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ABSTRACT OF DISSERTATION

Hannah B. Harris

The Graduate School
University of Kentucky
2011

THE RETURN OF THE BLACK BEAR TO EASTERN KENTUCKY:
CONFLICT AND TOLERANCE BETWEEN PEOPLE AND WILDLIFE

ABSTRACT OF DISSERTATION

A dissertation submitted in partial fulfillment of the
requirements for the degree of Doctor of Philosophy in the
College of Agriculture
at the University of Kentucky

By
Hannah B. Harris

Lexington, Kentucky

Director: Dr. Michael J. Lacki, Professor of Forestry

Lexington, Kentucky

2011

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ABSTRACT OF DISSERTATION

THE RETURN OF THE BLACK BEAR TO EASTERN KENTUCKY: CONFLICT AND TOLERANCE BETWEEN PEOPLE AND WILDLIFE

The black bear (*Ursus americanus*) has returned to Kentucky and is now part of a reproducing population in the southeastern Cumberland Mountain region. The broad objective of this project was to examine the interactions between people and bears, with the ultimate goal of improving bear management in a way that addresses stakeholder concerns. Using interviews of regional stakeholders, participant observation, and media reports collected between summer 2003 and fall 2006, I investigated how the presence of black bears in Harlan and Letcher counties in Kentucky has had an impact on area residents. I complemented this information with observations of bear behavior and an analysis of bear capture and handling data collected within the study period. Artificial provisioning of bears was widespread and >60% of black bears captured were confirmed to use anthropogenic foods at least some of the time. I found a significant difference ($P < 0.0001$) in the apparent physical condition of confirmed anthropogenic feeding bears and bears whose feeding behavior was unknown, and similar differences in physical condition between bears captured along traplines in Harlan and Letcher counties when compared to bears captured along traplines in Bell County ($P < 0.01$). Mean litter size was 3.25 ± 0.11 (SE), significantly above average for eastern North America ($P < 0.05$) although cub survival remains unknown. All documented mortality of adult bears was human-caused. Anthropogenic food sources may affect bear behavior, survival, reproduction, and physiology, as well as bring bears into close contact with humans. Artificial provisioning is currently an important part of bear-human interaction in eastern Kentucky, both facilitating bear tourism as well as precipitating nuisance problems. Cessation of provisioning could have important consequences for the developing tourism industry in the region and for the bears themselves. Both the Kentucky Department of Fish and Wildlife Resources and many local people have an interest in conserving bears, but problems have arisen due to differing conceptions of appropriate or desirable management. A better understanding of the human dynamics and cooperation taking place in this situation could provide much-needed information both in Kentucky and in other localities where stakeholders are debating how to co-exist with wildlife.

KEYWORDS: Anthropogenic feeding, Black bear, Human dimensions, Nuisance conflict, Wildlife tourism

Hannah Harris

July 15, 2011

THE RETURN OF THE BLACK BEAR TO EASTERN KENTUCKY:
CONFLICT AND TOLERANCE BETWEEN PEOPLE AND WILDLIFE

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DEDICATION

I dedicate this dissertation to Harlan County Extension Agent Jeremy Williams in appreciation of his many contributions to this project. I thank him for sharing his love of wildlife, place, and community; for offering a wealth of information and support; and for making me an honorary cousin.

I will always be grateful for both his help and his friendship.

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Finally, I am forever indebted to all the wonderful people who lent their voices to this dissertation by being willing to share their thoughts, ideas, and experiences with black bears in Kentucky and their lives in the region. I am especially appreciative of the Bear Watchers for their enthusiasm and dedication. I learned so much, not only about people and bears, but also about Appalachia, history, life, and even myself. This project was long and not always easy but I will forever be thankful to the many people involved who made it possible, who made it interesting, and who made it wonderful.

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CHAPTER 1: INTRODUCTION

North American Carnivores

History and current status: an overview

The recent history of large predators in North America is a rather bleak one, with more than half the mammal species once found in the Americas having gone extinct at the end of the Pleistocene, including large carnivores such as the dire wolf (*Canis dirus*) and short-faced bear (*Arctodus pristinus*). The reasons for their extinction are debated (Guilday 1967), but it was almost certainly exacerbated, if not caused, by heavy hunting pressure from humans (Martin 1984; Alroy 2001).

European settlement of North America brought with it intolerance of large carnivores dating back millennia in Europe (Lopez 1978) and further declines in carnivore population numbers. Negative attitudes towards carnivores and belief in man's dominion over the earth and its creatures are pervasive in Euro-American mythology, religion, and legends (Young and Goldman 1946; Casey and Clark 1996). This combination of attitudes and values has contributed to the decline of carnivores in recent centuries (Clark et al. 1996). Seen as competitors and predators, carnivores were eliminated opportunistically at first and later systematically through bounties and eradication programs (Matthiessen 1987; Dunlap 1988).

Today, large carnivores continue to face threats from hunting and poaching (Coblentz 1990), as well as loss of habitat (Diamond 1989), loss of prey (Poole 1994), disease (Cleaveland et al. 2007), and competition with exotic species (Schaller 1972; Kingdon 1997). Their decline represents not only the loss to humans of charismatic species, icons, and symbols (Kellert et al. 1996; Tremblay 2002; Knight 2003), but may also be part of a widespread ecosystem destabilization, in as much as carnivores can be drivers of environmental and evolutionary processes, regulating the numbers of their prey and both directly and indirectly affecting the structure of their ecosystem (Berger et al. 2001; Terborgh et al. 2002).

Of nine extant large carnivore species in North America, eight persist only in greatly reduced portions of their prehistoric range (Laliberte and Ripple 2004). The grey

wolf (*Canis lupus*) and grizzly bear (*Ursus arctos*) are still found in much of Canada and are recolonizing in some previously depopulated areas, but their ranges are limited and fragmented, and the grizzly bear exists only in low numbers in the lower 48 states (Laliberte and Ripple 2004; Mattson et al. 1996). In 1970, the United States Fish and Wildlife Service officially declared the red wolf (*Canis rufus*) extinct in the wild. Although a small number of red wolves have since been released as part of a restoration program, conservation efforts are threatened by genetic introgression from coyotes (*Canis latrans*). The wolverine (*Gulo gulo*) and lynx (*Lynx canadensis*) are both rare and are found mainly in remaining expanses of remote wilderness (Fortin et al. 2002 and Ray et al. 2003 respectively). The polar bear (*Ursus maritimus*) persists in the far north but its numbers are small, and it is highly vulnerable to reduction of sea ice. Warming temperatures due to climate change may cause its extinction during this century (Derocher et al. 2004; Monnett and Gleason 2006). The cougar (*Puma concolor*) has a greatly contracted range as well (Beier 1996), although it appears to be successfully recolonizing some areas from which it was previously extirpated (Van Dyke et al. 1986). However, its chances of success may be limited if high-profile attacks on humans capture national attention and create intolerance towards restored populations (Riley 1998).

The black bear (*Ursus americanus*) has suffered a 41% loss of its historical range in North America since human settlement (Laliberte and Ripple 2004) and as much as a 90% loss of habitat in the United States (McLean and Pelton 1994), including the southeast (Maehr and Brady 1984). Bears have been extirpated due to heavy hunting pressure, poisoning, development, and fragmentation (Servheen 1990; Hellgren and Maehr 1992) but, unlike most of North America's large carnivores, the black bear appears to be thriving in large portions of its existing range (Servheen 1990; Servheen et al. 1999; Hristienko and McDonald 2007). In some areas, wildlife managers feel that bear populations are sufficient for sustainable sport harvest (Garshelis and Hristienko 2006), though elsewhere, small populations face extinction because of habitat loss, poaching, and highway collisions (Maehr et al. 2001b).

Of all the large North American carnivores, only the coyote has enjoyed a range expansion rather than contraction over the last two centuries (Laliberte and Ripple 2004). With the extirpation of the grey and red wolves in many regions, the coyote has spread

east, south, and north across the continent (Gier 1975; Bekoff 1977; Crete and Lemieux 1996) and now lives throughout the United States. The coyote's ability to exist in close proximity to people and its high reproductive rate are both factors in its recent success (Parker 1995).

Human development and habitat use

As human development encroaches into what was previously wilderness, people and wildlife must be able to coexist for the latter to persist in those regions. If the current development trends continue, species that cannot live alongside humans will find their available habitat increasingly constricted. Animals that require vast stretches of uninterrupted wilderness or are highly susceptible to human disturbance will inevitably become threatened and imperiled (Purvis et al. 2000). Large carnivores face an especially challenging situation not only because they require larger areas of land to survive than herbivores of similar size, but also because humans may be far less tolerant of their presence (Kellert 1985). While compelling and charismatic, they also represent a threat (both real and perceived) to human life, property, and lifestyle (Kellert et al. 1996).

In 2002, 61.8% of 766.4 million hectares of land in the lower 48 states was in some kind of agricultural development (including 54 million hectares termed "forest land" but which was used for grazing), 27.6% was forested, and 3.1% was designated urban (Lubowski et al. 2002). The remainder constituted transportation, rural residential, defense and other usages. However, of the land still considered as forested, very little was "undisturbed" (Delcourt 2002). Where forested areas are heavily logged, located within urban areas, or otherwise under development, their value to forest obligate species may be reduced (Harris and Pimm 2004).

There is more remote forested land available to North American carnivores in Canada than in the United States, where much of potentially suitable habitat is in relatively close proximity to human development (Sutton et al. 1997; Sanderson et al. 2002). In the United States, species that are tolerant of human proximity or able to take advantage of human infrastructure have a distinct ecological advantage over those without these qualities. Human development brings with it abundant artificial food sources (Wigglesworth 2000), and species able to exploit these food resources gain

access to high-calorie nourishment with low energy expenditure (Adams 1994), allowing many carnivores, especially smaller generalists, to benefit from urbanization and expansion (Randa and Yunger 2006). Animals such as the raccoon (*Procyon lotor*), red fox (*Vulpes vulpes*), and coyote have increased in developed areas (Bounds and Shaw 1994), where the removal of human-intolerant competitors and predators contributes to the survival and success of these meso-carnivores (Nowak 1978).

Conservation challenges

The order Carnivora is exceedingly diverse in taxonomy and natural history, and not all members are rare or imperiled. However, certain characteristics common to many species, especially the larger carnivores, exacerbate challenges for those that are currently under pressure. Species with a low reproductive rate, small litter size, high age of first reproduction, a great deal of parental investment, and high infant mortality are especially vulnerable. Species with these traits therefore often have very low resilience to adult mortality. Sensitivity to fluctuations in prey availability, and high prey specificity may also threaten populations (O'Donoghue et al. 1998; Esch et al. 2005). These characteristics all raise a species' threat of extinction (Purvis et al. 2000). Conversely, carnivores that are highly adaptable, have a diverse food base, reproduce at a young age, reproduce often and prolifically, and can sustain moderate to heavy adult mortality should, theoretically, fare better (Purvis et al. 2000), although they may still be vulnerable to high rates of human-caused mortality (Mattson and Merrill 2002) or habitat loss (Woodroffe and Ginsberg 1998).

The black bear occupies a position somewhere between these extremes. As a generalist that is tolerant of human intrusion and well-adapted to take advantage of anthropogenic food sources (defined as those derived from human activities, e.g., garbage), the black bear is better able to coexist with people than most other bear species or large carnivores (Cowan 1972). Further, the black bear is generally passive with a docile temperament which leads to fewer direct conflicts with people (Herrero 2002). Consequently, there is greater acceptance of its presence than of other North American bears (Kellert 1994). However, like all bear species, the black bear has large habitat

requirements (Smith and Pelton 1990) and populations may not be able to sustain heavy adult mortality (Cowan 1972; Miller 1990; Freedman et al. 2003).

The black bear has an exceptionally low reproductive rate; among North American mammals it surpasses only the musk ox (*Ovibos moschatus*) (Jonkel and Cowan 1971). Sows do not usually give birth for the first time until they are four to five years of age and they produce between one and five cubs (typically two to three in each litter) (Powell et al. 1997). Mortality from cannibalism and starvation is often high (Bunnell and Tait 1985), especially in larger litters, so that many cubs do not survive to reproductive age themselves (LeCount 1987). Cubs usually remain with their mother until the summer of their second year when they are around 18 months of age (Jonkel and Cowan 1971), but may remain with her for an additional year in many cases (Rogers 1987). Sows do not breed again until their cubs disperse. Because of their limited reproductive potential, black bear populations are vulnerable to increases in adult mortality. Premature adult mortality of black bears from non-anthropogenic causes is extremely low (Klenzendorf 2002).

Social context of carnivores

Humans have a long history of regarding carnivores as competitors for game and land, as agricultural pests, and as predators of livestock (Matthiessen 1987; Karanth et al. 1999). At the same time, in other contexts carnivores are viewed with reverence (Lopez 1978; Kellert et al. 1996) and even as partners or peers (Shepard and Sanders 1985). Some people believe that carnivores such as bears are the spiritual brethren of humans (Brunner 2007). For peoples living in the northern hemisphere who had never seen a primate, the bear was believed to be man's closest animal relative and origin stories in these regions often describe how humans were descended from bears or vice versa (Brunner 2007). Many of the names for bears used by Native American tribes, such as "cousin" and "grandfather," denote that kinship, and bears and bear parts are widely featured in Native American ceremonial and ritual displays (Hallowell 1926).

In myths and legends from around the world, the line between people and bears is blurry; there are stories of humans becoming bears and bears transforming into people. Bears were often associated with shamans and healers, believed to be medicine men

taking other forms (Brunner 2007) or as healers in their own right “physicians of the woods” (Shepard and Sanders 1985). Even among cultures that did not believe bears and humans were related directly, bears sometimes served as totems or guardian spirits (Hallowell 1926) offering guidance and support to the humans they protected. Bears were also associated with strength, courage, and maternal care (Brunner 2007). However, the linkages between people and bears were not always positive, and bears also served as symbols or representations of man’s baser instincts, the uncouth, uncivilized, or pagan (Brunner 2007).

Today, sports teams are named after the bear and bears are still often seen as icons of strength and power (Lopez 1978), as well as to exemplify ferocity and unpredictability (Knight 2000). On the opposite end of the spectrum, there is the image of the teddy bear and the cartoon bear, the bear used as a symbol of all that is loveable and cuddly, goofy and comical (Forrest et al. 2005).

This fascination with bears, and carnivores generally, has, in some situations, been the genesis of wildlife-related tourism. Visitors may travel long distances for a chance to view certain charismatic species. In areas where carnivores such as the grey wolf or sea otter (*Enhydra lutris*) have been restored or repatriated, tourism and associated revenue have increased dramatically (Aldrich et al. 2001; Duffield et al. 2008); wolf-related tourism alone in Yellowstone National Park exceeds \$35 million annually (Duffield et al. 2008). Participation in hunting and fishing in the United States is declining but wildlife watching is increasingly popular, especially in the “east south central” region of the country, which includes Kentucky (USFWS 2007).

Rationale for carnivore conservation

As predators, carnivores can shape ecosystem structure (Berger 2007). Elk (*Cervus elaphus*), for example, behave differently in the presence of wolves than they do without them (Creel and Winnie 2005; Fortin et al. 2005). Studies conducted in the Greater Yellowstone Ecosystem clearly show an impact of wolf predation not only on the numbers of elk themselves but on their grazing and browsing patterns (Ripple et al. 2001; Fortin et al. 2005), which, in turn, affect plant species composition and nesting songbird success (Berger et al. 2001; Ripple and Beschta 2004). In circumstances where the

ecological importance of certain carnivores is more equivocal, one may still refer to Aldo Leopold's insights into "intelligent tinkering," in which he advises his audience to retain all the parts (Leopold 1949). Beyond ecological arguments, there are ethical and aesthetic justifications for conservation. As Steven Kellert wrote (1996):

"From a broader sociobiological perspective, these animals offer important dimensions of beauty, meaning, quality, and virtue to human life and society. In preserving these species, we protect all these values, recognizing that people depend on a broad array of relations to the living world in their efforts to achieve lives of meaning and purpose. Grizzly bears, wolves, and mountain lions have been, and, we hope, will continue to be irreplaceable contributors to human language, story, and myth about our species' connection to the natural world."

Carnivore conservation becomes integral to conservation generally when carnivores serve as umbrella species (Shrader-Frechette and McCoy 1993) and proxies for ecosystem protection. Their large habitat requirements mean that maintaining their presence protects many other species as well (Cox et al. 1994). Carnivores may be keystone species, their impact disproportionate to their abundance (Power et al. 1996) and their retention critical to the functioning of the ecosystem (Orians and Kunin 1991; Estes et al. 2004). They may also serve as flagship species, their charisma and appeal used to promote the conservation cause of the region and enlist the active support of the public (Shrader-Frechette and McCoy 1993; Caro et al. 2004). Some species, such as the African elephant (*Loxodonta africana*), may occupy all three roles simultaneously. The presence of the black bear does not generate the same type of trophic cascade as wolves described above, but the bear may still provide important ecosystem services, e.g., promoting seed dispersal and germination, depending on location and local food habits (Auger et al. 2002; Borchert and Tyler 2010). If it is an ambiguous keystone predator, the black bear still clearly fits the role of umbrella species due to its large area requirements. It may also serve as a flagship species, depending on public opinion in the area.

The Black Bear

The prehistoric black bear

The evolutionary success of the black bear can be evaluated both in terms of persistence and distribution. It has survived where other bears have been eliminated, first during the ice ages (Wooding and Ward 1997) and more recently in the face of human development (Laliberte and Ripple 2004). The black bear is found from Mexico to Alaska and from the Atlantic Ocean to the Pacific Ocean (Kays and Wilson 2002). It is a forest obligate, due to food and cover requirements (Maehr et al. 2001a; Maehr et al. 2003). However, within that constraint, the black bear uses diverse habitats, from swamps to desert scrub (Wilson and Ruff 1999; Onorato et al. 2003). The black bear is capable of colonizing distant habitat, allowing local populations to rebound following extirpation if conditions improve and a nearby source population is available (Brown et al. 2009).

Evidence of the black bear and its ancestors in North America dates back to the middle Pleistocene period, preceding all other extant North American species of bear (Herrero 1972). The black bear is a smaller and older species than either of the other two North American bears and is most closely related to the Asiatic black bear (*Ursus thibetanus*) (Talbot and Shields 1996). Prior to the last glacial period, the black bear shared its range with a variety of now-extinct mega-carnivores. It is hypothesized that it was pressure from pack hunting canids such as the dire wolf that promoted the evolution of avoidance behavior in the black bear, and necessitated the ability to climb trees (Martin and Klein 1984). This characteristic reticence persists today, even after all the mega-carnivores and most of the smaller carnivores were eliminated; similar behavioral holdovers have been observed in other species (Byers 1997; Herrero 2002).

Food habits

Though several factors contribute to make the black bear arguably the most successful modern North American large predator after the coyote, the most important of these is, rather ironically, its diet. While technically a carnivore, the black bear is functionally a generalist omnivore. Since their earliest ancestors, black bears have eaten meat opportunistically, but the majority of their diet is derived from plants (Landers et al.

1979; Eagle and Pelton 1983; Maehr and Brady 1984). Depending on seasonal and regional availability, plants typically account for at least 80% of the bear's diet (Beeman and Pelton 1980).

Black bears live in many different habitats and their food habits vary by locale. This flexibility may allow them to avoid the impact of many declines of certain food plants, especially when these declines occur on a limited time scale. Hard mast species like oak vary in their intensity of mast production; soft mast production is variable as well, even under normal unaltered conditions (Powell and Seaman 1990). The black bear's ability to eat a variety of foods is an advantage. If black bears were not adaptable, mild to moderate fluctuations in such important food sources could have devastating impact, but bears can eat different foods depending on availability (Maehr and Brady 1984). However, extreme changes in food availability demonstrably affect the black bear, though the impact varies depending on the extent and phenology of the shift (Kasbohm et al. 1996).

Studies of food habits done in the Smoky Mountains and elsewhere indicate that leaves and stems are the largest part of the spring diet of black bears (Eagle and Pelton 1983), and this is typical of black bear spring diets across their distribution (Powell et al. 1997), reflecting what is available during that time of year. Most of this forage has low nutritive value for the bear, which retains the digestive system of a carnivore and is unable to process much of the vegetative matter consumed (Welch et al. 1997). In areas where meat is available in the spring, often scavenged from the kills of more effective predators, it is consumed in large quantities (Irwin and Hammond 1985; Weaver 1986), suggesting that leaves and stems are eaten in the spring primarily because they are all that is commonly available.

In summer the black bear is able to feed on carbohydrate-rich soft mast, such as cherries, that has greater nutritive value than the plant matter available earlier in the season. Blackberries are a potential source of soft mast for Appalachian bears in the summer. Though studies of some undisturbed areas indicated blackberry was an unimportant summer food plant because it primarily grew along roads and was potentially behaviorally unavailable (Powell and Seaman 1990), bears in Shenandoah National Park make extensive use of blackberries growing along trails and roads during

the late summer; indeed, scat found in these areas may be composed of blackberries exclusively (personal observation). Bears may also eat persimmons, grapes, apples, and other types of berries during this period (Powell and Seaman 1990).

The same plant may provide food throughout the year. For example, bears will eat oak buds in the spring and acorns in the fall. In general, habitat use in spring and summer is related to soft mast availability, and in fall it is related to hard mast availability (Clark et al. 1994), with the exception that some studies have shown lower than expected use of pine regeneration areas, even when soft mast was abundant there (Clark et al. 1994). The gross energy content of particular foods may vary from site to site (Powell and Seaman 1990), and this affects the relative importance of different foods. In the Appalachians, failures of summer soft mast crops may be moderated if fall nuts and grapes are plentiful (Powell and Seaman 1990).

In the Appalachian region, hard mast dominates the fall diet of the black bear (Pelton 1989). Acorns are typically the most important fall food source but hard mast from hickory and beech trees is also eaten and may assume greater prominence in bears' diets during years of low acorn productivity (Beeman and Pelton 1980). Bears also consume fruits such as apples during this period, when they are available (Beeman and Pelton 1980).

Impact of food availability

Fall feeding is critically important because a bear must consume enough calories to sustain itself through the winter and into spring when high-quality food is not obtainable. Bears that enter hibernation at low weight do not usually die during the winter, but often starve the following spring (Rogers 1987). Sows in particular are vulnerable because they must store enough fat to supply both themselves and their cubs; females nurse 1-4 cubs for several months before they ever leave their den to eat or drink.

Food availability may have a profound effect on productivity. For example, a three-year shortage of huckleberries in Montana coincided with the near cessation of all black bear reproduction (Jonkel and Cowan 1971). Similarly, a year of manzanita (*Arctostaphylos manzanita*) berry failure in parts of California was coincident with low cub survival and was followed by a year where cub production was reduced, and no

yearlings were observed (Kelleyhouse 1980). Lightweight cubs have a natural mortality rate that is four times that of heavier cubs (Rogers 1976). Whether these cubs die of starvation or are more vulnerable to predation because of their weakened condition is not clear. In a three-year study, LeCount (1987) attributed 50% of the known deaths of collared cubs to cannibalism by other bears, but did not observe any deaths from starvation. In any case, the evidence does appear to link mortality with access to food, particularly fall foods.

Conversely, abundant food results in increased weight gain (Rausch 1961; Rogers 1976; Mansfield 2007) and a positive effect on overall reproduction in sows (LeCount 1980). Bears with good food access have a younger age of first reproduction (Alt 1980; Kordek and Lindzey 1980; Rogers 1987), heavier cubs upon spring emergence (Rogers 1987; Mansfield 2007), and higher rates of cub survival (Rogers 1987; Eiler et al. 1989). Acorn abundance is positively correlated with the number of lactating female bears observed the following year (Eiler et al. 1989; Pelton 1989). There is strong indication that greater food access results in larger litter size (Jonkel and Cowan 1971; Rogers 1976; Alt 1980; Kordek and Lindzey 1980; Beckmann and Berger 2003b), although not invariably so (Mansfield 2007). Food availability, rather than bear density, appears to be the primary factor regulating black bear reproduction from year to year (Rogers 1993).

Bear home range and habitat use are also strongly affected by food availability (Garshelis and Pelton 1981; Elowe 1984). The overall size of home ranges tends to reflect the quality of food in the region (Beeman and Pelton 1980; Garner 1986). Bears with good access to high quality foods have smaller home ranges, whereas drops in seasonal availability and food shortages will cause bears to range widely in their search for food (Pelton 1989).

Fall foods appear to be most important for bears and fall food shortages most devastating (Jonkel and Cowan 1971; Eiler 1981). Bears living in the Appalachian region depend heavily on acorns as a fall food (Garner 1986; Pelton 1989; Vaughan 2002), but acorn availability fluctuates widely year to year (Diamond et al. 2000) and shortages are common. The impact of these shortages can be complex and multi-factorial (Reynolds-Hogland et al. 2007): Bears living in areas with heavy oak defoliation as a result of a

gypsy moth outbreak showed unchanged reproduction and survival but fall home range sizes doubled (Kasbohm et al. 1995b).

One reason for the complexity is that a shortage of one food item may be associated with the surplus of another, confounding the effect of either. Following the defoliation event described above, spring and summer ranges did not change, even though defoliation occurred in early June, resulting in increased temperatures (McConnell 1988; Kasbohm 1994). In fact, there was actually some preference for defoliated areas during the summer, possibly because of increased soft mast production of blueberry (*Vaccinium spp.*), blackberry (*Rubus spp.*), huckleberry (*Gaylussacia spp.*), black cherry (*Prunus serotina*), and sweet cherry (*Prunus avium*). However, acorn shortages prompted fall moves (Kasbohm et al. 1995a). In the years following significant defoliation and resulting tree death, bear use of these areas decreased. Kasbohm et al. (1995a) observed a significant increase in dense understory vegetation to the point where many areas were impenetrable and the forbs that bears eat in the spring were unavailable.

The black bear and humans in Appalachia

The Fort Ancient peoples of eastern Kentucky lived primarily in the floodplains along large rivers (Cook and Schurr 2009), but likely made hunting forays into surrounding areas (Drooker 1997). Between 7,300 and 4,900 years ago it appears that Native Americans in eastern Kentucky began to use fire-created openings to attract white-tailed deer (*Odocoileus virginianus*), which comprised the largest source of terrestrial animal protein in their diet (Schneider 1986; Stafford et al. 2000). The extent of fire use by Native Americans is debated (Russell 1983; Delcourt et al. 1998). However, carbon and pollen studies suggest that by 4,800 years ago, people were actively setting fires to clear land for settlement and to improve hunting conditions, and by 3,000 years ago, fire was being used to clear land for agriculture (Williams 1989; Delcourt et al. 1998).

The impact of fire on the habitat of the black bear is multi-faceted. Periodic fire clears the understory of brush and kills fire-intolerant species with low wildlife food value, such as maples (*Acer spp.*), and offers a competitive advantage to species that provide hard mast to bears and other wildlife, such as oak (*Quercus spp.*) (Wright and

Bailey 1982). Shade-intolerant species, such as pines, grow in fallow fields; bushes bearing soft mast fruit grow in gaps. Such early successional plants have high wildlife value, providing food to both birds and mammals. There is evidence Native Americans might also have created gaps through the removal of timber for use in housing and palisade construction (Davis 2000). Though the black bear depends on forest habitat for survival, it does not require old growth forest and can make use of a wide variety of other habitat types. In fact, the black bear thrives in a patchy environment where it can take advantage of the rich variety of plants that grow in different stages of succession, and such an environment was provided by the native peoples of North America.

Decline of the black bear

It is unclear how much of an impact Native American hunting had on black bear populations. Early European visitors to the region describe the species as “prevalent” and also describe a substance called “butter” that scholars believe was probably bear fat (Davis 2000). Bones from bears and ornaments made from bear teeth have also been uncovered at many archaeological sites dating from this period in Kentucky and neighboring states (Mills 1904, 1917; Shetrone 1926; Webb 1928; MacCord 1953).

Although there was early subsistence hunting by native groups, the first large scale impact of hunting on the black bear likely began with the increased trade in hides following Spanish settlement. Trade among tribes had existed for some time but European demand for furs quickly surpassed anything that existed previously (Cronon 1983). European settlers may have initially lacked the experience to be efficient predators of furbearers, but the demand produced an incentive for native hunters to increase their take, where demand had previously been limited to what they could use (Arnow 1960; Cronon 1983). Though the native peoples of Appalachia were slower to become involved in trade with the Spanish than groups living farther south, by 1650, Appalachian Indians were actively involved in the trade of animal hides (Davis 2000). Bear hides are not mentioned specifically in early traders’ accounts; deer, bison, and beaver appear to have been the dominant species traded, and, extrapolating from early accounts, as many as 400 skins could be taken south on each trading trip (Davis 2000). The heavy toll on wildlife

continued and, by the 19th century, thousands of bear hides were being shipped to Europe to be made into hats (Collins 1882).

Overhunting caused perceptible declines of animals in the northeast as early as 1672 (Cronon 1983). By 1694, Massachusetts was trying to restrict deer hunting by establishing the nation's first closed season, which by 1717 had become a ban on deer hunting altogether (Penna 1999). Turkey, elk, lynx, and bear were considered rare in the region as early as 1672 (Penna 1999). Farther south, declines were not yet so advanced. In 1750 Dr. Thomas Walker traveled to what became known as the Cumberland. He described his journey, during which "We killed... 13 buffalos, 8 elks, 53 bears, 20 deers, 4 wild geese, and about 150 turkeys, beside small game. We might have killed three times as much meat, if we had wanted it" (Walker journal 1750 *in* Arnow 1960). In contrast, by 1781 it took a group of 20 men to bring back five bears (Arnow 1960). By the end of the 18th century, the black bear populations (along with elk and deer) were greatly depleted from all but the far north (Matthiessen 1987). Such impacts caused the Connecticut Mohegans to seek state assistance in 1789, saying:

"The times are Exceedingly Alter'd, Yea the times have turn'd everything upside down, or rather we have Chang'd the good Times, Chiefly by the help of the White People, for in Times past, our Fore-Fathers lived in Peace, Love, and great harmony, and had everything in great Plenty... But alas, it is not so now, all our Fishing, Hunting and Fowling is entirely gone." (Cronon 1983)

Loss of game was not the only problem for native people. With the influx of Spanish missionaries came diseases that decimated Indian villages and ultimately resulted in the loss of 90-95% of Native Americans in the south (Davis 2000). Whole cultures were eliminated and land uses changed as a result (Steward and Faron 1959). Areas of early successional growth returned to forest, causing a change in the distribution and number of resident animals (Cronon 1983). The people who settled these areas differed greatly from those who lived there previously, and these changes had an impact on wildlife as well.

There is ample evidence that the Native Americans had domestic dogs and that they used them to hunt ungulates (Walthall 1990; Kay 1994); Hallowell (1926) also reported use of dogs by Indians to locate hibernating bears in winter. However, the

advent of larger hunting dogs such as the Plott Hound utilized by European hunters, combined with the use of firearms, radically changed the nature of bear hunting (Arnow 1960; Davis 2000). Semple (1901) noted that old-fashioned English short-bows were still being used as late as the 1870s in Kentucky to hunt squirrels and other small game, but hunters saved their costly rifle bullets for deer and bear.

When a black bear is threatened, it will climb a tree. This strategy was effective during the Pleistocene, but highly disadvantageous in post-Columbian North America. Dogs were able to trail bears through the forest and, once treed, the bears could not escape and became easy prey for humans hunting with guns. European settlers' use of these techniques allowed them to exert increasing pressure on dwindling bear populations in Appalachia (Bogliano 1998).

The Return of the Black Bear to Kentucky

Recolonization

Based on genetic evidence and early accounts, semi-contiguous remnant black bear populations persisted in parts of the southern Appalachians even as they were being extirpated elsewhere within those states (LaFollette 1974; Wathen et al. 1983; VDGIF 2002). When hunting pressure relaxed and old farms returned to forestland, bear populations began to rebound (Cowan 1972; Clark and Pelton 1999). During the 20th century, the bear was present in the neighboring states of Virginia, West Virginia, and Tennessee, as well as nearby North Carolina (Maehr and Brady 1984), but even as bears recolonized other parts of the Appalachians, it is believed that they remained absent from Kentucky.

Although there was no definitive evidence of a breeding population until recently, black bears have been sighted periodically in Kentucky, with reports made to the Kentucky Department of Fish and Wildlife Resources (KDFWR) dating back to the 1970s (KDFWR unpublished data). These reports were all apparently of young males (KDFWR unpublished data), which is consistent with a colonizing front, as young male bears leave natal areas and disperse while female bears typically set up territories adjacent to or nearby their mothers' home range (Rogers 1987). In 2001, a resident

breeding population was confirmed in Harlan County, Kentucky, when cubs of the year were observed there for the first time (KDFWR unpublished data).

In addition to bears dispersing naturally into Kentucky from neighboring states, in 1996 and 1997 the National Park Service intentionally translocated 14 adult female bears and their 16 cubs from Great Smoky Mountains National Park (GSMNP) to the Big South Fork region of the Cumberland River (BSF) (Eastridge and Clark 2001). The relocation area included parts of north central Tennessee as well as a portion of McCreary County in southeastern Kentucky. Although some of these bears and their offspring survived and remained in the area to form a new resident population in the Commonwealth, recent genetic analysis indicates that this population is distinct from bear populations elsewhere in Kentucky with little migration between them (Hast 2010).

Today bears have been sighted in 52 different Kentucky counties, but it is not clear that all (or even most) of those sighted are part of resident breeding populations. There are confirmed reproducing populations in the greater Pine Mountain and Black Mountains areas and in Cumberland Gap National Historical Park, as well as BSF. The core black bear population is thought to be located in Harlan, Letcher, and Pike counties (Unger 2007). Whether by natural dispersal, reproduction, or both, bear numbers are believed to be increasing in the Commonwealth (KDFWR 2004; Stambaugh 2011).

A changing landscape

The black bear is returning to Kentucky in an altered landscape. Decades of timber removal and subsequent forest recovery, changes in the fire regime, coal mining, introduction of exotic species, highways and human development have created an environment that is distinctly different from the pre-Columbian eastern Kentucky, which was nearly entirely forested (Delcourt 2002). Human environmental manipulations may have far-reaching and multi-layered effects beyond the immediately obvious impact. For example, logging has a direct effect on the abundance of plant species like oak by removing large trees that might otherwise produce food or serve as den sites, but logging in combination with fire suppression may also alter the pattern of succession with long term consequences. In the absence of fire, rhododendron (*Rhododendron maximum*) prevents overstory regeneration of hardwoods and reduces species diversity (Van Lear et

al. 2002). While rhododendron provides cover and occasionally ground den sites (Wathen 1986), it has no food value for bears.

The American chestnut (*Castanea dentata*) was once among the largest and most widespread hardwood tree in North America and was found in almost every state east of the Mississippi River (Woods and Shanks 1959). Given its prevalence, it is likely that the American chestnut was the primary source of reliable hard mast for the black bear (and many other species) (Diamond et al. 2000), as well as potentially an important winter den tree. Chestnut blight (*Endothenia parasitica*) was discovered in New York in 1904 and quickly spread, effectively exterminating the species as a forest canopy dominant. It was replaced by as many as 11 different taxa, especially oak associations (*Quercus* spp.) (Woods and Shanks 1959; Van Lear et al. 2002). Oak and other replacement trees do provide hard mast but do so at a lower quality and quantity than the chestnut, and production from year to year is less consistent (Diamond et al. 2000).

Human development of what was formerly prime bear habitat has almost certainly lowered the environmental carrying capacity for black bear in Kentucky from what it was previously. It is also possible that a similarly sized tract of forest is no longer capable of supporting the number of bears it once did because of the loss of the chestnut and other environmental degradation, and any decline in oak because of fire suppression or successional changes reduces natural food availability still further.

Supplemental food sources

Anthropogenic food sources may mask and confound shortages of natural foods. In Virginia, respondents to a mail-in survey of bear hunters revealed that collectively they were supplying bears with 3 million kilograms of food in the form of bait annually, including pastries, whole-shelled corn, and grease (Gray 2001). Landers et al. (1979) showed that bait supplied by hunters is used as a food source by bears throughout the year in southeastern North Carolina. In this relatively warm climate, some bears did not den at all and ate corn through the winter. In Wisconsin meat-based bait made up 22% of spring bear diet (Irwin and Hammond 1985).

Although bear hunting using bait is prohibited in Kentucky, bears have widespread access to anthropogenic food sources. In state parks, bears routinely raid

trashcans in picnic areas and campgrounds. Bears frequent school dumpsters, occasionally during daylight. Residents who intentionally feed wild bears have incurred subsequent property damage as bears learn to expect food (KDFWR unpublished data). Bears with access to anthropogenic foods such as garbage may forage less, grow larger, and live at higher densities than natural conditions would allow (Beckmann and Berger 2003b). Some bears aggregate in the urban-wildland interface to take advantage of these resources, leaving natural areas depopulated (Beckmann and Berger 2003a). Maintained at artificially high densities by garbage, male bears can become concentrated and may kill young cubs when they come into contact with lactating females (Davis and Harestad 1996), potentially reducing reproductive success.

As carnivores are drawn farther into human-inhabited areas, they become habituated to human presence, growing bolder and potentially more destructive (Herrero 2002). These nuisance animals are at increased risk of being killed illegally by local residents (Gray et al. 2004) or euthanized by wildlife agencies for reasons of public safety.

Conflict

Bear/human conflicts often occur in heavily used areas where people feed or otherwise attempt to make direct contact with bears drawn in by available food (Whittaker and Knight 1998). Other conflicts occur when bears attempt to access pet food, garbage, or food stored by campers. Most conflicts between people and bears are precipitated by attempts at inappropriate food acquisition on the part of the bear (Spencer et al. 2007) and it is very difficult to change the behavior of bears once they are conditioned to unnatural foods (McCarthy and Seavoy 1994).

Since bears began to be seen in Kentucky regularly in the late 1990s, the number of complaints about nuisance animals has grown. Although there have been a few reports citing perceived aggressive behavior on the part of bears (primarily bluff charging), there has been only one bear-inflicted human injury reported to date in Kentucky (Hjalmarson et al. 2010). This injury occurred outside my study area and after my research was completed but did appear to involve a food-conditioned bear. In other parts of the United

States, human-habituated bears have been responsible for extensive property damage and have been involved in at least 33 attacks on humans since 1990.

Conversely, humans are responsible for nearly all mortality in black bears over two years of age (Rogers 1976). Hunting is the major cause of bear mortality elsewhere but is not yet a large issue in Kentucky, which opened its first season in 2009 and as of this writing has resulted in the known deaths of only two bears. However, other types of human-caused deaths are still problematic in Kentucky. Bears are shot while trying to access garbage or otherwise poached, and they are killed by cars when crossing roads. These situations are potentially exacerbated by food shortages precipitated by environmental degradation and drought, causing bears to range more extensively to find food (Delozier and Stiver 2001).

Project Justification

The recent return of the black bear to eastern Kentucky presents both opportunities and challenges to land managers, law enforcement officers, local businesses, and human residents. On the one hand, the bear is part of the restoration of an area that has suffered environmental degradation, and its presence could attract much-needed income to an economically depressed region. On the other hand, the number of complaints about nuisance bears has risen steadily over the past 10 years. Management and education efforts by the KDFWR have increased, but human-bear conflict continues to be a problem.

Understanding why and when these conflicts occur is the first step to reducing their frequency. As agencies incorporate human dimensions information into their decision making, they may begin to move out of crisis response mode (Schusler 1999) and shift resources directly to wildlife management (Duda et al. 1998). Knowledge of public opinion, values, and behavior can make the difference between success and failure (Kellert et al. 1996; Don Carlos et al. 2009). The greater our understanding about the ecological importance of the black bear and the kinds of situations that precipitate human-bear conflicts, the more likely it is that the black bear will be viewed as a public asset (Bjerke and Kaltenborn 1999).

When there has been a question about the will of the public, it has most often been addressed through a mail-out survey (Dillman 1978). Surveys have the advantage of being theoretically objective, of being able to query a large number of people at one time, and of including people across demographic boundaries and/or over a wide area. Surveys also allow researchers to focus on many important issues at once.

The problem with surveys is that they often fall short of their goals, may not actually take an unbiased snapshot of general public opinion, and may completely miss illegal and cryptic or otherwise hidden behavior (Duda et al. 1998). Response rates can be heavily skewed towards certain sectors of the population and away from others, so surveys may or may not sample the groups most relevant to the issue at hand (Armstrong and Overton 1977). Questions can be leading and/or misleading, and they can be unclear and draw ambiguous responses, or they can miss important viewpoints entirely because the questioner simply did not know enough to ask about certain topics (Russ-Eft 1980).

This project was developed to expand on a mail-out public opinion survey conducted by KDFWR in 2002, which experienced some of these difficulties, as well as an ecological study of the Kentucky black bear begun at the same time (Unger 2007). My intent was to improve understanding of the concerns, interests, and behavior of the people living in bear habitat, as well as the impact of this interaction on the bears themselves. This in turn could be used to develop community-sensitive wildlife management plans, educational outreach strategies, and nuisance bear mitigation techniques.

Activities such as artificial provisioning (e.g., garbage dumps), illegal feeding, and poaching represent some of the most important human behaviors for wildlife managers to understand and monitor (Hristienko and McDonald 2007), yet they are exceedingly difficult to study or quantify using traditional wildlife management research techniques such as surveys because people are reluctant to admit illegal activity, and nuances of motivation and behavior may be lost (Tope et al. 2005).

State and federal fish and wildlife agencies are continually challenged to reduce conflicts between bears and humans and to protect the safety of both people and bears. However, their ability to resolve these problems is limited by personnel and financial resources, and often by their position as outsiders in the communities they serve. A multidisciplinary approach that applies anthropological research techniques has the

potential to uncover practical, place-based management solutions for human-wildlife conflict (Cheng et al. 2003). A management and education plan developed from this research would also have implications for handling human-wildlife conflict in other rural areas, but the practice of using qualitative research to tailor a plan to a community has even more far-reaching implications.

It is not possible for any fish and wildlife agency to police all people all the time, nor is it feasible to stop people feeding bears in their own backyards. It is similarly problematic to apprehend and convict those who would illegally shoot bears. And yet, bears that eat anthropogenic foods are at risk of being shot just the same. Kentucky's small bear population may be ill-equipped to sustain any substantial adult mortality, and no one wants to see a human injured or killed by a marauding bear. My study is intended to address these issues and to explore the efficacy of developing place-based management strategies to resolve issues of conflict between black bears and humans in southeastern Kentucky.

CHAPTER 2: FIELD SITE DESCRIPTION

My primary study area was in the Tri-Cities region of Harlan County, comprising the cities of Cumberland, Benham, and Lynch (Figure 2.1). Cumberland is officially “the Black Bear Capital of Kentucky” and includes Kingdom Come State Park (KCSP), the site of a majority of bear sightings in the Commonwealth. I observed bears and conducted interviews both in the Tri-Cities and throughout Harlan County, as well as the eastern portion of Letcher County. Harlan and Letcher counties are 1212 km² and 878 km² respectively, and both are located within the Eastern Mountain Coal Fields, which cover all of Eastern Kentucky, stretching from the Appalachian Mountains across the Cumberland Plateau (Vesely et al. 2008).

Erosion of the ancestral Appalachian Mountains deposited sediment in a large inland sea 250-300 million years ago, creating layers of sandstone, shale, coal, and limestone, as well as erosion-resistant sandstone, which has formed rocky outcroppings and bluffs (Vesely et al. 2008). Pine Mountain was formed by a fault that pushed Mississippian and Pennsylvanian sandstone upward, creating a 201 km long ridge. Black Mountain, the site of Kentucky’s highest point at 1,263 m, lies in Harlan County, along the Kentucky/Virginia border. Between mountain ridges are long winding valleys and steep watersheds.

The region is primarily mixed mesophytic forest (Wharton and Barbour 1973). Historically, the American chestnut dominated the forest. However, the area now contains other hard mast-producing trees such as red oak (*Quercus rubra*), white oak (*Q. alba*), chestnut oak (*Q. prinus*), black oak (*Q. velutina*), shagbark hickory (*Carya ovata*), and black walnut (*Juglans nigra*). Soft mast-producing bushes such as blueberry and blackberry are found in the understory and in canopy gaps. Forests in the regions were heavily logged in the late 19th and early 20th centuries (Braun 1950), and large tracts of land were subjected to clear-cutting. By the 1920s, much of Kentucky’s timber had been harvested, and lumber production declined (Day et al. 2004).

Eastern Kentucky was once used as hunting grounds by the Shawnee and Cherokee Native American tribes, but was gradually settled beginning in the mid 1700s by white immigrants, primarily from Virginia and North Carolina, who entered the area

from the south through Cumberland Gap and along the Wilderness Road (Davis 2000). Hunters and traders arrived first, and were followed by homesteaders. By 1870, the population of Kentucky was around 70,000 (History of Kentucky 2008), though the population density of eastern Kentucky was low compared to the central and western parts of the state.

