EFFECTS OF EDUCATIONAL STRATEGIES ON BLACK BEAR-HUMAN CONFLICTS IN BLACK MOUNTAIN, NORTH CAROLINA

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December, 2011

Work submitted in partial completion of Master of Science in Environmental Education, Montreat College, Montreat, NC 28757.

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ABSTRACT

The purpose of this study was to answer the following research questions: (1) Are educational strategies effective in supporting people's intent to change their behavior resulting in a decreased availability of anthropogenic foods for black bears? (2) What types of educational strategies are most effective in supporting people's intent to change behavior regarding anthropogenic food availability? Public service announcements (PSAs), brochures, stickers, a presentation and a website were developed and piloted in Black Mountain, North Carolina. One hundred and fifty-seven randomly selected residents completed a survey about the educational strategies. Fifty-three percent of respondents were exposed to at least one educational strategy, and according to respondents, the most effective strategies were articles written in the newspaper and broadcasting PSAs on the television. The results were split on whether bears were a problem in the Town of Black Mountain: 54% of respondents strongly or somewhat agreed and 46% strongly or somewhat disagreed. A majority of residents (69%) were willing to use bear proof trash cans. The Town of Black Mountain will use the results to understand what types of strategies might be effective in dealing with the challenges of coexisting with black bears.

ACKNOWLEDGEMENTS

This thesis would not have been possible without the immense amount of help from so many people who supported me throughout this project. I would like to thank my husband, Bill, who continued to support me no matter how difficult it became for him; Kelly Ibrahim, web designer, editor, and constant supporter; and Jo and Dan who volunteered to be intercoders. The brochures and stickers were designed by Lori Lennon, who volunteered her graphic design skills and made it possible for me to use print materials designed specifically for the Town of Black Mountain. I would also like to thank my professors, Dr. Dottie Shuman, Dr. Brad Daniel, Dr. Brian Joyce and Dr. Andrew Bobilya, who with tremendous patience, taught, conferenced and supported me through this process.

A big thanks to the Town of Black Mountain staff: Pam, Darlene, Dean, and others, for all of their help preparing for meetings, answering questions, and assisting with preparation and mailing of the survey packets and premailers. In addition, I appreciate the amount of time Craig Bannerman dedicated to updating the Bear Pages website every time I needed to make an addition. I would also like to thank Mark Combs, for being a great mentor and providing the opportunity to work on this project. My most sincere thanks to the citizens of Black Mountain, and especially those who completed the survey, distributed brochures, or attended a presentation, for their interest in and support of my research.

And most of all, thanks to God, for teaching me that with his guidance I am capable of so much more than I ever imagined!

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CHAPTER 1.

INTRODUCTION

The opportunities for black bear-human conflicts increase when bear populations and/or human populations increase, when bears expand their range or when the natural food supply for bears is low (Peine, 2001). North Carolina's human population has grown from just under six million people in 1980 to over nine million people as of July, 2009 (U.S. Census Bureau, n.d.). Since 2000, there has been a 16.6% increase in the number of people living in North Carolina (U.S. Census Bureau, n.d.). In 2000, the U.S. Census estimated that there was an average of 165 people per square mile.

Based on the latest black bear range map provided by the NC Wildlife Resources Commission (NCWRC, 2010) bears are expanding their range throughout North Carolina. In addition, according to the NCWRC black bear biologist Offenbuttel, the number of black bears in North Carolina is increasing (C. Offenbuttel, personal communication, October 15, 2010). In the western part of the state it is estimated that there are between 4,000 and 6,000 black bears. The estimate in 2009 was around 4,000 bears. Given the increase in numbers of both humans and black bears in recent years it is not surprising that the number of bear-human conflicts has risen, as well.

The majority of bear problems in the mountains of North Carolina occur during the spring and early summer. During this time, bears are trying to regain weight lost during winter denning, but many of the foods they need to eat have not yet become available, resulting in continued weight loss. Biologists refer to this time period as a negative foraging period (Beeman & Pelton, 1980). During this negative foraging period

bears are especially hungry and are looking for food anywhere they can find it. However, if they have the opportunity to eat high calorie birdseed, dog food, or garbage, they will, without question, take advantage.

Availability of anthropogenic or human provided foods is considered to be the primary cause of conflicts between humans and black bears. Once bears have found human provided foods, they quickly become habituated and will return over and over again to find more human provided foods (Herrero & Higgins, 2003). Clark, van Manen and Pelton (2002) stated that "with increased density, competition for space and food resources may make it more difficult to discourage habituated bears from using developed areas" (p. 109).

It is important to know the history of North Carolina black bears to understand how they are managed in this state, what bears' needs are, and how bears behave throughout the year. This information can then be used to address how to better coexist with black bears. Jones (2008) described many key factors about black bears in North Carolina. The American black bear (*Ursus americanus*) has lived in North Carolina since before Europeans settlers arrived. By the early 1900s, there were very few black bears remaining in North Carolina. Surviving bears were restricted to the most isolated areas of the mountains and coastal swamps (Jones, 2008). The majority of the black bears were hunted by settlers for food, and to protect their families and property. In addition to the pressure from unregulated hunting by the settlers, the chestnut blight hit the mountains in the 1920s, decimating the chestnut trees that were the most important fall food source for bears.

Today, bears occupy over 50% of North Carolina's total land area (Jones, 2008). In the 1970's, the North Carolina Wildlife Resources Commission (NCWRC) designated over 500,000 acres of bear habitat as bear sanctuaries, within which bears cannot be hunted. Additionally, according to the NCWRC website (www.ncwildlife.org), there are hundreds of thousands of acres listed as *de facto* sanctuaries, including private and government owned lands, which are not accessible for hunting.

The western section of the black bears' range in North Carolina has seen a considerable increase in the number of black bear complaint calls in recent years. In the Town of Black Mountain there were 33 assistance calls in reference to bears in 2008, 92 calls in 2009 and 49 calls in 2010 as of September 27, 2010 (Police Department statistics presented at Town of Black Mountain Board of Aldermen meeting, 2010). There were over 400 bear observation and complaint calls documented in 2009 by the NC Wildlife Resources Commission's (NCWRC) district biologist for the westernmost counties: Haywood, Jackson, Buncombe, Macon, Swain, Henderson, Transylvania, Madison, Polk, Graham, Clay and Cherokee Counties. This was double the number of calls received in 2006 (NCWRC, 2009b). According to the NCWRC data, bear-human interactions are typically at the highest numbers in May (average = 50) and June (average = 44) (NCWRC, 2009a). However, in 2009, an extremely high number of bear-human interactions (80) were reported to NCWRC during October in the mountain region (NCWRC, 2009a). The average number of bear-human interactions for the month of October, from 1993 through 2008, in the Mountains is about 25 (NCWRC, 2009a). The hard mast production for the fall of 2009 was rated as poor according to the NCWRC

Western North Carolina Hard and Soft Mast Survey Report (Olfenbuttel, 2009). This may explain why there were so many nuisance bear calls in October of 2009, as bears had a low supply of the high calorie nuts and acorns they are so dependent on to help them gain enough weight to survive hibernation.

Many studies have been conducted in an effort to reduce bear-human conflicts. The majority of these studies agree that one of the most effective ways to reduce conflicts is to educate people, either as a stand-alone strategy or in conjunction with other strategies (Beckmann, Lackey & Berger, 2004; Gunther, 1994; Hristienko & McDonald, 2007; Spencer, Beausoleil, & Martorello, 2007). Beckmann *et al.* (2004) evaluated the effectiveness of deterrent techniques to alter the behavior of nuisance bears in the Lake Tahoe Basin of the Sierra Nevada range. Their data showed that deterrent techniques did not completely stop nuisance bears from returning to an area because there was still an availability of human-provided foods. In fact, they suggested to wildlife managers that a cost-benefit analysis be completed to decide if the use of deterrents was worth it. As an alternative, they suggested that a more effective strategy might be "aggressive public education" about the need to reduce accessibility of anthropogenic foods, and could be used in conjunction with deterrent strategies or ordinances to decrease bear/human conflict (Beckmann *et al*., 2007, p. 1145). Similar to Beckmann *et al*.'s (2004) study, Gunther (1994) found in a review of the Yellowstone National Park (YNP) Bear Management Plan from 1960-1993, that deterrents were not very effective if human-provided foods were still accessible to bears, and suggested that education "designed to

prevent bears from obtaining human foods and garbage must remain a permanent bear management priority within YNP" (p. 559).

Warburton and Maddrey (1994) found that most state wildlife agencies responded that educating the public was a top priority, but very few states actually implemented bear education programs. As a follow up to this study, Spencer *et al.* (2007) stressed the importance of education in his assessment of a survey of North American wildlife agencies. A majority of those agencies said they had bear education programs. Additionally, education has been a topic in all Eastern and Western Black Bear Workshops since they began in 1972 (Spencer, *et al.,* 2007). Hristienko & McDonald (2007) also surveyed North American wildlife agencies to compare the history of black bear management strategies among the agencies. Their conclusion was that management agencies should use a two-fold approach of regulated hunting and "aggressive public education" to manage black bears within their jurisdictions (p. 86).

The conclusions from these various studies to incorporate education into their bear management plans were based on the fact that the availability of human-provided foods continued to thwart other efforts to manage bears. To reduce the availability of these foods, wildlife managers needed to educate the public on how to make sure the anthropogenic foods were inaccessible to bears. However, the researchers did not discuss the need to evaluate those educational strategies they were implementing, as suggested by Gore, Knuth, Curtis and Shanahan (2006), so it could be determined which of the strategies were effective in helping the public understand the need to reduce the availability of anthropogenic foods.

Purpose and Research Questions

The purpose of this project was to determine if selected educational strategies (Table 1) were effective in increasing people's intentions to change their behavior to reduce bears' accessibility to anthropogenic foods, and, if so, were some strategies more effective than others. The study was conducted in the Town of Black Mountain, located in Buncombe County, in the southern mountains of Western North Carolina. Town officials are in the beginning stages of investigating options for decreasing the bear-human interactions occurring within the town.

The research questions include: (1) Are educational strategies effective in supporting people's intent to change their behavior which results in a decreased availability of anthropogenic foods for black bears? (2) What types of educational strategies are most effective in supporting people's intent to change their behavior regarding anthropogenic food availability?

Definition of Key Terms

Intent to change behavior, for the purpose of this study, is the aim or purpose to change one's behavior. The intent to change behavior is likely to increase when educational strategies focus on increasing three factors: knowledge of the subject, environmental sensitivity, and internal locus of control (Hungerford & Volk, 1990).

Environmental sensitivity is defined by Ramsey (1993) as "the belief that humans must live in harmony with the environment."

Internal locus of control, as defined by Ramsey (1993) is an "individual's perception of whether a particular action will result in an anticipated reinforcement for acting."

Ursus americanus is the *American black bear*, the only species of bear found in North Carolina.

Nuisance bear will be defined as "any bear in a developed area" (Clark, van Manen, & Pelton, 2003, p. 211).

Bear-human conflict is defined as "any negative interaction between a person and bear that is aggressive, defensive or nuisance in nature" (Gore, Knuth, Curtis and Shanahan, 2006, p.75).

Anthropogenic foods are foods provided by humans including, but not limited to, garbage, bird seed, and dog food.

Onsite release "involves capturing and immobilizing bears that frequent developed areas, collecting biological data, and releasing the bears into the area of capture" (Clark, van Manen & Pelton, 2002, p.104).

Aversive conditioning is "an operant technique that uses a negative stimulus to cause pain, avoidance, or irritation in an animal engaged in an unwanted behavior. In the case of bears, if aversive conditioning is successful, bears will learn to associate humans, human food, and human developments with the negative stimulus and avoid them" (Mazur, 2010, p.48).

Limitations

A limitation of this study was that although surveys were sent to random addresses, those people who chose to respond might have done so because they already had an interest in the study topic. Due to the support and partnership the researcher had with Town of Black Mountain officials, it is possible that participants did not answer survey questions honestly for fear that town officials would be able to track their responses. Another important limitation to consider is the potential for other factors not controlled by this study to affect residents' choices to change their actions in regards to coexisting with black bears, including direct encounters with bears or receiving information on coexisting with bears from other sources.

Delimitations

This study was delimited to the Town of Black Mountain, North Carolina and the survey respondents were delimited to the 350 residents who were randomly selected to receive a survey. Another delimitation of this study was the length of time the educational strategies were implemented prior to distribution of the survey. The earliest strategies, the brochure and website, were implemented at the beginning of April, and the last of the strategies, the locally-produced PSAs, were not implemented until July. The survey was sent out at the beginning of September; therefore, there was not much time for residents to be exposed to the strategies. Another delimitation was that the survey was conducted by mail. Completing surveys in person might collect a higher volume of data with more ability for the researcher to probe.

CHAPTER 2.

LITERATURE REVIEW

There are many factors that can affect black bear behavior when black bears come in contact with humans and developed areas: biological factors, deterrent strategies and educational strategies. This literature review will address these factors. Biological factors are natural limiting factors that affect bears' food supply and when natural foods are limited, bears will travel greater distances to find food, increasing the likelihood of an interaction with humans. Deterrent strategies are strategies used to try and discourage a bear from staying in a developed area. This negative conditioning may include loud noises, rubber slugs or dogs. The last strategy discussed is educational strategies. The focus of educational strategies, unlike the other two factors discussed, is not on the bears, but humans. Understanding the strengths, but more importantly, the limitations of the effects of biological factors and deterrent strategies, will show the importance of implementing educational strategies that can support people's intent to change their behavior to reduce the amount of human provided foods available to bears.

Biological Factors

Denning needs. American black bears den in the winter, during which time they may not eat, urinate or defecate for many months. Researchers hypothesize that bears are more reliant on fat reserves to survive the winter than other hibernators (Harlow, Lohuis, Grogan, & Beck, 2002). In the fall, bears will consume almost 20,000 calories each day to gain enough weight to survive hibernation (Masterson, 2006). To achieve this,

Hristienko and McDonald (2007) estimate bears would need to eat about 80 pounds of fruit or 6.6 pounds of nuts.

