift from people thinking about wildlife as utilitarian, to appreciating for its intrinsic and aesthetic value. As a result, there has been a growing pressure for zoos, wildlife parks and state and national parks to focus on conservation, research and education (Wijeratne et al., 2014). Several studies have investigated if educational messages in zoos and wildlife parks affect a person's behaviour and attitude. These studies have found that messages conveyed through multiple mediums, and which make use of multiple learning styles, are the most effective

(Weiler and Smith, 2009). Another study suggests that people who attend multiple interactive activities at zoos, national parks and other protected areas show the largest increases in knowledge and awareness of conservation issues (Madin and Fenton, 2004). These studies suggest wildlife education can be effective with well-designed interactive messages and programs that engage people in learning about wildlife at zoos, wildlife centers and parks.

1.3.2. Experiential Learning

The concept of interactive learning, or experiential education, learning 'to do', (McKenzie, 2013) has its roots in the 1970's, with programs such as Outward Bound and the National Outdoor Leadership Schools. These programs were founded on the theory that 'learning by doing' was a more effective method of teaching outdoor and leadership based skills than the conventional classroom and textbook (Smith et al., 2011). There are mixed opinions on the effectiveness of this theory. A study by Ballantyne, Packer and Sutherland demonstrated that different wildlife based tours and attraction could encourage people to conserve animals by educating participants on the conservation issues around that animal and that encouraging people to reflect on their experiences reinforced new and old feelings of conservation (Ballantyne et al., 2011). Similarly, a study by Millenbah and Millspaugh examined the use of experiential education in biology classes. They showed that students' ability to learn was improved by doing hands-on activities and through self- reflection (Millenbah & Millspaugh, 2003). In contrast to these studies which demonstrate the effectiveness of experiential education, a study by Haluza-DeLay suggests that short-term emersion into natural settings may not cause long-term changes in attitudes towards nature (Haluza-DeLay, 2001). As well, a study by

Waitt and Cook suggested that eco-tourist ventures may create only a superficial integration with nature for participants, where people appreciate the landscape visually, without actually becoming involved with their subject (Waitt & Cook, 2007).

While experiential learning was founded in practice, a body of literature has been generated as research has focused on the theories regarding how and why it is effective. Kolb's cyclical learning model is one of the key theories used in the design of modern experiential learning (Smith et al., 2011).

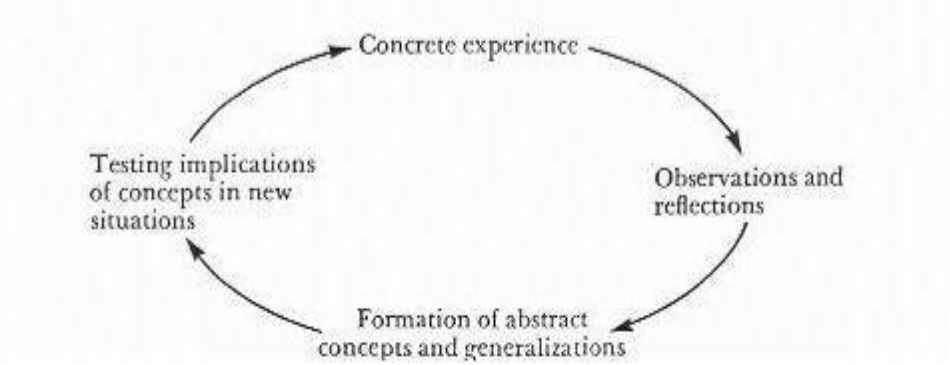

Figure 2. Kolb's Experiential Learning Model. Kolb, 1981, p.236

Kolb's experiential learning cycle is a four-step cycle where a student's experience with the subject is followed by observation and reflection on that experience. The student then uses those reflections to develop an idea or theory. The student continues by testing the new theory and the resulting new experience starts the cycle again (Kolb, 2014; Kolb, 1981, p.235-236). Using this concept in the development of bear safety education has both challenges and advantages. Experiential outdoor education can teach people how to act in high stress and dangerous situations by creating simulations of those events in a safe setting (Sponarski et al., 2016). For example, avalanche safety training involves taking part in a mock avalanche rescue where participants find and

excavate buried “bodies”. This allows participants to practice technically difficult skills, such as using avalanche beacons, but also skills such as leadership and communication that are needed in stressful and time sensitive situations. Similarly, Sponarski’s research on the coyote (*Canis latrans*) in Cape Breton, Nova Scotia involved simulating a coyote attack that used a mock coyote which allowed participants to practice self-defence (Sponarski et al., 2016). Bear encounters involve similar danger, stress levels and the need to make quick decisions. Is it possible to create a scenario where people can practice bear encounter skills without the danger?

1.4. Conceptual Framework

The conceptual framework for this thesis comes from previous research in the field of Human Dimensions of Wildlife Management. Herrero’s extensive examination of bear attacks and the common factors and actions taken by the people involved in those attacks was used to understand some of the frequent mistakes people make when people encounter bears (Herrero, 2007). Gore’s work on perceived risk and the variables used to measure it, is used to analyze changing emotional responses to varying levels of risk in different hypothetical situations (Gore et al., 2009; Gore 2007). Gore’s work involves the analysis of several emotional variables, primarily fear. In addition to Gore’s work, Jacobs’ work on emotions and wildlife, primarily the research about the role that emotions have on people’s behavior (Jacobs, 2012), was used to analyze the reactions that participants had to increasingly risky hypothetical scenarios.

The design of the future educational direction comes from the field of experiential and outdoor education. It is based around the concept that learning physical and outdoor

skills are learned best ‘by doing’ rather than traditional classroom techniques (Kolb, 1981, p.235- 236).

1.5. Black and Brown Bears: Characteristics, Distribution and Attacks

1.5.1. Black Bear (*Ursus americanus*)

The black bear is North America’s smallest bear, typically weighing between 40-300 kilograms (88lbs-661lbs) (Feldhamer et al., 2003). It is found across much of North America (Garshelis et al, 2008).

Figure 3. The Range of the Black Bear (Ursus americanus). Adapted from IUCN Red List 2008

The black bear is rarely aggressive, having evolved to live in the forested regions of North America (Taylor, 2006), its small size relative to its historical predators (the saber-tooth tiger, and the North American lion) has meant it has developed a flight, rather

than fight, response to most encounters. Its rounded claws have made it proficient at climbing trees to quickly escape from danger. While there are 16 subspecies of black bear in North America they are generally indistinguishable to the general public. The color which ranges from black to light blond (as well as a few Kermode or 'spirit' bear, which are white due to a recessive genetic trait that they carry (Craighead, 2000, p. 75)), is not an indicator of subspecies (Taylor, 2006, p. 24).

Records show that 63 people were killed in black bear attacks from 1900 – 2009 (Herrero et al., 2011). The worst black bear attack occurred in Algonquin National Park in 1978. In an extremely rare incident of predation, three teenage boys were killed in a single incident by a large, male black bear. Later, the bear hid two of the bodies in the forest as a food cache suggesting that the attack was motivated by a need for food (Kruuk, 2002, p.67).

Unfortunately, trends in bear attacks are difficult to follow. While individual agencies such as parks, municipalities, states and provinces may have their own databases of bear related incidences there is no comprehensive database. In addition, databases maintained by government and other agencies are often not readily available for examination, keep data is that is not comparable, are incomplete and/or disorganised. This makes it challenging to examine trends in the numbers of incidences, or to find recent accurate data, or even to make estimations on the number of attacks and close encounters that have occurred in North America.

1.5.2. Brown Bear (*Ursus arctos*)

Relative to black bears, the population of North American brown bears is much smaller with estimates in the U.S. (mainly in Alaska) of around 33,000 brown bears and of 25,000 bears in Canada (McLellan et al., 2017). Even though the North American population is small and the range is a fraction of what it used to be, it is the bear species with the largest range around the world. It is found across parts of northern North America, Asia and Europe as well as a few small, usually mountainous regions, in the mid-latitudes. Classified by the IUCN as an animal of least concern, its population remains large and stable (McLellan et al., 2017). While globally the brown bear populations remain stable, in North America it has seen a significant decline in its

traditional range (McLellan et al., 2008).

Figure 4. North American range of the brown bear (Ursus arctos). Adapted from the IUCN Red List, 2008

Between two and three subspecies of brown bear are found in North America. The Kodiak brown bear (*Ursus arctos middendorffi*) is recognized as a distinct subspecies (Craighead, 2000, p.34). The Kodiak brown bear is found in Alaska on Kodiak Island and the surrounding coastal areas. The relatively mild climate combined with the salmon rich rivers makes this the largest brown bear with males reaching up to 680kg (1500lbs) (Scott, 2001, p.18). Although the division is debated among bear biologists, the remaining North American brown bears are frequently divided into an additional two geographical subspecies: the coastal brown bear and the more widely known grizzly bear. While the

genetic differences between these bears is still under discussion, the geographic distribution of these bears varies. The coastal brown bear is found along Alaska's coast. It is larger than the grizzly and usually found in higher densities due to the proximity of salmon rich rivers. The grizzly, the smallest of the North American brown bears, is found further inland and further south. It is smaller than its coastal counterparts due to the lack of food inland (no salmon rivers) and needs a larger individual territory in order to find the small amount of food available. It is frequently thought of as a "dangerous" bear due to aggressive and territorial nature and it is the best known brown bear due to its more southerly range and the higher frequency with which people encounter it (Scott, 2001; Craighead, 2000).

In Herrero's book 'Bear Attacks', Herrero examines 126 encounters that resulted in injuries to people caused by brown bears from 1900-1979 in National Parks (Herrero, 2003, p.6). Of these incidents he concludes that the most common factors leading to attacks are trails and campgrounds located in areas frequented by bears, overly enthusiastic photographers, people being distracted and unaware of their surroundings while recreating, and bears becoming confident and aggressive due to easy access to food and garbage (Herrero, 2003, p.7).

Figure 5. Patron, a coastal brown bear at the Alaska Wildlife Conservation Center ©E. Spencer

1.6. Research Objectives

The overarching goal of this thesis is to examine the role that emotion and education play on how people act during bear encounters. The specific objectives of this research are:

- To explore the role that different media (video and written) have on people's perceived emotions during bear encounters.
- To examine the effectiveness of bear safety education messages by studying the consistency and wording of the bear safety programs found around North America.
- To use the data gathered to design an experiential educational program to provide visitors to the AWCC with bear safety information.

1.7. Study Area

Alaska has the majority of North American brown bears estimated at 33,000 brown bears (McLellan et al., 2017). While estimations are not as accurate for black bears, Alaska is estimated to have between 100,000 - 200,000 (Garshelis et al., 2008). As a result, both species of bears are frequently seen by visitors and locals in Alaska in both rural and urban environments.

This research was completed at the Alaska Wildlife Conservation Center (AWCC), located an hour's drive outside of Anchorage south along the Seward Highway (60.823307,-148.9884101). The AWCC is "dedicated to conservation, education, and quality animal care of Alaska's wildlife" (AWCC main page, 2015). The Center has over 185,000 visitors annually from Alaska, North America and around the world (Asia and Europe primarily). While some visitors are making only brief stops to Alaska on a one or two-day cruise tours, many spend extended periods of time in Alaska.

The Center is home to 16 species of Alaskan animals including several bears (three black bears, two coastal brown bears and a grizzly). These bears came to the center as rescued cubs which either lost parents, were food-conditioned, or were injured. They all are permanently housed within the Center's 7.3 hectares (18 acres) of bear enclosures that serve as a main attraction to visitors.

The AWCC recently received a grant to develop the bear enclosure into a more visitor friendly experience including a newly built 'bear boardwalk' which traverses the bear enclosure allowing people to see and photograph the bears without a fence in between. Additionally, an amphitheatre allows the people to view bears safely and easily.

Future plans include the expansion of the viewing space, which will give people a better, unobstructed view across the enclosure.

Figure 6. The new bear boardwalk viewing area at the Alaska Wildlife Conservation Center

Bear viewing and wildlife photography are an important part of Alaskan tourism and an important contribution to the Alaskan economy. Tourists are willing to spend more on viewing bears than any other species of wildlife (Miller et al., 1998). Aside from the revenue associated with wildlife tourism, the bear is used to symbolize the Alaskan wilderness. Movies based in Alaska feature bears prominently, sports teams, such as the Alaska Aces and University of Alaska Nanooks, which use a bear as their mascot. Bears are also used by various industries to represent wilderness (Stoddart, 2011). In addition bears are important to Aboriginal people in Alaska. Wildlife managers' work with

Aboriginal nations to ensure that traditions surrounding bear hunting are respected (Spaeder, 2005). There is perhaps nowhere in the world where the dual identities of 'The Bear' are more obvious than in Alaska. As a result, wildlife education programs need to find a balance between emphasizing the importance of bears as a wilderness symbol and as a potentially dangerous animal.

1.8. Outline of Papers

The literature presented in Chapters 2 and 3 is synthesized to achieve the primary goal of this thesis which is to reduce human-bear conflict through by understanding the role that education and emotions have on human-bear interactions. The first objective (presented in Chapter 2) is to explore the relationship between emotion and perceived risk in a study about how different media can be used to measure a person's perception of risk during a bear encounter. This study examines the effectiveness of a currently used methodology in the HDWM field, primarily the effectiveness of self-report surveys. The second study (Chapter 3) examines what bear-related educational messages exist in North America and assesses their strengths and weaknesses. Based on the outcomes from this examination it hypothesize as to how these messages may be contributing to some bear-related myths and misinformation currently found in North America. Bringing both these papers together Appendix B describes an alternative educational tool for bear safety messaging. The two papers examine how North American's relate to their largest carnivore, what elements of bear education are effective and not effective and what factors and emotions contribute to people's actions when they encounter a bear in the wild.