Thomas Walker observed the presence of coal in eastern Kentucky as early as 1750, but coal production was limited by the ability to transport it. By the late 1800s, coal mining had increased in scale and was greatly facilitated by the building of railroads (Kentucky Coal Education). World War I brought increased demand and generated a boom in the coal mines of eastern Kentucky, with a dramatic concomitant increase in area populations (Figure 2.2). Many Appalachian farmers left their land to work in the mines, and people from elsewhere in the United States and Europe began coming to the area for employment in the mines as well (Caudill 1963).

Coal towns sprang up throughout the region where no urban centers had existed previously. The size and amenities of these coal company towns varied, but model towns, such as Benham and Lynch, contained schools, churches, hospitals, and theaters. Smaller towns also existed, but with less infrastructure. Housing quality reflected relative status within the company, and homes ranged from closely packed one-room shanties to grand stone houses with mountain views. Coal-associated enclaves were found throughout the region both near city centers and in more remote areas.

The coal company system provided mining families with all their material needs, but this also meant that mining families were entirely dependent on the company, and when the industry crashed in 1927 in advance of the Great Depression, these communities began an economic collapse (Caudill 1963; Frontline 2006). The coal companies had to lower their prices and consequently lowered worker wages as well. Harlan County achieved some notoriety as the site of particularly violent labor unrest during the 1930s, leading to the nickname “Bloody Harlan” (Hevener 2002). The New Deal offered food and supplies to out-of-work miners and their families as well as employment in public works but unemployment remained widespread.

World War II temporarily brought increased demand for coal again, but the respite was short-lived, and when demand waned once more, it triggered another

economic decline and associated poverty and unemployment. The situation rose to national prominence as the face of President Kennedy's "Other America" as well as President Johnson's "War on Poverty." VISTA (Volunteers in Service to America) workers came to the region to help build schools and aid in development (Frontline 2006).

Coal mining continued to be the dominant form of employment with periodic episodes of worker unrest. The documentary film *Harlan County, USA*, which won an Oscar for best documentary feature, chronicled striking mineworkers in the area in the 1970s. Many of the people featured in that film, as well as their descendants, are still living in the county today.

The majority of people I spoke to had some association with the coal-mining industry and many were part of multi-generational coal-mining families. As surface mining gradually replaced deep mining, the need for miners dropped dramatically, even as the amount of coal produced increased. This has led to widespread population decline and outmigration as people leave the area in search of employment (Montrie 2003). Poverty continues to be an issue in the region, with 32.5% of the population and 40.1% of children living below the poverty line in 2000 (U.S. census data).

Today Cumberland is a small city, with about 2,600 residents. Together with the even smaller cities of Benham and Lynch, it makes up the Tri-Cities region, total population 4,100. This area is located along Highway 119, which runs through a river valley alongside the length of Pine Mountain. All three cities are similar, but Cumberland is the largest and the area center. To shop at Walmart, or buy clothes and other merchandise, residents must go to the city of Harlan, 36 km from the Tri-Cities area.

The main features of Cumberland are a small grocery store, a few chain restaurants, a drug store, post office, and two banks. Shops dot the main streets but many of the store windows are empty. The Poor Fork of the Cumberland River runs through the town, with houses perched precariously along its bank. Once during the summer of 2004, the river flooded so badly that a man's garage, and the two cars in it, washed away. This type of event is not uncommon, and the area is part of a planned redevelopment by the Army Corps of Engineers, though this has not yet taken place.

During the day, the city feels busy. There is a moderate amount of foot traffic as people shop in downtown Cumberland. The area is small enough that many people know each other and converse in line at the grocery store or meet to chat at the small arts and crafts shop. Residents sometimes make references to Mayberry when describing their town, and indeed there is a striking interconnectedness and involvement of the city's people. Neighborhood picnics and gatherings of extended relatives are common, and many families have been in the region for generations. Residents describe feeling a strong sense of community and attachment to their towns. However, there is a darker side too as this area, like many in Appalachia, continues to be plagued with unemployment, poverty, and drug addiction.

KCSP, located on Pine Mountain just above the city of Cumberland, is the hub of known bear activity in Kentucky. Bears are seen regularly within the park, often feeding on garbage and handouts left for them by park visitors. The presence of bears has dramatically increased park attendance and hundreds of people come to KCSP in the hopes of seeing a black bear.

KCSP is approximately 526 hectares and is surrounded by forested wildlife management areas (Figure 2.3). Much of the area that is now KCSP was developed as part of the Civilian Conservation Corps (CCC), a government program designed to provide local men with employment as part of the New Deal during the Great Depression. Several of the scenic overlooks commemorate the involvement of certain workers and some of their descendants still live in the area. The park itself was established in 1961, and included land donated by the Cumberland Lions Club, International Harvester Company, and two private individuals.

The drive to KCSP begins in the city of Cumberland, on a narrow road ascending abruptly up the side of Pine Mountain. At the bottom, there is a small brick house with a wooden bear posed out front. He holds a sign that reads "don't feed the bear" but sports varying decorations, including a bib from a seafood restaurant that reads "fed lobster." The drive up to the park is extremely steep and curvy, and there are several places where it is so narrow that meeting another car coming down is dangerous. There are a few houses and trailers along the road, tucked further into the mountainside and barely

visible. The temperature drops perceptibly as the road climbs. Even in summer, it is not usually hot on top of Pine Mountain, and at night it can be quite chilly.

The developed portion of the park begins with the pond, constructed in 1964 by KDFWR, as well as the gift shop and rangers' office. There is a large parking lot at the pond and people often come there to fish. A trail wraps around the pond, and on the back side there is an adjacent trail that runs up to a cave amphitheater and Raven's Rock, which vandals have covered with graffiti. There are usually visitors parked at the pond during the summer, often staying until almost dawn. On the other side of the road from the pond is an overlook with a gazebo that faces across the valley toward Black Mountain, where the scars of mining are visible over the trees. An area resident installed a wooden cutout bear silhouette near the gazebo so that it appears a bear is about to cross the road, which causes some newer park visitors to slam on their brakes as they round the corner. As the road climbs upward, there is a short looping side road to Log Rock where there is a trashcan. However, it is uncommon for bears to visit it and rarely does anyone park there.

Above the ponds, on the opposite side from log rock, are two picnic shelters and several campsites. The area by the shelters is flatter than the rest of the park and runs in a narrow strip along the side of the mountain below the main road between the shelter drive and a rock face. The one-way access road comes in above the upper picnic shelter, runs past both shelters, and rejoins the main road at the bottom. Along the shelter drive are designated camping spots and picnic tables. Typically in the summer, at least one or two campsites are occupied each night, often more on weekends. There are a few bear-proof trashcans but they are interspersed among conventional ones. The two shelters have electricity, bathrooms, and soda machines. They are made of stone, open on three sides and ringed with 6 trashcans each. The shelters are a good place to watch for bears at night if the rangers leave the shelter lights on, which they often do if someone they know is there watching.

The park road winds up past the campgrounds and shelters and through a narrow passage where rock walls extend upwards on either side. Dotted along gaps in the sides are picnic areas with trashcans. Between the picnic areas, the park is crisscrossed by a network of trails, which the bears appear to use more than people do. Bears often emerge

from the woods on a trail, knock over a trashcan, and then use the trail to retreat and access their next stop.

After the gap, the road widens again and there is “the swamp,” a boggy field with room for multiple cars and an excellent place for bear watching and congregating. It was here that I first saw people arrayed around a trashcan in picnic chairs. Bears visit the swamp, the nearby ball field, and adjacent overlook with the greatest frequency of any spots in the park. Watchers move back and forth among these cans in cars and on foot.

Visitors travel to the park looking for bears at all times of day. Driving up to KCSP through the fog, at dawn, one finds the park is still and quiet and may appear empty, but even at that hour, there are often people sitting in cars facing a trashcan hoping to see a bear. Many bring up their meals and park in one of the many viewing areas to eat. In the early evening, just before dark, the numbers of people watching for bears are greatest. Visitors often park en masse, pulled alongside each other to talk, or they may get out of their cars to visit with friends and family while they wait.

At the top of the mountain is the park office. The rangers often wait there or patrol the park, circling it in their jeep. In their law enforcement capacity they deal primarily with intoxicated people and vandals, but they also spend much of their time supervising the bears. They keep people from approaching too closely and will fire off rubber bullets or cracker shells to scare the bears back into the woods if they feel it’s necessary. However, they often simply circle the park, assisting where needed, talking with friends and answering visitors’ questions about where best to watch the bears.

From the offices, the road begins to descend again down the other side of the mountain, coming out at a gravel quarry outside of town. This access is not heavily used, although it is not as steep as the primary entry. Traveling along the top of the park in the other direction one reaches Creech Overlook, where stone steps built by CCC laborers lead up to a viewing platform that faces north off the mountain. In the summer, the sun rises to the right of the overlook over the valley. The change in temperature frequently generates fog in the low-lying areas that blankets the valleys; nearby mountains peek through the top like islands. To the left, the sunset is also visible from this vantage point, and after a storm the colors of the setting sun can be truly spectacular. First-time visitors to the park come to this spot more often than regular bear watchers; the regulars know

that the only trashcan is chained and rarely contains more than old beer cans to attract a bear.

Past Creech Overlook, Little Shepherd Trail continues along the spine of Pine Mountain for 19 km towards Whitesburg. At the beginning of my study, almost no one drove along the section of road that ran between KCSP and Whitesburg because it was not paved and was heavily rutted and studded with potholes. It was a good place to find bear tracks in the soft mud and bear scat was abundant. Small vernal pools along either side of the road were heavily used by wildlife as well. There is one point where the road narrows and the sides of the mountain drop off sharply to either side. The views are impressive, but it is easy to imagine a sudden lurch as the dirt gives way under the car, causing it to plummet off the mountain into the valley. Indeed, the road actually did give way in several less precarious spots during the time span of my study and repairs were slow and minimal. However, the road has since been paved and it now receives much more vehicular traffic, although it is possible that it is less often used by bears as a result.

Though the forest in this area surrounding the park, including the Hensley Pine Mountain Wildlife Management Area, is variously described as “pristine” and “a wilderness” in park literature, in truth it is a young and heavily disturbed forest. Few large trees survived logging and invasive exotic plants tangle the undergrowth. Nevertheless, it remains one of the best places in the region to hear forest-dwelling birds, and the collection of strange and usual moths drawn in from the forest by the floodlights that coat the side of the park office is impressive. Like the Tri-Cities itself, Pine Mountain is an interesting place with a history of prosperity followed by environmental degradation, now coming back, and perhaps changing into something new.

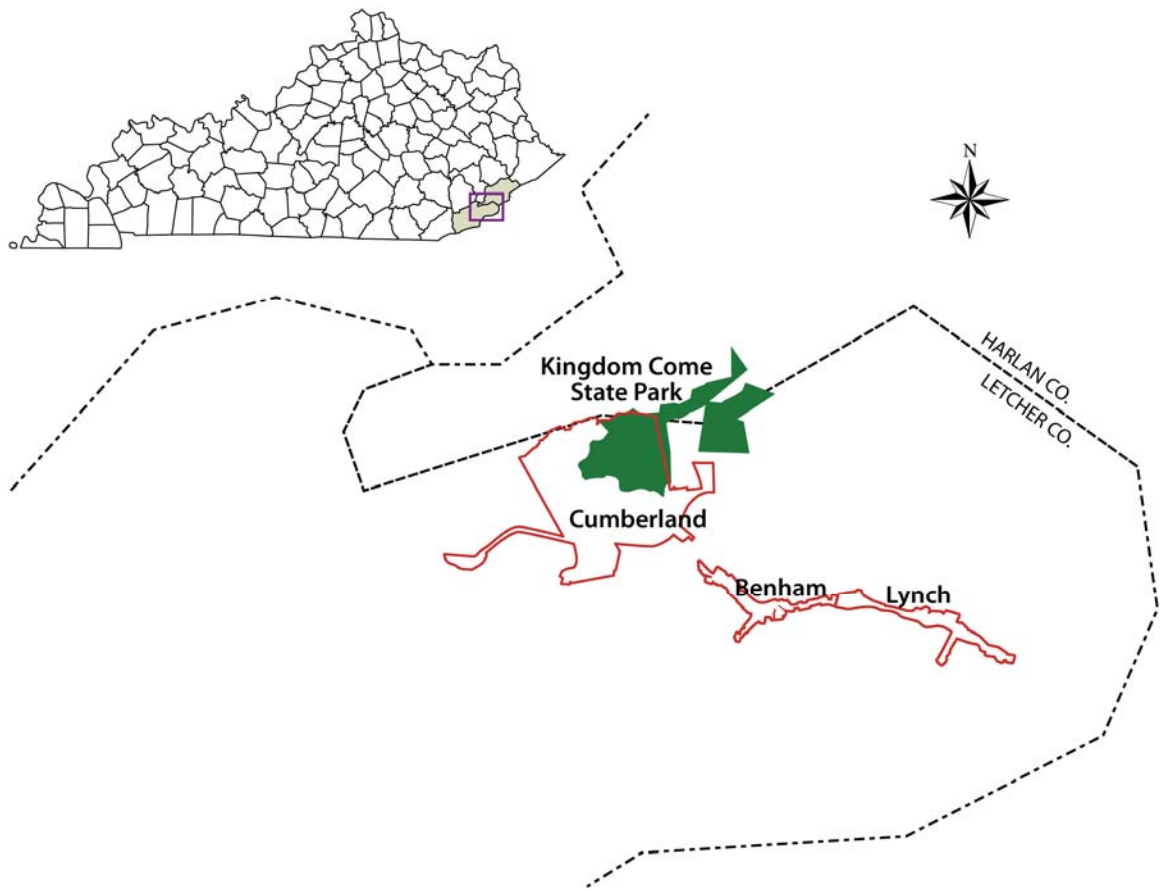


Figure 2.1. Map of the Tri-Cities region in Harlan County, southeastern Kentucky, including the cities of Cumberland, Benham, and Lynch.

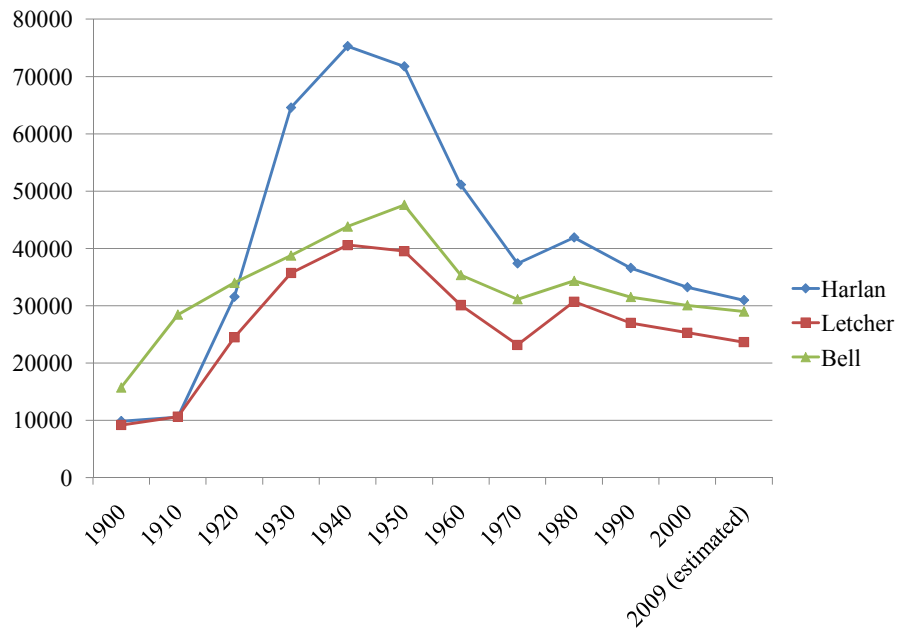


Figure 2.2. Human population numbers in Harlan, Letcher, and Bell counties from 1900 to 2009. Source: US Census data.

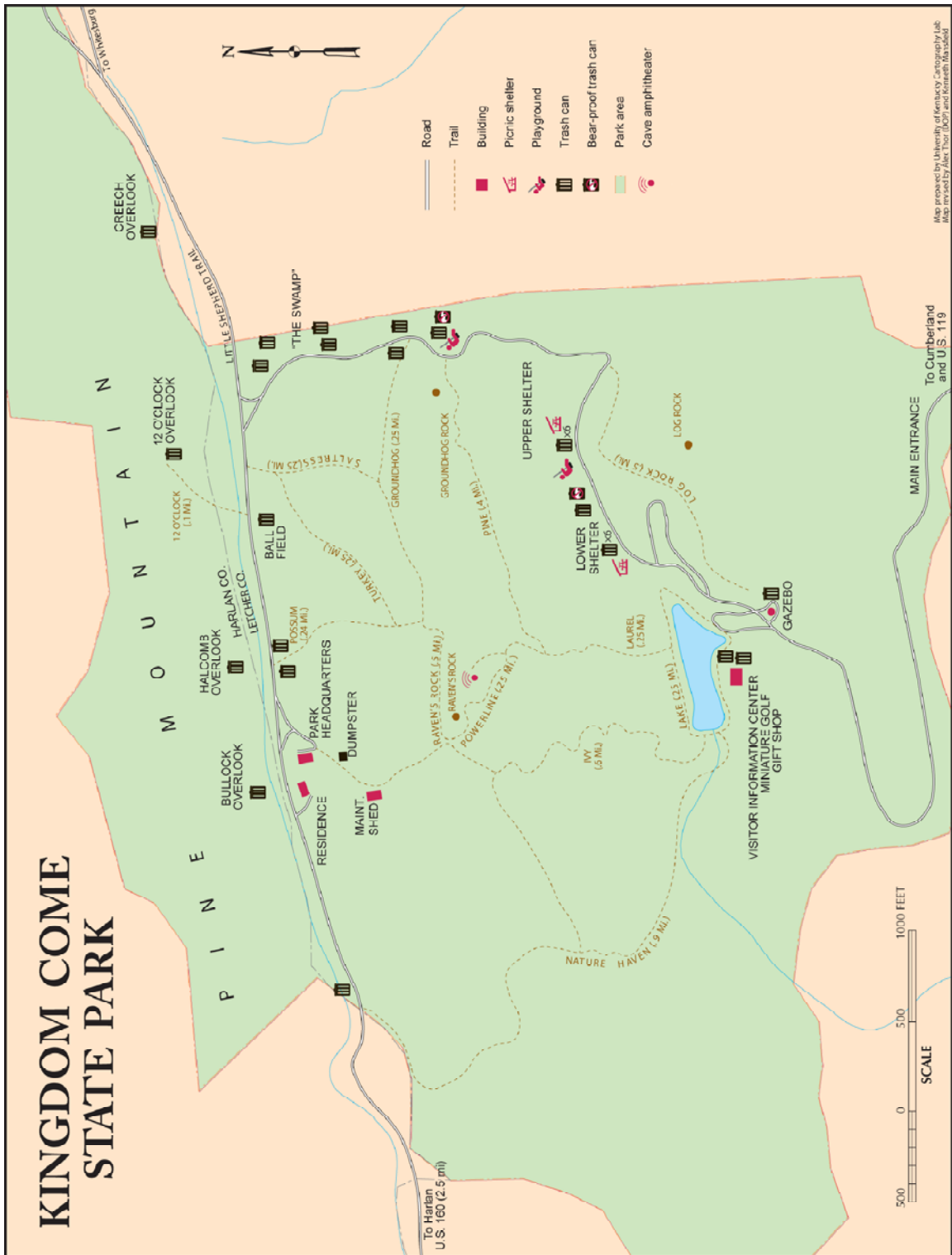


Figure 2.3 Kingdom Come State Park, Harlan County Kentucky, showing trails, picnic areas, and garbage receptacles. Adapted from a map prepared for the Kentucky Parks Department.

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CHAPTER 3: METHODS

For this project, I employed a mixed methods case study design, using a variety of techniques both from traditional wildlife biology and from the social sciences, in an attempt to examine human-bear interactions as holistically as possible.

Intercept Survey and Survey Pilot

Introduction

In 2002 the Kentucky Department of Fish and Wildlife and researchers from the University of Kentucky (UK) collaborated on a mail-out survey intended to assess public opinion regarding black bears in the eastern half of the state. This took place prior to the beginning of my project but is referenced here.

In preparation for a planned second public opinion survey, this time targeted towards residents of current bear habitat, I developed a modified version of the 2002 survey (Appendix A). I pre-tested this questionnaire (Bernard 2002) with six graduate students, three in wildlife biology and three in anthropology, and solicited comments to improve clarity and concision of the survey instrument. In August of 2004 I conducted a pilot test of the modified survey instrument within the study area. Subjects were recruited for participation using an intercept method and convenience sampling (Bernard 2002) in public areas within the Tri-Cities area. Pilot survey participants were selected from the adult population in the area including residents of both Harlan and Letcher counties.

Data collection

To administer the pilot survey, I set up a table with a large sign reading “UK Research Study” outside several area businesses and asked patrons if they would mind participating in a quick survey about black bears. Each person was provided with a letter explaining the purpose of the study and their role in it should they choose to participate. I explained the nature of the project and went through the informed consent process as required by the Institutional Review Board (IRB Protocol Number 04-0614-P4S). Participants were then provided with a paper copy of the survey and a pen and shown to a

nearby table and chair removed 3 m from the recruitment area. They were invited to ask any questions that occurred to them while they were filling their survey out. When they completed their survey, they inserted it through a slit into a closed box on the main table. After submission, I asked participants for feedback about the survey and invited them to make suggestions for improvement, for additions, or to highlight items they felt were unclear. This information was recorded on a new blank survey form. No incentives were offered for participation, but people were invited to have a piece of candy from a large bowl on the survey table. In total, I collected 30 completed surveys.

The recommendations made by participants were evaluated and often included in further changes made to the modified survey to be provided to KDFWR for future use. The purpose of this effort was first to get feedback from the target local population about the survey instrument itself (Salant and Dillman 1994; Bernard 2002) and second to test the efficacy and efficiency of conducting a survey using intercept delivery as a way to avoid some of the problematic issues with other survey delivery methods in this region.

Survey results were compiled but, with the exception of written comments, were not included in the larger analysis as an additional source of data because of the small sample size; answers were not necessarily indicative of overall public opinion, or the opinion of relevant stakeholders. The results were, however, a useful starting place to begin my understanding of possible areas for future exploration in subsequent phases of my research.

Interviews

Introduction

When KDFWR conducted their survey in 2002, the objective was to determine the relative proportions of the population with various views and behaviors regarding the black bear. A survey can provide important data on population attributes and attitudes. However, the scope of the information that a survey can gather is limited by the questions asked and the multiple choice answers provided (Duda et al. 1998). In addition, participants who perceive a survey does not pertain to them or that certain questions are irrelevant, or who feel in some way disenfranchised from the research agency, may not

respond, so that their opinions and views are absent from the results and potentially important information is lost. Therefore, to supplement the information collected from the 2002 KDFWR/UK mail-in survey, and include a more varied group of stakeholders with a direct connection to black bears in Kentucky, I conducted a variety of interviews with people who lived or worked within the study area and who were in some way involved with bears in the region. Interviews ran the gamut from “informal interviews” (*sensu* Bernard 2002), which took place opportunistically and were not prearranged or taped, to highly structured interviews where I delivered portions of the questionnaire orally and which were all tape recorded.

Data collection

I conducted 20 initial interviews, which were all informal and began in May of 2003. I used opportunity or convenience sampling to select participants (Denzin and Lincoln 2000; Bernard 2002). These initial interviews were unstructured, did not follow an interview guide, and had minimal structure or direction. Though informal, these interviews constituted the foundation of many of my field notes and were instrumental in identifying core issues and persons of interest.

Based on the information gleaned during early interviews, I identified six potential stakeholder groups, each of which had some vested interest in black bears in Kentucky and KDFWR’s management of them. I then used a purposive sampling frame (Bernard 2002) to select participants from six primary categories. Many of the people I interviewed belonged to overlapping categories (for example, nine of the people interviewed for other reasons also mentioned an involvement with coal mining during their interview), so the numbers below represent their primary affiliation only. I combined these interviews with ten of the more extensive (and therefore compatible) informal interviews mentioned above for the following stakeholder interview totals:

- Bear oriented wildlife watchers (n = 11)
- KCSP park staff (n = 3)
- People involved with local tourism (n = 4)
- Residential nuisance bear complainants (n = 11)
- Commercial nuisance bear complainants (n = 3)

- Government officials (both state and local) (n = 5)

During the course of the study, I added interviews with people from the following two categories:

- People involved with coal mining (n = 2)
- Anti-bear residents (with no other affiliation) (n = 3)

In total, I collected 42 interviews for in-depth analysis, including 32 taped and 10 untaped.

To select informants for formal interviews, I used a mixed method design to conduct non-probability sampling using purposive (Bogdan and Biklen 1998) and snowball sampling (Bernard 2002). Participant selection varied somewhat depending on the category of interviews being solicited. Initial interviewees were selected systematically but non-randomly using a snowball technique (Berg 1989), where each participant was asked to name other participants they thought might have had bear-related experiences. Efforts were made to interview community leaders as well as those involved directly with bear-related issues. In the case of public officials, interviewees were selected because of the position that they held. Everyone approached about being interviewed agreed to participate.

In order to find participants who were having problems with nuisance bears, I conducted follow-up visits with people in Harlan and Letcher counties who had filed an official complaint with KDFWR regarding nuisance bear activity, using reports described below. These individuals were interviewed using the same guide as the others but additional questions were added regarding the nature of the bear damage and the status of the conflict. I assessed the efficacy of various mitigation measures as well as evaluated the complainants' compliance with the responding KDFWR representative's recommendations and their satisfaction about the resolution of the problem.

Formal interviews began in May 2004 and continued through September 2006. The interviews were prearranged and took place at the location of the participants' choosing; in some cases this was a private home, in others their place of business, or at Kingdom Come State Park (KCSP). All interviews began with me explaining the

purposes of the study and assuring confidentiality to all participants. I also furnished all participants with a letter of explanation about my project, in compliance with IRB guidelines. Interviews lasted between 45 minutes and two hours.

These interviews were semi-structured (Lindlof and Taylor 2002; Bernard 2002); I used an interview guide (Appendix B) with a list of topics, questions, and follow up probes but the questioning was open-ended (Babbie 2001). While questioning followed the guide, participants were free to explore tangents or raise topics not covered by the guide. This format also allowed me to build rapport with participants, which facilitated the discussion of potentially sensitive topics (Barriball and While 1994). At the end of each of these sessions I conducted a brief structured interview where I ran through the questionnaire orally and recorded all responses.

The interview guide was developed from the above survey with significant modifications and covered topics such as personal experience with black bears, knowledge of their behavior and natural history, opinions about the management of bears in Kentucky, the availability of information about them, and reactions to several hypothetical management scenarios.

Data analysis

All formal interviews were tape recorded and later transcribed completely verbatim (Heritage 1984; Schegloff 1997). Following unstructured interviews, I took extensive field notes using a Dictaphone, which were also transcribed. I completed all transcription myself. This was largely due to budgetary necessity, but doing so gave me greater familiarity with the data and allowed a more nuanced understanding of the statements based on tone and inflection (Corden and Sainsbury 2006a).

All transcription was entered into the qualitative analysis software NVivo. NVivo allows for the importation of data including both text and images. This information is then coded, allowing the researcher to explore trends and relationships. For my analysis, I used the NVivo software primarily as a data management tool rather than for theory development. I analyzed the data using open coding in which I examined text line by line to find recurrent and significant categories (Strauss and Corbin 1990). I then used these codes to identify the recurrent themes and trends.

I created a list of broad topic areas and reassembled a new version of the coded text according to these categories (Agar 1980). This sorting and categorization of text allowed me to develop potential models for varying types of bear-human interaction in the region from the information. I then returned to the data to test my hypotheses and look for contradictory cases, gradually developing theories to explain my results (Carney 1990). Data analysis was an iterative rather than linear process, as I returned multiple times to my interviews and notes during the course of writing (Miles and Huberman 1994) for verification of my ideas.

Representative quotes in italics are used throughout the dissertation to highlight themes and concepts in the participants' own words. These quotes were lightly edited to remove some verbal artifacts (e.g., "um") and identifying information but are otherwise written verbatim unless otherwise noted. No direct attribution or identifying information is given, in accordance with my promise of confidentiality to participants, but quotes are identified by the gender of the speaker and their relevant stakeholder group (Corden and Sainsbury 2006b; Wiles et al. 2008).

Bear Behavior, Demographics, and Condition

Introduction

It is well documented that brown bears may aggregate in unusually high numbers where food is concentrated (Pierce and Van Daele 2006; Rode et al. 2007), altering their spatial distribution and behavior as dominant bears monopolize food sources (Stonorov and Stokes 1972; Egbert and Stokes 1974; Olson et al. 1998) and smaller bears or sows with cubs avoid them (Stringham 1986; Wielgus 1993). Human presence may also alter animal behavior, for example increasing vigilance (Fernandez-Juricic and Schroeder 2003; St. Clair and Forrest 2009), altering distribution (Nevin and Gilbert 2005), or altering spatial and temporal resource use (Rode et al. 2007). Black bears show similar patterns (Rogers et al. 1974; Rogers 1989; Beckmann and Berger 2003b). Although a large-scale study of this phenomenon was outside the scope of this project, I made an effort to observe and document the behavior of bears engaged in nuisance activities and corresponding human reaction whenever possible.

Data collection

From June of 2003 until September of the same year I participated in UK bear trapping efforts in southeastern Kentucky. Traplines were located in Cumberland Gap National Historical Park (CGNHP) and adjacent Shillalah Creek Wildlife Management Area (SCWMA) in Bell County, as well as the Hensley-Pine Mountain Wildlife Management Area (HPMWMA), which spans portions of both Harlan and Letcher counties. Trapping efforts by other graduate students continued in these locations throughout my study period, and in Kentenia State Forest in Harlan County as well (figure 3.1).

Although my own trapping efforts were primarily conducted in 2003 and my observational study began in 2004, I selected 2002 as a start date for calculations because it was the first year of any research trapping effort by UK. All handling procedures were reviewed and approved by the University of Kentucky International Animal Care and Use Committee (protocol # 626A2003); for additional information on trapping protocols, see Unger (2007).

Bears were trapped in remote forested areas using modified Aldrich snares (Johnson and Pelton 1980) along research traplines. These snares are made from steel cables that have been fashioned into a noose and then attached to a spring arm. The snare is placed in a short funnel constructed of available materials, such as rocks and brush, which terminates in a bait pile. The snare itself is anchored to a tree or other immovable object at the apex of the funnel and then the noose is laid over a slight depression dug in the earth containing the spring trigger and disguised with leaves and brush. When the bear approaches the bait and places its paw in the hole, the spring is released, and the bear is snared by the foot. This type of trap is lightweight and can be completely hidden using natural materials, making it useful for trapping bears in wilderness areas and/or bears that may be leery of human activity.

Bears were also trapped by KDFWR officials in these three counties, as well as elsewhere in the Commonwealth, in response to nuisance complaints. These bears were most often captured using a culvert trap (Figure 3.2). Culvert traps are extremely heavy and bulky and are typically only used in areas with vehicular access. However, they are considerably safer for both bears and nearby humans than snares, making them a good

choice for more developed areas where most incidences of nuisance activity occur (Erickson 1957). For more information on the capture and handling protocols for the bears in this study, see Unger (2007).

Combined trapping efforts resulted in the capture of 63 different bears between 2002 and 2006, each of which was given a unique UK identification number. At capture, some of these bears were fitted with VHF, GPS-enabled, or ARGOS-linked radio collars which allowed me, as well as other researchers, to track their movements remotely. These bears also received permanent numbered punch ear tags of the type used to identify cattle. From 2002 until 2005, most of these tags were retrofitted before application with three 12 cm colored strips or “streamers” of vinyl arranged in a unique color combination. This allowed positive identification of individual bears visually at some distance, when the streamers could be seen. From 2005 on, bears received ear tags without vinyl streamers.

In addition to the bears described above, there were 11 other bears captured as a result of nuisance activity, which were not collared or given identifying numbers, and 20 bears that were handled for the first time during this period as a result of mortality, primarily as a result of poaching or vehicular collision. In total, I examined data for 94 different individuals.

I gathered information on these 94 bears from my own trapping records and notes as well as from a database created by KDFWR and provided to UK, which detailed 167 relevant handling events between 2002 and 2006. Handling events included first captures, repeat captures, den visits, and mortalities. These data formed the basis of my analyses of bear demographics and condition across capture areas, and allowed me to compare bears with known anthropogenic feeding behavior to those not known to engage in this behavior. I also used these datasets to calculate mean litter size for collared female bears and compare these findings to data collected in other states. I used SAS (SAS Institute, Cary NC) for all statistical analyses and differences were considered significant at the $P < 0.05$ level.

Using witness reports and radiotelemetry of collared bears, I periodically located and monitored the behavior of several nuisance bears from June through October each year of my study. In 2003, I obtained approximate locations of collared bears by use of

aerial telemetry using techniques described in Eastridge (2000). As the error rate for radiolocations obtained in this manner can exceed 1500 m (Eastridge and Clark 2001), I used information gathered in this manner only as a general guideline for where to begin my search for a bear on the ground. In subsequent years, I located bears from the ground both by triangulating on their collar's signal and by pinpointing the direction of the loudest signal using techniques described in Springer (1979).

Between June 1 and September 1 in 2004, 2005, and 2006 I conducted first hand behavioral observations at KCSP as well as at private residences two to three nights per week, recording information about both marked and unmarked bears. When present, I observed bears engaged in nuisance activities and documented characteristics of behavior including: the time of approach, proximity to people and to other known bears, vigilance behavior, and reactions to human interference. I noted frequency of garbage visitation at the park, and, where possible, recorded what the bears ate and what they left behind.

Rangers often employed certain "hazing" techniques, described in greater detail in Chapter 5, where they shot rubber bullets and/or cracker shells at garbage feeding bears in an attempt to discourage nuisance activity. When hazing efforts were implemented, I recorded their apparent success as measured by the refractory period until the bear's next appearance. I also calculated how many observations by the public could be generated by a single bear and did informal interviews with observers following nuisance activities, recording viewer perception about the encounter in my field notes.

Individual bears with a previous capture history were identified by the unique color combinations of vinyl streamers and/or the radiotelemetry frequencies of their collars, if they were wearing one. When bears were unmarked, characteristics such as size, color, chest markings, and any scars or other unique features were used to distinguish them to the extent possible. A table of codes adapted from Nevin and Gilbert (2005) may be found in Appendix C as well as a related table of codes for human activity in Appendix D.

Data collection of bear behavior was too sporadic and non-random to allow valid statistical analysis but, wherever possible, behavior was examined and tied to concurrent human activity in the area in an attempt to determine average approach and flight

distances and evaluate habituation levels over time. Bear spatial and temporal habitat use trends were also documented in an attempt to lay the groundwork for future study.

I used two additional data sources in an attempt to evaluate the breadth of nuisance problems and individual bear activity. First, I examined 56 nuisance reports that were filed by KDFWR officials within the study area between May of 2002 and September of 2006. The reports were collected opportunistically from KDFWR whenever they were made available and do not represent the total number of reports filed by nuisance complainants with KDFWR during that period. Second, I looked at eight additional cases of nuisance activity identified via snowball sampling, for which I did not have nuisance reports, referred to here as “nuisance accounts.” Together these two sources gave me a total of 64 cases of nuisance activity for analysis.

Participant Observation

Introduction

Unlike interviews, which are becoming increasingly common as a technique to illuminate attitudes towards wildlife and wildlife management, participant observation is still rarely employed in human dimensions of wildlife research. This is unfortunate as participant observation allows researchers to contrast what people say with what they do and serves as an important check on reported behavior (Becker and Geer 1970; Gans 1999).

Participant observation has a rich history in both anthropology and sociology and in recent years has been widely used by researchers involved in public health and medical research (Gans 1999). It can include a range of different methods and while it is primarily a means of gaining qualitative data, quantitative information is often gathered at the same time. Participant observation allows the collection of detailed and accurate information about the population under study. It is the best way to study illegal or taboo behavior that would be impossible to examine via a survey or other method (Adler and Adler 1994).

The use of participant observation offers increased validity (Bernard 2002) and richer data (Snow et al. 1986), and it greatly facilitates the interpretation of related results (e.g., from a survey). Participant observation helps researchers understand the

perspectives of the people being studied (Mack et al. 2005) and allows researchers to uncover factors that could have an impact on the research questions but that were previously unknown (Gans 1999); the more cryptic the behavior of interest, the more important this becomes.

As a survey cannot yield information about a question no one knew to ask, participant observation can be a vital precursor to other research (Duda et al. 1998; Denzin and Lincoln 2000) as well as help to develop culturally appropriate survey questions (Bernard 2002). Conversely, participant observation can help in the understanding of the data already gathered using other methods (Tope et al. 2005).

Data collection

In addition to the various methods of data collection listed above, many of which might also be considered to overlap with the category of participant observation, I gathered a great deal of information simply by living within the study area for an extended period of time (Fontana and Frey 2002). In the summer of 2003, I spent June and July in the study area trapping bears for a study of their ecology, but at the same time was able to observe people observing bears. This initial study period and associated field notes helped form the basis of my later study of human-bear interactions. In February of 2004, this aspect of my field research and data collection began in earnest with the formal beginning of this project and the inception of the Black Bear Festival and Black Bear Task force, of which I was invited to be a member.

I was what is classified as a “participating observer” (Bernard 2002); the people about whom I was taking notes were aware I was doing a study on black bear-human conflict and that this was the nature of my involvement with bears in the area and with them. However, I lived in the area and participated in local events and activities as a resident, to the extent possible. I also gave presentations and participated in workshops and activities concerning black bear awareness, natural history, and nuisance mitigation techniques during the study period.

During the summers of 2004, 2005, and 2006, I lived in the city of Cumberland between May and August, shopping, eating, and recreating within my study area. In 2004, I lived in a garage apartment belonging to the tourism director. In 2005 and 2006 I

lived in a single apartment over a furniture store in downtown Cumberland, normally rented to coal miners. In addition to my presence in the summer, I made at least monthly and typically bi-monthly trips to the study area throughout the year for black bear task force meetings and other purposes. I became fairly well known in the community, and people would seek me out to ask me questions or tell me about bears. This allowed me to have multiple informal interviews with several people over time (Douglas 1985).

When in residence in the summer, I typically spent at least three or four evenings per week in Kingdom Come State Park, normally arriving around 6 pm and staying until midnight. I also made periodic trips to the park during the day depending on recent reported bear and human activity.

I participated in local activities, and attended meetings and social events. On these occasions I was sometimes able to conduct informal interviews; in other cases I recorded pertinent information about my interactions after the fact in taped or written field notes; the former were later transcribed. I collected quantitative and audio visual data when possible: I counted the number of vehicles I saw in the park or the number of times the same cars made a circuit of the park in search of bears. I took many pictures of bear-related artwork, signage, and statuary in the Tri-Cities area that appeared during my time there.

When researching the relationship between coal mines and human-habituated bears, I was unable to get as many taped interviews as I had originally hoped for, because of a reluctance of participants to comment on the record, but I was able to visit several different mines and talk with the foreman and miners. I was also able to talk to miners later in other places such as KCSP.

Other materials collected on site

In addition to interview and field notes, I included newspaper articles, web board postings, and other media in my analysis. These were collected opportunistically but every effort was made to include all articles written about black bears during the study period as well as all relevant text from three major message boards. All field notes as well as other materials were coded and analyzed using the same procedures as used with interviews described above.

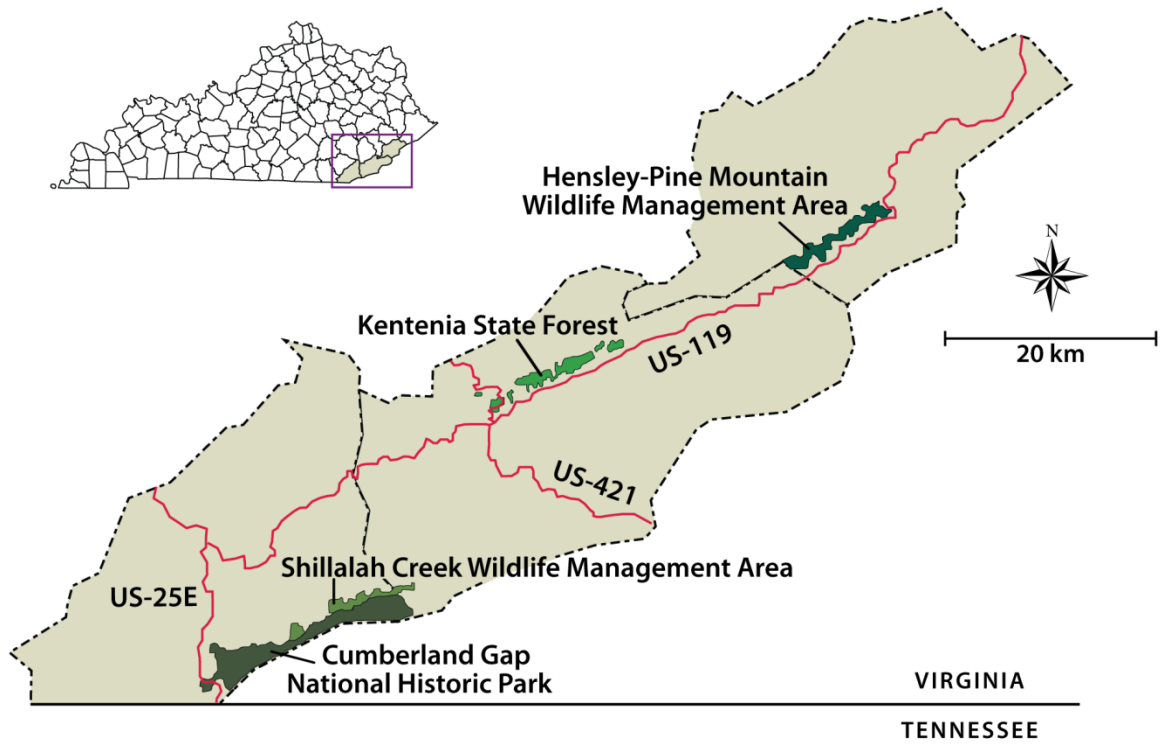


Figure 3.1 University of Kentucky black bear research trapline locations in southeastern Kentucky 2002-2006.



Figure 3.2 Photograph of a culvert trap belonging to the Kentucky Department of Fish and Wildlife Resources. Photo by Jeremy Williams, used here with permission.

CHAPTER 4: WATCHING BEARS IN KINGDOM COME: THE EVOLUTION OF BEAR-BASED WILDLIFE TOURISM IN EASTERN KENTUCKY

Introduction

In this chapter, I examine the development of a tourism phenomenon centered on bear watching in Kingdom Come State Park in Harlan County, Kentucky. The return of the black bear to this area provided a recreational opportunity for hundreds, sparked a citywide identity shift and a yearly festival, and created a backdrop of both hope and controversy for the Tri-Cities area. I explore the background that led to the dynamics described, the key stakeholders, and the consequences and repercussions of this activity.

Inception

Interactions with animals have been a huge part of human life dating back to the earliest humans, who both preyed upon and fell prey to other animals. Humans have hunted wildlife for food, pelts, and protection. They have sought out wildlife for cultural and spiritual reasons (Orams 2002). They have domesticated animals for food, clothing, assistance, and companionship. The role of animals has taken on different forms and levels of significance but has always been a part of human society (Clutton-Brock 1999).

In the last two centuries, human-wildlife interaction in the form of observing wildlife as a type of recreation has become increasingly formalized and widespread. In the 18th and 19th centuries, wealthy Europeans traveled to Africa to see and hunt exotic species (Adler 1989), while explorers and naturalists discovered and documented previously unimagined animal diversity around the globe. Many of the animals were sent back to the mother country as specimens, examples of new species. Most were sent back dead, but others were imported alive and formed the foundation of zoological gardens where people could come and see these strange new animals for themselves. Opportunities for observing wildlife *in situ* grew as well, and today many countries are managing natural areas in a manner intended to facilitate wildlife tourism (Shackley 1996).

Economics of tourism

Tourism, including wildlife watching, is big business. Tourism is the largest industry in the world (WTTC 2011), directly contributing \$1,757.5 billion dollars of economic activity to the global GDP in 2010 (WTTC 2011). One of every 12.3 jobs in the world is related to tourism and it is the economic cornerstone of many countries. In the United States alone, tourism is a multi-billion dollar industry (WTTC 2011) with wildlife-related recreation such as hunting, fishing, and wildlife watching accounting for \$120.1 billion of the total (USFWS 2007). Of the 87 million annual wildlife recreationists estimated in the United States Fish and Wildlife Service's 2007 review, 71 million were wildlife watchers, more than hunters and anglers combined. Between 2001 and 2006, hunting participation declined by 4% and fishing participation by 15%. In contrast, the number of Americans participating in wildlife watching activities increased by 8% (USFWS 2007). Wildlife watchers spent \$45 billion in 2006 alone, 53% of that on equipment.

The popularity of wildlife watching as a form of recreation is rising not only globally, but nationally and regionally as well. According to a 2006 state overview (Aiken 2009), residential wildlife watching increased nationally by 5% between 2001 and 2006, and by 1% in the east south central region, comprising Alabama, Kentucky, Mississippi, and Tennessee. In Kentucky, 41% of residents participated in wildlife watching activities, well above the national average of 31%. Wildlife watching activities taking place within the Commonwealth of Kentucky increased by almost 50% between 2001 and 2006, and observations of mammals specifically increased by 25% during that period. As the number of wildlife watchers increases, they represent a growing economic force.