Diet. In an effort to understand the composition of a black bear's diet, Beeman and Pelton (1980) conducted a survey of bear scat and stomach samples in the Great Smoky Mountains National Park (GSMNP). They found that 81% of the bears' diets were made up of plant material, 11% animal matter, 6% artificial foods and 2% debris. Animal matter consisted of mostly beetles, yellow jackets, wasps, hornets and ants, as well as carrion from mammals (Beeman & Pelton, 1980). Artificial foods were found during the spring and summer and were anthropogenic foods the bears found in campgrounds, garbage dumps and roadsides (Beeman & Pelton, 1980).

Beeman and Pelton (1980) also observed that food availability seems to fall into four time periods: "spring (emergence from limited winter activity through 30 June), summer (1 July through 30 August), early fall (1 September through 15 October), and late fall (16 October to approximately the first snow)" (p. 142). The same study found that ninety percent of the bears' spring diets consisted of grasses and other non-woody stems and leaves. The other 10% of the spring diets was squawroot, an abundant parasitic plant that is usually found growing on the roots of oak trees. Summer diets consisted of fruits and seeds from various plants such as squawroot, huckleberry, blueberry, black cherry and blackberry. Fall diets were split into early fall and late fall. Foods that are available in early fall were predominately black cherry fruits, although other fruits were still available, and some nuts depending on elevation. By late fall, nuts were the main food source for bears coming from oak, hickory, and beech trees, and a

few sources of fruits from black cherry, grapes and apples. Beeman and Pelton (1980) summarized because fall was such a critical time for bears to find foods high in fat, fall hard or soft mast failures would cause bears to move farther outside of their home ranges, many times into developed areas, increasing their chances of mortality. This was certainly the case during October of 2009 in Western North Carolina.

Driven by food. Bears looking for food will travel into open areas more often, sometimes dangerously traveling along roadways. Brody and Pelton (1989) found that bears tend to avoid roads that are well traveled unless there is a lack of food, especially fall hard mast (nuts and acorns), such as in 2009, and then bears take bigger risks by traveling along roadsides or walking into developed areas looking for food. This behavior increases their chances of getting into trouble in neighborhoods, towns, and campgrounds, and also makes them more susceptible to hunters and being hit by vehicles. This is likely the reason 2009 was a record year for bear harvests in Western North Carolina. There were 1,198 bears harvested in the mountains of North Carolina compared to the next highest harvest in 2008, which was only 857 bears (NCWRC, 2009c).

For bears, however, the risks are often worth the reward of gaining the weight needed to recover from the previous winter denning and prepare to survive the upcoming hibernation during the next winter. According to the NCWRC (2009a), the months of May and June are when the greatest number of bear-human interactions occurs. McLean and Pelton (1990) studied the physiological differences between wild and panhandler bears in Great Smoky Mountains National Park. Panhandler was the term given to bears

getting into human provided foods, such as garbage, coolers, and food left out at campsites. They found that panhandler bears grew faster, were larger in weight and size, and matured earlier than wild bears (McLean & Pelton, 1990). The female panhandler bears were also more fertile and produced more offspring more often than wild female bears. It is worth mentioning that 47% of the subadult panhandler bears tracked in this study was male (McLean & Pelton, 1990). After the second winter of denning with the maternal sow, male cubs must strike out on his or her own that summer. It is difficult for a subadult male to find a prime home range that is not already established by an older male. For this reason, subadult males are more likely to be the nuisance bears getting into in developed areas trying to find suitable sources of food.

Bears' focus on finding food will drive them to tolerate being close to humans and development if they are successful in finding a sufficient food source. There is very little that can be done to significantly affect the amount of natural foods available to bears during any given season. If the food supply is low, there will always be potential for bears to travel into developed areas looking for food. Therefore, ensuring that bears will not have access to human provided foods by educating the public on how to make sure anthropogenic foods are inaccessible, is essential.

Deterrent Strategies

Deterrent strategies utilize some form of a negative stimulus to encourage bears to stay out of a developed area, such as a campground or neighborhood. Examples of deterrent techniques are pepper spray, rubber buckshot, rubber slugs, loud noises, and dogs. Deterrents can be used after capture and on-site release of a nuisance bear or

immediately when a bear is spotted getting into human provided food sources. These strategies are also called aversive conditioning. Mazur (2010) defines aversive conditioning as "an operant technique that uses a negative stimulus to cause pain, avoidance, or irritation in an animal engaged in unwanted behavior" (p.48). Although Clark, van Manen and Pelton's (2002) study in GSMNP found deterrent techniques to be successful at discouraging bears from returning to an area, Beckmann, Lackey and Berger (2004) found that 92% of bears returned to the area where they were captured and 70% of those returned within 40 days.

Response to Aversive Conditioning. Mazur's (2010) 4-year study on aversive conditioning techniques of over 150 bears in Sequoia National Park found that wild and food-conditioned bears responded immediately by running away from rubber slugs 85% - 92% of the time. Wild bears ran away immediately 70% of the time when chased. Pepper spray and chasing kept a large majority of food-conditioned bears away for the hour after the hazing, proving to be the most effective technique for food-conditioned bears. Pepper spray and rubber slugs were the most effective at keeping wild bears away for the first hour after those techniques were administered. Aversive conditioning did not seem to have long term effects in preventing bears from returning to developed areas, though, unless the bears received the aversive conditioning immediately after obtaining anthropogenic food and they were wild bears and had not become food-conditioned. Individual bear behavior also seemed to have a major influence on whether a bear returned to the area after aversive conditioning (Mazur, 2010).

Long-Term Effectiveness. Mazur (2010) also quantified the long-term effectiveness of several deterrent techniques. Thirty-six food-conditioned bears were tracked for four years after the initial study. Twenty-five of those bears were treated less than 14 times each over the four years, and 11 bears were treated more than 23 times each over the four years. Of the 25 infrequently treated bears, 16 of them stopped returning after a year or so. Only one of the 11 bears treated frequently stopped returning to developed areas and 6 were killed or relocated due to their dangerous behavior. Of these eleven, six were food-conditioned before the study began, and the other five were their offspring. Considering the time and expense allocated to aversively conditioning the bears, the results are not that positive.

Limitations to Aversive Conditioning. Mazur (2010) discussed the difficulties of responding immediately to a nuisance bear call, which is crucial if aversive conditioning is going to be effective. Bears need to receive the negative response as soon as they get into human provided foods. In her discussion of management implications, Mazur (2010) states that aversive conditioning will not be effective if anthropogenic foods continue to be available to bears. Hence, the reason 11 bears were treated over 23 times each over a four year period. The difficulty for state wildlife agencies, though, is a lack of funding and staff to be able to respond immediately to nuisance bear calls and to educate and supervise communities to decrease the opportunities for bears to receive human provided foods.

Nuisance bears can cause considerable property damage. United States wildlife agencies estimated that the cost in 2004 associated with controlling bear-related damage

increased by 45% and the time personnel spent resolving bear-related complaints increased by 22% (Gore et al., 2006). In the 1990's in GSMNP, 1,414 nuisance bear incidents were reported, almost a third of which resulted in approximately $40,000 worth of property damage (Clark, van Manen, & Pelton, 2002). In 1997 in Yosemite National Park, bears caused $600,000 in property damage (Peine, 2001). Deterrent techniques can produce positive results, but are expensive, time consuming and dangerous and do not correct the ultimate cause of the problem – the availability of human provided foods.

Beckmann *et al*. (2004) suggest that once bears are habituated to human foods, they are unlikely to respond to deterrents. Aversive conditioning is more successful if bears are caught the first time they encounter human provided foods (Clark, Van Manen & Pelton, 2002). Beckmann *et al*. (2004) suggest "aggressive public education" in combination with laws regulating the use of bear-proof garbage containers and the intentional or unintentional feeding of bears (p. 1145). In addition, Clark *et al*. (2002) found that deterrent techniques, specifically on-site releases, were not effective on bears that were active during the day looking for food in campgrounds in GSMNP. Since bears are not normally so bold as to come out into developed areas looking for food, the researchers assumed that the bears that were active during the day were more food-conditioned than other bears only active at night. It is also suggested that females with young are likely the most difficult to deter from human provided foods because the need for high calorie food is so great.

Translocation. Another type of deterrent strategy that may be used by wildlife agencies is translocation. Translocation is different from on-site release in that once the

bear is captured; it is not released back on-site. Translocating a bear means taking it out of the area entirely. However, Clark *et al*. (2003) found that translocation as a detterent is not very effective. Translocating a bear is not effective because the bear becomes a problem in the new location. Without immediate aversive conditioning after the bear gets into a human provided food source to teach the bear that its behaviors were not acceptable, it will continue to behave in the same manner. Furthermore, if adult males are translocated out of the area, it allows subadult males to move in, replacing one nuisance bear with potentially another. Translocation increases the odds that a bear is going to be killed for three reasons. If a bear continues to be a nuisance bear in the new location, there is a likelihood the bear will eventually have to be euthanized. There is also potential for an accident to occur during the translocation process that could kill the bear. And thirdly, a translocated bear will be unfamiliar with its new habitat and is more susceptible to hunters or road accidents (Clark, van Manen & Pelton, 2003).

There are specific circumstances where deterrent strategies can be effective, but often aversive conditioning is not effective because there are not enough resources to continually reinforce the negative conditioning. Deterrent strategies such as rubber buckshot, rubber slugs, and pepper spray can also be expensive, including the cost of sending personnel out to administer the deterrent. If anthropogenic foods are not available when bears travel into campgrounds or neighborhoods, they will continue on in search of food and never become habituated to human foods. Educating people on how to make sure garbage, pet food, bird seed and other anthropogenic foods are inaccessible to bears will prevent the need for deterrent strategies.

Educational Strategies

For the purposes of this study, educational strategies are those strategies intended to educate humans, and do not include those strategies used by wildlife managers, such as aversive conditioning, to educate bears on what are appropriate and inappropriate behaviors. Educational strategies are often incorporated into bear management plans after it is discovered that other strategies are not effective in managing bear/human conflict because anthropogenic foods are still available to bears (Beckmann, Lackey & Berger, 2004; Gunther, 1994; Hristienko & McDonald, 2007; Spencer, Beausoleil, & Martorello, 2007). The educational piece of a bear management plan may contain more than one educational strategy, but there is often little or no evaluation to determine which strategies are most effective. Because the availability of human-provided foods is often the cause of bear/human conflict, the educational strategies, to be effective, should help people understand the importance of making sure anthropogenic foods are inaccessible to bears.

Case Studies. It has been discussed that bears are food driven and once habituated to anthropogenic foods, are unlikely to discontinue searching for human provided foods (Beckmann *et al*., 2004). The solution to this problem, then, is to ensure bears never gain access to anthropogenic foods. People need to be educated on why bears are food driven and why it is important to make sure bears do not have access to their garbage, bird feeders, pet food, and other irresistible foods (Gunther, 1994). Educational strategies have proven to be effective methods of dealing with bear-human conflict. Management of bear-human conflict most often begins with non-educational

strategies, such as removal of bears or aversive conditioning, and eventually includes educational strategies because managers see the need to ensure removal of human provided foods, as described above. Removal of anthropogenic foods can only be done with assistance from people living in or visiting the area. Without educating local people and visitors, bears will continue to become food-conditioned and therefore unlikely to change their behaviors.

Survey of Wildlife Agencies. Warburton and Maddrey (1994) surveyed wildlife agencies in Eastern North America and concluded that even though education was listed as a "top priority" by many states, over a third of the states did not have any educational materials related to coexisting with bears (p. 122). The authors suggest that "a comprehensive publication on bear biology and damage abatement techniques" should be developed to assist agencies in educating the public about nuisance bear problems (Warburton & Maddrey, 1994, p. 122). A comprehensive publication for the wildlife agencies' use would be beneficial, but would not be appropriate for the public. There should be materials made available to the public that are designed specifically to educate the general population on coexisting with bears.

Bear Management Plans in National Parks. Many of our national parks have had bear management plans written for thirty years or more that include a number of the deterrent strategies discussed above, as well as educational strategies, often implemented after other strategies were tested first. The measure of the effectiveness of those strategies is a decrease in bear-human conflict, which hints at the effectiveness of some strategies or combinations of strategies, but doesn't assist in separating which strategies

are most effective nor does it address the possibility of external factors not accounted for that can also have an effect on the number of bear-human conflicts. With decreasing budgets and staff, it is crucial for parks and other agencies responsible for managing bear-human conflicts to assess the effectiveness of strategies to ensure money and time are not being wasted on strategies that are not working.

In Denali National Park, the staff has focused on bear-human interactions since 1982 (Schirokauer & Boyd, 1998). Not only have wildlife management technicians patrolled the park to make sure visitors follow food and garbage regulations, but they also provided educational programs, and posted signs at campgrounds, restrooms and bulletin boards. All visitors go through the Visitor Center to obtain bus coupons, maps and other materials and received information about being safe in bear country through the park newspaper, a brochure, or direct contact with rangers. Visitors obtaining backcountry permits watched an interactive video on how to safely travel and camp in the backcountry, and were required to use bear resistant food containers. There was a $150 fine for non-compliance (Schirokauer & Boyd, 1998). The rates of bear-human incidents decreased over time and were attributed to education of park visitors, aversive conditioning of bears and the increased use of bear resistant food containers. Similar results were documented in Yellowstone National Park, Yosemite National Park, Jasper National Park and Shenandoah National Park (Schirokauer & Boyd, 1998). The difficulty is narrowing down if one type of strategy was more effective than another or if it was the combination of certain strategies that was most effective.

For example, a review of bear management strategies in Yellowstone National Park by Gunther (1994) uncovered some interesting facts about their effectiveness. Even after the removal of over 300 bears from the park, the number of bear-human incidents did not decrease significantly. It was not until the park began eliminating bears' access to anthropogenic foods, that they began to see a decrease in bear-human conflicts. The first ten years of Yellowstone National Park's bear management plan focused on removing nuisance bears, which was expensive, time consuming, and dangerous. By 1970, the bear management plan put more focus on eliminating human provided food sources. Visitors to the park were no longer allowed to feed bears, three dumps in the area where bears frequented were closed, and bear proof lids were installed on garbage cans within the park. When wildlife managers began focusing more on human actions instead of just bear behaviors, the number of bear-human conflicts appeared to decrease.