Chapter 2 is a paper to be submitted to Human Dimensions of Wildlife – An International Journal, with the title: "Video versus Written Surveys: Does survey medium affect perceptions of risk to hypothetical situations?" Human Dimensions of Wildlife – An International Journal is a peer-reviewed bi-monthly journal that examines the social considerations in fisheries and wildlife management. It has a theoretical focus with the intent that the content can be used in a practical application by people in the field of HDWM.

The paper submitted is an examination of the effectiveness of one of the common and currently used methodologies in HDWM. Written questionnaires are frequently used in the field of HDWM to examine a subject's emotional response to wildlife. This paper examines how different media (written and video) can produce different results in this type of survey. Subjects were shown either a written description of bear encounter or a video of the same encounter and then asked to rate their emotional response to that hypothetical encounter. The paper examines the differences in mean scores and variance between the two groups.

Chapter 3 is a paper that will be submitted to Ursus, a journal published by the International Association for Bear Research and Management. Ursus is a biannual peer-reviewed journal about topics related to bears. It is a publication of the International Association for Bear Research and Management. The journal is targeted towards individuals in the field of wildlife management. The paper to be submitted to Ursus is titled: "Two hundred and Eighty ways to Stay Safe in Bear Country: An Analysis of Bear Safety Messages in North America". The paper examines seven bear aware programs

found across North America. It examines what messages are delivered in each program, if they are consistent across North America, and if they are not, what might be the causes and the consequences of different messages in different regions.

1.9. Relevance of Research

As people increasingly use the backcountry for recreational activities, the number of human-bear encounters increases (Penteriani et al., 2016). It is important that these encounters have positive outcomes in order to prevent both human and bear injuries, the unnecessary loss of life, and to create and maintain positive attitudes towards bears and their conservation. While Alaska has a reasonably stable bear population, the regulations on hunting and shooting bears are fairly liberal. Alaskans are allowed to shoot a bear "in defence of life or property". As a result of this policy there has been over a thousand bear deaths during the 10 year period of 1986-1996 caused by negative human-bear interactions (Miller and Tutterrow, 1999). A more effective educational campaign could help reduce those numbers. In other areas in North America, bear hunting is more restricted but attacks foster a low tolerance for bears and frequently result in lethal management actions. Given what is at stake for bear-human well-being all bear safety educational materials in North America warrant ongoing evaluations. An initial examination of the messages found in those programs can reveal some of the potential problems. Many states, provinces and parks have wildlife education programs, however traditional methods of communicating knowledge through wildlife education programs have not been sufficiently evaluated and the few studies examining the effectiveness of these programs have yielded results that speak of only a modest success (Gore et al.,

2006; Cole et al., 1997). Looking for alternative teaching methods may increase success rates.

The field of HDWM is still a reasonably new field emerging within the 1970s. Trying to predict people's actions is challenging, if not more so, than trying to predict the actions of animals. However, in order to reduce negative human-wildlife interactions and in order to develop effective management plans and educational tools it is important to understand what variables contribute to people's decision making processes. The survey tools which are currently used for research provide some insight as to how people feel about a topic, but they are rarely analysed and evaluated for their ability to measure a person's hidden emotional responses. In a broader context there is a constantly changing and developing relationship between North Americans and wildlife. From men redefining their masculinity through adapting frontier activates such as hunting (Anahita and Mix, 2006), to members of the new age movement who place importance on a spiritual connection with nature (Bulbeck, 2005), it is important to understand the role that bears currently have with different groups of the North American public in order to manage them sustainably.

1.10. Data Collection

The data for the study were collected from May to September 2014 at the Alaska Wildlife Conservation Center. To achieve the objectives of the papers, the data were collected using iPads which enabled the surveyor to show both written descriptions and videos of bear encounters. The surveyors were positioned at the entrance to the bear

boardwalk. Visitors to the center were approached as they entered the boardwalk and asked to participate. The questionnaire took between 15-30 minutes.

The questionnaire was broken down into three parts:

1) Participants were asked to identify the bear species in each photograph:

a) A black colored black bear in a tree;

b) A brown colored brown bear;

c) A brown bear by its profile.

Figure 7. From left to right 1) A black bear 2) A cinnamon colored black bear 3) A silhouette of a brown bear

2) Participants were shown three short video clips **or** had three situations described to them:

a) The first was a bear eating berries;

b) The second was a bear walking towards the participant; and

c) The third was a bear running towards the participant.

Following each video clip or description, and using a seven point scale, participants were asked about their perceived risk of the situation using three indicators:

a) Their feeling of fear;

b) Their feeling of likeliness that a situation like that could occur; and

c) Their sense of control at preventing it from happening.

Using a set of possible ‘action’ options (i.e. run away, stay still, wave and yell at the bear) and a five point scale, additional questions were asked about what participants thought *they would do* in each situation. Using the same ‘action’ options participants were asked what they thought *they should do* in each situation.

3) Finally demographics were collected including:

a) Age;

b) Sex;

c) Geographic location of where they lived;

d) The frequency with which they encountered bears;

e) Recreational habits.

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2. Video versus Written Surveys: Does survey medium affect perceptions of risk to hypothetical situations?

2.1. Abstract

Written questionnaires are frequently used in the field of Human Dimensions of Wildlife research to examine a subject's emotional response to wildlife. This paper examines how different media (written and video) can produce different results in this type of survey. Subjects were shown either a written description of bear encounter or a video of the same encounter and then asked to rate their emotional response to that hypothetical encounter. Three variables that measure perceived risk: fear of the event, the perceived likelihood that that event might occur, and the perceived feeling of control that a person would have during that event were measured. The paper examines the differences in mean scores and variance between the two groups and concludes that certain variables in certain scenarios are affected by medium while others are not.

2.2. Introduction

Bear encounters generate a range of emotions and actions in people. Some people freeze, some people stay calm and some people run away. Being able to predict how people will act is important so that wildlife managers can tailor education programs for different responses. Currently these actions are measured and recorded through self-report surveys where participants are asked to describe their response to hypothetical situations. These hypothetical situations are typically described to the participant either in writing or verbally, by the researcher conducting the survey. However with the invention of new technology there is the possibility of presenting participants with visual and auditory

imagery for these hypothetical situations which might elicit different responses than that of traditional survey techniques.

One of the problems with measuring self-reported actions to hypothetical situations is that the participants themselves might be uncertain as to the action they will take when in a dangerous or stressful situation. The second problem is that when faced with a real-life version of the hypothetical situation, participants might act in a way they did not expect or predict. Quantifying emotional and behavioural responses to dangerous situations is challenging but in order to design effective educational programs for large groups of people, it is needed. Psychological studies have examined the relationship between attitude, behavioural intentions and behaviour (Karki & Hubacek, 2015; Shrestha et al, 2012; Hughes et al., 2009; Carlos et al., 2009; Azjen, 1991). These authors have discovered that while general trends can be identified in large groups, measuring the intended behaviour of small groups or individuals is extremely challenging (Jacobs et al., 2012; Azjen, 1991). Unfortunately, it is the behavior of these small groups or outlying individuals, who do not follow the larger group behaviours, which have the potential to act unexpectedly during a bear encounter. While the science of being able to predict an individual's actions by measuring their intended actions is still not precise, studies (Sponarski et al., 2015; Campbell, 2012; Johansson et al., 2012; Kubo & Shoji, 2014; Jacobs et al., 2014), in the field of Human Dimensions of Wildlife Management (HDWM) attempt to quantify intended behaviour and emotional responses as a tool for understanding and developing effective and successful wildlife management programs and policies.

The field of HDWM includes studies that focus on understanding human attitudes and behaviour towards wildlife in order to reduce human-wildlife conflict (Baruch-Mordo et al., 2009; Manfredo et al., 1998). There are numerous methods used to gather data on human behaviour, attitudes and beliefs toward wildlife. The techniques commonly used to gather qualitative data on people's emotional and behavioural responses to wildlife encounters and wildlife management policies include: unstructured face to face interviews, telephone interviews, focus groups and open houses. Conversely, the most commonly used tool to gather quantifiable emotional and behavioural responses to hypothetical situations and possible management policies is a survey in the form of a written questionnaire. Within this research instrument, participants are usually asked to respond to items that provide, in a written format, their emotions and behavioural intentions toward a described situation. For example, “in situation x, I would do y” or “in situation x, I would feel z”. This technique has been used in numerous studies (Purdy & Decker, 1989; Dubois & Fraser, 2013). New wireless and portable technology such as devices like iPads, tablets and smartphones have allowed written questionnaires to be re-designed. Therefore, surveys are no longer limited to written formats and instead can include high-quality photographs, audio, video and inter-active questions. In this paper, we compare how people’s emotional responses relating to a video of situation x differ from people’s emotional response to a written description of situation x.

2.3. Self-Reported Emotion based Surveys

Rosoff, John and Prager’s study on epidemic outbreaks found that as the intensity of a hypothetical situation increased so did the perceived risk of the situation and the

intended avoidance behaviour of the participants (Rosoff et al., 2012). However, research has also documented that the behavior to a real situation is not mirrored by self-reported emotion based studies. Multiple factors including; mental fatigue (Heerwegh & Loosveldt, 2008), social desirability bias, feedback bias, and the anticipation of future, or recall of past events, creates inconsistencies between behavioural intentions and actual behaviour (Kvale, 2006; Jacobs et al., 2012; Vannieuwenhuyze et al., 2011). Finally, self-reports are not able to capture emotional responses that remain unconscious to the participant (Jacobs et al., 2012).

While the mixed mode survey has become increasingly common (Vannieuwenhuyze et al., 2011), the large majority of these self-reported emotion-based studies currently use one medium (written) to describe a hypothetical situation. These studies are delivered in one of two ways; it is visually presented to the participant by being written on paper or the respondent is verbally presented with the situation by a researcher. In both cases the participant is asked to 'imagine' the hypothetical situation and their response to it, based on a series of words.

Recent improvements in technology allow for new media to be used. Video of hypothetical situations helps to reduce the 'imagination' needed by participants, reducing their projections of their past experiences or anticipation of future events onto the hypothetical situation. Similarly, physically seeing the event allows for the potential capture of unconscious emotional responses that would not be elicited by a worded description.

2.4. The use of various survey media

The use of surveys to gather information has been studied in many fields including HDWM. Research has focussed on the effectiveness, the advantages and the disadvantages of different survey media that have emerged as the result of rapidly changing technology. Current trends in research design focus on the differences in results between online, e-mail, mail out and telephone surveys (Hox & Leeuw, 1994; Duda & Nobile, 2010; Graefe et al., 2011). For example, Irvine, Drew and Sainsbury in a 2012 study focused on the difference between semi-structured telephone interviews and face-to-face interviews, documenting that different survey techniques can result in different results and emotional responses from people (Irvine et al., 2012). As technology continues to change, different techniques for gathering information have also appeared (Schaeffer & Dykema, 2011). The recent phenomenon of social media and smart phones, which have both a camera and an internet connection, has allowed data to be gathered using images and videos of people's experiences, yielding data that would have been extremely difficult to gather a decade ago.

While the use of one survey medium in comparison to another has been examined (Schaeffer and Dykema, 2011), there are only a few studies that look at the differences between hypothetical situations that are communicated to participants as video or worded descriptions. A study published in 2003 about the differences in reported asthma cases amongst 13-14 year olds used a comparative technique that allowed researchers to measure the differences in results between video and written descriptions. Researchers noticed that videos reduced confusion about word choice in surveys and allowed different cultures and social groups to understand a description, even if there were language barriers (Crane et al., 2003). A second study, published in 2014, used a video survey to

study pedestrian preferences with respect to roundabouts. It found that using video allowed participants to more easily understand certain variables (Perdomo et al., 2014). While these studies examine how people cognitively interpret videos differently from worded description, there has been little research done to examine how people's emotional reactions to video might be different from a worded description, especially regarding wildlife issues.

2.5. Hypotheses

Three factors were chosen to be analyzed in this study; fear, control and likelihood. These factors were adopted from Gore's research on perceived risks of bear attacks in Adirondack Park in New York State (Gore et al., 2007). She identified nine factors affecting a person's perceived risk of a bear attack occurring in the park: dread, environment, trust, responsiveness, agents, seriousness, frequency, volition and control. Three of the identified factors were chosen for the study: 'dread' (called 'Fear' in this study), the "feelings of distress, worry, fear, apathy, etc. regarding the effects of exposure". 'Control' (called 'Control') defined as the sense of "how much command an individual perceives over personally preventing exposure" and 'frequency' (called Likelihood) or how 'chronic an individual feels the effects of exposure to be" (Gore et al., 2007).

Using these three factors, we examined if showing a video of a hypothetical bear encounter creates a different perception of risk than describing that situation in a written format. The expectation is there will be less variance in these three factors that contribute to a person's perceived risk of a situation when a video is shown in comparison to a

written description of the scenario (Hypotheses 1, 2 and 3). In addition, those respondents who view the video will have more fear, perceive more likelihood of risk and be less likely to feel in control than those who respond to the written format (Hypotheses 4, 5 and 6).

- H1 Individuals who view a video are more likely to show less variability in their response to fear than those responding to the written description.
- H2 Individuals who view a video are more likely to show less variability in their responses to likelihood than those responding to the written description.
- H3 Individuals who view a video are more likely to show less variability in their response to control than those responding to the written description
- H4 Individuals who view a video are more likely to respond with a higher level of fear than those responding to a written description
- H5 Individuals who view a video are more likely to perceive the situation as more likely than those responding to a written description
- H6 Individuals who view a video are more likely to respond with a lower level of control than those responding to a written situation

2.6. Methods

An intercept survey was implemented at the Alaska Wildlife Conservation Center (AWCC) throughout the summer of 2014. Respondents were selected randomly from the visitors, who were visiting the bear enclosure. This research was part of a larger study examining the bear safety-related knowledge of visitors to the center. The questionnaire was designed to test the difference of a video versus worded descriptions in understanding behavioural intentions regarding potential human-bear interactions.