Semantics and tourism taxonomy

One result of increased wildlife tourism is that more attention is being paid to its environmental and cultural impact, both in the popular press and in scientific literature (Wilkes 1977; Boyle and Samson 1985; Duffus and Dearden 1990; Russell 1995; Lemelin 2004). In an effort to find a way for wildlife and ever-increasing human populations to coexist, NGOs, governments, and wildlife managers have sought

mechanisms that allow local populations to benefit from their proximity to wildlife and give them an incentive to conserve and protect natural resources. A profusion of conservation programs has sprung up around this premise, many of them based around wildlife-related tourism (Lybbert et al. 2004). However, the success and specifics of these programs vary widely as does the terminology used to describe them. These semantic considerations highlight the underlying debates and also the developing understanding of the importance and impact of these activities.

The term “ecotourism” is one commonly used in the popular vernacular to refer to tourism based around the natural environment (Wunder 2000). Ecotourism in its strictest sense implies a purposive activity: travel to a natural area conducted in a way that is not only non-destructive to the environment but contributes directly to conservation, and also benefits local people by bringing in income and promoting sustainable development (Boo 1992). Ecotourism may also include educational and conservation-oriented elements (Beaumont 2001).

Nature tourism is similarly focused on the visitation of natural areas but, in contrast to ecotourism, may encompass a larger variety of activities, many of which offer no ecological or conservation benefit (Lemelin 2004). Consumptive nature tourism typically refers to pastimes where resources are removed from the environment and includes such activities as hunting and fishing as well as specimen collection (Preece and Chamberlain 1993). In contrast, non-consumptive nature tourism activities, such as bird watching, are non-extractive and, in theory, involve no harm to the environment.

Non-consumptive wildlife tourism was originally intended to refer to “a human recreational engagement with wildlife wherein the focal organism is not purposefully removed or permanently affected by the engagement” (Duffus and Dearden 1990). The principal assumptions behind this kind of tourism are that even if it does not rise to the level of ecotourism, it may still be beneficial to the local economy (Whelan 1988), it is sustainable, and does not involve killing or harming any animal. The actual practice of most wildlife tourism is far more complex, and these key assumptions are challenged by recent research that shows that even viewing animals can cause harm when it results in stress to the target wildlife, behavioral changes, abandonment of young, or environmental degradation (Boyle and Samson 1983; Boyle and Samson 1985;

Jelinski et al. 2002). The observation that a great deal of non-extractive tourism still results in substantial negative environmental impact has made the term non-consumptive somewhat ambiguous and its basic premise now in doubt.

Even the designation of “tourist” is open to interpretation and is considered by some to be derogatory when applied to people by others engaged in similar activities but who consider themselves “recreationists” (Ross 1994). Rather than being considered as two different terms, tourism and recreation in natural areas are better conceptualized as points along a continuum (McKercher 1996); both activities occur in a natural setting and are related to leisure (Murphy 1986), with tourism focusing more on travel (Leiper 1979) and recreation focusing more on the activity. However, the distinction is somewhat arbitrary (HaySmith and Hunt 1995). The literature is rife with these kinds of nuanced semantic distinctions. For the purposes of the present project, I will be treating wildlife tourism and non-extractive wildlife recreation as synonymous and discussing the activity of wildlife watching *sensu* USFWS (2006), which refers to recreational behavior where wildlife is the primary focus of the activity and where the activity could include simply viewing wildlife but might encompass a variety of activities including observing, photographing, and even handling or feeding wildlife (Duda et al. 1998). It may occur at different scales, at the local level as well as in activities further afield. Residential wildlife watching refers to activities around the house whereas non-residential wildlife watching refers to trips taken >1.6 km from home (USFWS 2007). This definition of wildlife watching does not necessarily conform to the standards of the idealized conception of non-consumptive in that it may be harmful, beneficial, or neutral to the target wildlife, nor is it ecotourism as it may or may not be beneficial to the local economy. For the purposes of this analysis I am excluding activities sometimes included under the wildlife watching umbrella that involve captive wildlife such as zoo visitation (Shackley 1996).

Focal species

Tourists travel to see a diverse array of wildlife species from stingrays in the Cayman Islands along the coasts of Australia (Shackley 1998; Newsome et al. 2004) to Mexican free tailed bats (*Tadarida brasiliensis*) in Austin, Texas (Ryser and Popovici

1999). However, there is no question that some animals are more appealing to human viewers than others. So called “charismatic megafauna” are large-bodied animals, usually but not always mammals, and are often used as flagship species to promote and galvanize support for conservation not just of the target species but their associated ecosystem (Walpole and Leader-Williams 2002).

While tourism often centers around an exotic locale or a diverse activity base, the presence of a single species of interest can be enough to spark the development of wildlife based tourism (. Not perhaps charismatic in a conventional sense, but large and compelling nonetheless, Komodo dragons have allowed the development of wildlife tourism in Komodo National Park in Indonesia (Walpole 2001). By the beginning of the twenty-first century, whale watching tours were attracting 9 million tourists annually with steady growth predicted (Hoyt 2001), and tourists willingly pay thousands of dollars for a chance to see mountain gorillas in Rwanda and Uganda (Butynski and Kalina 1998). The appeal of the species in question is pivotal in the development of wildlife watching tourism, but at least as important is the animal’s accessibility and apparency to visitors (Hammit et al. 1993). People must have a high likelihood of visual encounters with the animals they have come to see for an associated tourism industry to develop (Shackley 1996).

Anthropogenic feeding

There are a variety of wildlife spectacles that occur predictably in time and space with no interference from humans whatsoever. Annual migrations, spawning salmon and the animals that feed on them, the nightly exodus of bats from their caves, all occur irrespective of human involvement. In these situations, the development of associated tourism is simply a matter of providing site access, viewing platforms, or other infrastructure to allow for wildlife watching. However, a great many species, particularly those that are naturally cryptic, reclusive, or do not gather en masse, require some type of incentive to bring them close enough to people for recreation based on wildlife watching to take place.

Typically, the incentive for approach involves food. In many cases this occurs when animals are drawn to an incidentally occurring anthropogenic (human-oriented)

food source and wildlife watching develops around it, such as the dump-feeding grizzly bears of Yellowstone in the 1960s (Craighead et al. 1995). In other situations, wild animals are intentionally attracted to a central location by food placed there to lure them out of the surrounding landscape. The unusual aggregations of Komodo dragons at Komodo National Park mentioned above are drawn to viewing areas by freshly killed goats, which are placed there with the express purpose of attracting them (Walpole 2001). In some cases, it is a combination of the two: wildlife is first attracted to a midden or natural byproduct of human activity and later that activity is increased and formalized in order to maintain and strengthen the appeal to wildlife and allow for regular observation. The stingrays (*Dasyatis* spp. and *Myliobatis australis*) of Hamelin Bay in Western Australia provide such an example. They were first drawn to the area by commercial shark fishermen who cleaned their catch in the bay and discarded the unwanted fish entrails in the water. Subsequently, a wildlife viewing industry evolved and tourists now use the provided fish-cleaning table to gut fish, tossing pieces into the water to the waiting rays (Newsome et al. 2004).

The impact of these associations on the target wildlife varies. There are a small number of studies that indicate that feeding wildlife can be benign or even beneficial to the target species, leading to larger body mass and increased survival (Rogers et al. 1974; Brittingham and Temple 1998; Beckmann and Berger 2003a), as well as higher reproductive success (Rogers 1976; Alt 1980; Ward and Kennedy 1996). However, there is also a growing body of literature that illustrates the ways in which human-wildlife interaction, especially that which depends on artificial provisioning, can have disastrous consequences for both people and animals (Raman et al. 1996; Orams and Deakin 1997) through unsafe habituation (Huber and Reynolds 2001; Herrero 2002), the creation of dependence (Craighead et al. 1974; Will and Hampton 2007), disrupted ecological relationships (Beckmann and Berger 2003a), and disease transmission (Robb et al. 2008; Gilardi 2010). What is clear is that, for better or worse, providing access to anthropogenic food has the potential to change the behavioral patterns, distribution, habitat use, and population dynamics of wildlife (Orams 2002).

Theoretical framework

Traditional wildlife management paradigms work well for consumptive pursuits such as hunting and fishing but do not apply to a situation where the final product is “a recreation experience” (Duffus and Dearden 1990). Recent papers address this (see for example Burns and Howard 2003) and have expanded the examination of these issues to include broader social and historical contexts for the current issues and associated conflicts. Within the last 20 years, wildlife tourism and wildlife watching have begun to be viewed as a social phenomenon and the consequences measured in both ecological and social terms (Reynolds and Braithwaite 2001; Orams 2002).

Duffus and Dearden (1990) presented a theoretical framework for wildlife tourism consisting of three central elements: the focal species, the human user, and the history of the relationship. These combine to form the basis of a wildlife tourism experience. Their consideration of the history of the relationship is unusual. The authors point out that history affects what the demand for wildlife contact will be through cultural conditioning and the influence of people on animals. Based on my research in the Tri-Cities, I include within historical impact the symbolic characteristics of the animal and identity of the stakeholders within the history of the people. Knight (2000) acknowledged these symbolic dimensions with a focus on human-carnivore relationships and conflict rather than tourism. He suggested “human conflict with wildlife is often an expression of conflict between people.” I combine these topics and submit that human relationships with animals (both conflict and alliance) are historically situated and are sometimes expressions of relationships between people.

Results

Patterns of visitation

According to park management, bears were first seen in KCSP in 1992; these were believed to be adult males and were seen late at night and only 2-3 times per year (R. Fuller pers. comm. August 2005). According to participants, the majority of park visitation during this time was unrelated to either bears or wildlife tourism. Visitors came

primarily to use the picnic areas, either as individuals or as part of larger events; family reunions and church picnics were both common.

Bear visitation to the park increased between 2000 and 2003, still occurring primarily at night (R. Fuller pers. comm. August 2005). With this increase, the number of people traveling to KCSP to observe bears increased as well. In 2003, the first year of my study, I conducted observations at least 3-4 days per week while trapping in the area and found that people began arriving to observe the bears around 9 pm and continued past midnight. Seventy five percent of the bear-oriented park visitors I observed during this period were male and many were teenagers or young adults. At any given point, there were typically < 5 cars circling the park at one time. This pattern was consistent with visitation observed in spring and summer of 2002 by other UK researchers as well (M. Orlando pers. comm. May 2003).

Beginning about 2000, that's when the [bear] visitation started hitting at least about a weekly basis. We had started seeing increase in traffic and the rangers reporting people driving through the park at night. Beginning about that time period, we started getting these people who were wanting to see the bears. Sometimes there was just this constant stream of cars going through the park.

– Male Park Employee

Though a nocturnal temporal pattern of park use by the bears predominated, there were a few exceptions to this pattern. The most notable occurred when a female bear and two yearling cubs appeared on the afternoon of 21 April 2003 while the park was full of Easter picnickers. The two yearlings entered a picnic area where they reportedly bluff charged several visitors (J. Plaxico pers. comm. April 2003) and ate the food abandoned by picnickers who retreated to their vehicles. These bears and their mother were darted and tranquilized by KDFWR personnel and given individual ID numbers, ear tags and radio collars following the protocol since outlined by Unger (2007). The sow was labeled F013. All three bears were then relocated by KDFWR to a reclaimed strip mine nearby. Following their removal from the park, the general pattern of nocturnal bear and bear watching visitation resumed.

Visitors usually drove through the park in a looping pattern, traveling through the upper park, down past the picnic shelters and campgrounds, and turning around at the

pond to repeat the circuit (see Figure 2.3). The most common place to see a bear was in either of the two covered picnic shelters. Since large groups of human visitors to the park regularly used the picnic shelters during the day, the cans there consistently contained discarded food that attracted bears, and they were often turned over by bears at some point during the night. In addition, both shelters were illuminated at night with overhead lights, which meant that the visiting bears could more easily be seen by observers. The constant traffic past the campsites led park staff to install a gate that was to be closed at night, although this turned out to be largely unnecessary because the following year attention was refocused to a different part of the park.

In the spring of 2004, F013 mentioned previously was once more observed in KCSP, this time with five cubs of the year. This family group began appearing >4 days per week at the park and received considerable media attention from newspapers within Harlan County. The bears' appearance was concurrent with a dramatic increase in park visitation (R. Fuller, pers. comm. August 2005).

Although these bears appeared regularly in the park, and were often seen in the middle of the day, I only ever observed them in the upper part of the park, never in the lower park picnic areas. They demonstrated both apparent temporal and spatial displacement from the male bears that continued to visit the picnic shelters at night. This pattern was observed for at least one other female with cubs as well: they were seen only in daylight and only in the upper part of the park.

After the appearance of F013 and her five cubs in the spring of 2004, the demographics of human visitors to the park changed. Based on my own observations and those of park staff (D. Quillen pers. comm. July 2004; R. Fuller pers. comm. July 2004) a greater percentage of park visitors were women, family groups, and retired people than in the preceding years and peak times and activity patterns of observation shifted. Peak visitation in 2004 occurred earlier in the day than it had in previous years and these new visitors circled the upper part of the park but passed through the campgrounds less frequently. People primarily visited the park from noon until dusk but generally left when it became too dark to see the bears without the use of a spotlight, which is illegal in KY (KRS 150.395, 360). The trashcans in the upper parts of the park saw heavier use during this period than they had previously, both because visitors to the park used these areas in

larger numbers for picnics and because these cans were often intentionally baited by visitors hoping to attract a bear.

F013 became quite habituated to people, feeding unperturbed as long as people maintained a distance greater than 15 m. Other bears, distinguishable by their unique ear tags or lack thereof, were observed by park visitors as well. In total, I observed 20 different, identifiably distinct, adult and subadult bears within KCSP during the study period between 2003 and 2006, including 15 males, 4 females, and 1 unknown. I also personally observed or was shown photos taken by park visitors of 15 different cubs of the year, for a total of 35 individual bears. During the summer of 2004, I observed or was shown photographs of three different sows with cubs present (including both cubs of the year and yearlings), including F013. In 2005, F013 continued to use the park with her cubs and an additional sow with cubs of the year used the park as well. In 2006, I only observed F013, who had 4 new cubs of the year.

Bears were occasionally seen or reported in the park foraging for natural foods such as acorns but, for the most part, when they were visible they were either eating anthropogenic foods or moving between anthropogenic food sources. Many newspaper articles were written about the bears in general and F013 and her cubs in particular, encouraging readers to come to the park to see them.

We've seen it go from local people coming up to see them, to the news media getting a hold of it, and then for about three years straight we had camera crews and AP wire service and everybody contacting us, each year wanting to do an article. We began to see a big increase in visitation. With the newspaper articles in 2003, 2004, we had people contacting us from other parts of the state, from as far away as Louisville and on into western Kentucky, asking "If I come there, will I see a bear? And what time do I need to be there to see it?" Of course we tell them "Yes the bears are here but we can't guarantee anything. You may happen to hit a dry spell where we won't see them for a week."

– Male Park Employee

Human park visitors

I divided park visitors into four basic categories based on their visitation patterns, which proved predictive for much of their other behavior and comments discussed below. Out-of-area visitors were classified as those traveling to KCSP from greater than 80 km

away. New or periodic visitors included both those visiting the park for the first 1-3 times or those that visited only sporadically (defined as fewer than three visits per month). Regular visitors were defined as those who had visited the park on more than four occasions over a period of one month. The final category was Bear Watchers, technically a subset of regular visitors, who began visiting the park typically at least once daily to observe the bears, and formed a kind of social club around the activity. The Bear Watchers not only watched bears but had cookouts and projects centered around bears and the park, including a chili dinner, and a visit with Santa for area children. Membership was somewhat fluid, but at any given point there were between 20 and 25 active Bear Watchers. Most of these people had known each other for some time (in excess of 50 years in some cases). Unless otherwise specified below, the term “regulars” includes both those who self-identified as Bear Watchers and those who did not but who still met the criteria for regular viewers.

More than 80% of the people visiting KCSP with whom I spoke lived within 50 km of the park and although they did not always describe themselves as “local,” they lived near enough to travel to the park as a day trip or to make multiple trips to the park during the course of a day, and they had a general familiarity with the area. Of the regulars I interviewed, one third had spent extensive time at the park and in the area even before it was a park, whereas others had not visited the park in years or not regularly but began to do so when they read or heard about the bears' return.

I never went to the park growing up. We may have went one time a summer. But this past year, I've spent more time in that park than in my entire life. I mean it's been every day. I get up, take my daughter to school and where am I at? I go straight from school to the park. I go off and I work an hour and I go back to the park. I go back off the hill and I work an hour and I go back to the park. I go pick her up from school, she walks out the door and the first thing she says is “Dad – we going to the park?” “Yeah, we're going to go to the park.” We'll stay up there until 9, 10, 11, 12 o'clock at night, sometimes later than that. But as far as going to the park before the bears, I bet I'd been in that park 10 times in my whole life, drove right through, I mean not stop. Just drove right through and come back off. But now, it's, you go to the park, you'll stay.

– Male Bear Watcher

Viewing

Visitors employed two strategies for seeing bears, sometimes alternately. They either circled the park driving slowly while looking for bears or overturned garbage cans, or would stake out “a good spot” and wait for a bear. “Good spots” were identified as certain areas that had been visited frequently by bears in the past, places where the visitor had observed other people eating earlier, or where there was an unobstructed view from the parking area to the garbage can. Typically several cars parked next to each other and the occupants conversed while they waited. Sometimes people got out of their cars and stood around talking. Occasionally, visitors brought lawn chairs and arranged them in front of a trashcan. Regulars were generally disdainful of this practice, however. Observing a family arranging chairs at a can one woman said, “No bear’s going to come when they’re doing that... it’s like they’re getting ready for a movie to start.”

The bears were usually only visible for a few minutes at a time, averaging from two to five minutes/visit, though they reappeared at different garbage cans during the same day, typically visiting multiple cans within a 45 minute. visitation period. Regular visitors became adept at judging where bears would go next and would relocate to that spot in advance of the bears' appearance. Visitors used cellular phones extensively to communicate between friends and family so that one group could monitor a greater area simultaneously as well as to alert people not on the mountain to the bears' presence. The rangers sometimes offered advice to newcomers about where the bears could best be seen.

In midsummer, the traffic became most intense around dusk. On three occasions in June of 2004 I counted more than 100 cars in the park at the same time, the largest numbers observed during the study. Because of the traffic volume and the number of new viewers who didn't know how to “act right” according to Bear Watchers and regulars, most bears were scared off almost as soon as they appeared and prolonged viewing opportunities were reduced. In July of 2004, F013 and her cubs altered their visitation timing and began feeding in the park early in the morning or early afternoon. This shift was tracked by Bear Watchers, and shortly thereafter I began seeing people in the park as early as 6-7 am, when previously the park had been largely unvisited at that hour. The early morning visitors were almost exclusively members of the Bear Watchers group.

Park visitors spent a lot of time talking with each other about when they were at the park last time, how long they were there, and what they saw. People appeared somewhat competitive and compared how many trips up to the park they had made in a day and how long they had spent there. Some couples made trips to KCSP two to three times per day at least five days per week, often staying over an hour each time.

We come up here early in the morning and leave late in the evening, sometimes come up here late in the evening and leave during the night, or early the next morning. We'll start off the hill to go home and see a bear coming up the road, so we'll just turn around and follow him back up.

– Female Bear Watcher

Motivation

People devoted considerable time and energy to come to KCSP. While the bears were the primary attraction, visitors mentioned multiple other reasons for visiting in addition to viewing bears, primarily to “escape from city life” and to socialize with other park visitors. Goals for bear viewing varied. New visitors simply said that they wanted to see a bear. Repeat visitors came for the thrill of seeing different bears, or watching the same bears do different things. Viewing was often highly goal-oriented.

You want to see more, you think well, next time I'll see a different one. You get that in your mind. That's like we come up here sometimes and we'll see one male or maybe see a female and then we see the cubs and mama and the next time we won't see anything. It makes you want to come back the next time to see what you can see.

– Female Bear Watcher

Even in the absence of bears, most visitors still enjoyed the experience, describing the park as “just a good peaceful place to come.” One man pointed out “you meet people and talk with ‘em. When you ain’t got nothin’ else to do, it’s a good hobby.” Although the word “hobby” was used by only two people in interviews, it seemed to describe the activity for many regular bear viewers and all of the Bear Watchers.

The majority of Bear Watchers I interviewed were retired or disabled and did not work. Several had coal mining-related injuries or illnesses. One man was disabled because of a mine rock fall, another had a back injury related to heavy lifting and also suffered from mid-stage black lung, a respiratory ailment that afflicts miners. Two of the

women had lung-related health issues, and several of the Bear Watchers interviewed mentioned that they were physically impaired for one reason or another. “I can’t get around like I used to” one told me. Despite these limitations, they enjoyed spending time outdoors observing nature, devoting a considerable amount of time to this pursuit. Visiting the park gave structure to their day. One Bear Watcher said “When I’m not here I’m planning my next visit. I miss it if I don’t get up here.” Regulars, especially the Bear Watchers, had a high affinity for the park and for spending time outdoors. However, with the exception of occasionally riding a four-wheeler in the woods, bear watching was the main outdoor pastime of all of the people I interviewed. Poor health may have been a factor in the selection of this particular activity, though it was rarely suggested as such in their interviews.

The area now encompassing Kingdom Come State Park had been a feature of most Bear Watchers’ lives long before the return of the black bear or the park’s formation. One woman told me about how her father had carved his initials in Raven’s Rock when he was a boy, more than 100 years ago. She said “Daddy just about lived in these woods and grew up in these woods.” Many of the people visiting the park to watch the bears had grown up in the Tri-Cities or general vicinity and knew each other quite well. People visiting the park on multiple occasions often renewed lapsed acquaintances or built new relationships. Social networks and related socializing were key aspects of the bear-watching experience.

When we first started bear watching, we wasn’t really bear watching. We’d go up and we’d ride through the park and if we didn’t see ‘em, we’d go back home. And then I got up with my friend and these other folks up there and we all just started hanging out. And that’s become the fun of it. You know, just going up ‘ere, being with your friends, having a cookout, sitting around talkin’ waiting for the bear to come. You know, one may come out, it may not. That’s the fun, that’s what makes it fun. You just go up ‘ere, and being with your friends, family, and what have you.

– Male Bear Watcher

Visitors shared a lot of information, and sometimes rumors, while visiting the park. During informal interviews I often heard certain stories in multiple iterations during an evening or over a few days. These discussions went on as part of the socializing that took place during the periods when bears are not present, which was the majority of the

time. One man told me about how much he liked “what’s taking place up at the park, with people getting out and meeting their neighbors.” He talked about how someone had recently told him that “her daughter now had something to do, and it had helped her meet people.” Another person described how he had known two cousins all his life, but that he had never really gotten to know them until they began coming to the park. In a newspaper article, titled “Simple Pleasures Make Bear-Watching Expedition Fun,” the author wrote “One evening we sang gospel songs as we watched a storm roll in...the lack of bears didn’t matter” (Harlan Daily Enterprise 5/28/04).

Another aspect of Bear Watchers’ social networks was sharing photographs. Most of the Bear Watchers maintained photo albums containing a selection of bear pictures they had taken at KCSP. They brought these albums with them to the park and shared them with others. They discussed which bears they had seen and what the bears were doing. If someone captured something unusual the rest quickly heard about it and in many cases others tried to get their own pictures of a similar event. When one couple photographed a bear opening a supposedly “bear-proof” garbage can, other Bear Watchers waited at that can with their cameras for three weeks afterward.

In the summer of 2004, the tourism bureau began hosting a website where park visitors and Bear Watchers could post their photo albums and have online discussions. Not all Bear Watchers were comfortable with, or had access to, this level of technology so many did not participate, but several were regular posters. More than 50% of the pictures posted were similar. A bear, typically F013 or her five cubs, near or feeding from a trashcan was a common theme.

Risk perception

Regular park visitors interviewed had a low perception of risk posed by bears. They believed bears to be potentially dangerous, but found them generally passive unless provoked, which they had never observed. One man put it this way: “I’m not at all bothered that they do come around. I’m not trying to say I’m not afraid of them because I am, but it’s good to have them to watch.”

Regulars expressed concern about the behavior of others and stressed personal responsibility in relation to bear encounters. One described a time that he watched a young woman trying to feed a young bear:

She shoulda known better. But she got out and took a hamburger bun and threwed that to the bear and it never even noticed, it just went back to eating [garbage]. She went back to the car and opened a bag of tater chips. And this time she didn't stop at the fence, she went around the fence and bent over and threwed them chips and when she did, that bear never did take its eye off her. It set and looked right at her. And she made some kind of a move towards it, and just like that, split second, it was gone. And I thought as I watched her, that the bear had more sense than she did. That's not very good, that's not very good sense when you walk up to a wild animal like that.

– Male Park Visitor

Visitors rarely reported feeling threatened by bears, and when they did it was related to their proximity rather than any overt behaviors they observed from the bears. Those interviewed cited getting between a female and her cubs as the most potentially risky behavior that might occur.

No stalking, charging, slapping, biting, or bear-initiated contact with humans was observed during the study. Jaw popping and blowing from male bears being hazed from the picnic shelter areas were heard on nine occasions. Bluff charging was reported (though never observed by me) in three incidents, all involving male bears under two years of age, but none of the bears made contact with observers. A fourth anecdotal account of a young adult male bear (identified as M015) charging children on bicycles was later amended to portray the children as the ones chasing the bear rather than vice versa as originally described. On one occasion, a bear climbed on top of an occupied car in search of food but was not aggressive in affect.

During the summer of 2004, F013 and her five cubs repeatedly approached active picnic areas containing people and ate the abandoned food after the people left. The female bear's usual habit was to sit in nearby bushes until the people moved back to their cars. Most did, and few took any of their food with them. Knowing this, on at least two separate occasions, visitors arranged an elaborate buffet of foods on the picnic table in order to lure the bears to the open picnic area where they could be easily observed. The

picnickers, as well as other visitors, then were able to enjoy a prolonged appearance while she and her cubs ate the remains of the picnic.

The reaction of viewers when a bear made an appearance varied. For the most part, Bear Watchers and many regulars maintained a certain bear-watching etiquette. They were careful to shut their car doors softly and not to make a lot of extra noise. They generally refrained from using their flashes to take pictures unless it was very dark. Most of them stood beside their cars while the bear(s) fed. This was not universally true of visitors however. There was a subset of regulars, including two Bear Watchers, who pursued bears on foot to get better photographs, although these same viewers often criticized others for getting “too close.” Regular visitors offered advice to newer visitors about where and how to see bears. Sometimes they complained that a bear was “run off” prematurely by people “acting crazy.”

You gotta teach people, you gotta show ‘em what to do. And that’s what we want to do. I want everybody that comes in that park to see a bear. It’s not possible, but that’s what I want.

– Male Bear Watcher

We’re trying to teach people about driving through the park. How they act through the park. A guy pulled up beside me out there one day, and he’s just a playing that radio. It wasn’t loud, but he had his radio on. And I just kept setting there and setting there, hit started getting on my nerves a little bit and that guy said “Reckon one of these bears’ll come out?” and I said “Well, they come out when they want to” you know, I said “They’re not on no time schedule, they’re a wild animal.” I said “But I would tell you one thing” and I said “I hope it helps” I said “You need to turn your radio off ‘cause if they hear any noise they’re not going to come around.”

– Male Bear Watcher

Bear Watchers consistently ascribed certain positive attributes to the bears. They described them as “big,” “powerful,” and “majestic” as well as “graceful.” Many also said they were “like people,” “caring,” and maternal. Visitors described feeling awe, admiration, and – much less often – fear at the sight of a bear. Regulars described “personal” relationships with individual animals. Many said they felt like they knew certain bears, primarily F013 and her cubs; they also felt that she knew them. One woman explained that the “Mama bear knows I don’t mean her any harm. She and I have had a

contact.” She said this is why the bear was willing to come so close and appeared unafraid.

While many interviewees said that they exercised certain safety precautions (e.g., standing next to their car), most seemed unafraid of the bears and were willing to approach quite close to them, often to within less than 15 m if the bear was tolerant of their proximity. On one occasion a large male bear was startled while eating out of a trashcan in the lower picnic shelter. As he ran away, his claws left 16 cm gouge marks in the concrete. Several observers present that night said that this event completely changed their perception of the bears and that they would maintain a safer distance in the future.

During the study period, the park had two metal signs posted with information about the bears but all of the regular Bear Watchers I interviewed felt these signs were inadequate. Another effort to discourage feeding appeared to backfire when rangers posted “do not feed the bears” bumper stickers on garbage cans throughout the park. The cans were selected as a place to display the bumper stickers out of convenience but led to a great deal of confusion about what they meant. Many visitors interpreted them to mean that they should not use the garbage cans for disposing of their food or associated trash.

Bear Watchers suggested there should be signs and potentially leaflets available at the gift shop or a kiosk that explained how and where to watch the bears and gave more specific information about maintaining a safe distance and appropriate behavior. Though their terminology was the same, their ideas for content of this information differed substantially from that used by KDFWR in terms of what was meant by feeding and a safe distance. Bear Watchers also mentioned the need for place name signs that would facilitate explanations of the best places to watch for bears.

Rebranding with bears and community identity

While human and bear visitation was increasing at KCSP, the Cumberland tourism bureau was engaged in an effort to promote bears as part of the community. Together with the mayor at the time, the tourism director commissioned a new city logo and other promotional materials rebranding the city of Cumberland around the black bear. This new logo was used on signage along the two primary entrances to the city of Cumberland, on municipal buildings, police cars, and decorative tiles along pedestrian

walkways. Other bear figurines and statuary were placed within the city and in front of the tourism office.

At the tourism director's urging, a black bear task force was formed, comprising representatives of the tourism department, Bear Watchers, KDFWR, agricultural extension, UK (of which I was the representative), and the mayor. This task force was designed to promote the bears and community with a black bear festival, and to educate people about how to live with black bears. The task force also worked together on a strategic plan to bear-proof the community.

The tourism director was concerned about attracting people to the area and creating an unsafe situation.

It's great that they're here and they can draw people in, and we should promote it, to draw tourists into the community to help the economy. But at the same time that we're doing that, we also have a responsibility to promote safety and education as well. If we were going to try to get people in here, we had to also do it responsibly and that's where the Black Bear Task Force came in, getting that started to start coming up with a work plan, to bear-proof the community and educate the community and also create ways, a plan for us to use to do that.

– Female Tourism Official

As an alternative to watching wild bears at the park, with all the attendant problems that bears eating garbage might entail, the tourism bureau commissioned a feasibility study for a captive bear facility to be located within KCSP; this project was commonly referred to as “the bear sanctuary.” The Bear Watchers were initially not enthusiastic about this idea, but the park rangers were major promoters. This led to perceived disagreements between project supporters and several other people (including UK researchers) who the supporters believed to be opposed to this plan.

Most of the Bear Watchers I interviewed liked the idea of an added attraction to boost area tourism but were concerned about a captive facility resembling those they had seen in other areas, which they felt were inhumane. They went on to say they would be in favor of such a facility if it provided an alternative to euthanasia for a “problem” bear and were large enough to allow the resident bear ample space and relative freedom.

Well, at first, nobody wanted the sanctuary because they don't want to see a bear caged up. They've been somewhere and they've seen 'em caged up and they don't want a bear that roams in these mountains free, you know, put in a cage, and I understand that, 'cause I feel the same way. But I believe at the same time, if they put a sanctuary up there big enough, nice enough, and natural enough, you know... I think if you had some little area where you could put a bear who was giving you problems, and you put it in there rather than put him down or something like that, that would be all right.

– Male Bear Watcher

Economic development

It is unclear whether area businesses benefited from bear-oriented tourism and the associated increase in park visitation. More than 95% of the visitors I spoke with lived close enough to the park that they did not require overnight accommodations, which are limited to two establishments in the Tri-Cities in any case. Several Bear Watchers reported investing in new audio-visual recording equipment to improve their ability to photograph and record the bears. However these purchases were primarily made through online vendors and so did not benefit the local economy. The most likely retailers to have experienced increased revenue were the fast food restaurants in Cumberland. Park visitors frequently brought fast food to the park with them, in particular food from Hardee's® restaurant, and may have purchased fast food when traveling to the park for its convenience when they might otherwise have dined at home. Fast food was also used to bait the garbage cans and the bears' apparent preferences in fried chicken, based on what was and was not consumed, was a running joke in many conversations. Money for picnics, gasoline, and car repairs (in particular brakes and rotors) were also mentioned as possible contributors to the local economy.

Interviewees differed in their predictions of the future for the Tri-City area and the potential impact of bear-related tourism. Some felt that the return of the black bear might bring economic development and a re-casting of their local identity into something more positive. Becoming "like Gatlinburg" was mentioned in several interviews and by local tourism officials, though others discussed the ways in which their area might represent a more authentic alternative to Gatlinburg for those who were turned off by its commercialism and who wanted to see a bear in nature. People generally acknowledged that major tourism development was some years off, but most believed that the return of

the bear would figure in the economic recovery of the Tri-Cities and that it was already beginning to do so.

It has made a difference because there are people from the western part of the state that are coming here to see the bears, they're, you know, swinging down through when normally they wouldn't swing through, even if they just stay for the day and one night, you know, they're still coming – it is helping. And it's actually helping the people in the community get out and go. There are people in this county that have never been to Cumberland before, and they're now traveling to Cumberland and they're buying gas, they're buying hamburgers, and they're going up the park and having a picnic and getting to the other end of the county. So, it's helping not only out of the county, but in its own community of people.

– Female Park Visitor

There was frequent mention of the shortage of stores and the restricted hours that the limited number of stores kept. One participant felt that the community was a “dying mining town,” and that nothing, not even bears, could halt its downward momentum. However, most expressed some optimism – provided the bears were allowed to stay and that they were promoted appropriately.

All this community has ever had is coal. You know, it's a little coal mining town. But I remember riding up here on a bicycle when I was small, right up here on this corner, 'cause we used to live down the street here. You'd have to set over there for 15 or 20 minutes, you couldn't get by the traffic. And I wasn't allowed on the streets up here on account of the dangers of the cars. I mean it was really a boom, boom town, you know. But boy has it changed. We need something to bring something back to this community. And here's something that we finally have. I'd like to see tourism, more tourism. I'd like to see more people in here. And uh, these bears are a very good opportunity for that. You know, if we can get things going right! I'm not saying it could save Cumberland, but I'm saying it could really help if it's promoted right and done in the right way and that's the way it's going to have to be done.

– Male Bear Watcher

Power and politics

Bear Watchers and other regulars displayed feelings of ownership and propriety towards the park, seeing the park management as “caretakers” with whose performance they were often dissatisfied. This was typically mentioned in the context of the history of

the land that is now KCSP and the longevity of its use by area residents. They also saw themselves as being allied with the bears and opposed to hazing and relocation or restrictions on feeding, feeling that they knew best what should be done. They resented the interference of outsiders with “their bears.”

These are our bears, that's the way we feel. You know, it's like they're our – kids. They're our adopted youngins. You know? And who wants to see their adopted youngin' packed off?

– Male Bear Watcher

Regulars were often unhappy with the actions of the rangers, who were state employees, but were generally more sympathetic towards them than they were towards agencies from outside the immediate area such as the Parks Department and KDFWR, which was often referred to generically as “Frankfort” (the state capital and government seat). A major difference in perception may have been that the rangers were also local residents with family ties to the area, and, as such, also invested in the economic development and fate of the community.

For the most part (exceptions discussed below) the rangers were tolerant of the Bear Watchers and allowed visitors to watch bears eating abandoned picnics for as long as 45 min. The two rangers said that they wanted people to be able to see the bears and get some good pictures. The rangers coordinated traffic and served an interpretive function, answering questions about the bears. Typically they did not attempt to “run the bears off” unless people were getting “too close.” Their interpretation of “too close” averaged from 20 to 30 m, considerably closer than the definition at other state and national parks such as Yellowstone National Park and Great Smoky Mountains National Park at 91 m and 46 m respectively.

If the rangers determined that people were too close, or they were angry about something related to bear watching (e.g., when one found a garbage bag full of pastries at a picnic site) they frightened the bears back into the woods by firing cracker shells at them. This is a common hazing technique used as part of a negative conditioning effort for human-habituated bears (Beckmann et al. 2004). The rangers rarely hit the bears and the bears almost always reappeared at another site within 30 min. On the other hand, the

hazing still served the function of interrupting the viewing and upset many visitors, which led to diminished satisfaction with the wildlife watching experience.

You know, I don't understand that. They want the bears in the park, but yet when one of 'em shows up they want to hit it in the hind end with a shotgun. You know? That's another thing. It makes no sense.

– Male Bear Watcher

Visitors began modifying their own behavior and encouraging others to do the same so that bears would not be scared off and their viewing could be extended.

I don't think visitors are being as aggressive towards the bears as they were at the beginning of the summer. It's like where the rangers are coming around, and a lot of them have learned that if they're doing those things they [the rangers] are going to run those bears off. And you'll hear those comments: "Don't get close, 'cause if they come they'll run that bear off" you know, and this sort of thing.

- Female Bear Watcher

The park rangers were both local men, born and raised in the area, and knew all of the regular viewers, many of whom were their elders. They sometimes found it difficult to get people to observe safety rules and disliked upsetting them. For example, on one occasion a sow became separated from two of her cubs by a crowd of onlookers. A ranger began yelling at people to get in their cars, to move along and to leave the area, but he was ignored. When I suggested a roadblock at each end of the road using people he felt he could rely on, he said he did not want them to be yelled at instead of him. He was finally able to scare the female bear off with his shotgun which also dispersed the crowd. When the crowd thinned, she collected her cubs from the tree and retreated into the woods again. The park visitors were visibly annoyed, and the ranger was upset for the rest of the evening because he had yelled at them. He said he had made a couple of kids cry and that he felt very bad about it.

Neither ranger ever told me that he felt subordinate to the retired Bear Watchers or any of the park visitors, but on several occasions I observed older women scolding them for having scared a bear off. One ranger told me that he worked hard to stay on their good side and the other discussed the fact that he found it very difficult sometimes to police people that he had known all his life. One described a summer night when he

discovered an entire garbage bag of food that someone had put in the trash for the bears. He told the park visitors, “Now, ya’ll have made me mad with this and for the rest of the night if a bear so much as sticks his head out of the woods I’m going to light him up and ain’t nobody going to get to see them!”

By the summer of 2006, the rangers were hazing more consistently and were assisted by two KDFWR personnel. The Bear Watchers were bothered by this and concerned for the welfare of the bears. Tensions had been somewhat high for several years between both KDFWR and UK and the Bear Watchers because the latter did not like the trapping program or distinctive ear tags used as part of the research and were especially resistant to any ideas of removing or relocating resident bears.

I think we did see that this year some of them, I won't say all of them, some of them did begin to, kind of think of the bears as their own personal property. And that they had the right to do or to dictate what activities should be done really pretty much to do with the bears and that basically they wanted to tell us what to do with the bears. We had a meeting with them and one of the things they brought up was that they wanted us to stop hazing the bears. I told them we will not stop hazing them. We have to try to protect the people from themselves. Are we doing a good job at it? I would say so. Can we do a lot better? Yes, but again, we've got a fine line of wanting people to see the bears and wanting to protect them, so it winds up being a judgment call. If everybody is in their vehicles and a bear is on the far side of the field, you know, do we need to haze the bear at that time from visiting the can? Maybe not.

– Male Park Employee

When KDFWR, with the assistance of the park rangers, decided to remove F013 and her now yearling cubs, the Bear Watchers were extremely opposed to the idea. Though relations eventually became cordial again when F013 returned on her own, the dynamics were never the same as they had been originally and remained strained for the duration of the study.

In general, regular park visitors, Bear Watchers in particular, seemed to feel an ownership and personal stake in the park and were not entirely happy with the way it was being run by “outsiders.” The term outsiders variously included the park manager as well as state park officials in Frankfort. Bear Watchers appeared ambivalent in their feelings towards both park employees and KDFWR personnel. They typically praised the efforts

or work of individuals, but made more critical comments about the agencies generally. Regulars with whom I spoke were much more likely to discuss the failings of the park in casual conversation than they were in interviews and they were sympathetic to the obstacles the park staff and rangers faced. The most frequent comment was that the park was not “all that it could be.” One woman made the comment that the Lions Club, who had donated the parkland, had to “get after them” (the park management) at one point for not keeping the park clean and the trails maintained. Most people interviewed felt that the park had yet to live up to its potential as a tourist attraction. Many suggested better signs as mentioned above, as well as widening the roads and putting in visitor cabins where people could spend several nights.

Discussion

Application of conceptual models

Reynolds and Braithwaite (2001) presented a conceptual framework for wildlife tourism that identified the factors affecting tourism and tourists and then integrated these with the needs of wildlife to create a matrix of possible combinations of circumstance. They offered six categories of wildlife products gleaned from wildlife brochures: 1) nature-based tourism with wildlife component, where wildlife viewing is an incidental bonus; 2) locations with good wildlife opportunities, accommodations provided in proximity to wildlife rich habitat or attractants; 3) artificial attractions based on wildlife (e.g., zoos); 4) specialist animal watching provided by tours; 5) thrill-offering tours; 6) hunting/fishing tours. According to their criteria, the bears of Kingdom Come fit perfectly into category two, based on locations with good (and enhanced) wildlife viewing opportunities.

These authors determined that the conditions for a desirable habitat are that it: 1) support a number of watchable and interesting species; 2) be open and allow good visibility for viewers; 3) have cover that obscures the observers’ approach; 4) have features which concentrate animal activity; and 5) allow the protection and mobility offered by transport vehicles. KCSP meets nearly all of these conditions. In addition to black bear, the park is home to deer, wild turkey (*Meleagris gallopavo*) and grouse

(*Bonasa umbellus*), mesopredators such as raccoons (*Procyon lotor*), striped skunks (*Mephitis mephitis*), both grey and red foxes (*Urocyon cinereoargenteus* and *Vulpes vulpes*, respectively), and Virginia opossums (*Didelphis virginiana*), as well as small mammals such as eastern cottontail rabbits (*Sylvilagus floridanus*) and grey squirrels (*Sciurus carolinensis*). These species vary in their attraction for human visitors, but sightings of other animals, particularly game species such as deer and wild turkey, were mentioned with enthusiasm by interviewees. Trashcans and grassy fields concentrate animal activity in certain predictable locations. Every viewing spot is accessible by vehicle, and many people elect to sit in their cars to watch. The only condition not met is that of cover that obscures observers' approach, allowing them to get closer than they otherwise would, but this is largely unnecessary because of the presence of so many habituated animals.

Reynolds and Braithwaite (2001) also suggested conditions that favor wildlife tourism depending on species, habitats, and the power to "hold" visitors. The bears of KCSP meet all of the species conditions: they are 1) predictable in activity or location; 2) approachable; 3) readily viewable (open habitats); 4) tolerant of human intrusion; 5) possess an element of rarity or local superabundance; and 6) have a diurnal activity pattern.

Although not every visitor to the park will see one, bears can be found in the park on most summer days, nearly always feeding on garbage or moving between feeding sites. The picnic areas where the garbage cans were found are kept mowed and pruned, which enhances visibility. The bears have become habituated to the presence of people and their accoutrements, such as video and camera equipment. For example, they appear unfazed by motor vehicles, human voices, or flash photography. The black bear is rare in Kentucky but easily seen at KCSP, making it both rare *and* locally superabundant. In addition, a sow with five cubs is unusual anywhere (McDonald and Fuller 2001) (see Table 5.2). Finally, as of 2004, bears began appearing in KCSP during daylight hours. This was a shift from their behavior in previous years and is somewhat in contrast to bears at other heavily used areas (Reimchen 1998; Beckmann and Berger 2003a).

One explanation for this behavior is general habituation. If people are no longer perceived as threatening, then foraging may occur at any time of day as it does in areas

without human activity (Fagen and Fagen 1994). I believe a more complete explanation is resource partitioning among bears *mediated* by human activity. In 2002 and 2003, bears were primarily seen after dark when human activity had diminished and visitation was largely limited to people who remained in their vehicles. The bears I observed in those years were either marked animals known to be male or tended to be larger animals and therefore likely to be males (Pelton 1982; Stringham 1990).

The finding that male bears were primarily nocturnal, allowing them to largely avoid people, is consistent with other research in both black and brown bears feeding in areas with human activity (Egbert and Stokes 1974; Warner 1987; Mattson et al. 1992). The male bears' avoidance can create what Nevin and Gilbert (2005) term a "temporal refuge" for sows with cubs. The use of the park by a nursing female in 2004 appears to represent such a temporal shift in feeding, requiring the sow to revert to a diurnal schedule, even in areas of human activity, to avoid bringing vulnerable cubs into proximity of potentially cannibalistic male bears (LeCount 1987; Rogers 1987; Hellgren and Vaughan 1989; Mattson 1990; Davis and Harestad 1996). While bears appeared to avoid high levels of human activity when possible, the refuge created by human visitors might be preferable for sows with cubs to the alternative (Nevin and Gilbert 2005; Peirce and Van Daele 2006). This shift had the additional effect of allowing increased viewing opportunities for park visitors, which increased daytime visitation still further. In their study of the impact of ecotourism on brown bears, Nevin and Gilbert (2005) found that sows and cubs were not adversely affected by tourists in their foraging or other observed behavior and that the temporal refuge afforded them by park visitors might have a positive impact on their survival by allowing them access to high quality feeding opportunities.

