Appendix A

HISTORY OF BLACK BEARS IN NORTH CAROLINA

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Life History of Black Bears

A. Physical Characteristics: In North Carolina, the black bear is usually black with a brown muzzle. Occasionally, a black bear will have a white patch on its chest, also called a "chest blaze." In other areas of North America, it is more common for black bears to be cinnamon in color or a more rare white. The average length of a black bear is five to six feet and the average height is two to three feet when standing on all fours. On average, adult females weigh between 100 to 300 pounds and adult males weigh between 200 to 700 pounds. The current world record black bear was harvested in Craven County in 1998 and weighed 880 pounds.

B. Habitat Requirements and Food Habits: North Carolina black bears primarily inhabit the Mountain and Coastal regions of the state and are uncommon in the heavily-developed Piedmont region.

The essential habitat components needed by bears are access to food, water, escape cover, den sites, travel corridors and enough space to exist. Bears are commonly associated with forested cover and make use of a variety of forest habitat types to meet all their seasonal needs. Despite expanding human populations and land-use changes, bears have persisted due to their adaptability to a variety of habitat types.

Optimal habitat conditions should be diverse, so that the habitat provides mast producing trees, early successional habitats (i.e., young forests created and maintained by timber/land management practices or other natural perturbations), edges of various successional stages, streamside management zones, and wildlife clearings. Agricultural crops, commonly found in the coastal plain region of North Carolina, can enhance habitat suitability for bears.

Fragmentation of bear habitat can have implications on population viability since fragmentation can restrict bear movements resulting in smaller populations that are more vulnerable to genetic isolation and mortality. The minimum area needed for populations of black bears will differ based on several factors, such as habitat quality and population management objectives (Rudis and Tansey 1995). Based on known and apparently viable bear populations in the Southeast, researchers have suggested that 79,000 acres of forested wetlands and 198,000 acres of forested uplands are needed as the minimum areas to support a black bear population. Another study in eastern North Carolina suggested 99,000 acres were needed in pocosin habitat (Zeveloff 1983).

Black bears must fulfill their nutritional needs for the entire year in 5-8 months for normal body maintenance, storage of body fat for the winter, and production and maintenance of cubs by females (Beeman and Pelton 1980). Researchers have observed that bears in areas that experience mast crop failures suffer from lower reproductive rates (Rogers 1987), decreased yearling survival, and disperse outside their home range (Jonkel and Cowan 1971, Reynolds and Beecham 1980, Garshelis and Pelton 1981, Rogers 1987, Smith and Pelton 1990). Therefore, feeding is one of the most important activities bears participate in and is reflected in the areas they use (Pelchat and Ruff 1986).

1) Mountains: Black bears in the Southern Appalachian Mountains of western North Carolina survive in a predominantly oak-hickory and mixed mesophytic forest. These

forest communities support important food plants such as blueberry (Vaccinium sp.), huckleberry (Gaylussacia sp.), and raspberry and blackberry (Rubus sp.). Evergreen thickets of laurel (Kalmia latifolia) and rhododendron (Rhododdendron sp.) provide dense escape cover.

Bear habitat use in the mountains shifts as food crops become available. In the spring, as bear emerge from dens, important foods such as bear corn (conopholes spp.), grasses, clovers, insects, and carrion are utilized. As fruit maturation continues into the summer, bear consume large volumes of blueberry, huckleberry, and other soft mast species. In fall, bears shift towards the hard mast like acorns and hickorynuts. The hard mast produced by a variety of oaks is heavily utilized by bears. However, hard mast is highly variable and depends upon weather conditions such as last frost and rain during acorn and nut development. During years of poor hard mast production, bears have been documented moving significant distances in search of this preferred food. In addition, bears seek soft mast species such as grapes, cherries, pokeberries, and dogwood berries, and all these species undergo fluctuations from year to year and area to area.

2) Coastal Plain: In the coastal plain of our state, habitat use is diverse and shifts with the seasons. Important habitat communities include Carolina Bays and pocosins, gum-cypress swamps, pine flatwoods, agricultural areas, and brackish marsh edges.