Gunther (1994) suggests that bear education programs must continue to be a priority of bear management plans. Although, without evaluation of each strategy, it is difficult to know exactly which strategies were most effective in decreasing bear-human conflict. Many of the reviews of bear management plans in national parks site that educational strategies were used, but do not specify, as was done in Schirokauer and Boyd's (1998) review of Denali National Park, what those strategies were. It is possible that certain educational strategies are more effective than other educational strategies. If the parks evaluated their education methods and found such a conclusion, they could discontinue those strategies and reallocate those resources to the strategies that were more effective.

Valuational Forces. Peine (2001) reviewed the bear management plans that four communities used to reduce the number of bear-human interactions. In Juneau, Alaska, many aversive conditioning techniques were tried with mixed success. The conclusion was that once bears were food-conditioned, it was very difficult to change their behavior. Beckmann *et al.* (2004) and Clark *et al.* (2002) supported this idea: when the number of bear-human conflicts continued to increase and more nuisance bears were being killed, the community began speaking out against the current practices to reduce bear-human conflict.

Peine (2001) defines the actions of the community as "valuational forces," when the focus is on public safety and protection of property, and attributes the changes in bear management techniques to the strong influence of these forces (p. 228). Once the public spoke out, a public ordinance was written specifying garbage storage and collection regulations using bear proof containers and the police department became responsible for enforcing the new regulations. Many residents complied with the new regulations, but it was not until an education campaign was started, consisting of videos, radio jingles, coloring books, pins, stickers, and fliers, that the community finally saw a significant decrease in the number of nuisance bear problems. Educating the public about why it was important to keep human foods, including garbage, away from bears helped them understand why the regulations were in place and they were more likely to comply with the new regulations, a process called "fact-based decision making" (Peine, 2001, p. 229).

Unique Circumstances. A similar situation took place in Mammoth Lakes, California, not far from Yosemite National Park. An increase in human injuries from

nuisance bears and an increase in dangerous bear behavior spurred the community to develop an ordinance defining how garbage was to be handled and instituting fines if wildlife were fed or hunted within the city limits (Peine, 2001). The unique aspect of Mammoth Lakes' management strategy was the hiring of a freelance wildlife management consultant, Steve Searles, who developed an aversive conditioning program and was employed by the town to implement his program (Peine, 2001). Because he was hired to specifically focus on the nuisance bears, he could respond quickly and catch many bears on their first attempts to obtain human provided foods. His deterrent techniques have been more successful than in other areas because of the speed and consistency with which he can respond to a nuisance bear call. For this reason, there has been more focus on educating the bears than educating the residents. However, most communities and wildlife agencies do not have the desire, time, money, or resources to implement such an extensive aversive conditioning program similar to Mammoth Lakes, and therefore, must use strategies that focus more on initially reducing bears' access to anthropogenic foods, often through education of residents and visitors.

The community of West Yellowstone, Montana also had a unique situation that allowed for traditional methods of decreasing bear-human conflict to be more effective than in most areas. West Yellowstone chose to adopt a strict, comprehensive ordinance enforced by the police department. The ordinance required residents to contain any type of food that might attract a bear in a bear-proof container. It also "prohibits the feeding, approaching, and harassing of bears" (Peine, 2001, p. 231). Bear-proof containers could be made by the homeowner, but must be approved by the police chief. Violating this

ordinance was considered a misdemeanor and fines ranged from $500 to 3 days in jail (Peine, 2001). Implementing strict ordinances and fines puts a large burden on the police department to enforce those regulations. West Yellowstone is a small community and the police department was able to take on the additional burden. The results were moderately successful, but there are many communities and government agencies whose police force is too taxed already to take on the additional duties of enforcing regulations and fines and approving all homemade bear-proof containers.

In all of these communities, it took time to convince the residents and sometimes town leaders to take action to solve their nuisance bear problems. Often, it was the valuational forces that initiated taking action. Aversive conditioning and implementation of fines were usually the first steps and, except for the unique circumstances of Mammoth Lakes and West Yellowstone, were not extremely effective as stand-alone strategies. In the end, educating the residents, visitors, and town leaders about the importance of changing their actions appeared to have the biggest effect on decreasing the number of nuisance bear incidents by decreasing bears' access to human provided foods. Therefore, no matter what strategies are used to decrease bear-human conflict, one component must be educating the public on how to decrease the opportunity for bears to receive anthropogenic foods, which will be an important component in the content of the educational strategies used in this study. Not only must education occur as part of any bear management plan, but there must also be some evaluation of the effectiveness of the strategies, including the educational strategies, so only the most effective strategies continue to be implemented to save time and money. Therefore, a primary goal of this

study will be to evaluate the effectiveness of the educational strategies implemented in Black Mountain to increase residents' intent to change behavior to reduce bears' accessibility to human provided foods.

Messages

Researchers agree (Dunn *et al*., 2008; Gore & Knuth, 2009; MacHutchon & Welwood, 2002) on the concepts that should be addressed when educating the public about coexisting with bears. Those concepts, as stated by MacHutchon & Wellwood (2002), are: "(1) local bear ecology, (2) habituation and food-conditioning, (3) preventing bear encounters . . ., (4) avoiding attracting bears to campsites, and (5) how to behave during a bear encounter" (p. 358). Dunn, Elwell and Tunberg (2008) identify the following points that need to be discussed regarding habituation and food-conditioning: "(1) do not feed bears; (2) store food and garbage in secure, hard-sided containers; and (3) store bird feeders, pet food, and barbeques in secure buildings when not in use and at night" (p. 44). Spencer, Beausoleil, & Martorello (2007) also cite the National "Be Bear Aware" Campaign in Missoula, Montana, the Provincial "Get Bear Smart" Society in Whistler, British Columbia, Canada, and the "Bear Wise" program in Ontario, Canada as having similar messages (p. 223). Finally, Gore and Knuth (2009) recommend the same concepts and include "keeping home compost contained and secure, and picking up fruit that has dropped from trees and harvesting fruit before it falls" (p. 1409). These definitions of the concepts helped to determine what should be included in the educational strategies implemented and evaluated in this study.

Study Model. Dunn, *et al*. (2008) implemented educational strategies in New Mexico with the purpose of evaluating the strategies' effectiveness measured by increased knowledge of the people surveyed on how to be safe in bear country. Dunn's objectives were to determine if residents would be more knowledgeable than campers on how to live in bear country, and if people who received information on how to be safe in bear country would be more knowledgeable than people who did not receive the information.

Two areas in New Mexico were chosen to have educational print material on bear safety disseminated based on two criteria: bear-human encounters were common in the area and bear safety information had not been widely disseminated in the area previously (Dunn *et al*., 2008). The print material consisted of brochures, posters and adhesive signs. To compare how effective the signs and brochures were, the authors designated areas that were non-treatment areas that were far enough away from the treatment areas that the chance of the information reaching the residents was minimal.

The print media contained messages about not feeding bears, intentionally or unintentionally, and what to do if you encounter a bear (Dunn *et al*, 2008). Brochures were mailed with utility bills, placed on store counters and at the entrances of businesses, and were given to campers by campground hosts. Posters were put up at kiosks of campgrounds and within the restrooms at campgrounds. Signs were placed on campground tables and garbage cans. Residents and campers were surveyed in the summer, either directly at the campgrounds or through random mailings (Dunn *et al*,

2008). The surveys gathered background information and asked questions about bear attractants and what should be done if you encounter a bear.

Dunn *et al*. (2008) found that "residents surveyed in treatment areas scored highest; campers surveyed in reference areas scored lowest" (p. 47). These results demonstrate that educational opportunities that happen once or twice are not going to be as effective as those that occur over and over again using multiple strategies. Except for residents in treatment areas, a low percentage of each group considered bird feeders to be an attractant. In many cases, nuisance bears' first connection with human provided foods was bird feeders, which supports the idea that there is a need for some educational efforts to focus specifically on bird feeders. Brochures, PSAs and the website designed for this study will all present a message about the importance of preventing bears from accessing bird feeders and bird seed.

Intent to Change Behavior Model. Dunn *et al*.'s (2008) research evaluated whether the public's knowledge increased after the implementation of the educational strategies, but to support behavior change in people so they will not continue to provide food, intentionally or unintentionally, to bears, other factors, in addition to an increase in knowledge, need to be assessed. An increase in knowledge could help someone choose to change their behavior, but according to Hungerford and Volk (1990), knowledge alone will not likely cause behavior change. In order to change behavior, there must be an increase in knowledge about the issue and people must also develop an internal locus of control, which means they feel they have the ability and obligation to make a difference.

Additionally, they must also have a desire to care for the environment. They label this desire environmental sensitivity (Hungerford & Volk, 1990).

Hungerford & Volk's behavior change model is widely used in environmental education to develop curricula that will help support students' progression to become environmentally literate and active citizens. One such program is called Issue Investigation and Action Training (IIAT), and has been used in formal classrooms to develop the three areas Hungerford and Volk speak of: knowledge of the issue, locus of control and environmental sensitivity (Ramsey, 1993). The IIAT model was tested with a group of eighth grade students, using a portion of the students as the control group. Students from the IIAT group and control group were interviewed three years later to attempt to document a change in behavior that resulted in more environmentally appropriate behaviors. The interviewers were able to distinguish which students were involved in the IIAT model based on their responses that represented more environmentally appropriate choices (Hungerford & Volk, 1990).

The Black Mountain study was on a much shorter time frame, but the same three factors were addressed in the content of the educational strategies. The hope was to identify respondent's intent to change behavior regarding anthropogenic food availability for bears. According to Hungerford and Volk's theory (1990), if the residents of Black Mountain increase their knowledge about how to coexist with bears, develop an environmental sensitivity about bears and develop their internal locus of control, they then will be more likely to increase their intent to change their behavior regarding the availability of anthropogenic foods. By providing the residents with educational videos,

presentations, and literature about bears, their knowledge of bears should increase. The third factor, environmental sensitivity, is difficult to address through these educational strategies and is difficult to evaluate, but the presentations and PSAs discuss concerns about orphaned cubs, as well as the fate of food-conditioned bears in hopes of addressing environmental sensitivity. The presentations and flyers that explain how to decrease the chances bears are being provided human foods should support the development of the residents' internal locus of control. In addition, explaining the actual steps residents should take if a bear is spotted in the area should give them confidence about how to react – their locus of control. If these three factors of Hungerford and Volk's (1990) behavior change model were effectively supported with the educational strategies used in Black Mountain, there is a possibility of increasing residents' intentions to change their behavior to decrease the opportunities for bears to access human provided foods.

Community-Based Social Marketing. Many of the decisions made about the educational approach to this project were based on the community-based social marketing approach defined by McKenzie-Mohr and Smith's (1999) *Fostering Sustainable Behavior*. McKenzie-Mohr and Smith provide suggestions about the types of tools that can be used to educate a community about a local issue to encourage a specific change in behavior of the residents. Many of those suggestions were used to design the educational strategies for this study, including prompts, such as flyers and stickers, easily accessible to the public and often placed near where the desired behavior should occur. For example, flyers were placed on refrigerators of many rental houses encouraging visitors to take their garbage out only on the morning of pick-up. Flyers and stickers,

listing the Town's web address, were also placed around town and on Public Works trucks to draw attention to the Bear Pages on the Town's website. A large silhouette of a black bear was in the center of the circle to catch people's eye and help them pay attention to the web address.

Other community-based social marketing tools implemented in this study were using PSA's with residents modeling appropriate behaviors to reduce anthropogenic food availability for bears and discussing overcoming the barriers associated with implementing those behavior changes. McKenzie-Mohr and Smith (1999) also discuss using vivid information to convey a message, increasing the likelihood the message will be attended to. A process they refer to as encoding. Vivid information is information that catches a person's attention and helps them remember the intended message. For example, Black Mountain presentations included a picture of a bear climbing across a rope to get to a bird feeder. At the bottom of the photo is the equation "7 lbs. of bird seed = 27 quarter pounders with cheese," helping residents understand why bears are so attracted to bird feeders. The community-based social marketing approach has been effective in changing behavior in many programs as outline by McKenzie-Mohr and Smith (1999). For the purposes of this short-term study, suggestions of educational tools were used to develop and design the educational strategies implemented in Black Mountain.

CHAPTER 3.

METHODOLOGY

Methods: Development of Educational Strategies

Specific educational strategies tailored for the residents and visitors of Black Mountain were developed to implement for this study. The following paragraphs describe the development of the educational strategies and the research that supports decisions made about those strategies.

Educational Strategies. A combination of educational strategies was used to educate the residents and visitors of Black Mountain on coexisting with bears. The purpose of this project was to determine if selected educational strategies (Table 1) were effective in increasing people's intentions to change their behavior to reduce bears' accessibility to anthropogenic foods, and, if so, which strategies were most effective.

Table 1

Summary of Educational Strategies Used

Strategy	Time Period
Presentations	April – July
Brochures/Flyers	April – December 2011*
Website	April – December 2011*
Newspaper articles	May
Public Service Announcements	April – December 2011*
Stickers	July – December 2011*

*Are available for continued use if town officials choose to use them.

Presentations. To provide face-to-face opportunities to interact with the public, four 1.5 hour educational presentations were held at the Black Mountain library during the months of April, May, June and July. Information about the presentations was posted on the Town of Black Mountain's Bear Pages website and included in the calendar in the local newspaper. The presentations gave participants the opportunity to learn about the natural history of black bears in North Carolina, current population estimates, and what bears are doing during each season of the year. Participants also learned what to do to prevent bears from having access to human provided foods, what to do when camping in bear country, and how to act during a bear encounter.

These topic areas were chosen based on recommendations by Dunn *et al*., (2008), Gore and Knuth (2009), and MacHutchon and Welwood (2002), and address the three areas of Hungerford and Volk's (1990) behavior change model: increase in knowledge, environmental sensitivity and locus of control. Brochures were available for participants to take with them, allowing them the opportunity to be actively involved in educating neighbors and friends, as suggested by McKenzie-Mohr and Smith (1999). McKenzie-Mohr and Smith (1999) suggest that this opportunity is likely to increase the participant's commitment to change their behavior.