Finally, Reynolds and Braithwaite (2001), elaborating on Benefield et al. (1986), suggested several factors that will "hold" visitors: 1) motion of the animal; 2) large size of the animal; 3) visitor participation; 4) presence of juvenile animal; 5) ease of viewability; 6) visitors' perception of the species' characteristics such as rarity value or "cuteness." Black bears are large, charismatic animals. Their behavior is captivating to many people, especially in its resemblance to that of humans. Watching a bear deftly lower a trashcan to the ground, or pick up a sandwich and eat it with its paws, it is easy to

make comparisons with the way a human would do these things. Cubs playing together, or a sow nursing are similarly evocative.

She and two cubs were up on there on that 12 o'clock overlook. We were sitting there and all at once we heard the can, we looked and the mama was eating them acorns out there, but those two little bears were like two little boys trying to lift that lid up. They just barely could lift that lid up – they were kind of hopping all the way around that can. Then somebody scared them, drove by, and they tried to climb the tree and they'd get up and then fall off, just fall off of it. And mama bear's still at the bottom of that tree and she made that noise she makes and they tried to climb that tree and then they'd fall back down. One of them did pretty good. He went up pretty good, but then that last one, he acted like he couldn't get his bottom up. She got tired of walking around and she just started north, and they took off running right behind her. I guess she got tired of watching them trying to climb that tree.

– Female Bear Watcher

Such perceptions reinforce the feeling of empathy and connectedness with the bears described by park visitors. The only one of the conditions proposed by Benefield et al. (1986) that was not fully met is that of “participation.” But that was captured as well if viewers intentionally provided food to the bears, which they frequently did.

Roehl and Fesenmaier (1992) suggested that high personal risk perception may enhance the wildlife watching experience for some people. Even though visitors described relatively low risk perception, this principle could be operating in KCSP in as much as the bear is a large and powerful animal and could potentially injure or kill a person. No fences, moats, or other barriers separate the bears from people in the park; people can approach a bear as closely as their own sense of self-preservation and the bear itself will allow. Black bears can seem unpredictable, and while a bear has never hurt anyone in the park, having one suddenly turn and approach a park visitor (or researcher) can be a memorable experience.

Facilitation and motivation

Anthropogenic food is integral to the KCSP bear watching situation. Although there are variably occurring natural foods such as blackberries and acorns within the park, bear visitation would likely be sporadic and bears not highly visible without access to garbage, picnics, and associated handouts. Feeding wildlife is the most expedient way to

bring animals in close enough and for long enough to get quality pictures and video (Orams 2002; Knight 2009). There is also a subtler motivation that is difficult to quantify but seems ubiquitous in human-wildlife interactions. Intentional feeding allows viewers to make a direct connection with wildlife, which is important to many wildlife tourists (Knight 2005; Servais 2005).

Visitors to KCSP watch bears for many of the same reasons that people everywhere watch wildlife. Seeing such a large and powerful animal close up is an exciting way to experience nature. What is more unique is the attachment of local people to the bear, both to individual animals and as a symbol, as well as the development of a sort of bear-watching fraternity that connects area residents to one another.

While health was not offered as an explanation, my observations suggest that other nature-recreational pursuits would not have been available to many Bear Watchers, had they desired to participate in them. Bear watching in KCSP offered a chance to connect with a wild animal and to spend time “in nature” but it was uniquely suited to this group because it could be done from a car and did not require high levels of strain or activity. This seems to be a common trend in organized wildlife watching, much of which is done from stationary viewing platforms, boats, as with whale watching tours, or other vehicles such as the tundra buggies used to observe polar bears in Churchill, Manitoba in Canada (Lemelin 2004).

Take only pictures: the problem of trophy hunters

Literature about bears – even educational material aimed at discouraging feeding – often features highly focused and appealing close-up shots of bears. While it is not clear that these types of materials encouraged picture taking, there is no question that photography was a huge part of the KCSP bear viewing experience, and the desire to obtain quality photographs was highly correlated with higher levels of risk-taking behavior. In addition, seeing a particular photograph seemed to inspire others to seek out a similar or better one.

Members of the Bear Watchers group were consistently oriented towards taking high-quality pictures of the bears. These photos were displayed on the Internet and at the annual Black Bear Festival, where they were judged competitively. Bear watchers as well

as some other park visitors were goal oriented, seeking out close-up, clear, and dynamic bear photos. Approaching the bears in the pursuit of these pictures was common. Though not all people with cameras came within close proximity of the bears, those that did leave the parking areas to get closer to the feeding bears usually did so either to take a closer picture themselves or to have another participant take a picture of them interacting with the bear.

All you gotta do is just keep your distance. Most the time we just set in our vehicle even if they do come out, but we have been getting out because we get out and take pictures.

– Male Bear Watcher

In contrast, viewers without cameras tended to maintain greater distance from the bears and remain in or by their cars.

Habituation: a two way street

Habituation occurs when a response to stimulation is gradually extinguished because it is not paired with any reinforcement (Whittaker and Knight 1998). The repeated exposure results in gradually diminished reaction, much in the same manner that chronic exposure to an object of fear is a therapy used in the treatment of phobias. At some point, proximity of the feared object without negative repercussions will lead to a reduction in fear and/or avoidance.

Most wildlife species are wary of people and do not approach them under normal circumstances; notable exceptions to this include a small number of animals from areas with no natural predators, such as flightless birds in the Galapagos Islands, but most animals will naturally avoid humans (Knight 2009). However, habituation of otherwise wary animals may take place if they encounter humans repeatedly without negative consequence. The presence of a food resource that attracts animals, and the absence of any negative reinforcement, accelerates this process and will often result in the gradual extinction of fear response so that the animals begin to tolerate human presence while feeding (Fagen and Fagen 1994; Smith et al. 2005). This type of learning may be highly contextual, with wildlife learning not to fear humans in some situations but continuing to avoid them in others (Blom et al. 2004; Mansfield 2007).

Beyond habituation, there is active attraction. If an animal learns to associate human activity with a food reward, it may become “food conditioned” and begin to seek people out in search of food (Rogers 1989; Bounds and Shaw 1994; Dyck 2006). Tourism operators and tourists often exploit this fact to bring wild animals close enough to see, photograph, and in some cases even handle. This certainly occurred at KCSP as some food-habituated black bears in KCSP were not only tolerant of human activity but approached occupied areas because of the association with food, as in the case of F013 and the picnickers.

Habituation of animals to people because of food is a common thread in human-dimensions of wildlife literature. Less covered, and yet at least as important, is the habituation of humans to animals (though see Smith et al. 2005 for an exception). People vary in their inherent wariness of wild animals but whatever their beginning level and perception of a “safe” distance, their perception of risk can be substantially diminished over time through repeated exposure to wild animals with no negative consequences. It became increasingly obvious during the course of this study that the loss of fear observed in the bears was mirrored by a loss of fear in the people. As park visitors became more familiar with the bears, and the apparent predictability of their behavior and unthreatening demeanor, visitor fear diminished and individuals were increasingly willing to approach feeding bears.

There were questions from some new visitors about the care and feeding of the bears that indicated a belief that the bears were in some way captive animals. Questions such as “what time do they let out the bears?” and “when will they feed the bears?” were common and revealed a zoo-going mentality. These visitors typically had no experience with bears but no fear either. On three occasions I felt it necessary to admonish people who were running up to a bear for a photographic opportunity.

Other visitors believed that the bears had been intentionally released in KCSP to provide an attraction for local tourism. In all likelihood, these rumors arose from the real practice of trapping, relocating, and releasing nuisance bears, possibly in combination with the knowledge of the elk restoration project that had taken place nearby, where animals were indeed brought in from elsewhere to replace an extirpated population. Stories of having seen or heard of bears being imported under similar circumstances were

common. Given the widely held belief that the bears were brought in for the express purpose of encouraging touristic activities, it becomes more understandable that visitors would think it appropriate for them to feed and approach the bears.

Park visitors appeared to take their cues on how to behave around wild animals from the people around them as well as what they saw in the media where apparent proximity (i.e. close up photographs) on television and in print is common. These images may encourage wildlife tourists to approach wild animals with a feeling of safety in an attempt to get similar photographs. Because there were no fences or barriers in KCSP, people had a low perception of risk posed by wild bears. There was a widespread sense of “if it wasn’t safe, they wouldn’t let me do it.”

The signage currently in place at KCSP does not address many of the beliefs of visitors. Widely used messages like “a fed bear is a dead bear” fail to resonate in places where visitors see bears eating anthropogenic foods over a long period of time with no (apparent) ill effects. Similarly, viewers may have a hard time taking these admonishments from park staff and signage seriously when little of the park is bear-proofed and bears feed from trash cans at will. The risk of this type of heavy-handed instruction and absolutist declaration is that the entire message may be discredited and rejected by its recipients. Similarly, while highly focused and attractive pictures of bears with messages like “keep wildlife wild – don’t feed the bears” are intended to discourage feeding or approaching bears, they may instead encourage these very activities as visitors attempt to take similar pictures themselves. The design of interpretive information must take these issues into account if it is to be effective.

The impact of habituation and food conditioning

When discussing the effects of human-wildlife interaction it is common for there to be an implicit assumption that such effects are by definition detrimental and to use the terms “effects” and “detrimental effects” synonymously (Shackley 1996; Ballantyne and Hughes 2006; but see Orams 2002 for an exception). However, depending on what is meant by “detrimental,” and the scale of impacts under consideration, this may or may not be accurate. Some well-documented effects are clearly detrimental by any standards – when wild animals ingest garbage that causes impaction and which results in death, or

habituated wildlife injure humans, clearly that is detrimental. In contrast, a great many other changes, such as shifts in feeding patterns or changes in home range size, are potentially neutral, and some effects, such as increased productivity and weight gain, might even be considered “beneficial.”

From a philosophical standpoint, many wildlife biologists consider any interaction between wildlife and the human world to be inherently negative because it is seen as “unnatural.” While there is certainly a case to be made for the argument that certain types of interaction result in ultimately negative outcomes for target species, the use of terms like “detrimental” must be qualified as to the exact meaning implied to avoid confusion. Many people do not consider the feeding of wildlife to be detrimental in the sense of directly harmful, and may actually consider it helpful. Home bird feeders offer one obvious example of a type of anthropogenic food provisioning that is believed to be beneficial by those that have them. Multiple park visitors mentioned the importance to the bears of the food available at the park and expressed concerns about their survival without it.

It takes a lot of food for a population of bears. Now, I can remember, we used to hunt all over the top of that mountain, there were big large oaks up there, red oaks, white oaks, which they've got to have. Well, you go up there two or three years later and they'd cut everything and they cut the trees down and they'd go through and they wouldn't even take the whole tree. They'd cut the choice logs out of it, and then there was lumber stacked up all around that mountain that when I was working for the saw mill people would have been glad to have, but they just left them stacked up. They'd go through a tree that would have a hole in it for a den tree or seed trees. They'd cut everything. That's no good. If you keep cutting the timber, there's not going to be enough food. But they don't care, they're ready to go. They want to mine it so they want the timber off so they don't have to fool with the pollution part of it. Get the timber cut off, burn it, what's left. They don't care. That's why I worry more about the timber not being there for bears. I don't think you need to bear-proof or kill no bears until you see what the timber is going to do.

– Male Bear Watcher

The bear's got to get some food in her before she goes in that den. They can't live through this cold weather unless they get some food. They can walk right over there in that library and stack all the books up they want, take me everywhere on the Internet they want to show me, and educate me

on bear, I don't care where you look – it says garbage is one of their foods.

– Male Bear Watcher

Park visitors recognized the potential importance of anthropogenic food in the bears' diets and observed that the bears coming to the park appeared to be in good condition and highly productive. Therefore, interpretive and educational materials that begin with the a priori assumption that human-wildlife interaction is negative may be rejected out of hand by people who do not accept that starting premise. This appears to be a common occurrence, and is potentially at the root of the disconnect between wildlife managers and the public.

Whether or not the bears that fed at the park objectively benefited or suffered from this interaction is unclear. Preliminary data and observations indicate that females who used the park had larger than average litters and reproduced at a younger than average age (see Chapter 5) which is consistent with garbage feeding bears studied elsewhere (Rogers 1993; Beckmann and Berger 2003b); however, long-term data about the survival and recruitment success of bears using the park are not yet available. At least three of F013's eleven known offspring died and/or were relocated as a result of their use of anthropogenic food. F013 herself was euthanized in 2009 by KDFWR because of her high level of food conditioning, so the benefits of anthropogenic food usage are not unequivocal.

Conclusion

Bears were essentially extirpated from Kentucky prior to the lifetime of anyone living today. Lacking bears until quite recently, most park visitors had not had any negative experiences with them. Previous encounters with bears, if they existed, were positive and typically occurred while visiting Great Smoky Mountains National Park as tourists. There is not the same history in the region of significant crop and property damage or even injuries that would typically accompany a longstanding bear population. It is possible that for some residents, the bear's long absence has allowed for the dissolution of the antagonism in the man-predator relationship (Kruuk 2002; Fascione et

al. 2004). In KCSP, many visitors had an image of the bear as passive, harmless, and even friendly.

Instead of the large carnivores with which their ancestors dealt, the recent history of Tri-Cities residents has been with the challenges of natural resource extraction and loss of jobs associated with increased mechanization. Inundated with outsiders wanting to “help” their community, beginning with the settlement schools in the early 20th century and continued by VISTA workers through the 1960s, many Bear Watchers saw bears as the means by which they could empower *themselves* and move in a direction towards economic development.

Even, even with everything that we've lost, you know, we had something black that has really built three cities... coal. Black coal. Now we've got something else that's black and it can build a lot in three cities if they'll let it. And I, I'm getting up there, you know, and I've done and I've done and I've done, and I feel like saying "let the young ones take over" but still, yet, you've got to try... I want to see something. I want my grandchildren to have something to do. I want to see something happen.

– Male Bear Watcher

That bear-tourism could be the salvation of economically depressed communities adjacent to the park was a recurrent theme in conversations and interviews. Devastated over outmigration due to unemployment and the “loss of a generation” to drugs like Oxycontin, older residents had seen the area decline since its heyday during the coal boom and were anxious for something to change and to “get [their] town back” for themselves and for their children and grandchildren. For the Bear Watchers in particular, the bear has lost some of the typical symbolic characteristics associated with large carnivores. These have been replaced by connotations of pride and strength in their community.

For local people to support a carnivore against outside influences is the inverse of the relationship more commonly seen in human-carnivore issues (Mishra et al. 2003). Typically, introduced or protected re-colonizing wildlife is seen as a product of governmental agency effort rather than an extension of the local people (Brunner et al. 2002). However, either scenario echoes Knight's (2000) ideas that human conflict with wildlife may express conflict between people.

Wildlife is often a driver for ecotourism (Baker 1997; Loon and Polakow 2001; Hsu et al. 2009) and, as such, it is sometimes a driver for local economic change. It does not typically provide a social venue for area residents, nor does the push for economic change usually originate with local people. The unique history of the bear and the Cumberland Plateau are combined in this situation to create an unusual wildlife-watching phenomenon.

CHAPTER 5: ANTHROPOGENIC FEEDING AND NUISANCE ACTIVITY

PART ONE: BEARS

Introduction

When human development expands into bear habitat, and bear populations increase and expand into human habitat, it is inevitable that people and bears will come into contact with one another. Satellite imagery shows that the United States is losing forest cover at an alarming rate; in fact, it has experienced proportionally more gross forest loss in recent years than any other heavily forested country (Hansen et al. 2010). As widespread habitat destruction continues, there is less and less truly wildland habitat left, yet bear numbers appear to be increasing (Hristienko and McDonald 2007). A growing population and large home ranges mean that a bear's territory will frequently overlap with residential and commercial property, especially where forest habitat abuts human development. Where there is increased overlap, the level of risk to both people and wildlife goes up as well (Schusler and Siemer 2004).

Bears' generalist feeding habits and behavioral plasticity allow them to take advantage of any likely food resources that present themselves, and many bears quickly learn to exploit anthropogenic food sources where they are available (Clark and Pelton 1999; Spencer et al. 2007). If anthropogenic food access is ongoing, bears feeding near human habitation often learn to ignore the presence of humans, becoming habituated (Whittaker and Knight 1998). Bears that encounter people frequently without harmful effect will tend to tolerate people in closer proximity and potentially ignore them (Herrero 2002). While the presence of a food resource accelerates habituation, habituation can occur wherever humans and bears encounter each other, even if no anthropogenic food is available. However, bears that lose their wariness towards people and instead become attracted to developed areas as a source of food are said to be "food conditioned" (McCarthy and Seavoy 1994; Hopkins et al. 2010). This has happened with bears feeding in Kingdom Come State Park as discussed in the previous chapter.

While the black bear's flexibility and tolerance of human activity has meant its survival in areas where other large carnivores have been extirpated, its unusual

willingness to live alongside people is not always advantageous for either humans or bears; in many cases, contact with humans results in property damage or human injury and, quite often, death for the bear (Herrero 2002; Woodroffe et al. 2005). The primary challenge for wildlife professionals managing black bears is in reducing the potential for conflict between people and bears. As conflict most often begins with an anthropogenic food attractant (Mattson 1990; Landriault et al. 2000), it is important to understand the impact of these resources on bear behavior and ecology, as well as to examine the various types of attractants that may exist and the human-mediated reasons for their persistence and potential escalation.

Types of nuisance activity

The general category of anthropogenic foods spans a variety of potential food sources with different associated risks and benefits for the bear, as well as varied economic and social impacts for people. Foraging black bears can cause considerable damage to agricultural crops, for example trampling cornfields or breaking limbs in apple orchards. One marauding bear can destroy an apiary and will usually do so over several visits, if access is not prevented (Hygnstrom et al. 1994). Bears may also prey on domestic animals, including both pets and livestock (Mattson 1990). Black bears often damage property in their search for food, pulling doors off of vehicles (Breck et al. 2009), breaking into cabins, or pulling siding from houses. Black bears are responsible for a small number of human injuries each year and, although it is extremely rare, black bears may even kill and eat people (Floyd 1999; Herrero 2002). However, most human-bear conflicts are comparatively minor. Residential garbage is by far the most common attractant leading to nuisance complaints; 69% of wildlife management agencies surveyed by Spencer et al. (2007) said that garbage was their most frequently reported bear issue. Food left out for pets and bird feeders are also frequently associated with bear nuisance behavior. The human impact of bear nuisance activity is discussed further in the next chapter.

Physical and behavioral impact of anthropogenic foods on bears

Anthropogenic foods represent a potentially important food source for many different types of wildlife (Adams 1994), and animals that consume them may gain a nutritional advantage over those that do not (Stringham 1986; Rogers 1987; Orams 2002). Depending on the source, anthropogenic foods may be substantially higher in both calories and protein than what is available naturally (Stringham 1989). Anthropogenic food is also often more predictable in time and place than natural foods and more abundant generally, and for these reasons may represent a primary food source for bears (Van Daele 1995).

Food availability, whether natural or anthropogenic, appears to be the single most important factor governing black bear populations, affecting bear denning chronology, home range overlap, population growth, and reproductive potential (Rogers 1987). The consumption of anthropogenic food has the potential to alter natural bear habitat use, social activity, and behavioral patterns (Mattson 1990; Beckmann and Berger 2003a; Matthews et al. 2006; Beckmann and Lackey 2008).

Although bear activity patterns may be affected somewhat by seasonal variation and weather (Garshelis and Pelton 1980), in the absence of humans both brown and black bears are typically diurnal, foraging by day and sleeping at night (Rogers 1987; Matthews et al. 2006). Urban black bears feeding on garbage show a significantly more nocturnal activity pattern than wildland bears (Beckmann and Berger 2003a), as do bears in areas of high human activity (Matthews et al. 2006). Brown bears observed at a dump in Alaska rarely fed during the day and were primarily nocturnal and crepuscular (Peirce and Van Daele 2006).

Because anthropogenic food resources are clumped in space, predictable in time, and potentially unlimited, bears that use them are able to meet their caloric needs more easily than bears that do not. Anthropogenic feeding bears have been found to have larger body mass, lower activity levels, and smaller home ranges than those eating only natural foods (Rogers et al. 1974; Matthews et al. 2006). Beckmann and Berger (2003a) found that urban-interface bears were 36% less active than wildland bears, presumably because achieving satiation was possible in a shorter period of time.

Aside from the need for a protected space to give birth to cubs, bears hibernate in order to survive seasonal periods of food scarcity. Therefore, relative access to food seems to be the primary determinant of bear denning chronology (Rogers 1987; Beckmann and Berger 2003a). Unlike natural foods, anthropogenic foods are typically available year-round, so that human-provisioned bears may enter their dens a month later than wildland bears (Shideler and Hechtel 2000; Beckmann and Berger 2003b) and some urban bears do not den at all (Beckmann and Berger 2003a).

The larger a food resource, the more bears it may potentially support. However, bringing bears into close contact with each other alters bear behavior and requires negotiation of time and space. Peirce and Van Daele (2006) found that the number of brown bears using a dumpsite in Dillingham, Alaska, increased with the volume of garbage available, and aggressive encounters between bears increased with the number of bears using the site. There was considerable individual variation in the extent of dump usage, so that it was more important as a resource to some bears than others. Less socially dominant bears were not able to feed during periods of heavy dump use by more dominant ones, and some of these bears eventually stopped using the dumpsite altogether. Rogers' (1987) study of black bears yielded similar observations. Females with cubs regularly used dumpsites within their normal home range and were generally successful at avoiding or repelling male bears at those locations; however they avoided using dumpsites nearby but outside their territory, suggesting an avoidance of unknown male bears. As natural food availability declined, aggressive encounters at dumpsites increased.

Anthropogenic food availability and bear-human conflict

Although anthropogenic attractants may draw bears out of woodlands and into urban habitat even when natural foods are readily available (Beckmann and Berger 2003b), bears are more likely to use anthropogenic food sources during seasonal or episodic periods of natural food scarcity (Gunther et al. 2004; Peirce and Van Daele 2006; Mansfield 2007). These natural food shortages do not typically result in bear mortality from starvation (Rogers 1987), but they dramatically increase nuisance activity as well as anthropogenic mortality as bears search for other food sources. In years of low

whitebark pine (*Pinus albicaulis*) seed availability, brown bears used areas adjacent to human habitation much more frequently than in more productive years (Mattson and Knight 1989). This resulted in increased reports of nuisance activity as well as increased bear mortality from hunting.

Rogers (1976) found that the main anthropogenic cause of mortality for black bears over two years old was being shot while trying to access garbage and that three times as many bears were killed this way during years of food shortage than were during years when natural food was plentiful. During a major acorn crop failure in 1968, four times as many black bears were harvested in the surrounding area during legal hunts, than in years of higher mast production, in spite of the availability of some hard mast from hickories and beech (Beeman and Pelton 1980). In 1972, there was another year of low mast production and a congruent seven-fold increase above the average in the number of bears handled by wildlife agencies in areas adjacent to Great Smoky Mountains National Park (Beeman and Pelton 1980).

Similarly, the loss of one type of anthropogenic food source, such as a dump, can result in increased nuisance encounters elsewhere in the area as bears are forced to seek out alternative food sources (Peirce and Van Daele 2006). Following dump closures in Yellowstone National Park, many brown bears were killed by wildlife managers because of increased nuisance activity and human injuries (Craighead et al. 1974). The remaining bears lost weight and had reduced reproductive success (Craighead et al. 1974; Stringham 1986; Robbins et al. 2004).

When dealing with anthropogenic feeding bears, and associated nuisance activity, wildlife managers are often forced into the role of conflict resolution specialist. There is a variety of management tools employed to deal with problem bears, although application success varies widely. These techniques are discussed below.

Relocation

An obvious approach to dealing with problem wildlife in a particular location is to move it somewhere else. To be relocated, animals are first captured using some type of trap, in the case of bears usually a culvert trap or, occasionally, by being shot with a projectile loaded with a tranquilizer. The animal is then moved to another area as a means

of eliminating nuisance problems at the original site. When relocation is successful, the displaced animal does not return, nor does it resume nuisance behavior at a new location. This approach is often popular with the general public and may be viewed as a humane alternative to lethal removal or aversive conditioning (Bull et al. 2003). However, it is expensive, and finding sufficiently remote locations for release may be difficult (Andelt 1996). It also overlooks the importance of species-specific behavior and territoriality; mortality for translocated animals can be extremely high (Adams et al. 2004).

The success of relocation as a nuisance management technique for black bears is mixed. Bears moved greater distances are less likely to return to their capture area than those released nearer by, and physiographic barriers, such as mountain ranges, appear to discourage bears from coming back (Costello et al. 2001). Certain demographic characteristics are also associated with differential rates of return (Rogers 1986). Landriault et al. (2009) found that adult female bears exhibited a high degree of site fidelity and would return to the area of capture even when moved long distances. In contrast, subadult male bears were the most likely to be successfully translocated, both returning and reoffending least often.

Hazing

The term hazing refers, in this context, to the use of operant conditioning techniques intended to deter future nuisance activity by treated bears. These protocols employ the principles of aversive conditioning (Blood et al. 2007) where a reinforcer is used to decrease the chances of a target behavior. Negative reinforcement may be used to create an association between the target behavior and an undesired consequence, or punishment, so that the likelihood of the target behavior decreases. In the case of bears engaged in nuisance activity, the target behavior is usually either feeding on anthropogenic food or, more generally, the use of human-occupied habitat. In theory, bears that are hazed while they are engaged in nuisance activity receive negative reinforcement for their behavior and should, consequently, engage in that behavior less frequently in the future.

The most common hazing techniques involve using pain as a negative reinforcer by firing projectiles, such as rubber bullets, rubber shot, or bean bags at the bears. While

unpleasant, this technique is not supposed to result in serious injury for the bear, and practitioners are advised to aim at the bear's rump and away from the face or other vulnerable areas. Alternatively, negative acoustical stimuli, such as cracker shells fired toward the bear from a shotgun, may be used both to frighten the bear and cause sensory discomfort. Finally, specially trained dogs, most commonly Karelian Bear Dogs but also sometimes Black Mouth Curs, are sometimes used to re-instill fear of humans in offending bears and discourage their return. These dogs "work" a bear both on and off leash, depending on their training and the situation. The sound of barking dogs is part of the aversive experience for the bear but the dogs may make physical contact with the bear as well. In theory, dogs might be a particularly effective negative reinforcer for bears because their use combines several different types of negative reinforcement for the bear and draws upon a presumed evolutionary history of bears being pursued by predatory canids and more recently by human hunters with hounds (Frid and Dill 2002).

Another approach that attempts to use aversive conditioning to create avoidance of nuisance behavior is the use of chemical deterrents, such as emetics (e.g., lithium chloride; thiabendazole), that cause target animals to become ill after feeding on anthropogenic foods. An example of this approach might be to bait a garbage can with emetics concealed within food so that the bear becomes nauseated after eating from the can. Nausea is believed to be a powerful negative reinforcer for both humans and animals, and some studies have shown a significant reduction in consumption of associated foodstuffs by other species following this type of conditioning (Garcia and Hankins 1977). Aversion therapy using emetics has been shown to be extremely effective in reducing the appeal of alcohol to alcoholics, diminishing actual consumption as well as cravings (Elkins 1991). Rats quickly learned to avoid previously neutral flavors after they were paired with an emetic (Garcia et al. 1974). However, the limited research done on this approach with bears has shown little change in foraging behavior following treatment (Dorrance and Roy 1978; McCarthy and Seavoy 1994), apparently because bears are able to detect the added chemical within the bait (Homstol 2011), and this approach is still relatively uncommon (Spencer et al. 2007).

Categorization of nuisance bears

One of the first and most important issues in an analysis of anthropogenic feeding bears is the methodology used to determine that status. Bears may be categorized as “nuisance” and “non-nuisance” based on their capture history (Weaver et al. 2003); their use of habitat as determined by radiotelemetry locations (Beckmann and Berger 2003a; Beckmann and Lackey 2008); and the observation of individual bears in both developed and wildland habitat (Matthews et al. 2006). Some researchers have approached the problem from a different angle and sought to quantify anthropogenic food availability, as assessed by mail-in questionnaires of people supplying bait (Gray 2001). Others have looked at the extent of anthropogenic food use via scat analysis (Maehr and Brady 1984; Partridge et al. 2001), and there have been a small number of recent studies where researchers were able to ascertain and quantify anthropogenic food use by individual bears either by stable isotope analysis (Greenleaf 2005) or by examining their adipose tissue for the presence of trans fats, substances found only in human-modified foods (Thiemann et al. 2008).

The differences in the methods used to examine anthropogenic food use by bears often lead to differences in the results as well. For example, Weaver et al. (2003) defined nuisance bears as “individuals who demonstrated unwanted destructive behavior resulting in property damage.” Their method for identifying these animals was to capture them using a culvert trap following a nuisance complaint. They compared the bears captured in this way to other bears they captured using modified Aldrich type foot snares in forested areas. They found that bears in their nuisance category were both bigger and older than bears not captured as a result of nuisance activity. They determined litter sizes between both groups were comparable, with litter sizes of non-nuisance captured bears averaging 2.65 and nuisance captured bears 3.00, both higher than national averages.

However, using nuisance activity as a proxy for anthropogenic feeding is problematic. While a nuisance capture can be taken as strong evidence that a certain bear *does* use anthropogenic food sources, the lack of such a capture cannot be taken as proof that an individual bear *does not* eat these foods. Other factors, such as gender, may affect capture probability (Hellgren and Vaughan 1989; Beckmann and Berger 2003b), and due to their cryptic behavior and the time and energy involved in trapping, most bears that

consume anthropogenic foods are not captured in any case. Whether anthropogenic feeding is observed depends on both the overtness of the behavior and how hard the researcher is looking. Animals that are highly habituated to human activity will be more readily observed than animals that are shy and secretive, but this does not mean that the latter group are not using anthropogenic resources or engaging in nuisance activity. An absence of nuisance captures or anthropogenic feeding observations is, therefore, insufficient evidence to allow the conclusion that a certain bear is not a nuisance animal or does not regularly consume anthropogenic foods.

Using location to determine feeding habits may be a more accurate method of assessing anthropogenic feeding but only in regions where there is a discreet border between areas of development and those containing exclusively natural foods. Beckmann and Berger (2003a) found almost complete spatial separation between the two groups of bears they examined, with one group located within urban areas > 90% of the time (urban areas defined by city and town coverage in ArcView 3.2 software) and the other located outside such areas > 90% of the time. Their findings, some of which are referenced below, were different from those of Weaver et al. (2003). Unfortunately, the landscape and settlement patterns of eastern Kentucky make this sort of distinction impossible; telemetry locations may be a suitable information source when examining gross scale habitat use, but they offer little information about feeding habits when a diverse array of food types are available within the bears' observed range as they are in Kentucky. GPS collars, which record a more precise location as well as record locations more frequently, offer better information about habitat use but cannot always answer fine scale questions about food habits within a mosaic landscape.

It is still possible to make comparisons between capture or location groups, but it is important to recognize the limitations of these sampling methods. One must pay close attention to the terminology used. For example, while "anthropogenic feeding" and "nuisance activity" (usually referring to nuisance captures) may be used synonymously in some studies, they are distinct in others. Bears that eat anthropogenic foods may or may not ever be captured as a result of a nuisance complaint or even perceived to be a nuisance as a result of their feeding.

Even when capture data are supplemented with observations and locations of animals, as I have done here, the two categories of bear are most accurately described as those that are *known* to use anthropogenic foods and those whose behavior is *unknown*, rather than anthropogenic feeding versus non-anthropogenic feeding or wildland bears.

Another layer of complication is in determining the extent of anthropogenic food use where it exists. Because of the inherent difficulty in quantifying anthropogenic food use, it is tempting to treat it as a binary variable, either bears use these resources or they do not, and to some extent I have succumbed to that temptation here. However, in reality, anthropogenic food use by bears must necessarily exist as a continuum, with some bears relying heavily on artificial foods and others subsisting entirely on natural ones, as well as variation from month to month and from year to year. Techniques such as the trans fat analysis used by Thiemann et al. (2008), hold promise not only for identifying bears that consume anthropogenic foods but also in quantifying the importance of those foods in the bears' diets. This has implications for understanding black bear ecology not only on an individual level but on a regional and population level as well. However, no study of this type has been conducted in Kentucky.

For the purposes of this project, I considered all bears captured as a result of nuisance activity, bears captured while engaged in anthropogenic feeding at established sites (e.g., garbage cans, dumpsters etc.), and bears observed in the act of anthropogenic feeding as bears confirmed to use anthropogenic foods, and it is this general category that I compare to bears whose behavior is unknown. However, there were other bears frequently located in developed areas that shared overlapping physical and reproductive characteristics with confirmed anthropogenic feeding bears, but which were never directly observed in the act of using these resources. As such, all comparisons likely represent minimum values because some of the bears whose behavior was unknown probably did use anthropogenic foods, in which case actual differences between bears using and those not using these resources are likely to be even more pronounced.

The bears described below were trapped in one of two ways. Following nuisance activity, bears were typically trapped using culvert traps which were baited with a variety of anthropogenic food items, most often peanut butter. I classified bears captured in this manner as "nuisance captures." For research purposes, KDFWR and UK set up traplines

through forested areas along Pine Mountain in HPMWMA, Cumberland Mountain in CGNHP, and in 2006 in KSF, which is also along Pine Mountain but to the west of KCSP (figure 3.1). These traplines employed modified Aldrich foot snares baited with feed corn and/or donated pastries. I classified bears captured in this manner as “trapline captures.” Although both types of traps are baited with anthropogenic foods, bears are opportunistic feeders and, therefore, even bears that do not normally consume anthropogenic food sources should be attracted to this type of bait when encountered in the natural environment (Schoen 1990).

Categorization of capture type was not always straightforward because there was a subset of bears captured for research purposes, rather than in response to a specific nuisance complaint, but trapped while engaged in anthropogenic feeding activities (e.g., within KCSP or a residential area while feeding on garbage). I categorized this type of capture as “anthro-trap.” When determining prior anthropogenic feeding history for individual bears, I counted these as “nuisance” captures. This allowed me to distinguish bears on the basis of their own behavior rather than the trapper’s intent, and to differentiate between bears captured in developed areas while using anthropogenic food sources, such as garbage, and those that were trapped in natural areas, away from human habitation or activity.

Results

According to the data available from my own observations and the KDFWR database, there was a total of 94 bears (excluding newborn cubs) processed during 167 handling events between 2002 and 2006. These included 76 trapline captures, 8 anthro-trap captures, 44 nuisance captures, and 6 den investigations (Figure 5.1). There were also 32 mortalities processed by KDFWR, all of which appeared to be human-caused, including bears struck by vehicles, bears euthanized because of recurrent nuisance activity and associated safety concerns, bears killed illegally, and marked Kentucky bears killed legally during hunting season in Virginia (Figure 5.2).

Of the 94 different bears handled, 74 (78.7%) were male, 17 (18%) were female, and 3 were of unknown gender (Figure 5.3). Of the 84 bears whose age could be

confirmed with reasonable certainty, 84.5% were ≤ 3 years of age when first captured during the study period, comprising 2 cubs, 22 yearlings, and 47 subadults (bears aged 2-3 years). Only 21 bears were classified as adults at first capture and 8 of these were estimates, unconfirmed by tooth analysis. At the other end of the spectrum, 8 bears reached the age of 8 years or older during the study period. Of these, 5 were female and 3 were male (Figure 5.4). There were 3 bears for which neither age nor estimated age was recorded.

Anthropogenic feeding

Of the total number of bears handled, 58 (61.7%) were individuals confirmed to use anthropogenic food sources as established by a history including nuisance captures and/or personal observation. This total includes 5 of the 20 bears that died; the backgrounds of the remaining 15 are unknown (Figures 5.5 and 5.6). Of the 74 different bears captured during the period examined, 53 (71.2%) were confirmed by direct observation or capture circumstances as eating anthropogenic foods (Figure 5.7) and a majority of both male and female bears used these resources (Figure 5.8).

Because some of the bears were captured specifically as a result of nuisance activity, the population percentages may be artificially weighted towards bears using anthropogenic resources and not representative of the activity of the entire bear population. When bears captured exclusively as either nuisance animals or anthro-trap captures are removed from analysis, 23 out of 45 bears captured along all traplines collectively were individuals confirmed to use anthropogenic foods; 3 out of 14 bears captured in Bell County were known to use anthropogenic foods and 20 out of 31 bears captured along traplines in Harlan and Letcher counties were known to use anthropogenic foods (Figure 5.9).

Many of the bears for which anthropogenic food use was unknown lacked identifying streamers and/or were captured late in the study period, which limited opportunity for either nuisance capture or further observation. Therefore my numbers represent an absolute minimum number of trapline-captured bears that used anthropogenic foods, rather than the total number of bears engaged in such activity.

Physical condition

At each handling event, bears were rated as being in poor, fair, good, or excellent condition based on observation of their body fat and overall appearance. While various linear measures were taken of each animal, weights were commonly estimated visually, making all condition assessments subjective. I condensed the four listed condition categories into two: poor/fair and good/excellent in order to minimize issues of rating subjectivity.

Of the 58 captured bears known to use anthropogenic foods, 52 received condition ratings. Of these, 44 were rated as good or excellent at all captures; 7 were rated as poor/fair at one capture but good/excellent subsequently; and 1 was rated as poor/fair at her only capture. Of the 33 bears for which anthropogenic feeding was unknown, 25 received condition ratings. Of these, 10 were good/excellent at all captures; and 15 were rated as poor/fair at all captures. Of the 10 bears with unconfirmed feeding habits and rated good/excellent, 4 were suspected of nuisance feeding based on telemetry locations and 3 were one-time handling events of mortalities, which therefore provided little opportunity to assess feeding behavior. I used a chi-square and Fisher's exact test to compare the condition of bears known to consume anthropogenic foods and those for which feeding behavior was unknown. Even though the bears suspected of anthropogenic feeding and the one-time mortality handling bears were included in the unknown feeding habits group, statistical analysis confirmed that the rated conditions of the two groups were significantly different ($\chi^2 = 35.56$, d.f. = 2, $P < 0.0001$) (Fisher's exact test $P < 0.0001$).

Overall, 87.9% of confirmed anthropogenic feeding bears were rated good/excellent at one or more captures and 1.9% rated poor/fair across all captures. In contrast, 40% of bears with unknown anthropogenic feeding histories were rated as good/excellent at one or more captures and 60% were rated as poor/fair across all captures.

I also examined bear condition in relation to capture location and type, first comparing bears by county of first capture (figure 5.10) and then by comparing bears captured along the HPMWMA trapline in Harlan County with those captured along the CGNHP/SCWMA trapline in Bell County (figure 5.11). There were a total of 28 trapline

captures along HPMWMA where bears were rated: 16 bears were rated as good/excellent at all captures; 7 bears were rated as poor/fair initially but later rated as good/excellent at subsequent captures (some of which were nuisance captures); and 5 bears were rated as poor/fair at all captures. There were a total of 14 bears captured along traplines in Bell County, 3 of which had been previously captured for nuisance activity in another area and relocated to SCWMA. Of the 14 total bears: 7 bears were rated as good/excellent across all captures, including all three of the bears with previous nuisance capture histories; and 7 bears were rated as poor/fair across all captures. Again, I used a chi-square and Fisher's exact test to compare the condition of bears captured along the two traplines. When the three relocated bears were removed from analysis, the difference between the two groups was statistically significant ($\chi^2 = 12.49$, d.f. = 4, $P < 0.05$) (Fisher's exact test $P < 0.01$), with bears captured along the HPMWMA trapline being more likely to be rated favorably than those captured in CGNHP/SCWMA.

Overall, 76.7% of bears captured along traplines in Harlan and Letcher counties were rated good/excellent at one or more captures and 23.3% were rated poor/fair across all captures; bears captured along traplines in Bell County were evenly split with 50% of bears rated as good/excellent at all captures and 50% of bears rated as poor/fair at all captures. When separated by trapline, and with three bears captured as a result of nuisance activity and released in SCWMA omitted, the trends were similar although slightly more pronounced with 63.6% of bears captured only along the CGNHP ($n = 7$) rated as poor/fair across all captures. Both bears captured along the KSF trapline in Harlan County were rated as poor/fair across all captures, but only 17.9% of bears captured along the HPMWMA trapline were so rated (Figure 5.11).

Hazing

Hazing efforts, if any, were not recorded for most captures outside KCSP beyond the experience of a nuisance capture itself. Non-capture related hazing occurred in KCSP, often several times per week, but with no noticeable reduction in nuisance activity. The hazing technique most often employed was the firing of cracker shells. I observed or received credible reports of nine different identifiable bears being hazed in non-trapping situations while engaged in nuisance activity, in one case by homeowners. Three bears

were hazed after being trapped and released. One bear was hazed in both situations. This tally represents a minimum number as not all hazing events were reported and hazing often occurred at night under conditions of poor visibility. Identification in those situations was limited to radio-collared animals. Many unidentified bears were hazed and some of these were likely known animals but positive identification was not possible.

Of the nine individuals known to have been hazed at least once, but typically more than once, two were female and seven were male. At the time of hazing, one was a male subadult, one was a male yearling, and one was a female yearling; the rest were adult bears. Of these, the yearling female was found dead shortly after the hazing incident, and the yearling male was relocated to SCWMA. He was uncollared and his fate is unknown. The remaining seven bears all engaged in further nuisance activity following hazing, often on the same night.

There were 52 different bears captured as a result of nuisance activity during the study period, including 7 females, 44 males, and one capture where gender was not recorded but based on other recorded data was almost certainly a male. There were 35 bears captured for nuisance activity within my study area, including 27 of the male bears listed above. All 7 of the female bears listed above as nuisance captures as well as the one bear of unknown gender were captured in either Harlan or Letcher counties. There were 18 bears captured as both nuisance and trapline animals. In 9 of the 35 cases, the subsequent behavior of the bears was unknown; in the remaining 26 cases bears appear to have resumed anthropogenic feeding activity following a nuisance capture.

Relocation

There were recorded relocations for 34 of the 74 live-captured bears, including 2 females and 31 males. Both females were adults and returned to their capture sites within two weeks. Male return rates varied and were unknown in most cases.

At least 17 of these animals appear to have resumed nuisance activity following relocation, either at their new location or elsewhere. Relocated bears suffered at least 32.3% mortality with 11 of the relocated bears confirmed as killed; most were either poached or hit by cars. Of the 21 relocated bears that were originally captured within my study area, 9 were killed. Of these, 2 were euthanized because of a perceived threat to

people (although one of these occurred after the study period), 2 were killed legally in Virginia, 4 were killed illegally in Kentucky, and one disappeared suddenly following a period of intense nuisance activity at his relocation site and was presumably poached, although his body was not found.

Habituation and food conditioning

There were 14 bears handled that demonstrated a high degree of habituation, as determined by their willingness to feed in close proximity to humans and lack of reaction to loud noises. Seven had previous nuisance capture histories and 7 were first time captures. In all cases where I was able to trace the activity of individuals over time using personal observation and/or previous nuisance reports, nuisance activity usually began as a highly cryptic and nocturnal behavior. Severe nuisance activity was preceded by a slow escalation where bears became habituated and food-conditioned at progressive levels, learning to approach closer and closer and to have less and less fear because of repeated positive encounters with and around people. As the bears fed without any negative experiences, the timing of visitation became more varied even including some diurnal activity. Bears approached closer to human habitation and became more persistent in their attempts to acquire food, removing trashcan lids, tearing through screens, and even pulling back siding. When severe nuisance activity appeared to begin suddenly in one location, the perpetrating bear almost always had a prior history of nuisance activity and a more gradual escalation elsewhere.

In all but one case observed during my study, bears that engaged in repeated nuisance activity that involved the destruction of personal property, and/or displayed no fear of people, had a history not only of habituation and food conditioning via garbage feeding, but of hand feeding as well. Most documented cases of this level of food conditioning occurred either at mine sites or at a housing development in Cumberland, although hand feeding of bears occurred at private residences as well. There was one bear that demonstrated these qualities but that was not empirically tied to mining or other intensive feeding activity; however, she was still suspected of such because of her location and other characteristics that fit the overall profile.

Reproduction

There were 12 females captured within the study period that were ≥ 3 years in age, and, therefore, potentially reproductive. UK researchers estimated reproductive activity by visiting the den sites of radio-collared females and making auditory assessments in 2003 and 2004, and by full den examinations and cub counts in 2005 and 2006. I participated in these investigations in 2003, but other graduate students and faculty carried them out during subsequent field seasons. For further information on denwork protocols see Unger (2007). Additional reproductive information was gathered from observation of bears engaged in anthropogenic feeding and/or when captured. I also collected photographs of cubs taken by area residents, privately-owned trail cameras, and park visitors.