Carolina Bays and pocosins are an extremely important habitat component of coastal bears (Hamilton 1978, Lombardo 1993, Jones and Pelton 2003). This habitat type provides escape cover and a variety of fruits that make up a large volume of the bear's diet (Hamilton 1978). Important foods that are common in these habitats include gallberry (*Ilex coriacea*), blueberry, huckleberry, blackberries, greenbrier (*Smilax sp*.), devil's walking stick (*Aralia spinosa)*and horse sugar (*Symplocus tinctoria*) (Maddrey 1995, Hamilton 1978). Fruits are used extensively in late summer (Maddrey 1995).

Utilization of agricultural areas increases significantly as crops mature. In the spring, bear forage on green winter wheat (*Triticum aestivum*) eating the green foliage early after den emergence in April and shifting to the grain heads as they develop in May and June. Bears will continue eating wheat heads until they are removed by harvest. Shortly after wheat harvest, bears direct their attention to corn (*Zea mays*) fields. Beginning in late June to mid-July, corn begins to enter the milk stage, and the diet of bears in agricultural areas is dominated by corn (Maddrey 1995). Although corn is consumed until it is harvested and gleamed from the field, the heaviest usage occurs during the milk stage (Maddrey 1995). In late fall, as black gum fruit declines, bears shift their diets to soybeans (*Glycine max*) (Maddrey 1995). This high protein food is easily obtained and widely utilized by bears.

As the season progresses into the fall, bears increase their use of black gum-cypress swamps. This habitat type provided both food and refuge. Black gum (*Nyssa sylvativa)* and tupelo gum (*Nyssa aquatica)* trees provide fruits that are heavily utilized by bears (Hamilton 1978, Hellgren 1988). In addition to providing important fall foods, the typically large swampy characteristics of this vegetative community provided excellent

refuge from man and hounds. Escape habitat may be one of the most critical habitat components for black bears on the coast (Jones et al. 2003).

C. Home Range and Movements: Burt (1943) provided one of the first descriptions of home range, which is still widely cited by researchers; home range is "that area traversed by the individual in its normal activities of food gathering, mating, and caring for young. Occasional sallies outside the area, perhaps exploratory in nature, should not be considered as in part of the home range."

1) Factors influencing bear movements: Several characteristics can affect the size and shape of a bear's home range. These include sex, age (Reynolds and Beecham 1980, Garshelis and Pelton 1981), kinship (Jonkel and Cowan 1971, Garshelis and Pelton 1981), social behavior (Jonkel and Cowan 1971, Lindzey and Meslow 1977), reproductive status (Hellgren and Vaughan 1989), and food availability and distribution (Jonkel and Cowan 1971, Young and Ruff 1982, Smith and Pelton 1990). Individuals foraging in habitats containing large amounts of food likely have an advantage over those foraging in habitats containing smaller amounts of food because they can reduce the amount of energy they expend in searching for food. Smith and Pelton (1990) stated that home ranges could be indicative of habitat quality and that comparative analyses of the sizes of black bear home ranges in different populations would be useful in evaluating habitats.

   Concentrations of hard mast, soft mast, and/or artificial food resources appear to stimulate seasonal change in home range movements. Responses to hard mast failures have resulted in black bears exhibiting increased fall movements and home range expansions (Beeman 1975, Amstrup and Beechum 1976, Garshelis and Pelton 1981, Garris 1983, Pelchat and Ruff 1986, Rogers 1987). Powell et al. (1997) found that both male and female black bears responded to yearly variations in productivity of hard mast in fall. In years when hard mast abundance was great, male and female annual home range size, summer home range size, and fall home range size were smaller than in years when hard mast abundance was low. When mast abundance was low, bears in Tennessee, Idaho, Alberta, and North Carolina increased their movements and expanded their home ranges (Beeman 1975, Amstrup and Beechum 1976, Garshelis and Pelton 1981, Garris 1983, Pelchat and Ruff 1986, Powell et al. 1997).