Brochure. A tri-fold brochure entitled "Help Keep Bears Wild," paid for by the Town, was designed to provide brief tips on coexisting with black bears and included information on keeping garbage, dog food, barbecues and bird seed inaccessible to bears (Appendix D). It also included a simple description of what to do if a person encounters a bear. The information included in the brochure attempted to address two of the three

areas of Hungerford and Volk's (1990) model: increase knowledge and develop an internal locus of control. The inside of the brochure was designed to serve as a flyer when opened completely and brochures were displayed in this manner in store windows and on community bulletin boards throughout town.

A total of 97 stores posted the flyer in a prominent place, 42% of the 232 businesses in Black Mountain, not including churches, doctor's offices, and banks (J. Tipton, personal communication, November 4, 2011). Brochures were also posted on community bulletin boards, and were given to residents when they came to the Town Hall to pay their water bills and were made available on the front counter and brochure racks for anyone visiting the Town Hall or Chamber of Commerce.

Additionally, Greybeard Realty placed flyers on the refrigerator doors in their rental homes to help educate visitors, with the specific focus on storing garbage and only putting it out the morning of pick-up. The realty company expressed interest in this project from the beginning because of the consistent problem on their properties of garbage not being stored properly, allowing bears to get into garbage and spread it everywhere. McKenzie-Mohr and Smith (1999) suggest that prompts, such as the flyer, be placed close to the desired behavior. In this case, the refrigerators are close to the kitchen trashcans, and remind visitors not to put trash out until the morning of pick-up.

Webpage. A webpage was also developed as a part of the Town of Black Mountain's website and provided more in-depth information about black bear biology and living in bear country (Appendix E). The section titles were: "Bear Facts," "Food Conditioning," "Preventing Bear Encounters," and "What to Do If You Encounter a

Bear." As with the presentation topics, information included in the webpage was chosen based on recommendations by Dunn *et al*., (2008), Gore and Knuth (2009), and MacHutchon and Welwood (2002), and attempted to address all three areas of Hungerford and Volk's (1990) model. The Help Keep Bears Wild brochure was downloadable from this website and an email account was set up to field questions or comments related to coexisting with bears. Presentation dates were also posted on the website's main page. A bright yellow icon with a black bear silhouette and the title "Keep Bears Wild" was placed on the home page of the Town's website to link visitors directly to the Bear Pages.

Newspaper. An article was written for the local paper, the *Black Mountain News*, providing information on coexisting with black bears (Appendix F). As with other strategies, topics included in the article were based on suggestions by Dunn *et al*., (2008), Gore and Knuth (2009), and MacHutchon and Welwood (2002), and attempted to address all three areas of Hungerford and Volk's (1990) model. Additional shorter articles were written to encourage people to visit the Bear Pages website and attend a presentation. The final article written for the newspaper was to let the residents of Black Mountain know that surveys were being mailed (Dillman, Smyth, & Christian, 2009). The article explained the importance of completing the survey and mailing it back in a timely manner.

There were also articles written by a staff writer of the *Black Mountain News* during this time period that addressed the topic of coexisting with bears. The articles were written for a naturalist section of the newspaper and discussed mainly changes in

seasons and birds. It was mentioned in several articles that bears were likely to get into birds feeders and garbage and the writer suggested these items be secured so they were not accessible to bears. These articles were not a part of the educational strategies being tested, but were considered as external factors that could have an effect on behavior change.

Public Service Announcements. The local government television channel BCTV, aired six public service announcements (PSAs) throughout the summer and early fall. The first two PSAs that aired were from the Get Bear Smart Society in Whistler, British Columbia (www.bearsmart.com). The Get Bear Smart Society has many educational materials that are free to anyone interested in educating about coexisting with bears. During the time these two PSAs were being aired, BCTV was producing four locally filmed PSAs highlighting interviews of Black Mountain residents.

Residents were filmed speaking about the difficulties they have had with bears in their neighborhoods, and modeling desired actions to prevent bears from accessing human provided foods. This supported the idea that the issue was a community-wide issue and one that residents could work together to resolve (McKenzie-Mohr & Smith, 1999). One of the North Carolina Wildlife Resources Commission's district biologists was also a part of the videos, speaking about living in bear country and what not to do if bears are seen in a person's yard or neighborhood.

These videos ranged from thirty-one seconds to five and a half minutes long and were aired on the local government channel in Buncombe County, YouTube, BCTV's website, and on the Bear Pages website. It was estimated that the videos played an

average of 165 times per week on BCTV (J. R. Davidson, personal communication, October 8, 2011). "Don't Feed The Bears" was the title of the 31 second PSA and was viewed 111 times from June 27th through November 18th. "Orphaned Cubs," a one minute and 20 second video, was viewed 204 times during the same time frame. The 5 minute and 31 second PSA entitled "Coexisting With Bears" had 278 viewers, and a one minute and 10 second video entitled "Discouraging Bears" was watched 61 times on YouTube. The "Discouraging Bears" video was the only video, of those made by BCTV, not available for viewing on the Bear Pages website. Because videos were accessible through YouTube, the viewers may not all have been Black Mountain residents or visitors.

Sticker. The final educational strategy used was the development of a European-style oval sticker designed to promote the project and direct people to the Town of Black Mountain's website (Appendix G). The words "Keep Bears Wild" were printed in a large font above a silhouette of a bear with the Town's web address underneath. With permission from the Town, the stickers were placed on town vehicles and distributed around town. They were also used as an incentive to complete the survey and were included in the survey packet. As suggested by McKenzie-Mohr and Smith (1999), stickers, like the flyers, could also be placed near the opportunity for the desired behavior, such as on the refrigerator near a kitchen trash can or on an actual trash can, to serve as a prompt to only take trash out the morning of pick-up.

The public service announcements, brochures, website, newspaper articles, and presentations included the topics suggested by Dunn, *et al.* (2008), MacHutchon and

Welwood (2002), and Gore and Knuth (2009) that were discussed previously. The educational strategies hopefully increased the public's knowledge on how to coexist with bears and also helped the public understand the simple steps they can take to prevent bears from accessing human provided foods, developing their internal locus of control. In addition, the PSAs hopefully also increased their environmental sensitivity, as one video made them aware of the concern for the orphaned cubs and other bears that can get into trouble in developed areas. These three factors, content knowledge, internal locus of control, and environmental sensitivity, are the areas Hungerford and Volk (1990) stressed must be developed to elicit a change in behavior.

Methods: Research Design

The following section will describe the research design used to answer the research questions. In addition to discussing the target community, the survey instrument, data collection techniques, and data analysis methodology will be further explained.

Target Community. The Town of Black Mountain is located in Buncombe County, North Carolina and encompasses 6.44 square miles (City-data.com, n.d.). The 2000 North Carolina Census estimated the population for Black Mountain to be 7,511. The population of Black Mountain in 2009 was estimated to be 7,910 (City-data.com; n.d.). In the Town of Black Mountain (according to statistics from the Police Department) there were 33 assistance calls in reference to bears in 2008, 92 calls in 2009 and 49 calls in 2010 as of September 27, 2010 (Town of Black Mountain Board of Aldermen meeting, 2010). Because the Town of Black Mountain has seen an increase in

calls concerning nuisance bears, town officials have decided to pursue opportunities to educate residents and visitors on coexisting with black bears. The town is also considering the purchase of bear proof garbage containers.

Evaluation Methods. A mixed mode survey using the Tailored Design Method was conducted in September to assess the intent to change behavior in residents and visitors (Dillman, Smyth, & Christian, 2009). Survey research was an inexpensive method of collecting information and allowed for a quick turnaround of information (Creswell, 2009). Before surveys were sent to residents, a pilot study was conducted, as suggested by Dillman, Smyth, and Christian (2009), to ensure clear interpretation and content validity of the survey questions. Nine people volunteered to participate in the pilot study, including professors, classmates, and residents of Black Mountain. A survey review committee, consisting of professors, a resident of Black Mountain, and the Public Services Director for Black Mountain, town liaison, examined the initial survey draft and made suggestions before the pilot was distributed. Suggestions included changing the survey format from a letter size sheet of paper to a booklet format, reformatting questions so they were easier to read and offering additional response options for a few of the questions. The committee also approved the final revisions to the survey that were based on comments from the pilot participants.

Survey Instrument. Survey packets, sent a week after the prenotice letter, included a cover letter (Appendix B), the survey (Appendix C), a stamped return envelope, an entry form for a drawing, and a Keep Bears Wild sticker (Appendix G). The drawing was used as an incentive to complete the survey and return it. The sticker

was included as a token for completion of survey to reduce non-response bias and to get a more representative sampling from the community, encouraging those who may not be interested in bears to complete the survey so the survey is not attractive only to those who are interested in bears (Dillman, Smyth, & Christian, 2009, p.240). The contents of the packets were packaged according to the Tailored Design Method (Dillman, Smyth, & Christian, 2009). Each survey and stamped return envelope was coded so they would be anonymous when returned. The Tailored Design Method suggests that a follow-up postcard be mailed within a week after the initial surveys to increase response rate (Dillman, Smyth, & Christian, 2009), but since 48% of the respondents returned completed surveys, and funding was limited, the follow-up postcard was not used.

A mixture of quantitative and qualitative questions was included in the survey, as well as demographic questions that helped separate residents' responses from visitors' responses. Visitors were asked whether they were in Black Mountain during the months the educational strategies were implemented so responses of people who were not in town during the implementation period could be compared to responses of people who were in town during the implementation period.

Questions were geared towards finding out whether residents received any of the education and information on coexisting with bears from the strategies listed above. If so, did the strategies encourage respondents to change their actions to better coexist with bears. The study also asked which strategies, if any, they found most useful in encouraging them to change their current practices. Additionally, respondents were asked if they had ever seen bears on their property, and if so, how many. To provide

information to the town officials on respondents' views concerning bear proof trash cans, respondents were also asked if they were willing to use a bear proof trash can, and if not, they could choose one of four explanations.

Data Collection. Using a list of 4,000 addresses provided by the town from a database of water customers, 350 Black Mountain residents were randomly selected using a random number generator from the website, www.random.org, thus providing a 95% confidence level with a +/- 5% margin of error for this mixed methods study (Dillman, Smyth, & Christian, 2009). Prior to the mailing of the survey packets, to follow the steps of the Tailored Design Method, a prenotice letter was mailed to each address preparing them for the arrival of the survey packet and stressing the importance of completing the survey (Appendix A). The inclusion of a token of appreciation in the survey packet was also mentioned, without going into detail about the type of token to be included (Dillman, Smyth, & Christian, 2009). A prenotice letter has been consistently proven to increase response rates to mail surveys by three to six percentage points (Dillman, Smyth, & Christian, 2009). Similar information was placed in the local newspaper and on the Bear Pages website. The town seal was placed on the letters and envelopes and the Town Hall's address was used to mail the letters. Since not all of the addresses included the names of the occupants, which prevented personalization of each letter, the town seal was used as a "community-relevant graphic" to personalize the letter as suggested by Dillman, Smyth, and Christian (2009, p.237). The title of the survey was "2011 Bear Awareness Community Survey" to continue to personalize the survey to the community of Black Mountain and encourage their support of the project.

Analysis of Data. This mixed methods study contained both qualitative and quantitative survey responses. Each survey was coded prior to mailing so returned surveys would be anonymous. Qualitative and quantitative codes from each respondent were entered into a Microsoft Excel spreadsheet, which was used to generate the descriptive statistics. Number codes were assigned to each response code to allow for ease of tabulating frequencies.

Qualitative responses were coded by the researcher as she read through each response and recorded emerging key phrases or ideas. Those phrases were then given a number code. The first reading of the responses developed the initial codes. A second reading of the qualitative responses looked for phrases or key words similar enough to be combined into one code. The second reading by the researcher also checked to see that responses were coded exactly as they were written; trying to eliminate shifts in the code meanings. Two intercoders were used to check 10% of the qualitative responses for what Creswell (2009) calls intercoder agreement, to increase the reliability of the research findings. The intercoders were retired national park rangers, who although had knowledge of and experience with the topic, were not involved in this research project in any other way. Intercoders checked codes developed by the researcher to classify open-ended responses to survey questions. After comparison and discussion of codes intercoder reliability score was 96.5%.

Quantitative choices to survey questions were given a number related to the order in which they were listed within each question. For example, respondents selected from a list of choices an age range that correlated to their age: 18-25, 26-35, 36-45, 46-55, and

56+. "18-25" was coded as a "1," "26-35" was coded as a "2," and so on. Numerical codes allowed for easy analysis of both quantitative and qualitative data in Microsoft Excel, including the generation of frequency tables and graphs.

Ethical Considerations. It is important to note that although using the town seal was beneficial in personalizing the survey packets potentially increasing response rates, there was also concern that residents might be apprehensive that the town would have access to the surveys and felt pressure to respond in a certain way for fear the town might match their responses with their addresses. There was no intention to mislead anyone about the purpose of the survey, though, and it was stated that their responses would remain anonymous.

CHAPTER 4.

RESULTS

Demographics

A self-selected sample of 157 surveys was returned out of the 350 Black Mountain addresses that were randomly selected, for a 48% response rate. Twenty-three were returned undeliverable. Of the 135 respondents who chose to answer this question, 53% (*n* = 71) were female, and 47% were male (*n* = 64) (Table 2).

Fourteen percent (*n* = 22) chose not to respond (Table 2). Fifty-nine percent (*n* = 91) of respondents were 56 years old or older, 19% (*n* = 30) were between the ages of 46 and 55, 8% (*n* =13) were between 36 and 45 years old, 10% (*n* = 15) were 26-35 years old, and 4% (*n* = 6) were between 18 and 25 years old. Two respondents did not select an age range on their survey.

Full-time residents made up 95% (*n* = 149) of respondents. The other 5% (*n* = 8) were part-time residents. Two of the part-time resident respondents stay in Black Mountain for 2 months each year, 3 stay for 3 months, 2 stay for 5 months and 1 part-time resident stays for 6 months in Black Mountain (Table 2).