Of the 12 reproductive aged female bears captured, 10 were collared for the denning period for at least one year and all of these appear to have produced at least one litter, although the reproduction of one of the bears (F017) is based on a secondhand observation of an unknown number of cubs feeding with her immediately preceding her death in 2004. The 9 females for which reproduction was confirmed produced 15 different litters collectively (Table 5.1). Based on the bear handling database and my own observations, there were 8 litters for which the number of cubs could be visually confirmed, although two of these represent minimum estimates because the litters were not observed until after den emergence and cub mortality can be high in the first few months (Garrison et al. 2007). In spite of this, mean litter size across these 8 litters was $3.25 \text{ cubs} \pm 0.11 \text{ (SE)}$, well above estimates obtained in similar studies of black bears elsewhere (Table 5.2). Despite the relatively small sample size, this difference was significant for comparisons between Kentucky and studies conducted in Great Smoky Mountains National Park in North Carolina and Tennessee (McLean 1991) ($P < 0.0001$), Shenandoah National Park in Virginia (Carney 1985) ($P = 0.0017$ and $P = 0.0127$), western North Carolina (McLean 1991) ($P = 0.0039$), northern Minnesota (Rogers 1987) ($P = 0.0287$), Vermont (McDonald and Fuller 2001) ($P = 0.0083$), Alaska (Bertram and Vivion 2002) ($P = 0.0221$), inland Louisiana (Hightower et al. 2002) ($P = 0.0026$), and a newly introduced population in Arkansas (Clark 1991) ($P < 0.0001$). It was also significantly higher than a composite mean for eastern North America compiled by

McDonald and Fuller (2001) ($P = 0.0176$). I was not able to determine average age of first reproduction in Kentucky because 5 of the females were already of reproductive age when first captured. However, at least two of the females reproduced for the first time at age 3 which is normally the youngest age at which black bear reproduce (Tate 1983).

Cub survival was not monitored and is unknown except for incidental data. F013 was observed with two yearling cubs in 2003 and 5 yearling cubs in 2005. I obtained photographs of two yearling cubs belonging to an unknown female in 2004 from a park visitor, and a total of 22 yearlings were captured between 2002 and 2006, 15 of which were in either Harlan or Letcher County. This indicates that at least some cubs born in Kentucky survived until or near the age of dispersal; however, overall litter survival was unknown. Several females produced new litters in successive years, indicating a loss of the preceding litter (LeCount 1983). F001 produced an unknown number of cubs in 2003 and again in 2004, and then a litter of 3 in 2006. She was not collared during the winter of 2005, so production that year is unknown. No cub was ever seen with her when she was captured in 2003 and 2004. F003 produced an unknown number of cubs in 2003 and a litter of 4 in 2005, but there are no data available for production in 2004 or in 2006; she was tracked to a den but no information was recorded about the presence or absence of cubs. F005 was collared only during the 2006 den season, when she was confirmed as having 2 cubs. Like F003, F006 produced an unknown number of cubs in 2003 and a litter of 3 in 2005, but there are no data for production in either 2004 or 2006 (Table 5.1).

Discussion

Development of nuisance activity/feeding

The progression of nuisance behavior appeared to be affected by the nature of the anthropogenic food source used. Contrary to concerns raised by wildlife officials in interviews, I found little evidence that black bears were learning to seek out anthropogenic foods at KCSP and then taking that behavior into other areas. Ten of the 18 bears that were seen feeding in KCSP were also documented residential nuisance bears, but from trapping histories and observation it appeared in most cases that residential feeding preceded their park visitation. There were also habituated bears such

as F013 which were very visible but only ever seen at the park and never implicated in residential nuisance activity. If these bears did in fact avoid residential nuisance activity, it is possible that natural reticence coupled with the availability of high value food rewards in KCSP, which did not require the bear to approach people directly, may have created a sort of buffer that inhibited those bears from ever becoming food conditioned to the level of individuals used to approaching human residences.

In contrast, extreme nuisance behavior did appear to be fostered by nuisance activity and subsequent hand feeding at both coal mines and at the Cumberland Manor housing development. Bears that were hand fed generated a disproportionate number of nuisance complaints and damage reports compared to garbage eating bears that were not fed by hand. Residential garbage feeding was also associated with a gradual escalation of activity, food conditioning, and sometimes associated property damage. Based on my observations, nuisance bear activity seemed to follow a fairly predictable pattern with bears becoming gradually bolder over time, although there was considerable individual variation and many bears maintained their wariness of humans and/or were never reported to have damaged property in spite of regular nuisance activity.

In terms of residential and agricultural nuisance activity, anthropogenic food sources near houses resulted in gradual escalation of nuisance activity by bears. This was not the case for more isolated or less proximate food sources. For example, bears that initially ate at bird feeders set some distance from the house did not typically move on to garbage feeding, even where garbage was available. However, bears that initially ate garbage nearer to houses frequently approached closer over time as homeowners moved their garbage nearer the house, or garbage feeding bears began to eat pet food left on the porch where available.

Mansfield (2007) found that bears using feeding stations did not engage in unwanted nuisance activity and were rarely seen by residents of nearby houses that did not provide food. She also found that provisioned bears, even those that were handfed at some residences, shied away from people in other areas where they were not used to being fed. It is, therefore, not necessarily the act of hand feeding, nor other food conditioning per se which results in this escalating behavior.

The extent to which bears generalized these positive experiences and became food conditioned across multiple sites varied and appeared somewhat dependent on context. As mentioned above, F013 received food reinforcement from picnics and garbage at KCSP but was not known to engage in nuisance activity anywhere else and did not require direct contact with humans to obtain her reward. I often saw her waiting along the wooded edge while people ate nearby, but she never fed until they left their tables nor did she ever attempt to make direct contact; visitors at the park were generally fairly quiet while she fed. In contrast, coal mine bears and bears at the housing development obtained positive reinforcement for dumpster foraging as well as by approaching many different people over time at heavily populated and noisy sites. This resulted in these bears becoming not only food conditioned, but completely habituated to a variety of vehicles, loud noises, and other types of anthropogenic disturbances. These bears readily approached people for food at the conditioning site and elsewhere, where they also obtained food rewards. Their behavior was generalized to include people and human habitation as a broad category and, unlike the behavior of F013, was not site-specific.

Based on my analyses, it is likely that the impact of anthropogenic feeding varies according to the specifics of the situation. Feeding scenarios that occur only in very specific locations and/or with a small number of people involved might be less readily generalizable than feeding which occurs across multiple settings and/or with larger numbers of human participants.

In situations of limited food availability, bears will seek out any food source more aggressively, and if anthropogenic foods are available, bears will use them opportunistically. Although it has not been demonstrated with individual bears over time, the finding that nuisance complaint numbers rise during periods of natural food shortage (Gunther et al. 2004; Peirce and Van Daele 2006; Mansfield 2007) would seem to indicate that natural food shortages encourage bears to become anthropogenic food users, and it follows then that the more limited the overall food supply, the more persistent bears may become in seeking out whatever food is available, anthropogenic food included. In areas where anthropogenic food is available but limited, food conditioned bears may enter houses or break into cars in search of it (Meagher and Phillips 1983; Breck et al. 2009).

Theoretically, the scenario most likely to prevent unwanted nuisance activity would be an unlimited food supply, provided only in a specific context (e.g., a feeding station), where the surrounding area is bear-proofed. Conversely, the scenario most likely to generate unwanted nuisance activity would be multiple anthropogenic food sources available in a variety of contexts (e.g., residential garbage), in an environment that is food-limited.

These possibilities are borne out by the findings of Ziegler (2008), who found that diversionary feeding sites reduced damage to managed conifers but did not increase nuisance activity in the surrounding area. Rogers (2009) demonstrated that access to feeding stations did not increase nuisance activity, and reduced problems in nearby campgrounds. This is in contrast to behavior of food conditioned bears following the closure of previously important anthropogenic food sources such as dumps, many which aggressively sought out replacement anthropogenic foods (Craighead et al. 1995; Wood and Ciarniello 2011).

The bears in this study appeared to occupy a position between these two extremes. There were no accounts of bears entering homes or locked vehicles, nor did bears ever attempt to enter or destroy tents or RVs at KCSP, in spite of the presence of food. One evening I observed an unidentified male bear feed from two trashcans located less than 1.5 m on either side of the wings of an occupied pop-out camper but at no time did he investigate the camper itself. The camper's occupants told me the next morning that they had been completely unaware of the bear's presence. I did, however, receive accounts of bears outside the park in residential areas entering and damaging other structures in the pursuit of anthropogenic food. Whether the bears engaging in this behavior did so because their overall access to food was limited, or because they were food conditioned to a level that such activity was no longer perceived by them as risky, is unclear. A thorough examination of the development of nuisance behavior over time would require a longitudinal study of semi-habituated bears. Few studies of this type are conducted, probably because of the logistical difficulties entailed and the controversial nature of intentional habituation, and so these questions remain largely unanswered.

Demographics

The sex ratio of bears captured in Kentucky was strongly biased towards males. Whether this is an artifact of trapping bias favoring males (Hellgren and Vaughan 1989; Beckmann and Berger 2003b), because males are disproportionately represented among nuisance bears (Beeman and Pelton 1974; McLean and Pelton 1990; Beckmann and Berger 2003b; Weaver et al. 2003), or because Kentucky's current bear population represents a colonizing front led by male bears dispersing from their natal areas, is unclear.

In addition to being mostly male, a large majority of the bears captured in Kentucky were young in age. These numbers from the total population were similar to the demographics of animals known to use anthropogenic foods, where 82.8% (n = 48) were male and 15.5% (n = 9) were female (there was one bear for which gender was not listed, although based on the eartags was probably also male). Of the bears known to use anthropogenic food, 72.4% were ≤ 3 years of age. The preponderance of males in the population, as well as the young age structure, are consistent with anthropogenic feeding bears elsewhere (Rogers et al. 1974; McLean and Pelton 1990; Beckmann and Berger 2003b).

Given the telemetry data collected by me, as well location information obtained subsequently (B. Augustine pers. comm.. June 2011), I suspect that the real number of bears using anthropogenic foods exceeds the number of bears I was able to document conclusively. If this is the case, then the similarities between the overall population demographics and the demographics of known anthropogenic feeding bears are not surprising, as they are essentially measuring the same population at two different scales.

There were only 4 bears (2 female and 2 male) ≥ 6 years of age at first capture during the study period. An 8 year old female (F014) was captured for the first and only time along a trapline in CGNHP in 2003; an 8 year old male (M009) was captured along a trapline in 2002 after having been previously captured as a nuisance animal prior to the study in 2000; a six year old male (M008) was captured in 2002 after having been previously captured as a nuisance animal in 1999; and an 11 year old female was captured for the first time in an anthro-trap in 2005. Other bears reached these ages during the study period, however. Out of a total of 8 animals who were ≥ 6 years of age

at one or more captures, 5 were female and 3 were male. All but one of these bears were confirmed to use anthropogenic foods and were classified as being in good or excellent condition across all captures. Even with the removal of the one bear not known to use anthropogenic foods, this group was disproportionately female when compared to overall capture statistics and gender ratios for other age groups.

These findings are consistent with Rogers et al. (1974) who found that the sex ratio of garbage conditioned bears under 7 years of age was significantly skewed towards males, but that females were more common among nuisance bears over 8. He suggests that this is an artifact of hunting, which disproportionately targets males both because of its timing and because hunters used dumps and other central feeding spots where males predominated. Although two study bears were killed legally in Virginia as part of the bow hunting season there, bear hunting was illegal in Kentucky prior to and throughout the study period. Hunting did not appear to be a major source of mortality for marked Kentucky bears in neighboring states and, therefore, is an unlikely explanation for this observation. An alternative explanation is that, while perhaps less abundant overall, female bears experienced differential mortality for reasons other than hunting.

Bears were frequently estimated at capture to be ages other than those subsequently indicated by tooth analysis. Both underestimates and overestimates of age were made. Not surprisingly, animals in poor or fair condition tended to be estimated as younger than they actually were and animals in good or excellent condition were often believed to be older than their actual age due in both cases to their size. Some estimates were off by several years in either direction. For example, a female bear captured in CGNHP (F014) was estimated to be a subadult at capture but was subsequently determined to be 8 years based on tooth data. Another bear was captured as a yearling on a mine site in June of 2005 (M040) but was estimated to be an adult at his death in November of the same year. In each of these cases, food availability may have played an important role in the relative size – and consequently the estimated age – of the two bears. During the time she was radio-collared, F014 was located primarily within CGNHP and had a home range several times that of female bears in and around KCSP (Unger 2007), possibly a sign of low food availability (Hixon 1980; Mitchell and Powell 2007); she had no known history of anthropogenic feeding. At capture she was believed

to be pre-reproductive based on nipple pigmentation (M. Orlando pers. comm.; Beck 1991) and was believed to be a subadult based on both this and her size. In contrast, M040 consumed anthropogenic foods extensively. He was first captured at a coal mine in Harlan County because of nuisance activity and suspected hand feeding. He was then relocated to HPMWMA, after which he established similar behavior at a different mine in Letcher County, where he was also hand fed. In addition, he foraged extensively in the surrounding residential area, eating garbage and pet food, and where he was hand fed as well, before finally being killed illegally that fall. Given the extreme variability in bear size by age, especially due to the impact of food availability on growth, the use of an objective age measure, such as cementum annuli analysis, is paramount. Findings in Kentucky were, in general, consistent with observations of anthropogenic feeding bears in other areas. However, without the ability to distinguish definitively between bears that used anthropogenic foods and those that did not, i.e., lacking a control group, it is difficult to know the precise impact anthropogenic feeding had on observed demographics.

Reproduction and mortality

Female bears in Kentucky consistently produced larger than average litters when compared to bears in other regions. Every observed litter belonged to a female known to or strongly suspected of using anthropogenic food resources but even when compared to sows in other areas that also used anthropogenic resources, the average litter size of Kentucky bears was still higher (Table 5.2). There are several possible explanations for this observation, among them that the litters included in my analysis were in some way unrepresentative of the general population. While my results were statistically significant, it is possible that a more extensive investigation of annual reproduction in the Commonwealth might yield different results. However, the indication thus far is that Kentucky black bear litter sizes are high compared with black bear populations elsewhere in the distribution, and these are the litters on which current management decisions are being made. From my analysis, it also appears that this high level of production, as well as young first age of reproduction, may be tied to the widespread use of anthropogenic resources instead of an abundance of naturally available food, as suggested by others

(Unger 2007; Dobey 2007). This is of particular importance because higher production as a result of artificial food availability may not increase population growth.

Cub mortality is poorly understood because determining cause of death is difficult (Rogers 1983; LeCount 1987). However, Beckmann and Berger (2003a) found that survival and recruitment of urban interface cubs may be 80% lower than wildland conspecifics, in spite of the fact that urban interface mothers had a lower age of first reproduction and larger litter sizes than wildland females.

While four study females were documented as having cubs on a 2 year schedule (Unger 2007), which would be consistent with successful reproduction and cub survival, these bears were not checked during the intervening years to verify that the cubs observed from the preceding year were still alive or if the sows had produced new cubs of the year that were subsequently lost before reproduction was documented again. In the one case for which data on den occupancy was available two years in a row, the female had new cubs each year, suggesting loss of the previous litter (Table 5.1).

Given the capture of 22 different yearling cubs, and observation of two litters of yearling cubs with collared mothers (of which 3 are represented in both tallies), at least some cubs born in Kentucky are surviving to the age of dispersal. However, there has been no study of bear cub mortality associated with the apparent high cub production in Kentucky to date. Reproduction in successive years, as mentioned above, as well as the capture of reproductive females with no sign of lactation or attendant cubs, may indicate the loss of entire litters. Only one marked bear, F013, was ever observed with yearling cubs, although she was seen many times by many people, creating an impression of high levels of fecundity. In light of the rest of the data, the apparently high rate of cub production must be interpreted with caution when attempting to extrapolate what it might mean for population growth. More information is needed to understand overall survival rates and mortality.

Mortality

More is known about the sources of adult mortality in Kentucky black bears, although long term monitoring will be necessary to corroborate the observed trends. As has been found elsewhere, most adult mortality for black bears is human-caused (Rogers

1976; Rogers 1987; Sorensen and Powell 1998; Costello et al. 2001). Outside Kentucky, hunting typically accounts for the majority of the mortality of adult bears but bears are also commonly struck and killed by cars, poached, or euthanized for management reasons. Some of these outcomes could contribute to the observed gender imbalance although they are unlikely to explain it entirely. In addition, anthropogenic feeding is more closely associated with some causes of death than others.

During my study, there were two capture-related bear deaths, one male and one female. A subadult male captured as a result of nuisance activity appeared to have had an adverse reaction to the drugs used to sedate him and suffered respiratory arrest, and a yearling female asphyxiated after being snared along a trapline. In the absence of gender-based capture bias, capture-related mortality would reasonably be expected to occur irrespective of all other variables, with the possible exception that poor condition might make a bear less tolerant of sedation; however condition was not suspected as a factor in either of these two bear deaths.

Two marked male bears, both with previous nuisance histories, were killed legally during bow hunting season in Virginia. This form of mortality might be expected to affect male bears more than females because of the timing of hunting seasons, although the impact on anthropogenic feeding bears versus natural feeding bears is less clear. One of the bears was two years old and his size at death is unknown, and the other was a 4 year old male weighing 195.5 kg at the time of death. Either large body size or habituation might contribute to the likelihood of a bear being killed during a hunt although the evidence that hunts target nuisance bears is equivocal (Weaver et al. 2003; Hristienko and McDonald 2007).

Two bears were euthanized by KDFWR because of nuisance activity, one for apparent aggression towards people (M012) and a first time captured yearling male who was depredating goats. Management euthanization is not currently a major source of bear mortality in Kentucky. If nuisance activity increases as management options such as relocation become more limited, then this pattern could change.

While all causes of mortality are potentially important in a small population, the two primary known causes of death for Kentucky bears at present are: being struck by vehicles and being killed illegally. During the study period, 13 bears died as a result of

being hit by cars and one was struck by a train. Similarly, 13 bears were poached or suspected of having been poached, and either killed outright or injured so severely that they were later euthanized by KDFWR. The larger home ranges and roaming behavior of male bears may make them differentially vulnerable to being hit by cars. Twelve of those hit were male and one was unknown, although one female bear was hit by a car but not killed or seriously injured. It is unclear whether these numbers represent differential mortality biased towards males or simply the overall demographics of the bear population. Half of the bears struck by cars were known to use anthropogenic foods.

Anthropogenic feeding almost certainly contributed to poaching. Nine of the 13 bears killed this way had a known history of nuisance behavior; the remaining 4 were handled for the first time at their deaths and so their previous behavior is unknown. Anthropogenic feeding brings bears into contact with people making them vulnerable to poaching (McLean and Pelton 1990) even when the act is unrelated to their nuisance behavior; however, so-called “defense of life and property kills” are also widespread and being shot while accessing garbage is a primary source of mortality for bears (Rogers 1976).

Comparison between trapping areas

I did not conduct observations of anthropogenic feeding in Bell County, and therefore am unable to compare the two regions in that respect. However, KDFWR responded to nuisance complaints throughout eastern Kentucky and there was only one nuisance capture listed for Bell County between 2002 and 2006, in contrast to 35 nuisance captures in Harlan and Letcher counties during the same time period. This may be an indication that nuisance activity and, by extension, anthropogenic feeding, are not occurring consistently across the landscape.

The discrepancy in apparent physical condition between bears trapped in CGNHP and HPMWMA is notable and has potentially important research and management implications. There are no data currently available that would allow the quantification of either naturally occurring or anthropogenic foods by black bears in Kentucky, regionally or otherwise. However, one interpretation of my results is that there is a difference between the two areas in terms of food availability. This possibility warrants further

examination before overall bear numbers, or average condition observed, are used to make assumptions regarding natural food availability and habitat quality for bears in Kentucky.

Mitigation measures and their efficacy

Relocation of black bears is widely practiced but does not appear to be a successful strategy for reducing nuisance activity in a majority of cases (Spencer et al. 2007) nor was it in Kentucky. Although not all of the translocated bears returned, at least half of them resumed nuisance activity following capture and the fate of the others is unknown. This is often the case in many states because relocated nuisance bears are not identified or radio-collared and therefore it is impossible to know if these animals continue their previous anthropogenic feeding behavior. As in other studies, adult females appeared to be the most likely to return to their original home range, and both adult females in this study did so. Relocation was associated with an increase in mortality, although a causal relationship is not necessarily clear as the bears that were relocated were typically those engaging in extreme nuisance behavior.

Capturing and releasing a bear on site, as a component of an aversive experience (typically coupled with other hazing techniques), is another method of discouraging nuisance activity (Clark et al. 2003; Beckmann et al. 2004); this method is also used in Kentucky. This technique may not be any more likely to discourage nuisance behavior elsewhere but the more direct relationship for the bear between the nuisance activity and the proceeding aversive experience could increase the likelihood of it avoiding the associated site.

Seventy nine percent of states that actively manage black bear populations use deterrent techniques to address nuisance activity (VDGIF 2002). Four of the six methods listed are currently being used in Kentucky: buckshot, rubber slugs, cracker shells, and loud noises. The two remaining techniques – pepper spray and chasing with dogs – are not currently used in the Commonwealth.

In spite of widespread use, there is little research demonstrating the efficacy of any of the above hazing techniques (Beckmann et al. 2004). Even where studies have demonstrated some reduction of nuisance activity at a specific location due to aversive

conditioning, 93% of conditioned animals continued nuisance activity in the same area (McCarthy and Seavoy 1994). Other studies indicate that an overwhelming majority (92%) of bears hazed following nuisance activity returned to the area of capture, just over half within 30 days (Beckmann et al. 2004). These results were consistent with my observations in Kentucky, where hazing failed to deter future nuisance activity over time or in some cases, even on the same day.

There have been a small number of studies in other areas where hazing appears to have been a part of a general reduction in nuisance activity (Chi et al. 1998; Clark et al. 2002). The efficacy of hazing as a nuisance bear management technique appears to depend heavily on the consistency with which it is applied and therefore the degree to which it is generalizable. In areas where it is used aggressively each and every time a bear comes into the town and where, very importantly, it is paired with other measures that successfully reduce bear access to anthropogenic foods, hazing has shown to be effective at reducing nuisance behavior and can be a useful tool (Dolson 2002). Unfortunately, the hazing of bears in Kentucky is likely to continue to be ineffective where it is inconsistently applied and anthropogenic food continues to be available at previous nuisance sites. Either the positive reinforcement of access to food dwarfs the impact of any negative conditioning or conditioning is limited to highly specific situations and the bears fail to associate those negative experiences with garbage feeding generally. This type of application means that bears will continue to engage in nuisance activity even after being hazed because aversive experiences are relatively uncommon and limited to situations that also have unintended cues. In the presence of hazing-specific cues, bears only associate the negative reinforcement with the cue, and not with the nuisance activity; therefore, generalization by bears among sites does not occur (Domjan 2006).

I observed bears that clearly reacted to the sound of a shotgun being cocked but had learned to ignore other loud percussive noises, such as slamming car doors, coal-mining machinery, and even a handgun fired into the ground. Bears at KCSP reacted to the arrival of the jeep driven by the park rangers, but not the vehicles driven by other park visitors. Multiple nuisance complainants noted that bears avoided their house when a culvert trap was present but resumed visitation as soon as it was removed. In each of

these cases, the bears had clearly been successfully negatively conditioned; the problem was that the conditioning hinged on certain specific cues rather than the nuisance behavior itself. The conditioned aversion was not generalized to other situations where those cues, as well as the associated negative experience, were absent. This was very similar to the findings of McCarthy and Seavoy (1994) who tested a variety of potential deterrent techniques and found that bears failed to develop an aversion to nuisance foraging behavior, but that several bears learned to react to the sound of rifles being cocked and the presence of police cars.

McCarthy and Seavoy (1994) suggested using this propensity to create an intentional cue which can then be used to deter nuisance activity even when the unconditioned stimulus is no longer present. In this situation a bear would learn to associate a particular sound or smell with an aversive experience, such as being shot with a rubber slug or ingestion of an emetic. The sound or smell cue would then be used to discourage bear activity but without the necessity of further use of emetics or hazing activity, or could be used as a deterrent measure by homeowners while waiting for wildlife officers to respond (Homstol 2011). A conditioned aversion will quickly become uncoupled if a bear is able to obtain a food reward with negative repercussions and, therefore, the effectiveness of this approach hinges on the extent to which the cue continues to be reinforced and the speed with which behavioral extinction occurs in the absence of negative reinforcement. The availability of alternative food sources may also affect the rate at which a bear will test the conditioned stimulus. In a food-rich environment, a bear might be expected to err on the side of caution and use alternative food sources. Where food is scarce or the target source is particularly rich, a bear may be more likely to return in spite of previous negative experiences. If bears are able to feed with no negative reinforcement, the aversion to the conditioned stimulus will dissolve.

Similarly, the force or scale of negative reinforcement necessary to deter nuisance behavior and develop an aversion at the outset is likely to depend on the relative benefit to the bear of the activity. Where food is plentiful, the importance of that particular food source to the bear may be low and therefore less force will be required to discourage bear visitation. However, if food access is limited or a food source is especially rich, bears will presumably be willing to incur a higher cost in order to obtain it. There is certainly

evolutionary precedent for such behavior: Grizzly bears may expend a large amount of energy and assume a great deal of risk to access ungulates killed by wolves, especially in the case of sows with vulnerable cubs of the year (Gunther and Smith 2004); however, the benefit of this high protein food source apparently makes it worth the possible cost. Similarly, black bears may be stung hundreds of times by bees when raiding hives for honey, and more importantly, protein-rich larvae, and yet they continue to engage in the feeding behavior (Grosse et al. 2003).

Conclusion

Bears at KCSP had unlimited access to large quantities of garbage, and in most cases food was left uneaten even when bears were allowed to feed without interruption. Therefore, there was little nutritional incentive to approach people more closely or to raid tents or vehicles, as often occurs in other recreational areas. Additionally, the presence of the park rangers and some degree of social pressure probably discouraged many overt attempts at hand feeding. In contrast, bears feeding at coal mines and a local housing development were usually restricted to a small number of dumpsters and were offered high value food items by many different people on a regular basis. This type of feeding experience appeared readily generalizable to other contexts and led to the development of an extremely high degree of habituation and food conditioning, resulting in the deaths of these bears.

Certain mitigation strategies, like relocation of problem bears, are ubiquitous in black bear management (Spencer et al. 2007) in spite of the fact that evidence for their efficacy is lacking. These strategies are often labor intensive and potentially expensive and are conducted largely at the request of nuisance sufferers, not because they are likely to resolve the nuisance conflict.

The variability in the success of hazing techniques across studies may be a consequence of the relative abundance of additional reinforcers in different locations. For example, a woodland apiary is an isolated and individual food source; therefore, aversive conditioning applied at that site may be more readily associated with that depredation activity. In contrast, urban/suburban landscapes have potentially hundreds of different opportunities of positive reinforcement of garbage feeding. In this situation, aversions are

more likely to develop between cues specific to the hazing experience itself rather than with garbage feeding. At best, bears may develop an aversion to a particular home or garbage can, but hazing does not appear effective at reducing nuisance activity overall. As a management technique in eastern Kentucky, the utility of hazing is probably limited to isolated locations and most effective when combined with additional barriers to attractant access (e.g., electric fencing around an apiary or a covered chain link surround for a dumpster).

While hazing created an unintentionally narrow relationship between specific cues and an aversive experience, certain types of feeding created broad based food conditioning which was readily generalized to other contexts, resulting in further nuisance activity. Access to anthropogenic foods was widespread. The fact that 62% of all bears handled (58 out of 94), 87% of bears captured and tagged in a way that made them visually identifiable (27 out of 31), and 100% (23 out of 23) of identifiably tagged bears captured within Harlan and Letcher counties, were confirmed as using anthropogenic foods raises a number of important issues. The large litter size, small fall home range size, and diurnal activity pattern observed in Kentucky has been attributed to abundant natural food resources (Unger 2007), consistent with similar patterns observed in highly productive regions (Alt 1980). However, all but one of the bears on which these conclusions are based were confirmed to have used anthropogenic food which can produce the same results.

While many of the demographic parameters of Kentucky's bears, such as age and gender, are consistent with a colonizing population, all of the parameters are consistent with a population heavily dependent on anthropogenic foods, as described in other studies, and so it may be that artificial not natural foods are the cause. If the core of Kentucky's black bear population is using anthropogenic foods, this has broad implications for both the interpretation of the data currently being gathered as well as for management decisions in the future.

Table 5.1: Annual reproduction of 10 female black bears in Kentucky 2002-2006 as determined by visual observation, auditory assessment, and full den investigation.

UKID	2003	2004	2005	2006
F001	Yes	Yes	Unknown	Yes (3)
F003	Yes	No data	Yes (4)	Unknown
F005	No data	No data	No data	Yes (2)
F006	Yes	No data	Yes (3)	No data
F013	Yearlings	Yes (5)	Yearlings	Yes (4)
F014	Not collared	Yes	No data	Not collared
F017	Unknown	Unconfirmed	Deceased	Deceased
F018	Yes	Not collared	Not collared	Not collared
F037	Not collared (not born yet)	Not collared	Not collared	Yes (3)
F039	Not collared	Not collared	Not collared	Yes (2)

Table 5.2. Black bear litter size comparison between Kentucky and other regions. Data presented here within the dashed lines are adapted from a table by McDonald and Fuller (2001) showing black bear litter counts obtained throughout eastern North America. Significant differences ($P < 0.05$) between Kentucky and comparison areas are indicated by an asterisk.

Location	Number of Litters	Mean	Litter size					Source
			1	2	3	4	5	
Kentucky	8	3.25	0	2	3	2	1	This study
GSMNP ^a	83	1.99*	23	40	18	2	0	McLean 1991
Western North Carolina	34	2.24*	7	14	11	2	0	McLean 1991
East-central Ontario	18	2.5	1	8	8	1	0	Kolenosky 1990
SNP1 ^b	21	2*	6	9	6	0	0	Carney 1985
Northeast Minnesota	70	2.54*	5	26	35	4	0	Rogers 1987
West Virginia	41	2.73	4	9	22	6	0	Alt 1989
Northeast Pennsylvania	211	2.98	10	45	102	48	6	Alt 1989
Arkansas, Dry Creek	13	2.38	2	5	5	1	0	Clark 1991
Arkansas, White River	14	1.36*	9	5	0	0	0	Clark 1991
SNP2 ^c	26	2.31*	1	17	7	1	0	Kasbohm 1994
Maryland	13	3.08	0	2	8	3	0	Mathews and Garner 1993
Mexico	12	2.75	0	5	5	2	0	Doan-Crider and Hellgren 1996
Quebec	15	2.53	0	9	4	2	0	Samson and Huot 1995
Ontario	10	2.7	0	4	5	1	0	Smith and DeAlmeida 1991
Vermont	14	2.07*	3	8	2	1	0	Hammond 1997
<i>Eastern North America</i>	<i>595</i>	<i>2.56*</i>	<i>71</i>	<i>206</i>	<i>238</i>	<i>74</i>	<i>6</i>	<i>McDonald and Fuller 2001</i>
Alaska	10	2.1*	2	5	3	0	0	Bertram and Vivion 2002
Coastal Louisiana	14	2.4	1	6	7	0	0	Hightower et al. 2002
Inland Louisiana	11	1.5*	4	6	1	0	0	Hightower et al. 2002

^a Great Smoky Mountains National Park, Tennessee

^b Shenandoah National Park, Virginia

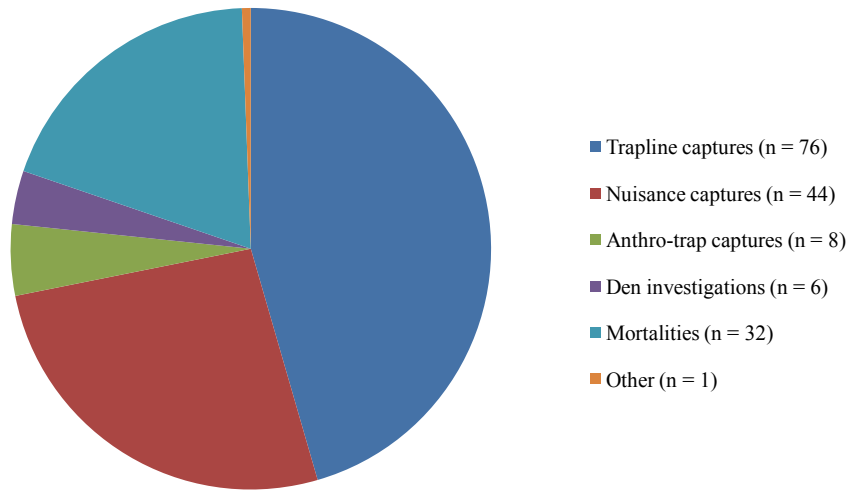


Figure 5.1. Total handling events of Kentucky black bears 2002-2006 (n = 167) by type.

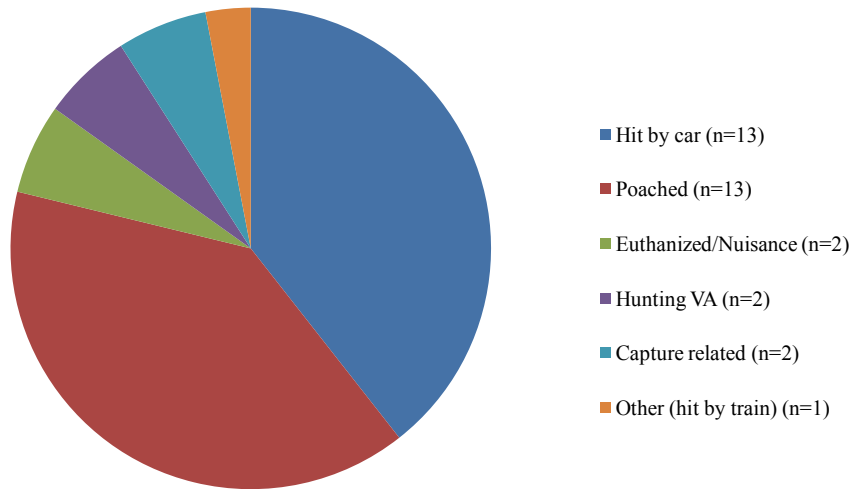


Figure 5.2. Observed sources of mortality for Kentucky black bears 2002-2006 (n = 33).

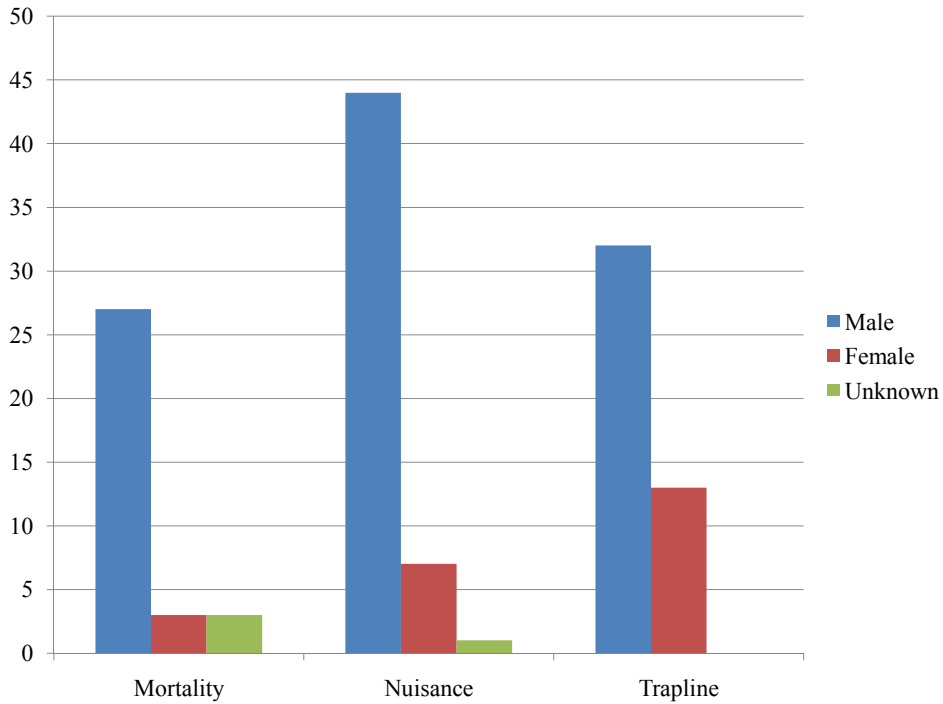


Figure 5.3. Kentucky black bear handling category type by gender, including all handling events 2002-2006 (n = 94).

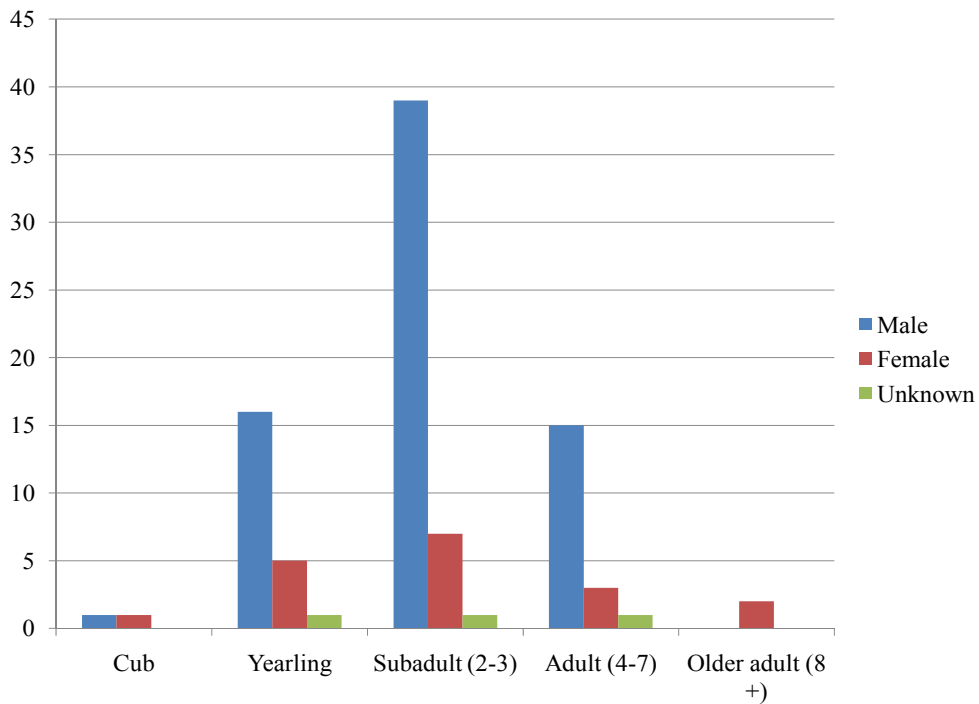


Figure 5.4. Kentucky black bear age class at first capture by gender as determined by visual estimate, and cementum annuli where available. Includes all handling events 2002-2006 (n = 94).

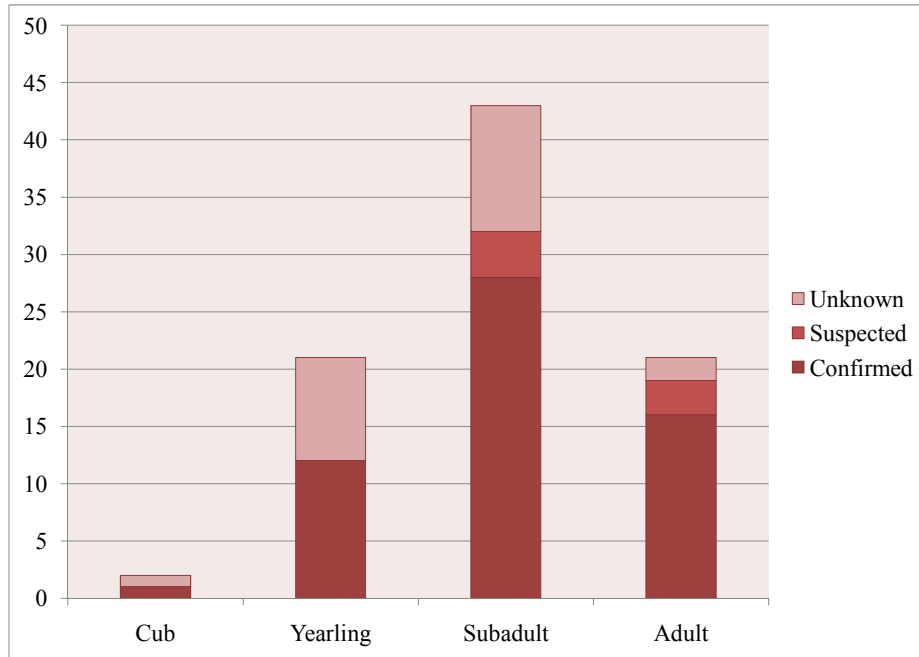


Figure 5.5. Kentucky black bears confirmed and suspected to use anthropogenic foods as a proportion of total bears handled 2002-2006 (n = 94).

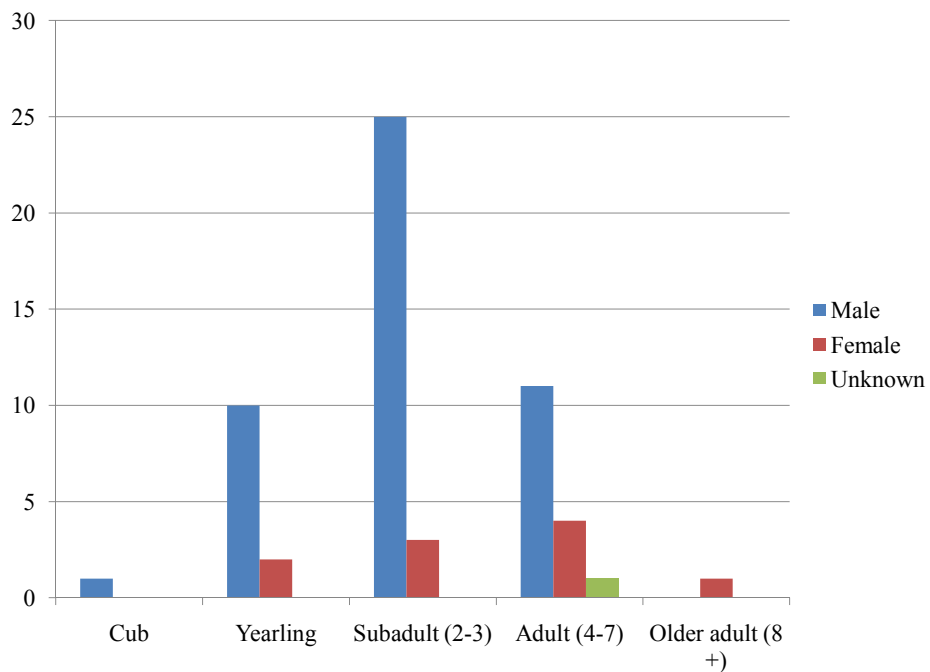


Figure 5.6. Confirmed anthropogenic feeding by Kentucky black bears by age at first capture 2002-2006 (n = 58).

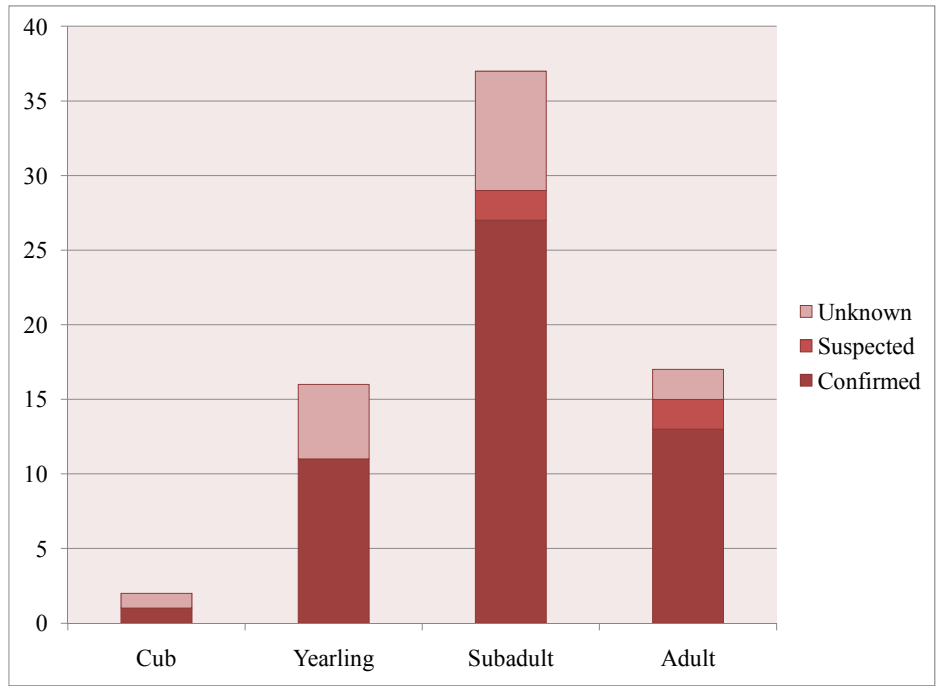


Figure 5.7. Kentucky black bears confirmed and suspected to use anthropogenic foods as a proportion of all bears captured alive, 2002-2006 (n = 74).

