

**RESIDENTIAL PERCEPTIONS OF BROWN AND BLACK BEARS  
AND HUMAN-BEAR CONFLICT MITIGATION ON  
THE KENAI PENINSULA OF ALASKA**

By

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## TABLE OF CONTENTS

ACKNOWLEDGEMENTS.....	iii
LIST OF TABLES.....	v
LIST OF FIGURES.....	vii
LIST OF APPENDICES.....	ix

### **CHAPTER ONE. Residential Community Attitudes, Risk Perception, and Tolerance toward Brown and Black Bears on the Kenai Peninsula, Alaska**

1.1 ABSTRACT.....	10
1.2 INTRODUCTION.....	11
1.3 HYPOTHESES.....	21
1.4 METHODS.....	21
1.4.1 Study Area.....	21
1.4.2 Survey Design and Administration .....	22
1.4.3 Data Analysis.....	25
1.5 RESULTS.....	29
1.6 DISCUSSION.....	36
1.7 MANAGEMENT IMPLICATIONS.....	44
1.8 LITERATURE CITED.....	47

### **CHAPTER TWO. A Review of Human-Bear Conflict Mitigation Strategies on the Kenai Peninsula, Alaska**

2.1 ABSTRACT.....	68
2.2 INTRODUCTION .....	68
2.3 HUMAN-BEAR CONFLICTS.....	69
2.4 MANAGEMENT AGENCIES.....	72
2.5 INTERAGENCY CONSERVATION TEAMS AND OBJECTIVES.....	75
2.6 CURRENT MANAGEMENT OF BROWN BEAR POPULATIONS.....	78
2.7 STRATEGIES AND OUTREACH PROGRAMS ON THE KENAI.....	81
2.7.1 Wildlife Conservation Community Program.....	87
2.7.2 Wildlife Habitat Incentive Program.....	89
2.8 FUTURE RESEARCH AND RECOMMENDATIONS.....	91
2.9 LITERATURE CITED.....	96

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## LIST OF TABLES

### Chapter One

<b>Table 1</b>	Selection of low and high defense of life or property communities based on housing density, human population size, and the number of defense of life or property bear kills (DLP) on the Kenai Peninsula, Alaska, 2011 .....	55
<b>Table 2</b>	Demographic characteristics for survey respondents in select low versus high defense of life and property (DLP) communities on the Kenai Peninsula, Alaska, 2011.....	56
<b>Table 3</b>	Comparison of sightings and negative experiences with brown and black bears on private property in select defense of life and property (DLP) communities on the Kenai Peninsula, Alaska, 2011.....	57
<b>Table 4</b>	Comparison of attitudes and risk perception toward brown and black bears in select defense of life and property (DLP) communities on the Kenai Peninsula, Alaska, 2011.....	58
<b>Table 5</b>	Model comparisons for determining respondents' attitude toward brown bears on the Kenai Peninsula, Alaska, 2011.....	59
<b>Table 6</b>	Evaluation of predictor variables for determining respondents' attitude toward brown bears on the Kenai Peninsula, Alaska, 2011.....	59
<b>Table 7</b>	Model comparisons for determining respondents' attitude toward black bears on the Kenai Peninsula, Alaska, 2011.....	59
<b>Table 8</b>	Evaluation of predictor variables for determining respondents' attitude toward black bears on the Kenai Peninsula, Alaska, 2011.....	59
<b>Table 9</b>	Model comparisons for determining respondents' risk perception toward brown bears on the Kenai Peninsula, Alaska, 2011.....	60
<b>Table 10</b>	Evaluation of predictor variables for determining respondents' risk perception toward brown bears on the Kenai Peninsula, Alaska, 2011.....	60
<b>Table 11</b>	Model comparisons for determining respondents' risk perception toward black bears on the Kenai Peninsula, Alaska, 2011.....	60
<b>Table 12</b>	Evaluation of predictor variables for determining respondents' risk perception toward black bears on the Kenai Peninsula, Alaska, 2011.....	60

<b>Table 13</b>	Comparison of tolerance toward brown and black bears in select defense of life and property (DLP) communities on the Kenai Peninsula, Alaska, 2011.....	61
<b>Table 14</b>	Demographic characteristics for survey respondents on the Kenai Peninsula, Alaska, 2011.....	62

## LIST OF FIGURES

### Chapter One

<b>Figure 1</b>	Map of agencies responsible for bear management on the Kenai Peninsula, Alaska, 2012.....	63
<b>Figure 2</b>	Distribution of defense of life or property bear kills (DLP) from 1960-2008 on the Kenai Peninsula, Alaska.....	64
<b>Figure 3</b>	Defense of life or property bear kills (DLP) and human population size on the Kenai Peninsula, Alaska, 1960-2010.....	65
<b>Figure 4</b>	Total brown bear mortalities from 2000-2011 on the Kenai Peninsula of Alaska due to harvest, non-hunting kills (i.e. road kills, illegal kills), and defense of life or property kills (DLP).....	65
<b>Figure 5</b>	Sites selected for surveys on the Kenai Peninsula, Alaska, 2011.....	66
<b>Figure 6</b>	Overall experience of respondents with brown and black bears on the Kenai Peninsula, Alaska, 2011 (n=426).....	66
<b>Figure 7</b>	Preventive measures respondents used or had to mitigate conflicts with brown and black bears on the Kenai Peninsula, Alaska, 2011.....	67
<b>Figure 8</b>	Losses/damages that respondents have incurred from brown and black bears on their property on the Kenai Peninsula, Alaska, 2011.....	67

### Chapter Two

<b>Figure 1</b>	Percentage and location of defense of life or property bear kills (DLP) on the Kenai Peninsula of Alaska from 1960-2008.....	101
<b>Figure 2</b>	Attractants on surveyed properties of the Kenai Peninsula, Alaska, 2011.....	101
<b>Figure 3</b>	Map of agencies responsible for bear management on the Kenai Peninsula, Alaska, 2012.....	102
<b>Figure 4</b>	Total brown bear mortalities from 2000-2011 on the Kenai Peninsula due to harvest, non-hunting kills (ex. road kill, illegal kills), and defense of life or property kills (DLP).....	103

**Figure 5** Game Management Units (GMU) on the Kenai Peninsula of Alaska,  
2012.....104

**LIST OF APPENDICES**

**Chapter One**

**Appendix A** The survey instrument (questionnaire).....105

**Appendix B** Assessing non-response bias postcard survey.....113

**Chapter Two**

**Appendix C** Kenai Peninsula Bear Awareness Materials.....114

**Appendix D** New Bear Awareness Pamphlets.....116

**CHAPTER ONE: Residential Community Attitudes, Risk Perception, and Tolerance toward Brown and Black Bears on the Kenai Peninsula, Alaska**

**Abstract**

The Kenai Peninsula of Alaska has experienced a drastic increase in the number of conflicts between humans and bears that result in bear kills in defense of life or property (DLP). Research is needed to better understand human attitudes, risk perception, and tolerance toward both brown (*Ursus arctos*) and black bears (*Ursus americanus*). My objectives were to determine if there were differences in attitude, risk perception, and tolerance toward brown and black bears among respondents from low versus high DLP communities and whether experience with bears was a strong factor influencing attitude and risk perception. I therefore conducted a total of 432 door to door surveys of these issues in six communities on the Kenai Peninsula (2011). I selected survey communities to represent 3 each from low or high DLP incidences during 2000-2010. Respondents showed an overall positive attitude toward both brown and black bears in all six communities. Both communities displayed a neutral response for risk perception toward bears, yet there was significantly more risk perception in high DLP communities towards brown bears. Key factors in predicting attitudes toward bears were opinion about the population size, age and education of the respondent, risk perception, and overall experience. Risk perception toward bears was best predicted by opinion about the population size, attitude, and overall experience. There were no significant differences in tolerance toward either bear species among community types relative to responses of contacting authorities or use of lethal methods. In addition, low DLP respondents had

fewer attractants on their property and more education. My research provides wildlife managers with information on community attitudes and perceptions of risk posed by bears, as well as an understanding of tolerance during bear encounters. In addition, a greater understanding of the frequency of sightings and conflicts with bears, including the type of conflicts, will aid managers in determining the best form of conflict resolution.

## INTRODUCTION

The Kenai Peninsula (Kenai) is connected to the mainland of south central Alaska by a narrow (18 km) isthmus. Research with microsatellite and mitochondrial DNA has verified that Kenai brown bears (*Ursus arctos*) are genetically less diverse than mainland Alaskan brown bears (Talbot & Farley, 2009). In addition, this population of brown bears does not breed with the brown bear population on the mainland (Talbot & Farley, 2009). The genetic isolation and small size of the Kenai brown bear population, along with rapid urban development leading to human encroachment on bear habitat, creates concern about maintaining a healthy population of brown bears. The Alaska Department of Fish and Game (ADF&G) listed the Kenai brown bear as a “Species of Special Concern” (Del Frate, 1999),<sup>1</sup> and the United States Forest Service considers presence of Kenai brown bears an indicator of the health of the ecosystem (DeBruyn, Harris, Morton, & Selinger, 2006). There was an estimated 625 brown bears peninsula wide on the Kenai during summer 2010 (Morton, Bray, Hayward, White, & Paetkau, 2012, unpublished data). Considering available habitat, Morton et al. (2012) estimated 45 brown bears per

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<sup>1</sup> At the start of 2012, the ADF&G no longer uses the “Species of Special Concern” list. The species/populations of special concern have been relegated to an appendix in the State Wildlife Action Plan. As of September 2012 no changes had been made to programs regarding brown bear research on the Kenai (Selinger, Personal Communication, 2012).

1,000 km<sup>2</sup>, while Miller et al., (1997) reported studies on southern coastal habitats to contain 191–551 brown bears per 1,000 km<sup>2</sup> and studies in interior Alaska ranged from 10–30 brown bears per 1,000 km<sup>2</sup> in available habitat. The Kenai is considered a coastal habitat and brown bear management is therefore a high priority and concern for wildlife managers on the Kenai. There is a fall and spring harvest of brown bears allowing residents and non-residents to register for a permit every four years. Total annual harvest does not exceed 14-18 bears.

Black bears (*Ursus americanus*) are common in the western United States (Witmer & Whittaker, 2001) and occur over most of the forested areas of Alaska (Alaska Department of Fish and Game, 2011). On the Kenai, black bear populations appear stable, with greater densities along the southern coast, possibly due to the low density of brown bear competitors during the salmon run (Alaska Department of Fish and Game, 2011). ADF&G estimates the Kenai contains 3,000–4,000 black bears with an annual, average harvest of 410, allowing three bears per year for residents. In communities where both bear species occur, attitudes towards bears vary and people may view black bears as less of a threat than brown bears, possibly due to their smaller size (Petko-Seus, 1985; Hastings, 1986). People generally are more familiar with black bears than with other large mammals (Kellert, 1994), and attitudes toward black bears are generally positive (Kellert, 1994; Morzillo, Mertig, Garner, & Liu, 2007), even in instances of human-black bear conflict (Jonker, Parkhurst, Field, & Fuller, 1998), which perhaps reflects higher tolerance for black bears.

Human coexistence with brown and black bears rests upon a fine balance of many biological and social factors. As human development continues in areas near bear

habitat, wildlife managers must consider the type of habitat necessary to maintain a sustainable population of bears while also addressing concerns from residents who live in these areas. Conflicts often occur when either bears move into areas of high human use or when human development encroaches on bear habitat (Stowell & Willging, 1992; Peine, 2001). Human encroachment often leads to habitat fragmentation which diminishes the value of bear habitat (Proctor, McLellan, Strobeck, & Barclay, 2005; Waller & Servheen 2005; Nawaz, 2007) and isolates bear populations, decreasing their ability to survive (Proctor, Servheen, Miller, Kasworm, & Wakkinen, 2004). In addition, areas of high human use often become population sinks for bears (Nielsen et al., 2004; Nielsen, Stenhouse, & Boyce, 2006), and even small numbers of bears killed can have adverse effects on population growth (Wakkinen & Kasworm, 2004). Currently, brown bear populations in Alaska remain intact; however, they may follow the same trend as bear populations in the continental United States because humans are the most significant source of mortality on adult brown bears (Servheen, Herrero, & Peyton, 2004). An understanding of human behavior and attitudes regarding bears has important implications for the conservation of bears and supporting habitat (Peyton, Bull, Reis, & Visser, 2000; Siemer & Decker, 2003; Siemer & Otto, 2005).

Wilder, DeBruyn, Smith, and Southwold (2007) defined a human-bear conflict as an incident that involves an interaction between a bear(s) and person(s) in which the bear acts aggressively, including all instances where bears obtained food, damaged property, or were judged to be negatively affected by human activities. This includes instances where bears obtained food, damaged property, or were judged to be negatively affected by human activity. When a conflict escalates beyond the tolerance of a human,

also defined as the point at which one would act or demand action from an authority to deal with a situation (Peyton et al., 2000), the bear may be killed. The state of Alaska allows the killing of a brown or black bear in defense of life or property (DLP) if a bear attack was not provoked or caused by negligence with food or garbage (Alaska Administrative Code 5 AAC 92.410). Trend in DLP cases have been documented by the ADF&G on the Kenai since 1960 (Figure 1) and only reflect trend in brown bear numbers as black bear numbers are not documented in this manner.

Not only is the Kenai one of the most visited areas of Alaska, it is also the second-fastest developing area of Alaska (2010 US Census data). Over the past ten years, the human population has grown significantly, with about 10,000 new residents each decade since 1960 (US Census data 1960-2010). In turn, number of conflicts between humans and bears that result in DLPs has also increased (Figure 2). Similar trends occur in other areas of North America with the rise of human-bear conflicts and human population. During the 1980s and 1990s number of conflicts with bears and humans increased, yet this increase was disproportional to human growth (Beckmann and Berger, 2003), especially in areas adjacent to public lands containing large carnivores.

Suring and del Frate (2002) reported that DLP cases on the Kenai had increased from < one bear death each year in the 1960s to an average of 5 per year in the 1990s. From 2000-2009, 164 documented DLP cases occurred on the Kenai; averaging over 16 bear deaths each year. Since DLP numbers typically reflect brown bear kills, this increase in DLP cases emphasizes concerns that the brown bear population may not persist with these high rates of mortality (Schwartz & Arthur, 1997; Suring & del Frate, 2002). The ADF&G bases management on an assumption of human-caused brown bear

mortalities at 6% of an estimated population of 250 bears (Miller, 1989). If accurate, during 2000-2011, the annual number of DLPs has surpassed that threshold seven out of twelve years, and only in 2000 did the total human caused mortalities fall below the threshold (Figure 3). Due to the growing human population, the potential exists for conflicts between humans and bears to also continue increasing over time. For sustainable bear conservation, wildlife managers must understand and address people's attitudes and behavior regarding human-bear conflict (Wang, Lassoie, & Curtis, 2006; Palmeira, Crawshaw, Haddad, Ferraz, & Verdade, 2008; Ogra, 2009). Currently, bear managers on the Kenai have only nominal data on why people kill bears in DLP situations, and therefore lack adequate tools to reduce human-bear conflicts, and ultimately, bear fatalities.

Peninsula-wide documentation of human-bear interactions is lacking currently. There are four agencies that manage bears on the Kenai; ADF&G along with three federal agencies including the Kenai National Wildlife Refuge (KENWR), Kenai Fjords National Park (KEFJ), and the Chugach National Forest (CNF, Figure 4). Typically, each agency collects and manages data on human-bear interactions within their own jurisdiction, but little interagency cooperation and data coordination exists. During the 1980s, these agencies formed the Interagency Brown Bear Study Team which served as a way for each agency to have input on the research conducted and management of brown bears peninsula-wide, however, human-bear interaction data was not a priority of the interagency team. The only comprehensive information besides DLP data that the Kenai has regarding human-bear interactions is with the Bear Human Interaction Management System (BHIMS). This database allows bear management teams throughout all National

Parks in Alaska to enter data on human-bear interactions (Wilder et al., 2007). This system has yet to be shared with other federal agencies.

There has also been little research conducted regarding the public's perception of bears on the Kenai. Community involvement is often essential for wildlife management to be successful. For example, managers in the Wrangell-St. Elias National Park and Preserve attempted to decrease human-bear conflicts within the by focusing on educating visitors. However, data later revealed that 80% of incidents involved residents who lived outside the park boundaries (Wilder, 2003). After redirecting management and including educational programs on bears for the community, human-bear conflicts decreased. The Wrangell-St. Elias National Park and Preserve example underscores the importance of effective wildlife management policy as a result of understanding public attitudes toward wildlife and conservation programs (Naughton-Treves, Grossberg, & Treves, 2003; Tarrant, Bright, & Cordell, 1997). Without this understanding of community attitudes, which shape behavior towards bears, the human-bear conflicts on the Kenai will continue.

Local resource users should also participate in wildlife management decisions. For example, government resource managers and locals can have very different perceptions on issues (Kendrick, 2003). Understanding stakeholders' opinions and considering them in management actions can lead to more effective wildlife management strategies. Wilson and Clark (2007) stated that the ultimate threat to carnivore conservation, including bears is not habitat loss, but rather human populations and their behaviors and attitudes toward carnivores. Subsequently, Carroll, Noss, and Paquet (2001) stated that when strategizing the conservation of carnivores, biological science

should be central to the discussion, yet efforts are likely to fail if other disciplines such as the social sciences and education are not involved to aid in finding politically acceptable solutions. Studies that do not include other disciplines often perform poorly, and even failed (Carroll et al., 2001). Research must therefore be directed at an understanding of human attitudes, risk perception, and tolerance toward both brown and black bears on the Kenai.

### *Attitude*

Understanding attitudes toward bears can lead to a better understanding of human behavior toward bears and circumstances leading to a DLP. While there are many definitions of attitude, a common theme among definitions is that a person's attitude represents his or her evaluation of the subject in question (Ajzen & Fishbein, 1977). Ajzen and Fishbein (1977) argued that a person's attitude toward an object influences the overall pattern of their response to the object, but it doesn't necessarily predict a given action; therefore, attitudes do not necessarily cause a certain behavior (Ajzen, 2001; Bohner & Wanke, 2002). Ajzen's (1991) theory of planned behavior states that intentions to perform behaviors of different kinds can be predicted with high accuracy from attitudes toward the behavior, subjective norms, and perceived behavioral control. It is the theory of reasoned action (TRA) that follows the assumption that humans will process information and use it to decide how to act (Ajzen & Fishbein, 1980; Fishbein & Manfredo, 1992). It is therefore the combination of attitude toward a behavior and the subjective norms - an individual's perceptions of the social pressures placed on them by others to either perform or not perform a certain behavior - are what determines the

performance of a behavior (Fishbein & Manfredo, 1992). By understanding the attitudes of residents on the Kenai, we can get a better sense of the outcomes of their interaction with bears.

Bright and Manfredo (1995) found that people who hold strong positive attitudes toward bears are more likely to support actions favorable to bears, tolerate bear damage, and maintain those ideals during conflict. The population status of bears has also been shown to affect people's attitudes, with more positive attitudes found when bears are considered rare in the area (Cardoza, 1976; Brown, Decker, & Hustin, 1981) and more negative when overpopulation deems hunting necessary for damage control (Colorado Division of Wildlife, 1989). Negative attitudes toward bears can be found by people who feel their livelihood may be threatened due to dependence on common resources with bears (Kellert, 1994). Don, Carols, Bright, Teel, & Vaske (2009) also found that people with negative attitudes toward certain wildlife species may be more likely to kill or support the killing of wildlife in response to damage.

### ***Risk Perception***

Risk perceptions are intuitive judgments made by people themselves rather than those made by experts who base their judgments on technical assessments (Slovic, 1987). Slovic (1987) further defined risk perception as the degree to which people believe they are or could be exposed to some danger. Studies have found that risk perception toward bears can influence beliefs, attitudes, and behavior toward bears (Knuth, Stout, Siemer, Decker, & Stedman, 1992), as well as influence a community's attitude toward management policy (Decker, Lauber, & Siemer, 2002). Concern about bears led to about

33% of Alaskan voters reporting that they occasionally avoid trips into the countryside (Miller, Miller, & McCollum, 1998). Also, people's perception of wildlife risks tended to focus on events where the damage is rare and extreme, rather than damage that may amount to small losses at first, but become cumulatively greater in the end (Naughton-Treves, 1997). This may be related to a concern about common resources tied to economic and social stability whereby brown bear protection conflicts with economic well-being (Power, 1991). Siemer, Hart, Decker, and Shanahan (2009) revealed that more positive experiences with black bears in local residential areas led to decreased risk perception among residents. Understanding the factors influencing risk perception could supply wildlife managers with the tools to better manage concerns about human-bear conflicts.

### ***Tolerance***

Tolerance toward bears is based upon the idea that a person will reach a point at which they will no longer accept an interaction with a bear (Peyton et al., 2000). Once a person reaches this point, they would either act themselves or request action from an authority to eliminate the situation, sometimes resulting in the death of the bear.

Understanding tolerance of bears will give a better idea of what must occur before someone decides to kill a bear. Research has shown that hunting of predators is thought to increase tolerance among affected communities as it is believed to promote conservation of those species within communities (Loveridge, Reynolds, & Milner-Gulland, 2007; Treves, 2009). Decker et al. (2002) found that people who perceive benefits from a wildlife species tend to have a higher tolerance for conflicts with that

species. In addition, moderate damage will be tolerated if people have positive attitudes toward bears (Agee & Miller, 2009; Jonker et al., 1998; Kellert, 1994; White, Shropshire, & Staten, 1997). In regard to gender, Miller and McCollum (1994) found that women with more concern about bears and no history of hunting were more tolerant of bears in urban settings. Iossa, Soulsbury, Baker, and Harris (2010) speculated that areas with a lack of tolerance could be linked to the large size of bears, making them appear to be a greater threat to humans. A greater understanding of tolerance toward bears on the Kenai will aid wildlife managers in identifying where to put their energy and resources into education and wildlife conflict management.