Participants were approached at the bear enclosure to complete an on-site, face-to-face survey using a random sampling technique (Vaske, 2008, p.183). Subsequently, the next person to enter the bear viewing area, once a survey was completed, was approached

for the next survey. Tour groups were excluded due to their limited time; and only people fluent in English and over the age of 19 were included in the study. The entire questionnaire was conducted on iPads. The interviewer held the iPad allowing the participants to view the screen while orally asking the questions at the same time as the participants could see them. The items were based around three different situations that the participant either saw as a worded description or as a video clip. The video clips were short, between 2 to 5 seconds in length. The participants were then asked a series of questions about their perceived risk of the situation, their behavioural intentions in that situation and their knowledge about recommended appropriate action in that situation. Additional information was subsequently gathered on the demographics of the participants.

2.6.1. The three situations

The three situations shown to participants can be described as:

Situation1-Written: While hiking by yourself in the forest, you see a brown bear eating berries 60 feet (18 meters) ahead of you, the bear stops eating and looks at you.

Situation 1-Movie: While hiking by yourself in the forest, 60 feet (18 meters) ahead of you, you see... (Figure 8)

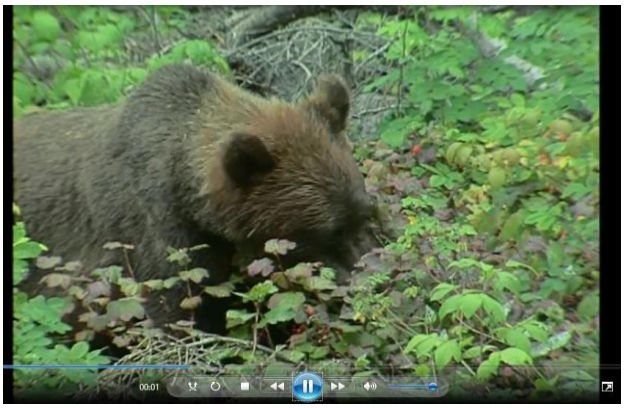

Figure 8. Video of Bear eating berries

Situation 2-Written: While hiking by yourself in the forest, you see a brown bear walking towards you.

Situation 2-Movie: While hiking by yourself in the forest, you see... (Figure 9)

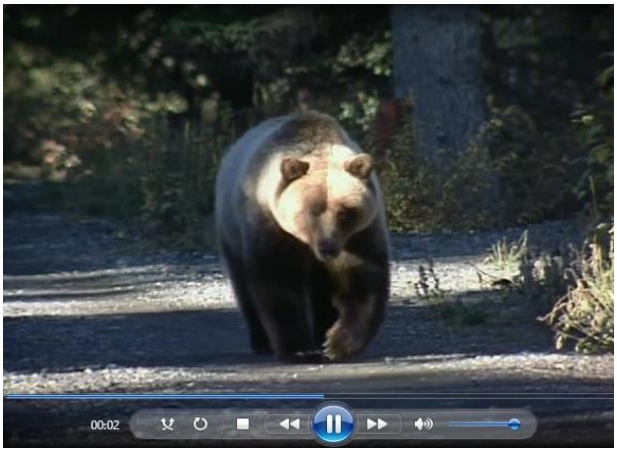

Figure 9. Video of bear walking towards you

Situation 3-Written: While hiking by yourself in the forest, you see a brown bear running towards you.

Situation 3-Movie: While hiking by yourself in the forest, you see... (Figure 10)

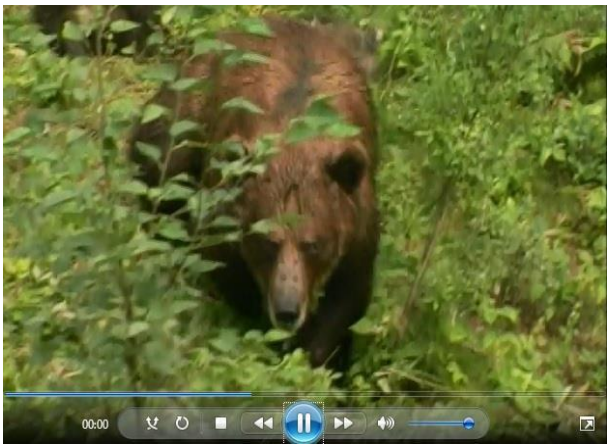

Figure 10. Video of a Bear running towards you

Following the presentation of each scenario, participants were asked a series of questions including three based around perceived risk:

1. How afraid would you be in that situation?
2. How likely do you think that situation is?
3. How much control do you feel you have at preventing the situation from happening?

The participants were asked to respond to these questions using a seven point scale ranging from Very Unafraid (-3) to Very Afraid (3), Very Unlikely (-3) to Very Likely (3) and No Control (-3) to Complete Control (3).

An independent sample t-test was done to check for the significant difference between the means of the three different factors, across the three different situations. Situation 1 is comprised of the variables Fear1, Likelihood1 and Control1, Situation2 is comprised of the variables Fear2, Likelihood2 and Control2 and Situation3 is comprised of the variables Fear3, Likelihood3 and Control3. Cohen's d was used to check for effect

size (Vaske, 2008). Finally, the potential for conflict index (PCI_2) was used to visually examine the variance between written and video survey results (Vaske, 2008).

2.7. Results

Of the 327 individuals approached, 287 agreed to complete the questionnaire (88% response rate). Of the 287 participants, 138 (48.1%) were shown the written situation and 149 (51.9%) were shown the video clips.

2.7.1. Differences in Fear, Likelihood and Control

Cohen's D was used to measure effect size (Figure 11).

	f value	Sig	Cohen's D	Conclusions
Fear 1	5.888	0.016<0.05	0.33	A minimal to typical relationship
Fear 2	5.56	0.019<0.05	0.4	
Fear 3	11.085	0.001<0.05	0.23	
Likelihood1	0.27	0.604>0.05	0.01	
Likelihood2	0.399	0.528>0.05	0.27	A minimal to typical relationship
Likelihood3	0.394	0.531>0.05	0.27	
Control1	1.315	0.252>0.05	0.08	A minimal to typical relationship
Control2	0.356	0.551>0.05	0.17	
Control3	0.003	0.958>0.05	0.002	

Figure 11. Measurement of Effect Size

An Independent sample t-test was used (*n*=287) to compare the means of the variables Fear, Likelihood and Control across Situation1, Situation2 and Situation3 (Figure 12).The t-tests demonstrate that H4 and H5 are true in some situations but not all, and that H6 is false.

Variable	Written $\bar{x}$	Movie $\bar{x}$	t value	p value	Conclusions
Fear1	.57	1.13	-2.789	.016	Significant difference between video clip and written surveys for Fear1 and Fear2 but not Fear3
Fear2	1.75	2.20	-3.299	.019	
Fear3	2.66	2.83	-1.821	.07	
Likelihood1	1	.99	.075	.940	No significant difference for Likelihood1 but significant difference for Likelihood2 and Likelihood3
Likelihood2	.37	.78	-2.279	.023	
Likelihood3	-.21	.23	-2.244	.026	
Control1	.14	-.01	.666	.506	No significant difference for control between any of the three variables for the written and video clip surveys
Control2	.15	.45	-1.407	.161	
Control3	.69	.67	.125	.901	

Figure 12. T-test

The t-tests indicate that there was a difference between participants who viewed the video clips and those that saw the written description in some of the perceived risk variables but not in others. In the variable of fear, the overall mean values for the people who viewed the video clips were higher (more afraid) than those who saw the written description, although the t-test indicated that only in Fear1 (t=-2.789, p=0.016) and Fear2 (t=-3.299, p=0.019) was there a significant difference.

The fear variable shows a difference between people who viewed the video clips and the people who saw the written description in Fear1 and Fear2, but not Fear3. In contrast the t-test indicated a difference between the groups in Likelihood2 and Likelihood3, but not in Likelihood1. As the situations escalated, people increasingly thought that the situation was less likely to happen to them. In situation1 (Likelihood1) the mean values of both the written and video clips were almost identical (Written $\bar{x}$=1, Movie $\bar{x}$=0.99) and no significant difference (t=.075, p=0.94) was found. As the situations escalated, the participants who had viewed the video clips perceive the likelihood of the event to be higher than the individuals who saw the written description. In Likelihood 2 (video$\bar{x}$=0.78 and written$\bar{x}$=0.37) and a significant difference between the two groups was noted (t= -2.279, p=0.023). A similar difference was seen between the two groups in Likelihood3 (video$\bar{x}$=0.23 and written$\bar{x}$=-0.21, t=-2.244, p=0.026)

In Control1, Control2 and Control3 no significant difference was found. All of the average means remained between +1 and -1 on the scale and significant values of the t-tests were (Control1 t=0.66, p=0.506, Control2 t=-1.407, p=0.161, and Control3 t=0.125, p=0.901). This suggests that while the medium used in a survey can affect certain factors that make up a person's perceived risk of a situation, it has very little influence over a person's sense of control at preventing a situation.

Vaske's Potential for Conflict Index$_2$ (PCI_2) was used to examine the variability within the results (Vaske, 2008). To examine the validity of H1, H2 and H3 we use PCI_2. The PCI_2 values show both an increase in fear with participants who watched the short video clip and a decrease in variance. In the case of both Fear1 and Fear2 (Figure 13) we

see a statistically significant difference between the two groups. For Fear1 d=2.69 and for Fear2 d=2.11 therefore the difference is statistically significant at p<.05. For Fear3 d=1.88 and therefore not a significant difference between the groups. This lack of variability, may be yet again attributed to the fact that in both groups the vast majority of people responded "very afraid" to Situation3 and it is possible the scale did not capture the true variation between the two groups.

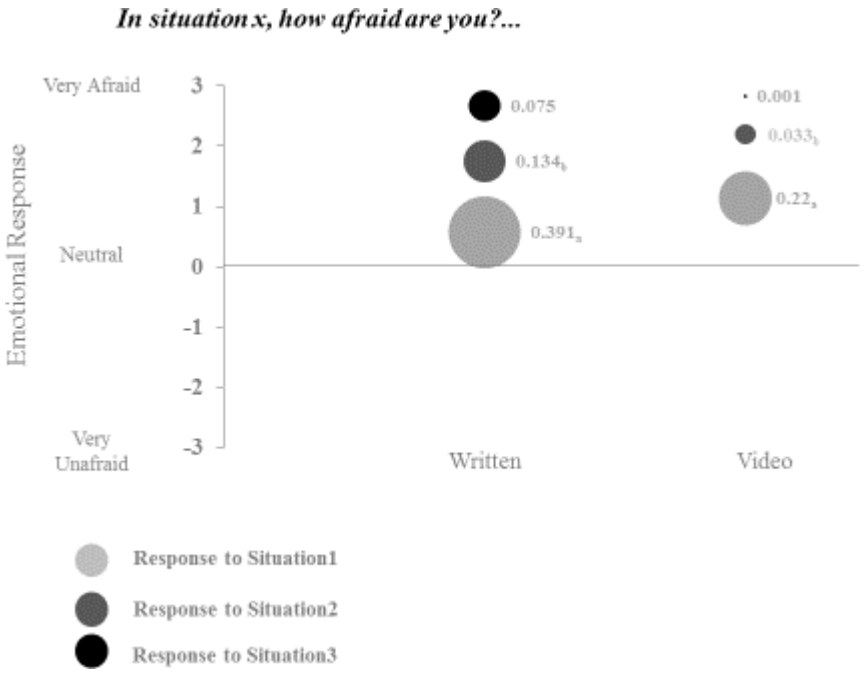

Figure 13. Mean Responses to the variable Fear for Video and Written Surveys with Potential for Conflict Index$_2$ (PCI_2) used to show the variance between groups. Significant differences between video and written surveys noted by the addition of a subscript (Situation1=a, Situation2=b and Situation3=c) to the PCI_2 variable.

For Likelihood1, Likelihood2, Likelihood3 (Figure 14), we see an increase in variability in the video clip group but not in the written group. In Likelihood1 the video clip group has less variability in their responses than the written group (Video Clip PCI_2=0.252 in comparison the Written PCI_2=0.311) and by Situation3 the variability is almost identical in the two groups (Video Clip PCI_2=0.338 in comparison to Written

PCI_2=0.376). However in all three cases the differences are not considered significant (Likelihood1 d=0.99, Likelihood2 d=0.98 and Likelihood3 d=.78) at $p<0.05$.