2) Dispersal: When the female's offspring are just over a year old, they will separate from their mother sometime after den emergence (April through early June) and disperse until they establish a home range (Rogers 1987, Schwartz and Franzmann 1992). Purported advantages to dispersing include reduction of feeding competition with female kin, reduced mate competition with male kin, and inbreeding avoidance (Rogers 1987). However, these advantages are more applicable to male bears. It appears that female yearlings and subadults do not travel as extensively as males after family breakup, and in fact, often they don't disperse (Elowe and Dodge 1989, White et al. 2000). Rather they establish their home range adjacent to or within their mother's home range (Alt 1978, Rogers 1987, Schwartz and Franzmann 1992, Lee 2003).

3) Home Range Size: Numerous studies in North America and in North Carolina consistently show that annual home ranges of males are larger than home ranges of females, (Beeman 1975, Amstrup and Beecham 1976, Lindzey and Meslow 1977, Reynolds and Beecham 1980, Alt et al. 1980, Garshelis and Pelton 1981, Hugie 1982, Young and Ruff 1982, Carr 1983, Hellgren 1988, Smith and Pelton 1990, Fuller 1993, VanManen 1994). Male home range size may be function of larger male body size (Harestad and Bunnell 1979, Quigley 1982), breeding behavior (Rogers 1977, Herrero and Hamer 1977), and site fidelity exhibited by females (i.e. females stay in one area, thus males must travel to encounter them; Clark 1991). Male bears likely travel more extensively in search of food to meet the metabolic needs necessary to maintain their larger body size. Other factors affecting range size of male and female bears may be differences in their strategy for maximizing individual fitness. The reproductive success of males likely depends on their ability to breed with several females (Orians 1969, Rogers 1987, Powell et al. 1997). Hence, it is advantageous for promiscuous males to be mobile, less attached to specific areas, and occupy large areas that overlap with ranges of many females. The reproductive success of females is not as likely to improve by breeding with many males, so females could maximize fitness through detailed knowledge of resource abundance, phenology, and location within their home range (White 1996). Thus, they are less mobile, occupying areas only extensive enough to ensure adequate food for self-maintenance and the development of young (Amstrup and Beecham 1976).

   Several studies have been conducted in North Carolina since the 1970's (Table 1). Based on these studies, the average home range is 13 km^2 for coastal females and 110 km^2 for coastal males; 14 km^2 for mountain females and 47 km^2 for mountain males.

Table 1. Home range size (km^2) of male and female black bears in North Carolina.

Location	Source	Year	Male	Female
Coastal Region Dare County	Hardy	1974	175.0	11.0
Coastal Region Bladen County	Hamilton	1978	91.0	8.0
Coastal Region Great Dismal NWR	Hellgren and Vaughan	1989	111.7	27.0
Coastal Region CampLejeune	Lombardo	1993	60.5	20.4
Coastal Region Neuse Pamlico Peninsula	Jones	1996	--	8.6
Coastal Region Alligator River NWR	Allen	1999	N/A	N/A
Coastal Region Washington County	McCollister and van Manen	2001	--	2.7 - 3.9
Coastal Region Big Pocosin	Jones and Pelton	2003	--	11.6
Coastal Region Gum Swamp	Jones and Pelton	2003	--	6.6
Coastal Region Hyde County	Langer	2006	18.8	5.6
Coastal Region Washington County	McCollister and van Manen	2007	--	7.4 - 8.0
Mountain Region Great Smoky Mtn. NP	Garshelis and Pelton	1981	42.0	15.0
Mountain Region Pisgah National Forest	Warburton	1983	61.0	16.9
Mountain Region Pisgah National Forest	Beringer	1986	--	14.8
Mountain Region Pisgah National Forest	Brody and Pelton	1989	18.7 – 28.3	11.4 – 12.7
Mountain Region Pisgah National Forest	Seibert	1989	39.0	12.0
Mountain Region Pisgah National Forest	Reagan	1991	--	9.1

D. Denning Behavior: Bears utilize various types of structures for dens in North Carolina. The preferred den consists of a suitable cavity inside a standing tree, whether it is live or a snag. Research indicates that tree dens are more efficient at thermoregulation; in one study, tree

dens resulted in 15.5% savings in energy expended for body maintenance compared to ground dens (Lentz et al. 1983). Tree dens provides insulation and increased protection from weather elements and disturbances versus ground dens. Bears will also utilize a hollow log on the ground, the cavity formed in the ground as the result of a wind-blown tree, a dug-out ground cavity, a natural cavity under a rock outcropping or simply a bed on top of the ground in a thicket.