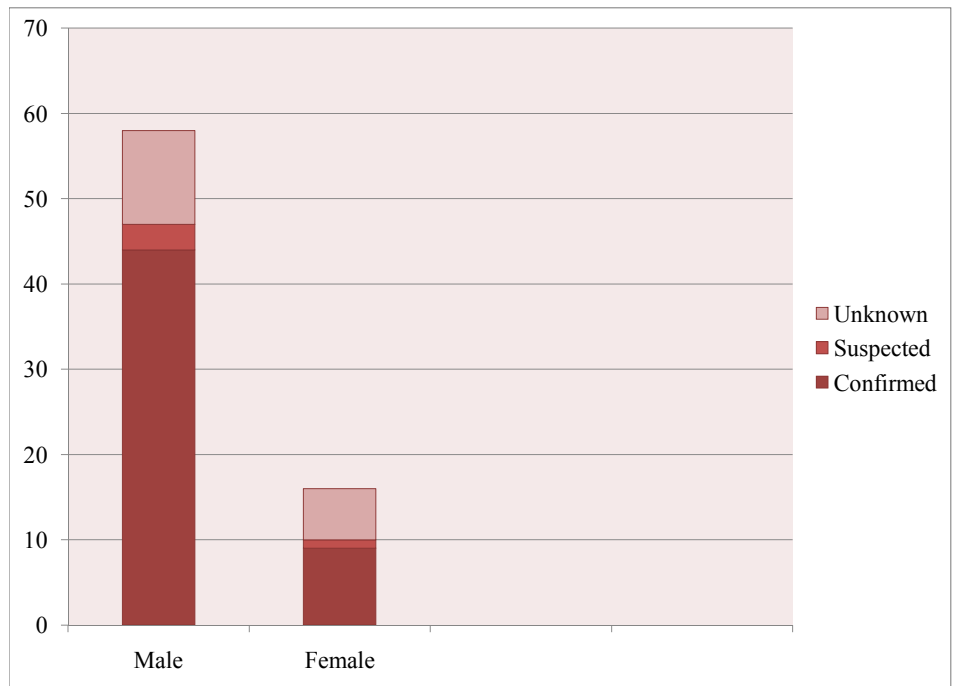


Figure 5.8. Confirmed and suspected anthropogenic feeding of live-captured Kentucky black bears by gender (n = 74).

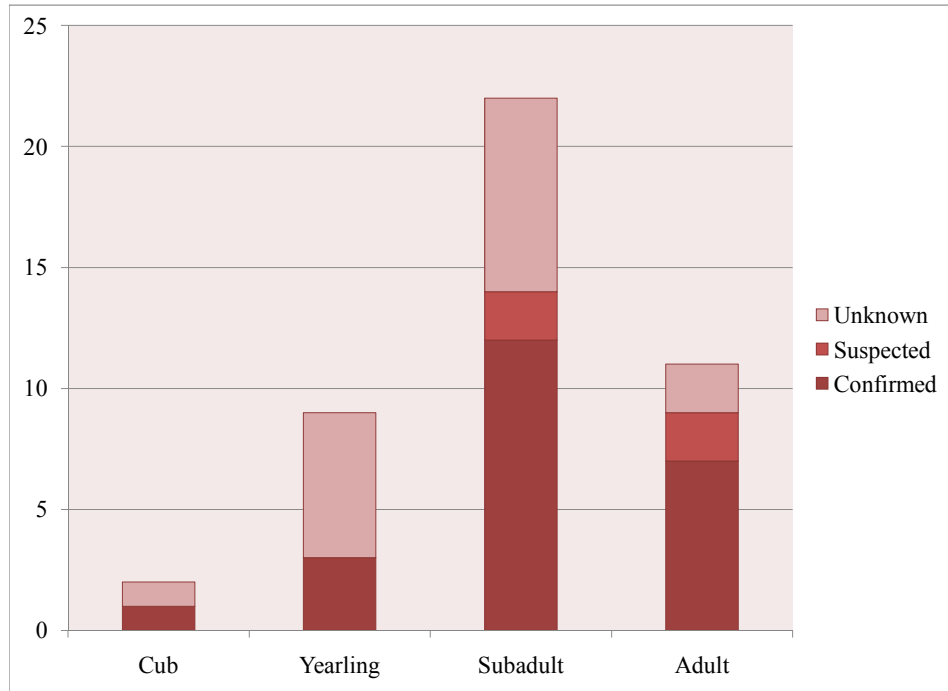


Figure 5.9. Kentucky black bears confirmed and suspected to use anthropogenic foods as a proportion of total bears captured along traplines 2002-2006 (n = 45).

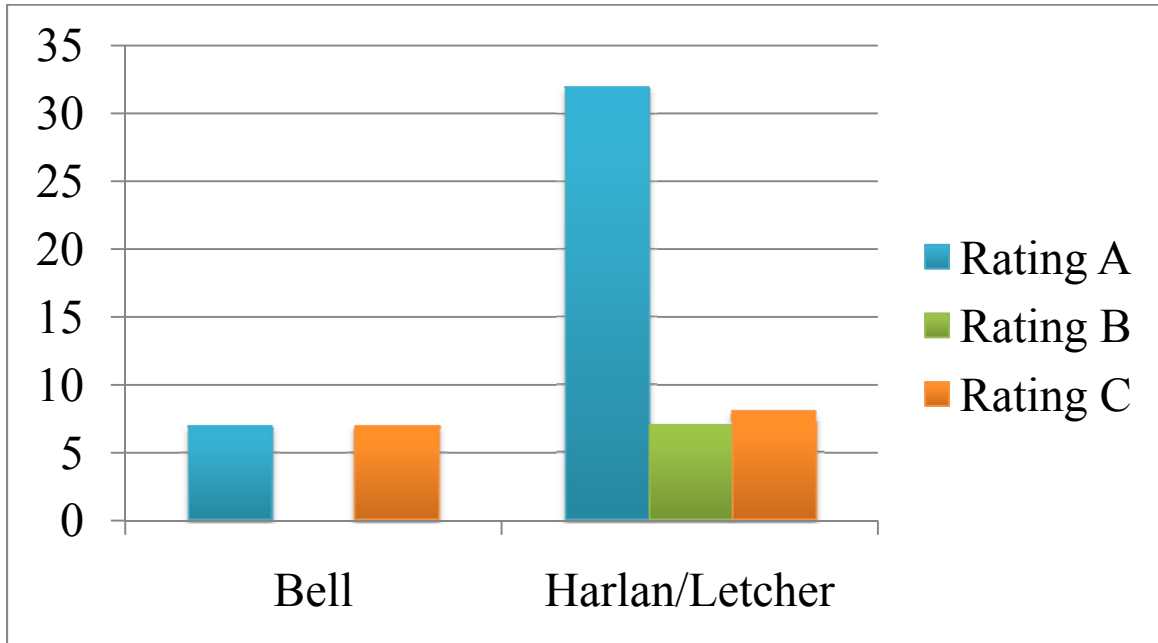


Figure 5.10. Rated condition of Kentucky black bears at capture across all captures for each individual by county of first capture, 2002-2006 (n = 61). “A” rated bears were classified as good/excellent condition across all captures; “B” rated bears were classified as good/excellent at one or more captures and poor/fair at one or more captures; “C” rated bears were classified as poor/fair at all captures.

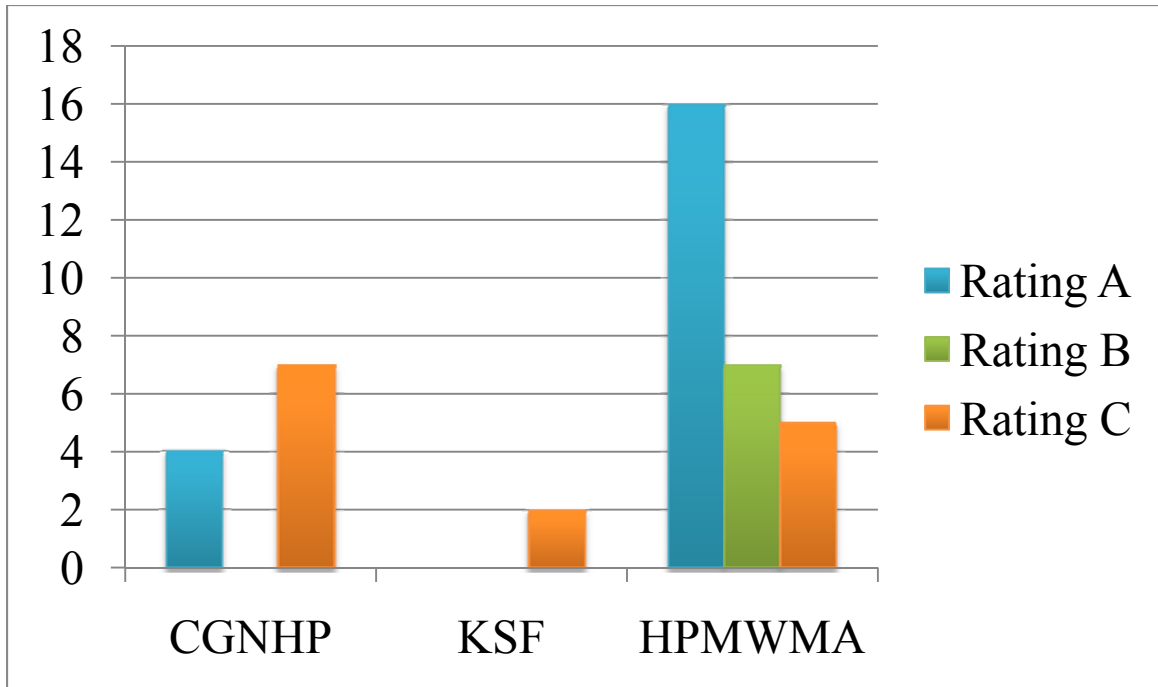


Figure 5.11. Rated condition of Kentucky black bears at capture, across all captures for each individual by trapline, 2002-2006 (n = 41). Excludes three male bears relocated from other areas to SCWMA near CGNHP as a result of nuisance activity and subsequently captured in CGNHP the same year. “A” rated bears were classified as good/excellent condition across all captures; “B” rated bears were classified as good/excellent at one or more captures and poor/fair at one or more captures; “C” rated bears were classified as poor/fair at all captures.

CHAPTER 6: ANTHROPOGENIC FEEDING AND NUISANCE ACTIVITY

PART TWO: HUMAN IMPACTS

Introduction

As discussed in Chapter 5, anthropogenic food use can have a significant impact on both the behavior and physiology of black bears. Nuisance activity precipitated by this kind of feeding can also have an important impact on human residents, affecting their attitudes towards bears and their tolerance of bear presence. Negative interactions may make residents less willing to support bear conservation and may also contribute to friction between nuisance sufferers and fish and wildlife agencies, making mitigation even more difficult. When people lack information about carnivore behavior they may be more likely to engage in risky or potentially dangerous behavior (Herrero 2002; Siemer et al. 2010). Resolving these problems requires that wildlife managers understand not only the type of conflict being experienced but also the underlying perceptions and attitudes of the people involved. Management efforts and outreach will be more successful if residents are supportive of management actions (Purdy and Decker 1989; Siemer et al. 2010).

While the success of individual populations varies, bear populations nationally appear to be increasing (McCracken et al. 1995; Peine 2001; Siemer et al. 2009). Hristienko and McDonald (2007) reported that wildlife managers observed increasing bear numbers in 28 of 33 states with bear populations; three states reported stable populations and two a decline. However Beckmann and Berger (2003b) observed that human-bear conflict is occurring at a rate disproportionate to population growth, possibly because of a redistribution of bears within the landscape in response to anthropogenic attractants.

Nationally, human-wildlife conflict is increasing (Conover and Decker 1991; Conover 1994). Agriculture is particularly hard hit, with 89% of producers surveyed reporting wildlife-related damage, often in excess of \$500, in spite of spending twice that on prevention (Conover 1998). When extrapolated across the nation's farms, this means that wildlife-related damage exceeds two billion dollars annually (Messmer 2000). Wildlife conflict is not limited to these industries, but also affects 60% of urban and

suburban households (Conover 1997), resulting in property damage as well as injuries, and occasionally human fatalities. These conflicts run the gamut from ornamental plant damage by browsing animals to vehicle collision and Lyme disease. Conover et al. (1995) estimated that approximately 5000 people are injured each year either directly or indirectly by wildlife, and 415 die.

In spite of this, wildlife species are associated with many positive values and a majority of people say that “their lives would be less satisfying if wildlife were not present” (Messmer 2000). Rural residents are more likely to experience problems with wildlife as a virtue of proximity, yet rural residents are more likely than urban residents to assign positive values to wildlife and say that they appreciate living close to nature (Messmer 2000).

Wildlife acceptance capacity (WAC) refers to the wildlife population level that the public finds acceptable (Decker and Purdy 1988) and is a similar concept to cultural carrying capacity (Duda et al. 1998), a term used synonymously in the literature. Nuisance activity and associated wildlife damage can affect WAC. Unlike biological carrying capacity, which may fluctuate but exists on only one level at a time, WAC may differ among stakeholder groups simultaneously (Decker and Purdy 1988). When people perceive an elevated risk from wildlife, WAC is likely to go down. Conversely, economic or social benefit associated with a certain species will make WAC go up.

Risk perception in this context refers to the intuitive judgment that people make about the possible threat (Slovic 1987), rather than an expert interpretation or absolute risk in statistical terms. Risk perception may be influenced by both experiential and analytic processes (Gore 2009). Information sources, basic beliefs, and demographic characteristics may all affect risk perception (Siemer et al. 2010), and risk perception can affect tolerance for wildlife presence and activity.

Wildlife managers have traditionally focused on increasing the numbers of desirable wildlife species, often to provide opportunities for recreation and hunting, using indirect management approaches such as habitat manipulation, as well as direct approaches such as harvest quotas (Messmer 2000). However, today’s wildlife professionals are increasingly dealing with a society with different wildlife values and interests (Kellert 1994). These new constituents may have different problems and

concerns, as well as varying tolerance for conventional approaches (Decker et al. 1996). Lack of understanding of stakeholder values on the part of decision-makers and managers can result in communication breakdowns and unnecessary conflicts between stakeholders (Miller and McGee 2001). Finding solutions that successfully reduce nuisance problems and are acceptable to the public will only become more important as human development spreads (Applegate 2008).

Wildlife management efforts are more likely to be successful when managers understand the public being served (Manfredo et al. 1998). An accurate understanding of stakeholder needs and concerns allows managers to identify salient differences between groups as well as to find common ground. One of the most commonly recommended approaches to human-bear conflict is to launch an educational outreach campaign directed at human residents or site users which offers information on how to behave safely around bears and reduce the availability of attractants (Herrero and Higgins 2003; Beckmann et al. 2004). The content of these programs varies depending on the target audience. For example, this approach has been used to address residential problems, problems with hikers and in campgrounds in national parks, municipal dump issues, and agricultural depredation problems (Gore et al. 2006b). The form of outreach programs varies as well, but efforts may include the creation and dissemination of educational leaflets, mailers, prominently posted signage, and material given out when hikers or campers register or enter a protected area. They may also include presentations to community groups or schools. These programs attempt to inform the public about wildlife and wildlife related problems but they also typically advocate particular strategies for reducing conflict (Gore 2004).

Results

Of the 66 cases of nuisance activity I examined, 16 pertained to commercial or public sites, but only two sites accounted for 11 of the 16 reports. I received three reports of agricultural damage and found one additional account by means of snowball sampling. The remaining cases of reported nuisance activity, and by far the majority ($n = 46$), were residential (Figure 6.1). All complaints were categorized by the type of damage

experienced or attractant involved within the following categories: garbage, pet food, garden, bee hive, orchard/nursery, livestock, bird feeder, and other taken from the KDFWR nuisance report form. I added an additional category labeled “concern” to include the full spectrum of issues leading to the identification of nuisance activity as reported during the study period. Although I toured public, commercial, and agricultural nuisance sites, the focus of my study was on residential nuisance problems because of their greater prominence in the region as well as their potential for more severe outcomes for both people and bears due to the fact that, unlike problems that occur in public spaces, residential encounters are completely unsupervised.

Agricultural complaints

The primary agricultural-oriented complaint was damage to bee yards (two out of four cases). Bears destroyed bee gums and hive boxes in bee yards located in forested areas. Both of the cases I monitored were resolved using electric fencing to exclude bears from the bee area which was effective at eliminating further damage. The remaining two cases involved a bear breaking tree branches while accessing fruit in an orchard (n = 1) and a bear reported to be eating chicken feed (n = 1). Further problems were reduced when the first owner encircled his fruit trees with fencing and the latter reduced access to the chicken feed. None of the four agricultural complainants sustained long term bear visitation and problems appeared to be resolved the most quickly of the three general categories examined. When doing my final analysis of all bear handling events during the study period, I reference a young bear euthanized by KDFWR because of goat depredation, but this occurred after data collection was complete and I did not interview anyone about this incident.

Public and commercial area complaints

Seven of the nuisance reports I examined originated in KCSP and, of these, four involved F013 and her cubs. Bears eating from garbage cans were a daily occurrence at KCSP at times during the study period and so this was not typically considered a nuisance. Within KCSP, nuisance complaints were filed primarily in response to incidents where particular bears habitually approached human visitors or human visitors

habitually approached certain bears. In these cases the most common response was to haze the bears using rubber bullets or cracker shells (7 cases observed). For a further discussion of bears and garbage in KCSP see Chapter 5.

The second largest source of complaints was an apartment complex of subsidized housing units located approximately 1.6 km from KCSP. Although in some sense this might be thought of as a residential nuisance problem, I elected to categorize it in this group because of the large number of people using a small number of garbage sites and offsite owners in charge of making any modifications. As with KCSP, bears visiting the complex had constant and unfettered access to garbage, in this case from one of three dumpsters. There were multiple accounts in interviews where participants reported seeing or hearing about people intentionally putting food out for the bears and in some cases hand feeding them (5 cases reported).

As with KCSP, the primary mitigation method employed was hazing. This was largely conducted by the local police department. After being hazed, the bears continued to be sighted in the area and continued to feed at the complex over time. No attempt was made to restrict bear access to the garbage during the study period; when approached by the Black Bear Task Force, apartment managers cited prohibitive expense.

One of the first commercial areas in the region to suffer nuisance bear problems was a retirement home located along Highway 119 just outside of the city of Cumberland. Bears were reportedly feeding from the dumpster at the site. The manager of the retirement home resolved the problem within a few weeks of its inception by enclosing the dumpsters with 2.5 m chain link fencing topped with barbed wire at an expense of \$1800. Although the enclosure lacked a top, these measures were sufficient to eliminate any subsequent nuisance issues at the site.

A local school experienced escalating bear problems beginning in 2002 and continuing through 2004. Bears visited the school dumpster occasionally during daylight hours, prompting child safety concerns from school officials. Both hazing and relocation were attempted as mitigation measures without success. A bear resistant dumpster was installed but failure to keep it closed and locked allowed bears to continue using the site. In 2004, a more concerted effort was made to keep the dumpster closed and subsequently bear visitation decreased.

There were reports of bears eating garbage at two city parks during the study period. In the one case I examined, bear visitation occurred over a period of two years. The garbage cans were used seasonally and bear visitation was intermittent. The primary complaint was concern for visitors and children in the park. The problem was effectively eliminated following the installation of a bear resistant garbage can.

A local church reported problems with mess and bear damage to trashcans located in the parking lot, which adjoined a forested area. Bear visitation was primarily at night and marauding bears knocked down trashcans and dragged the bags of garbage into the woods. Church officials constructed a wooden surround to hold the trash cans in place believing it would deter bear activity but as the cans were left accessible from the top, bear visitation and associated trash bag removal continued.

In all cases, nuisance issues in public spaces were ongoing, lasting weeks or months, but in some cases, such as the apartment complex and KCSP, the issues persisted for several years. All cases involved garbage as the primary attractant. At KCSP and the apartment complexes, intentional feeding occurred concurrently, and the nuisance situation remained unresolved in spite of hazing, relocation, and the euthanization of certain problem bears. In the cases of the retirement home and the public park, bear visitation was eliminated through effective bear proofing of garbage receptacles. No further bear problems were reported following those measures. While the church members and school officials attempted to make their garbage area more bear resistant, their efforts were ineffective and garbage remained accessible to bears and so they did not resolve the problem.

Coal mine bears

I investigated a nuisance complaint at one mine site and found out about similar issues at three additional mine locations during the course of the study. The problems that developed at these locations formed a special case of commercial nuisance encounters. In two of the situations a young male bear was initially attracted to the mine area by an on-site dumpster which he began to visit regularly. These bears became increasingly habituated and food conditioned over time. At some point miners started offering them food from their lunches, sometimes feeding them directly from their hands. Eventually

these two bears became highly habituated to human presence and noise as well as food-conditioned to the point that they would approach people when they saw them, expecting hand outs.

They'd go there to feed it you know, and she said that all you had to do was start rattling those Twinkies packages, get out and she said 'oh it come running' you know.

– Female Bear Watcher

They were stopping up here at the (coal) washer site, back and forth through loads, and feed the bear. He climbed up on the side of 18 wheelers with them running. They'd feed him through the window. What does that tell a bear?

– Male Nuisance Complainant

The behavior at the other two sites was similar, the only difference being that the male bears at those locations arrived following relocation, having already been food-conditioned at a previous site (in one case at KCSP and in the other a different mine).

It is unclear exactly why the phenomenon of coal mine bears exists but in investigating the issue, I found precedent throughout the region of coal mine pets, most commonly dogs, but occasionally other animals including wild horses at one Virginia mine and a rattlesnake in another. The dogs adopted by miners typically emerge out of the forest, attracted by the onsite dumpsters, and just “take up” and so it is not hard to understand how a bear behaving in a similar manner might be adopted in the same way. The dogs (and bears) were provided with a dog house, bowl of water, and steady supply of food and handouts.

You get these mines up in these hollers where these guys bring all this food from home and if a bear starts coming around they're going to try to get that bear to stay. Cause, you know, then they've got the biggest “dog.” All these mines, they converse with the other mines, “hey, we got a bear over here!” you know. It's just like a matter of pride, who's got the biggest mine dog. Maybe the old testosterone kicks in. I don't know. I have thought maybe it was something to do with, I don't know, being there underground, all these guys, and you just want to hang out with something different. I don't know what it is. I just see that every mine has a pet. Every single one.

– Male Nuisance Complainant (Mine Affiliated)

Adoption of a bear by miners goes back to at least the 1980s and I found one more recent case in the bear capture database in addition to those I observed during my study. These bears, primarily young males around the age of dispersal, appeared at coal mines, apparently attracted by the onsite dumpster. The bears began to use the site regularly and at some point miners began offering handouts from their lunches. Miners typically fed the bear over a period of time, usually for a few months but for as long as a year in at least one case. The miners became quite attached to their respective mine bears, almost making pets out of them. They brought the bears special snacks and foods specifically for them in their lunches. In at least one case, miners arranged for someone to go feed the bear when the mine was closed. The bears became exceptionally tame, taking food right out of people's hands, and climbing in and on their vehicles. I received multiple reports regarding the bear described below as well as photos of him climbing in and on one of the miner's trucks. (Figure 6.2)

Twenty five years ago, maybe more, there was a small bear, before any of this big population of bears came. There was a small bear came to a mining area that US Steel had. Anyway, people got to being real friendly with the bear and would feed the bear. A lot of the coal miners, some coal miners work on the surface, some come out of the mines to eat, and they had these shacks and shanties built, you know, with heaters and lights and all this, and they would come, especially at night, come out and have their lunch. So anyway, they had kind of made a pet out of this small bear. But this was like the only bear that had been seen in the area here, the only bear that had been seen in years and years. Well anyway, they would feed the bear and made friends with it and all that. Suddenly the bear disappeared and they didn't see it for a long time. They went looking and somebody found a bear out in the woods, it had been shot with a small caliber gun and wandered off and died. Now that was a long time before this.

– Male Nuisance Complainant (Mine Affiliated)

The miners I spoke with seemed to have real affection for the bears they fed and I heard several people describe the outrage and sadness they felt when the first mine bear described above was killed. Because of the illegality of feeding bears in Kentucky, most people were not willing to speak on the record about hand feeding bears themselves but did offer general comments about the situation. Many of the explanations for the appeal

of adopting these bears were similar to those given by people engaged in similar activities at other sites. People enjoyed seeing such a large and charismatic animal up close and being able to interact with it.

On the other hand, I found that hand feeding of bears at mine sites dramatically increased the incidence of nuisance complaints within the surrounding area and that these issues were linked to the same individual bears. During my study period, two mine bears in particular were associated with residential nuisance problems nearby. One of these bears peeled pieces of vinyl siding off of the side of a house and tried to gain entrance into another residence via an open window. While some area residents also engaged in hand feeding of these bears themselves, most participants were upset with the miners for creating a problem animal that they did not wish to see harmed and which they were unsure how to manage humanely.

We have some mining that goes on around here and people are not from right here, they just work here. And that bear is being fed, and I know it's being hand petted.

– Male Nuisance Complainant (Mine Affiliated)

Now when a bear gets to when it's eating out of people's hands and it's being fed and it ain't scared of you and then it ain't got an option. It ain't wild no more. It needs to be put into a zoo or something. It needs to be put somewhere in a controlled environment. Everybody else made it that way, but it can't live like that, expecting to get people's garbage and stuff. A bear can't live like that. Once it gets like that, it's not a bear.

– Female Nuisance Complainant

All of the mine-associated bears I observed were unaggressive in their demeanor but showed no fear of humans. Even when a resident fired several rounds from a handgun into the ground in an attempt to frighten one bear away, the bear appeared unfazed. KDFWR trapped and relocated two of these bears but they were moved to areas not far from their origin and, although they did not return, they quickly became problem bears elsewhere.

While I found no reports of any of the mine-associated bears behaving in an objectively aggressive manner towards humans, they were all eventually shot and killed illegally. In some cases it was unknown who killed them or why, but in others they were

killed by people who stated that they perceived the presence of bears to be threatening (Harlan Daily Enterprise 2005).

Residential complaints

Garbage-related conflict accounted for, by far, the greatest number of complaints I examined, at 68% of all complaints and 61% of residential problems. Due to the historic absence of bears, garbage handling in the area was not designed to be resistant to wildlife. At the inception of most issues, garbage was freely accessible to the bears.

Residents with weekly or biweekly municipal pick up, and those who drove their own garbage to a commercial dumpster, typically stored garbage in some type of receptacle near their home or at the end of the street in a communal trash area serving the neighborhood. Trash receptacles varied from commercially available garbage cans, both plastic and metal, with and without lids, to repurposed containers such as oil tanks (Figure 6.3) or chest freezers. Prior to filing bear complaints, three of the homes I visited had made minor modifications to guard against stray dogs and raccoons such as containing their cans in a wooden surround and/or placing them on a raised platform; however, I did not observe any commercially manufactured bear-resistant trash cans.

Residents without municipal trash collection or access to a dumpster either periodically drove their garbage to a dumpsite elsewhere, or used a midden or refuse pile located near the home for waste disposal. This was often in a gully or downhill from the residence. I did not observe any compost piles or other structures designed for processing organic waste at any of the homes I visited although one complainant interviewed described separating her food waste from the rest of her garbage and discarding food scraps in a nearby creek.

I don't keep old food in my garbage or no way on account of stuff like that, I just throw it over in the creek and let the fish have it.

– Female Nuisance Complainant

Where bears had access to a refuse pile, visiting bears normally fed directly from the pile. In cases where garbage was stored in cans, some bears fed directly from the trashcans, tipping them over and pulling out the garbage, but in many cases the bears

removed intact bags from the can which they then dragged into the wooded edge before stopping to feed.

They will get a bag of garbage out of the can and go maybe one hundred twenty five feet, one hundred fifty feet up there, up in the mountains and tear it open and get what they want out. Then they come down and get another one.

– Male Nuisance Complainant

It was unclear whether bears targeted garbage cans and middens based on their location or because of their contents. There was anecdotal evidence in two cases that bear visitation might be related to the use of an outside grill earlier in the day which produced a scent plume, possibly attracting the bears, although grilling out might also have affected the trash contents which could have produced the same effect.

After garbage complaints, pet food was the next most commonly listed attractant with five reports. However, in each case, pet food proved to be a secondary attractant only used after bears had established a pattern of visitation based on garbage. Garbage appeared to serve as a “gateway” or primary attractant, drawing in bears that subsequently began eating and investigating other available anthropogenic food sources nearer the house. Because pet food was typically stored in proximity to domestic animals, the human residence, or both, pet food related nuisance activity resulted in higher levels of safety concerns and was more likely to be reported than the antecedent garbage visitation.

Bird feeders were the only primary attractant besides garbage in residential areas and were listed as the cause of complaint in four cases. Unlike garbage, bird feeders did not appear to be a gateway attractant leading to other types of nuisance activity. In all four cases, visitation and associated damage was restricted to the bird feeder and did not escalate into problems with pet food or subsequent issues nearer to the house.

Other complaints were not explicitly related to specific attractants but were a result of elevated safety concerns because of the presence of bears and/or observed damage caused by bears. Residential property damage included dents in motor vehicles (four incidents), partial removal of residential siding by bears (two incidents), as well as damaged porch screens, doors, and windows (four incidents). Food acquisition appeared

to be the underlying motivation behind the behavior of bears in all cases. Fast food wrappers were found in the damaged vehicles and there was a report of intentional feeding in the back of the vehicle in one case. A dead rat was found in the substructure of the trailer behind the area where the bear removed the siding, and screens were damaged after residents moved their garbage onto their porches. There were two incidents in which a bear was suspected or implicated in the death of a dog but neither was confirmed and no bear was actually seen attacking a dog. Either or both of these killings might have been committed by coyotes, which are also found in the region and may feed on livestock or kill domestic dogs (Bider and Weil 1984). In one case, bear tracks were observed in the area, in the other there was no concrete evidence of bear involvement. Bears were also the proximate cause of secondary nuisance complaints involving dogs when bear visitation precipitated incessant barking by neighborhood dogs.

Tolerance of nuisance activity

Based on my eleven interviews with residential nuisance sufferers, the three primary reactions to bear visitation were encouragement, tolerance, and intolerance. I divided people experiencing recurrent bear visitation into three possible categories: 1) people who were intentionally (even if passively) provisioning bears so that they could see them; 2) people who were intolerant of bears generally, or became intolerant of bears after initially tolerating them, but who were not altering their behavior sufficiently to reduce visitation; and 3) people who immediately removed attractants but continued having problems because of neighbors and area attractants over which they had no control.

Nuisance sufferers used a variety of decision trees in their handling of nuisance problems, with three possible outcomes observed: 1) cessation of problem; 2) tolerance of problem; 3) lethal removal of problem (Figure 6.4). While cessation of the problem and lethal removal of a problem bear are both terminal end points (in the latter case, literally), tolerance is a fluctuating state. The degree to which nuisance sufferers believed they could solve their own problems or had accessible help in doing so seemed to have an impact on their tolerance levels.

Regardless of their ultimate level of tolerance and/or risk perception, the primary reaction of those interviewed following their initial bear nuisance experience was fear. Concern for children was a common theme, followed by personal safety, and concern about pets or livestock.

When that first one came, I did call my neighbor because she has two small children and I was afraid that the bear would go down there, maybe, and the kids not know about them or something. Which, she told me she was glad I called, 'cause she said she goes out late at night and smokes outside – she doesn't smoke in her house – so I told her she needed to, you know, think about going outside.

– Male Nuisance Complainant

However, if bear visitation continued and people became more accustomed to seeing bears near their homes with no aggressive encounters, fear diminished and people became more tolerant.

When I first saw one I was scared! I was scared to begin with, but you know, since this bear kept coming around... you know, after he quit trying to tear the house down, I'm not as afraid right now as I was.

– Female Nuisance Complainant

Six of the residents I interviewed initially saw bear visitation as a novelty and were intrigued with the bears. They discussed the bears dumping their trashcans with a similar level of tolerance to what they might apply to other “neighborhood” problems such as loud music or a domestic animal running loose. They regarded bear visitation that only happened once in a while as “not a big deal” and did not do anything about it (tolerating). When bears came regularly and limited their interest to the garbage cans, participants reported that they enjoyed watching them.

We move the garbage in the warm season from the edge of the bank, from the edge of the mountain over here, over to the other area near the light 'cause it's kind of, it's kind of intriguing to me to watch 'em come from out of the thicket, from out of the wilderness and come down and uh, just totally disregard the dogs barkin' at them and whatever. I guess if you're that big and powerful you don't have to worry about people

– Male Nuisance Complainant

Eight of the residents I interviewed were fascinated by the bears and excited to see them in Kentucky. For many of these people the bears were a novelty and they did nothing to discourage their presence, instead watching and photographing the bears in a similar manner to those who observe birds at backyard feeders. I observed four cases where opportunistic scavenging evolved into intentional feeding as dog food or other treats were left out specifically for bears.

Most people appeared at least initially interested in and sympathetic to bears and for each perceived “nuisance bear” that generated complaints, there were typically other people in the same vicinity who did not find the bear behavior problematic or at least not at first. However, while many residents were intrigued by visiting bears at first, many eventually became disenchanted with picking up garbage several times a week and decided they did not want bears around quite so much after all, especially if they experienced property damage during bear visitation.

I've always said that, you know, when you get something like that torn up the first time, it's sort of a novelty. Because you talk about it, everybody does, you know, it's the talk of the community. Well then, after the second or third time, it's not, it's not fun anymore. And that's when people start disliking bears all of a sudden. You know, you go from enjoying seein' 'em, watchin' 'em, to thinkin', you know, "these things are a pest!" I never thought that I would get to the point where I thought bears were just a pain, but they – they're fast becoming a pain with me.

– Male Nuisance Complainant

The tipping point for those that moved from tolerant to intolerant was typically when bear visitation increased so that residents were picking up trash >2 times per week. At that level of visitation, tolerance decreased markedly and a majority of people wanted the problem resolved.

We were really beginning to get tired of picking up trash because it's hard, it's hard to co-exist with something when you're trying to raise a family and you work, and you, you're having to pick up trash and you're trying to maintain a home and everything else.

– Male Nuisance Complainant

In a minority of cases (n = 3), residents disliked the bears from the start and wanted them removed. Interestingly, in these situations there was little effort on the part

of these residents to change their own behavior or garbage handling. These complainants stated that the human residents were present first and the bears needed to be the ones to change or go. Others were more tolerant but in both cases in the subsequent descriptions, bears were treated like an errant neighbor and the conflict was a property rights issue.

No, I don't mind them being around, but they got their area and I need mine. You know what I'm saying? They need to know where the boundaries are at. Other than that, then I'm cool with it. They cross that boundary, then it's, like, my kids and stuff, particularly where they play or something, that's when it's a problem.

– Male Nuisance Complainant

Several factors were consistently indicative of the level of tolerance that complainants had towards visiting bears: their conception of the danger posed by bears, their beliefs about the origin of the bears, and their initiative in seeking out additional information on bear biology and behavior.

Elevated risk perception was, not surprisingly, associated with lower tolerance for bear visitation. Risk perception was itself also associated with the perceived temperament and predictability of the bear. Although there was considerable variability in risk perceptions for people I spoke with, in general, bears that appeared only at night, maintained a distance of at least 10 m from human habitation, and that startled easily and ran away, were generally thought to be less threatening than bears that fed on porches, looked into windows, or approached houses during the daytime.

I drove my vehicle up there and stopped in the road and I was from here to you from it [less than 2 meters] and it's sitting there looking at me and just sitting there eating like it wasn't even paying me no mind. It's not afraid of humans, it didn't run off. And if my kids had been outside our home that day – who knows? We are supportive of the repopulation of black bears in eastern Kentucky, the only concern that we have is it comes through the yard during the daytime. That's what bothers me; the kids are out playing and everything.

– Female Nuisance Complainant

Exactly where the marauding bears originated was a subject of considerable debate among these residents and beliefs about this issue were sometimes, although not always, associated with the level of tolerance toward nuisance activity. Many

interviewees believed that the bears had been intentionally introduced by KDFWR, perhaps as a tourism boon; the majority believed this was helpful or neutral but a few felt that local residents were now suffering the consequences of a poorly designed plan conceived by administrators in Frankfort. Others did not believe KDFWR had necessarily introduced the bears but felt constrained by the laws regulating their management. Several saw this as yet another example of governmental interference and problem-causing for the people of eastern Kentucky.

Well, the way I look at it – who wanted the bear in here to start with? And they can either go back and say “who do these things belong to?” Do they belong to Kingdom Come? Do they belong to you? Who do they belong to? Now look – the damn bears are out here, now this is the problem we have. I think the state is responsible for them. The state is the one that regulates you, the state is the one that will throw a fit if you shoot one of them, so I think if the state has a problem, then they need to say “okay, bears are getting in your garbage and look, you don’t want a bear there” they need to take care of it.

– Male Nuisance Complainant

This view was associated with lower tolerance levels towards the bears in general and nuisance activity in particular. Those expressing higher levels of tolerance towards bear activity also tended to seek out additional information about bears and bear natural history. The primary source of information about black bears was the local newspaper. This was followed by personal experience and information provided at GSMNP. Bear-oriented individuals also sought out information on the Internet.

Mitigation

In three cases examined, people took it upon themselves to bear proof their facilities and, with the help of their agricultural extension agent in two of the cases, were able to do so effectively.

I’ve gotten to where I put my garbage, I’ve got me one of those 275 gallon oil drums and I cut out a door and put hinges on it and a latch and I put my garbage in that. The garbage people will pick it up and I never have a problem. I’ve got a street light around my, in the front of my house and it shines around the back of the house, and I never, I never see one. And other people tell me, “oh, I’ve seen one ’bout every night.” These people

live above me, they've got a bunch of cats. Got a bad habit, taking a kittle of scraps and just slinging it over the bank. And I told 'em, I said "You will definitely see one if you keep a throwing out stuff. And you'll also see the mountain rats will come in and take over your place." I think they've got a little more careful about their scraps.

– Male Park Visitor

These individuals had shown little desire to view the bears at their homes when they first began appearing, engaged in the process of bear proofing early on, and were highly self-motivated to outwit the bears. One continued to have issues initially but seemed to regard each failure as a challenge and kept modifying his set-up until the bears were eventually defeated and visitation ceased.

In contrast, the preferred alternative for the majority of people suffering from recurrent bear visitation was the removal of the nuisance bears from their property and relocation to some other area far away from human habitation. Few showed any desire for the bear to be harmed; they simply wanted it removed and the problem resolved.

I mean, they won't put it down will they? We don't want it put down. If the bear could make it elsewhere, if it wasn't a nuisance for somebody else. It's a nuisance but you know, I don't want to see it hurt. It just needs to be away from people.

– Female Nuisance Complainant

Many bears were indeed relocated by KDFWR but this management strategy proved ineffective and problematic as relocated bears either returned, were killed while trying to return, or initiated nuisance activities elsewhere as discussed in Chapter 5.

KDFWR then shifted into a strategy of trying to get people to change their garbage handling practices. The most common advice listed on nuisance reports by responding KDFWR officers was to keep garbage indoors until the day of pick up and put out only as much pet food as the dog or cat would eat in one sitting. Similar advice was offered on leaflets and included at the end of news articles and press releases. Participant comments in interviews indicated that this advice was typically not followed or not followed effectively. Those that did change their garbage handling usually did so on their own. In the remaining cases, where people were advised to modify their attractant handling practices following a nuisance complaint, residents either refused to change their behavior, reasoning that they had been doing things this way for decades and

they saw no reason they should have to be the ones to change; felt they were unable to change their garbage handling because of logistical constraints; or did attempt to modify their behavior but were unsuccessful at reducing bear visitation because they failed to understand bear capability or what constituted effective food removal.

We decided that we were going to have to do something different. We finally decided that we needed to put our trash inside the chain link fence in our backyard. That way we could keep the bears out; deter 'em from coming in and getting our trash. Well, that worked good for about two days and then a bear climbed over the chain linked fence, got into our backyard and proceeded to tear trash all over the place.

– Male Nuisance Complainant

Few residents had existing alternative garbage handling options – garages, basements, or other secure storage facilities not being readily available at most homes – which left them unable to comply with instructions to put garbage cans out only on the morning of scheduled trash pick-up.

I called the game warden and I said “look, it’s like this: I’ve got 2 small kids here and I can’t keep my trash in my living room like the fish and wildlife department wants me to.”

– Male Nuisance Complainant

Complainants lacked information about commercially available bear resistant garbage containers and these cans were cost prohibitive for many even if they had known about them. Garbage cans were instead moved inside short chain link fences, as mentioned above, or onto both screened and open porches. Dog food was relocated from bags to plastic tubs, also kept outside. While some of these modifications might have proven effective had they been employed at the outset, by the time they were used, the visiting bears had already lost much of their fear about approaching human habitation and came to associate these residences with available food so these adjustments did not appear to provide any added barrier.

They were coming once every other night, probably. And that went on for a period of a few weeks until we tried to wise up and do things differently. At that point, I was really starting to get perturbed because I had repaired the screen and it was starting to cost me money. I was wanting to come to

some type of terms that we could stop incurring bear damage and, and uh, just get over the thing.

– Male Nuisance Complainant

Hazing of nuisance bears by fish and wildlife officers or the distribution of cracker shells to residents for use in hazing with problem bears occurred in at least 7 cases but did not appear effective at reducing visitation or nuisance activity based on subsequent problems at the same locations. Where the problem was not resolved in spite of attempts at mitigation people described feeling powerless to address it.

I was expressing to him what, what our problems had been, what we had tried to do to resolve our problems on our own. And uh, I told him, I said “I’m not wanting to shoot this bear.” I said “But you all” – and you all being fish and wildlife officers anywhere in the Commonwealth – “you wouldn’t incur damage like this. You know, you wouldn’t put up with it and you shouldn’t expect other people to put up with it.” Because there comes a point when enough is enough.

– Male Nuisance Complainant

Some of the people who continued to have bear problems, either because they did not effectively change their attractant handling practices or because of neighbors who had failed to do so, became frustrated at KDFWR’s perceived unwillingness or inability to resolve their problem. At least a few individuals in this situation took matters into their own hands and dispatched the offending bear. While no one I interviewed admitted to having done this themselves, 6 of the people I interviewed mentioned hearing of things like this happening.

I’ve heard people say “well if I have problems with bears, I’ll just take care of it.” And by “take care of it” they mean they’re going to shoot ’em or shoot at ’em or haze them or do whatever they want to do.

– Male Nuisance Complainant

Although it was rarely possible to know for sure who had killed a bear or why, during the study eight known nuisance bears were found shot and otherwise undisturbed (that is, not missing any parts typically associated with bears killed illegally for resale) in areas not far from human habitation. An additional nuisance bear was found alive after being shot but was so seriously injured that he was euthanized by KDFWR officials. Four

of these bears were known to be highly habituated to people as well as being food conditioned.

Satisfaction

Many participants spoke highly of individual officers and biologists but during the first two years of the study residents often expressed dissatisfaction regarding their interactions with KDFWR as an agency. They made statements holding KDFWR responsible for solving the bear problem and when problems continued, they were unhappy. They often commented that they felt ignored or talked down to by KDFWR representatives.

Mountain people are a group of people that, they're not ashamed to ask for help if they can't do something or can't figure something out, they'll ask for help, but if they get an answer that they don't want or don't like, or they feel like they're being shunned, they'll just take things into their own hands. I can remember the first time that I heard somebody talking about getting their trash bin tore up, in Harlan County, they had contacted the department of fish and wildlife and told them that they had a bear problem. And whoever the person was on the phone, they asked what their problem was, and the person explained to them that bear had torn their trash bin apart, and that the uh, that the bear had done damages to their trash bin. And the person on the other end of the phone told them that they didn't have a bear problem, they had a trash problem. And uh, the person was very upset because they felt like they, they hadn't got the answer that they needed.

– Male Nuisance Complainant

I've called them! I have called them twenty times and they said, they tell me the last three times that they'll send somebody over and I've still not seen nobody and it's been three weeks ago. I've still not seen anybody.

– Female Nuisance Complainant

We didn't get any service. The guy that my wife initially reported it to that day got kind of, kind of disrespectful to her. Kind of halfway accused her of feeding the bear.

– Male Nuisance Complainant

Others attributed problems with responsiveness to the sheer volume of bear nuisance activity in the region.

You can't get ahold of a biologist. You can't get ahold of a game warden, and it's not because the biologists don't want to be got ahold of, I mean you've got one biologist that's having 48 bear complaints and he can't answer all them in one day.

– Male Nuisance Complainant

The hiring of two young men to handle bear complaints in 2006 seemed to improve community relations, as these employees were felt to be easier to reach and more responsive to residential complaints. Those participants I interviewed during that period responded more favorably about the experience.

They do an excellent job. I know they're just on contract for the summer but they were absolutely wonderful. I know they're young. It was their first year but their ability to be contacted easily, and they were prompt in calling back. If they were a little late calling back they would say "I'm very sorry but I was tied up with an incident." You know, they were very professional and very easy to communicate with and very, very easy to get ahold of and to work with.