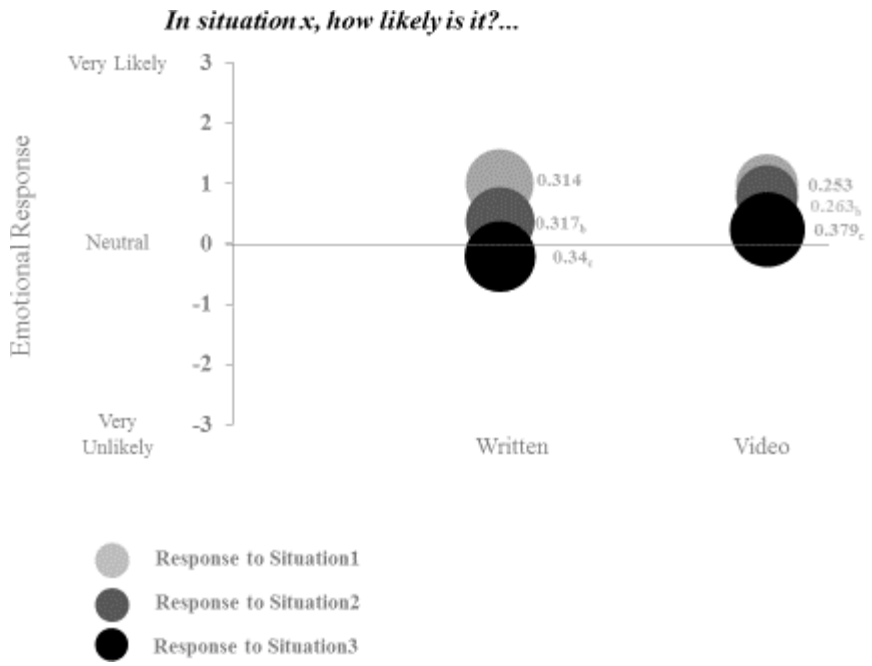

Figure 14. Mean Responses to the variable Likelihood for Video and Written Surveys with the Potential for Conflict Index$_2$ (PCI_2) used to show the variance between groups. Significant differences between video and written surveys are noted by the addition of a subscript (Situation1=a, Situation2=b and Situation3=c) to the PCI2 variable.

In Control1, Control2, Control3 (Figure 15) no significant difference was found in the variability (Control1 d=0.079, Control2 d=0.23, Control3 d=0.08) in responses between the two groups at p=0.05. Like the values of the t-test, the PCI_2 values show the medium used had little effect on people's sense of control at preventing a situation from happening.

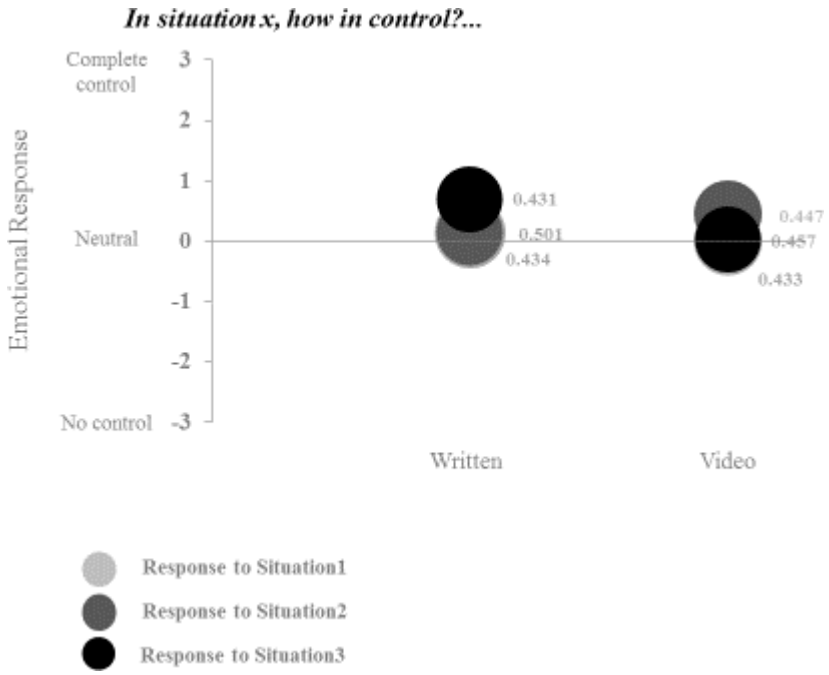

Figure 15. Mean Responses to the variable Control for Video and Written Surveys with the Potential for Conflict Index$_2$ (PCI$_2$) used to show the variance between groups. Significant differences between video and written surveys are noted by the addition of a subscript (Situation1=a, Situation2=b and Situation3=c) to the PCI2 variable.

2.8. Discussion & Conclusion

Encountering a bear creates a strong, often negative, emotional response in people. A recent study by Kubo and Shoji on bear encounters in Hokkaido, Japan, showed that after a bear encounter "recreation managers have no way to salvage recreational users' satisfaction" (Kubo & Shoji, 2014). The encounter often evokes emotions of surprise, of fear and a lack of control over the following events. Simulating that experience, in a controlled environment, in order to measure the strength of that response is challenging, especially if those emotions are unconscious (Jacobs, 2012). Yet studies increasingly attempt to quantify this type of intended behaviour and emotional responses to understand and develop effective and successful wildlife management programs

(Sponarski et al., 2015; Campbell, 2012; Johansson et al., 2012; Kubo & Shoji, 2014; Jacobs et al., 2014).

As studies in mixed mode surveys have found, behavioral intentions reported in self-report surveys do not provide a replication of actual behavior (Vannieuwenhuyze et al., 2011). While asking questions about hypothetical scenarios provides some insight into how people believe they may act, it fails to capture actual emotional responses which only appear in the actual scenario (Jacobs et al., 2012). Asking written questions to people to gauge their emotional responses to hypothetical situations can provide a direction but not an exact measure of variance or strength of those emotions. This does not suggest that video surveys provide a better measure of people's emotional responses, but rather implies that it is possible to increase or decrease the strength of certain emotional responses and to increase or decrease the consensus in a group depending on the medium used. Researchers should take this into account when designing and interpreting studies which are asking people to describe emotional reactions to hypothetical high stress situations.

The differences found in the t-test and the PCI_2 values suggest that the link between medium and perceived risk is complex. The strongest difference is found in the variable fear, where both the t-test and the differences between the PCI_2 values were significant in the first two situations. In contrast to what was hypothesized a significant difference was not found for the third situation (Fear3). The reason that the t-test for Fear3 did not show a difference could be the result of one or more factors. The method used to measure the fear level was a 7 point scale ranging from very unafraid (-3) to very afraid (3). In Fear3 (the situation where the bear runs towards you) most people rated very

high (i.e. very afraid) on that scale (Written $\bar{x}$=2.66 and Video $\bar{x}$=2.83). It is possible that the video clip participants were more afraid than the written group but the scale used was unable to capture that data. It is also possible that as the perceived risk of a situation reaches a "worst case scenario" (i.e. the bear running towards you) the medium used does not matter because the participant will always rate at the highest end of the scale (i.e. very afraid).

While not captured quantitatively, we noted that when showing the video clip of the Fear3 to participants, participants regularly 'gasped' (in what appeared to be a combination of surprise, fear, etc.), which was a response not seen in participants who had the situation described to them. This unconscious emotional response does suggest that participants who saw the short video clip, did have a different emotional reaction to the video than those who saw the written form. Additional research using a continuous scale may be able to capture a more distinct difference between the two groups.

While there is an obvious trend in both variability and mean difference for the variable of fear, the trend is less obvious for the variable likelihood. In general, as the situation escalated, people thought that it was less likely that it would occur; they thought it was more likely they would see a bear eating berries, than a bear charging towards them. For Situaiton1, the t-test showed no difference between the two groups, however for the Situation2 and Situation3, where the bear is approaching, participants who saw the movie thought it was significantly more likely to happen than participants who saw the written description. Unlike the t-test, the PCI2 values were not significantly different but a trend was observed. As the situations escalated, increasing variability can be seen in the video group, but not in the written group. This suggests that as the situation escalates

seeing a video, rather than a written description, people are more likely to have stronger reactions to the concept that a situation may occur. People were more likely to rate the situation as very likely to happen, or very unlikely to happen, than people who saw the written version.

In contrast to the variable of Fear and Likelihood, no trends are noted for variable of Control. This may be due to one or more factors. It is possible that only some variables are influenced by the medium being used in a survey, and a person's sense of control over whether they can prevent a situation from happening is not one of those variables.

However, there was also some refusal by some participants to acknowledge the framing of the question. While the question framed the hypothetical situation by stating that they had 'gone hiking alone', some participants chose to ignore that preface and state that they had complete control over the situation because "they would never go hiking alone in bear country". While this group of people was relatively small in both groups, it is possible that this misinterpretation of the question confounded results and more research on the subject is needed.

Results for each variable show that the relationship between perceived risk and the medium used in a survey is complex. Additional research is needed to understand the nuances of this complex relationship. This study does suggest that future research on emotions and perceived risk should explore the effect of medium used in the survey, on its results, and understand that depending on the medium used some variability in results should be expected. In addition, wildlife managers should consider the implications of creating management actions and policies based on the emotion-based data and

understand that emotional responses displayed using one medium, may not be mirrored in another, or, in life.

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3. Two hundred and eighty ways to stay safe in bear country: An analysis of bear safety messages in North America

3.1. Abstract

The effectiveness of bear safety education is an under-evaluated area of wilderness education. In this study, seven programs across North America were evaluated for the messages found in their online bear safety programs. Within those seven programs, two hundred and eighty different messages were found. Two main reasons for the large number of messages were identified: 1) Inconsistent terminology used across the programs and, 2) Temporal inconsistences found across the programs. While some topics relating to bear safety were reasonably succinct, with consistent messaging across the programs, several areas were particularly prone to inconsistent messaging. These areas included the use of bear spray, when to play dead, and how to identify the type of encounter (defensive, non-defensive, aggressive, predatory etc.) a person was having. Understanding where these problem areas are in the education programs allows for wildlife managers to develop more effective bear safety messaging and provides insight into the causes of human-bear conflict.

3.2. Keywords

Bear Attacks, Bear Aware, Bear Encounters, Bear Safety, Black Bear, Brown Bear, Parks

3.3. Introduction

The increasing numbers of human-bear conflicts in North America are usually attributed to several factors: North America's parks and wild spaces being used by a growing number of people for recreational activities, residential areas encroaching on

America's wilderness, and natural resources and natural spaces increasingly being used for industrial and commercial purposes (Penteriani et al., 2016; Hristienko et al., 2007). These human-bear conflicts result in injury and death to people and more frequently death to the bears (Miller and Tutterow, 1999). Management plans that are designed to reduce human-bear conflict by controlling bear behaviour (i.e. aversive conditioning, relocating problem bears) are often ineffective (Hanlon, 2015). As a result, wildlife agencies are looking for alternative solutions to reduce these conflicts. They are increasingly turning to the social sciences, specifically sociology and psychology, to modify human behaviour towards large carnivores and to produce positive wildlife-oriented beliefs and values among their public (Baruch-Mordo et al., 2009; Spencer et al., 2007). This focus on altering human behaviour as a technique for reducing human-bear conflict has resulted in the creation of numerous bear 'aware', 'safe' and 'smart' programs across North America. While the appearance of these programs indicates a new direction in wildlife management, there has been "little research conducted on the design, application and effectiveness of wilderness education programs the in changing levels of knowledge, attitudes and beliefs about wilderness" (Gunderson et al., 2000). As a result, there has been increasing concern that "evaluation of education interventions is lacking, even in communities with extensive programs" (Gore, 2004). The large number of unevaluated programs has resulted in inconsistencies in messages where no one is certain which messages, if any, are effectively conveying information to the public.

These bear aware programs focus on one or two main subjects: "do not feed the bears" and/or "how to be safe when recreating in bear country". The "do not feed the

bears" messages are usually designed for a town, community or campsite and emphasize the importance of preventing a bear from becoming food conditioned and habituated. In contrast, the "bear safety" messages are typically found in parks and recreational areas, such as trailheads, and focus on informing people about what to do if they encounter a bear while recreating. Frequently, bear aware programs will discuss both types of messages; for example some towns will send out pamphlets informing people of what to do if they encounter a bear in the backyard (New Jersey Division of Fish and Game, 2015), and many parks will discuss how to not attract a bear to a campsite by properly storing garbage and food (Yosemite, 2015; Yellowstone, 2015; Kenai, 2015).

The small amount of evaluation which has been done on bear aware programs has a) focused on the "do not feed the bear" messages (Gore, 2004), and b) been geographically specific (Campbell, 2012; Baruch-Mordo, 2011; Gore, 2006). In a review of literature, Gore discusses the effectiveness of "do not feed the bear" programs through the evaluation of six different programs designed to reduce a bear's access to human food. She examined locations across North America, including the Adirondack Park in New York, Whistler in British Columbia, Lake Tahoe in California, West Yellowstone, the state of New Jersey and the state of Florida (Gore, 2004). While these case studies represent a varied cross-section of different geographic locations, they focus solely on restricting bears' access to garbage, not the effectiveness of bear safety messages in those areas.

Not only have few evaluations of program efficacy been conducted, but the studies which have been done on "do not feed the bear" programs show mixed results as

to the effectiveness of education at changing people's actions. For example, Campbell (2012) evaluates a 'Bear Smart' program for cabin owners in Manitoba, Canada. His conclusions were that the program had very little impact on the behaviour of residents with regard to changing their behaviour around the maintenance of attractants such as garbage and barbeques (Campbell, 2012). An earlier study conducted by Dunn, Elwell and Tunberg found mixed results about the effectiveness of bear attractant and bear safety messages in New Mexico (Dunn et al., 2008). In contrast to the negative and mixed results from Manitoba and New Mexico, since the implementation of the 'Bear Smart' program in Whistler, British Columbia there has been a reduction by 75% of the number of problem bears that are destroyed each year in the area (Gore, 2004). It appears that some elements of some programs are proving effective while others are not.