### ***Experience***

Peoples' experiences with bears shape attitudes, risk perception, and tolerance toward bears. Beliefs and previous experiences with animals contribute to the development of attitudes, which influence tolerance of wildlife (Spash, 1997; Zimmermann, Walpole, & Leader-Williams, 2005). Often, one or more events can strongly affect people's attitudes and influence their reaction to future encounters (Conover, 2001; Woodroffe, Thirgood, & Rabinowitz, 2005). In addition, people tend to hold positive attitudes toward nuisance wildlife until they have experienced some type of damage (Clark, Clapp, Smith, & Wigley, 1991; West & Parkhurst, 2002). More familiarity with wildlife species often decreases the uncertainty of the consequences of interactions. Therefore, when a person becomes more familiar with bears in the form of sightings and non-negative interactions, a negative correlation may exist with perceived risk from bears.

To minimize effectively human-bear conflicts, it's important to understand people's experiences with bears and how their attitudes, risk perceptions, and tolerance levels can influence their behaviors toward bears. Therefore, the objective of my research was to measure these attributes to identify key factors that predict human behavior during bear conflicts. By looking at communities with a low number of DLPs compared to those with a high number of DLPs I can test whether there are significant differences among these attributes for respondents in different community types. While DLP numbers only reflect brown bear numbers it's also important to address questions based on both bear species to determine whether respondent attributes differ depending on species. I tested the following hypotheses:

- 1) Communities with a low number of bears killed in defense of life or property will have more positive attitudes and less risk perception toward brown and black bears than people in communities with a high number of bear kills.
- 2) Positive experiences with bears will be a strong factor influencing positive attitude and less risk perception toward bears.
- 3) Communities with a low number of bears killed in defense of life or property will be more tolerant of both brown and black bears than people in communities with a high number of bear kills.

## **METHODS**

### ***Study Area***

The Kenai Peninsula lies in south central Alaska between the Cook Inlet and Prince William Sound. The 23,000 km<sup>2</sup> of land is composed of a heavily glaciated

mountain range that divides the eastern mountains and western lowlands. The western side of the Kenai supports northern boreal forests composed of black spruce (*Picea mariana*), white spruce (*Picea glauca*), black cottonwood (*Populus balsamifera trichocarpa*), quaking aspen (*Populus tremuloides*), and paper birch (*Betula papyrifera*). The eastern side of the Kenai is considered a temperate coastal rainforest mainly composed of sitka spruce (*Picea sitchensis*), western hemlock (*Tsuga heterophylla*), mountain hemlock (*Tsuga mertensiana*), and white spruce. The Kenai also includes shrub and peat communities, numerous lakes, salmon (*Oncorhynchus* spp.) fed streams, and tundra. Unlike most of Alaska, the Kenai has a well-developed road system which has facilitated rapid development and high tourist traffic on the peninsula. Most (roughly 75%) of the Kenai is federally owned public land managed by KEFJ, KENWR and CNF. The remaining quarter is private native, borough, and state land composed of communities along the highways. According to the 2010 United States census, approximately 55,000 residents lived in 29 communities on the mainland of the Kenai. The population averaged 52% men, the average age was between 55-59 years for all people 18 or older, most adults have a high school diploma or the equivalent, and the most common occupation is management/professional.

### ***Survey Design and Administration***

From May 25- July 5, 2011 I handed out a total of 432 questionnaires to residents in six communities on the Kenai to determine attitudes, risk perception, and tolerance toward brown and black bears. The survey included: (1) a 4 page questionnaire and (2) a cover letter describing the purpose of the study, whom to contact if questions arose, and a

guarantee of confidentiality. The questionnaire (Appendix A) contained questions regarding individual attitudes and risk perception toward brown and black bears which were measured on a 5-point Likert scale. Open ended questions regarding experience with bears were included as well as closed ended questions regarding tolerance toward bears. Some questions were adapted from Kaczensky, Blazic, and Gossow (2004); as well as Siemer et al. (2009). The survey was approved by the Institutional Review Board (IRB) for Human Subjects at the University of Wisconsin-Madison in the spring of 2011 (Protocol: SE-2011-0196).

I selected the six communities for the survey based on the number of brown bears killed in defense of life or property (DLP) from 2000-2010 within those community boundaries based on absolute DLP numbers rather than per capita rates. I chose three communities with low DLPs (0-3) and three with high DLPs (11-21). Furthermore, it is important to note that DLP numbers for low DLP communities could be due to low brown bear numbers in those communities rather than intrinsically benign behaviors of those residents.

Low DLP communities included Cohoe, Moose Pass, and Seward. Cohoe is a rural community on the western side of the Kenai, an area near the Cook Inlet shoreline with little variation in terrain. Moose Pass is a very small community along the Seward Highway in the eastern mountains near Kenai Lake. Seward is the most urban community sampled, located on the Resurrection Bay, surrounded by mountains. Moose Pass and Seward have bear awareness programs more specifically for garbage management and Seward has a cost share program for bear-resistant garbage containers which most residents appeared to have used.

High DLP communities included Sterling, Cooper Landing, and Bear Creek. Sterling is a rural community on the western side of the Kenai, in the flatlands and has more agriculture than any other community of those sampled. Cooper Landing is in the mountains of the Kenai and has a strong program for promoting garbage management and brown bear education due to its close proximity to the Kenai and Russian River confluence, an area of high salmon and angler activity. Bear Creek is a suburb of Seward tucked into the mountains. Each of the six communities shared similarities when grouped as high or low DLP communities, including human population, housing density, and road accessibility (Table 1; Figure 5). I weighted the number of surveys per community based on population size in order to provide a representative sample of surveys from all communities despite variation in population size.

I located homes in each community by use of a street map which outlined the community boundary and proceeded to randomly deliver questionnaires by hand following Kaczensky et al. (2004). If nobody was at home during the time of delivery or if they refused to fill out the questionnaire, I proceeded to the next neighboring house. I only asked adults 18 years or older to fill out the questionnaire and if their age was uncertain I mentioned they must be 18 years or older to participate. I then informed them that I would return in two hours to collect the completed questionnaire which they could leave outside for me if they would no longer be home. If this time frame did not work for them I offered to come at a more convenient time. I also varied the time and days that I surveyed to minimize bias in age, gender, and employment status of respondents.

To address non-response bias, I placed a self-addressed, stamped postcard with five diagnostic questions from the original questionnaire at each residence I attempted to contact without success (Appendix B).

Before leaving each residence I used a checklist of categories to characterize the property in regards to the habitat and attractants for bears. I classified properties as (1) either urban, suburban, or rural, (2) on a high or low traffic road, (3) mostly forested, mostly open, or forested/open (half forested, half open), (4) riparian ( $\leq 800\text{m}$  of a water body) or non-riparian ( $> 800\text{m}$  of a water body). Protective measures (ex. type of fencing such as electric fence) to reduce/eliminate bear conflicts were noted. Attractants on the property were also listed including garbage not in bear resistant canisters, pet food, pets/animals on property, beehives, and other. Gardens and natural vegetation was not included as it was more difficult to define from a distance relative to other attractants.

### *Data Analysis*

Data analysis included descriptive statistics summarizing responses to all questions with Microsoft Excel. I completed all other analysis using R (version 2.14.2, R Foundation for Statistical Computing, Vienna, Austria).

### *Non-response bias*

I determined whether there was a non-response bias by testing if the distribution of responses differed between respondents and non-respondents for the five diagnostic questions. For the question, “Please rate your overall experience with brown/black bears,” responses were measured on an ordinal scale and analysis completed with the

Wilcoxon-Rank Sum Test with continuity correction. For the question, “Has a brown/black bear been killed in a non-hunting related incident on your property,” categorical responses were analyzed with a two-tailed Fisher’s Exact Test for count data. For analysis of categorical responses to the question regarding hunting in the past two years, I used Pearson’s  $X^2$  Test with Yates’ continuity correction. Differences among responses to attitude and risk perception questions were measured with Pearson’s  $X^2$  Test, and Bonferroni’s correction was applied when multiple comparisons were needed. Significant differences were determined at the  $p < 0.05$  level and moderately significant at the  $0.05 < p < 0.1$  level.

#### *Variables influencing attitude and risk perception toward bears*

I measured general attitude and risk perception toward bears based on responses to three statements for attitude and three for risk perception. Each statement used a 5-point Likert scale in which respondents were asked whether they strongly agreed, agreed, were neutral, disagreed, or strongly disagreed to each statement. All attitude and risk perception questions were constructed in a similar manner to facilitate comparison of responses. Answers were coded so that positive feelings were expressed by high values and negative feelings by low values. In order to determine whether all responses for the three attitude and three risk perception questions were highly correlated and showed high reliability to support grouping of related questions, I performed a test to determine Cronbach’s alpha coefficient which measures internal consistency among responses to each question (Zeller & Carmines, 1980; Gliem & Gliem, 2003). Levels of acceptability range from  $\alpha = 0.7$  acceptable,  $\alpha = 0.8$  good, and  $\alpha = 0.9$  excellent. Responses for the three

attitude questions were highly correlated and showed high reliability according to Cronbach's alpha coefficient (brown bear:  $\alpha = 0.85$ , black bear:  $\alpha = 0.83$ ), supporting the grouping of related questions. In addition, risk perception responses for the three different questions were highly correlated resulting in an index for risk perception (brown bear:  $\alpha = 0.89$ , black bear:  $\alpha = 0.88$ ). A mean index was then calculated for attitude and risk perception for both bear species for each respondent by adding the three responses together and dividing by three.

Four response variables were examined for analysis using multiple linear regression: (a) attitude toward brown bears, (b) attitude toward black bears, (c) risk perception toward brown bears, and (d) risk perception toward black bears. Although attitude and risk perception responses were measured on an ordinal scale, they were considered to be continuous variables for the regression analysis (Borgatta & Bohrnstedt, 1980; Vaske, 2008).

Due to the large number of possible predictor variables, two alpha levels were used ( $\alpha = 0.1$  and  $\alpha = 0.05$ ) to sort through the noise of the model when first performing simple linear regressions to aid in selection of variables for full models. To check for multicollinearity among predictor variables I looked at the variance inflation factor (VIF) for each variable. No variables exceeded the VIF cut-off criteria of 4.0.

Complete full models included the following predictor variables for analysis of attitude and risk perception: (a) AGE (continuous variable); (b) GENDER (male=1, female=2); (c) EDUCATION (grade school or high school=1, some college or college degree=2); (d) HUNTER (Yes or No, where 'Yes' is defined as a respondent who reported having "hunted in the past two years" or "regularly hunted at any other time in

[their] life”); (e) HIGHLOW (respondent in either high=1 or low=0 DLP community); (f) ATTRACTANTS (Yes or No, where ‘Yes’ is defined as respondent that either had pets visible at the time of survey drop off or collection and/or food/garbage not secured in bear resistant canisters); (g) SIGHTINGS (continuous variable; total number of sightings of both brown and black bears in community during 2010); (h) NEGATIVE EXPERIENCES (continuous variable; total number of negative experiences with both brown and black bears in community during 2010); (i) OVERALL EXPERIENCES (continuous variable; positive=1, somewhat positive=2, neutral=3, somewhat negative=4, and negative=5); (j) CONFLICT (Yes or No, where ‘Yes’ is defined as a respondent who reported having experienced some type of loss/damage from bears on their property at some point); and (k) OPINION (continuous variable; too high=1, high=2, about right=3, low=4, too low=5, don’t know=6). In addition, analysis of attitude included risk index while analysis of risk perception included attitude index as explained previously.

I created four multiple linear regression models to determine variables contributing to attitude and risk perception toward brown and black bears. Using the stepwise method forward and backwards, I removed the weakest predictor variables one by one. For model selection, I used Akaike’s Information Criterion (AIC), delta AIC, and AIC weights. I determined significance of predictor variables in each of the best fitting models at  $p < 0.05$ .

### *Tolerance toward bears*

To measure tolerance for interactions with a brown or black bear near one’s home I set up a 7-question bear sensitivity index (BSI) (Peyton et al., 2000; Siemer et al.,

2009). Tolerance is defined in a BSI as the point at which someone notifies authorities to take management action with the bear. I used the accepted definition of BSI plus included the use of lethal methods by respondent due to the fact that authorities would legally have to become involved in the event of a DLP. Each of the seven questions described a scenario of a human-bear interaction (e.g., “You see a brown bear near your home *once*”) from which respondents were asked to choose their preferred response by selecting one of the following: 1) do nothing, 2) use non-lethal methods (ex. pepper spray, hazing), 3) contact authorities, or 4) use of lethal methods. I applied Pearson’s  $X^2$  Test to examine differences among high and low DLP communities for both nuisance brown and black bears and preferences for responses to each scenario. Bonferroni’s correction was applied when multiple comparisons were necessary. To look at overall tolerance including all scenarios, for each respondent I summed the number of responses someone chose to notify the authorities or use lethal methods (value of 0-7). This value was then compared among low versus high DLP respondents with Pearson’s  $X^2$  Test. Significance was determined if  $p < 0.05$ .

## **RESULTS**

### ***Survey Response Rate***

I visited 620 residences in six selected communities on the Kenai. One hundred fifty-five residents were not home when I visited. Out of the 465 that were home, 26 refused to fill out a survey. Of the 439 homes that accepted a survey (acceptance rate of 94%), 432 residents completed a survey for a total response rate of 70%. According to Cochran’s (Snedecor & Cochran, 1989) my sample size of 432 completed surveys from a

population of 12,138 people for the six communities gave me a 4.6% margin of error with use of a 95% confidence interval.

Of the 155 postcards left at resident's doors, a total of 54 postcards were mailed back and analyzed for a response rate of 35%. There were no statistical differences found in responses from those that completed a questionnaire to those that filled out a postcard for all five of the questions.

### ***Comparing Low versus High DLP Respondents***

Respondents in high DLP communities reported killing significantly more brown bears than respondents in low DLP communities (Fisher's Exact Test,  $p=0.01$ ; Table 2). Low DLP communities saw significantly more black bears than brown bears (Pearson's  $\chi^2$  with Bonferroni's correction=226.54,  $df=1$ ,  $p<0.001$ ) and significantly fewer brown bears than high DLP communities (Pearson's  $\chi^2$  with Bonferroni's correction=315.60,  $df=1$ ,  $p<0.001$ ). Low DLP communities had significantly more negative black bear experiences than brown bear experiences (Pearson's  $\chi^2$  with Bonferroni's correction=13.25,  $df=1$ ,  $p=0.001$ ) and had fewer negative brown bear experiences than high DLP communities (Pearson's  $\chi^2$  with Bonferroni's correction=87.68,  $df=1$ ,  $p<0.001$ ). High DLP communities also experienced significantly more negative interactions with brown bears than black bears (Pearson's  $\chi^2$  with Bonferroni's correction=25.69,  $df=1$ ,  $p<0.001$ ; Table 3).

There was a moderately significant difference between low and high DLP communities relative to brown bears in response to the attitude question; "There is no need to have bears on the Kenai." Low DLP communities in general disagreed with this

statement more than high DLP communities; however, overall, at least 89% of respondents in both community types disagreed with the statement (Pearson's  $\chi^2$  Bonferroni's correction=9.24,  $df=1$ ,  $p=0.06$ ), revealing an overall positive attitude. In regards to risk perception, respondents in high DLP communities answered "I worry about problems bears may cause" and "I fear being injured by bears on the Kenai" with significantly more perceived risk toward brown than black bears (Pearson's  $\chi^2$  with Bonferroni's correction=9.99,  $df=2$ ,  $p=0.04$ , Pearson's  $\chi^2$  with Bonferroni's correction=13.69,  $df=2$ ,  $p=0.01$ ; Table 4).

#### ***Variables influencing attitude toward brown and black bears***

The best fit model for predicting attitude toward brown bears included the predictor variables GENDER, OPINION, AGE, EDUCATION, RISK PERCEPTION, and OVERALL EXPERIENCE (adjusted  $R^2=0.46$ ,  $n=383$ ; Table 5).

The coefficient estimate (Table 6) for GENDER was negative and not significant ( $p=0.13$ ), yet important to the model thus female respondents tend to have a more positive attitude toward brown bears than male respondents. The coefficient estimate for OPINION was positive and significant ( $p=0.03$ ) thus respondents who were less likely to think the brown bear populations were too high were more likely to have an increasingly positive attitude toward brown bears. The coefficient estimate for AGE was negative and significant ( $p=0.01$ ), revealing that younger respondents were more likely to have a more positive attitude toward brown bears. The coefficient estimate for EDUCATION was positive and moderately significant ( $p=0.06$ ), suggesting respondents with at least some college were more likely to have a more positive attitude toward brown bears than those

with a high school education or less. The coefficient estimate for RISK PERCEPTION was positive and significant ( $p < 0.001$ ), indicating that those respondents who perceive less risk were more likely to have a more positive attitude toward brown bears. In regards to OVERALL EXPERIENCE, the coefficient estimate was negative and significant ( $p < 0.001$ ), indicating that those with more positive experiences were more likely to have a more positive attitude toward brown bears.

The best fitting model explaining attitude toward black bears included the variables OPINON, AGE, EDUCATION, RISK PERCEPTION, and OVERALL EXPERIENCE (adjusted  $R^2 = 0.41$ ,  $n = 386$ ; Table 7).

The coefficient estimate for OPINION (Table 8) was positive and moderately significant ( $p = 0.07$ ) thus respondents who were less likely to think the black bear populations were too high were more likely to have a more positive attitude toward black bears. The coefficient estimate for AGE was negative and significant ( $p = 0.01$ ), revealing younger respondents were more likely to have a more positive attitude toward black bears. The coefficient estimate for EDUCATION was positive and not significant ( $p = 0.68$ ), yet included in the model, thus respondents with at least some college were more likely to have a more positive attitude toward black bears than those with a high school education or less. The coefficient estimate for RISK PERCEPTION was positive and significant ( $p < 0.001$ ) thus those with less perceived risk were more likely to have a more positive attitude toward black bears. In regards to OVERALL EXPERIENCE, the coefficient estimate was negative and significant ( $p < 0.001$ ), thus those with more positive experiences were more likely to have a more positive attitude toward black bears.

***Variables influencing risk perception towards brown and black bears***

The best fitting model to describe risk perception toward brown bears contained the predictor variables OPINION, ATTRACTANT, ATTITUDE, and OVERALL EXPERIENCE (adjusted  $R^2=0.39$ ,  $n=400$ ; Table 9).

The coefficient estimate for OPINION was positive and significant ( $p<0.001$ ; Table 10), indicating that respondents who were less likely to think the brown bear populations were too high perceived less risk toward brown bears. The coefficient estimate for ATTRACTANT was negative and significant ( $p=0.04$ ), thus respondents with no attractants on their property were more likely to perceive less risk toward brown bears than respondents with attractants on their property. The coefficient estimate for ATTITUDE was positive and significant ( $p<0.001$ ), indicating those with more positive attitudes toward brown bears were more likely to perceive less risk from brown bears. In regards to OVERALL EXPERIENCE, the coefficient estimate was negative and significant ( $p<0.001$ ), thus those with more positive experiences were more likely to perceive less risk toward brown bears.

Risk perception toward black bears was best predicted by the model containing the predictor variables OPINION, GENDER, AGE, ATTITUDE, and OVERALL EXPERIENCE (adjusted  $R^2=0.39$ ,  $n=386$ ; Table 11).

The coefficient estimate for OPINION was positive and significant ( $p<0.001$ ; Table 12), thus respondents who were less likely to think the black bear populations were too high perceived less risk from black bears. The coefficient estimate for GENDER was positive and significant ( $p<0.001$ ) indicating that male respondents were more likely to perceive less risk from black bears than females. The coefficient estimate for AGE was

positive and significant ( $p < 0.001$ ), thus older respondents were more likely to perceive less risk from black bears. The coefficient estimate for ATTITUDE was positive and significant ( $p < 0.001$ ), thus those with a more positive attitude were more likely to perceive less risk from black bears. In regards to OVERALL EXPERIENCE, the coefficient estimate was negative and significant ( $p < 0.001$ ), indicating that those with more positive experiences were more likely to perceive less risk from black bears.

### ***Tolerance toward brown and black bears***

Tolerance toward both brown and black bears was not significantly different between low versus high DLP communities except for two out of the seven scenarios I presented in my questionnaire (Table 13). In regards to black bears for the scenario “You see a bear near your home more than once a week,” low DLP communities were more likely to do nothing (44%) than high DLP respondents (30%;  $p = 0.05$ ). Significant differences were also found for the scenario, “You see or hear a bear attempting to enter some part of your home”. Low and high DLP respondents treated each bear species differently in this situation. While the majority of respondents from both types of communities chose to use lethal methods, a greater percentage of high DLP respondents (brown bears: 73%, black bears: 71%) chose lethal methods compared to low DLP respondents (brown bears: 54%, black bears: 53%; brown bears:  $p < 0.001$ ; black bears:  $p = 0.001$ ). When examining responses to the tolerance scenarios in which authorities became involved, such as “use of lethal methods” or “contact authorities”, no significant differences existed relative to low versus high DLP communities or bear species.