– Female Nuisance Complainant

Of those I interviewed after that point, the only complaint (two cases) was the continued difficulty at reaching someone and getting them to come out. Satisfaction with treatment once the officers arrived on the scene was high. Overall satisfaction regarding the handling of a nuisance complaint seemed less based on the actual resolution (or not) of the nuisance problem than of the attitude, demeanor, and general apparent helpfulness of the KDFWR respondent; satisfaction was associated with higher levels of tolerance towards the bears.

Discussion

The term “nuisance” is often used by wildlife professionals and biologists to describe any bear that frequently exploits anthropogenic food resources. The implication is that the bear, in exploiting these resources, is behaving as a nuisance for people. However, during the course of my study it became clear that the term “nuisance” was not only inadequate for describing anthropogenic feeding behavior on the part of bears, as discussed in

Chapter 5, it was also not an accurate, or at least not a complete, descriptor of the residential and commercial human-bear interactions I observed.

While any and all close range human-bear interactions by non-professionals might be considered “nuisance activity” by wildlife biologists, a great deal of it is intentional, directed, and very much enjoyed by the human participants, making the term “nuisance” for these encounters rather misleading. Some interactions could reasonably be considered nuisance activity in its traditional sense but others, such as the exchanges taking place at coal mines, were far more closely related to the experiences and motivations described in bear-tourist encounters. In addition, many interactions moved along a continuum of both human and bear behavior, at times perceived to be a nuisance and at other times tolerated or even welcomed. Conceptually, risk, tolerance, and action, then comprised three dimensions of the human reaction to nuisance activity/bear visitation. Each of these appeared to be informed by experience and perception as well as influenced by knowledge level.

Historical context

Lacking bears until recently, garbage handling in the region was not set up to be bear-resistant and this was at the root of many of the problems observed. In addition, the social context for bears in the area, both historically and at present, may be contributing to nuisance problems because it normalizes provisioning black bears.

In spite of the historic absence of a large bear population, bears have nonetheless been a part of the history of the region and many residents have had previous experiences with them. Several widely known events have become part of bear lore in the area and it appears that these experiences are, at least in part, informing the overall norms regarding black bears for area residents. For example, everyone I spoke with was aware of the mine-fed black bear from the 1980s. Some people related personal experiences with the bear but even those who never saw it themselves knew of its existence, and many had seen pictures of the bear being hand fed and climbing on people’s cars. Another widely known story was of a bear that appeared along a roadside and ate placidly while a crowd of onlookers gathered. A local man offered the bear a jar of honey, which the bear held in his paws and consumed, much to the delight of spectators. Again, many area residents

witnessed this encounter themselves and most others had at least heard about it. Finally, a local mine owner had a pet bear during the 1980s which he sometimes took for drives in his car and which, on one occasion, escaped, causing him to close down his mines for the day, equip his employees with candy bars, and send them out in search of the bear.

Vacationing in Great Smoky Mountains National Park or Gatlinburg was common, and residents described seeing bears, both wild and captive, in those locations. Many of these visits dated back to the period where roadside panhandling by wild black bears was still allowed within the park and participants described those encounters. Completely lacking is any local history of bear-related injuries or deaths, or significant property damage. While this has not resulted in a universally favorable impression of the black bear, these experiences are likely to affect social norms regarding bears for area residents.

Tolerance and risk perception

For nuisance complainants, tolerance, risk perception, and action taken comprised the three primary dimensions of human reaction to bear nuisance activity. Bear behavior, knowledge level, and firsthand experience were the three primary factors that influenced risk perception. Risk perception, in turn, was a major factor influencing tolerance levels but neither was reliably predictive of outcome. The most important driver of risk perception appeared to be the level of previous experience, which was consistent with the findings of Siemer et al. (2010). Where people lacked previous experience with bears they were more likely to believe that the bears posed a greater safety risk. Conversely, when people had the opportunity to observe bears over time their perception of risk decreased. The level of knowledge participants had about black bears was often related to their perception of risk posed in the same manner as previous experience, with participants who were more knowledgeable about bears perceiving them as less threatening. Kellert (1994) found that knowledge in and of itself does not predict attitudes towards wildlife; rather knowledge serves as a basis for reinforcing and rationalizing attitudes. Without a quantification of knowledge levels or a more thorough investigation of attitudes, it is difficult to judge the overall implications of that observation in this situation, although it is certainly potentially the case.

In general, the black bear compared favorably to other species of wildlife in perception of risk. Participants classified the risk associated with bears as more closely equivalent to deer and elk, beautiful majestic animals with positive wildlife values. Contrary to injury statistics (Kruuk 2002), snakes, wolves, mountain lions, coyotes, and grizzly bears provoked more negative reactions and were perceived as posing greater risks to humans than black bears. For the most part, people did not appear to believe that the black bear was harmless but they felt bears were unlikely to injure someone unless provoked and this was borne out in their observations of bears over time. Attitudes towards black bears were generally positive, as is the case nationwide (Kellert 1994).

Three people had extremely high risk perception which persisted throughout the study, but they lacked any firsthand experience with bears. In other cases where initial risk perception was high, with repeated exposure to bears, the risk perception of people only went down. Even a fatal bear attack in Tennessee in 2006 did not increase the perception of risk posed from Kentucky black bears for the people I interviewed. When I asked about it specifically, the event was attributed to some other environmental or behavioral factor not at work in Kentucky. Personal experience and observation trumped other sources of information when assessing threat level, and repeated observation in the absence of any overt aggression or injury resulted in decreasing risk perception. My findings were similar to those of Gore et al. (2005; 2006a) who conducted two public opinion surveys of residents of New York's black bear range and observed no increase in safety risk perception following the bear-related death of an infant in the region.

Risk perception was the number one driver of initial tolerance levels of both bear presence generally and nuisance activity specifically. Other factors affecting tolerance were the frequency of bear visitation, any damage caused, the degree to which people felt they could address the situation, how responsive they thought KDFWR was to their concerns, and any benefit or perceived benefit to the presence of bears. Tolerance itself spanned two dimensions – with tolerance of bears generally and tolerance of nuisance activity specifically existing as distinct, if overlapping, spheres.

Many residents were extremely tolerant or even encouraging of bear visitation. Others were less so and, although I did not knowingly interview any, some were likely intolerant to the point of illegally killing the offending bears to resolve the problem. To a

large extent, the tolerance levels of nuisance sufferers did not exist as discrete categories, as much as both risk perception and tolerance level represented points on two continuums along which residents moved. While lower risk perception was associated with higher initial levels of tolerance, both risk perception and tolerance tended to decrease over time, decoupling the original relationship.

For residents who initially enjoyed bear visitation there was often a tipping point beyond which nuisance outweighed the benefit of being able to see a bear at close range. The tipping point at which bear visitation became a nuisance appeared to be associated with the frequency with which residents had to clean up trash following a bear encounter and their perception of safety risk posed by the visiting bear. The degree to which people felt they could address nuisance issues themselves as well as their perception of KDFWR's responsiveness to their concerns seemed to have a large impact on their willingness to tolerate the presence of bears. Where people felt unable to address or remedy the problem, they became extremely frustrated with KDFWR and intolerant of bear visitation.

In spite of this, residential nuisance sufferers were for the most part quite tolerant of the presence of bears. Even those who had experienced serious nuisance issues, including property damage, said that they would not want a bear killed unless it inflicted an unprovoked injury on a human, and even in that scenario, they wanted control measures restricted to the offending bear only. Some degree of tolerance may be due to the perception of a community benefit from the presence of bears in the area (Romanach et al. 2007). Two of the people I interviewed indicated their reluctance to complain about bear activity because they did not wish to "make trouble" for those in the community promoting bears and bear-related tourism (Table 6.1).

In many cases neither outreach efforts made by state and local officials nor the bear proofing information available changed trash handling practices of residents. When they began to have a problem, the nuisance value of which outweighed the enjoyment (if any) of seeing bears, then and only then did people begin to change their behavior. The problem then became that their initial attempts at modifications were ineffective. In these situations, residents who were initially tolerant of bear visitation actually had more significant problems and potentially less tolerance long term than residents who were

intolerant of bear visitation at the outset. Tolerance, then, is not an unequivocally positive attribute when trying to resolve nuisance issues because it may exacerbate nuisance problems over time.

Tolerance of bears generally was not linked to tolerance of bear nuisance activity in a one to one fashion. People who enjoyed watching the bears were extremely tolerant of bear visitation and garbage feeding. However, many of the people who bear proofed immediately, and were therefore functionally intolerant of residential bear visitation, were quite tolerant of bears generally and very positive about their presence in Kentucky.

On the extreme end of the intolerance spectrum for nuisance activity was vigilante removal of problem bears. It is somewhat difficult to speculate about the motivations of those who kill bears illegally since I did not interview anyone firsthand who admitted to having done so. However, from apparently secondhand comments and observation, it would appear that the main motivation for a majority of the types of killings observed was a desire for the bear to be gone and nuisance activity to cease. The two primary scenarios described were of “others” who were variously described as “ignorant,” “rednecks,” or otherwise lacking in judgment and compassion for killing a bear, and of people who were genuinely concerned for their personal safety and that of their family and felt stymied and helpless to address the situation via other channels. For some, this end may have come after a period of semi-tolerance and/or attempts to handle the problem in other ways; for others, perhaps those who did not believe there should be bears in Kentucky at all, poaching may have occurred more readily. In cases where the bear was killed illegally after a prolonged period of nuisance activity, it may be that a reduction in risk perception and the ready availability of other mitigation measures could reduce the mortality of such animals.

Mitigation measures

Relocation was initially a preferred alternative for many of the people I interviewed although, as discussed in Chapter 5, it was unsuccessful at reducing nuisance activity in most cases. Even those with negative views about black bears preferred relocation to lethal removal, consistent with Siemer et al. (2010). However, some participants also expressed doubts and concerns about the availability of suitable habitat

for problem bears far away from people. Those individuals were more willing to consider alternative approaches.

Hazing was generally ineffective at modifying the behavior of the bears, as discussed in the previous chapter, and bear visitation and nuisance activity did not appear to decrease overall following hazing. However, hazing did result in increased spatial separation between people and bears at KCSP. Bears in KCSP were typically hazed when the rangers felt that tourists were approaching bears too closely or otherwise behaving inappropriately, and this hazing of bears served to deter such tourist activity in future, or at least made it less overt; using hazing to interrupt bear feeding proved to be an effective aversive stimulus at least for human behavior, if not for the bears.

Wildlife managers may need to reconsider the definition of success for the hazing of nuisance bears. Even if commonly used hazing techniques appear ineffective at deterring bear visitation long term, they can be important in terms of the social and psychological impact their use has on human complainants (Shivak 2006). Hazing at businesses or private residences may allay resident concerns and improve constituent relations. Beckmann et al. (2004) suggest that while aversive conditioning approaches should not be expected to eliminate nuisance activity, these techniques may still be useful in delaying it or improving public relations. This was found to be the case in the present study with residential nuisance complaints. Although much of the time responding officers never even saw the bears, their presence and occasional hazing efforts seemed to increase the perception that KDFWR was responsive to the concerns of residents.

Regulation

Although provisioning black bears, either intentionally or unintentionally, is illegal in Kentucky, the practice is extremely widespread. In that sense regulation was ineffective as a deterrent measure. Whether that would still be the case had there been punitive enforcement of infractions is less clear. The illegal killing of bears was prosecuted where the perpetrator could be determined, but the prohibition against provisioning bears was not legally enforced. There was a rumor at one point that undercover fish and wildlife agents would be present at KCSP and would give out citations for feeding bears; however, as far as I know this never occurred. At present the

main function of the law seems to be to discourage overt intentional feeding but it has not been successful at eliminating the activity.

Knowledge of the anti-feeding regulation varied. Many park visitors were aware that “feeding” the bears was prohibited but this was widely interpreted to mean “hand feeding.” Given the preponderance of (apparently sanctioned) conventional trashcans within the park, this belief is understandable. Similarly, residents who allowed repeated bear access to their garbage, pet food, bird feeders, etc., did not believe themselves to be breaking any law. The law itself is somewhat ambiguous for although it mentions unintentional feeding, it does not specify garbage cans or other possible food sources, nor does it offer guidelines about what type of garbage handling might be acceptable.

While some municipalities have implemented “dusk ‘till dawn” ordinances which offer more specific regulations, such as forbidding setting out trash until the morning of garbage pickup (Dolson 2002), this approach is likely to be problematic in eastern Kentucky since the problem for many residents is not a lack of willingness but the lack of an alternate place to store their garbage in the interim. If residents are cited or fined for garbage handling without being provided with a ready alternative, it may result in decreased tolerance overall and more bears being killed illegally. Given the current preponderance of anthropogenic food sources currently available and, therefore, the difficulty at eliminating them completely, this seems to be an unproductive approach at this time. Enforcement is more likely to be successful if paired with access to acceptable alternatives (Davis et al. 2002), for example, if bear-resistant garbage cans were freely available to individuals or bear-resistant dumpsters were placed in convenient location within neighborhoods.

Education

KDFWR officers responding to bear nuisance complaints frequently left behind a brochure with information about bears and bear biology. Additional educational efforts included presentations at schools and informational booths at the black bear festival. There was no explicit effort to examine the impact of these approaches but demonstrated efficacy in other areas has been low (Peine 2001; Gore et al. 2006b) and that appeared to be the case in Kentucky as well.

Nuisance sufferers said there was not enough information available and they wished there was more; the information that was provided was frequently ignored and did not result in behavior change. Many residents initially failed to understand the mitigation advice offered and made changes which were ineffective and/or resulted in an escalation of nuisance behavior. Even when residents understood what was being suggested, they typically failed to change their behavior. Siemer et al. (2010) suggest that this may happen because homeowners believe that bear visitation is a one-time event and so taking these steps is not necessary. However, many of the nuisance sufferers in my study experienced bear visitation over a prolonged period of time and still did not take sufficient steps to remove the relevant attractants. It appears the primary reasons for this were logistical and philosophical, as discussed below.

For the most part, people lacked an easy and effective way to reduce black bear access to garbage. Without an outbuilding or similar structure, residents were limited to keeping their garbage inside their home until the day of trash pick-up and most were unwilling to do this. This viewpoint did not necessarily mean that they felt the cost/benefit was not worth it or that bear visitation was inconsequential. Indeed, many of these residents were extremely concerned about continued bear visitation from both a safety and nuisance perspective. The reason that they did not modify their behavior appeared to have more to do with a rejection of the available alternatives and a belief that KDFWR was responsible for handling bears. My results suggest there was a disconnect between complainants and KDFWR in terms of the expectations of each, resulting in frustration on both sides.

While education is an intuitively obvious approach to human-wildlife conflict, there has been little empirical data on its efficacy (Gore 2004). Where assessments are made, they often depend on frequency of nuisance complaints. However, many complainants stop calling when they perceive that managers will not help them, even when nuisance issues are ongoing (Siemer et al. 2010). Nuisance complaint totals may also be influenced by environmental factors affecting food availability, unrelated to human behavior (Gunther et al. 2004; Peirce and Van Daele 2006; Mansfield 2007). Where behavior following educational outreach has been assessed through other means, educational efforts do not appear to alter behavior (Gore et al. 2007; Siemer et al. 2010).

Conclusion

Agricultural complaints were relatively uncommon and when they occurred, their specificity, both in location and the nature of the attractant, made mitigation more straightforward. In addition, people appeared more motivated to spend money to resolve agricultural nuisance problems because of the potential economic loss of ongoing bear visitation. In contrast, residential problems were more difficult to resolve. Nuisance bear activity was spread across a wide area and encompassed many different residents with differing garbage handling practices, and varying viewpoints and levels of tolerance. This resulted in mixed messages for the bears, allowing escalation at one home which was then transferred to other houses where residents were less tolerant. Similarly, solutions to residential nuisance problems were necessarily more individual and involved different logistical and financial constraints.

Like aversive conditioning, education is frequently promoted as a solution to human-wildlife conflict (Beckmann et al. 2004), but it was not effective for the people I interviewed. This is not to say it may not be worthwhile as a part of community outreach but it did not result in participant behavior change and consequently did not reduce nuisance issues. Similarly, regulation was ineffective both because it was poorly understood and/or compliance was logistically impossible. At best, each of these elements are only part of the solution and, when applied without adequate understanding of behavior (both bear and human), may be a poor use of time and money.

Willingness to implement suggested mitigation measures depended to a large extent on ability. In terms of garbage attractants, where residents understood the recommendations and had an alternative method of garbage handling, most were able to eliminate garbage access successfully, although for the most part these individuals did this on their own rather than in response to KDFWR's suggestion. For those without access to a storage building or alternate means of garbage disposal, bear visitation continued. These participants grew increasingly frustrated with KDFWR's perceived unwillingness to help them resolve the issue.

Unlike the situation in many other studies of human-carnivore conflict (Redpath et al. 2004; Romanach et al. 2007), economic loss as a consequence of bear activity was not a primary concern of residents. In contrast, the potential for economic benefit

appeared to increase tolerance. Participants who were experiencing nuisance problems and did not, themselves, have particularly positive opinions about the bears, were still reluctant to complain about their presence because they supported other members of the community who were promoting the bears. Whether this social pressure resulted in a higher WAC or absolute level of tolerance from the nuisance sufferers is unclear, but it did reduce the likelihood of them objecting publicly or to KDFWR. The high level of tolerance expressed by most participants as well as the social investment in the presence of bears in Kentucky would seem to indicate that there is potential for resolving bear-human conflict in a way that benefits most parties. Possible approaches and recommendations for management are discussed in Chapter 7.

Table 6.1: Factors affecting risk perception and tolerance of black bears in the region identified during interviews with local stakeholders in eastern Kentucky.

Factor: Risk Perception	Increased	Decreased
Bear Behavior	Diurnal activity, high degree of habituation (initial perception only)	Low habituation; nocturnal visitation
Knowledge Level	Low	High
Previous Experience	Low	High
Factor: Tolerance	Increased	Decreased
Risk Perception	Low	High
Damage	Low	High
Locus of control	Internal	External
Benefit	Personal; community	None
Perception of KDFWR	Responsive	Unresponsive

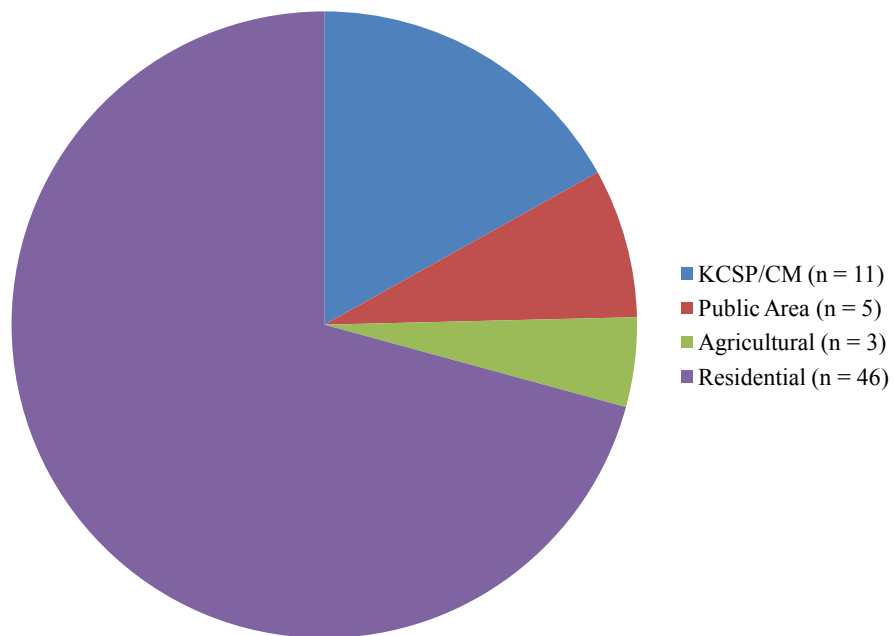


Figure 6.1. Nuisance complaints filed with the Kentucky Department of Fish and Wildlife Resources following black bear visitation by category of complaint type.



Figure 6.2. Photograph of a young food-conditioned male bear at a coal mine in Harlan County Kentucky in the 1980s. Photo by Bob Lunsford, used here with permission.



Figure 6.3. Photograph of bear-resistant garbage receptacle made by modifying an empty oil tank and reinforced with steel plating.

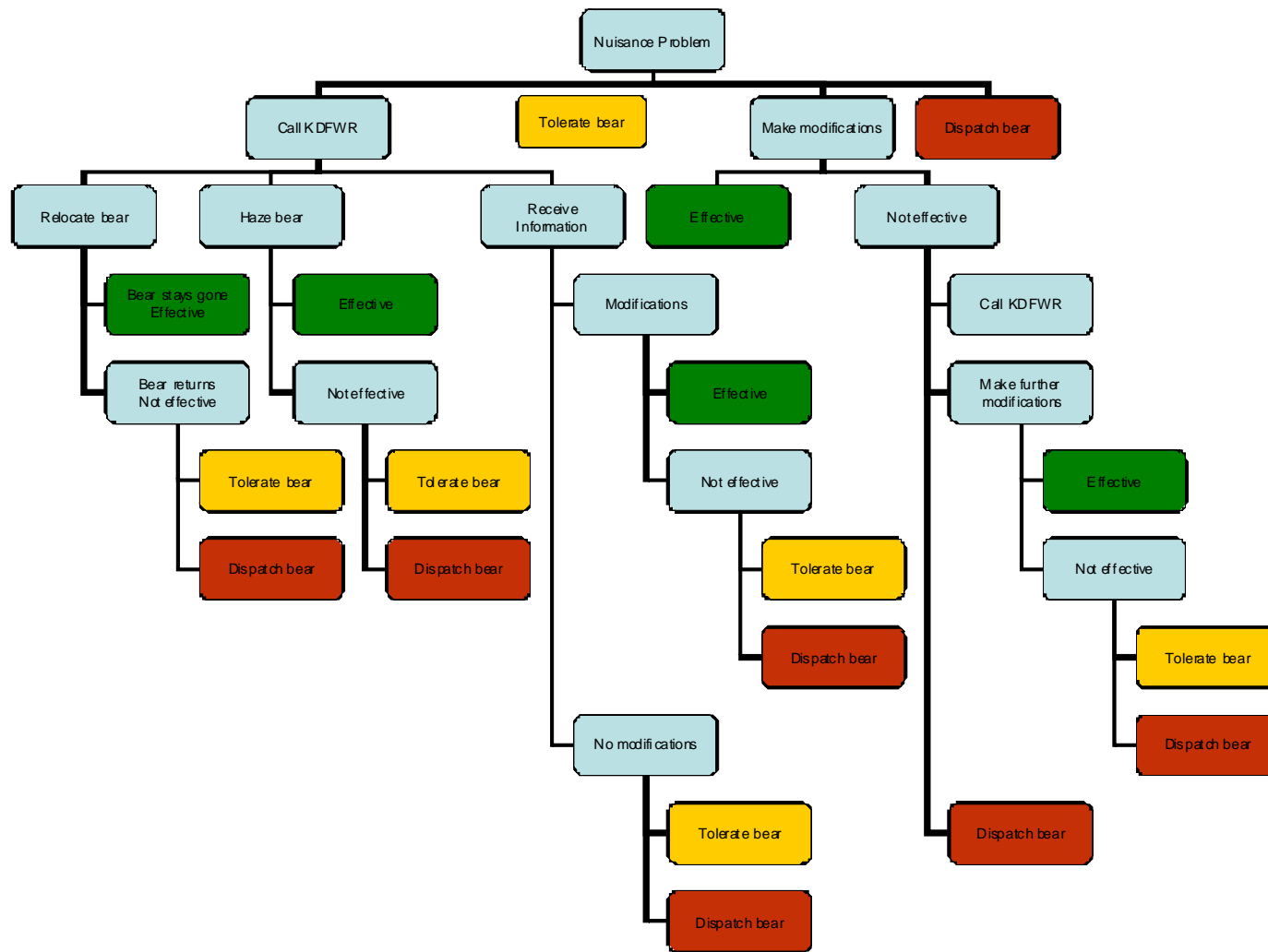


Figure 6.4. Conceptual model showing decision-making options for research participants in Harlan and Letcher counties, Kentucky, experiencing unwanted bear visitation as a result of anthropogenic attractants.

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CHAPTER 7: LOOKING BACK AND MOVING FORWARD: LEARNING FROM THE PAST AND PRESENT TO MANAGE HUMAN-BEAR INTERACTIONS IN THE FUTURE

Introduction

Bear populations appear to be increasing both in the U.S. overall (Siemer et al. 2009) and in Kentucky specifically (Unger 2007). As bears and humans occupy more and more overlapping space, the likelihood of human-bear interactions increases. At the same time, traditional paradigms for wildlife management are shifting. While wildlife managers once served a fairly narrow constituency of hunters, anglers, and trappers, they are now called upon to meet the needs of a much more diverse collection of constituents (Decker et al. 1996). Stakeholders with an interest in Kentucky bears and their management currently encompass not only hunters, and wildlife managers themselves, but also researchers, wildlife watching recreationists, residential nuisance sufferers, and community leaders. Knowing what people think about wildlife, what they expect from managers, and how they would like problems resolved is an important first step in designing a management plan. Understanding where stakeholder needs conflict and where compromise is possible is also vital in moving forward towards a comprehensive management strategy.

Human dimensions of wildlife

A careful consideration of public opinion may be important for wildlife managers when contemplating policies or management actions concerning a species of interest (Treves and Karanth 2003). This can be particularly significant in the case of large and charismatic animals like the black bear, where people are more likely to have strong opinions (Kellert et al. 1996). Typically public opinion is assessed through some kind of survey, and surveys do provide important data on population attributes and attitudes. However, the scope of the information that a survey can gather is limited by the questions asked and the multiple choice answers provided, as well as by the representativeness of its participants.

“Public opinion” encompasses a wide variety of viewpoints held with varying strengths and conviction. Public opinion as sampled in a survey is a snapshot at a moment in time, but opinions are not static. Rather than being frozen, opinions may be changed over time and/or be extremely variable and vulnerable to alteration. Nor are opinions two dimensional. They may be held for very different reasons and a simple answer on a multiple choice questionnaire can mask an extremely complicated rationale. Conversely, a survey forces an opinion on people who may or may not really have had one before they were asked the question. Even when “no opinion” is offered as a choice, people may choose some opinion even when the issue is of relative unimportance to them, and their proffered opinions may be highly fragile and open to change. Public opinion, then, can become meaningless or misleading to wildlife management efforts if opinions are not strongly held or if people are not involved with the wildlife resource. Basing policy and management decisions on loosely held or uninformed convictions or answers that are misleadingly simple may result in poorly grounded policies that fail to achieve management objectives, waste time and resources, and result in acrimonious relationships between stakeholders (Redpath et al. 2004; Decker et al. 2006).

The question of interest may in fact not be *what* people think at all, it may instead be *why* they think what they do, and this question is not readily answered using survey methodology. The issue is particularly salient when a management agency is contemplating an educational strategy or program designed to change human behavior. With a mail-in survey, such as the one conducted by KDFWR in 2002, an attempt is made to determine the relative proportions of the population with various views and behaviors regarding the black bear. Overall, in that case, attitudes toward the presence of the bear were positive but only 14.5% of the respondents had ever seen a bear in Kentucky and only 2% of the respondents lived in Harlan or Letcher counties (KDFWR unpublished data). While the survey asked about participants’ willingness to adjust their garbage handling practices to reduce the potential for conflict with bears, their answers were largely theoretical as few respondents lived in areas with resident bear populations. With so few participants actually interacting with bears, there was limited potential to understand their particular behavior, concerns, or possible constraints regarding bear proofing.

To design an effective management program, one must understand not only what people are doing, but why they are doing it, and, finally, what arguments they find compelling enough for them to replace their current behavior with the desired response. It is vital to understand the context and background that inform the opinions and preferences being observed, as well as the nature of the conflict itself, since the unique dynamics of the situation may be pivotal in how conservation and management take shape. Developing this sort of multifaceted perspective has been the underlying motivation of this project.

Historical context

The question of why black bears remained apparently absent from Kentucky even as populations grew in neighboring states is an interesting one. Eastern Kentucky contains contiguous habitat with West Virginia and Virginia, both of which have longstanding bear populations (Cottam et al. 1939). In terms of topography and vegetation, eastern Kentucky is not radically different from western North Carolina and eastern Tennessee, two more nearby states with longstanding black bear populations.

The interviews for this study offered some insight. For one thing, participants confirmed that the black bear has not been entirely absent from Kentucky for extended periods. First and secondhand stories of bear sightings extend throughout the twentieth century and to an earlier time when bears were abundant.

My grandpa, they hunted bears down here when they were kids, from Harlan and up and Evarts. From what I understood from what he told, they'd go in the dens in the winter time when the bears hibernated and shoot them in the dens and drag them out. There was an area called Greasy Creek – do you know why they called it Greasy Creek? Bear grease. There was lots of bears back then. I'm telling you, they would eat them, and I guess, sold the hides. They used it for meat, you know, to eat, and heat, the houses didn't have heat like they do now, and I heard him say in the winter time, the snow would blow through, they'd have to get up and shake it off the quilts; it would blow through the cracks. So you know it was rough living. This was years ago, in the 1800s. They hunted the bears... and they killed them out.

– Male Bear Watcher

None of the participants believed that bears continued to exist in Kentucky at modern population levels but collectively their stories indicate the presence of some bear activity at least intermittently, throughout most of the twentieth century. Two accounts of a mother bear with cubs suggest a breeding population. One woman told a story she had heard many times from her grandmother about being followed by a bear around 1927.

When my granny was a young woman, she and her sister were walking down the holler in Terry's Fork; Terry's Fork was a mining community. They were walking along the railroad tracks, there was no real road up in there at that time, so anybody that happened to have a car still had to go up the creek bed that the railroad went up, where the road is now. And there was a bear – I've heard my granny tell the story so many times, that I can almost remember her voice. They were walking down, they had actually been out looking for the cow, because everybody's cattle ran free at that time and there was no fences, and they were walking down the railroad and this bear came down off the hillside. My great aunt was carrying her small baby and my granny, who was just a couple years younger than her sister, grabbed the baby and took off and her sister just started running behind her, and they were running down the railroad track. Just as they passed the cow stall, a train came up the holler and that light on the train, scared the bear and the bear veered back up the hill and went back up into the tree line, which was only a fringe up on top of the ridge. The understanding that I got as I grew up was that a bear was – it's so silly, I mean I guess it is – that a bear was uh, drawn to mother's milk. That was the reason that was given for it chasing them, that's why she grabbed the baby and run, because the baby had been nursing., I guess that's a wives' tale, but that was the reason they gave.

– Female Harlan Resident

Another man, now in his 70s, said that he had never actually seen a bear as a child but occasionally saw what he now believes was bear sign when out gathering berries with his siblings.

We'd pick them blackberries like that. And we'd always do, like I say, we were real gentle with them vines because we wanted them for years to come. But we'd find sometimes where they'd just been tromped all to pieces. And I guess that was bears more than likely. We don't know what it was.

– Male Bear Watcher

However, it is clear that bear population numbers dropped precipitously, probably between the late 1800s and 1920, and reports did not increase beyond the occasional

sighting until the 1990s. Given that black bear populations existed in neighboring states throughout this period, it is not surprising that individual bears sometimes found their way into Kentucky. The question is why these occasional migrants did not represent the leading edge of a colonizing front until late in the twentieth century. Clues to a possible answer lie in the history of Harlan, Letcher, and Pike counties.

Eastern Kentucky, like West Virginia and parts of western Virginia, is home to many coal mines. Based on current bear populations in Kentucky and neighboring mining states, coal mining, in and of itself, does not appear to represent an impediment to bear colonization or habitat use. The reasons bears were effectively barred from Kentucky but not from neighboring states may lie not in coal mining itself, but in its social consequences for human participants and their impact on the landscape.

Coal mining in the early and mid twentieth century drew thousands of people to parts of the Commonwealth which had previously been sparsely settled by farming families (Aron 1990). Urban centers developed, as in areas supported by other types of industry, but unlike areas where the overwhelming majority of people lived within the city limits, coal mining development led to large numbers of people living in high densities in coal camps spread throughout the landscape rather than concentrated in one city center.

Mining families often had small gardens and some livestock but they were no longer primarily involved in agricultural pursuits. Coal miners' salaries were low and families often had many mouths to feed (Caudill 1963). In interview after interview, older participants described the importance of foraging for natural foods during their childhoods. Chestnuts, before the blight, as well as walnuts, berries, and mushrooms were all gathered by these mining families.

They had concrete hearths in these old Benham houses and we'd set them walnuts on that hearth, take a hammer and bust it and throw the hulls in the fire. They burn just like coal. Where we'd do that all winter long, there'd be a little hole, beat out down in the hearth. The company'd come up spring yearly, and fill all them holes back up. We'd gather enough for all winter long and we'd put them in candy, cakes. Black walnuts, hickory nuts and all the stuff like that. We'd go out in spring of the year, fall of the

year, or first fall, when these walnuts and hickory nuts came in, we'd get them in.

– Male Bear Watcher

We'd always be in picking blackberries and pull the vines back and it had to be done gentle because if you didn't they'd fall off. Big juicy black berries! We'd just reach in and get them and it wouldn't take long to fill a bucket. You took your belt and put the bucket through that loop. We used a lard can. A lard can is the best bucket in the world. That right there and then you'd just start pickin'. And you'd keep a 2 gallon water bucket over here and poured them in it. We'd get the blackberries and apples, everything we could find. And I'd see my mother, she'd can and can, 200, 250 cans of fruits. I've picked as many, I'd guess, 40 gallons of black berries per year.

– Male Bear Watcher

In addition, as mentioned in the story of the lost cow above, it was common practice for livestock like hogs to roam the forests unconfined (Aron 1990; Davis 2000).

Well, my mother, she told about when she was young. She said right in the, what we called your backyard now, she said people kept animals in the backyard. And she said her daddy always had hogs back there. She said they always said it was their mother's cows and daddy's hogs. People had, you know, their barns that they put their cows in, their calves, and, milk cows. And then before I could even remember, they couldn't have hogs down in town anymore, but they would let them put them up in the pastures in different places or let them roam. They'd run wild all the time.

– Female Bear Watcher

The combination of these practices meant that a great deal of what might otherwise have been food for bears was instead consumed by people, either directly or indirectly. Foraging by people and livestock as well as scavenging wood for fuel can dramatically change the character of the forest as well (Hunter 1999). Many participants remarked on the changes between the forest of their youth and the forest they observed today.

Back then the woods were just clean – you could walk under it just like walking in a house. There was not no undergrowth.

– Male Park Visitor

Exotic and introduced species frequently outcompete native animals and as the food supply is depleted, less competitive animals may be dramatically reduced in number

or extirpated altogether (Sinclair 1989). While habitat loss due to logging or other sources may have been an exacerbating factor in the degradation of potential bear habitat, it would appear that loss of soft mast and undergrowth alone may be sufficient to cause the extirpation of black bears. Côté (2005) documented the apparent extirpation of the black bear on an island following the colonization of the island by introduced deer. As deer populations increased, they gradually consumed the shrubs on which the island bears depended. Although the bears may have preyed on fawns, their availability was largely limited to spring (Kunkel and Mech 1994; Vreeland et al. 2004), leaving inadequate food resources during the summer and fall when bears must put on large amounts of weight in preparation for hibernation.

It is possible, then, that the reason the black bear did not re-establish a more extensive resident and reproducing population in Kentucky until the last part of the twentieth century is that coal camps and associated foraging degraded the habitat quality and reduced food availability for colonizing bears. As strip mining began to replace the more labor intensive deep mining, population numbers in the region dropped dramatically and the people who remained in the area became more concentrated in towns. Today the population of Harlan County is only half what it was during its peak (see figure 2.2). It is somewhat ironic that not only has the bear arrived as a potential replacement economic driver for a region once dominated by coal mining as discussed in chapter 4, but the bear's return may actually have been made possible by the economic decline, and associated population decline, of the community.

Current Status

Population

There is no standard methodology used by wildlife managers to assess bear population levels (Hristienko and McDonald 2007). In some cases, numbers of nuisance reports are used as a proxy for the overall number of bears (Garshelis and Hristienko 2006); as the number of nuisance reports increases, the greater bear population is assumed to be increasing as well. The accuracy of this method is extremely questionable however, because while a tandem increase in both bear number and nuisance activity is

intuitive, the relationship is not necessarily linear. One area may be a hotbed of nuisance bear activity but have multiple reports being generated by a few animals and have a small total bear population, while another area may have few or no nuisance complaints but contain a larger number of animals. Nuisance activity is typically the byproduct of anthropogenic attractants which can artificially concentrate bears in certain regions without reflecting an overall population increase (Beckmann and Berger 2003b). In addition, non-population based factors, such as natural food shortages, can result in increased nuisance activity or bait station visitation without any concurrent population increase (Rogers 1976; Clark et al. 2005; McCall 2009).

Mark-recapture techniques offer a more objective approach to population estimation. Animals need not be captured literally when employing this approach; for example, they may be identified from photographs taken by automated cameras (Mace et al. 1994), or by collecting hair samples that are sequenced for DNA, using genetic markers to distinguish individual animals (Mowat and Strobeck 2000; Mowat and Paetkau 2002). In any case, mark-recapture studies use statistical models which look at the number of different individuals captured and recaptured in relation to the overall trapping effort to extrapolate population size. These models are not perfect and they are vulnerable to violations, such as the requirement of many that a population be “closed,” that is, lacking immigration or emigration. “Trap-happy” bears that revisit the capture site more than what would be randomly predicted can also reduce their power (Williams et al. 2002). However, in spite of these limitations, when well-conducted, this method represents a significant advance in population estimation when compared to a subjective observational assessment. There have been two studies of Kentucky bears that employed a mark-recapture methodology using hair snares and genetic analysis to estimate population levels by identifying individual bears visiting the trap sites.

Vowell (2002) obtained genetic samples from 100 hair snares located throughout eastern Kentucky but concentrated in wildlife management areas and state parks. She also included information from live captured bears, bears hit by cars, and genetic profiles obtained from scat. She identified 39 different individual bears, 33 of which were found in Harlan or Letcher County. Bears showed a 2:1 male to female ratio. Using different models, she generated several alternate state-wide estimates that ranged from 54 to 211

total bears in Kentucky; however, because of sampling issues, she urged caution when interpreting these results.

Frary (2008) sampled areas throughout Bell, Harlan, Letcher, and Pike counties, and in the southwestern portions of Knox, Leslie, Perry, Knott, and Floyd counties. He identified 54 individuals, including 20 males and 34 females. In spite of a wide ranging trapping effort, an overwhelming majority of the bears were captured in Bell, Harlan, and Letcher counties, corroborating previous observations about relative abundance of bears within the Kentucky landscape (Unger 2007). Two competing models offered overall population estimations of 89 and 127 total bears respectively for the surveyed area. These totals are well below the subjective estimate offered by a KDFWR representative of 300-400 bears in McCreary and Pike counties alone (Spencer 2010).

The exact origin of the black bears currently roaming eastern Kentucky is unclear, although preliminary genetic evidence indicates that the Kentucky bear is more closely related to the bears in West Virginia and Virginia than those introduced from GSMNP into the Big South Fork area (Hast 2010). Individual bears with ear tags from West Virginia have also been captured in Kentucky, further supporting this hypothesis. The bear population within Kentucky appears to be part of a larger meta-population that includes neighboring states (Frary 2008). Based on the number of sightings over the past 20 years (KDFWR unpublished data; Unger 2007), it does appear that bear numbers in Kentucky have increased during that period; however the rate of increase, whether that increase is ongoing, and smaller fluctuations in population level are unknown.

Anthropogenic feeding

Currently, a majority of the Kentucky bears studied, and on which current knowledge is based, appear to be using anthropogenic foods at least some of the time. There are three possible interpretations of this observation:

First, there is the possibility that anthropogenic food use has a negligible impact on bear ecology and behavior, and therefore this observation is immaterial to the conclusions drawn about the population. This interpretation can be largely ruled out based on the consistent observation of significant impact of anthropogenic feeding in other areas and the consistencies between observed growth rates and reproductive rates of

bears in Kentucky when compared to both anthropogenic and non-anthropogenic feeding bears elsewhere.

The second interpretation is that while a majority of the bears studied may be utilizing anthropogenic foods, the bears included in the study are disproportionately likely to do so, possibly as a result of capture location, and are not representative of the larger Kentucky black bear population. This possibility has important ramifications for current bear management, which is based on data gathered from the studied population. If the bears on which management decisions are based are not representative of the general population then those policies lack a solid biological foundation. There is some argument to be made that not all bears in Kentucky eat anthropogenic foods, and some of the bears in this study appeared not to do so, but more information is needed about the bears that do not use these resources, both to understand how they compare to the bears that do and to ascertain the relative proportions of each in the wider population.

The third interpretation is that the bears currently under study *are* representative of the larger Kentucky black bear population, in which case a majority of black bears in Kentucky consume anthropogenic foods. This is, to my mind, the most likely interpretation both because of the widespread availability of these resources and because of the behavior and appearance of the bears captured in other parts of the state. Based on capture and handling data, Harlan and Letcher counties contain the largest density of black bears in the Commonwealth, and it is these bears which have been most conclusively tied to anthropogenic foods.

The use of human-derived food sources has been repeatedly demonstrated to affect bear biology, ecology, and behavior; however, the exact impact is equivocal, with some studies indicating one impact and others showing another. Whether or not anthropogenic feeding is “good” or “bad” or even what it does for and to bears remains ambiguous, in part because of the subjective nature of some of those determinations but also because of the variety of methods used and dynamics examined. The attempt to distill the relationship between bears, humans, and foods down to its simplest components and reconstruct a good predictive model, collapses several non-analogous categories and ultimately obfuscates important differences in outcome which depend on the relevant variables. While the relationship may always be ambiguous, it can at least be

instructive to separate various factors and variables which are too often lumped together, for example: black versus brown bears; habituation versus food conditioning; human injuries caused by defensive versus predatory bear attacks. Each of these categories has its own distinct differences in background and outcome, making any generalization about bears and anthropogenic food necessarily inadequate.

One of the most common arguments against feeding bears is that it increases the risk of injury to humans. There is some evidence that this is true for both brown bears and polar bears (Herrero and Fleck 1990; Gunther 1994; Herrero 2002). However, the evidence that feeding black bears increases aggression towards humans is weak. The majority of fatal black bear attacks on humans involved bears with no known history of habituation or anthropogenic feeding and were the result of predatory behavior (Herrero 2002). Some human injuries have occurred when habituated bears have slapped observers who got too close but such injuries are usually minor (Floyd 1999). The argument has been made by bear biologists like Lynn Rogers (2009) that, on balance, human habituated bears are actually *less* dangerous than naïve bears because they know what people are and where to expect to see them.

There have been a few unfortunate cases where people were injured or killed by apparently human-habituated black bears, including an encounter in Sullivan County New York in 2002 which resulted in the death of an infant (discussed in Gore et al. 2005). But this situation seems to be more an unfortunate confluence of events rather than either a predatory or defensive attack. The evidence from this study would tend to support the idea that anthropogenic food use and habituation does not necessarily result in an increased danger to humans. In 6 years of human-black bear interaction there have been no injuries to humans in KCSP whatsoever. Bears at KCSP have avoided direct contact with humans and although there have been a small number of incidents of hand feeding and one encounter where a bear climbed on top of an occupied car, for the most part the bears have preserved a minimum distance from humans of at least 10 m at all times, in spite of some human efforts to close that gap. Sudden movements, car doors slamming, and the arrival of the rangers all resulted in bears retreating into the wood line.

While my observations do not support the conclusion that feeding or providing access to anthropogenic foods for bears increased risk to humans, there was no question

that habituation and food conditioning resulted in increased risk to the bears. Habituation and food conditioning brought bears into closer proximity to people and proximity is often viewed by both wildlife managers and members of the public as a precursor to harm (Rogers 2009). Consequently, habituated and food conditioned bears were often killed by wildlife managers or home owners who regarded their behavior as threatening. Bears that became habituated to humans and food conditioned either at KCSP or private residences were also at elevated risk of being trapped and relocated, which was itself associated with increased risk of mortality. Bears that became habituated to humans and food conditioned as a result of feeding at coal mines suffered almost 100% mortality by the time they were 2 years old.

Anthropogenic food sources may not be inherently problematic. The issues caused by them are not typically first order problems like impaction or poisoning by ingestion of foreign substances. Nor do the data support the idea that anthropogenic food sources inherently contribute to either increased aggression or predatory attacks by black bears (Tate 1983; Herrero and Fleck 1990; Herrero 2002; Rogers 2009). However, anthropogenic food sources, whether intentional or unintentional, unquestionably bring bears into closer contact with people. That, in and of itself, is not necessarily negative, but when barriers between people and wildlife are removed, the potential for conflict increases. Habituation can facilitate the crowding or close approach of bears, increasing the risk of human injury or harm to the bear (Herrero 2002). Where wildlife agencies or the public remove habituated animals because of safety concerns or there is an increased chance of bears being struck by cars, then anthropogenic foods can create a population sink for bears (Beckmann and Lackey 2008). So, these secondary issues represent the potentially destructive impact of anthropogenic food sources.