Table 2.

Demographics of Survey Respondents

Gender	**Number of Respondents**	**Resident Status**	**Number of Respondents**
Male	64	Full-time	149
Female	71	Part-time	8
Age	**Number of Respondents**	**Number of Part-time Residents**	**Length of Stay**
18-25 years old	6	2	2 months
26-35 years old	15	3	3 months
36-45 years old	13	2	5 months
46-55 years old	30	1	6 months
56 + years old	91		

Note. n = 135

Are Bears a Problem in Black Mountain?

When asked to respond to the statement "Bears are a problem in Black Mountain," respondents could "strongly agree," "somewhat agree," "somewhat disagree," or "strongly disagree." There were seven non-respondents. Fifty-four percent of the 150 respondents who answered this question, either strongly (18%, *n* = 27) or somewhat agreed (36%, *n* = 54). Forty-six percent of respondents somewhat (27%, *n* = 40) or strongly disagreed (19%, *n* = 29).

Table 3.

Responses to the Statement: Bears are a Problem in Black Mountain

Response	**Number of Respondents**
Strongly Agree	27
Somewhat Agree	54
Somewhat Disagree	40
Strongly Disagree	29

Note. n = 150

Bear Sightings

Respondents were asked if they had ever seen a bear on their property and if so, how many times (Figure 1). One respondent did not answer this question. Of the remaining 156 respondents, nineteen percent (*n* = 30) said they had never seen a bear on their property. The remaining 81% (*n* = 126) were then asked to quantify how many times they had seen a bear on their property in a year. "Less than one time per year" was chosen by 17% (*n* = 21) of respondents. The majority of respondents, 53% (*n* = 66), said they have seen a bear on their property 1-5 times per year. Fifteen percent (*n* = 19) chose "6-10 times per year," 2% (*n* = 3) chose "11-15 times per year," and 7% (*n* = 9) chose "16+ times per year." The remaining 4% (*n* = 5) selected "other." Of the five responses, two consisted of "every day," one respondent said they saw bears "once a week," one said "every week," and one respondent said "every night, spring and fall."

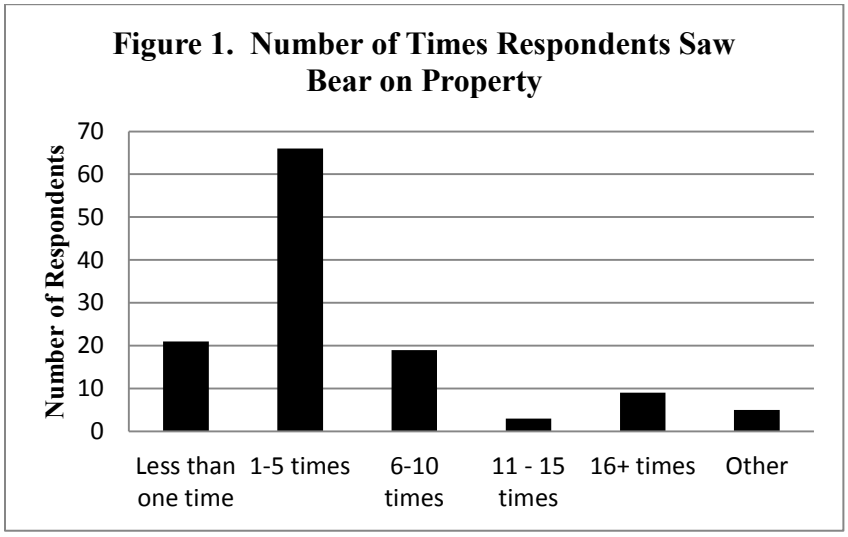

Figure 1. The number of times respondents saw a bear on their property. n = 156

Bear Attractants

Respondents were given a list of possible bear attractants and were asked to select which they thought would attract bears. This question is intended to assess whether respondents increased their knowledge, which is one factor in Hungerford and Volk's (1990) model. They could choose one or more items from the following list: wood piles, shiny objects, chicken coops, garbage, hummingbird feeders, pet food, bird seed feeders, barbeques, loud noises, brightly colored tents, compost piles, and the option to write in a response. Of the 155 respondents, the most notable responses were: 92% (*n* = 143) chose garbage as an attractant, 82% (*n* = 127) of respondents chose bird feeders to be an attractant, and 73% (*n* = 113) chose pet food as an attractant (Figure 2). Other responses included: 45% (*n* = 70) chose hummingbird feeders, 38% (*n* = 59) chose compost as an attractant for bears, 37% (*n* = 57) chose barbeque grills, and 30% (*n* = 47) chose chicken

coops. Of those who selected "other," (n = 34) some of the items respondents thought were also bear attractants included beehives, fruit trees and bushes, fish ponds, and people intentionally feeding bears.

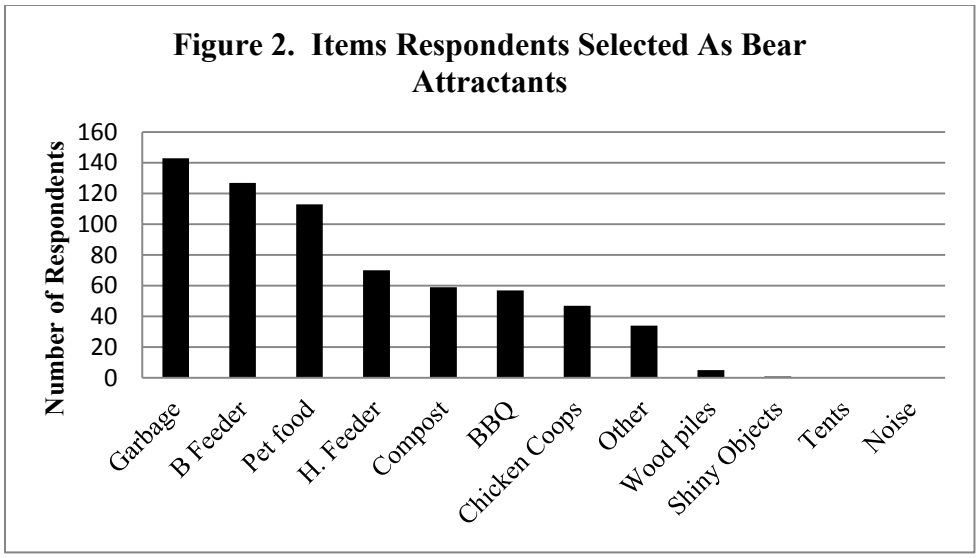

Figure 2. Respondents selected from the above list of items, those they felt would attract a bear.
n = 155

Effective Deterrents

Respondents were asked to choose from a list of eight methods that might be effective in keeping bears out of an area (Figure 3). They could make more than one selection. This question was intended to evaluate respondents' locus of control. Two respondents did not answer this question. Of the 155 responses, "no access to food" and "bear proof trash cans" were both selected by 81% of respondents (n = 125). The next most selected option was "neighborhood effort," chosen by 43% of respondents (n = 67). Thirty-two percent (n = 49) thought relocation was one of the best ways to keep bears out

of an area and 16% (*n* = 24) of respondents felt that noise would deter bears. "Decrease the bear population" and "assistance from wildlife officers/law enforcement" were each chosen by 12% of respondents (*n* = 19, *n* = 18). Six percent (*n* = 9) thought an electric fence would be an effective deterrent.

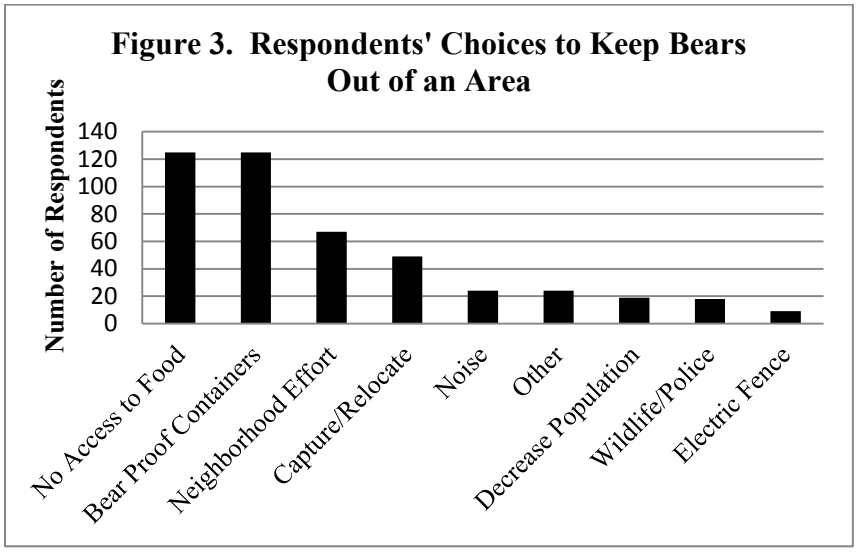

Figure 3. Respondents selected which actions they felt would keep bears out of an area. n = 155

Educational Strategies

Since the main focus of this research was to determine if residents were exposed to the educational strategies, and if so, which were the best educational methods, multiple survey questions focused on the educational strategies implemented throughout the spring and summer. Participants were first asked if they saw or heard any of the information on coexisting with bears from the Town of Black Mountain (Figure 4). Fifty-three percent (*n* = 83) of respondents said "Yes," and 47% (*n* = 74) said "No."

A list of strategies was provided so respondents could select the ones they were exposed to (Figure 5). Of the 83 who responded in the affirmative, the newspaper received the highest number of responses with 70% (*n* = 58) of the respondents selecting that method. Thirty-one percent (*n* = 26) saw information on television and 27% (*n* = 22) said they saw one of the shorter PSAs. The 5-minute PSA, "Coexisting With Black Bears" was selected from the list by 24% (*n* = 20) of respondents and 23% of respondents (*n* = 19) saw the brochures. Twenty-two percent (*n* = 18) found information on the Town's website, and 8% (*n* = 7) heard about coexisting with black bears through personal contact. Only one person surveyed attended one of the presentations held at the Black Mountain library.

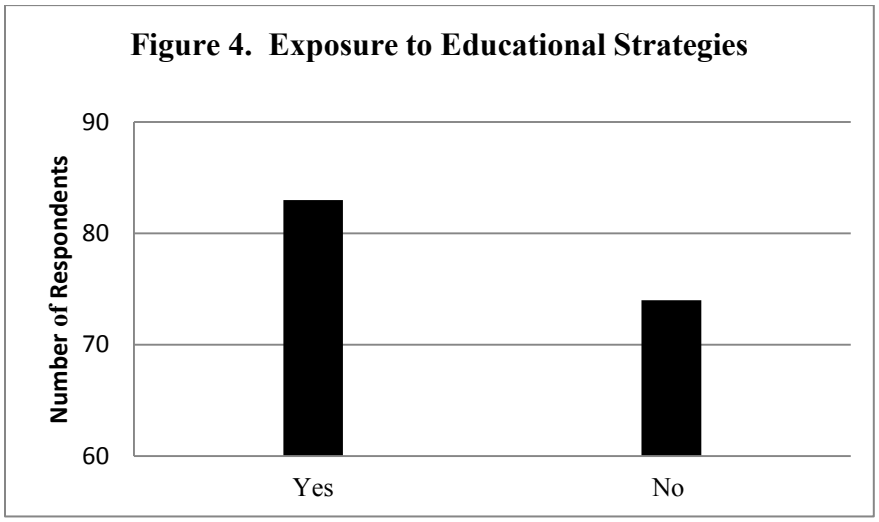

Figure 4. The number of respondents who did and did not see the educational strategies. n = 157

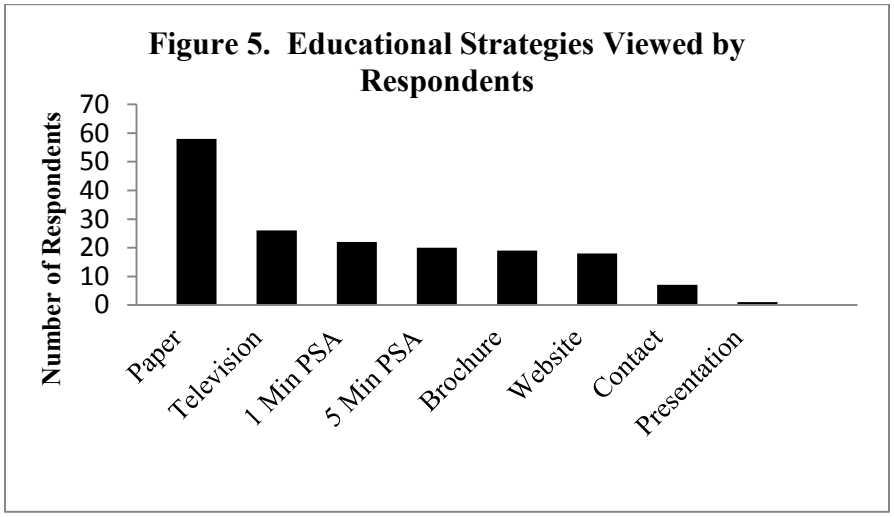

Figure 5. The educational strategies viewed by respondents.
n = 83

Effectiveness of Educational Strategies. Of the 83 respondents who said they had viewed educational strategies, 43% (*n* = 36) saw only one of the possible eight strategies. (Figure 7). Six percent (*n* = 5) saw five out of the eight possible choices of strategies. Six percent (*n* = 5) also saw four strategies, 17% (*n* = 14) saw three strategies, and 28% (*n* = 23) saw two strategies.

More than 83 respondents wrote in responses to the question: "Which type(s) of information did you think was most effective and why?" In order to guarantee that respondents had seen a strategy they were writing about in their response to this question, responses were checked against the strategies they selected as having viewed on the previous question. Of the 58 respondents who saw the newspaper, 41% (*n* = 24) said it was most effective (Table 4). Of the 18 respondents who saw the website, 28% (*n* = 5) said it was most effective. Twenty-one percent (*n* = 4) of the 19 respondents who saw the

brochures thought it was most effective. Thirty-five percent (n = 9) of the 26 respondents who selected "television" from the list, thought it was most effective. Of the 26 respondents who saw the videos, ten of whom did not see both videos, 31% (n = 8) said videos were most effective. Respondents' open-ended answers often listed more than one strategy as most effective.