### ***Respondent Characteristics***

Significantly more respondents in low DLP communities (41%) reported having a college degree than high DLP respondents (28%) (Pearson's  $\chi^2=12.39$ ,  $df=3$ ,  $p=0.01$ ). The average age of respondents was 52 and 55% were male. Ninety-eight percent of respondents had at least a high school degree, and 68% had attended at least some college. The average length of residency on the Kenai was 17 years. Although most respondents (59%) indicated regular hunting participation, most (64%) had not hunted within the last 2 years nor had hunted brown (81%) or black bears (64%; Table 14).

Over 80% of respondents experienced positive to neutral experiences with both bear species (Figure 6). The majority (91%) of respondents used some type of routine preventive measure to protect themselves, family, pets, and/or property from bears. The most common management options reported by respondents included using or having firearms (63%; did not specify whether this included lethal or non-lethal rounds), dog/s (41%), and other (36%; Figure 7). "Other" included such things as air horns and warning neighbors of sightings. In regard to conflicts, there was no significant difference among respondent type or bear species. The majority of respondents had not experienced a loss or damage from brown (71%) or black bears (69%). Those that did experience a conflict categorized the loss/damage as mostly structural damage (i.e., buildings, vehicles, etc.; 14% due to brown bears, 10% due to black bears), a threat to themselves or family members (12% due to brown bears, 9% due to black bears), and other loss or damage (12% due to brown bears, 10% due to black bears; Figure 8). There was no significant difference among respondent type or bear species for these three categories of conflict.

## **DISCUSSION**

While I had hypothesized only low DLP respondents would have a positive attitude toward brown and black bears, respondents from both low and high DLP communities appeared to have an overall positive attitude toward both brown and black bears. Both communities displayed a neutral response for risk perception toward both bear species, yet there was significantly more risk perception in high DLP communities towards brown bears. These findings were similar to my hypothesis that low DLP respondents would have less risk perception toward both bear species, however, I did not hypothesize that risk perception by high DLP respondents would be specific to brown bears. My hypothesis that overall experience with bears would be a strong predictor of attitude and risk perception was verified in my models. Other key factors in predicting attitude toward bears included opinion about the population size, age and education of the respondent, and risk perception. In addition, risk perception toward bears was best predicted by opinion about the population size and attitude. Attractants were also a key factor in predicting risk perception toward brown bears. While I had hypothesized that low DLP respondents would be more tolerant of brown and black bears, there were no significant differences in tolerance toward either bear species among low and high DLP respondents in regards to responses of contacting authorities or use of lethal methods. In addition, low DLP respondents had fewer attractants on their property and more education.

### *Comparing Low versus High DLP Respondents*

Low DLP respondents saw significantly more black bears and significantly fewer brown bears than high DLP respondents. Low DLP respondents also reported significantly more negative black bear experiences and significantly fewer negative brown bear experiences than high DLP respondents. These findings suggest that overall bear species composition in communities may be different with more black bears in low DLP communities and more brown bears in high DLP communities. The reason for this is unknown, but may be explained by the availability of more suitable brown bear habitat in the high DLP communities compared to low DLP communities, and more suitable black bear habitat in low DLP communities relative to high DLP communities. However, thorough habitat analysis of these communities would aid in determination of this assumption.

Most respondents in both types of communities tended to have positive or somewhat positive attitudes toward both bear species (80%), although those in high DLP communities were slightly less positive toward brown bears. This is consistent with my hypothesis as well as with research conducted by Jonker, Muth, Organ, Zwick, and Siemer (2006). Jonker et al. (2006) found that while some respondents experienced problems with beavers, their attitude remained positive, yet less so compared to respondents that experienced no problems with beavers. It's possible that these slight differences in attitude stem from the greater amount of negative experiences with brown bears for those respondents from high DLP communities relative to respondents in low DLP communities. In addition, more negative attitudes have been found by people who

are dependent on local land resources for a living as they feel that their livelihood may be threatened because of bears (Kellert, 1994).

Two out of the three risk perception questions found that high DLP respondents perceived greater risk from brown bears than low DLP respondents, which is consistent with my hypothesis that low DLP respondents have less perceived risk; however, I did not state that risk perception would be specific to bear species. Research by Siemer et al. (2009) showed that more positive experiences with black bears in local residential areas led to decreased risk perception among residents. It seems likely that the increased negative experiences with brown bears among high DLP respondents has contributed to their increased sense of risk perception compared to fewer negative brown bear experiences, and thus less perceived risk for low DLP respondents. Gore, Siemer, Shanahan, Schuefele, & Decker (2005) found that a slight increase in risk perception by respondents corresponded with an increase in print media coverage of bear incidences. I do not know whether there is a greater amount of communication in high DLP communities to attribute to more risk perception among respondents compared to low DLP respondents.

### ***Variables influencing attitude towards brown and black bears***

My hypothesis that overall experience with bears would be a strong predictor of attitude was verified in my models for both brown and black bears. Other variables influencing attitude toward bears included their opinion on the population size, age and education of the respondent, and risk perception. For the variable of opinion regarding the population size of both brown and black bears, my results were consistent with the

literature which states that when bears are considered rare, relatively speaking, more positive attitudes are found among respondents (Cardoza, 1976; Brown et al., 1981). On the contrary, when bear populations are perceived as being overpopulated, more negative attitudes are found (Colorado Division of Wildlife, 1989). There are no data regarding the population size of brown or black bears in each of my surveyed communities, but in general, the majority of respondents from my survey were of the opinion that both bear populations were not too high, therefore having little negative effect on their attitude.

My results for age of respondent are consistent with research by Morzillo (2007), who found younger respondents often have a more positive attitude toward bears than older respondents. This could be due to the fact that often older respondents have more time to incur loss or damage from bears which affects attitude negatively and it is likely these younger respondents have experienced none or little loss to bears.

In accordance with research by Knuth et al. (1992), risk perception toward bears can influence attitudes toward bears. People who perceive less risk tend to have more positive attitudes toward bears. My results were consistent with my hypothesis that positive experiences with bears will be a strong factor influencing positive attitudes, which is also validated by the literature. Often one or more events can strongly affect people's attitudes and influence their reaction to future encounters (Conover, 2001; Woodroffe et. al, 2005). Those that tend to hold positive attitudes toward nuisance wildlife do so until they have experienced some type of damage (Bowman, Leopold, Vilella, Gill, & Jacobson, 2001; Clark et al., 1991; Jonker et al., 2006; West & Parkhurst, 2002).

I found nominal studies regarding a significant link between education level and attitude toward bears, yet my results indicate a more positive attitude toward bears with higher educated respondents. The fact that women were found to have a more positive attitude toward bears than men has been documented in the literature regarding wildlife in general. Kellert and Berry (1987) pointed to strong differences in the types of attitudes men and women have with women having more humanistic and moralistic views and expressing more concern about wildlife conservation.

#### ***Variables influencing risk perception towards brown and black bears***

My hypothesis that overall experience with bears would be a strong predictor of risk perception was verified in my models for both brown and black bears. Other variables that best predicted risk perception toward both brown and black bears included opinion and attitude. I could not find literature regarding people's opinion relative to the size of a bear population and how it may be related to risk perception. My research suggests that people who thought brown or black bear populations were not too high also perceived less risk from that species of bear. As with other research regarding attitudes, those with less risk perception also tended to have more positive attitudes toward bears (Knuth et al., 1992). The fact that more positive experiences with bears are associated with decreased risk perception among residents is also supported by Siemer et al. (2009) and supports my hypothesis that positive experiences are a strong factor influencing less risk perception.

Other variables that predicted risk perception toward brown bears included attractants, while variables related to black bears included respondents' gender and age,

and negative experiences. Why attractants were a factor relative to brown bears and not black bears is unclear, but could have to do with my data collection process or even the model selection process. I recorded attractants based on a quick survey of the property. Therefore, it is likely that I missed attractants even though they were present. In addition, my survey of attractants represented a one day snapshot, and it is possible that people tended to vary the amount of attractants on their property over time. However increased risk perception has been associated with more negative experiences, which could be due to the fact that I found more attractants associated with respondents' properties in high DLP communities compared to low DLP communities.

Gender results were consistent with literature as females tended to perceive more risk (toward large carnivores) than men (Arrindell, 2000; Roskaft, Bjerke, Kaltenborn, Linell, & Andersen, 2003; Tucker & Bond, 1997), which is possibly due to the majority of women lacking familiarity with bears as more men traditionally hunt more than women. Age also had a significant relationship with risk perception in that older respondents perceived less risk than younger respondents. Age may factor into the amount of experience a person has with black bears as research has found the more experience and familiarity someone has with bears, the less risk they perceive. Research has also found that older people are more afraid of wolves and brown bear than younger people, (Bjerke, Kaltenborn, & Thrane, 2001; Roskaft et al., 2003).

### ***Tolerance toward brown and black bears***

While I had hypothesized that low DLP respondents would be more tolerant of brown and black bears, there were no significant differences in tolerance toward either

bear species among low and high DLP respondents in regards to responses of “contact authorities” or “use of lethal methods”. My results suggest that according to these situations authorities would deal with residents from both community types with the same frequency. However, the specific cases might still differ such as authorities responding to DLPs more in high DLP communities, while responding to low DLP communities before DLPs have occurred. This leads to speculation of whether measuring tolerance in this manner is an accurate predictor of how people would behave in real life scenarios.

When examining the various situations described for tolerance questions, I found that respondents answered only two of the seven situations in significantly different ways. While most responses from both community types were similar for these two situations, a significant percentage differed in which low DLP respondents chose less aggressive measures and high DLP respondents chose more aggressive measures. Research by Zinn, Manfredi, Vaske, and Wittman (1998) found that as people experience more negative encounters, they are more likely to support proactive management, which includes invasive or lethal techniques. Therefore, the greater number of negative experiences that high DLP respondents reported could be leading to more aggressive actions regarding these tolerance scenarios. In addition support for lethal techniques will become stronger depending on the type and severity of the wildlife-caused problems (Stout, Knuth, & Curtis, 1997; Loker et al., 1999; Koval & Mertig, 2004). Although I did not gauge the severity of negative experiences with bears, there was no significant difference in the type of conflicts people reported for brown and black bears among communities.

### *Conflict mitigation efforts*

My survey results indicated that 91% of residents have available or have used some type of routine preventive measure against bears, with most respondents (63%) having available or using firearms for protection from bears. Other preventive measures used included dogs (41%), bear spray (34%), and bear-resistant garbage cans (33%). Many respondents used more than one type of preventive measure. From my data, it appears that residents are aware of bears in the area and prepare for interactions with them with a potentially lethal response. My results were not able to determine if respondents are aware of the effectiveness of other non-lethal measures and strategies.

The fact that there was no significant difference in the type of conflict experienced among respondents from either community type or bear species suggests that some conflicts are universal for the Kenai. While most respondents had not suffered a loss or damage, those that did, typically experienced structural damage (buildings, vehicles, etc.), a threat to themselves or a family member, or other category, caused by both bear species. When respondents filled out what the category of “other” consisted of, most described objects being destroyed such as barbecues and bird feeders. In general, the reliability of determining which bear species may have caused these losses may be low because loss or damage can happen at night or when no one is present. Since this question did not specify if the person actually saw the bear or could positively ID bear sign, differentiating bear species was not possible.

## MANAGEMENT IMPLICATIONS

Understanding human attitude, risk perception, and tolerance toward bears provides managers with greater insight into factors that could hinder effective wildlife management. Successful coexistence with bears means taking a closer look at private lands and requires interaction and cooperation with residents and wildlife managers (Primm & Wilson, 2004). This is especially important as residents are responsible for 80% of DLPs (Kenai Peninsula Brown Bear Conservation Strategy, 2000) and 40% of these DLPs occur on private property (ADFG, 2012). Determining the source of conflicts and mitigating those conflicts becomes a job for the whole community.

Peine (2001) found that food conditioned bears can increase the likelihood of human-bear conflicts. Therefore, it is important that wildlife managers work on addressing attractants such as food, garbage, pets, and livestock as they are often the primary cause of human-bear conflicts associated with property damage, human injury, and bear kills (Herrero, 1985; Gunther, 1994; Gniadek & Kendall, 1998; Herrero & Higgins, 2003). Residents that are uneducated about bear behavior toward attractants, as well as negligence of those that do know the consequences, can significantly contribute to conditioning bears to human attractants. On the Kenai, food conditioned bears become nuisance bears which often result in dead bears after creating problems on people's property. By eliminating attractants fewer nuisance bears will exist and therefore residents will experience less negative experiences with bears on their property, increasing positive attitudes toward bears. Strengthening the enforcement of ordinances already in effect that work to penalize residents for negligently feeding wildlife can be an

effective way to reduce attractants on people's property. However, if other issues such as risk perception are not addressed, residents may still feel threatened when a bear is on or near their property.

A more comprehensive understanding of risk perceived by residents on the Kenai would help wildlife managers to focus efforts in a way to reduce those levels. This could greatly benefit high DLP communities in regards to their risk perception toward brown bears. Gore (2007) found that by focusing on the factors that influence wildlife-related risk perception, outreach efforts can be better designed with a clear message to aid in reducing those levels of risk perception. Cho (2003) also found that people who had increased risk perception were also linked to increased risk-reducing behavior, so it is likely that this group of residents would be receptive to education on the subject of better understanding bears and bear behavior. Research has also found that risk perception can be strongly affected by people who would not feel in control of their own response during an encounter with a bear (Johansson & Karlsson, 2011) Therefore, if they were taught how to handle an interaction, it is likely this information would help to decrease their level of risk perception. Offering bear safety and awareness classes to the public would provide them with the skills to successfully handle an interaction with a bear.

Wildlife managers should also work to increase tolerance of bears on the Kenai. Studies have revealed that decreased tolerance of bears was correlated to respondents who were less knowledgeable about bears, those with less education, and lower incomes (Clark et al. 1991). Working to improve residents' knowledge about bears with educational programs could help increase tolerance of bears. Increasing education about

wildlife has also been associated with an increase in support of wildlife agencies (Peyton & Grise, 1995), which would greatly benefit wildlife managers on the Kenai as brown bear management has been a contentious subject among the public, state, and federal agencies. In addition, research on hunting clubs in Mississippi and Arkansas found that clubs with fewer bears wanted more bears and those with more wanted fewer (White et al. 1997). This is suggestive of tolerance decreasing when bear populations are high. Taking this into account, it's important that bear populations on the Kenai are not perceived as being too high to negatively affect tolerance and measures that work to keep bear populations at socially acceptable levels should be considered.

With the ever increasing human population on the Kenai it is likely human-bear conflicts will escalate and the number of bears killed in defense of life or property will become a significant source of mortality for brown bears not only on the Kenai Peninsula, but the rest of Alaska as well. This implies that residents who live in these areas will determine the success of bear conservation. Gaining support of residents and teaching them that their actions and efforts are required for successful conservation of bears will be an invaluable tool.

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## TABLES- Chapter One

**Table 1. Selection criteria\* of low and high defense of life and property communities based on housing density, human population size, and the number of defense of life or property bear kills (DLP) on the Kenai Peninsula, Alaska, 2011.**

Community	Housing Density mi <sup>2</sup> (2000)	Pop. (2000)	DLPs (2000-2010)
Sunrise	1.9	18	0
Crown Point	10.7	75	1
Lowell Point	6.1	92	0
Primrose	1.3	93	2
Hope	3.4	137	2
Clam Gulch	8.4	173	2
<b>Moose Pass</b>	<b>6.6</b>	<b>206</b>	<b>2</b>
Nikolaevsk	3.4	345	1
<b>Cooper Landing</b>	<b>5.7</b>	<b>369</b>	<b>18</b>
Kachemak	136.2	431	0
Kasilof	20.1	471	2
Happy Valley	4.5	489	1
Funny River	22.8	636	8
Ninilchik	3.7	772	10
Salamatof	34.8	954	1
<b>Cohoe</b>	<b>9</b>	<b>1168</b>	<b>1</b>
Fritz Creek	15.7	1603	0
<b>Bear Creek</b>	<b>19.2</b>	<b>1748</b>	<b>10</b>
Diamond Ridge	17.8	1802	3
Anchor Point	10.8	1845	1
Ridgeway	56.3	1932	5
<b>Seward</b>	<b>73.3</b>	<b>2830</b>	<b>0</b>
Soldotna	240.7	3759	5
Homer	177	3946	0
Nikiski	25.4	4327	9
<b>Sterling</b>	<b>33</b>	<b>4705</b>	<b>18</b>
Kalifornsky	35.8	5846	5
Kenai	100.4	6942	4

\*Fox River was not included as it was not road accessible to the mainland of the Kenai Peninsula.

**Table 2. Demographic characteristics for survey respondents in select low versus high defense of life and property (DLP) communities on the Kenai Peninsula, Alaska, 2011.**

<b>Self-reported demographic data</b>	<b>Low DLP Community</b>	<b>High DLP Community</b>	<b>P-value</b>
Number of respondents	150	282	<0.001
GENDER	41% female 59% male	47% female 53% male	0.35
AGE	18-86 years old	18-84 years old	NA
EDUCATION (report having a college degree)	41%	28%	0.01
RESIDENCY (range of residence in years)	1 to 75	1 year to 65	NA
HUNTER			
Regular hunting participation	53%	60%	0.16
Hunted in the past two years	31%	38%	0.27
Hunted brown bears at some time in past	17%	19%	0.80
Hunted black bears at some time in past	32%	35%	0.42
Brown bear killed in non-hunting related incident on property	0.7%	1.7%	0.01
Black bear killed in non-hunting related incident on property	3.3%	2.1%	0.52

**Table 3. Comparison of sightings and negative experiences with brown and black bears on private property in select defense of life and property (DLP) communities on the Kenai Peninsula, Alaska, 2011.**

Survey question and response options	Respondents				P-value
	Low DLP Community		High DLP Community		
	Brown bear	Black bear	Brown bear	Black bear	
Total sightings	203	640	752	718	
Respondents	n=145	n=146	n=274	n=272	
Mean	2.6	3.9	2.7	4.2	< 0.001 <sup>a,c</sup>
Range	0 to 20	0 to 29	0 to 40	0 to 30	
SD	6.1	8.1	6.4	8.5	
Total negative experiences	14	41	124	56	
Respondents	n=145	n=144	n=269	n=268	
Mean	0.4	0.2	0.4	0.3	< 0.001 <sup>a,b,c</sup>
Range	0 to 2	0 to 7	0 to 10	0 to 13	
SD	2.8	1.1	2.9	1.1	

<sup>a</sup>Significant with bonferroni's correction for low DLP communities among brown vs. black bears.

<sup>b</sup>Significant with bonferroni's correction for high DLP communities among brown vs. black bears.

<sup>c</sup>Significant with bonferroni's correction for brown bears among low vs. high DLP communities.

**Table 4. Comparison of attitudes and risk perception toward brown and black bears in select defense of life and property (DLP) communities on the Kenai Peninsula, Alaska, 2011.**

Type of Question	Survey question and response options <sup>a</sup>	Respondents				P-value
		Low DLP Community		High DLP Community		
Attitude		Brown bear	Black bear	Brown bear	Black bear	
	I enjoy having bears on the Kenai	n=149	n= 149	n=280	n=282	
	Agree	75%	79%	74%	77%	0.33
	Neutral	15%	18%	17%	17%	
	Disagree	10%	3%	9%	7%	
	Bears are a sign of intact nature	n=148	n=149	n=278	n=280	
	Agree	82%	81%	80%	80%	0.95
	Neutral	12%	14%	13%	14%	
	Disagree	6%	5%	8%	6%	
	There is no need to have bears on the Kenai	n=148	n=148	n=281	n=281	
	Agree	9%	5%	5%	5%	0.01*
	Neutral	5%	6%	14%	14%	
	Disagree	86%	89%	81%	80%	
	Mean Index	4.18	4.26	4.08	4.11	
	SD	0.98	0.80	0.84	0.80	
Risk Perception	I worry about problems bears may cause	n=149	n=147	n=280	n=280	
	Agree	45%	35%	51%	38%	0.01**
	Neutral	32%	31%	24%	28%	
	Disagree	23%	34%	25%	34%	
	I feel threatened by bears on the Kenai	n=147	n=147	n=280	n=281	
	Agree	16%	13%	21%	15%	0.09
	Neutral	22%	20%	27%	23%	
	Disagree	63%	67%	53%	62%	
	I fear being injured by bears on the Kenai	n=147	n=147	n=280	n=281	
	Agree	22%	16%	29%	17%	0.001**
	Neutral	26%	22%	30%	27%	
	Disagree	52%	61%	42%	56%	
	Mean Index	3.26	3.50	3.06	3.37	
	SD	1.04	1.03	1.07	1.01	

<sup>a</sup>Scores were derived from a 5-point likert scale, with 1 indicating strongly disagree, 5 strongly agree, and 3 neutral.

\*Moderately significant with bonferroni's correction for brown bears among high vs. low DLP communities.

\*\*Significant with bonferroni's correction for high DLP communities among brown vs. black bears.