Bear usually begin to enter their winter dens in mid-December and emerge in late March or early April. Bears in eastern North Carolina entered dens as early as November and as late as January. Weather and food availability can affect timing of den entrance and den emergence. Females typically hibernate longer than males. Females with cubs emerge from their dens last in spring; emergence is dependent on weather and cub development. A female bear will emerge from her den once her cubs are capable of leaving the den and following her.

In its simplest definition, hibernation is a specialized reduction in metabolism brought about by low food availability and/or low temperatures. Several body changes occur to bears during hibernation. These include lower heart rates, constriction of blood vessels, suppressed shivering, reduced breathing, lower oxygen consumption, and lower body temperature. Bears drop their body temperatures by 10-15 degrees in most cases. In addition, bears do not consume food, defecate or urinate during hibernation. During hibernation bears are lethargic, but can be easily disturbed and are in full charge of their faculties within seconds of the disturbance.

E. Reproduction: Black bears in North Carolina attain sexual maturity at age 2.5 years old and over half breed at this age (Collins 1973, Carlock, et al. 1983, Powell et al. 1996). Mating occurs from June through early August, peaking in early July (Eiler et al. 1989). Implantation of the blastocyst (i.e. the fertilized egg) is delayed until late fall. Once the blastocyst implants, the true gestation period begins. The overall gestation period for black bears is 45-60 days and cubs are born from January through mid-Feburary. An average of two to three blind and hairless cubs, weighing less than one pound, are born in winter dens. In North Carolina and throughout North America, younger females (3- and 4-year old) have smaller litter sizes than older females ($\geq$ 5 years old; Elowe and Dodge 1989, Kordek and Lindzay 1980, Kolenosky 1990, Noyce and Garshelis 1994, Costello et al. 2003, Bridges 2005).

Cubs stay with their mother for their first two winters. When the female's offspring are just over a year old, they will separate from their mother sometime after den emergence (Rogers 1987, Schwartz and Franzmann 1992, Lee et al. 2003). Once the female's offspring have separated, the female bear will mate again that summer (Brown 1996). Females mate every other year, resulting in low reproductive potential when compared to other animals.

F. Mortality: Adult black bears have very low natural mortality rates, due to the fact they have no natural predators and they seem relatively unaffected by disease and parasites (Brown 1993). Causes of mortality include legal harvest, poaching, vehicle collisions, depredation permit kills, starvation, and intra-specific predation. Of these, human-induced mortality is the greatest source of black bear mortality in North Carolina (Figure 1). Various factors increase

a bear's vulnerability to mortality, such as increased access (i.e. roads) into bear habitats and increased movements by dispersing bears or bears in search of food sources.