Aside from Gore's 2004 and 2006 comparative studies, most other studies examine the effectiveness of bear-food campaigns in geographic isolation. Each study examines one town or region (Campbell, 2012; Baruch-Mordo et al., 2011; Dunn et al., 2008). This is a problem for two reasons. The first is that a lack of comparative studies means that the effectiveness of one bear-food campaign cannot be easily compared to another and, as a result, the evaluation of what works and what does not is difficult to assess. The second problem is that people are transient. People may not receive education from just one bear safety education program. They are exposed to multiple bear safety education programs when they travel, when they recreate in different parks and when they move to different towns. The lack of comparative studies means there is a lack of understanding about how information from multiple bear aware campaigns can influence

a person's attitude and decision making with regards to bears. A more holistic approach is needed to understand the variety of variables that contribute to a person's bear knowledge. Aside from Gore's evaluation of six bear programs (Gore, 2004; Gore, 2006), there are few studies which are comparative. Gore's review of bear programs concludes by highlighting this problem; "Human-black bear conflict is not a local, small-scale phenomenon; rather, the issue spans a diverse array of geographic and human demographic contexts" (Gore, 2004). It is important to recognize the specific geographic location of the program, and the specific issues found in that location, but also to recognize that the programs are part of a broader network of education programs found across North America and that these different programs should be compatible with each other.

Unfortunately, the evaluation of the effectiveness of bear safety education programs comes with a unique set of challenges. The potential of a research subject being attacked by a large animal during fieldwork is usually enough to dissuade a researcher from continuing with that particular research. Not only are researchers restricted due to safety concerns of participants, but the limited number of case studies (bear encounters and attacks) available come from a wide variety of geographic places, and include multiple of uncontrollable factors which makes a comparison of incidents difficult. This can be especially difficult when trying to isolate a single factor such as a person's familiarity with a specific bear safety message (Herrero, 2003). As a result, it is very difficult to gauge the effectiveness of bear safety messages found in many parks, towns, states and provinces of North America.

While it may be difficult to measure the direct impact of bear safety messages on the reduction (or increase) of bear attacks, it is possible to evaluate the messages themselves. Research that has been done on outdoor education, wildlife education and interpretive signs can provide some indication of the common pitfalls that occur in these type of messages and can provide some insight into what can be done to make messages more memorable and useful.

This study examines the wide variety of messages found in bear safety messages across North America. It examines whether people travelling around North America, visiting different parks and recreational areas, are being exposed to consistent, easy to understand, and memorable messages, or if the messages have conflicting information which may create confusion.

This problem was identified during the survey conducted at the AWCC. Participants in the questionnaire frequently engaged the surveyor in conversations about bear safety after the questionnaire was completed. These discussions either involved the participant asking questions about bear safety or involved the participant telling a story about the time he/she or "their friend/relative" encountered a bear and the actions they took. These discussions provided insight into some of the more confusing logic that people used when deciding what they should do during a bear encounter. Notes were recorded about unexpected things people had done during bear encounters, as well as unusual actions (outside the recommended actions of bear experts), that people thought they should do during a bear encounter and their reasons for doing so, if they provided a rationale. These informal discussions provided insight into the confusion and wrong information that people across North America have about bear safety and suggest a need

to analyze the messages that were already out there to try and understand how people were interpreting this information.

Given the confusion surrounding topics which are extensively covered in bear education programs, there is a need to review what messages are being presented in these programs and to try and understand why this misinterpretation of that information is occurring. The study examines two questions: 1) Are there too many messages? And 2) are the messages consistent?

3.4. Method

This study used data from two sources; the data was primarily gathered through a qualitative analysis of messages found across seven bear aware campaigns. The second is a questionnaire about bear encounters and the subsequent discussion with the participants. Messages from seven different bear aware campaigns were analyzed in this study. The areas were a selection of high profile locations around North America. These locations were chosen to highlight the broad range of bear aware messages from different regions, countries (Canada and US), states and provinces, and national parks. This study and the locations chosen for analysis do not provide a comprehensive or complete study of bear messages in North America, but rather highlight some of the issues surrounding the wide variety of bear messages found in the US and Canada. The campaigns chosen for this study come from seven locations around North America: the National Park Services - Yellowstone National Park (YNP) website, the National Park Services - Yosemite National Park (YOSE) website, the Alaska Department of Fish and Game (ADFG) website, Kenai National Park (KNPS) website, Juneau Municipality (JM) website, the

Canadian Rocky Mountain Park System (RMPS) website and the New Jersey Department of Environmental Protection, Division of Fish and Wildlife and Division Parks and Forestry (NJ) website.

Given the broadness of the content found in some of the programs, only information which instructed people on what to do when encountering a bear in the wild was analyzed in-depth. Other areas, such as specific advice about hunting, fishing, and how to protect your campsite from bears was noted, but the messages were not included in the analysis. It should also be mentioned that only the online content for these parks and regions was analyzed. Each program may have additional education material such as pamphlets and signs that are on site, rather than online.

The in-depth analysis of the programs involved subdividing each web page into individual messages. If a sentence had two or more safety messages, it was divided into separate messages (i.e. “Travel in groups and make noise while hiking” would become “Travel in groups while hiking” and “Make noise while hiking”). This allowed the information presented across multiple programs to be comparable. Next, an inductive thematic analysis of these messages was conducted. Messages were placed into groups based on the main sub-topics found in bear aware messages. For example, all messages which discussed bear spray were grouped together and all the messages which discussed when and how to 'play dead' were grouped together. These themes were arranged chronologically, in the way that all (except for JM’s) bear safety programs were arranged. These programs start with how to avoid bears, what to do when you see a bear, and then follow through an escalating encounter which ends with the bear attacking a person. This

arrangement allowed for a more consistent analysis that followed the layout of messages found in the programs. The programs all (except JM) describe low risk situations first, followed by increasingly riskier and dangerous encounters.

Then the messages were compared to each other across the programs. If the messages meant the same thing, then they were placed together and considered one message. If it was possible to interpret the messages differently, they were left separate.

The second source of data came from a quantitative questionnaire which took place over the summer of 2014 at the Alaska Wildlife Conservation Center (AWCC). As part of a larger questionnaire, visitors (*n*=286) to the Center were asked a variety of questions about bear safety. Participants at the bear enclosure were approached and asked to complete an on-site, face-to-face survey based on a random sampling technique (Vaske, 2008, p.183). Once completed, the next person to enter the bear viewing area was approached and asked to complete the next survey. Tour groups were excluded due to their limited time; and only people fluent in English over the age of 19 were included in the study. The questionnaire was conducted on iPads. The interviewer held the iPad allowing the participants to view the screen while asking questions while participants read them. The questions were based around three different situations that the participant either saw as a worded description or as a video clip. Video clips were short, 2 to 5 seconds in length. Participants were asked a series of questions about their perceived risk of the situation, their behavioural intentions in that situation and their knowledge about appropriate action in that situation. Additionally, information was subsequently gathered regarding participant demographics.

A mixed method approach of analysis was used because the quantitative survey was designed to measure participants' actions based on how they thought they should act during a bear encounter. The list of possible actions participants could choose from in the survey was developed from bear safety literature and programs. However, the discussions following each survey revealed that some respondents were greatly misinformed or 'thinking outside of the box' as to what actions would be appropriate to stay safe in bear country. The quantitative survey, with its answers based on the best practices put forward by industry experts, failed to capture these viewpoints. By using responses from these discussions and then going back and gathering information from qualitative analysis of bear safety messages it was possible to understand some of the reasons as to why there were so many misinformed individuals.

3.5. Results

This study identified a variety of issues in current bear programs including; concern over the large number of messages, inconsistent and confusing terminology, and temporal inconsistencies of 'when' certain actions should do done.

3.5.1. The Number of Messages

In total, 280 different messages were identified which discussed appropriate actions to take when encountering a bear. Those messages were broken down into 19 different categories.

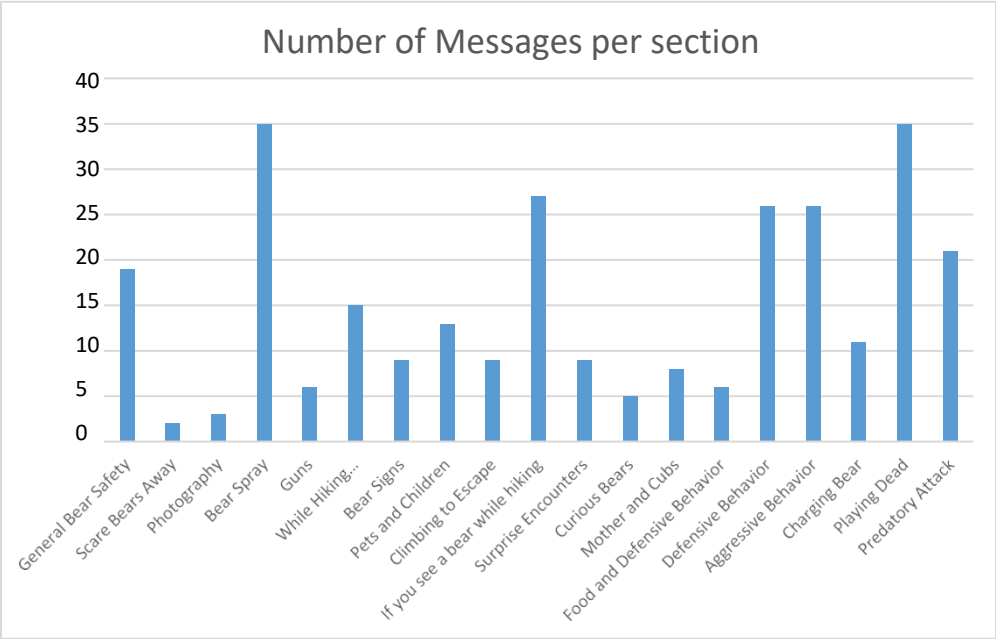

Figure 16. Number of messages found in each category

Figure 16 presents the range in the number of messages by category. These categories are subjective, but illustrate that certain categories have few messages whereas others, such as bear spray, have many different related messages.

When the number of messages in each category is compared to the number of times they occur across the various programs, it is clear which areas have repeating messages in comparison to those that do not. For example, advice on what to do while hiking is fairly concise (List 1 of Appendix A); on average each message was found 2.9 times among the seven campaigns. In contrast, bear spray messages were only found 1.3 times on average (List 2 of Appendix A) suggesting that different bear spray messages were found in each program. Overall the average number of times a message was found in the programs was 1.4 times. In other words, most messages were only found once among the seven campaigns.

Confusion around the use of bear spray as a deterrent for an aggressive bear was found during the survey. When participants were asked about a hypothetical situation where they encountered a non-aggressive bear foraging on berries at a distance and ignoring people, 28% of participants said they would sometimes, often, or all of the time, use bear spray. When asked what they thought a "bear expert" would tell them to do in that same situation, 38% of participants were not certain or, thought that a bear expert would support the use of bear spray on a non-aggressive bear in that situation. In contrast, when asked about what they thought they would do when a bear was charging towards them, only 42% of participants said they would use bear spray and only 68% of participants thought that a bear expert would support the use of bear spray while a bear was running towards them.

The reasons for the varied answers seemed to be a confusion as to what exactly bear spray did, as well as when it should be used. Conversations subsequent to the interview revealed that while some people carry bear spray with them every time they go into bear country, others had never heard of it before, were reluctant to buy it because of the price, or were uncertain as to its purpose and therefore disinclined to use it, including a couple of participants who thought that it actually attracted bears (they gave the impression that they had misunderstood the bear safety messages which told them to not spray it on clothes or tents, as spraying it on objects attracts bears to the area) rather than deterred them. The large number of messages found among the seven programs analyzed suggests that the overwhelming number of inconsistent messages found in North America may play a role in people's confusions surrounding bear spray.

3.5.2. Inconsistent and confusing terminology

One of the biggest causes of the large number of messages was the differing terminology found in each program (Figure 17). While many messages may suggest a similar meaning, the different and incompatible language meant that the number of messages found was much larger than it needed to be. The best example of this is the terms used to describe bear behavior. Each program had its own terms for each type of encounter.

Location	An encounter with a surprised or uncertain bear	An approach by a bear acting aggressive	An attack by a surprised or nervous bear	A predatory attack	Notes
Juneau, AK					no mention of aggressive bears
Yosemite NP	“surprise encounter”		“surprise attack”		
Yellowstone NP	“surprise encounter”		“surprise attack”		
ADFG	“surprise encounter”		“defensive attack”	“seeking food”	
Rocky Mountain NPS	“defensive approach”	“non-defensive approach”	“defensive attack”	“predatory attack”	
Kenai NP	“surprise Encounter”		“brown bear attack”	“black bear attack”	“most non-defensive charges do not end in contact”
The state of New Jersey		“aggressive bear”	“bluff charge”	“black bear attack”	

Figure 17. Terminology found in different programs

Not only does each program have its own terms but some programs use multiple terms. For example, the National Park Service in Yellowstone uses many of these terms interchangeably:

- "Running to a tree may provoke a non-aggressive bear to chase you",
- "If a bear charges you after a surprise encounter, stay still and stand your ground",
- "During a surprise attack where the bear is reacting defensively, you should not fight back"
- "If a bear has not reacted aggressively, and has not initiated a charge or otherwise acted defensively, you should back away". (Yellowstone, 2015)

3.5.3. Temporal Inconsistencies

Aside from the problems created by terminology there were additional problems identified with the "when" certain actions should take place. Out of the 278 messages, 33 discussed bear spray, of which eight messages were identified which tell a person *when* to use bear spray. The numerous bear spray messages show how the 'when' can become confusing when discussing bear safety messages (List 2 of Appendix A).

This issue of 'when' to do something was one of the biggest issues that the researcher noticed when discussing bear safety with visitors at the AWCC. Respondents were frequently confused as to 'when' certain actions should be taken. People would be shown a video of a brown bear eating berries and asked what they would do if they came across that situation. Even though the bear was described as calm and not acting defensively, participants repeatedly said they would "drop to the ground and play dead because that is what you are supposed to do when you see a brown bear". While the message to 'play dead' has been understood and remembered by the public; the appropriate time when to take that action has not.