**Table 5. Model comparisons for determining respondents' attitude toward brown bears on the Kenai Peninsula, Alaska, 2011.**

Model		AIC	$\Delta$ AIC	AICw <sub>t</sub>
<b>Best Fit Model</b>	ATTITUDE~GENDER+OPINION+AGE+EDUCATION+RISK PERCEPTION+OVERALL EXPERIENCE	809.26	0.00	0.96
<b>Full Model</b>	ATTITUDE~OPINION+CONFLICT+HUNTER+GENDER+AGE+ EDUCATION+RISK PERCEPTION+SIGHTINGS+NEGATIVE EXPERIENCES+OVERALL EXPERIENCES	815.51	6.25	0.04
<b>Null Model</b>	ATTITUDE~1	1045.73	236.47	<0.001

**Table 6. Evaluation of predictor variables for determining respondents' attitude toward brown bears on the Kenai Peninsula, Alaska, 2011.**

Predictor Variables	Coefficient Estimate	Std. Error	t value	P-value
<b>GENDER (Male)</b>	-0.11	0.07	-1.5	0.13
<b>OPINION</b>	0.05	0.02	2.25	0.03
<b>AGE</b>	-0.01	0.00	-2.45	0.01
<b>EDUCATION (Some College)</b>	0.15	0.08	1.91	0.06
<b>RISK PERCEPTION</b>	0.31	0.04	7.99	<0.001
<b>OVERALL EXPERIENCES</b>	-0.26	0.03	-7.49	<0.001

**Table 7. Model comparisons for determining respondents' attitude toward black bears on the Kenai Peninsula, Alaska, 2011.**

Model		AIC	$\Delta$ AIC	AICw <sub>t</sub>
<b>Best Fit Model</b>	ATTITUDE~OPINION+AGE+EDUCATION+RISK PERCEPTION+OVERALL EXPERIENCE	773.54	0.00	0.82
<b>Full Model</b>	ATTITUDE~OPINION+HUNTER+AGE+EDUCATION+RISK PERCEPTION+NEGATIVE EXPERIENCES+OVERALL EXPERIENCES	776.55	3.02	0.18
<b>Null Model</b>	ATTITUDE~1	970.02	196.48	<0.001

**Table 8. Evaluation of predictor variables for determining respondents' determining attitude toward black bears on the Kenai Peninsula, Alaska, 2011.**

Predictor Variables	Coefficient Estimate	Std. Error	t value	P-value
<b>OPINION</b>	0.04	0.02	1.85	0.07
<b>AGE</b>	-0.01	0.00	-3.18	0.01
<b>EDUCATION (Some College)</b>	0.14	0.07	1.83	0.68
<b>RISK PERCEPTION</b>	0.24	0.04	6.45	<0.001
<b>OVERALL EXPERIENCES</b>	-0.29	0.03	-8.59	<0.001

**Table 9. Model comparisons for determining respondents' risk perception toward brown bears on the Kenai Peninsula, Alaska, 2011.**

Model		AIC	$\Delta$ AIC	AIC <sub>w<sub>t</sub></sub>
<b>Best Fit Model</b>	RISK PERCEPTION~OPINION+ATTRACTANT+ATTITUDE +OVERALL EXPERIENCES	1023.72	0.00	0.97
<b>Full Model</b>	RISK PERCEPTION~OPINION+CONFLICT+HIGHLOW+ ATTRACTANT+ATTITUDE+SIGHTINGS+NEGATIVE EXPERIENCES+OVERALL EXPERIENCES	1030.62	6.89	0.03
<b>Null Model</b>	RISK PERCEPTION~1	1222.37	198.64	<0.001

**Table 10. Evaluation of predictor variables for determining respondents' risk perception toward brown bears on the Kenai Peninsula, Alaska, 2011.**

Predictor Variables	Coefficient Estimate	Std. Error	t value	P-value
OPINION	0.11	0.03	3.84	<0.001
ATTRACTANTS (Yes)	-0.17	0.09	-2.02	0.04
ATTITUDE	0.43	0.06	7.40	<0.001
OVERALL EXPERIENCES	-0.23	0.04	-5.18	<0.001

**Table 11. Model comparisons for determining respondents' risk perception toward black bears on the Kenai Peninsula, Alaska, 2011.**

Model		AIC	$\Delta$ AIC	AIC <sub>w<sub>t</sub></sub>
<b>Best Fit Model</b>	RISK PERCEPTION~OPINION+GENDER+AGE+ATTITUDE+ OVERALL EXPERIENCES	968.64	0.00	0.72
<b>Full Model</b>	RISK PERCEPTION~OPINION+GENDER+AGE+ATTITUDE+ NEGATIVE EXPERIENCES+OVERALL EXPERIENCES	970.49	1.85	0.28
<b>Null Model</b>	RISK PERCEPTION~1	1152.31	183.67	<0.001

**Table 12. Evaluation of predictor variables for determining respondent's risk perception toward black bears on the Kenai Peninsula, Alaska, 2011.**

Predictor Variables	Coefficient Estimate	Std. Error	t value	P-value
OPINION	0.14	0.03	4.70	<0.001
GENDER (Male)	0.38	0.09	4.47	<0.001
AGE	0.01	0.00	3.42	<0.001
ATTITUDE	0.42	0.06	6.83	<0.001
OVERALL EXPERIENCES	-0.23	0.05	-4.99	<0.001

**Table 13. Comparison of tolerance toward brown and black bears in select defense of life and property (DLP) communities on the Kenai Peninsula, Alaska, 2011.**

Type of Question	Survey question and response options	Respondents				P-value
		Low DLP Community		High DLP Community		
Tolerance		Brown bear	Black bear	Brown bear	Black bear	
You see a bear near your home once		n=147	n=146	n=277	n=275	0.08
	Do nothing	80%	86%	81%	81%	
	Use non-lethal methods	3%	3%	8%	8%	
	Contact authorities	15%	7%	10%	8%	
	Use lethal methods	2%	4%	1%	3%	
You see a bear near your home more than once a week		n=144	n=145	n=272	n=271	*<0.001
	Do nothing	33%	44%	23%	30%	
	Use non-lethal methods	8%	9%	17%	18%	
	Contact authorities	57%	40%	56%	46%	
	Use lethal methods	3%	7%	29%	6%	
A bear damages a garbage can at your home once		n=142	n=144	n=264	n=261	0.01
	Do nothing	50%	53%	45%	42%	
	Use non-lethal methods	12%	14%	37%	25%	
	Contact authorities	35%	26%	28%	26%	
	Use lethal methods	3%	6%	4%	7%	
A bear damages garbage cans at your home more than once a week		n=139	n=142	n=252	n=255	0.15
	Do nothing	12%	14%	10%	9%	
	Use non-lethal methods	17%	15%	18%	20%	
	Contact authorities	64%	59%	60%	53%	
	Use lethal methods	8%	11%	12%	18%	
A bear chases a pet once		n=143	n=144	n=266	n=269	0.02
	Do nothing	34%	35%	26%	27%	
	Use non-lethal methods	18%	17%	26%	23%	
	Contact authorities	36%	31%	31%	27%	
	Use lethal methods	11%	16%	17%	23%	
A bear chases a pet more than once a week		n=141	n=144	n=266	n=270	0.04
	Do nothing	8%	8%	5%	5%	
	Use non-lethal methods	12%	15%	11%	12%	
	Contact authorities	55%	51%	45%	42%	
	Use lethal methods	26%	26%	39%	41%	
You see or hear a bear attempting to enter some part of your home		n=145	n=146	n=272	n=274	**<0.001
	Do nothing	1%	1%	2%	3%	
	Use non-lethal methods	10%	14%	9%	9%	
	Contact authorities	35%	32%	16%	16%	
	Use lethal methods	54%	53%	73%	71%	

\*Significance with bonferroni's correction for black bears among high vs. low DLP communities.

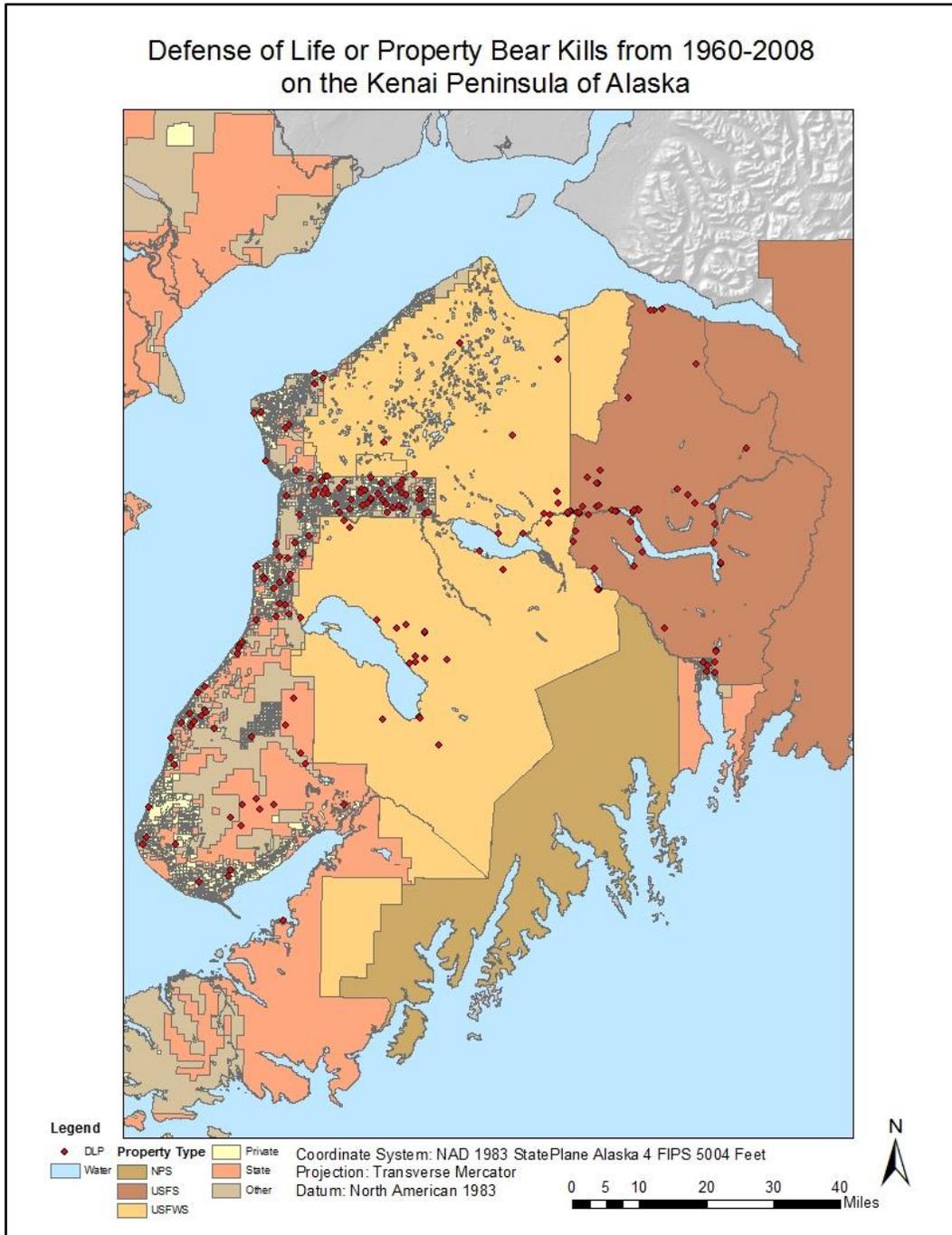
\*\*Significance with bonferroni's correction for brown bears among high vs. low DLP communities, and black bears among high vs. low DLP communities.

\*\*\*Use of non-lethal methods (ex. pepper spray, hazing)

**Table 14. Demographic characteristics for survey respondents on the Kenai Peninsula, Alaska, 2011.**

<b>Variable</b>	<b>N</b>	<b>Response Category</b>	<b>Percent</b>
AGE	429	Mean Age	52
GENDER	417	Female	45
		Male	55
EDUCATION	421	Grade School	3
		High School Degree	29
		Some College	35
		College Degree	33
RESIDENCY (in years)	418	Mean Length	17
<b>HUNTER</b>			
Regular hunting participation	419	No	41
		Yes	59
Hunted in the past two years	419	No	64
		Yes	36
Hunted brown bears at some time in past	411	No	81
		Yes	19
Hunted black bears at some time in past	420	No	64
		Yes	36

**FIGURES- Chapter One**



**Figure 1. Distribution of defense of life or property bear kills (DLP) from 1960-2008 on the Kenai Peninsula, Alaska.**

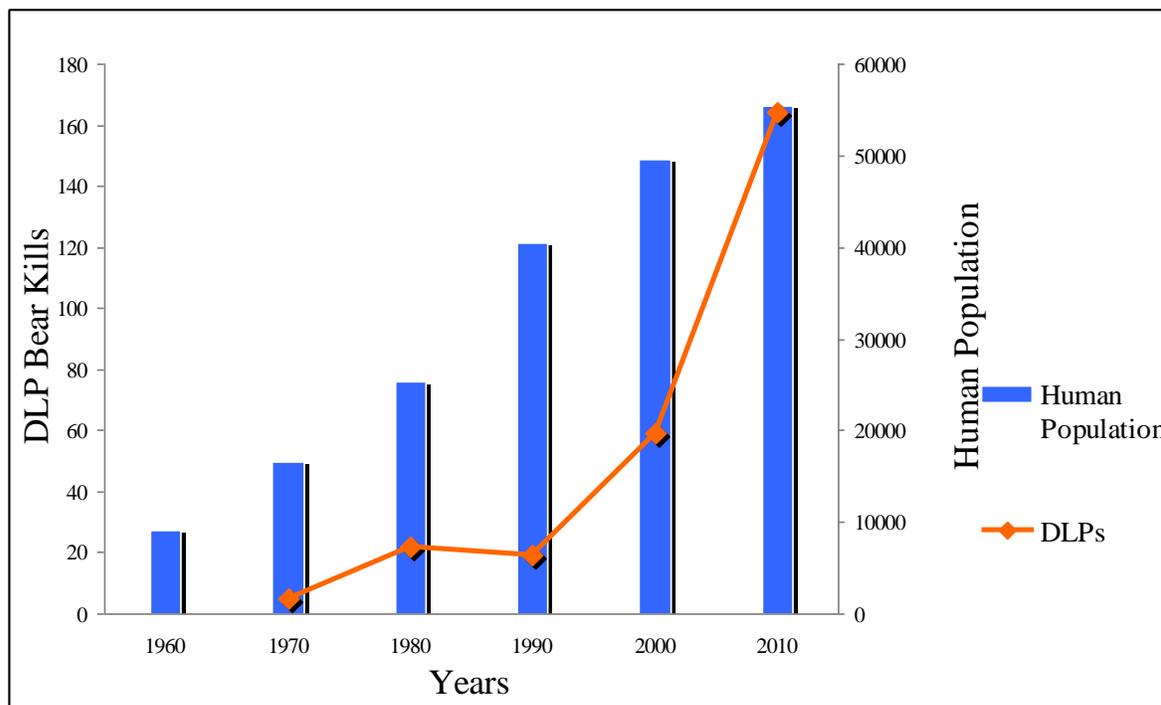


Figure 2. Defense of life or property bear kills (DLP) and human population size on the Kenai Peninsula, Alaska, 1960-2010.

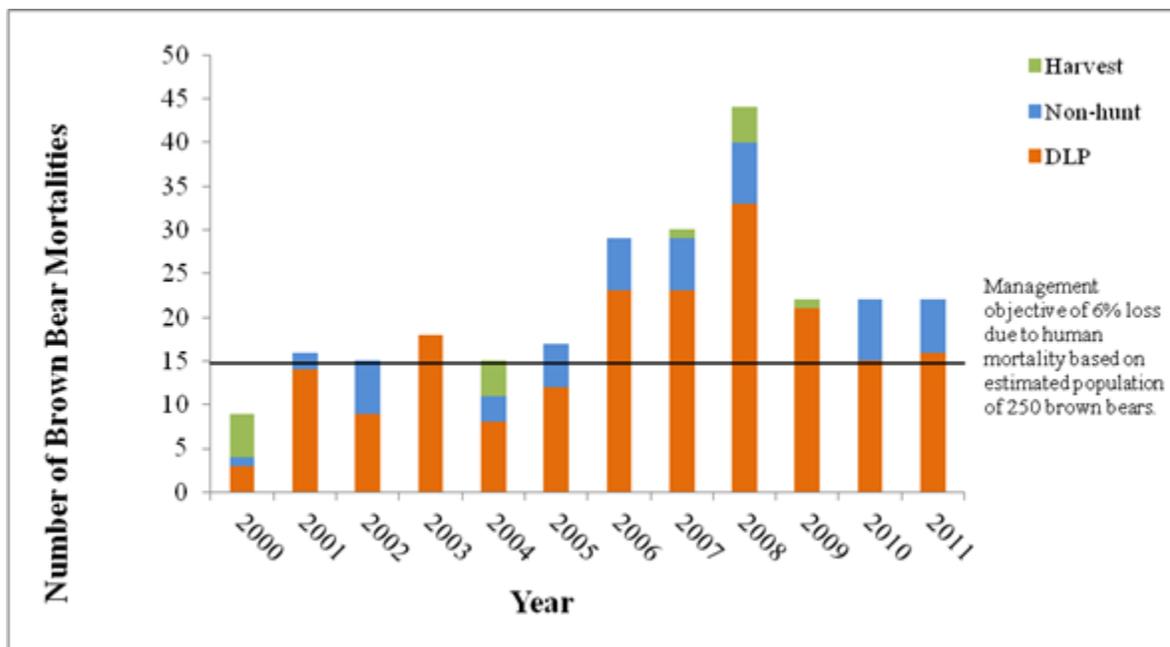


Figure 3. Total brown bear mortalities from 2000-2011 on the Kenai Peninsula of Alaska due to harvest, non-hunting kills (ex. road kills, illegal kills), and defense of life or property kills (DLP).

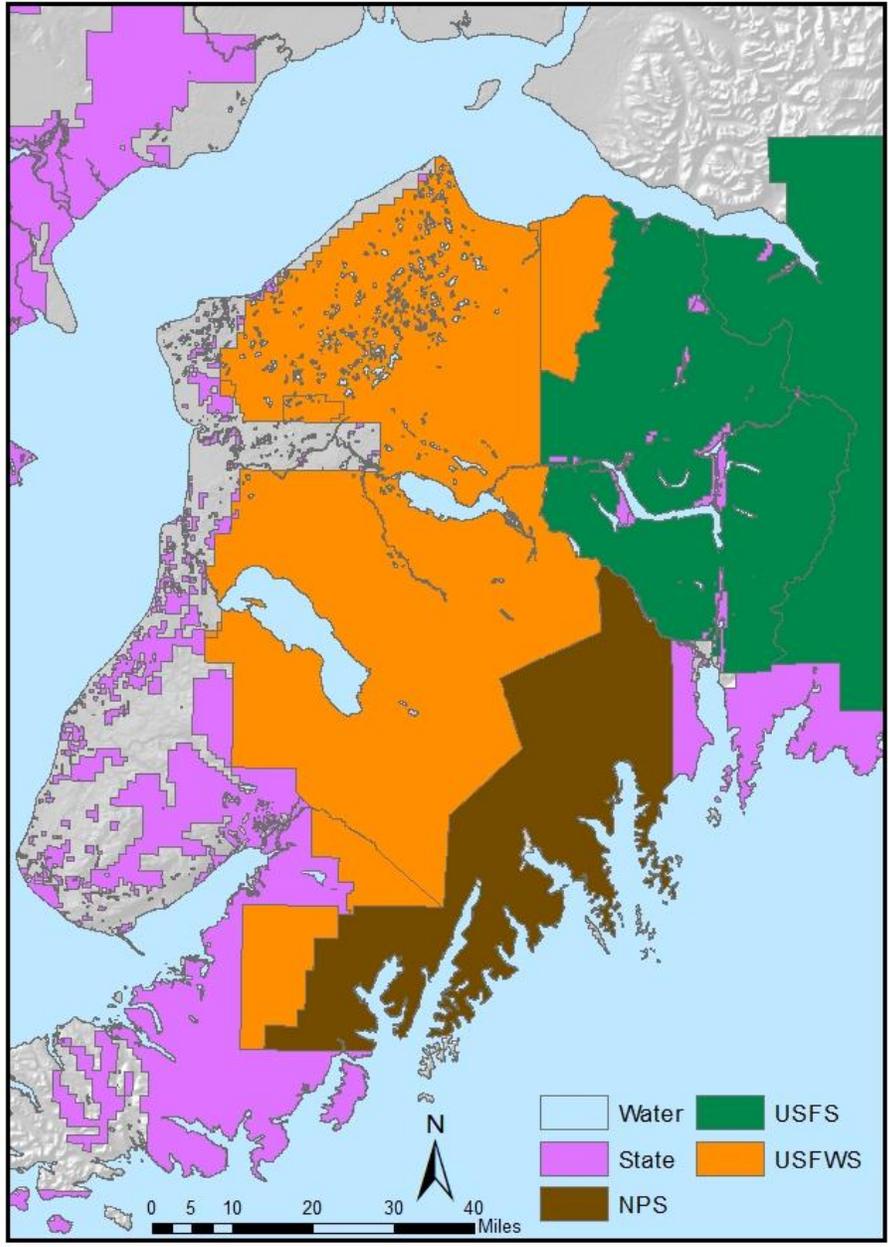


Figure 4. Map of agencies responsible for bear management on the Kenai Peninsula, Alaska, 2012.