Responses were also compared from the 47 respondents who said they saw more than one strategy. Answers were checked against their selection of educational strategies they viewed to make sure respondents were writing about a strategy they had actually seen (Table 5). Of the 34 respondents who saw more than one strategy, including the newspaper, 29% (n = 10) chose the newspaper as one of the most effective strategies. A female who was in the "56+" age group said the newspaper was most effective because she "gets it every week and reads it." Of the 15 respondents who saw more than one strategy, including the website, 27% (n = 4) said the website was one of the most effective strategies. A gentleman in the 26-35 year old age category said the website was most effective because "it was easy to navigate the website. Also most people now have access to the internet so much more information is available at your fingertips!" Of the 23 respondents who saw more than one strategy, including the television, 30% (n = 7) chose the television as one of the most effective strategies. A male in the 56+ age category said television was most effective because "more people watch TV." Of the 15 respondents who saw more than one strategy, including the brochure, 27% (n = 4) said brochures were most effective. A male in the 56+ category said brochures "in downtown Black Mountain were noticed and viewed by residents and visitors who may have had

past experience with bears." Of the 24 respondents who were exposed to more than one strategy, including the videos, 38% (*n* = 9) chose the videos as one of the most effective strategies. A female between the ages of 26-35 said videos were most effective because it was "effective to hear first-hand accounts; also to see an official point and say 'this is a bear feeder'." And finally, one person who attended a presentation and saw other educational strategies said the presentation was most effective because it was "a good talk, good slides, and answered my questions I posed."

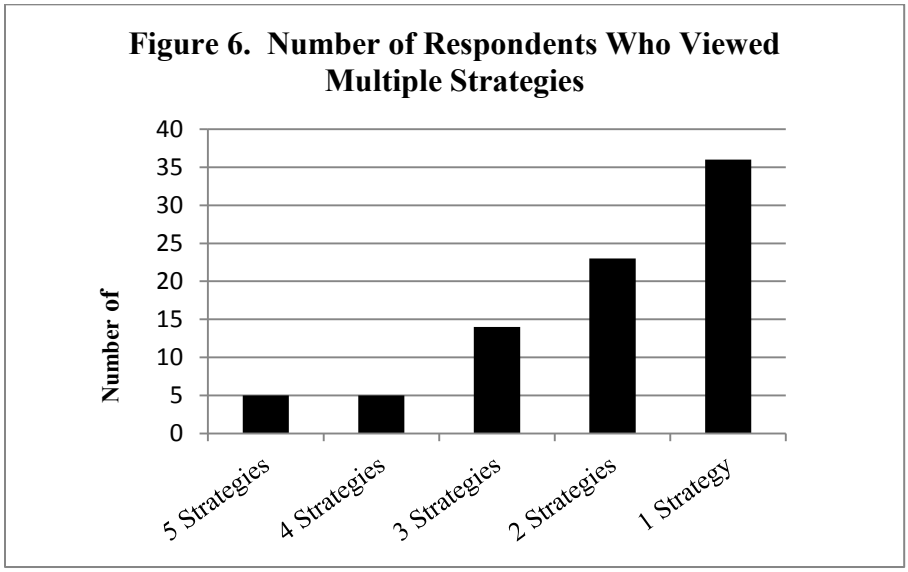

Figure 6. The number of respondents who viewed one or more strategies.
n = 83

Table 4.

Number of Respondents Who Viewed Each Educational Strategy and Selected That Strategy as Most Effective

Strategy	Number of Respondents	Respondents Who Selected As Most Effective	Percentage
Newspaper	58	24	41%
Website	18	5	28%
Brochure	19	4	21%
Television	26	9	35%
Presentation	1	1	100%
Videos	26	8	31%

Note. n = 83

Table 5.

Number of Respondents Who Viewed More Than One Educational Strategy, Including the One They Selected as Most Effective

Strategy	Number of Respondents Who Viewed More Than One Strategy	Respondents Who Selected As Most Effective	Percentage
Newspaper	34	10	29%
Website	15	4	27%
Brochure	15	4	27%
Television	23	7	30%
Presentation	1	1	100%
Videos	24	9	38%

Note. n = 47

Public Service Announcements. At the time the surveys were approved and printed, Black Mountain residents and visitors could view the public service announcements on

television through a local cable channel, or through the Town's website, and learned of these PSAs through the newspaper and presentations. Respondents had the option to either select "television," "Town of Black Mountain website," or "did not view the videos" (Table 6). Twenty-four percent (*n* = 38) were non-respondents. Of the 119 who responded to this question, 70% (*n* = 83) said they did not view the videos. Twelve percent (*n* = 14) of respondents who answered this question saw the PSAs on the television and 18% (*n* = 22) viewed the PSAs on the internet.

Table 6.

Number of Respondents Who Viewed the PSAs on Either the Television or Website

Viewing of PSA	**Number of Respondents**	**Percentage**
Television	14	12%
Website	22	18%

Note. n = 119

Effectiveness of PSAs. When asked which video was most effective, 87 respondents answered this question, and 60% (*n* = 52) did not view the video (Figure 8). Seventy respondents did not answer this question. Of those who did respond, "Coexisting with Black Bears," the five minute video, was ranked the highest, with 30% (*n* = 26) of respondents selecting that PSA. Fifteen percent (*n* = 13) of respondents chose "Don't Feed Bears," the 30-second PSA, and 7% (*n* = 6) chose "Orphaned Cubs," which was approximately a minute long, as the most effective PSA. There were six videos total,

two of which were borrowed from the Get Bear Smart Society while the local PSAs were being produced. Only three of the PSAs could be viewed on the Bear Pages website, so the fourth video was not included in the survey.

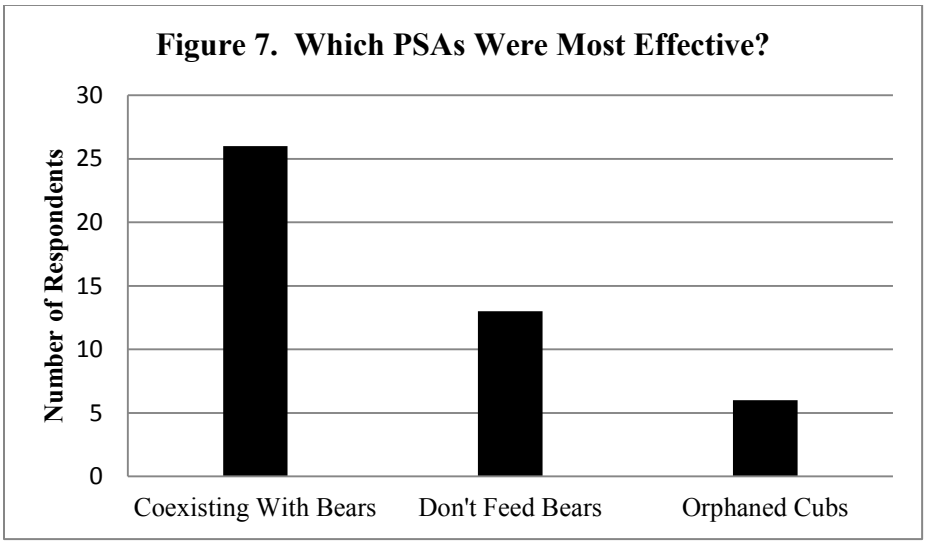

Figure 7. Respondents' choices for which PSAs were most effective. n = 87

Intent to Change Behavior. As a means to address the effectiveness of the educational strategies on residents' intentions to change their behavior, respondents were asked if the information they received about coexisting with bears changed their mind about black bears in their community and were given space to write in their response. Ninety people chose not to respond. Of the 67 who responded, 70% (*n* = 47) said "No," often with little or no explanation (Figure 9). Twenty-five percent (*n* = 17) said the information confirmed what they already knew. Some of these responses were clarifying their "No" response, such as a female in the 56+ age category who said "not really, I've lived here 34 years, so I already had it figured out – but this is a fabulous idea for

'newcomers'." And 9% (*n* = 6) simply said "Yes" with no further explanation. Six percent (*n* = 4) made a comment about their concern for safety around bears and 3% (*n* = 2) specifically wrote that the strategies increased their awareness of how to coexist with bears. A female in the 56+ age category said she "didn't realize bird feeders were attractive to bears," and a male in the 56+ age category said he realized "not to leave food or garbage out."

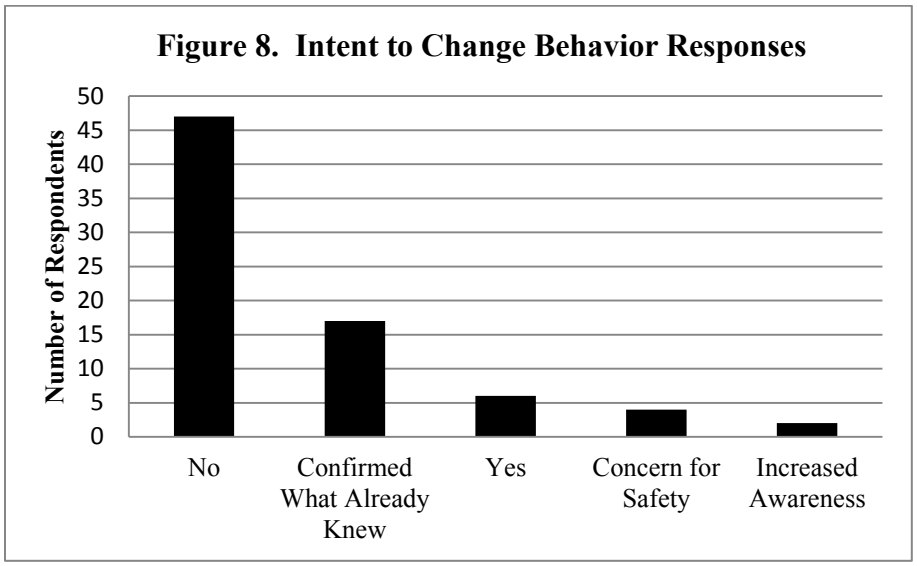

Figure 8. Respondents' comments when asked "Did the information you received change your mind about black bears in your community? If so, how?"
n = 67

Bear Proof Trash Containers. The final question on the survey asked respondents if they would be willing to use a bear proof container to store their garbage, and 71% (*n* = 108) confirmed that they would be willing, while 29% (*n* = 45) said they would not be willing to use a bear proof trash container (Figure 10). There were four

non-respondents. This question was intended to address respondents' locus of control. Did respondents feel it was within their control to use a bear proof trash can to keep garbage inaccessible to bears?

Respondents were then given the option to select explanations for why they might have selected "No." Of the 45 respondents who said they were not willing to use a bear proof trash can, the most common response selected was that bear proof trash cans were "too expensive," chosen by 42% (n = 19) of respondents (Figure 11). Twenty-nine percent (n = 13) said they would not use a bear proof trash can because bears did not come in their yard. Nine percent (n = 4) of respondents said they did not know how to obtain a bear proof trash can, and 4% (n = 2) said it was too much trouble. Thirty respondents wrote in answers, even though a space was not provided. One male in the 56+ age category said "I already keep all garbage inside until the morning of pick-up." A female between the ages of 26-35 said she would be willing to use a bear proof trash container "only if the town provided." One gentleman in the 56+ age category did not select "Yes" or "No," but said "I didn't know there was one available. Cost would be a consideration. A neighbor 'bear proofed' his…they ripped it up. How well do they work for GDS?"

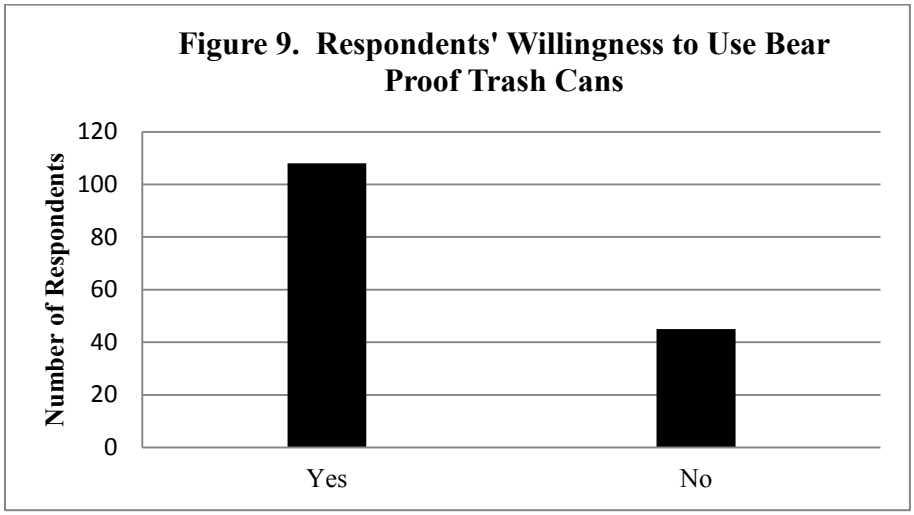

Figure 9. Respondents' willingness to use bear proof trash containers.
n = 153

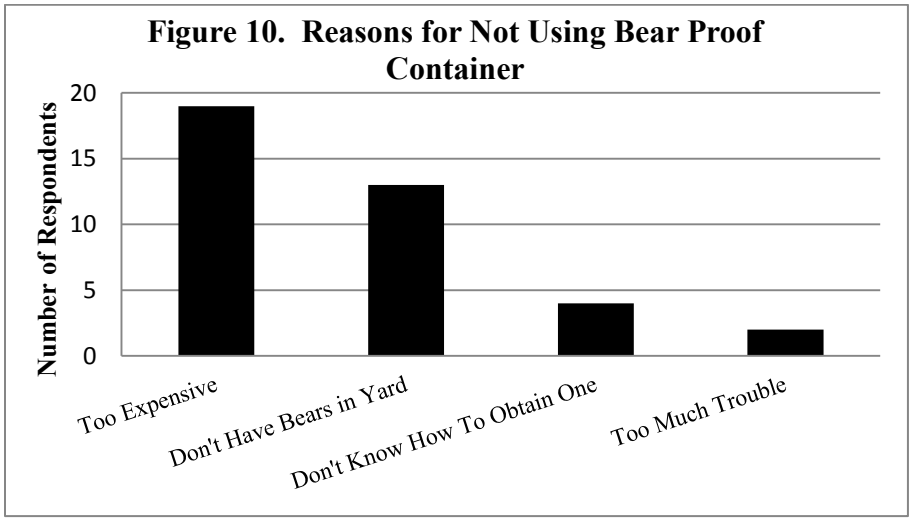

Figure 10. Respondents' selections for why they would not use bear proof trash containers.
n = 45

Fifty-three percent of respondents were exposed to the educational strategies, and 41% said the newspaper was most effective, which received the highest response for most

effective strategy. Television was the next most selected strategy, with 31% of respondents choosing that strategy. Seventy percent of respondents who chose to complete the qualitative question in reference to intent to change behavior, stated that the strategies did not change their mind about black bears in Black Mountain. However, two respondents clearly stated what information they learned: I "didn't realize bird feeders were attractive to bears," and "not to leave food or garbage out." Seventy-one percent of respondents said they were willing to use bear proof trash containers. Of those who said they were not willing to use a bear proof trash container, the most common response, at 42%, was that they were too expensive.