Even the most simplistic bear encounter rule, “do not run”, can become confusing when a temporal clause is added to the message (List 4 of Appendix A). For example, both the programs for New Jersey and Juneau state '*If a bear charges*, do not run' whereas Yellowstone states 'if you see *warning bear behaviour,* do not run' and Rocky Mountain National Park says that if the ‘*bear is approaching* you should not run’. While these messages do not contradict each other, they do not mean the same thing. While they remain consistent as to 'what' the appropriate action is, they are not consistent with the 'when'.

3.6. Discussion

From the analysis of these various programs, three themes emerged. The first is the large number of different messages found in the seven campaigns, the second examines the problem of using inconsistent terminology in different campaigns, and the third theme looks at the temporal inconsistencies in the messages—the 'when' an action should be done.

3.6.1. Two hundred and eighty is too many

Research suggests no more than seven things can be remembered at once (Miller, 1956) and that in order to retain information in the long-term memory, it must be seen several times. The bear aware programs which were examined have as many as 50 messages on a single webpage. In addition, messages were only found on average 1.4 times in the programs. When these messages change from region to region, it prevents people who are travelling from seeing reoccurring messages. If these messages remained consistent and were reduced to the smallest number possible, it might be possible for people to remember them.

3.6.2. A Question of Semantics?

Two hundred and eighty messages were identified which tell a person what to do when they encounter a bear. These messages often convey similar information but use different terminology. Each campaign has their own set of terms to describe an escalating encounter. There is confusion amongst different campaigns' use of terms such as "aggressive", "defensive" "non-aggressive" "surprise" and "predatory".

What is written in the bear safety programs may be well-informed messages but unusual and complicated phrasing of the messages, along with the many terms, makes it difficult to understand the situational context. When you consider the variation among institutions that use different terms such as Parks Canada where they use the terms "defensive approach", "non-defensive approach", "defensive attack" and "predatory attack", the ADFG which uses the terms "surprise encounter", "defensive attack" and an attack where the bear is "seeking food", it becomes clear why people have trouble differentiating between different types of bear encounters.

Yet another problem with these interchangeable terms is that eventually they can create wrong information. In Kenai National Park, the bear aware campaign states, "If a bear charges, stand your ground. Most **non-defensive** charges do not end in contact." According to other campaigns a non-defensive approach would mean an approach by an aggressive bear where there is greater potential for it to end in an attack. Other campaigns would state, "Most **defensive** charges do not end in contact". As there is no definition for either a defensive or non-defensive attack, the meaning remains uncertain. If bear safety

campaigns used consistent terminology, or included definitions for certain terms, it would help eliminate confusion.

3.6.3. The Temporal Issue

In the seven campaigns analyzed, ten different ways of stating “don't run from a bear” were used. All of these messages are correct—it is widely recognized that running from a bear is not a recommended action. But the temporal clauses added to each message makes them more complicated than they need to be. It can be argued that the one golden rule of all bear encounters is “never run from a bear” but when a temporal clause is used in the statement, such as “do not run when a bear approaches” or “do not run when you see a bear” it implies that there may be an appropriate time when you should run.

Removing unnecessary temporal clauses in messages simplifies and reduces the number of messages.

3.7. Conclusion

In 2013, after an incident where a person encountered a three hundred pound black bear in their backyard in Cranston, Rhode Island, NBC Channel 10 ran a short segment, featuring reporter Julie Tremmel, who described the appropriate actions to take when being attacked by a bear. The video clip became an internet sensation because of the over the top antics in which the reporter claims that her news team have “put together a few tips from the experts” describing what to do should you encounter a bear. The entertainment factor is created by Tremmel acting out these messages where she repeatedly (and unintentionally) misinterprets the advice into some dangerously wrong, yet funny, actions. For example, in the clip Tremmel recommends her viewers “play

dead" if attacked by a bear (ABC News, 2015). This advice may not be out of place in brown bear country however it is considered a wholly inappropriate, and dangerous, response to a black bear under all circumstance. Making matters worse, the admonition to "fight back if attacked", is unfortunately absent. This video clip is an example of how easily bear messages can be misinterpreted by the general public. The ease with which people misinterpret messages shows a need for education to take a new direction.

Evaluating the effectiveness of messages designed to keep people safe from bears has many challenges. However as Gore states in her study in 2006 "If education programs are to retain their role in bear conservation and management, it is essential to understand their ability to reduce conflict, foster awareness, modify behaviour and encourage coexistence between people and bears" (Gore 2006).

Consistent terminology across programs would help reduce the number of messages and prevent the problem of 'when' you should do certain actions during your bear encounter. For example, the messages surrounding bear spray could be shortened to "bear spray deters charging bears" and "familiarize yourself with the instructions on the can of bear spray thoroughly before going into bear country" and "carrying bear spray is encouraged/illegal in this national/state park/region". This would simplify messages and encourage visitors to read their bear spray canister for specific messages rather than getting confused and inconsistent terms with unnecessary temporal clauses.

There is a risk that by simplifying messages that certain nuances of the bear behavior might be lost. However, it is important to remember that the average reader of a bear safety message is not a bear expert. What seems obvious to people who work with

bears and bear education regularly is completely new to the average visitor to a national park. Overwhelming a visitor with information as they enter the park is not an effective means of informing them. There is a trade-off between providing many, specific messages with precise information and a few, simplistic messages which a person can remember.

Wildlife managers could also move away from written messages altogether. Video, or image-based, educational programs have advantages over written messaging in that they engage the viewer's emotions, they can be effective for non-English speaking visitors and can eliminate confusing and inconsistent terminology. To further this point, consider an airline safety pamphlet. Airline safety messages change as a function of the aircraft and airline, but only slightly because safety regulations have to adhere to certain industry standards. While the content changes slightly, people know before they fly that all aircraft safety pamphlets tell them to turn their phones off, in the same way people who see a 'no running from a bear' image based message would become familiar that this message is found in every bear safety program. In contrast, people travelling by plane know that depending on the type of aircraft, a flotation device is either under their seat or is their seat cushion. Similarly, it should be possible to have two images for bear spray—a can of bear spray with a green tick through it means that carrying bear spray is encouraged, while a park that does not allow bear spray, such as Yosemite, widely recognized red slash could be used. In addition, an airplane safety pamphlet contains no words allowing people who do not speak the language or who cannot read to understand it. The lack of words removes the confusion of changing terminology.

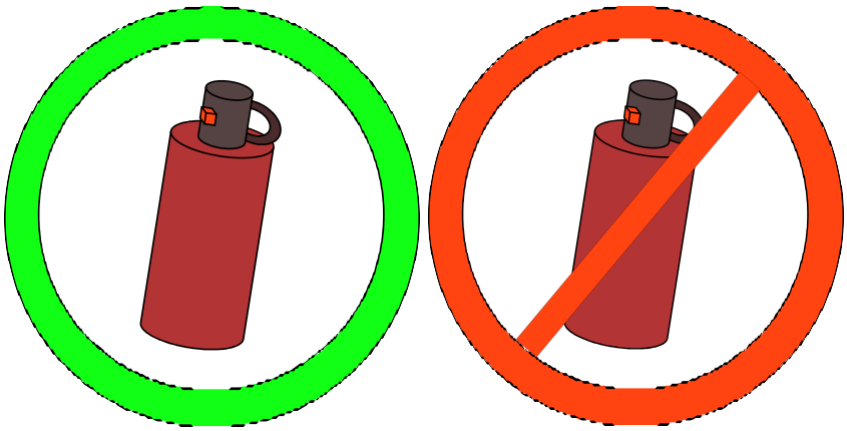

Figure 18. Concept design for visual bear spray messages

Most bear safety campaigns are geographically and socially specific; that is they are written in such a way that is most useful for the park, town, state or province. However, as people move from one region to another, they visit multiple parks and, as a result, are exposed to multiple bear safety campaigns. A lack of consistency between campaigns can create confusion. There is a need for localized messages, specific to the unique geography of these areas, yet there is also a need for consistent messages across programs. While evaluating bear safety campaigns for their effectiveness is extremely difficult, the number of messages found across seven programs suggests that more could be done to simplify the messages making them consistent across the different programs and therefore easier to remember for people travelling around North America. A visitor to Yellowstone National Park may be a visitor to Glacier National Park hours later. Keeping messages consistent across North America would also help reduce the confusion.

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4. Summary

This final chapter contains the highlights of the findings in the thesis, as well as a discussion about what direction is needed for continued education and research in bear safety messages.

4.1. Discussion

The field of human dimensions of wildlife management continues to explore the connection between people's emotions and their relationship to the environment. Tools such as self-report surveys are used by scientists to measure people's emotions, but the effectiveness of these tools at measuring true emotional responses is rarely evaluated. Fortunately, advances in technology allows for developments in methodology.

Chapter 2 compares the use of two forms of media: a written scenario to a video scenario. Current research in the field of HDWM frequently attempts to predict the success of certain management options by measuring the emotions, attitudes and intended behaviors of people (Sponarski et al., 2015; Campbell, 2012; Johansson et al., 2012; Kubo & Shoji, 2014; Jacobs et al., 2014). However the research is hampered by several biases that occur in self-report surveys (Jacobs et al., 2012). One of the issues with written hypothetical situations is that the context of the situation is often not adequately described, forcing participants to create their own context and imagine the parts of the situation which are not specified in the worded description. An individual's past experiences and personality affects how they imagine the situation and, as a result, how survey participants respond to different scenarios. If "a picture is worth a thousand

words", then a video should be worth a million. By seeing a video of a scenario, participants experience a more precise and consistent situation than participants who have to extrapolate an entire scenario from a single sentence. In theory, the use of video media should reduce the amount of imagination needed by participants. Therefore, providing a consistent scenario through a video should reduce the amount of variability within the response group.

Participants were asked to self-report their feelings of fear, likelihood of the event and their sense of control over three escalating scenarios. These three variables comprise a person's sense of perceived risk (Gore et al., 2007). Participants were divided into two groups, one which read a written description and the other which viewed a short video clip.

Results showed that the medium used influenced a person's sense of perceived risk. People who had seen the video reported being more fearful than those that read the written situation. A similar trend could be observed when people reported their sense of likelihood that the situation could occur while they were hiking in Alaska. In contrast, a person's sense of control at preventing the situation was not affected by the medium being used.

Within each of these variables the relationship with the medium was complex. For example, with the variable 'fear', both the PCI value and the t-test value was significantly different between the two groups for the first two situations and yet in the third (bear charging), where the biggest difference was expected between the groups, the difference

was statistically insignificant. This may be because by the time people think about the fact that a bear is running towards them they are so afraid that the medium makes little difference. Conversely, it may be possible that a seven point scale is insufficient to categorize differences in the amount of fear a person feels, whereas a sliding scale would be sensitive. More research is needed to understand the relationship between the amount of fear a person feels, the variability of fear within a group and the medium being used.

Trends in the variable 'likelihood' were similar to those in the variable 'fear'. As situations escalate, both groups' responses indicated that they believed it is less likely that they would experience a bear encounter. However, there are some differences between the groups. As situations escalate, participants that saw the video thought it was more likely to occur than those that read the written situation. While variability within the group remains consistent for participants who saw the written scenario across all three scenarios, variability in the group that saw the movie increases as the situation escalates. However, when you examine variability between the two groups, the group that viewed the video has less variability than the group that read the written description, especially in the lower risk situations. This suggests that media type influences a person's sense of the 'likelihood' of a situation occurring, especially in lower risk situations.

The use of video as a tool to reduce variability in self report studies has implications for the field of HDWM. Wildlife management policies are developed using results of these studies. These studies frequently attempt to gauge the success of management options based on participants' emotional responses to different scenarios. These emotions can be more precisely measured when a direct question is asked. Using

video in surveys creates a more precise question by adding consistent context to the question. With video, participants are not required to imagine a small bear or a big bear, a rainy day or a sunny day, thick undergrowth or tall trees.

Video may be useful beyond a methodological tool as a more effective teaching tool because it enables an educator to engage emotions such as fear (seeing a bear charging), or lack thereof (seeing bear cubs playing, bears grazing on grass etc.). While the use of video may be an effective teaching tool, education programs will remain ineffective as long as the messaging remains overwhelming and unprecise.

In chapter 3 we examined reasons why current educational tools are proving ineffective. In addition we discuss why it is important to evaluate those tools and consider new user groups such as transient visitors, non-English speaking visitors, and people who traditional educational tools do not reach. For example, Banff National Park had two area closures (and one attack) in the winter of 2016 when ice climbers disturbed hibernating bears (Gripped, 2016). Typically these two groups (ice climbers and bears) do not interact, but as more people continue to spend more time exploring remote areas of bear country, the frequency of encounters will increase. An increasing number of encounters between people and bears (often in increasingly unusual places and at unusual times of the year) highlights the need for more effective bear safety education (Penteriani et al., 2016).

While most parks, communities and states have bear safety programs, there has been little evaluation of their effectiveness. A few studies have examined the effectiveness of programs at preventing bears' access to food, or have examined the

success of alternative methods for reducing garbage bears, such as enforcing town by-laws (Campbell, 2012; Dunn et al., 2008; Gore, 2006). Very little research has focused on human behavior while recreating bear country. As a result, it is uncertain what parts of bear safety education programs are effective and which are not.

This study identified some of the problems with current education programs. The main issues identified was the overwhelming number and inconsistent messages found across North America. The large number of messages results from 1) inconsistency in terminology used in messages, and 2) 'when' certain actions should take place. These two issues may be part of the reason why so many people seem aware of bear safety messages (i.e. know they should play dead) but can be dangerously wrong with context (e.x. they see a brown coloured bear on the other side of a field so they drop to the ground and curl up in a ball).