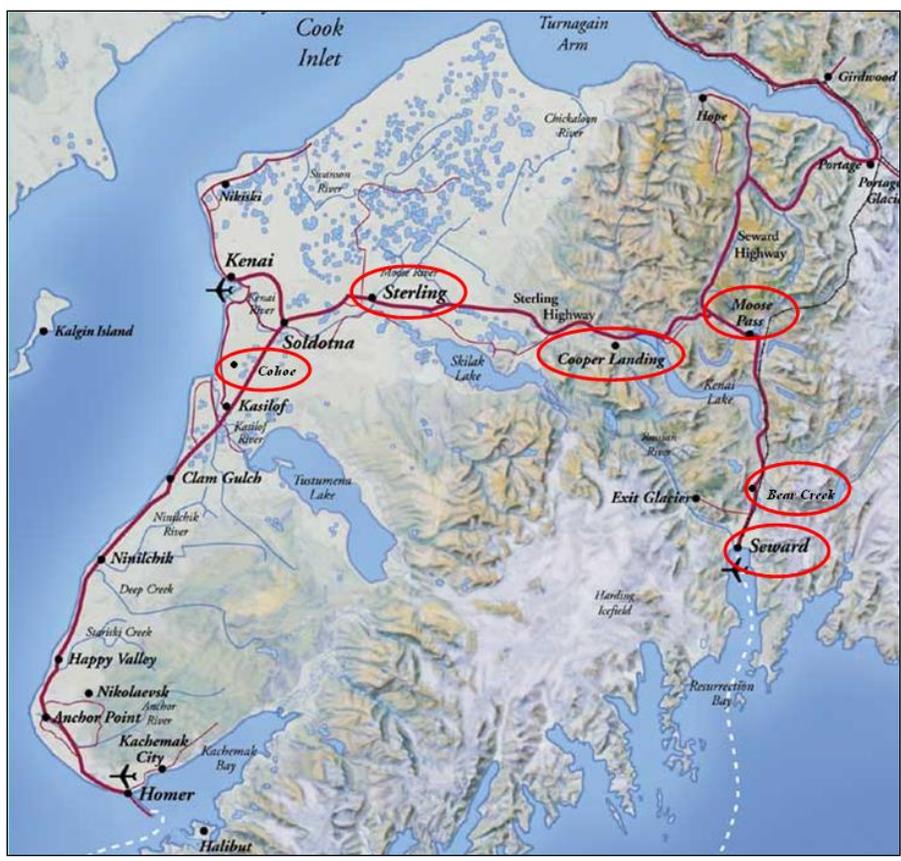


Figure 5. Sites selected for surveys on the Kenai Peninsula, Alaska, 2011.

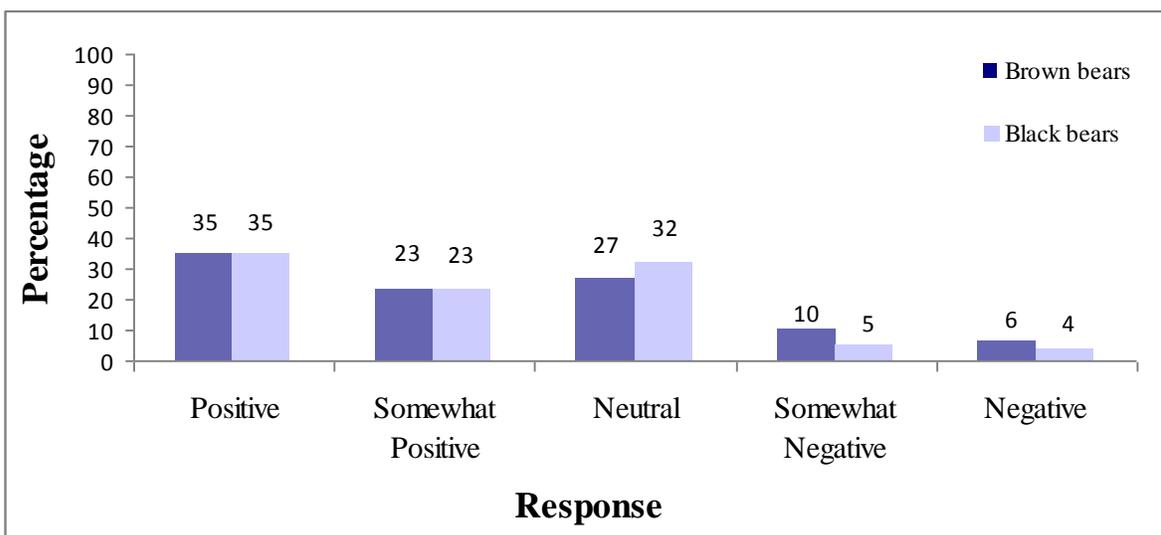
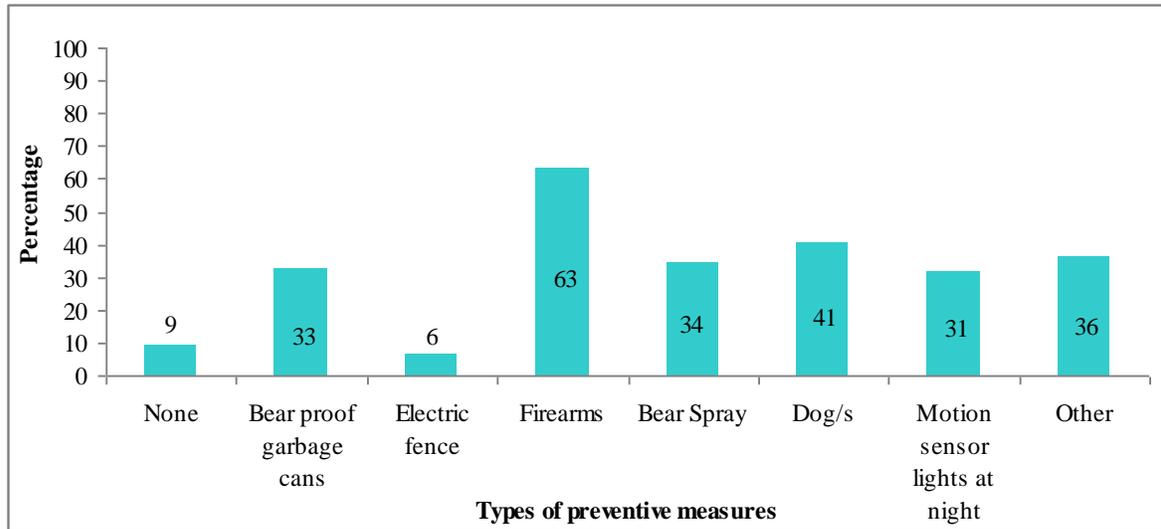
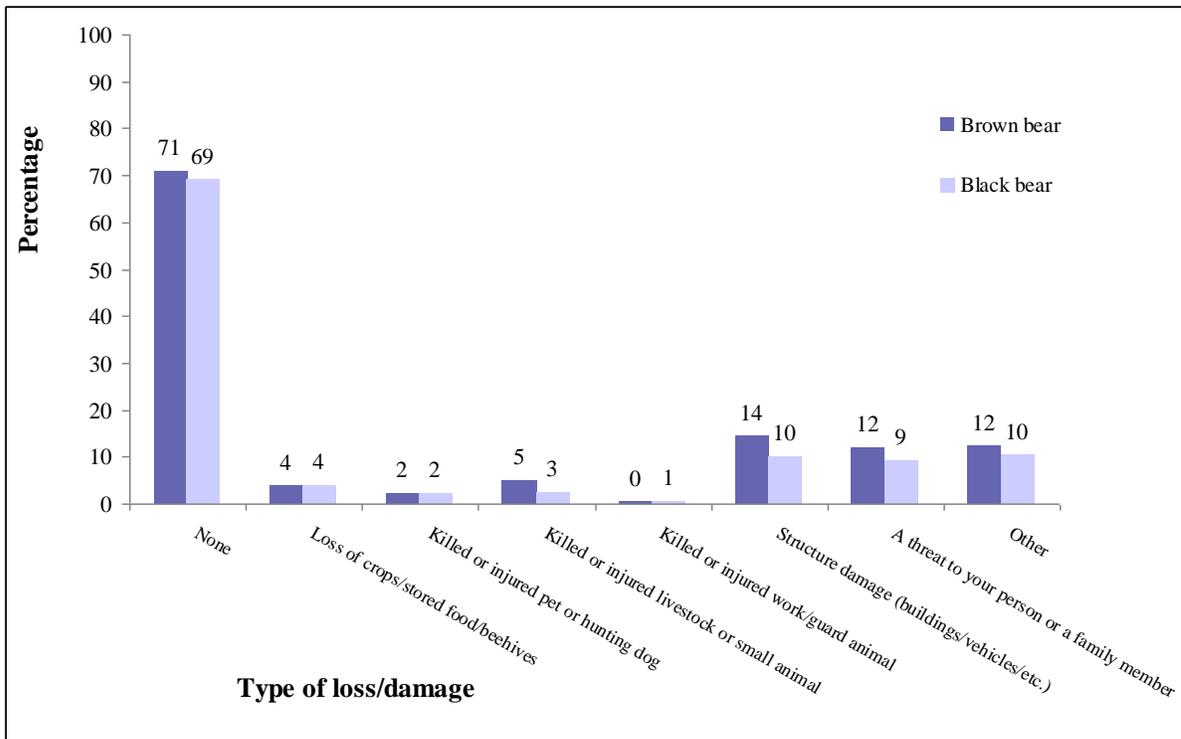


Figure 6. Overall experience of respondents with brown and black bears on the Kenai Peninsula, Alaska, 2011 (n=426).



**Figure 7. Preventive measures respondents used or had to mitigate conflicts with brown and black bears on the Kenai Peninsula, Alaska, 2011. These categories are not mutually exclusive and many respondents used or had more than one method for routine preventive measures.**



**Figure 8. Losses/damages that respondents have incurred from brown and black bears on their property on the Kenai Peninsula, Alaska, 2011. These categories are not mutually exclusive and respondents may have experienced more than one type of loss/damage.**

## **CHAPTER TWO. A Review of Human-Bear Conflict Mitigation Strategies on the Kenai Peninsula, Alaska**

### **Abstract**

The Kenai Peninsula is one of the fastest developing areas of Alaska and also has experienced a drastic increase in the number of brown bears killed via the defense of life or property (DLP) law since 2000. In an attempt to decrease DLP numbers, various programs have been initiated by wildlife management agencies to address human-bear conflicts. This is a review of human-bear conflict mitigation strategies used on the Kenai Peninsula along with recommendations on how to strengthen current programs as well as other strategies to improve proactive management of these conflicts.

### **INTRODUCTION**

For the persistence and health of brown bears (*Ursus arctos*), including their habitat on the Kenai Peninsula (Kenai), coexistence among humans and bears must occur. While a portion of the land on the Kenai is federally protected as designated wilderness, human encroachment threatens quality bear habitat on the remaining private and public land. The Kenai is the second fastest growing region in Alaska, having grown 11.5% in the last decade (US Census, 2010). This includes 1.5 new houses being built each day (Kenai Peninsula Borough, 2012). Additionally, road density and other infrastructure to service communities continues to fragment bear habitat, leading to an increase in human-bear interactions. This increase in interactions also has led to an increase in the number of conflicts between humans and bears that result in bears killed in defense of life or property (DLPs), averaging five per year in the 1990s to an average of 16 per year during

the past decade (ADF&G, unpublished data). In 2000, the Alaska Department of Fish and Game (ADF&G) reported that residents, as opposed to wildlife managers and law enforcement, were responsible for about 80% of the bears killed in DLPs (Kenai Peninsula Brown Bear Conservation Strategy, 2000), and about 40% of DLPs occurred on private property (Figure 1). This raises concerns among bear managers on the Kenai because it is difficult to control what happens when humans and bears come in contact with each other.

In November of 1998, the ADF&G listed the Kenai brown bear population as a “Species of Special Concern.”<sup>1</sup> This identified the brown bear population as “vulnerable to significant decline due to low numbers, restricted distribution, dependence on limited habitat resources, or sensitivity to environmental disturbance” (Kenai Peninsula Brown Bear Conservation Strategy, 2000). In an effort to ensure the future of brown bears on the Kenai, many programs have been developed, ranging from concentrating management on available bear habitat to human-bear conflict mitigation and outreach. The following is a review of human-bear conflicts on the Kenai as well as the goals outlined and programs created by the agencies responsible for promoting coexistence of humans and bears on the Kenai.

## **HUMAN-BEAR CONFLICTS**

Conflicts often occur when either bears move into human use areas or when human development encroaches on bear habitat (Stowell & Willging, 1992; Peine, 2001),

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<sup>1</sup> At the start of 2012, the ADF&G no longer uses the “Species of Special Concern” list. The species/populations of special concern have been relegated to an appendix in the State Wildlife Action Plan. As of September 2012 no changes had been made to programs regarding brown bear research on the Kenai (Selinger, Personal Communication, 2012).

mostly due to bears seeking out food sources which are now limited in availability after displacement, or loss of vital habitat. Since even small numbers of bears killed by humans can have adverse effects on population growth (Wakkinen & Kasworm, 2004), areas of high human use often become population sinks for bears (Nielsen et al., 2004; Nielsen, Stenhouse, & Boyce, 2006). For example, over a 10 year period, Beckmann and Lackey (2008) reported 151 black bear deaths in urban environments of the northern Sierra Nevada Mountains of Nevada including the Lake Tahoe Basin of California. All of the deaths were due to humans, and deaths exceeded recruitment.

Developed areas attract bears as they search for a food source. Attractants offered in a human-dominated landscape are often high calorie foods that can be obtained more easily than natural, lower calorie foods found from foraging for longer periods of time (McCarthy & Seavoy, 1994). Seeking human attractants such as garbage, bird and pet food, fish carcasses, and livestock becomes habitual once a bear becomes conditioned to this type of food. Bears habituated to human-dominated areas tend to frequent more areas inhabited by humans in search of non-natural food sources, altering their foraging patterns (Beckmann & Berger, 2003; Beckmann & Lackey, 2008). Food-conditioned bears are more likely to inflict human injury because they are habituated to humans and their attractants (Herrero, 1985; Herrero & Fleck, 1990). Understanding the cause of human-bear conflicts on the Kenai is essential for mitigation of those conflicts.

Research I conducted on the Kenai Peninsula in 2011 regarding residents' attitudes, risk perceptions, and tolerance toward bears (Zulueta, 2012, unpublished) sheds light on the types of conflicts people are experiencing with bears. I found that 44%

(n=191) of respondents experienced some type of conflict with brown and/or black bears on their property. Types of conflicts included loss of crops, stored food, or beehives; killed or injured pets or hunting dogs; killed or injured livestock or small animals; killed or injured work/guard animals; structural damage (buildings, vehicles, etc.); threats to themselves or a family member; and/or other. There was no significant difference in the number of reported conflicts or bear species among respondents in high versus low DLP communities. Those that experienced a conflict with bears categorized the loss/damage as mostly structural damage (buildings, vehicles; Brown:14%, Black:10%), threat to themselves or family members (Brown:12%, Black:9%), and “other” loss or damage (Brown:12%, Black:10%). “Other” most often included objects on property that were damaged such as barbeque grills/smokers, bird feeders, garbage cans, and rubber items, which can also be described as attractants. There was no significant difference among respondent type or bear species for conflicts.

Most respondents (91%, n=394) used some type of routine preventive measure to protect themselves, family, pets, and/or property from bears. Most of the preventative measures included firearms (63%), dog/s (41%), and other (36%), such as use of bells, air horns, and word of mouth/warning neighbors.

While 56% (n=242) of respondents have never had a conflict with either a brown or black bear on their property, 46% (n=112) of those respondents had attractants on their property based on a sight survey. Attractants included garbage not in bear resistant canisters, pet food, pets/animals on property, beehives, and other. Other possible attractants such as dirty barbeque grills, unlocked freezers, natural vegetation, gardens, and composts were not included due to difficulty in detection. In total, 51% (n=221) of

respondents surveyed had some form of attractant visible on their property. When looking at respondents in low versus high DLP communities, 20% (n=99) more respondents in high DLP communities had attractants on their property compared to respondents in low DLP communities (59% vs. 39%, respectively). Since these percentages only include listed attractants and those that were visible, this is most likely a conservative estimate. Due to the fact that each house was only surveyed one day and was therefore a snap shot in time, this information does not mean that attractants were out on the property every day, all the time or that they were never there. Of the attractants observed, 90% were pets/livestock (Figure 2). Only 18% (n=78) of total respondents had some type of fencing on their property, and of those residents, 13% (n=11) had electric fencing.

## **MANAGEMENT AGENCIES**

When considering the management of brown bears on the Kenai, it is important to note that the responsibility is shared among multiple agencies. Along with the State of Alaska through ADF&G, there are three federal agencies who manage brown bears and their habitat. This includes the United States Fish and Wildlife Service- Kenai National Wildlife Refuge (KENWR), the United States Forest Service- Chugach National Forest (CNF), and the United States National Park Service- Kenai Fjords National Park (KEFJ) (Figure 3). Each agency has specific objectives regarding brown bear and habitat management on their respective lands and ADF&G also focuses largely on the private sector.

The Alaska National Interest Lands Conservation Act (ANILCA) passed in 1980 dictated purposes for each Federal Conservation Unit in Alaska. The purpose of the KENWR regarding bear management is to conserve populations and habitats in their natural diversity, including habitat restoration and population monitoring; and to continue to support research plans identified and/or developed by the Interagency Brown Bear Study Team (United States Fish and Wildlife Service, 2009). In addition, the KENWR works with the CNF on management of the Kenai-Russian River Complex which includes the confluence of the two rivers and a portion of the designated wilderness on KENWR land (Suring & Barber, 2010). Human-bear interactions are high in this area due to spawning salmon and lots of anglers during the summer months and involve a great deal of human and bear management.

The Revised Land and Resource Management Plan for the CNF (2002) delineates brown bear management into habitat and core areas. For brown bear habitat management, important brown bear feeding areas are designated in which new road construction and vegetation management not intended to maintain or improve ecological conditions for brown bears are not allowed within 750 feet of those areas. There are also guidelines to locate long-term human concentrated activities away from important seasonal brown bear concentrations. The brown bear core areas identify selected landscapes and their associated habitats for management to meet population objectives for brown bears and to reduce dangerous encounters between humans and brown bears.

KEFJ has developed a comprehensive bear management plan that identifies responsibilities in specific management areas and guidelines to manage various types of interactions and conflicts with bears (Phillips, Thompson, Hilderbrand, & Adams, 2012).

The KEFJ also uses the Bear-Human Information Management System (BHIMS) developed for all parks in Alaska to document bear-human interactions and conflict. This system provides a systematic and comprehensive way to document conflicts and summarizes events such as the number of bears killed as a result of conflicts with humans, the number and type of attacks on people, and use of protective measures like bear spray. The data from this system is then used to develop improved bear-safety messages, as well as to refine management strategies for human-bear conflicts (Phillips et al., 2012).

The ADF&G's mission became to (1) protect and forestall or mitigate serious threats to populations before they become critical; (2) identify conservation concerns at an earlier stage while avoiding the necessity for listing on the State Endangered Species List or through the federal Endangered Species Act; and (3) provide for recovery efforts to be initiated under a more flexible management system (Kenai Peninsula Brown Bear Conservation Strategy, 2000). Federal aid is given to the Wildlife Restoration Program and provides half of the state's wildlife management budget, including an annual budget of about \$700,000 for brown bear research and management. The ADF&G has minimal authority to manage non-hunting activities that contribute to the rise of DLPs, as most occur on private land or are managed by other agencies (Kenai Peninsula Brown Bear Conservation Study, 2000). However, they can work to increase understanding and awareness of brown bear conservation.

Since the responsibility of brown bear management is split among four agencies, each with their own management plan, a variety of strategies are used on the Kenai leading to inconsistent approaches with management, research and outreach for residents

and visitors regarding bears. As an example, the KEFJ promotes non-lethal techniques to deal with nuisance bears and does not allow hunting (Phillips et al., 2012). The KENWR on the other hand has a portion of the refuge that lies next to KEFJ land that allows hunting and only recently adopted non-lethal techniques, yet lethal techniques are still used under certain circumstances. In addition, the KENWR has a small portion of their land where hunting is not allowed (Skilak Wildlife Recreation Area). While the focus for management of brown bears among these agencies is typically on their respective lands, due to the natural movement of bears and relative proximity of federal and state land on the Kenai, management in one area can greatly affect that of the other, and therefore collaborative efforts for brown bear management must exist. For the most part, collaborative efforts are established through interagency teams and strategies.

## **INTERAGENCY CONSERVATION TEAMS AND OBJECTIVES**

### ***Interagency Brown Bear Study Team***

In 1984 staff from the KENWR, CNF, KEFJ, and ADF&G created the Interagency Brown Bear Study Team (IBBST). The goal of IBBST was to coordinate research and provide information to managers to maintain a viable population of brown bears on the Kenai. Viable population of bears is defined as “a population that persists despite the effects of demographic, environmental and genetic stochasticity, plus human induced mortality” (deBruyn, Harris, Morton, & Selinger, 2006). This means that the population is self-sustaining over time while coexisting with humans. The IBBST is the primary organization responsible for coordinating brown bear research on the Kenai and sharing results with stakeholders that use scientific research when developing

conservation strategies. They separate themes of their “step-down” plan into three sections: demographics, population, and habitat.

The IBBST places a heavy emphasis on confidently describing and modeling the demographics of the Kenai brown bear population to achieve an accurate assessment of the rate of population increase (deBruyn et al., 2006). The IBBST believes that maintaining a viable population of Kenai bears requires understanding landscape use by bears and humans and addressing interactions to promote coexistence.

There is no formal plan by the IBBST to evaluate coexistence between humans and bears due to difficulty and expense (deBruyn et al., 2006). The IBBST emphasizes the need for information on how human presence and activity influence bear behavior. They list two reasons for this: (1) human numbers are increasing the potential for negative effects on brown bears, and (2) more people in the wild raises the likelihood of humans encountering brown bears, which may raise the potential for mauling incidents or DLPs. Realizing the importance of human bear interaction research, the IBBST actively solicits grants to support interested students and advise appropriate research.