On the other hand, anthropogenic food sources may represent an important resource for foraging bears. Research on the impact of diversionary feeding stations indicates that intentional food sources can actually reduce nuisance problems (Ziegler 2004; Mansfield 2007). In those studies, bears preferred natural foods to anthropogenic ones in periods of natural food abundance, and feeding at the stations was seasonal. Bears are contextual learners and retained their wariness of humans away from the feeding station. Anthropogenic foods may compensate for shortages of natural foods, but over the

long term this type of supplementation may allow population growth and individual bear size beyond what the environment can support naturally (Stringham 1986; Robbins et al. 2004). This could have positive ramifications for both bears and people while the food source is available but potentially devastating consequences if the food source disappears (Craighead et al. 1995; Robbins et al. 2004).

Because bears are intelligent, their behavior individual, and the situations they may encounter so multifaceted, it can be difficult to establish any consistent cause and effect dynamic. At a minimum, the behavior of habituated and food-conditioned brown bears should not be used as a basis for the apparent threat posed by comparably habituated or food-conditioned black bears as the behavior of the two species is distinctly different (Herrero 2002). Similarly, the “impact” of anthropogenic food cannot be evaluated as a single entity. Impact can and does vary by the type of food and the mode of availability; bears feeding from unique bait stations may behave very differently from bears feeding from easily generalized residential garbage cans.

Reproduction and mortality

Even less is known about reproductive rates of bears in Kentucky than overall population numbers. As discussed in chapter 5, the female bears studied thus far have produced larger than average litters and several have had a very early first age of reproduction (Unger 2007). However, the survival rate of these cubs is unknown. Research in other regions indicates that while anthropogenic feeding bears may have greater cub production than non-anthropogenic feeding females (Rogers et al. 1974; McLean and Pelton 1990; Baldwin and Bender 2009), their overall cub survival is lower (Beckmann and Berger 2003b; Beckmann and Lackey 2008). Currently nothing is known about the reproduction of female bears in Kentucky that are definitely not using anthropogenic food sources. If it turns out that a majority of reproductive females in the region *are* consuming anthropogenic foods, this could have important implications for cub survival.

All known mortality of adult black bears in Kentucky appears to be human-caused, which is typical of studies throughout the U.S. (Rogers 1987; Hellgren and Vaughan 1989; Costello et al. 2001). Both poaching and vehicle collisions are significant

sources of mortality for this small population. These factors may also be related to anthropogenic feeding if nuisance activity results in illegal kills, food conditioned bears being euthanized, or the relocation of bears which are subsequently hit by cars.

For both these reasons, bears that use anthropogenic foods often have negative population growth, and regions where this behavior is widespread may represent a population sink, only maintained by immigration from outside (Beckmann and Lackey 2008). Long term studies of individual animals are needed to explore these issues in Kentucky.

Attitudes

Socioeconomic status, including both education and income, as well as age and gender have been shown to predict attitudes towards wildlife conservation in other studies (Kellert 1994; Williams et al. 2002) and rural residents are believed to possess utilitarian values rather than moralistic or humanistic ones (Kellert and Berry 1981; Reading and Kellert 1992) and to be less tolerant of carnivores. However, these trends were absent from my study. Here rural residents, many of whom had low income and lacked college educations, were strongly supportive of bear restoration. Similarly, some of the most vocal advocates for the presence of bears were older men, the opposite of what has been found by many others (Bjerke et al. 1998; Williams et al. 2002). One key difference between my study and others may be the relatively low importance of agriculture, and therefore agricultural damage, in the region as well as the perceived economic benefit of the presence of black bears. This dynamic inverts the relationship seen between other landowners and carnivores, for example with wolves and ranchers in the western U.S. (Chavez et al. 2005).

Because seeing bears is a part of the day to day life experience of so many local residents and these encounters have not resulted in any injuries, the argument that bear provisioning is inherently “dangerous” did not resonate with most bear watchers or others in the community. While most participants agreed that human behavior had the potential to precipitate aggression from bears, they did not feel as though their own behavior was risky and the lack of injuries incurred seemed to support their perception. Conversely,

residents with minimal prior experience with bears were more likely to perceive the presence and proximity of bears as threatening.

Mitigation

Management strategies for problem bears during my study were ineffective, in large part because of the widespread and continued availability of anthropogenic foods. Of particular issue were food sources, such as garbage, that were available across multiple contexts as well as food conditioning and habituation that took place with large numbers of people. Temporary removal of attractants was ineffective. Although problems ceased while the attractants were absent, when residents replaced feeders or went back to storing their garbage in an accessible manner, the bears returned, often the same night. This suggests that bears continued to patrol the area unseen in search of possible food sources.

The efficacy of targeted removal of problem bears depended in large part on the nature of the nuisance complaint. The removal of highly habituated coal mine bears, for example, did result in a reduction of area nuisance activity and associated complaints. However the removal of non-habituated bears, for example feeding at backyard bird feeders, is not likely to be effective over the long term because, although one bear is gone, the food resource will be discovered subsequently by other bears. Even in the case of coal mine bears, if the mine is discovered by another bear, which is then habituated in a similar fashion, area nuisance problems will continue. In both cases, a more effective strategy would be to remove the original attractant.

Of the cases I examined, the only mitigation measure that had any discernable impact at reducing nuisance bear visitation was the effective removal of attractants. This resolved all problems except those caused by mine-associated bears, which continued to generate nuisance complaints as they visited houses during the day, looking into windows and doors, and exploring other possible food sources.

However, as discussed above, the impact of anthropogenic food removal is multifaceted, and incomplete removal is likely to exacerbate existing problems rather than relieve them. If bears experience a sudden and dramatic loss of food availability,

both the amount and severity of nuisance activity should be expected to increase (Rogers 1976; Ziegltrum 2004).

Conflict Resolution and Bear Management

Tourism

Currently, bear related tourism in Kentucky depends heavily on the accessibility of anthropogenic foods. People who supported non-natural feeding of bears or were opposed to bear proofing existing garbage cans offered two primary reasons: 1) they enjoyed seeing the bears and realized that without these anthropogenic attractants and food conditioned/habituated animals, those opportunities would be severely limited; 2) they believed that without the supplemental feeding the welfare, reproductive success, and survival of the bears would suffer. Consequently, none of the arguments commonly offered to discourage non-natural food provisioning resonated with these residents.

The situation with bears in Kentucky is different from many other areas where carnivores have recolonized or been reintroduced, largely because of the perceived economic benefit of the resurgence of bear populations and their continued presence. Romanach et al. (2007) found that commercial ranchers were actually more tolerant of predators than were community members because these large scale landowners were able to benefit from the presence of carnivores through ecotourism and trophy hunting. The impact of benefit accrual from wildlife presence is mixed overall, however. Other research has shown that attitudes and tolerance decline if promised benefits are not received (Walpole and Goodwin 2001; Mishra et al. 2003; Walpole and Thouless 2005). And it may be that individuals must benefit for there to be a positive impact on tolerance levels for wildlife (Archabald and Naughton-Treves 2001; Walpole and Goodwin 2001; Walpole and Thouless 2005).

While the perceived benefits of having bears in the area are being accrued on a community-wide level, residents are currently benefitting on a personal level if they participate in wildlife-watching based recreation, and they stand to benefit further from potential economic development of the region. Any economic benefit is, as yet, unrealized; however many people are receiving intangible benefits from the presence of

bears in Kentucky in terms of recreational opportunities, socialization, and community pride.

Hunting

Posters on Kentucky online hunting forums frequently cited the incidents of nuisance bear activity as evidence of a robust bear population at levels high enough to sustain hunting. In a typical exchange, one member posted close up pictures of a bear he took near an ATV park in Harlan County that showed the bear looking into his truck window and approaching his cooler. Another member responded:

And they say we don't have enough of a population to hunt!

In contrast, 16 out of 20 people interviewed who thought a hunt might one day be necessary or desirable, felt the population was not yet at huntable levels. No one I interviewed in the Tri-Cities region thought that a sport hunt for bear would significantly increase revenue in the area. They believed this in part because of the lack of amenities available to would-be hunters in the form of restaurants and hotels, but more so because of the likely low volume of tags available and therefore small number of hunters who would need accommodations. They contrasted this with the possible revenue available from tourism which they felt had a greater potential to attract larger numbers of people to the region. Twelve mentioned the apparent contradiction in promoting the bear as a basis for tourism, while at the same time endorsing killing bears in hunts and possibly hampering the growth of the population.

I think the bears in this community is really going to push Harlan County towards tourism. But it seems like every time we get something in here for tourism, it gets yanked and the bears are becoming a big thing. You've got people coming from everywhere to see the bears. And I think, you know, people come to the park, they're going to have to come through our town, they're going to have to stop. They're going to stop and eat, they're going to buy picnic supplies, stay in a motel. I, I think it'll really help Harlan County, but more especially Cumberland, Benham, and Lynch. Cause the bears is a really big thing. And they've been gone for what? Years and years and years, you know. They wiped them out by hunting to begin with. No, I'm not for a hunt. I don't think there should ever be a hunt. If you

want to hunt bear, go to Virginia. Actually, I'd rather 'em go to Minnesota.

– Male Bear Watcher

None of the people I interviewed expressed an anti-hunting or animal rights oriented viewpoint as a reason for opposing a hunt. All of the participants were current or past hunters themselves or had close family members who were. In spite of a strong tradition of hunting in the region, however, few expressed any interest in participating in a bear hunt themselves.

I mean, I could care less if they ever have a hunt in that, the way that it will be set, a person would stand, probably very little chance of drawing the tag because it probably be on a quota hunt type system. It's not so much I, me personally killing a bear. I could care less about me killing a bear.

– Male Nuisance Complainant

No, I personally wouldn't hunt a bear. Number one, I don't eat the meat. Number two, I just, that's just not an animal that I feel it is a sport hunting, you know? A lot of people do and a lot of men just die to kill a bear because they think "Ah! I killed something bigger than me!" That's just not, not one of the animals that I – I, you know, deer hunting's fine, grouse and turkey and squirrels because the populations of all are, except for the grouse, are – But now, uh, even though the elk is here, I still wouldn't hunt the elk right now. I mean, I know there's enough population and I know the herd's thriving and doing well and so forth and so on, but that's just me personally. I just wouldn't hunt that. I'd rather, much rather watch them. I'll go over and I have a particular place I go watch them. I have several actually. But I'll go sit on a rock and watch 'em for hours. You know, just watch them for hours. I just love that animal. And the bears are kind of about the same. You know.

– Female Nuisance Complainant

The three most mentioned reasons for opposing a hunt in order of incidence were:

1. There are not currently enough bears to support a hunt (16 cases);
2. A sport hunt is wasteful; people should eat what they kill and are unlikely to do so with bears (9 cases); and
3. Safety concerns: A bear might be injured but not killed as part of a hunt and thus pose an elevated risk to area residents (8 cases).

Six bear watchers and two tourism officials said that they believed there would come a time when a hunt would be necessary to control bear population levels but they did not believe that time had yet arrived. They cited their understanding of biological carrying capacity, rather than wildlife acceptance capacity, as the threshold at which they would support a black bear hunt. Participants almost universally opposed lethal control of problem bears except in cases of human injury, and only in situations where the injury was not a result of unsafe behavior on the person's part. However, participants generally accepted the idea of hunting as a tool to reduce bear numbers in the event of bear overpopulation.

Frequent comparisons were made to deer, as an example of a species that required management in the form of hunting to prevent overpopulation.

I don't know. Certainly not anytime soon and I don't know that I would ever be in favor of it. I don't know. It's just a really controversial subject. We would have to be overrun with them before I would be in favor of it. I mean, we would have to be severely overrun with bears and be needing to weed some of them out, like with deer. You know. You have to have hunts or you got too many. But not anytime soon.

– Female Tourism Official

Well, if you got so overpopulated, just like with the deer, if you got so overpopulated that there wasn't enough food to sustain them or something then, you know, you'd probably have to have a hunt or something like that, you know.

– Female Bear Watcher

If it were to control the food chain and you know. So forth and so on, you know if they get too many, they're just, you know, you pick up disease. You've got issues of, are they going to have enough food? Are they going to starve to death? No, I wouldn't oppose it. I just personally wouldn't do it myself.

– Female Nuisance Complainant

Because whether the people here believe it or not, there are some who do, eventually it's going to have to happen. If they keep breeding like they are, there has to be something to keep the population in check. And, what eats a bear? I don't know of anything that's going to eat a bear. We don't have anything around. Mountain lions? What have we got around here?

– Female Park Visitor

Others, while not opposed to the concept of a hunt if necessary to control the population, thought it was unlikely ever to become necessary because they felt that other limiting factors would prevent the bear from becoming overpopulated.

You're going to lose some of them to one thing and another. I guess disease, and you're going to have those poachers, I don't care what you do, it's like break-ins on a city, you could have a policeman on every corner and they'll still break in.

– Female Bear Watcher

Naw, I'd hate to see a bear hunt. It's too soon to have a hunting season, it sure is. They're just beginning to come in. we've got all this mining outside, this blasting, how long do we know we're going to keep them anyway?

– Male Bear Watcher

Education

Increased knowledge is often associated with positive attitudes toward wildlife species (Kellert 1985) and that is consistent with my observations here. Nuisance sufferers who sought out additional information about bears were more likely to be tolerant of bear activity. However, there was no direct causal relationship in that dynamic; it may well be that residents who were motivated to seek out additional information about bears were already more tolerant than those who were not. Another complicating factor is in the nature of knowledge and information.

When wildlife managers attempt to educate the public about a wildlife species, some of that information may be rejected as invalid if it runs counter to people's lived experience or other beliefs (Siemer et al. 2009). Most notably in this situation, the message that habituated and food conditioned bears are dangerous to people was rejected by many bear watchers because it was not supported by their personal experiences with bears. As discussed above, there is reasonable empirical evidence supporting that perception. In nuisance situations, many complainants were offered information from responding officers on reducing accessibility of anthropogenic attractants but found that information unhelpful because of logistical or financial constraints.

While all stakeholder groups expressed a consistent desire for additional educational information and outreach, the specifics of those efforts and the material

covered varied widely and current signage and literature were felt to be inadequate. Suggestions for alternative educational approaches are discussed below.

Current dynamics and recommendations for the future

The situation of black bears in eastern Kentucky is simultaneously unusual and typical of carnivore conservation issues. It is unusual in many of the specifics, in particular that local people are opposing the killing or removal of carnivores by wildlife managers, rather than vice versa. However it is typical because, like all carnivore conservation, it is highly complicated and contextual.

There are three main groups with a vested interest in the conservation of the Kentucky black bear: KDFWR, the Bear Watchers, and residents of Kentucky who wish for there to be bears. KDFWR is euthanizing bears as a result of nuisance activity, relocating bears which are later hit by cars, and sanctioning the taking of bears as part of an annual hunt. Wildlife watchers are provisioning bears which results in many being killed illegally by less tolerant residents. Both of these outcomes are counter to these two groups' respective conservation goals, especially when considered in light of the apparently small overall bear population size as well as the negative population growth of urban interface bears elsewhere. Increased bear mortality means fewer bears to hunt and fewer bears to watch; it could even threaten the existence of the population itself. Neither group is likely to abandon its goals but both could work together to achieve their mutual objective of a healthy black bear population in Kentucky.

The people killing nuisance bears are presumably doing so because it appears an expedient way of resolving a nuisance problem (Muth and Bowe 1998). Interventions that provide other avenues for reducing unwanted nuisance activity would likely reduce the number of bears killed for this reason. However, these interventions must be acceptable to the people who need them. Remedies that are either logistically or financially insupportable will be rejected.

This conceptual model (Figure 7.1) illustrates the simplest rendering of the current interests, actions, and outcomes. While wildlife managers may view anthropogenic feeding as one problem with one solution, whether or not it is intentional

or unintentional makes an enormous difference in perspective and outcome and must be addressed through different, though sometimes overlapping, strategies.

Although the idea of intentionally provisioning black bears to reduce human conflict may seem to many to be a counter-intuitive approach, there is actually mounting evidence of its efficacy. Certain types of anthropogenic food sources may reduce nuisance conflict (Ziegltrum 2004; Mansfield 2007; Rogers 2009). Mansfield (2007) found that houses without attractants were rarely visited by bears, even in areas where they were being fed by other residents. The key to successful provisioning seems to be providing bears with a food source that is unlike unsanctioned sources elsewhere so that the anthropogenic feeding behavior is not generalized to other, undesired, locales. In combination with a mechanism for bear resistant garbage handling, this may reduce the number of true nuisance conflicts while avoiding food deprivation for the bears and its physical and behavioral consequences.

A complementary feeding strategy is the establishment of “natural” food plots. There are physiological and temporal limitations to a bear’s ability to consume calories from plant-based foods (Welch et al. 1997; Rode et al. 2001; Robbins et al. 2004) and so food plots are inadequate as a total garbage replacement tool, but they could be part of an overall strategy to reduce unwanted nuisance feeding. Both food plots and sanctioned feeding stations could be situated in such a way that foraging bears would be visible to human observers, which would promote bear-related tourism and address some of the concerns of Bear Watchers. KCSP staff should work with Bear Watchers to establish agreed upon safe distances and behavior within the park and Bear Watchers should be enlisted to model those norms and encourage the desired behaviors from newer visitors.

In the case of residential issues, monetary and logistical constraints were an insurmountable problem for many participants suffering unwanted bear visitation. Bear resistant garbage receptacles may need to be provided free of charge to people who want them if nuisance activity is to be diminished. Grants or other outside funding are one possible source as is facilitating the construction of homemade versions. Where financial problems are not the issue, and voluntary bear proofing is rejected, regulatory recourse may be required. This approach is not recommended for private landowners as it may precipitate the illegal killing of bears, but in cases such as the housing development or

coal mines where owners can afford to provide bear-resistant dumpsters they should be required to do so. Although residents and workers at both sites were intentionally provisioning bears, their opportunities for close contact would be greatly diminished if access to the initial attractant were removed.

Relocation should be considered a last resort as an alternative to euthanasia or an immediately dangerous situation. When relocating, managers should consider bear demography and focus on bears least likely to return, e.g., young males rather than adult females.

Hazing by either KDFWR or local police is too sporadic to be effective and almost invariably involves the presence of additional cues for the bear. An alternative approach would be to provide nuisance complainants with capsaicin (pepper) spray and instructions on how to haze a bear themselves. Sue Mansfield of the Wildlife Research Institute reports good success discouraging nuisance activity and instilling renewed fear of humans when residents sprayed visiting bears with capsaicin spray which their group provided (pers. comm. July 2006). This product results in extreme local irritation but no lasting ill-effects (Jenkins and Hayes 1962). No bear attacks have ever been associated with the use of this spray and it does not appear to cause aggression (Rogers 1984; Herrero and Higgins 1995).

Capsaicin spray may be a more effective deterrent than other hazing techniques because it can be used by home owners and therefore applied as a negative reinforcer more frequently and consistently than aversives that require wildlife manager participation. In addition, the conditions under which the bear is sprayed more closely resemble the conditions in which the bear engages in nuisance activity troubling to the residents, without the addition of extraneous variables perceptible to the bear. The appearance of certain vehicles, dogs, or culvert traps appears to cue experienced bears to impending danger and they may avoid an area for the duration of their presence but return as soon as it is removed. However, the only additional variable when the homeowner uses capsaicin spray is the presence of the resident, so that even if the bear decreases its approach of people or visitation when residents are present, this represents a practical improvement in the nuisance situation. Psychologically, giving homeowners

some alternative to shooting the bear may be helpful in promoting a sense of control and reducing the number of illegal kills (Bjerke and Kaltenborn 1999).

Wildlife managers should emphasize the manner and attitude of first responders to nuisance bear issues as this seems to be a more important determinant of complainant satisfaction than actual resolution of the problem. In addition, educational material about non-controversial topics such as bear biology or natural history may be more effective than "dos and don'ts" lists. Where mitigation suggestions are offered, they must be exceedingly clear, with site-specific suggestions for removing attractants. The cases where responding wildlife officers came up with specific and site-based solutions were more successful and resulted in a higher level of caller satisfaction.

Wherever possible, neighborhood watch groups or other citizen-based task forces should be used to address local nuisance issues. Where intentional feeding is occurring in residential areas, a citizen task force or neighborhood watch group will likely be more effective in deterring this activity than KDFWR or law enforcement personnel who may be believed to have a conflicting agenda and act as a negative source cue for many people (Petty and Cacioppo, 1979); they are perceived as trying to persuade people and their credibility is poor. Therefore promoting messages through other channels may be more effective, for example through the newspaper or community leaders. Messages must be relevant and cannot run counter to firmly held beliefs. Arguments that point towards desirable outcomes are more likely to lead to favorable thoughts than those pointing to negative outcomes (Petty et al. 1997).

To this end, KDFWR should consider encouraging community-based or collaborative management strategies. Community leaders and members could be included in bear trapping and handling experiences to promote ownership over the larger bear conservation effort and citizen task forces should be established that work to protect the bears by reducing illegal feeding and attractants but address their concerns by allowing alternative provisioning opportunities as described above. Many people really want to interact and connect with wildlife in some manner. Substituting a less damaging activity for a more damaging one may be a more effective means of reducing conflict than trying to convince them not to want to interact with wildlife.

Similarly, education programs are most effective when there is a receptive audience. Investing in an education program designed to change the behavior of people who do not see any reason to change their behavior is potentially a waste of money. The funds would be better spent by taking a step backward and working to convince people of the need for change or enlisting their assistance in a mutually beneficial project.

Final thoughts

My personal background as a biologist has informed my starting perspective, which was that I wanted bears to live as “naturally” as possible, free from human interference or impact. From an aesthetic standpoint, I wish for there to be black bears in the forests of Kentucky because they were once part of a complicated ecosystem and their return is a part of that restoration. I was initially disposed to identify with the “official” perspective and to be opposed to local residents’ attempts to involve bears in their own recreation. Through the course of this study, I was forced to re-examine many of my assumptions and found myself changing my position in several key respects.

My discovery that a majority of studied bears are using anthropogenic food sources has meant that humans are already thoroughly integrated with current bear biology and behavior, indeed, as they have been for hundreds of years. While encouraging the bears to move towards a natural diet still seems to me a desirable goal, doing so will undoubtedly impact both humans and bears in the region. I came to realize that simply stopping the bears from eating all anthropogenic foods was neither possible nor, necessarily, desirable, but at the same time, many of the current trends are potentially negative for everyone and the stakes are very high.

KDFWR wishes for there to be a wild-feeding and sustainable, huntable black bear population in Kentucky. They are invested in this goal and have complete legal jurisdiction over the bears. However, other stakeholders with different goals are not without power in this situation because it is impossible for KDFWR to eliminate anthropogenic feeding through regulatory channels. Many of the people provisioning bears, or advocating for the provisioning of bears, are highly motivated to maintain a viewable bear population in the area. They feel that the bear represents the last best hope

for their community and they will not readily abandon the effort to promote bear watching, which currently depends on anthropogenic feeding. Both groups feel a sense of ownership and both groups believe they are acting in the best interest of the bears themselves.

A third group of people is frustrated by continued bear nuisance activity and is resorting to illegal lethal removal of problem bears as a solution. As with bear provisioning, it is difficult to eliminate poaching through regulatory channels. The best way to reduce the illegal killing of bears is to reduce the nuisance activity precipitating it, and the only way to accomplish that is by providing people with practical garbage handling and hazing alternatives. Both local bear enthusiasts and wildlife managers should work together towards this aim.

There is no solution that will perfectly address the demands of all stakeholders but there is certainly the potential for common ground if different stakeholders are willing to approach the situation with an open mind and a willingness to collaborate. My hope is that this study has gone a little of the way toward highlighting some of the relevant issues and perspectives, identifying areas where more research is needed, and offering some alternative approaches so that black bears may continue to roam the mountains of eastern Kentucky as a valued part of both the natural landscape and the cultural heritage of the region.

Table 7.1. Conflicts, arguments, impediments, and potential solutions to conflicts related to bear-human interactions in Kentucky.

Situation	Stakeholder desired outcome	Their current argument(s) for change	Impediments to change	Potential solutions
Case 1: Park visitors and some residents are intentionally provisioning bears (either to provide bear watching opportunities on an individual level or to promote tourism).	KDFWR wants this type of anthropogenic feeding to cease.	Provisioning bears is bad for bears and may result in their death; food conditioned bears pose a human safety risk.	People like seeing the bears; people believe that anthropogenic food availability is necessary for bear viewing and associated economic development; people believe that it contributes to bear well-being and health.	Natural food plantings and/or diversionary feeding stations and associated bear viewing areas at KCSP; local task force groups appeal to home-feeders on behalf of other neighbors who do not want bear visitation.
Case 2: Residents are allowing access to anthropogenic foods (unintentionally provisioning bears).	KDFWR wants this type of anthropogenic feeding to cease.	Provisioning is bad for bears; bear proofing will stop nuisance activity.	People don't understand how to bear proof effectively; people are prevented from bear proofing effectively by logistical or financial constraints; people see this as KDFWR's problem not theirs; people like seeing the bears – refer to case #1.	Community outreach to help people build bear resistant garbage containers (extension workshops etc.); grants/supply funds to buy bear-resistant containers to be supplied to requesting residents. Model after rain barrel programs.
Case 3: Bears are eating anthropogenic foods resulting in complaints to KDFWR.	Reduction of nuisance complaints which are both expensive and time consuming.	Efforts at change: hazing, advocacy of bear proofing.	Hazing is being ineffectively applied, people are not bear proofing – refer to case #2.	Enable residents to haze bears themselves using pepper spray; refer to case #2 for bear proofing solutions.

Situation	Stakeholder desired outcome	Their current argument(s) for change	Impediments to change	Potential solutions
Case 4: Park visitors, some residents, and coal miners are approaching bears.	KDFWR/KCSP management want them to stop.	Approaching bears could result in human injury or death; taming bears could result in their euthanization or relocation - refer to case #1.	People enjoy having a close interaction with bears; people do not believe these bears are dangerous, based on their previous experience; people attribute bear removal to KDFWR/KCSP rather than provisioning.	Establish allowable viewing opportunities with physical barriers; captive facility (debatable); include community leaders and members in bear research experiences; enlist community leaders and members (e.g., bear watchers) to model agreed upon norms of behavior; limit opportunities for habituation on a level that allows for close contact in the first place via bear proofing, especially at mine sites and housing development.
Case 5: Bears are approaching people.	KDFWR/KCSP management want this to stop.	Hazing, advocacy of bear proofing (from KDFWR only).	Hazing is being ineffectively applied; KCSP has a disincentive to bear proof; bears obtain food reward for approach; bears are being food conditioned elsewhere (primarily in mine and residential situations).	As above, limit opportunities for high levels of habituation which facilitate food conditioning; improve hazing protocol so that it offers clear guidelines for the bears on what is and is not allowed.
Case 6: KDFWR is relocating/killing anthropogenic feeding bears.	Tourists and community members interested in tourism want them to stop.	Relocation and lethal control are unnecessary; anthropogenic feeding is necessary for bear viewing and tourism, and potentially bear health.	KDFWR does not care about bear viewing or tourism; KDFWR believes food conditioned bears pose a risk to public safety.	Collaboration between stakeholders, listen to concerns and allow some level of community-based management; cease relocation and lethal control of non-aggressive bears; enlist community support on above measures so that extreme habituation is reduced; recognize that cooperation is necessary for successful outcomes for anyone.

Situation	Stakeholder desired outcome	Their current argument(s) for change	Impediments to change	Potential solutions
Case 7: KCSP is hazing anthropogenic feeding bears.	Tourists and community members interested in tourism want them to stop.	Hazing interferes with bear viewing and tourism.	KCSP feels that closely approaching bears pose a public safety risk.	As above – establish sanctioned viewing opportunities; establish consistent rules and hazing protocols that allow viewers to anticipate and correct problem situations.
Case 8: Bears are eating anthropogenic foods (and causing concern/damage).	Residents want them to stop.	People were here first (or at least most recently) and therefore the onus to change is on the bears.	Bears have an enormous biological disincentive to stop eating anthropogenic foods, and are unaware of the debate in any case.	As above, enlist community involvement and promote personal agency; community watch/help programs; targeted educational outreach.
Case 9: Bears are eating anthropogenic foods (and causing concern/damage).	Residents want KDFWR to stop them.	KDFWR wanted the bears (and potentially introduced them) and KDFWR-related regulations limit personal options (e.g., killing offending bears), therefore the bears are the responsibility of KDFWR.	KDFWR did not introduce the bears and believes they are a public resource; KDFWR believes residents have options they are not exercising (i.e. bear proofing).	KDFWR develop action plan that is responsive to residents' concerns; KDFWR coordinates with local resources (see above) to assist residents with bear proofing; targeted education explaining possible management options and their drawbacks; enlist public assistance.
Case 10: Residents are poaching nuisance bears.	KDFWR and bear watchers want them to stop.	Killing bears is illegal; bears are beneficial to the economy and ecosystem.	Low probability of prosecution; low tolerance for the presence of bears in Kentucky.	Make bear resistant garbage cans available free of charge; provide hazing alternatives to poaching such as capsaicin spray.

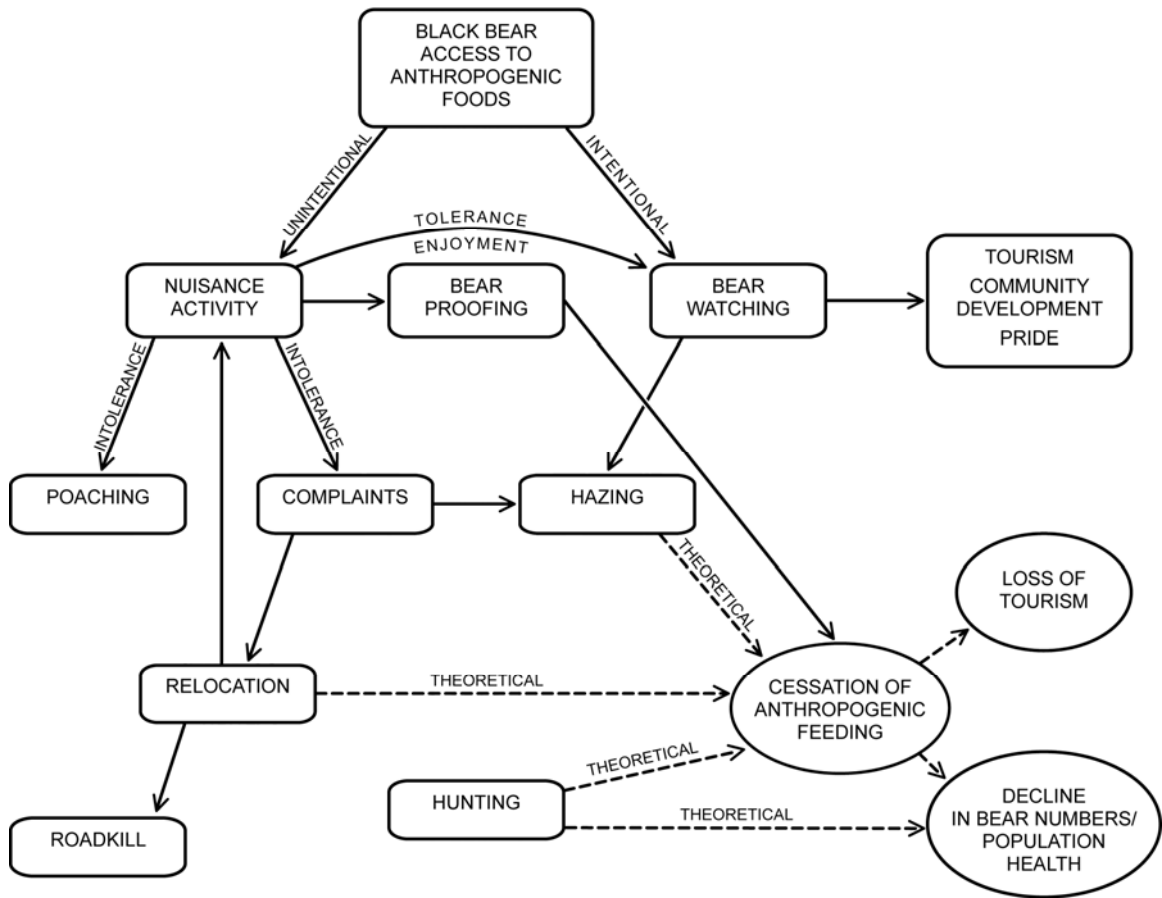


Figure 7.1. Conceptual model of bear-human interactions and possible outcomes for both black bears and humans living in the Tri-Cities region of eastern Kentucky.

APPENDICES

Dear Participant,

I am studying the impact of the black bear on people living in eastern Kentucky. This is part of a larger research project regarding the return of the black bear being conducted at the University of Kentucky in the Department of Forestry under the supervision of Dr. David S. Maehr. I am currently interviewing people in the town of Cumberland who have had personal experiences with black bears in Kentucky. Those experiences might range from seeing a black bear in the state park to having a recurrent problem with bears getting into garbage. My goal is to develop an accurate understanding of the ways in which the return of the bear has changed the lives, either positively or negatively, of Cumberland residents. Your participation is completely voluntary and you may withdraw from the project at any time. The information gathered as a part of the project is completely confidential. Your name will not be used under any circumstances without your express permission.

Your cooperation is very much appreciated. If you have any questions or would like more information please feel free to contact me.

Hannah Harris
Doctoral Student
Department of Forestry, University of Kentucky
Office: 859-257-5841
E-mail: (omitted)

Public Opinion Regarding Black Bears in Eastern Kentucky

1. Have you ever seen a black bear in the wild? (Circle one)
 - a. No
 - b. Yes

If you answer no to question 1 please skip to question 9

If you have had multiple encounters with black bears, please use your most recent encounter to answer the following questions

2. What were you doing when you saw the bear/
 - a. Hiking
 - b. Hunting
 - c. Riding an ATV
 - d. Fishing
 - e. Driving or riding in a car
 - f. Other (please specify)_____
3. Please describe your feelings at the time (Circle all that apply)
 - a. Fear
 - b. Concern
 - c. Excitement
 - d. Happiness
 - e. Other (please specify)_____
4. How would you rank your experience?
 - a. Negative
 - b. Positive
 - c. No feelings
5. What was the bear doing when you saw it?
 - a. Eating garbage
 - b. Eating natural foods (such as berries or acorns)
 - c. Walking or running
 - d. Sitting in a tree
 - e. Other (please specify)_____
6. When was the date of this encounter? (please be as specific as possible)_____

7. Where was this encounter?
 - a. In another state
 - b. In Kentucky (please specify county)_____

8. Did you observe any man-made markings on the bear (such as a collar, ear tag, or ear streamers)?
 - a. No, the bear was unmarked as far as I could tell
 - b. Yes (please specify)_____

9. Some people believe that the presence of the black bear in eastern Kentucky will increase tourism to this area. Do you believe this is true?
 - a. No
 - b. Yes

10. If the presence of black bears were to increase tourism in eastern Kentucky, what kind of overall effect do you think it would have on local communities?
 - a. Positive
 - b. Negative
 - c. No effect

11. Some people believe that the presence of the black bear will provide an additional opportunity for sport hunting in Kentucky. Would you be in favor of a black bear hunt if the bear population would support it?
 - a. No
 - b. Yes

12. Would you yourself participate in such a hunt?
 - a. No
 - b. Yes

13. Where do you think the black bears currently found in eastern Kentucky came from?
 - a. Neighboring states, on their own
 - b. Introduced by fish and wildlife department
 - c. There have always been bears in Kentucky
 - d. Other (please specify)_____

14. In your opinion, black bears eat mostly
- a. Plants
 - b. Deer
 - c. Insects
 - d. Garbage
 - e. Other (please specify)_____
15. How do you feel about the number of bears in Kentucky? (circle one)
- Too few Just right Too many
16. Would you consider the black bear to be native to Kentucky?
- a. No
 - b. Yes
17. In your opinion, black bear attacks on humans in North America are
- a. Very rare (fewer than one every 10 years)
 - b. Rare (fewer than one per year)
 - c. Occasional (between one and 10 per year)
 - d. Common (between 10 and 30 per year)
 - e. Very common (more than 30 per year)
18. In your opinion, black bear attacks on pets or livestock in North America are
- a. Very rare (fewer than one every 10 years)
 - b. Rare (fewer than one per year)
 - c. Occasional (between one and 10 per year)
 - d. Common (between 10 and 30 per year)
 - e. Very common (more than 30 per year)
19. If a black bear injured someone in Kentucky, which of the following statements would best describe your reaction?
- a. I would want the specific bear relocated
 - b. I would want the specific bear destroyed
 - c. I would want all the bears relocated
 - d. I would want all the bears destroyed
 - e. I would not want anything done to any of the bears
 - f. My reaction would depend on what the person in question was doing at the time
 - g. Other (please explain)_____
-

20. Please evaluate the following animals with respect to the risk, if any, that you feel they pose to humans. 0 indicates little or no risk, 10 indicates extreme danger.

Circle the number you feel most accurately represents the risk posed.

- | | | | | | | | | | | | |
|---------------------------|---|---|---|---|---|---|---|---|---|---|----|
| a. Black bears | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| b. Brown or grizzly bears | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| c. Wolves | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| d. Mountain lions | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| e. Coyotes | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |

21. How would you best describe the community in which you currently live?

- a. Rural forested (nearest neighbors are some distance away and house is adjacent or near to forest)
- b. Rural agricultural (nearest neighbors are some distance away and surrounding land is in agricultural production)
- c. Small town
- d. Suburb (cluster of houses on edge of larger city)
- e. City of 50,000 people or more

22. How would you best describe the community in which you grew up?

- a. Rural forested (nearest neighbors are some distance away and house is adjacent or near to forest)
- b. Rural agricultural (nearest neighbors are some distance away and surrounding land is in agricultural production)
- c. Small town
- d. Suburb (cluster of houses on edge of larger city)
- e. City of 50,000 people or more

23. Do you live on a farm that produces at least some of your household income?

- a. No
- b. Yes

24. In which county do you currently live? _____

25. Have black bears been sighted in your area?

- a. No
- b. Yes
- c. Don't know

26. If black bears were (or have been) sighted in your area, which of the following statements would best describe your attitude?
- a. I would be willing to change my habits in order to coexist with them if any conflict arose (for example using a bear-proof garbage can)
 - b. I would not change my habits, but would want the bears left alone
 - c. I would want the bears relocated to another area
 - d. I would want the bears destroyed
 - e. I don't know
 - f. Other (please explain)_____
-

27. How would you rate the availability of information concerning black bears and how to avoid conflicts with them?
- a. No information
 - b. Some information but not enough
 - c. Enough information
 - d. Too much information
 - e. I don't know

28. If you feel that information on black bears is lacking, what areas do you feel most need to be addressed?
- a. Current population of bears in Kentucky
 - b. Current range of bears in Kentucky
 - c. How to avoid conflicts with bears
 - d. All of the above
 - e. Other (please specify)_____

29. What kinds of things, if any, do you like to do outdoors? (circle all that apply)
- a. Hunt
 - b. Fish
 - c. Hike
 - d. Camp
 - e. Ride ATVs
 - f. Other (please specify)_____
 - g. I do not often spend time outdoors

30. On a scale of 0, meaning that you have no interest in wildlife, to 10, meaning that wildlife is of great interest to you, what number best represents your interest in wildlife in Kentucky?

1 2 3 4 5 6 7 8 9 10

The following set of questions will be used for statistical purposes only. Your answers will not be associated with your name under any circumstances.

31. In what year were you born? _____
32. What is your gender?
- a. Male
 - b. Female
33. What is your highest level of education?
- a. Grade school
 - b. Some high school
 - c. Graduated high school
 - d. GED
 - e. Some college, no degree
 - f. Vocational/technical degree
 - g. Graduated junior/community college (AA etc.)
 - h. Bachelor's degree (BA, BS, etc.)
 - i. Some graduate school work
 - j. Graduate degree (MA, MS PhD, JD, etc.)
34. Last year, what was your total household income from all sources before taxes?
- a. Under \$10,000
 - b. \$10,000 to less than \$20,000
 - c. \$20,000 to less than \$30,000
 - d. \$40,000 to less than \$50,000
 - e. \$50,000 to less than \$70,000
 - f. \$70,000 to less than \$90,000
 - g. \$90,000 to less than \$120,000
 - h. More than \$120,000

This concludes our survey. Thank you very much for your participation. Do you have any comments, questions, or concerns regarding black bears in Kentucky?

Interview Guide

Introduction; purpose; duration; recording; confidentiality. Offer information letter; thanks

1. How long have you lived in the area?
 - a. Tell me about where you grew up (study area or elsewhere)
 - b. (If here) are your parents from this area as well?
 - c. What brought them/you to this area?

2. How would you describe the area where you live? (Rural or not, forested or not, agricultural or not.) What about the area where you grew up?
 - a. Do you farm or garden? Do you have livestock?
 - b. What kinds of things do you like to do outside?

3. Have you ever seen a black bear?
 - a. What were the circumstances? (Where? What were you doing? What was it doing? When did this happen? etc.)
 - b. What did you think?
 - c. If recent in Kentucky –
 - i. Did you see any man-made markings on the bear such as a collar or ear tags?

4. Where do you think the bears currently in Kentucky came from?
 - a. Do you consider black bears native to Kentucky?
 - b. What does that mean to you?

5. How do you feel about the current number of bears in Kentucky?
 - a. What would you like to see happen with them?

6. Do you know if black bears have been seen in the area where you live?
 - a. How do you feel about that?
 - b. Have you had any problems with bears at your house? Tell me about that.
 - i. (If not) If you were to have a problem with a bear, how do you think you would handle it?
 - c. Do you feel like you had/have the information you need?
 - i. If not, where did/would you look?
 - ii. What kinds of information do you think are most needed?

7. Some people think the presence of the black bear will provide an additional opportunity for hunting in Kentucky. What do you think?
 - a. Would you participate in a bear hunt if there was one? (Why, why not?)

8. Some people think the presence of black bears might increase tourism in eastern Kentucky. What do you think?
 - a. (If yes) In what ways?
 - b. (If no) What do you think the limitations might be?
 - c. Do you ever go to KCSP? What kinds of experiences have you had there?
9. How common do you think it is for bears to injure humans? What about pets or livestock?
 - a. If a bear in Kentucky injured someone in Kentucky, what do you think should happen with that bear?
10. How do you feel about the risk posed by black bears to people in comparison to some other animals? (Go through each: black bears, brown/Grizzly bears, wolves, mountain lions, coyotes, snakes)
11. How would you rate your interest in wildlife?
12. Do you know anyone who has had an encounter with a black bear in Kentucky?
 - a. Do you think they might be willing to talk with me?
 - b. (If yes) How can I get in touch with them?
 - c.
13. Do you have any questions for me?
 - a. Is there anything you wanted to add?
 - b. Is there anything you wanted to talk about that we didn't discuss?

Closing: discuss analysis; option to confirm with them over quotes used, review results; offer thanks.

Appendix C. Behavior codes and descriptions used during observations of black bears in Kingdom Come State Park, Cumberland Kentucky. Adapted from Nevin and Gilbert (2005).

Coarse Scale		Fine scale	
00	Unobservable	00	(Bear known to be present but not visible)
10	Locomotion	11	Walking
		12	Running
		13	Avoiding people (fast vs. slow)
		14	Approaching people (fast vs. slow)
		15	Stop
		16	Lying down
		17	Sitting
		18	Standing
20	Alertness	21	Watch
		22	Stare
		23	Sniffing the air
30	Feeding	31	Standing to examine can
		32	Pushing over can
		33	Punching over can
		34	Eating from can
		35	Eating from ground
		36	Carrying bags
		37	Eating from bag in the woods
		38	Eating from picnic table
		39	Being fed directly by a person
40	Social behavior	41	Interacting with cubs
		42	Intra adult bear interaction
50	Communication/Vocalization	51	Calling to cubs
		52	Woofing
		53	Blowing
		54	Slapping the ground
60	Visibility	61	Lurking within vegetation
		62	Emerging from vegetation
		63	Crossing open area

Appendix D. Behavior codes and descriptions used during observations of people in Kingdom Come State Park, Cumberland Kentucky. Adapted from Nevin and Gilbert (2005).

Coarse Scale		Fine scale	
00	Unobservable	00	(People known to be present but not visible)
10	Driving	11	Driving in circles
		12	Driving through park (fast vs. slow)
20	Stationary	21	Parking at picnic areas
		22	Sitting in vehicle (open vs. closed)
		23	Sitting beside vehicle
		24	Cars pulled together for conversation
		25	Standing quietly
		26	Talking and socializing
		27	Eating (added to any of the above)
30	Bear watching	31	Quiet
		32	Loud
		33	Stationary
		34	Approaching bear
		35	Retreating from bear
		36	Spotlighting with car
		37	Spotlighting with flashlight
		38	Taking pictures
40	Provisioning bears	41	Throwing away garbage (unintentional)
		42	Baiting garbage can
		43	Baiting other (e.g., picnic table)
50	Hazing	51	Due to bear behavior
		52	Due to human behavior
		53	Projectile contact confirmed
		54	No contact confirmed
60	Other park activities	61	Hand feeding/tossing food
		62	Fishing
		63	Hiking and walking
		64	Jogging
		65	Playing at playground
		66	Playing ball/frisbee

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