Previous research has shown that traditional wildlife education techniques are ineffective because many people do not read signs, pamphlets and other literature presented to them. If amongst the small group that does read the literature, the overwhelming number of messages about what to do when you encounter a bear is often too much to remember. The development of wildlife education programs should also address the emotional responses of their audiences. A person who is already terrified of a bear does not need to be told that bears are dangerous and that encounters are stressful which have a unpredictable outcome. In contrast, people who are overly confident (i.e. those who claim that they can handle a bear encounter), need to be educated regarding the dangers that bears present, especially when visiting new places. By understanding those

areas of messaging that are confusing, stressful, and able to provide a more experiential learning experiences, it may enable people to be better prepared for an encounter. Research presented in Chapter 3 is designed to assist bear education professionals as they develop new bear education tools which may address some of these issues.

4.2. The Future

In response to the varied responses received from the human dimensions survey conducted at the AWCC over the 2014 summer, an experimental learning tool was developed to help teach people best practices when encountering bears in the wild. An analysis of results from the quantitative instrument show a variety of answers to the situation-based questions, including responses which suggest that a certain segment of the population might place themselves in danger by acting inappropriately during a bear encounter. For example, with a bear running towards them, 23% of people stated that they thought they would 'sometimes', 'often' or 'all of the time' run away from a bear encounter. Equally concerning is that depending on the situation, 19% of people surveyed believed that a bear expert would approve of them taking that action.

Not only do people not remember the information from bear safety messages but given the highly stressful nature of most bear encounters, people are uncertain about how they will act during an encounter. In a recent bear safety talk, a young woman explained to the instructor that she was terrified because while she knew she should not run from a bear, she did not believe that she could control herself and was worried that if she did encounter a bear her instinctual reaction would be to run away. After the talk, she went outside to practice using inert bear spray. At the end of the practice session, she confided

that she was feeling much more confident about a bear encounter. She thought it was less likely that she would run during an encounter. The act of practicing gave her a feeling of competence that she did not have while simply seeing, reading or being told the information. Examples like this highlight the need for alternate solutions to traditional bear safety education. Just as people practice first aid on a dummy or practice avalanche rescues in mock scenarios, bear encounters are stressful situations where physically acting out the scenario enables people to be prepared to act when they actually encounter a bear.

In an attempt to address these issues as well others discussed in Chapter 2, the Bear Maze was developed. The Bear Maze (Appendix 1) was part of an experiential learning experiment at the Alaska Wildlife Conservation Center where people learn recommended actions to take by encountering model bears on a series of trails. The bear maze simulates the experience of hiking through thick brush and the potential types of encounters a person can have with a bear along the way. With each bear encounter, directions regarding appropriate actions are provided.

A situation-based approach such as the bear maze, which educates people on appropriate actions and allows them to practice that action by encountering a mock bear, should help increase participants' bear safety knowledge, increases their sense of control during a bear encounter, and encourages them to act safely when encountering a bear

4.3. Future Directions

4.3.1. Recommendation for Future Research

Further research is needed on the relationship between perceived risk and media being used to gather that data. The varying results in Chapter 3 suggest that there is a relationship between some of variables of perceived risk but not all. Additional research on the relationship between medium used in a survey and the perceived risk could define more clearly the relationship between perceived risk and the medium used in surveys. One of the main concerns raised in this research about current wildlife education is the lack of evaluation. Given that the Bear Maze is a pilot project, evaluation is needed to determine its effectiveness.

4.3.2. Recommendation for future bear safety education

1. Evaluation of current bear safety educational programs on people's awareness and understanding of bear safety messages is key. Some areas of knowledge well understood while others appear to be badly understood.
2. There is a need to evaluate bear safety knowledge by geographic area and establish the strengths and knowledge gaps in each area.
3. The development of a consistent set of terminology to be used in messages in North America would help reduce variability between messages and help transient groups in retaining information.

4. Examine the possibility of moving away from language-based educational messages to graphic-based messages in order to reduce confusion over terminology and allow non-English speakers to understand messages.
5. Design and implement more experiential-based programs where possible.

4.4. References

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5. Appendices

5.1. Appendix A

5.1.1. LIST 1 – While Hiking…

- Be alert for bears
- Before hiking review bear encounter procedures
- Hike during daylight hours
- Avoid hiking at dawn, dusk or night when grizzly bears are most active
- Hiking in a group is one of the best ways of avoiding a negative encounter
- Hike on official trails and marked paths
- Do not surprise a bear, see it before it sees you
- Alert the bear to your presence while hiking
- Make noise while hiking
- Some people prefer to wear bells
- Bear bells are not enough
- Be especially alert and loud while passing through areas where your view is obstructed
- Be especially alert and loud when your scent is carried the wrong direction by wind
- Be especially alert and loud while near loud stream
- Let someone know where you're going and when you'll be back

5.1.2. LIST 2 – Bear Spray

- Bear spray is not 100% effective
- Bear spray is non-lethal
- Bear spray is proven to be highly successful at stopping aggressive bears
- It is a good idea to bring bear spray with you in case of a surprise encounter
- During a non-defensive encounter if the bear approaches, use your bear spray
- During a defensive attack use your bear spray
- If a defensive bear keeps approaching use bear spray
- If you are charged use your pepper spray
- Use bear spray within 30-40 feet
- Use bear spray at 40 feet
- Use bear spray within 15-30 feet
- If you see a bear prepare to use your bear spray
- Remove safety tab before using bear spray
- Prepare to use bear spray if the bear attacks
- If you see warning bear behaviour, draw your bear spray
- Bear spray is useful but should not be used instead of common sense
- Bear spray contains capsicum
- There are many ways to use bear spray incorrectly which could hurt the user and make it less effective
- If you have bear spray keep it close and know how to use it

- Familiarize yourself with instructions for bear spray before use
- Bear Spray is used to deter aggressive bears
- When used properly bear spray causes temporary incapacitating discomfort
- Bear spray is effective in 90% of the cases it has been used in
- EPA approved bear spray is recommended
- When spraying bear spray aim for the face but slightly downwards
- When spraying a bear spray for 1 to 2 seconds
- When spraying a bear, if the first spray doesn't work, use a second
- If the bear does not stop after a second spray empty the can
- Leave the area immediately after using bear spray
- Bear spray should be easy to reach
- Bear spray should not be kept in a backpack while hiking
- You don't need good aim to use bear spray
- Bear spray works by putting a cloud of spray of between you and the bear

5.1.3. LIST 3 - Playing Dead

- If a bear continues its charge do not play dead too early
- Wait until just before the bear makes contact to play dead
- If the bear makes contact play dead
- If a bear attacks you have 2 choices: play dead of fight back
- In order to choose the best option you have to decide if the bear is acting defensively or seeking food

- Most brown bear attacks are defensive
- Play dead during defensive attacks
- Lie still and wait for the bear to leave
- To play dead, hit the ground and lie still if it is a brown bear, female with cubs
- To play dead lie flat on your stomach
- To play dead spread your legs for stability
- To play dead use your hands to protect the back of your neck
- To play dead curl up in a ball
- If the bear flips you over roll back over
- To play dead drop to the ground
- If a bear sees you, keep your pack on as it may provide protection
- To play dead lie face down
- A defensive bear usually ends an attack when it feels you are not a threat
- A brown bear usually ends an attack when it feels you are not a threat
- When playing dead remain motionless for as long as possible
- If you move while playing dead the bear may notice and return
- When playing dead use your elbows to protect the side of your face
- While playing dead remain still and silent so the bear knows you are no longer a threat
- After a surprise encounter where the bear is reacting defensively, do not fight back
- Fighting back during a surprise encounter will only prolong an attack
- If a bear has not reacted aggressively, you should back away
- Never play dead unless the bear is acting aggressive

- Never play dead unless the bear is acting defensively
- Playing dead could cause a curious bear to become predatory
- Being submissive could cause a curious bear to become predatory
- A defensive bear will charge immediately during a surprise encounter
- A defensive bear will charge with head low and ears back
- Surrender if a brown bear attacks
- Brown bears are often only trying to neutralize a threat

5.1.4. LIST 4 – Bears and Running

- Never run from bears
- Bears can run fast
- Bears will chase running things
- Running to a tree may trigger a chase response
- If a bear approaches you, do not run
- If you see a warning bear behaviour, do not run
- If you see warning bear behaviour, running from a bear may trigger a chase response
- You cannot outrun a bear
- If a bear charges, do not run
- Bears can run 35mph

5.2. Appendix B

5.2.1. Introduction

The Bear Maze is designed to be part an experiential learning experiment at the Center. It is designed to be engaging, educational and fun. The Bear Maze will be a maze through a thicket of alder trees, with educational stations along the way which will educate people about safety messages regarding traveling in bear country. At each station model bears will be encountered with directions as to the appropriate actions to take in a given situation.

Results from the survey at the Center suggest that people are confused as to when certain actions are appropriate when encountering a bear. A situation-based approach such as the Bear Maze, which educates people on appropriate actions and allows them to practice that action by encountering a mock bear should help increase participants' bear knowledge, increase their sense of control over a bear encounter and encourage them to act safely when encountering a bear.

5.2.2. Entrance

The entrance will be a single track into the bear maze. At the entrance there will be a cut- out sign of game warden or park interpreter who will introduce the maze through a speech balloon. The game warden will have bear spray attached to her belt, allowing people to become familiar with the object.

Sign 1

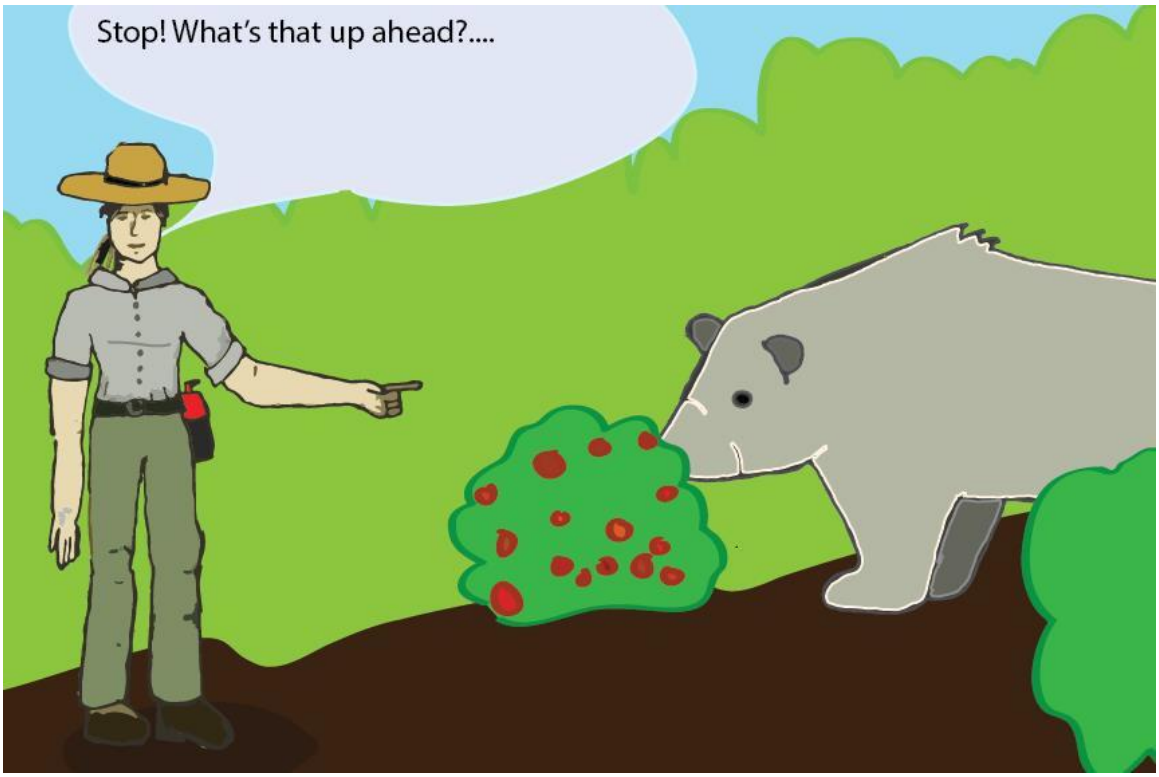
"Welcome to the bear maze! As you enter make sure you are prepared for a trip into bear country. Check and make sure you've got your bear spray and noise makers. No bear spray and noise makers? Bring a friend and don't be afraid to talk loudly or sing songs! Let the bears know that you're coming so they are not surprised."

Learning outcomes:

- A person may meet a bear in bear country
- A person should be prepared by bringing bear spray and noise makers

- What bear spray looks like
- Making noise is a good safety precaution

5.2.3. Station 1



The participant walks around the corner in the maze to see a dead end. Beside them is cut- out game warden pointing towards a cut out bear eating berries from shrubs.