### ***Kenai Peninsula Brown Bear Conservation Strategy***

The Kenai Peninsula Brown Bear Conservation Strategy (KPBBCS) was the first collaborative project developing proactive management for Kenai brown bears among the public, local, state, and federal governments. In June of 2000, the KPBBCS was published by the stakeholder’s group in hopes of creating a strategy that would also avoid having to list the Kenai brown bear population under the Endangered Species Act (Kenai Peninsula Brown Bear Conservation Strategy, 2000). The three phase strategy first

involved a survey of the Kenai Peninsula and Anchorage residents with the aim of assessing attitudes about brown bears and their conservation. Phase two involved stakeholders from both the public and government working to develop a conservation strategy. Public support was emphasized and encouraged through public meetings, workshops, and written comments. The third phase was continuing education and outreach about the KPBBCS and issues regarding Kenai brown bears.

The survey of Kenai and Anchorage residents was conducted via telephone (Kenai Peninsula Brown Bear Conservation Strategy, 2000). Anchorage residents were included in this survey because of the frequency with which they visited the Kenai. The majority of both groups of residents thought it was important to have a healthy population of brown bears (Anchorage: 88%, Kenai: 79%), and thought that the population should remain viable (Anchorage: 51%, Kenai: 49%). Over 90% of residents in both areas said they enjoyed brown bears; however, many worried about problems caused by Kenai brown bears. These results are similar to my 2011 survey of residents on the Kenai, where 82% of respondents had a positive attitude toward brown bears, but a significant number of respondents perceived more risk associated with brown bears when living in communities with a high number of DLPs (Zulueta, 2012, unpublished). Phase two and three were more thoroughly developed by the Kenai Brown Bear Committee.

### ***Kenai Brown Bear Committee***

The Kenai Brown Bear Committee (KBBC) was formed in 2004 to continue the work that the KPBBCS stakeholder's group had started in 2000. The KBBC meets 1-2 times a year and focuses on the theme "Keep Our Communities Safe and Our Bears

Wild." The KBBC is made up of an extensive group of representatives from the ADF&G, Alaska Department of Natural Resources, CNF, KENWR, KEFJ, Kenai Peninsula Borough, Alaska Resource Management, Safari Club International, Alaska Audubon Society, Defenders of Wildlife, Kenai Peninsula Tourism Marketing Council, Kenai Convention and Visitors Bureau, Soldotna Visitors Center, The Wilderness Society, and Alaska Center for the Environment (Alaska Department of Fish and Game, 2012). With a focus on research, human-bear interactions, land planning, and public education, the goal of the KBBC is to decrease the number of DLPs while increasing the understanding and knowledge of conserving brown bears. The committee educates residents and visitors about how to reduce conflicts and manage bear attractants properly through public service announcements, printed materials, and a website.

### **CURRENT MANAGEMENT OF BROWN BEAR POPULATIONS**

The ADF&G is charged with the task of maintaining “an estimated population of 250 brown bears with a sex and age structure that will sustain harvest, comprising at least 60 percent males” (Kenai Peninsula Brown Bear Conservation Strategy, 2000). The 250 bear estimate was proposed based on the extrapolation of data from studies completed in other areas of Alaska and used for about the past 30 years of management on the Kenai (DeBruyn et al., 2006). At the current population size, allowable human-caused mortalities (including road kills, DLPs, illegal kills, and harvest numbers), equals approximately 14 bears, with no more than six of those being female. The hunting season will close if the number of brown bears killed either by hunting or DLPs equals 14, which is about 6% of the estimated population (Kenai Peninsula Brown Bear

Conservation Strategy, 2000). Looking at data on brown bear mortalities from 2000-2011, only in 2000 did the total human-caused mortalities fall below the 6% threshold of allowable human-caused mortalities (Figure 4). This pressure on brown bears from human-caused mortalities leads to questions about the population's viability and whether using the estimate made over 30 years ago is an accurate way to manage today's brown bear population.

Due to the need for updating the population estimate of brown bears in a rigorously scientific way, the IBBST met in 2009 to discuss proposals based on pilot research in 2008; this was the last time the IBBST met (Morton, Personal Communication, 2012). Despite disagreement about the proposed population estimate by ADF&G with the three federal partners and prevention of sampling outside the Federal lands for peninsula-wide data, the DNA-based, mark-recapture estimate of the Kenai brown bear population was completed in 2010 (Morton, Bray, Hayward, White, & Paetkau, 2012, unpublished). ADF&G has yet to formally recognize the findings of an estimated 625 brown bears peninsula-wide. When compared to other coastal studies such as Miller et al. (1997), which reported 191-551 bears per 1,000 km<sup>2</sup> of available bear habitat, the 45 bears per 1,000 km<sup>2</sup> on the Kenai (Morton et al., 2012, unpublished) is relatively low.

Compounding the issue of revising the brown bear estimate for the Kenai is the issue of a declining moose population. Many people on the Kenai hunt moose which they eat throughout the following year. Since the 1990s, community members and hunters have been pressuring wildlife managers to do something about the declining moose population and asking them if an increasing brown bear population is responsible

for the decline. It is understood by agencies that this decline is mostly due to loss of quality moose habitat in Game Management Unit (GMU) 15A, correlating well with the fire history in this region, and low bull to cow ratios in GMU 15C. The ADF&G has developed intensive management plans in these two of the four game management units on the Kenai focused on sustaining elevated moose population levels (Figure 5). As part of the Alaska Board of Game (BOG) recommendations, the hunting season on brown bears will be liberalized creating more pressure on brown bear populations. The ultimate objective of this plan is to “maintain current moose densities by increasing human harvest as predation declines” (Alaska Department of Fish and Game, 2012).

In early spring of 2012, about a year after this plan was developed, ADF&G conducted a calf mortality study by collaring 54 calves in a GMU at the southern end of the Kenai (Schwartz, 2012). Preliminary results revealed 45 of the 54 died, 19 of them due to brown bear kills. Other research conducted in Alaska has found that brown bear predation is a significant source of mortality for moose calves (Ballard, Spraker, & Taylor, 1981). This information about brown bear predation on moose will not likely change the intensive management plans for moose, focused on wolf control, and will likely lead to BOG increasing brown bear mortality (McDonough, Personal Communication, 2012). There is a plan to open registration of brown bear hunting beginning April 1 and ending May 31, then restarting again September 1 to run until November 1<sup>st</sup>. “The bag limit shall be one brown bear every regulatory year in 2 intensive management areas and one brown bear every four regulatory years in 2 non-intensive management areas on the Kenai Peninsula” (Alaska Board of Game, 2012).

While this remains a proposal for brown bear management, the ADF&G continues to liberalize the public harvest of brown bears as a way of managing moose populations.

Although ADF&G has not acknowledged the new population estimate of brown bear on the Kenai, they have been liberalizing harvest of brown bear for many years. In the spring of 2003, BOG advised ADF&G to increase the brown bear quota from 14 to 20, and increased the female quota from six to eight. Until 2007/08 there was one season in the fall allowing a licensed bear hunter one bear every four years. Since then, there has been a fall and spring harvest with the length of fall harvest increasing by 15 days in 2009/10. Also in the spring of 2009, non-residents were allowed to apply for permits, but were required to use guides. As of January 2012, the BOG adopted a proposal to change from a drawing system to a registration-based system for the harvest of brown bears. They also enacted a three-year running average to manage the reproductive-age female deaths to a total of 30. These actions, slowly liberalizing harvest of brown bear over the years are resulting in greater pressure on the population.

## **STRATEGIES AND OUTREACH PROGRAMS ON THE KENAI**

There has been much research on the effectiveness of modifying the behavior of bears with the use of non-lethal methods. The KEFJ uses non-lethal methods to deal with nuisance bears (Phillips, et al., 2012). In addition, ADF&G has been conducting research with TASER International, Inc., to determine whether these Electronic Control Devices can be an effective and safe tool as a non-lethal method to deal with nuisance bears (Lewis & Mooney, 2012). However, a study in the Lake Tahoe Basin found that the most

common non-lethal deterrents used by agencies, including such things as pepper spray, rubber buck shot, rubber slugs, and cracker shells, are not effective at altering black bear behavior for more than one month (Beckman, Lackey, & Berger, 2004). In general, non-lethal techniques are rarely a permanent solution to keeping bears that have become habituated to human attractants away from human dominated landscapes. McCullough (1982) found that once a bear becomes habituated to humans, the removal of attractants may not change behavior.

When a bear becomes conditioned to human food attractants, the use of lethal methods is currently the most common way many wildlife managers on the Kenai deal with these types of bears. This is because of the general lack of success in strategies that work to modify behavior in bears. The use of lethal methods is often controversial, yet some feel that if they are highly selective with only eliminating the nuisance animals it can help decrease conflicts (Treves, 2002; Treves et al. 2004). Rather than attempting to change the behavior of a bear or using lethal methods, managers on the Kenai have also translocated bears.

The ADF&G and KENWR translocated bears off the northwest side of the Kenai, only to have them return to human use areas and eventually be killed after additional conflicts with humans (Selinger, Personal Communication, 2012). KEFJ has never translocated a bear, and any nuisance bear issues on CNF land is handled by ADF&G, USFS law enforcement, or Alaska Troopers (Laves, Personal Communication, 2012). While translocation of bears has been a common, non-lethal method to deal with predation of livestock or nuisance behavior, most do not stay at the site of release and there are specific range requirements due to the ability of bears to intrinsically navigate

and travel over long distances (Linnell, Odden, & Smith, 1997). According to information compiled from a review of literature by Linnell et al. (1997), areas  $<300\text{km}^2$  are too small for brown bears to ensure that after translocation they do not come back to the same area and translocation is therefore not cost-effective on the Kenai due to its small size. Managers on the Kenai have therefore have started to emphasize the use of proactive methods in reducing human-bear conflict by first working with people before a bear becomes conditioned to attractants.

Modifying people's behaviors can be one way to successfully reduce human-bear conflicts. The theory of reasoned action (TRA) states that humans will process information and use it to decide how to act (Ajzen & Fishbein, 1980; Fishbein & Manfredo, 1992). With this understanding, the attitude toward the behavior as well as the subjective norms- an individual's perceptions of the social pressures placed on them by others to either perform or not perform a certain behavior- affects the individual's intention to perform the behavior and it is the intention that is a direct indicator of whether the behavior will be performed (Fishbein & Manfredo, 1992). Understanding these factors can lead to effective modification of people's behaviors when it comes to strategies aimed at reducing conflicts between humans and bears.

Currently, throughout Alaska, there is an ordinance in effect to encourage behaviors that decrease the likelihood of bears becoming conditioned to human garbage. Negligently feeding wildlife results in a fine of \$310; the intentional feeding of wildlife results in a misdemeanor, a standard fine of \$1000, and a mandatory court appearance (Alaska Administrative Code 5 AAC 92.0). While this ordinance is state-wide, enforcement is lacking peninsula-wide. Programs specifically aimed at controlling

garbage, including banning the feeding of bears and negligence with garbage, as well as ordinances requiring the use of bear-proof garbage containers, have been effective in many areas, including Juneau, Alaska (McCarthy & Seavoy, 1994; Peine, 2001). If enforcement were strengthened on the Kenai, it's possible that conflicts would diminish, as they did in Juneau (Selinger, Personal Communication, 2012).

Current strategies to modify people's behaviors also emphasize education (Peine, 2001; Lackey & Ham, 2003; Gore, 2004). Educational programs and campaigns have successfully led to a reduction of conflicts, primarily through the reduction of human attractants, in several areas with black bears including New York, central Florida, northern New Jersey, Lake Tahoe area of Nevada and California, as well as areas with both brown and black bears, including Montana and British Columbia (Gore, Knuth, Curtis, & Shanahan, 2006). Successful programs work to create social pressure within communities to sustain changes to human behaviors (Ajzen & Fishbein, 1980; Gore, 2004). ADF&G and other agencies on the Kenai provide informational mailers, host booths at high profile venues, give school programs, and broadcast relevant public service announcements on television and radio commercials to educate residents.

ADF&G has also declared April to be Alaska Bear Awareness Month. April was chosen because it is typically the month when bears first come out of hibernation for the active bear season (April 15 to October 31). Programs and informational services start the first week of April to remind people to become more vigilant about avoiding attractants for bears by keeping trash in bear resistant containers, taking down birdfeeders, and using electric fencing around livestock, among other recommendations.

While there have been many different educational programs over the years aimed at reducing human-bear conflict on the Kenai, I will focus on the current program offered by the KENWR, created with the help of ADF&G, the Safari Club, and the KBBC since it is the program promoted by all agencies on the Kenai. The program for school children starts in April and focus on bears in the community. A classroom visit includes inducting children into the Alaska Junior Ranger Program where they receive a badge and recite a pledge. They are then asked to take a look at their yard at home and assess it for bear attractants. If they have any, they are asked to come up with changes or solutions.

ADF&G will give similar programs upon request for bears, but typically the Alaska Junior Wildlife Ranger Program is promoted on the Kenai. This program has also been shared with KEFJ to serve the Seward area of the Kenai, and Lake Clark National Park which gives programs based out of Homer on the southern end of the Kenai. Home school programs have also been presented by agencies. While educational programs are established to change people's behaviors, few are typically given a formal evaluation to determine the effectiveness of the information provided to the public (Lackey & Ham, 2003; Beckmann et al., 2004; Gore, 2004; Gore et al., 2006). In the past ADF&G also held programs for adults, but found turnout to be poor so the programs were retired.

ADF&G has found public service announcements to be a more cost effective way for reaching adult residents (Selinger, Personal Communication, 2012). Bear safety training is another program ADF&G, as well as private individuals, present to interested parties. As an example, oil companies on the Kenai have annual bear safety training for their workers in which ADF&G employees train the workers on safety precautions and how to handle interactions with bears (Selinger, Personal Communication, 2012).

ADF&G's main office on the Kenai (Soldotna) also maintains a wealth of information available to residents and visitors regarding their management strategies and how to reduce conflict with bears (Appendix C). Information available includes:

- Bear facts including natural history information.
- Bear behavior information and quiz sheet.
- How to handle interactions with bears and safety precautions to avoid conflict.
- How to store garbage to prevent bears from becoming habituated.
- Information on predator management of bears and why it is sometimes implemented in the state of Alaska.
- Tips for women traveling in bear country.
- A checklist which includes information for people living in cities like Anchorage that also have bears. Cartoons and rhymes for children about bear awareness.
- Bumper stickers regarding a "fed bear is a dead bear".

ADF&G not only provides information on bears and bear awareness at their office in Soldotna, they also maintain a website that includes safety principles around bears and how to avoid conflict with bears. Information on the website was primarily adapted from "Living in Harmony with Bears." The information provided is largely designed to help people co-exist with brown and black bears. Along with similar information at the office, the website includes:

- More detailed information on proper handling of garbage to keep bears away; focusing on the idea that keeping human food away from bears is

the most important thing humans can do to prevent conflicts and confrontation between bears and people. This includes solutions at-home and while camping. Home solutions range from reminders about bird seed and gardens as attractants to the use of different types of bear resistant garbage canisters as well as how to obtain them. In addition, there is information on the use of garbage incinerators and extensive information on erecting an electric fence, material requirements, maintenance, and vendors. Information on camping with bears includes proper food storage, camp set up, and cooking procedures to minimize odors.

- Safety information for outdoor recreation, including hunting, fishing, and specifics for children. This information comes in the form of videos on loan to the public in larger cities on the Kenai Peninsula, bear sighting posters, and bear behavior information and use of bear spray/firearms. There is also a list of procedures to follow if you have a negative encounter with a bear and kill it in defense of life or property.

While education efforts to address human-bear conflicts have been a significant focus of conflict mitigation strategies on the Kenai, two programs have been developed which provide financial aid to residents who seek to proactively reduce attractants.

### ***Wildlife Conservation Community Program***

In an effort to address the high number of calls to the City of Kenai police department and other agencies regarding human-bear interactions, the City of Kenai initiated a Bear-Safe Neighborhood pilot project in 2007. The ADF&G, Alaska

Audubon, Waste Management, Inc. and the City of Kenai, focused efforts on reducing bear problems due to improper waste storage and other human-caused attractants in two subdivisions within the city. This collaborative effort was awarded a grant to determine whether communities with a high number of bear conflicts would benefit from a program which gave residents bear proof garbage containers to use as well as a free pick up service for two years. Police would also increase the amount of patrolling in the target neighborhood. In the past, this area had many problems with bears, but during the two years of the pilot project no negative interactions were reported. After the program, 3 out of the 30 households involved continued to use the free canisters and paid for pick up. Conflicts increased again but not to the extent as before the program. As a result of the pilot program's success, ADF&G asked the City of Kenai to expand the efforts municipal wide creating the Wildlife Conservation Community Program (WCCP), with funding from the U.S. Fish and Wildlife Service Private Landowners Stewardship Grant. The WCCP offers residents of the City of Kenai bear resistant containers at a cost of \$50 instead of \$200. These containers were also purchased for use in city parks. Since then, other programs on the Kenai were initiated in Cooper Landing, Homer, Hope, Moose Pass, and Seward.

In 2008, the City of Kenai adopted a Bear Problem Area and Emergency Bear Declaration ordinance. This requires that residents keep garbage in bear resistant containers in areas of town considered bear problem areas. In the fall of 2010, an increase in incidences with bears was reported and the first Emergency Declaration of a Bear Problem Area occurred in the City of Kenai.

The WCCP is now a community-based cooperative effort involving municipal, state and federal agencies, businesses, non-profits, and residents of Kenai. One main objective of the WCCP is to reduce the number of brown and black bears becoming conditioned to human generated attractants in residential areas, thereby reducing the number of DLP killings. Other benefits include safer neighborhoods, less agency time spent dealing with bears, a reduction in animal deaths caused by ingestion of non-digestible materials and a reduction in human-wildlife conflicts with other species such as moose. There has been an interest in extending the program throughout the Kenai Peninsula Borough, yet as of 2012, the program has not been initiated due to lack of funding from grants.

In addition to individual residences obtaining bear resistant containers, the Kenai Peninsula Borough modified all transfer sites and implemented bear resistant dumpsters which were completed peninsula wide 2010-2011. The clean-up project at transfer sites has led to fewer bear conflicts for these locations and people are learning how to properly store and dump their garbage (Selinger, Personal Communication, 2012).

### ***Wildlife Habitat Incentive Program***

The Natural Resources Conservation Service (NRCS) created the Wildlife Habitat Incentive Program (WHIP), which is a cost share program that helps to improve a wide variety of wildlife habitat conditions and reduce negative impacts to wildlife species on private land. During the 2011 fiscal year the NRCS developed a new program available to landowners only on the Kenai Peninsula. Typically, the NRCS develops programs that work with property owners on ways to allow wildlife movement on private property and

do not normally develop programs aimed at keeping wildlife out of private property. However, due to the high number of DLP bear kills on the Kenai and the listing of brown bears as a species of special concern by ADF&G, the program was implemented to help decrease the amount of human-bear conflicts.

WHIP works to reduce potential human-bear interactions at sites of human-provided bear attractants such as chicken coops and bee hives by providing matching funds to landowners to install permanent electric bear fencing. Electric fencing has been proven to exclude bears from areas of potential food sources and was determined the most effective method for decreasing human-bear conflicts due to agricultural attractants in a Massachusetts study (Jonker, Parkhurst, Field, & Fuller, 1998). Once shocked, bears tend to avoid those fence lines, and when properly designed, the mere sight of the fence often aids in reminding bears of the shock they may receive.

The NRCS and ADF&G also provide fence designs, site management plans, and recommendations for the installation of fences. This site inventory and assessment is part of the technical assistance landowners receive in addition to or aside from cost-share assistance.

Since the start of the program in 2010, five parties have applied for funding, and six new applications have been submitted. In order to qualify for funding, all who apply must have some type of attractant such as livestock, fowl, or beehives. As of May 2011, no one who applied has been declined. However, only one fence has been installed to date.

## **FUTURE RESEARCH AND RECOMMENDATIONS**

The successful conservation of bears on the Kenai will depend on the cooperation of residents and visitors to coexist with bears. While residents are responsible for the majority of DLPs, these DLPs occur on private and public lands with similar frequency. By specifically addressing residents and visitors as well as management needs on private and public land, the Kenai could be more successful in reducing the number of human bear conflicts that result in DLPs.

Due to the high number of calls regarding wildlife complaints, and limited staff in the ADF&G office in Soldotna, I would suggest that the ADF&G implement a program similar to Florida's "Bear Response Agents." The Florida program provides a handful of individuals' extensive training regarding how to handle nuisance complaints. They are then charged with the task of responding to complaints and speaking with landowners to educate them about how to mitigate the problem (Gore, 2004). Bear Response Agents could work with residents to survey property thoroughly for attractants and help them figure out ways to reduce or eliminate attractants. This type of program would give wildlife managers an opportunity to address the concerns of residents and help them minimize the potential for human-bear conflicts while also strengthening communication between residents and wildlife managers.

In my 2011 survey of residents on the Kenai, risk perception toward brown bears was significantly higher in high DLP communities compared to low DLP communities. To address this, wildlife managers should focus on communities with programs that provide residents with the tools for how to handle an interaction. Research has shown that learning about your own reaction when encountering a bear has reduced fear of those

interactions (Johansson & Karlsson, 2011). I would suggest offering the public the same bear safety awareness classes that federal and state employees receive each year.

Providing this option to residents may help to reduce risk perception by increasing self-confidence in their ability to handle an interaction successfully. In addition, offering these classes to visitors could also help with human-bear conflicts that occur on public property such as those in the backcountry.