CHAPTER 5.

DISCUSSION AND RECOMMENDATIONS

The purpose of this project was to determine if selected educational strategies (Table 1) were effective in increasing people's intentions to change their behavior to reduce bears' accessibility to anthropogenic foods, and, if so, were some strategies more effective than others. Hungerford and Volk's (1990) behavior change theory that increasing knowledge, environmental sensitivity and locus of control will lead to behavior change, and community-based social marketing strategies (McKenzie-Mohr & Smith, 1999) were used to support choices made concerning types and content of educational strategies and implementation of those strategies for this project. Additionally, recommendations were used from researchers on the content the educational strategies provided the public (Dunn *et al*., 2008; Gore & Knuth, 2009; MacHutchon & Welwood, 2002).

Considering that of the 7,000 residents in Black Mountain only 350 were chosen to participate in the study, and of those only 48% returned completed surveys, results of the study cannot be assumed to represent the opinions of all residents in Black Mountain. However, in the short amount of time the educational strategies were available before the surveys were distributed, 50% of respondents saw at least one strategy.

Similar to Dunn *et al*.'s (2008) study in New Mexico, a majority of respondents of this study (81%) knew that keeping food away from bears could be a successful deterrent, and that garbage was a bear attractant (92%). Unlike Dunn *et al*.'s (2008) study, though, a majority of respondents of the Black Mountain survey (82%), knew bird feeders were a

bear attractant. Less than half of each sample group in Dunn *et al*.'s (2008) study selected bird feeders as an attractant. The New Mexico study implemented educational strategies and assessed whether strategies increased residents' or campers' knowledge on coexisting with bears. The Black Mountain study attempted to take that a step further and look for survey responses that indicated an increase in a person's intent to change their behavior related to coexisting with bears.

It is difficult to assess behavior change, especially when the researcher does not document the actual behavior. The purpose of this project was to determine if selected educational strategies (Table 1) were effective in increasing people's intentions to change their behavior to reduce bears' accessibility to anthropogenic foods, and, if so, were some strategies more effective than others. This study was successful in developing and piloting strategies, but the results are inconclusive as to whether the educational strategies actually affected intent to change behavior in the residents of Black Mountain as it relates to coexisting with bears. Only a few of respondents' written comments suggested their intention to change their behavior, such as a female in the 56+ age category saying she "didn't realize bird feeders were attractive to bears," and a male in the 56+ age category saying he realized "not to leave food or garbage out." Most of the other written responses were not clear enough statements to make assumptions about their intention to change their behavior. It must also be considered that these responses cannot be explicitly tied to the educational strategies used in this study. The respondents may have learned about taking those actions from other sources.

In fact, those who responded to this survey appeared to already be environmentally sensitive on some level about bears, which also may have accounted for their decision to complete the survey. That these respondents were environmentally sensitive may also have accounted for the 70% of respondents who said the educational strategies did not change their mind about bears in Black Mountain; they were already aware of the issue concerning bears in Black Mountain. Comments such as "we have an obligation to honor the bear population," "Bears belong in our mountains. We must protect our bears," and "we should take care of them" suggested that these respondents were environmentally sensitive. It cannot be concluded that the educational strategies affected their environmental sensitivity. Ultimately, though, how respondents became environmentally sensitive is not of concern. For the purpose of increasing respondents' intent to change their behavior, it is only important that they have some level of environmental sensitivity, in addition to an increase in knowledge and an increase in their locus of control.

Based on respondents' written comments about the educational strategies used in this study, it appears the suggestions from McKenzie-Mohr and Smith (1999) were helpful in designing the types of educational strategies and how they were implemented in Black Mountain. However, due to the short-term nature of this study, definitive conclusions about the effective use of community-based social marketing strategies cannot be made. Continued implementation of this approach on a long-term basis and reassessment in a few years could produce more conclusive results.

Even so, the data would suggest to the town that the *Black Mountain News,* the local newspaper, should be used on a regular basis to disseminate information on coexisting with black bears because a large percentage of respondents, 77%, said they regularly read the newspaper. It is an avenue that is readily accessible to a large percentage of residents and visitors. Because there are brochures and stickers still available for distribution, the town should continue to share these with residents and visitors. The Bear Pages website can remain active and the PSAs can continue to be available for viewing. Very little effort would be required to continue these efforts. Because only one respondent attended a presentation, no conclusions can be made about the effectiveness of those presentations. Presentations are more time consuming, and someone would have to take responsibility for giving those presentations, but if possible, the town should try to continue them, as well.

Town of Black Mountain officials, in their search for strategies to assist residents in coexisting with bears, have also considered the use of bear proof trash cans. Many respondents said the trash cans were too expensive to use. Possibly, respondents did not feel the amount for rental or purchase was too expensive, but that it was a fee they should not be asked to pay. Bear proof trash containers can be rented for only $5.50 a month and purchased for $80 (J. Harris, personal communication, November 9, 2011). Thirty respondents chose to write in a response underneath the survey question regarding the use of bear proof trash containers, even though a space was not provided. Those respondents felt it was important to voice their opinion. Ten of those respondents made a reference to cost, either just that it was a concern or that the town should cover the cost of using the

bear proof trash cans. Further clarification of these responses, possibly through interviews or focus groups, would shed light on whether the selections made by respondents were their actual opinions about using bear proof trash containers to help town officials decide what role bear proof trash cans will have in managing bear-human conflict in Black Mountain.

Limitations

Response bias was a concern in this study. It is possible that, even though the response rate was 48% and the Tailored Design Method was used to decrease response bias, residents chose to complete the survey because they already had an interest in bears or coexisting with bears (Dillman, Smyth, & Christian, 2009). Black Mountain has a large bear population living on protected lands surrounding the town and many of those bears have been making their way into town and in sight of residents and visitors. In order to maintain the anonymity offered to participants in the survey pre-letter, the researcher did not follow up with non-respondents.

It is also possible that respondents did not answer survey questions honestly because of concern that their responses were not anonymous and town officials could identify respondents' selections. As discussed earlier, the town emblem was included on all survey materials, which might give the impression that town officials would view the survey responses. In the prenotice letter, however, it was explained that responses were coded to keep them anonymous. A post office box outside of Black Mountain was also used as the return address for surveys to confirm that town officials were not receiving the completed surveys.

Another limitation to this study was that it was not possible to say the educational strategies were the only cause of behavior change in residents, even if it appeared so from survey responses. There were many external factors not controlled by this study that could also have affected residents' choices to change their actions in regards to coexisting with black bears, including direct encounters with bears or receiving information on coexisting with bears from other sources.

This study was used to pilot educational strategies focused on changing human behavior to reduce opportunities for bears to access anthropogenic foods. The amount of time the strategies were implemented was relatively short and therefore, assumptions cannot be made about the long term effectiveness of these strategies. Follow-up surveys completed next year would help to support conclusions about the effectiveness of the strategies to support behavior change.

Recommendations for Future Research and Suggestions

To further the impacts from this study, strategies used in community-based social marketing could be more extensively implemented in Black Mountain, including forming a community group that would continue to hold presentations throughout the year, disseminate flyers and stickers, and actively encourage neighbors to make sure human provided foods are inaccessible to bears. According to McKenzie-Mohr and Smith (1999), taking action supports behavior change in the individual taking part in the activity, and those viewing the desired behaviors by their peers will likely see the action as a community "norm" and will be encouraged to change their behavior, as well (p. 35).

On a smaller scale, block leaders could be established that would be responsible for supporting neighbors in removing bear attractants (McKenzie-Mohr & Smith, 1999).

Consistent with Dunn *et al*.'s (2008) recommendations, findings from this Black Mountain study also recommend that educational strategies continue to be used long-term and should be reassessed annually or within a few years. A follow up survey next year would be helpful to look for long term changes in residents' actions comparing results to this study. A limitation of this study is the relatively short amount of time all educational strategies were available to the public prior to survey implementation. It is unlikely that a large percentage of residents and visitors in Black Mountain had the opportunity of being exposed to an educational strategy. However, the website, brochures, PSAs, and stickers will remain available to residents and visitors and, with a small amount of effort the print materials can continue to be disseminated.

To truly assess behavior change, the actual behaviors should be documented. A similar method to Homstol's (2010) study on the effects of community based social marketing strategies could be used. Teams would canvas neighborhoods and assess and record the numbers and types of bear attractants. After implementation of educational strategies, such as those used in this study, teams would reassess neighborhoods to see if there are fewer bear attractants present.

The purpose of this project was to determine if selected educational strategies (Table 1) were effective in increasing people's intentions to change their behavior to reduce bears' accessibility to anthropogenic foods, and, if so, were some strategies more effective than others. Although there were various limitations, the results from this study

laid the groundwork for the Town of Black Mountain to begin understanding what strategies might prove effective in dealing with the challenges of coexisting with black bears.

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APPENDIX A

PRE-NOTICE LETTER

Town of Black Mountain 2011 Bear Awareness Community Survey

September 1, 2011

Tanya Poole
Black Mountain Bear Study
Graduate Student/Montreat College
Montreat, NC 28757

Dear Black Mountain Resident,

I am writing to ask for your help with an important study I am conducting with the Town of Black Mountain to help determine the best ways to reduce conflict with black bears. In the next few days you will receive a request to participate in this project by answering questions about information that has been distributed in Black Mountain about living in black bear country. You are one of a select number that have been randomly chosen to participate in this study.

With tremendous support from the Town of Black Mountain, BCTV, Montreat College and many others, I have developed a website, a brochure and flyer, a presentation, and three videos that have been made available to those in the Black Mountain area over the past few months. If you have not had the opportunity to view these materials and have access to the internet, you can visit the Town of Black Mountain's website, www.townofblackmountain.org, and click on the black bear icon on the left-hand side of the page. Here you can view all three videos and the brochure, and can also read additional information about coexisting with black bears.

I would like to do everything I can to make it easy and enjoyable for you to participate in the study. I am writing in advance because many people appreciate knowing ahead of time that they will be asked to fill out a questionnaire. It will provide very useful information to the town. This research can only be successful with the generous help of people like you.

To say thanks, you will receive a small token of appreciation with the questionnaire. I hope you will take 10-15 minutes of your time to fill out the questionnaire. Most of all, I hope you will enjoy the questionnaire and the opportunity to voice your thoughts and opinions about coexisting with black bears in Black Mountain.

Best Wishes,

Tanya Poole
Graduate Student, Montreat College

APPENDIX B

SURVEY COVER LETTER

Town of Black Mountain 2011 Bear Awareness Community Survey

September 9, 2011

Tanya Poole
Graduate Student/Montreat College
Montreat, NC 28757

Dear Black Mountain Resident,

I am a graduate student from Montreat College and I am conducting a survey of the Town of Black Mountain's residents and visitors to help determine the best ways to reduce conflict with black bears and I need your help. You are one of a small number that have been randomly selected to participate in this study.

The questions should only take about 10 minutes to complete. Your responses are voluntary and will be kept confidential. Your identity will not be revealed in any publication or presentation of the results. This research has been approved by the Montreat College Institutional Review Board. If you have any questions about the research study, please contact Tanya Poole at blackmtnbearstudy@gmail.com or Dr. Brad Daniel at bdaniel@montreat.edu. By completing this survey you are giving permission to allow your responses to be used for this project. Your responses are anonymous and will not be connected to your name or contact information. A code has been given to your survey to assure your anonymity.

By taking a few minutes to share your thoughts and opinions, you will be helping me out a great deal, and a small token of appreciation is enclosed as a way of saying thank you. In addition, if you complete the separate sheet of paper included asking for your contact information and return with your survey, your name will be entered in a drawing for a copy of Linda Masterson's book entitled *Living With Bears* or Bill Lea's *Great Smoky Mountains Wildlife Portfolio*.

The enclosed envelope is provided, postage-paid, for you to return your survey and your entry for the drawing. I hope you enjoy completing the questionnaire and look forward to receiving your responses.

Please make sure that an adult (age 18 or over) in your household is the one to complete the enclosed questionnaire.

Many Thanks,

Tanya Poole
Graduate Student, Montreat College

APPENDIX C

SURVEY

Thanks again for completing this survey!

Your answers will greatly help in this research effort.

If you have any additional thoughts about bears in Black Mountain or the survey itself, please share them here.