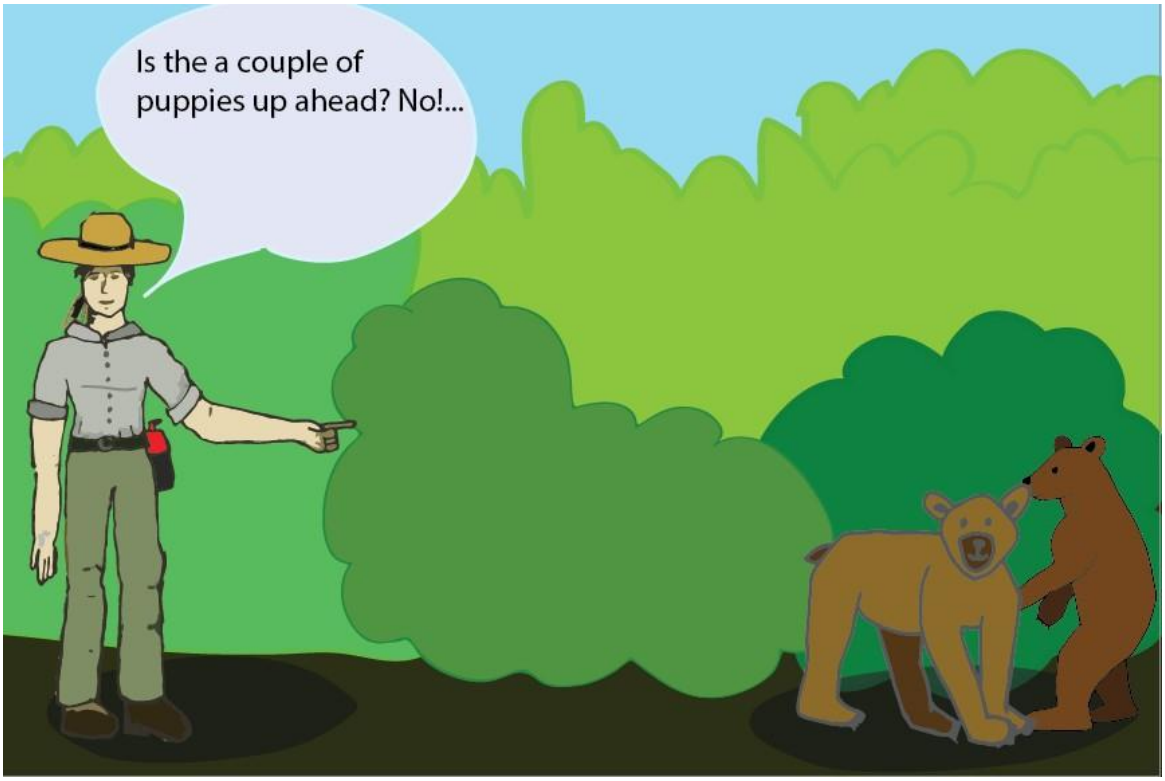
Sign 2

"Stop! What's that up ahead? A bear eating berries. It doesn't seem interested in you. Take your bear spray out, have the safety off and have it ready to use in case the bear approaches. Get close to your friends and back away slowly while facing the bear until you're out of sight. If the bear starts to approach you, spray the bear when it is within 30 feet. Group up and continue to back away. You've got to persuade a curious bear that you're not worth messing with."

Learning outcomes:

- What to do when the bear is not interested in you
- What to do if a bear is approaching you

5.2.4. Station 2 - Part A



Participants come around a corner and see the game warden pointing a two cute bear cubs ahead on the trail.

Sign 3

Is that a couple of puppies on the trail ahead of you? No? They're two adorable bear cubs! I know you want to stop and take pictures but mom is probably hanging out nearby and she's really protective of her cubs. Time to leave the area!

Learning outcomes:

- Potential dangers when viewing young bears
- What to do when you see a young bear

5.2.5. Station 2- Part B

If participants ignore the first sign instructing them to leave the bear cubs alone and approach closer to the bear cubs they can see around the corner. Around the corner is sign and a cut out of large, snarling brown bear.

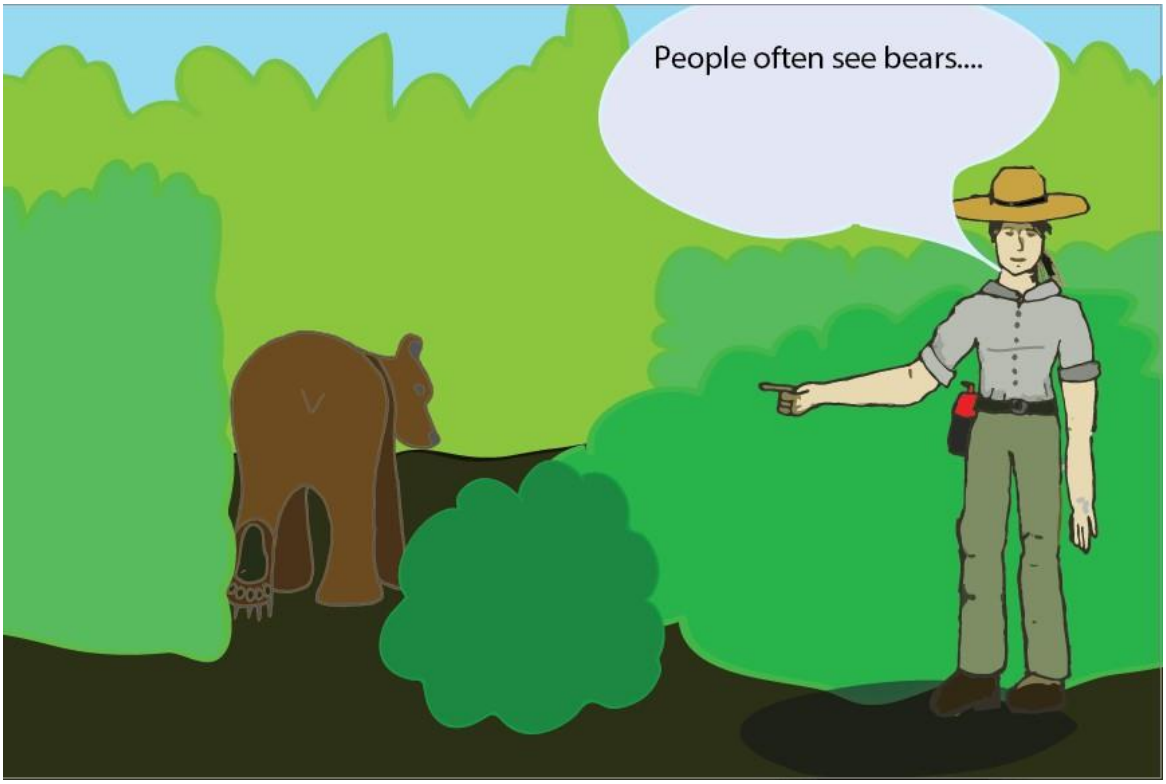
Sign 4

You got closer? Why?! Now mom brown bear has noticed you and she is really nervous and upset. Back away slowly. If she attacks, play dead. Lie flat, face down and cover your neck and head with clasped hands. If she rolls you over, maintain momentum and roll back over and don't move until you're sure she has left the area. Once she has decided you're not a threat anymore she'll leave you alone.

Learning outcomes:

- What might occur if you are too confident in bear country
- What to do when a defensive brown bear attacks

5.2.6. Station 3



Sign 5

People often see bears while out in Alaska. With 100,000 black bears and 30,000 brown bears this isn't surprising. While the idea of encountering a bear may seem scary, often these encounters are exciting, memorable moments to a trip. Talking loudly and being aware of your surroundings helps prevent you from having any unpleasant, surprise encounters. Bears are risk-averse and avoid confrontations, therefore it is not usual to see a bear simply leaving the area as you approach.

Learning outcomes:

- Bear encounters in Alaska are common
- Most bear encounters in Alaska are positive encounters
- Making noise and being aware helps reduce dangerous bear encounters

5.2.7. Station 4

People enter a clearing in the alder maze. In the clearing is a tent made out of canvas and lashed together poles. In the campground is a bear-proof garbage container, bear-proof food lockers and a bear pole. Signs explain each object and encourage people to try and test out each object. A sign in the tent explains the importance of cooking away from where you are sleeping and of keeping smelly items out of the tent.

Sign 6 - Campground entrance

We've stumbled across someone's campground. Camping in bear country can be a fun experience. It is not unusual for bears to visit a campground in bear country. Sometimes they're curious, sometimes they're just passing through. Problems usually only occur when they have a reason to stay and that reason is almost always FOOD! Take a look around and see what you can do to make a bear proof campground.

Sign 7 - Bear Box

Many campgrounds in North America will have bear-proof boxes in which you can place your food. Just remember bears have an amazing sense of smell. They can smell your toothpaste and deodorant you left in your tent, as well as that extra chocolate bar you were saving for a midnight snack.

All food and scented products should be placed in bear boxes.

Sign 8 - Bear Proof garbage containers sign

They're so difficult to open!!!! But that's the idea. You're a human so I'm sure you can figure it out. (Reach in and press left). Place your garbage in here. Bears that have access to garbage become familiar with people and start to cause problems. A problem bear is a danger to people and as a result is often shot when repeatedly found in human areas. Help save a bear’s life. Ensure that all your garbage is placed in bear-proof containers.

Sign 9- Bear Pole

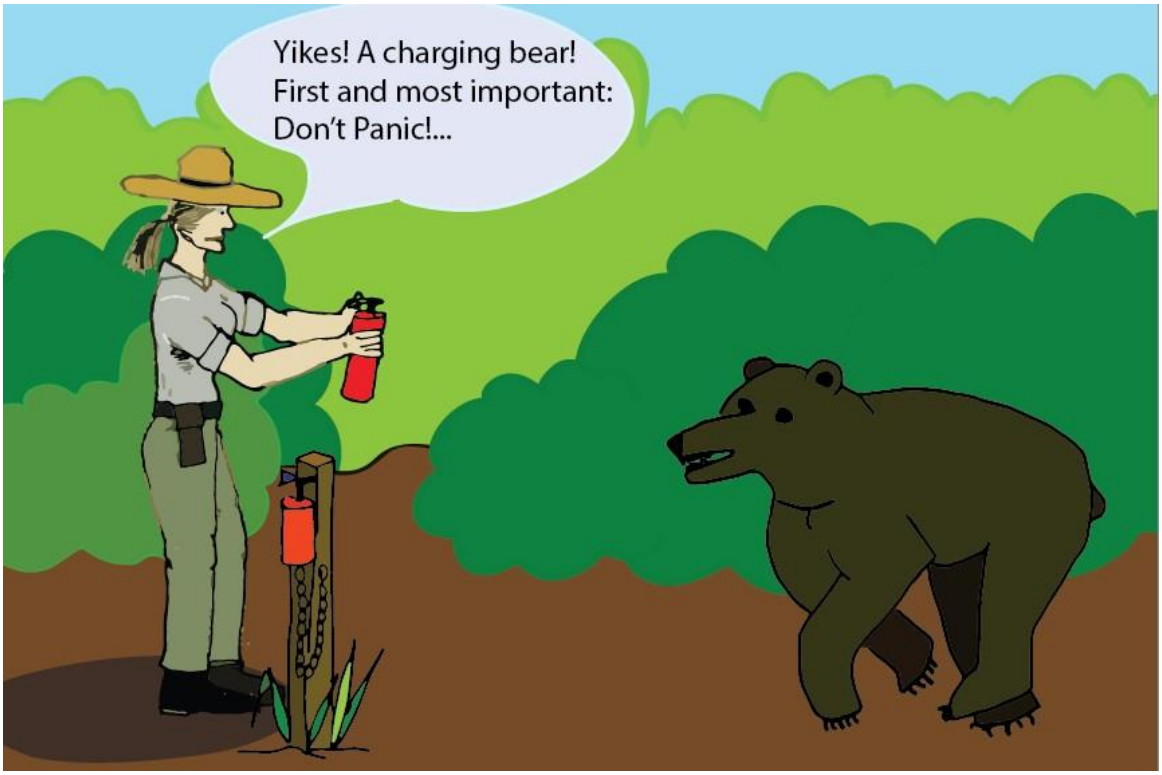
Sometimes remote campgrounds don't have bear boxes and bear-proof garbage receptacles in which case your food and garbage have to be safely stored some other way. Hanging food and garbage in a tree or up a bear pole makes it difficult for a bear to reach your supplies.

Learning outcomes:

- How to create a bear proof campgrounds

- What and how to use a bear pole, bear proof garbage, bear proof lockers
- The dangers of a bear becoming familiar with people and food

5.2.8. Station 5: Bear charge



The bear charge situation will be more difficult to find. The participant will have to find a narrow trail leading off of one of the other trails. The small trail will have several sharp bends with a final 90 degree bend around which a model charging bear will be found. The cut out of the game warden will be using bear spray. On a pole next to the game warden can of bear spray will be attached by a chain. The participant will be encouraged to pick up and practice. Ideally water will be inside so that the participant can get the experience of using something similar to bear spray

Sign 10

Yikes! A charging bear! First and most importantly **don't panic**. There are still many things you can do to prevent an attack.

- Don't run! Running away from this situation is dangerous. Often a bear is just as uncertain and nervous about the situation as you are. In order to intimidate you a bear may "bluff charge". A bluff charge is a charge where the bear will run towards you but stop before it makes contact. Try to back away but do not run. Running away from a predator suggests that you are prey and bluff charge will become an actual charge.
- Act big and loud: show the bear you're not afraid
- In the rare event the bear actually attacks: If it is a black bear, fight back immediately! If it is a brown bear, lie down and play dead unless the attack persists in which case fight back.

Sign 11

On the sign next to the bear spray: What's that on the pole? Bear Spray! Bear spray is similar to pepper spray. It comes in an aerosol container. When it is sprayed at a bear it deters the bear from approaching in the same way that pepper spray deters a person from attacking.

Don't spray it on clothes or a tent. Bear spray only works when deployed quickly and at close range. In the same way a person might like hot sauce on food, bears are attracted to bear spray that is sprayed on clothes or a tent. But in the same way that hot peppers hurt when you rub them in your eyes, spraying a bear in the face with bear spray will make the bear uncomfortable enough to leave you alone. Be aware of wind direction and distance.

Most bear sprays only work at short range and if the wind is strong can potentially blow back in your face.

Learning outcomes:

- Not to run during a bear charge
- What a bluff charge is
- To act big and loud
- Brown, stay down, black, fight back
- How to use bear spray
- What bear spray is