Stronger promotion of non-lethal deterrents such as bear spray for residents and visitors would be a very effective way to reduce human-bear conflicts. While the federal agencies require their employees to carry bear spray in addition to firearms, there seems to be little promotion of bear spray for the public. Research by Smith et al. (2008) and Smith, Herrero, Layton, Larsen, & Johnson (2012) found that bear spray was often more effective than lethal methods, especially for people not competent with the use of firearms. In addition, the use of electric fencing can be an effective way to reduce conflicts if more residents and visitors were aware of their effectiveness. As of 2011, less than 3% of Kenai residents surveyed had electric fences on their property (Zulueta, 2012, unpublished). In addition, although the WHIP program was established in 2010 to aid residents in the purchase and set up of electric fencing, as of the summer of 2011 only one party had completed all the paperwork necessary and set up a fence with these funds (NRCS, Personal Communication, 2011). Promotion of electric fences on public land could also be useful for hunters and campers on the Kenai as research in Banff National Park found a decrease in human-bear conflicts after implementation of electric fencing (Madel, 2012).

Education regarding the natural history of bears could be very useful for both residents and visitors on the Kenai, as there is much controversy over bear numbers. In the past, Miller and Ballard (1992) found that in many areas of Alaska there was great support for proposals to reduce bear numbers mainly because residents were fearful of bears and felt the populations were too high for optimal moose populations. In my 2011 survey of residents on the Kenai, some respondents mentioned that they felt the brown bear population was too high and directly responsible for sub-optimal moose populations. Education about the fluctuation of moose populations due to habitat factors and the fire cycle could be useful in demonstrating other factors than bears that decrease moose populations so as to not unnecessarily target brown bears as the primary cause of low moose populations.

Evaluation of existing and new educational programs is critical and woefully lacking. The use of performance indicators could help determine changes in behavior and perceptions (Gore et al., 2006). Without such ways to evaluate the effectiveness of programs, time, effort, and money could be lost.

Wildlife managers could also address human-bear conflicts on public land in a temporal and spatial manner. Understanding the need to control human access has been recognized in Banff (Gibeau, Hererro, McLellan, & Woods, 2001), Denali (Schirokauer & Boyd, 1998), and Yellowstone National Parks (Gunther, 1994; 1998) and has been key for bear management success. For example, areas of high human use due to a common resource such as the Kenai and Russian River confluence during the salmon run could be managed by limiting the hours the river is open to the public. If use of the area was only allowed during the daytime, bears would be free to use it at night without humans.

Research has found that bears will recognize the pattern of human use to either completely avoid humans and/or areas where humans frequent (Nevin & Gilbert, 2005). Limiting the areas people are allowed to recreate could help avoid conflicts with bears. The KENWR promotes limiting access as a way to decrease conflicts most years by temporarily closing off sections of the refuge that start to have high levels of bear activity, especially of sows and cubs.

The Kenai also lacks a peninsula-wide systematic collection of human-bear conflicts data. As it stands, ADF&G holds all DLP reports and shares only certain information with its federal partners. The KEFJ is the only state or federal agency to have a comprehensive database on the Kenai, but is available to a limited number of wildlife managers. The BHIMS was established to standardize the collection of bear data across all national parklands in the Alaska Region. Data include bear-human conflicts, bear observations, bear harvests, and bear natural history data. In addition, other forms and images can be attached to each incident report to provide other information not already stored in the system. The system automatically creates a Case Incident Record from the data entered and a dynamic link to ArcView will display a visual map of the incidents. From ArcView or Access one can also query incidents. While the individuals responsible for creating this database work for the U.S. Fish and Wildlife Service, they have yet to distribute the program to U.S. Fish and Wildlife Service users. If this program were connected to all wildlife managers on the Kenai, it would be an effective way to facilitate data sharing and strategize human-bear conflict mitigation.

In addition to collecting data on human-bear conflicts, it's important to consider environmental factors that may contribute to fluctuations of conflict each year. Without

annual monitoring, it is difficult to determine the extent of environmental factors that may be contributing to the increase or decrease of human-bear conflicts. ADF&G already collects information each year about the salmon run. Other natural vegetation data is collected by various agencies and with more collaboration, better analysis of available bear habitat could be determined each year.

While it appears that human-bear conflict mitigation strategies on the Kenai Peninsula have been a continual focus for wildlife management agencies, there needs to be more comprehensive evaluations of efforts made. By doing so managers can better direct their education and outreach strategies using their time and funds more efficiently. Changing human behavior takes strong, consistent efforts as people are habitual creatures. Creating fool proof measures to ensure compliance will aid in this process.

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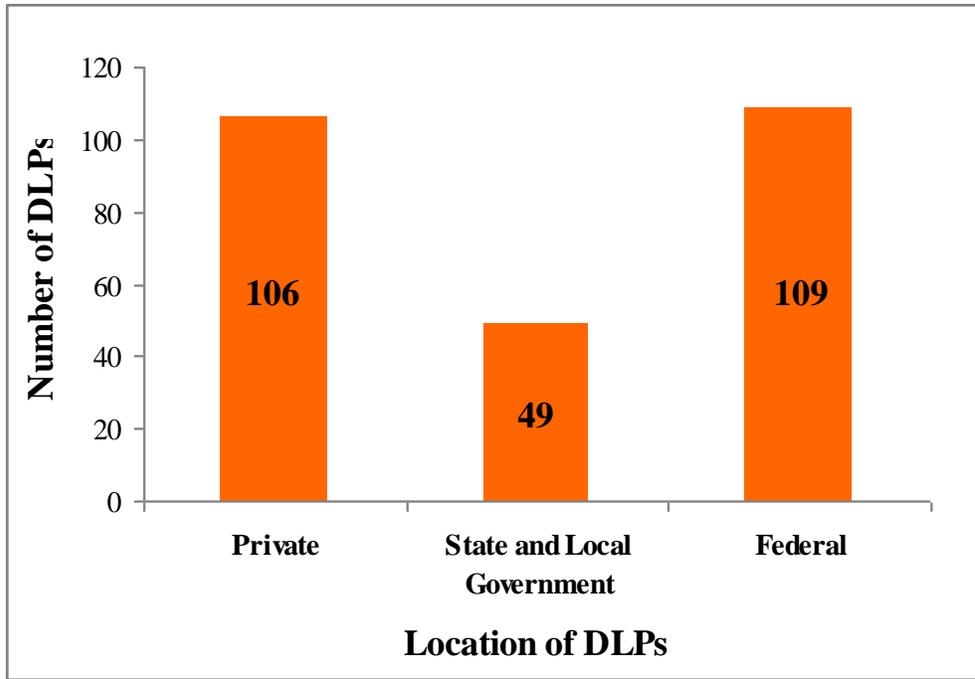
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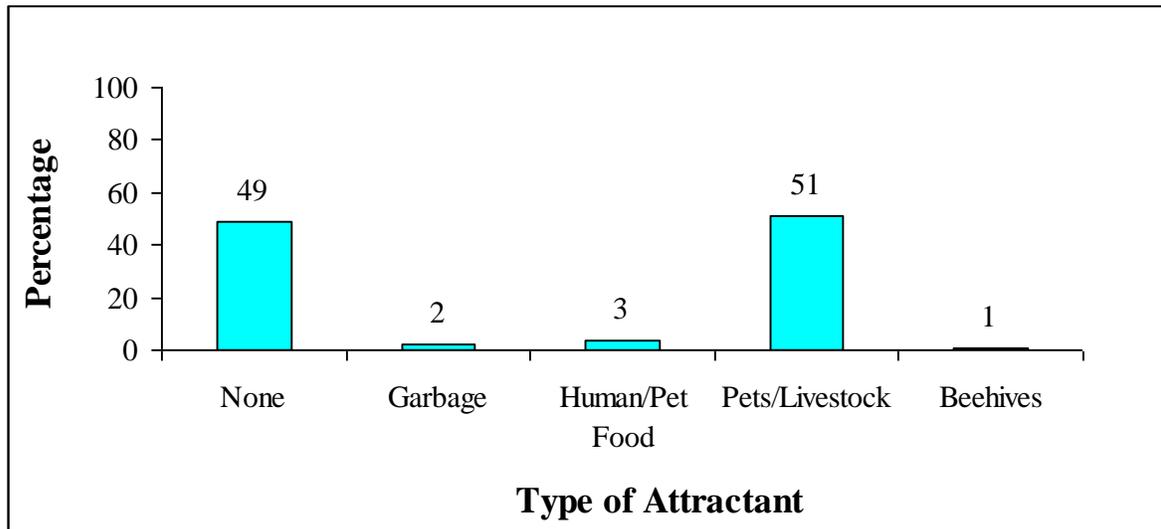
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**FIGURES- Chapter Two**



**Figure 1. Percentage and location of defense of life or property bear kills (DLP) on the Kenai Peninsula of Alaska from 1960-2008.**



**Figure 2. Attractants on surveyed properties of the Kenai Peninsula, Alaska, 2011. Categories were not mutually exclusive and more than one type of attractant may be found on each property.**

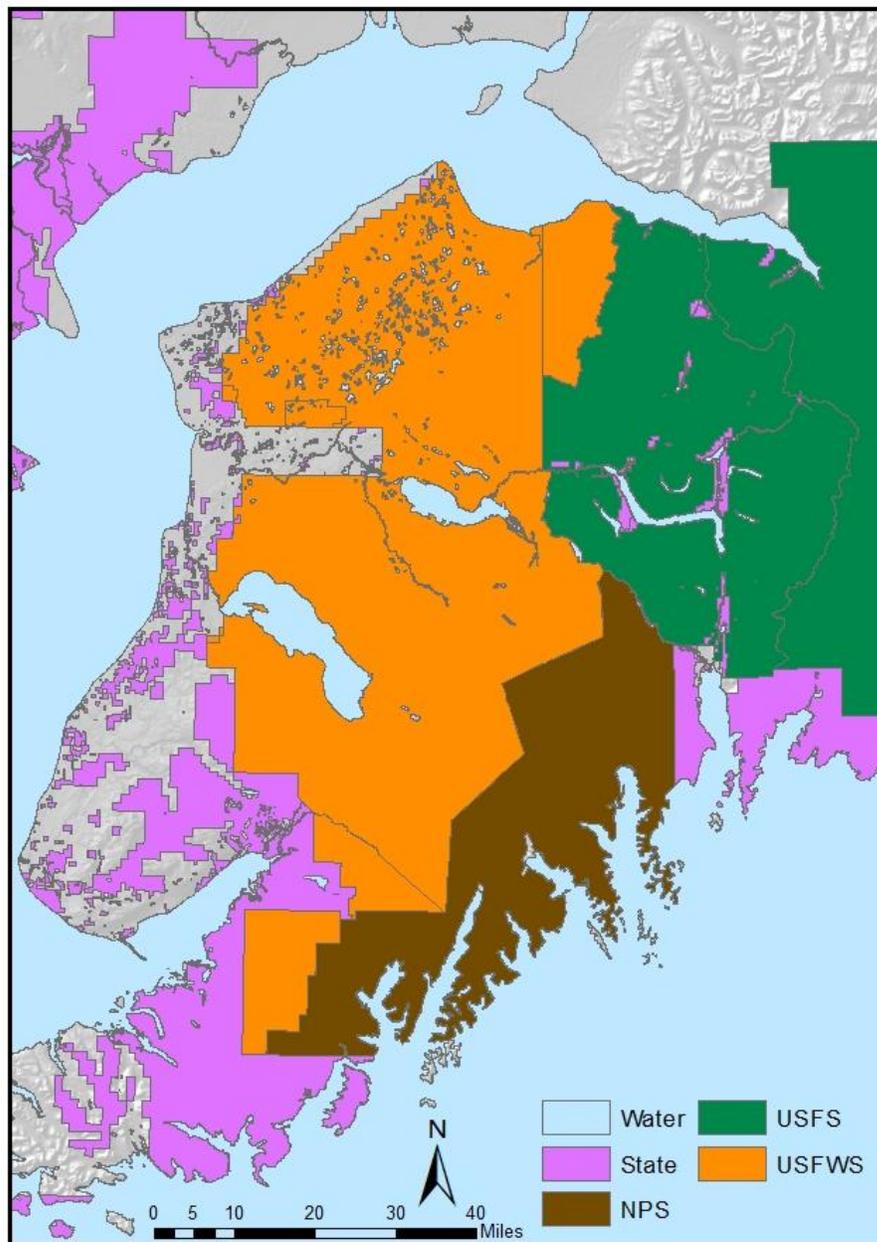


Figure 3. Map of State and Federal lands on the Kenai Peninsula of Alaska, 2012.

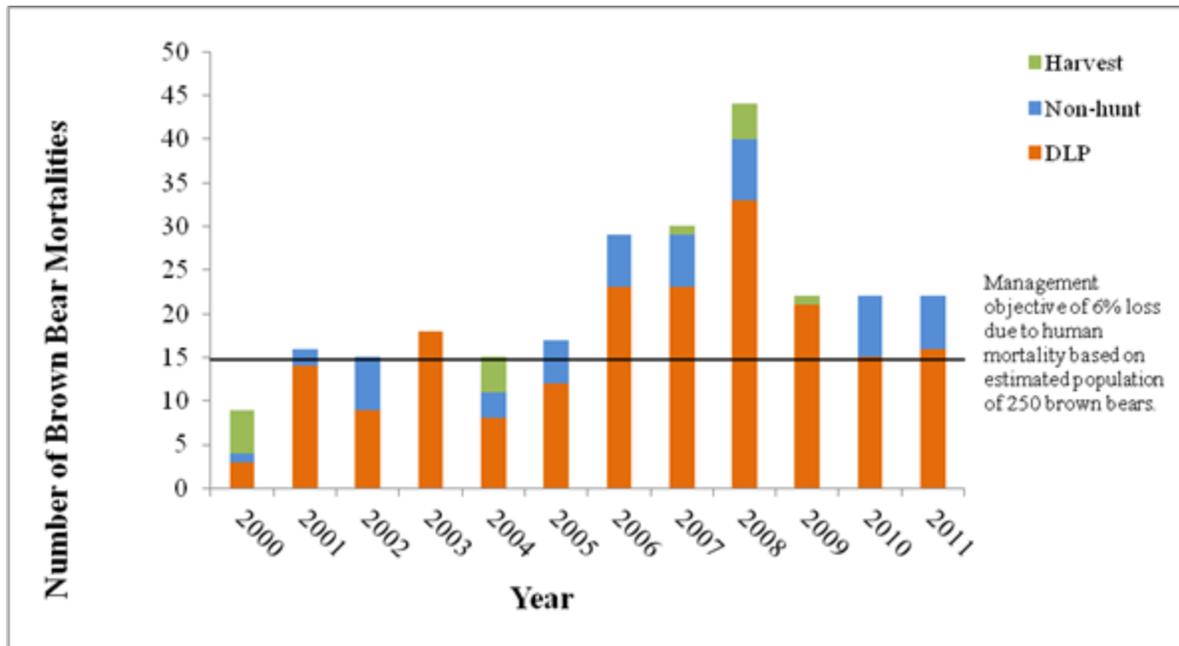
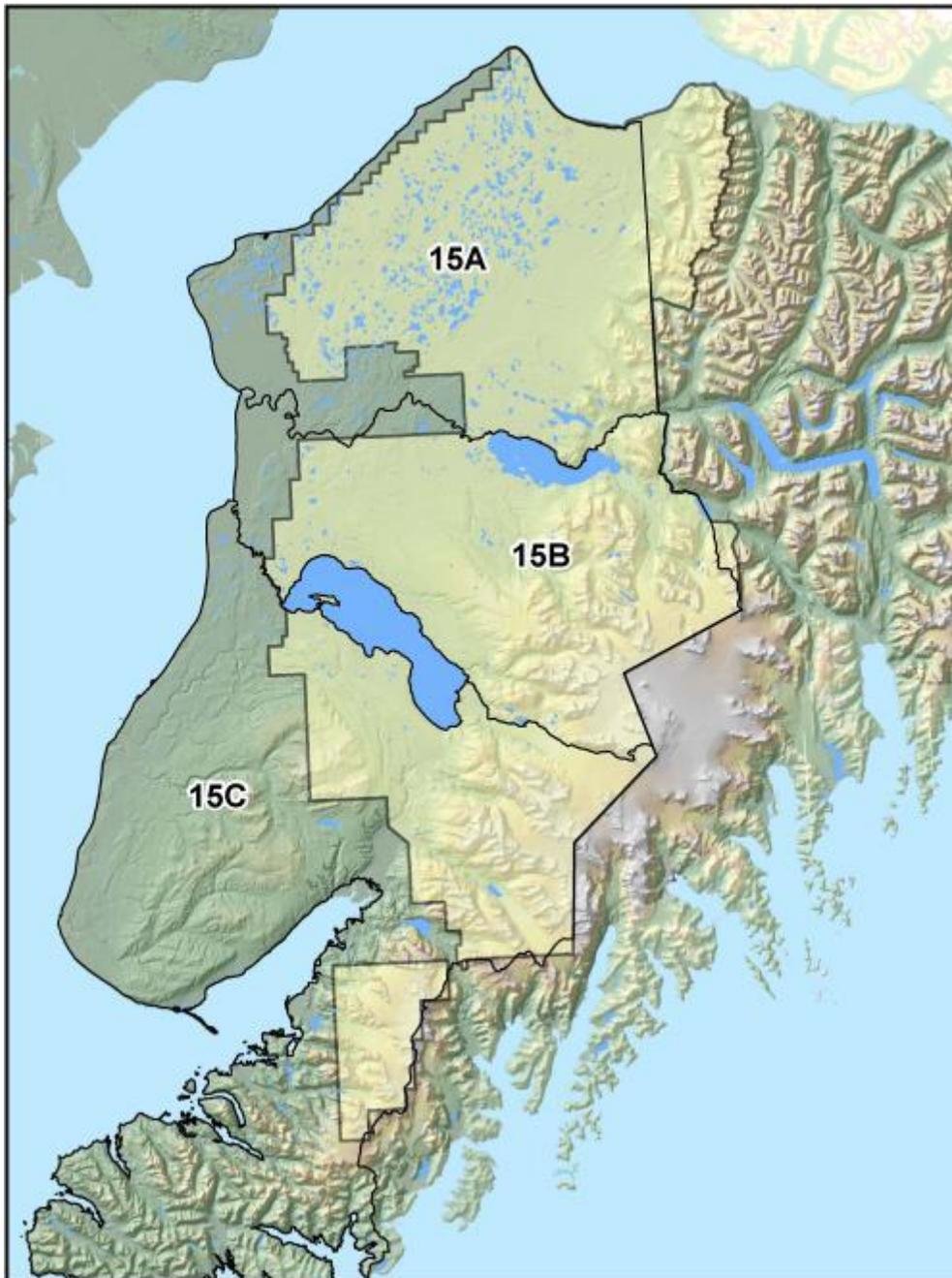


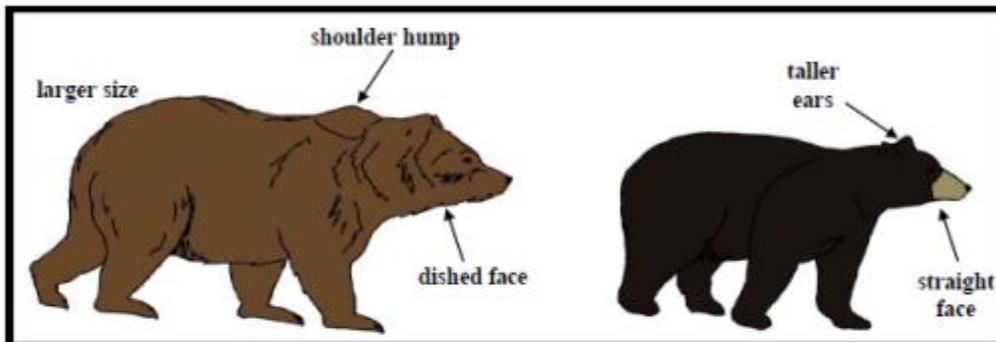
Figure 4. Total brown bear mortalities from 2000-2011 on the Kenai Peninsula due to harvest, non-hunt kills (ex. road kill, illegal kills), and defense of life or property kills (DLP).



**Figure 5. Intensive management area for moose in Game Management Unit (GMU) 15A and 15C on the Kenai Peninsula of Alaska, 2012. Kenai National Wildlife Refuge boundaries are in yellow.**

Appendix A- The Survey Instrument (questionnaire)

## Opinions and Experiences with Bears on the Kenai Peninsula



**Brown Bear**

**Black Bear**

Colors of both bears vary



Research conducted by the  
Forest and Wildlife Ecology Department  
Nelson Institute  
University of Wisconsin Madison

June 2011

Dear Alaska Resident,

You have been randomly chosen to participate in a survey we are conducting through the University of Wisconsin. We are delivering this 2011 survey to residents in various communities throughout the Kenai Peninsula to learn about your opinions and experiences with bears.

Our aim is to provide wildlife managers with accurate information about community views of bears. **Your response is very important to us.** The success of this survey will be determined by the number and quality of responses we receive. **Please have an adult in your household complete the survey. It should take about 15 minutes to complete.**

**Your participation in this survey is voluntary and all answers are completely anonymous and confidential.**

We are happy to answer any questions you may have about this survey so please feel free to contact our Principal Investigator, David Drake at [ddrake2@wisc.edu](mailto:ddrake2@wisc.edu) or call (608)890-0445. You may also contact Rebecca Zulueta at [zulueta@wisc.edu](mailto:zulueta@wisc.edu) or call (661)972-8167 with any questions. To answer questions about your rights contact the Social and Behavioral Science Institutional Review Board at (608) 263-2320. Thank you very much for taking the time to help us with our research.