Black Mountain Bear Study
PO Box 702
Clyde, NC 28721

blackmtnbearstudy@gmail.com

Town of Black Mountain

2011 Bear Awareness Community Survey

Graduate Student Project

Montreat College

1. □**Male** □**Female**

2. Age range
□18-25 □26-35 □36-45 □46-55 □56+

3. Are you a permanent resident or visitor?
□Resident □Part-time Resident (Number of months per year: ____)
□Visitor

4. If you are a resident, how long have you lived in Black Mountain?
□0-5 years □6-10 years □11 years or more

5. If you are a visitor, how long are you staying?
□Less than 7 days □8-14 days □15-30 days □More than a month

6. Were you in Black Mountain during the months of April – July 2011? □Yes □No

7. Do you have children under 18 years old living at home? □Yes □No

8. Do you have pets that stay outside in your yard? □Yes □No

9. To what extend do you agree or disagree with this statement: "Bears are a problem in Black Mountain"?
□Strongly agree □Somewhat disagree
□Somewhat agree □Strongly disagree

10. Have you seen bears on your property? □Yes □No
If yes, on average, how many times have you seen a bear on your property in a year?
□less than 1 time per year □11-15 times per year
□1-5 times per year □16+ times per year
□6-10 times per year □Other: _____

11. If you have seen a bear on your property, where were you (inside or outside) and what did you do?

12. In your opinion, which of the following may attract bears to an area? Mark all that apply.
□Wood piles □Bird seed feeders
□Shiny objects □Barbeques
□Chicken coops □Loud noises
□Garbage □Brightly colored tents
□Hummingbird feeders □Compost piles
□Pet food □Other: _____

13. In your opinion, what is the best way to keep bears out of the area? Mark all that apply.
□Electric fences □No access to food source(s)
□Capture and relocate nuisance bears □Loud noises directed at bears
□Wildlife officers/ law enforcement □Bear-proof garbage cans
□Decrease bear population □Neighborhood efforts
□Other: _____

14. In 2011, did you see or hear any information from the Town of Black Mountain or Buncombe County on coexisting with bears? □Yes □No
If yes, how did you receive the information? Mark all that apply.
□Posters or brochures □Personal contact
□Television □Newspaper
□Town of Black Mountain website □Presentation at the Black Mountain Library
□I saw the 5 minute video entitled "Coexisting with Black Bears"
□I saw one of the one minute or less videos entitled "Orphaned Cubs" or "Don't Feed Bears"

15. If you watched one or more of the videos, where did you view them?
□Television □Town of Black Mountain website □Did not view videos

16. If you watched the videos, which did you think was most effective?
□"Coexisting with Black Bears" – approximately 5 minutes long
□"Orphaned Cubs" – approximately a minute long
□"Don't Feed Bears" – approximately 30 seconds long
□Did not view videos

17. If you answered yes to Question 14, which type(s) of information (flyers, brochures, videos, presentations, website) did you think was most effective and why?

18. Did the information you received change your mind about black bears in your community? If so, how?

19. Would you be willing to use a bear-proof container to store your garbage? □Yes □No
If not, why not?
□It is too expensive □It is too much trouble
□I don't know how to obtain one □I don't have bears in my yard

APPENDIX D

BROCHURE

Western North Carolinians are experiencing more black bear encounters partially due to an increased availability of unnatural food sources such as bird seed, garbage and pet food.

Bears continue to seek food sources that are easily accessible and high in fat or calories.

When people leave garbage, bird seed and dog food outside their homes, they are unintentionally teaching bears that human dwellings are a reliable source for food, which increases the likelihood of a conflict. Bears that are involved in conflict with people can not be relocated.

What to do if you encounter a black bear

- **DO NOT** run.
- **DO NOT**, for any reason, feed a bear.
- **At home, DO** make a lot of noise to let the bear know he is not welcome (providing you are at a safe distance). Bang pots, set off your car alarm, use whistles, or yell in a deep voice.
- **In the woods, DO** make noise, talk loudly, sing or break sticks to alert the bear of your presence. Then back away or make a wide detour around the bear.

www.townofblackmountain.org

Help Keep Bears Wild

Are you inviting bears into your yard?

HelpKeepBearsWild

Bears are tempted by items such as bird seed, garbage and pet food because they provide a lot of fat and calories without a lot of effort. A bear can acquire around 12,000 calories from 7 lbs of bird seed.

For a bear, the temptation is irresistible, and they can become "food conditioned."

It takes a community-wide effort to keep bears wild.

Keep your home free from easily accessible food to help prevent wild bears from becoming food conditioned bears.

To minimize encounters with bears

- Put bird feeders away for at least 2 weeks or until the bear is no longer seen in the area. In areas of regular bear activity, feeding birds should be discontinued completely.
- Only put garbage out the morning of pick-up, or utilize bear-resistant trash containers.
- Store your grill and pet food inside a locked building or garage (please remember not to store your propane tank inside, as it is a fire hazard).

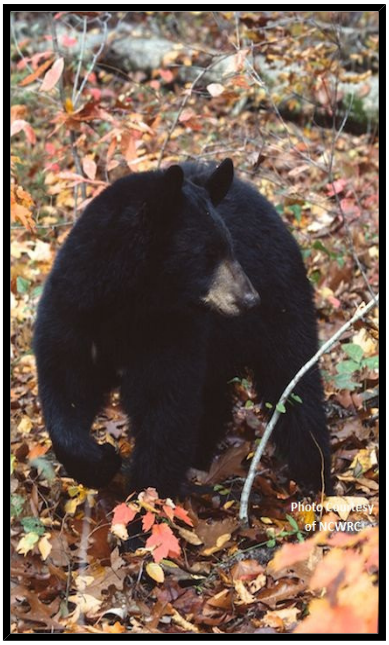
www.townofblackmountain.org

TOWN OF BLACK MOUNTAIN 1893 NORTH CAROLINA

APPENDIX E

WEBSITE

Town *of* Black Mountain



Welcome to the Black Mountain Bear Pages

Take the Survey (coming in August)

[Bear Facts]

[Food Conditioning]

[Preventing Bear Encounters]

[What to do if you encounter a Bear]

Attend an Event!

Help Keep Bears Wild

Presentations will be held at the Black Mountain Public Library located at 105 Dougherty St.

Free. All ages welcome.

April 20th, 6-8pm

May 18th, 6-8pm

June13th, 6-8pm

July 16th, 10am - noon

Other Questions?
Contact Us

Home
Contact Lists
Weather
Calendar
Participate
Employment
About Our Town >
Departments >
Boards & Commissions >
Services >
e.gov >
Emergency Contacts >
Links
Search the Site

Welcome to the Black Mountain Bear Pages

Survey

Over the past several months, the Black Mountain Bear Study has provided information to the Town of Black Mountain's residents and visitors on coexisting with black bears. To help measure the success of this project, many of you have been randomly selected to receive a survey by mail. You will be receiving the survey within the next two weeks. Your feedback is needed and if you receive a survey, we would appreciate it if you could take 10-15 minutes of your time to complete the survey and return it to the Black Mountain Bear Study. A self-addressed stamped envelope and a small token of appreciation will also be included in the survey packet.

The information received from this survey will help the Black Mountain Bear Study determine the best ways to help residents and visitors of Black Mountain coexist with black bears. If you have questions about the Black Mountain Bear Study, you can email blackmtnbears@bellsouth.net.

Town *of* Black Mountain

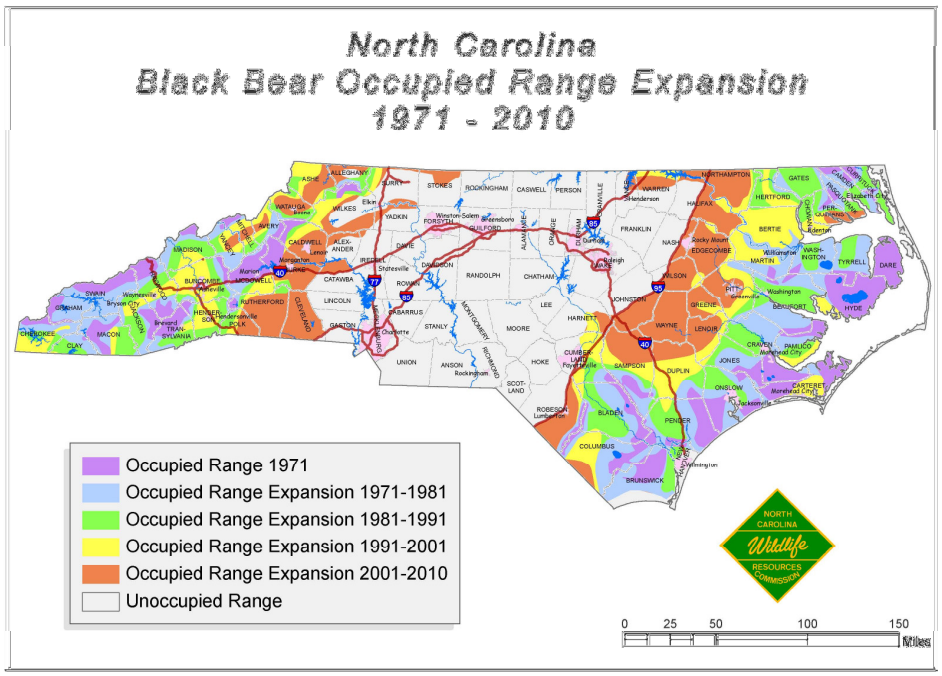
Black Bear Ecology

Black bears are found in the Mountains and Coastal Plain of North Carolina. There are between 4,000 - 6,000 bears in western part of North Carolina, and between 9,000 - 11,000 bears in the eastern part of North Carolina. Bears, on average, are larger at the Coast than the Mountains. The average weight for male black bears in the Mountains is 211 pounds and the average weight for female black bears in the Mountains is 167 pounds. Coastal male and female bears average 333 pounds and 198 pounds, respectively.

Black bears are opportunistic and will it eat a variety of foods such as plants, berries and other fruits, insects, nuts and carrion (dead animals). Their eyesight is fair, but they have a great senses of smell and hearing. They can run up to 35 miles per hour, are great tree climbers and can also swim. Sometimes they will stand up on their hind legs or come closer to get a better look. This is not necessarily a sign of aggression.

If food is not available, bears do not have to eat, urinate or defecate all winter long and can simply sleep through the winter. Some scientists call this winter denning, others call it hibernation. Bears differ from groundhogs, squirrels and other hibernators in that they do not have to wake up to eat and excrete waste. When bears come out in the spring, they are very hungry and most of our bear encounters happen during the spring and summer. Typically, by fall, there is enough natural food available for bears, like nuts and acorns, decreasing their need to roam into towns and neighborhoods in search of food.

85



For more information on black bears, please visit the North Carolina Wildlife Resources Commission

Questions?
Contact Us

Back to Main Page

Town *of* Black Mountain

Preventing Bear Encounters

Tips for making sure you are not providing food for bears:

1. Store bird seed, pet food, grills and garbage in secure buildings or bear-proof trash cans.

2. If bears have been seen in the area, put up bird feeders, including hummingbird feeders. Make sure extra bird seed that has fallen on the ground is also picked up. Store seed and feeders in a secure building or bear-proof trash can. Bird feeders may only need to be put up for two weeks or so, but if bears continue to be seen in the area, bird feeders may need to be put up permanently during the spring and summer. Birds have plenty of food in the spring and summer, so this will not negatively effect them.

3. If you feed pets outside, only put out enough food for your pet to eat within the day. Clean up excess food and store pet food in a secure building or bear-proof container.

4. Make sure grills are clean, including the grease trap.

5. If you are having trouble with bears getting into gardens, compost bins or beehives, consider putting up an electric fence.

What to do if you encounter a bear

If a bear comes into your yard you can teach him that your yard is not a suitable place for him to be. If you are a safe distance from the bear, such as up on a porch or balcony, you can yell, bang pots, honk car horns, whistle or make any other noise that will annoy the bear. You are teaching the bear not to like being

in your yard.

If you encounter a bear while walking in town or on a trail:

1. Do not run or look the bear in the eye.

2. Back away slowly.

3. If necessary, make yourself look bigger (put your hands over your head or raise a backpack over your head) and yell in a deep voice.

4. Do not try to scare a bear off of food, if they are eating.

5. Keep dogs on leash. Do not let them chase a bear.

Questions?
Contact Us

REMINDER: BEARS CANNOT BE RELOCATED. It is expensive, time consuming and risky for wildlife personnel to relocate bears. There are not enough suitable areas uninhabited by people and bears to move the bears to. Bears can also travel long distances and will often return to their original location.

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Town *of* Black Mountain

Food Conditioning

The black bear population in Western North Carolina is growing, which means there are more bears looking for food. When bears discover food that is easy to access and high in fat or calories, they will continue to return to that food source. Many people are unintentionally teaching bears that they can provide them with food, such as garbage, bird seed, and dog food. Bears become conditioned to return to a site that provides a great food source.

Food-conditioned bears are bears that continue to return to locations of human-provided foods even when there are people around or other deterrents that would normally scare a bear away. This can be dangerous for the bear and for the humans.

We will hopefully always have bears living in the woods surrounding Black Mountain, and the woods are where bears belong. It is only when they encounter an easy source of food, such as pet food, bird seed, or garbage that the bears begin to consider our neighborhoods and towns suitable places to return to find more food. Don't feed bears. Help keep bears wild!

Questions?
Contact Us

Back to Main Page

APPENDIX F

NEWSPAPER ARTICLE

Help Keep Bears Wild
May 12, 2011
For *Black Mountain News*

Did you know that the 7 lbs. of bird seed you have under your back deck could provide an easy 12,000 calories for a black bear? That would be like a person eating 28 double cheeseburgers in one sitting. And to black bears, that's just a snack. A black bear needs, on average, about 5,000 calories a day to stay healthy. As black bears come further and further into the Town of Black Mountain looking for food, residents need to be shown the precautionary steps to keep them out. On May 18th, from 6-8 pm, June 13th, from 6-8 pm, and July 16th, from 10 am-noon, informational meetings will be held at the Black Mountain Library presenting ways to keep the black bears out of our back yards and in the wild. These meetings will also give insight to the bear's habits and reasons for coming into town, as well as explaining further steps that Black Mountain will be taking to ensure both the bears' safety and our own.

Black bears are part of our state's history and a beautiful representative of the mountains that surround us. If this problem continues to go unsolved, however, we may stop seeing the bears as such and instead as very large pest that likes to eat our thrown-out leftovers and inadvertently damages our property. So please, come to the Black Mountain Library and help us keep black bears wild!

APPENDIX G

STICKER


Keep Bears Wild
www.townofblackmountain.org
Black Mountain, North Carolina