Sincerely,

Rebecca Zulueta  
Graduate Student  
Department of Forest and Wildlife Ecology  
Nelson Institute  
University of Wisconsin Madison  
A141 Russell Laboratories  
1630 Linden Drive  
Madison, WI 53706-1520  
[zulueta@wisc.edu](mailto:zulueta@wisc.edu)

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1. To what extent do you agree or disagree with the following statements about **BROWN** bears.

	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
• I enjoy having brown bears on the Kenai.....	<input type="radio"/>				
• Brown bears are a sign of intact nature.....	<input type="radio"/>				
• I worry about problems brown bears may cause.....	<input type="radio"/>				
• I feel threatened by brown bears on the Kenai.....	<input type="radio"/>				
• I fear being injured by brown bears on the Kenai.....	<input type="radio"/>				
• There is no need to have brown bears on the Kenai.....	<input type="radio"/>				

2. To what extent do you agree or disagree with the following statements about **BLACK** bears.

	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
• I enjoy having black bears on the Kenai.....	<input type="radio"/>				
• Black bears are a sign of intact nature.....	<input type="radio"/>				
• I worry about problems black bears may cause.....	<input type="radio"/>				
• I feel threatened by black bears on the Kenai.....	<input type="radio"/>				
• I fear being injured by black bears on the Kenai.....	<input type="radio"/>				
• There is no need to have black bears on the Kenai.....	<input type="radio"/>				

3. Please rate your overall experience with bears:

	Positive	Somewhat Positive	Neutral	Somewhat Negative	Negative
BROWN bear.....	<input type="radio"/>				
BLACK bear.....	<input type="radio"/>				

4. Have you seen a bear in the wild anywhere (not just on the Kenai Peninsula)?

*\*\*If you answer no to both questions, please skip to question # 7\*\**

	Yes	No	Not sure
BROWN bear.....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
BLACK bear.....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

5. How many times did you see a bear in your community during 2010?

*(please fill in a number of sightings)*

BROWN bear.....	<input style="width: 50px; height: 15px;" type="text"/>	# of sightings
BLACK bear.....	<input style="width: 50px; height: 15px;" type="text"/>	# of sightings

6. How often do you see a bear in your community?

	At least once a week	At least once a month	At least once a year	At least every other year	Never
BROWN bear.....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
BLACK bear.....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

7. Do you feel the bear population in your community is...

	Too high	High	About right	Low	Too low	Don't know
BROWN bear.....	<input type="radio"/>					
BLACK bear.....	<input type="radio"/>					

8. What types of routine preventive measures do you take or have to protect yourself, family, pets, and/or property from bears? *(please fill in ALL that apply)*

<input type="radio"/> None	<input type="radio"/> Firearms
<input type="radio"/> Bear proof garbage cans	<input type="radio"/> Bear spray
<input type="radio"/> Electric fence	<input type="radio"/> Dog/s
<input type="radio"/> Other (please describe below)	<input type="radio"/> Motion sensor lights at night

9. What types of losses/damage from bears have you suffered? (please fill in ALL that apply)

<p><b>BROWN bear</b></p> <p><input type="radio"/> None</p> <p><input type="radio"/> Losses of crops, stored food, beehives</p> <p><input type="radio"/> Killed or injured pet or hunting dog</p> <p><input type="radio"/> Killed or injured livestock or small animal</p> <p><input type="radio"/> Killed or injured work/guard animal</p> <p><input type="radio"/> Structure damage (buildings, vehicles, etc.)</p> <p><input type="radio"/> A threat to your person or a family member</p> <p><input type="radio"/> Other (please describe below)</p> <div style="border: 1px solid black; height: 80px; width: 100%;"></div>	<p><b>BLACK bear</b></p> <p><input type="radio"/> None</p> <p><input type="radio"/> Losses of crops, stored food, beehives</p> <p><input type="radio"/> Killed or injured pet or hunting dog</p> <p><input type="radio"/> Killed or injured livestock or small animal</p> <p><input type="radio"/> Killed or injured work/guard animal</p> <p><input type="radio"/> Structure damage (buildings, vehicles, etc.)</p> <p><input type="radio"/> A threat to your person or a family member</p> <p><input type="radio"/> Other (please describe below)</p> <div style="border: 1px solid black; height: 80px; width: 100%;"></div>
---	---

10. How many negative experiences with bears did you have on your property during 2010? (please fill in a number)

BROWN bear.....  # of negative experiences

BLACK bear.....  # of negative experiences

11. How often do you have negative experiences with bears on your property?

	At least once a week	At least once a month	At least once a year	At least every other year	Never
BROWN bear.....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
BLACK bear.....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

12. Please number three of the statements 1-3 where 1=the statement you most strongly believe:

I have a strong emotional attachment to nature and bears.

I have concern for the proper treatment of nature and bears.

I have interest in the value of bears as well as their relationship to the environment.

I have interest in direct outdoor recreation where I may view bears.

I have interest in the dominance, mastery, and control of bears.

I have interest in practical use of bears such as hunting or use of their habitat.

I am fearful, dislike, or indifferent toward bears.

13. Please fill in one answer that best represents how you would respond to each of the situations described below for a **BROWN** bear.

SITUATION	Do nothing	Use non-lethal methods (ex. pepper spray, hazing)	Contact authorities	Use lethal methods
a) You see a brown bear near your home <u>once</u> .....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
b) You see a brown bear near your home <u>more than once a week</u> .....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
c) A brown bear damages a garbage can at your home <u>once</u> .....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
d) A brown bear damages garbage cans at your home <u>more than once a week</u> .....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
e) A brown bear chases a pet <u>once</u> .....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
f) A brown bear chases a pet <u>more than once a week</u> .....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
g) You see or hear a brown bear attempting to enter some part of your home.....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

14. Please fill in one answer that best represents how you would respond to each of the situations described below for a **BLACK** bear.

SITUATION	Do nothing	Use non-lethal methods (ex. pepper spray, hazing)	Contact authorities	Use lethal methods
a) You see a black bear near your home <u>once</u> .....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
b) You see a black bear near your home <u>more than once a week</u> .....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
c) A black bear damages a garbage can at your home <u>once</u> .....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
d) A black bear damages garbage cans at your home <u>more than once a week</u> .....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
e) A black bear chases a pet <u>once</u> .....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
f) A black bear chases a pet <u>more than once a week</u> .....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
g) You see or hear a black bear attempting to enter some part of your home.....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

15. Has a bear been killed in a non-hunting related incident on your property?

	Yes	No	Not sure
BROWN bear.....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
BLACK bear.....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

16. How many months or years have you lived in this community?

months      or       years

17. What year were you born?

18. Are you?

Male      or       Female

19. How many years of school have you completed?  
*(Please fill in the highest level completed)*

Grade school  
 High school  
 Some college  
 College degree

20. Have you hunted in the past two years?

Yes       No

21. Have you regularly hunted at any other time in your life?

Yes       No

22. Have you hunted bears at some time in the past?

	Yes	No
BROWN bear.....	<input type="radio"/>	<input type="radio"/>
BLACK bear.....	<input type="radio"/>	<input type="radio"/>

23. Have you hunted wolves at some time in the past?

	Yes	No
.....	<input type="radio"/>	<input type="radio"/>

**Thank you for your help!**  
**Please feel free to use this space for any comments you may have.**



**Appendix B- Assessing non-response bias (postcards)****FRONT**

Sorry we missed you at home. Please help us provide an accurate response for our survey of opinions on bears for the Kenai Peninsula. Just answer this anonymous survey and place the postage paid card in the mail. Thank you for your help!

1. **Have you hunted in the past two years?** .....Yes  .....No
2. **Please rate your overall experience with bears:**
- |                 | Positive              | Somewhat Positive     | Neutral               | Somewhat Negative     | Negative              |
|-----------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| Brown bear..... | <input type="radio"/> |
| Black bear..... | <input type="radio"/> |
3. **Has a bear been killed in a non-hunting related incident on your property?**
- |                 |                           |                          |                                |
|-----------------|---------------------------|--------------------------|--------------------------------|
| Brown bear..... | Yes <input type="radio"/> | No <input type="radio"/> | Not sure <input type="radio"/> |
| Black bear..... | Yes <input type="radio"/> | No <input type="radio"/> | Not sure <input type="radio"/> |

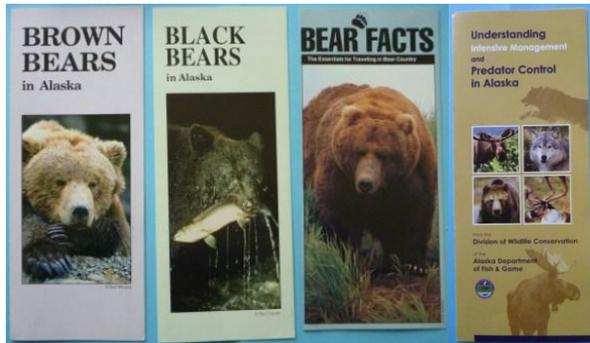
**BACK**

Rebecca Zulueta  
 University of Wisconsin  
 Forest & Wildlife Ecology Dept.  
 1630 Linden Dr.  
 Russell Labs A141  
 Madison, WI 53706

**Appendix C- Kenai Peninsula Bear Awareness Materials**

Examples of educational material and program information offered to the public by various agencies on the Kenai Peninsula, 2011.

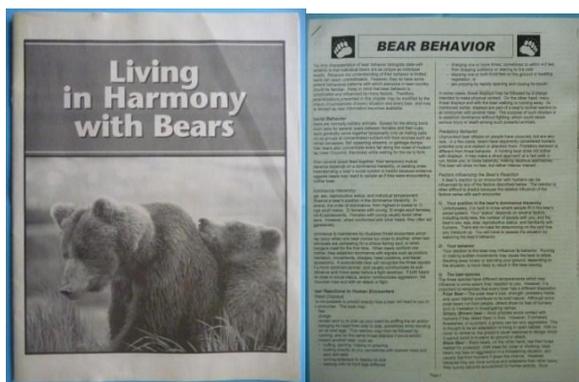
a. Pamphlets regarding natural history of bears and predator management.



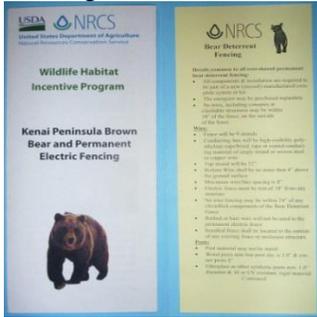
b. Pamphlets regarding bear awareness during recreational activities.



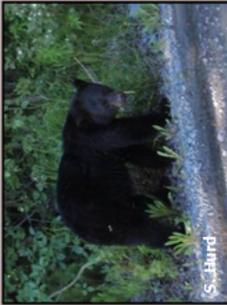
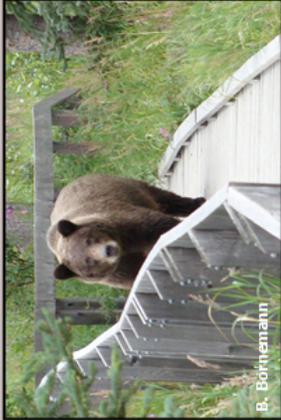
c. Informational booklet on coexistence with bears and fact sheet on bear behavior.



d. Pamphlets regarding the Wildlife Habitat Incentive Program by the NRCS for electric fencing as bear deterrent.



## Appendix D- The New Bear Awareness Pamphlet

<p>3</p>	<p>6</p>	<p>1</p>
<p>Of the residents surveyed, <b>51%</b> had <b>some form of attractant on their property</b> at that time.</p> <p>Attractants for bears can include:</p> <ul style="list-style-type: none"> <li>• Garbage not in bear resistant garbage canisters</li> <li>• Pets and livestock not within electric fencing</li> <li>• Pet food outside</li> <li>• Bird feeders</li> <li>• BBQs and smokers</li> <li>• Gardens, berry bushes, etc.</li> <li>• Compost piles</li> </ul>	<p>For more information on how to decrease attractants on your property please contact:</p> <p>Kenai Brown Bear Committee Mark Burch: (907) 267-2387 mark.burch@alaska.gov</p>  <p>S. Hurd</p>	<p><b>Easy ways to decrease potential bear conflicts on your property</b></p> <p>USFWS – Kenai National Wildlife Refuge</p>  <p>B. Borhiemann</p>
<p>Therefore, it's very important to not let your guard down when protecting your home from bears by leaving out things like pet food, dirty BBQs, and bird feeders. You not only put yourself in danger, but your neighbors as well.</p>	<p><b>A Fed Bear is a Dead</b></p> <p>Facts come from a survey conducted by the University of Wisconsin Madison and the USFWS, in 2011 looking at residential attitudes, risk perception, and tolerance on the Kenai Peninsula, AK. If you have any questions about the information provided please contact:</p> <p>rebecca.zulueta@gmail.com</p>  <p>Kenai National Wildlife Refuge P.O. Box 2139; Ski Hill Rd MS 519 Soldotna, Alaska 99669-2139 Phone: 907-262-7021 Toll Free: 1-877-285-5628 Fax: 907-262-3599 kenai@fws.gov</p>	<p><b>Keep our Neighborhoods Safe and our Bears Wild</b></p>

<p>2</p> <p>In a survey of <b>Kenai Peninsula residents</b> in 2011, <b>44%</b> of the total respondents reported having <b>some type of conflict with a bear</b> on their property at some point during the past.</p> 	<p>4</p> <p><b>Here are some easy ways you can protect your home from potential bear conflicts:</b></p> <ol style="list-style-type: none"> <li>1) Keep garbage inside your home, garage, or shed till you bring it to the transfer station or on the day of pick up.</li> <li>2) BBQ grills, smokers, freezers, and beehives will also attract bears. Always clean your BBQ grill after each use. Keep freezers in locked buildings. If they must be outside keep them locked or wrap a ratchet strap around it. Electric fences can also be used around smokers and beehives.</li> <li>3) Remember to take down bird feeders by the start of April till the end of October when bears are out. Don't forget to clean the area of any fallen seed.</li> <li>4) Keep pet food indoors or bring any left over food inside after your pet has eaten for the day.</li> <li>5) Any animal outdoors will attract bears regardless if they're your pet dog, chickens, or horses. An electric fence will keep your animals safe from bears when you can't bring them inside a building.</li> <li>6) Protect gardens by planting them in open spaces as bears are less attracted to these areas. Harvest ripe fruit right away. Also consider electric fences around compost piles as odors can attract bears.</li> </ol>	<p>5</p> <p><b>There are programs available for residents to help decrease the potential of bear conflicts on your property...</b></p> <p><b>You can obtain bear resistant garbage canisters at a discounted rate through the Wildlife Conservation Community Program. If interested please contact:</b></p> <p>Alaska Department of Fish and Game Division of Wildlife Conservation Larry Lewis: 907-260-2931 larry.lewis@alaska.gov</p>
<p>2</p> <p><b>While every situation is different, most bear conflicts on property involve some type of attractant for bears.</b></p>	<p>4</p> <p><b>The most common conflicts were:</b></p> <ol style="list-style-type: none"> <li>1) <b>Structure damage</b> (ex. buildings, vehicles, etc.)</li> <li>2) <b>Threat to themselves or family members</b></li> <li>3) <b>"Other"</b> which most often included damage to items such as <b>BBQs, bird feeders, and garbage cans</b></li> </ol>	<p>5</p> <p><b>In addition, the NRCS has established a program to aid residents with the purchase and set up of electric fencing for livestock, chickens, beehives, etc. If interested you can find more information at:</b></p> <p>NRCS Kenai Field Office 110 Trading Bay, Suite 160 (907) 283-8732</p> <p>NRCS Homer Field Office 4014 Lake Street, Suite 201 (907)235-8177</p>

# Ways to help prevent human-bear conflict

## Bear-resistant canisters

Bear-resistant garbage canisters are available to help prevent bears from getting into your trash. There are also smaller bear-resistant canisters to use for food storage while in the backcountry. Both of these canisters help prevent bears from becoming conditioned to food attractants and in turn, help decrease potential human-bear conflicts.

For more information on the types of canisters available: [www.adfg.alaska.gov/index.cfm?adfg=livingwithbears.bearcontainers](http://www.adfg.alaska.gov/index.cfm?adfg=livingwithbears.bearcontainers)

Check this website for a list of all containers that meet the criteria for "bear-resistant": [www.igbconline.org/](http://www.igbconline.org/)



Larry Lewis: (907)260-2931  
[larry.lewis@alaska.gov](mailto:larry.lewis@alaska.gov)

The Wildlife Community Conservation Program also offers bear resistant garbage containers at a reduced cost to residents in different areas on the Kenai Peninsula. Contact the Alaska Department of Fish and Game for more information to find out if this program is available in your community: [www.adfg.alaska.gov/index.cfm?adfg=livingwithbears.kenaiprogram](http://www.adfg.alaska.gov/index.cfm?adfg=livingwithbears.kenaiprogram)

Here are a few places to purchase bear-resistant containers on the Kenai Peninsula and in Anchorage:

- Home:**
- Anchorage Refuse
  - A Waste Management Company  
6301 Rosewood Street  
Anchorage, AK 99518  
907-563-3717
  - Peninsula Sanitation
  - A Waste Management Company  
43335 Kalifornsky Beach Rd, Suite #7  
Soldotna, AK 99669  
907-262-4847
- Camp:**
- Wilderness Way  
44370 Sterling Highway  
Soldotna, AK 99669  
(907) 262-3880  
[www.wildernessway.com](http://www.wildernessway.com)
  - Sportsman's Warehouse  
44402 Sterling Hwy  
Soldotna, AK 99669  
(907) 420-3000  
[www.sportsmanswarehouse.com](http://www.sportsmanswarehouse.com)



## Electric Fencing

Electric fencing is an effective deterrent for bears when protecting attractants while camping or at home. Take care to ensure proper installation of the fence and in a dry area so that an electrical current can properly pass through the bear.

Use Electric Fencing for:

- Chicken coops
- Livestock
- Smokers
- Gardens and composts
- Beehives
- Camping site, etc.



© Lily Goodwin

Find more information about the types of fencing and set up requirements at the ADFG website:

[www.adfg.alaska.gov/index.cfm?adfg=livingwithbears.bearfences](http://www.adfg.alaska.gov/index.cfm?adfg=livingwithbears.bearfences)

Interested in an electric fence? You may already meet requirements for a cost-share program through the NRCS. Contact the NRCS for more information on how to apply to the Wildlife Habitat Incentive Program:

- IRCS Kenai Field Office  
110 Trading Bay, Suite 160  
(907)235-8177
- IRCS Homer Field Office  
4014 Lake Street, Suite 201  
(907)235-8177

Here are a few places to purchase permanent and temporary electric fencing on the Kenai Peninsula and in Anchorage:

- Home:**
- Alaska Mill and Feed  
1501 1st Avenue  
Anchorage, AK 99501-1827  
907-276-6016  
[www.alaskamillandfeed.com](http://www.alaskamillandfeed.com)
  - Alaska Power Fence  
35250 Schade Drive  
Homer, Alaska 99603  
907-235-8949  
[rtis@xyz.net](mailto:rtis@xyz.net)
- Portable:**
- Dillingham Electric Fence  
Bill Carlund  
907-842-2715  
907-842-5808
  - Sportsman's Warehouse  
44402 Sterling Hwy  
Soldotna, AK 99669  
(907) 420-3000  
[www.sportsmanswarehouse.com](http://www.sportsmanswarehouse.com)



More solutions on the other side →

# Ways to help prevent human-bear conflict

## Bear Spray

A study in 2011 determined that 63% of Kenai Peninsula residents have firearms for protection from bears while only 33% of residents have bear spray. Research has shown that the use of bear spray has been more effective in a variety of situations compared to firearms.



**Bear spray stopped aggressive brown, black and polar bears 80 – 90% of the time when it was properly deployed.** Spray is most effective at a range of 5 meters and takes about 2-5 sec to deploy, therefore practicing deployment is encouraged. Keep canisters from getting cold as effectiveness decreases. Spray in front of the bear downward so you do not miss the bear. Be sure to spray with the wind as spray can disable the user. Residue after deployment can act as an attractant for bears later so be sure to clean up afterwards.

**For more information about bear spray visit:**

[www.bearsmart.com/becoming-bear-smart/home/bear-deterrents/bear-spray](http://www.bearsmart.com/becoming-bear-smart/home/bear-deterrents/bear-spray)

**Here are a few places you can purchase bear spray on the Kenai Peninsula:**

Wilderness Way  
44370 Sterling Highway  
Soldotna, AK 99669  
(907) 262-3880  
[www.wildernessway.com](http://www.wildernessway.com)

Sportsman's Warehouse  
44402 Sterling Hwy  
Soldotna, AK 99669  
(907) 420-3000  
[www.sportsmanswarehouse.com](http://www.sportsmanswarehouse.com)

True Value Hardware  
Seward Homer  
(907) 224-8286

## Other Deterrents and Effectiveness



**•Air horns-**  
There have not been any studies proving the effectiveness of air horns to deter bears. They do not work well in cold weather. Bears may become conditioned to the sound if used often.



**•Bear Bells-**  
Bear bells are used as a way to warn bears of your presence while on trails. If confronted with a bear, bells will not scare a bear away.



**•Tasers-**  
Research is currently being conducted about the use of Tasers on wildlife. Some have special settings for large animals. The effectiveness of tasers for personal protection against bears has not been analyzed yet.



**•Rubber bullets/bean bags/cracker shells-**  
Rubber bullets and bean bags have been used on problem bears with mixed effects. They are normally not a permanent solution to a bear that has become food conditioned. Cracker shells may misfire and may be illegal in some areas. Check the regulations where you're going to see if these methods are appropriate for your use.

**More solutions on the other side** →