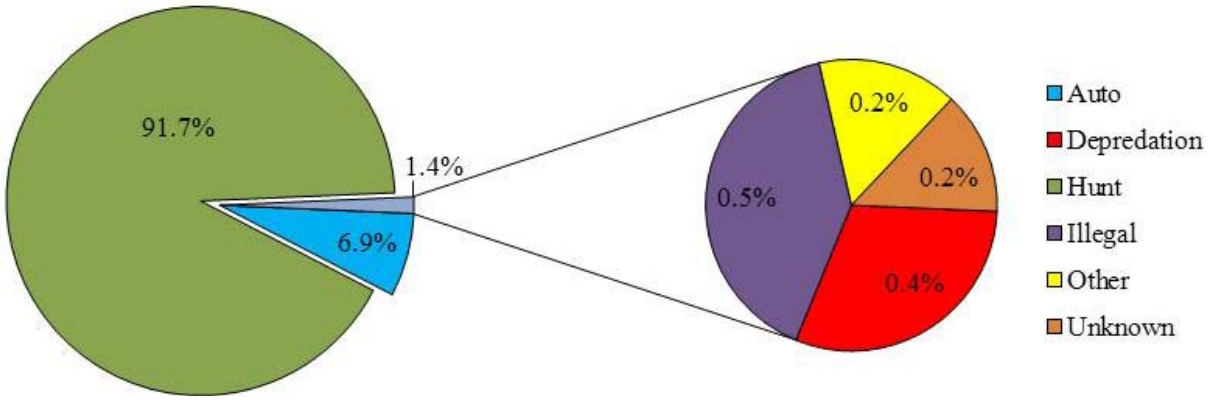


Figure 1. Causes of mortality among bears sampled by NCWRC from 1969 through 2010.

There have been few studies examining survivorship rates on black bears in North Carolina and the Southeast. Hellgren and Vaughan (1989) estimated annual survival rates of 0.87 for females (>2.5 years old) and 0.59 for males (>2.5 years old) in the Great Dismal Swamp. From 1981 through 2007, survival rates of female bears in the Pisgah Bear Sanctuary in the southern Appalachian mountains of western North Carolina ranged from 0.59 to 0.83 (Brongo et al. 2005). Powell et al. (1996) calculated the proportion of radio-tagged bears surviving from each age to the next and found survivorship ranging from 0.60 to 0.75 for bears in the Pisgah Bear Sanctuary and adjacent huntable areas (Table 2).

Table 2. Mean survivorship for bears in the Pisgah Bear Sanctuary and adjacent areas (1981-1990).

Bear age (years)	Survivorship (SE)	n
1	0.75 (±0.14)	12
2	0.73 (±0.12)	15
3	0.62 (±0.12)	16
4	0.67 (±0.15)	9
5	0.60 (±0.22)	5
6+	0.73 (±0.12)	15

Overall, survivorship is higher among females than males, with males more vulnerable to mortality due to increased dispersal distances, increased movements during breeding season, and bear hunters selectivity towards male bears. Survivorship rates reported in North Carolina were similar to what has been observed in other states. Based on bear population growth that has occurred since the early 1980's, the reported survivorship rates of North Carolina bears appear to allow a growing bear population.

1. History of the Black Bear Program (BBP)

A. Historical Records: Black bears were abundant in North Carolina when Europeans first arrived (Timberlake 1765, Arthur 1914). According to accounts from early historical records, native Americans and European settlers hunted bears for food, clothing, and medicine (Bartram 1998). John Lawson traveled into the piedmont area of North Carolina in 1708 and reported that "Bear-hunting is a great sport in America, both with the English and the Indians" (Lawson 1967). In 1761, Colonel Henry Timberlake accompanied a delegation of Cherokees into the area of eastern Tennessee and western North Carolina and reported the presence of many bears (Timberlake 1765). William Bartram reported that "The bears are yet too numerous" when he explored areas of western North Carolina in 1774 (Bartram 1998). Bears were common in many parts of North Carolina in the 18th and through much of the 19th centuries.

The European expansion and settlement of most areas of the state took its toll on bear populations in the latter part of the 19th century as forested areas were converted into agricultural croplands (Carlock et al. 1983, Pelton & Van Manen 1997). Settlers considered bears to be a threat to livestock and killing was intensive and unregulated. Legendary bear hunters, such as "Big Tom" Wilson, his father Tom Wilson, and others are reported to have killed hundreds of bears during their lifetimes in many areas of North Carolina in the 1800's and early 1900's (Aleshire 2008). Extensive logging decimated habitat in the early part of the twentieth century as vast areas of the state were clear-cut. As forests began to recover, the chestnut blight, introduced in 1925, further decimated bear habitat (Carlock et al. 1983). American chestnuts had provided a consistent and abundant food supply for bears and other wildlife throughout the fall and winter months. Half of the chestnuts were dead by 1940, and virtually all of the mature chestnut trees were dead by the early 1950's (LaFollette 1974). By the middle part of the 20th century, bears had been extirpated from the piedmont, and populations had receded into remote areas of the mountains and coastal plain.

In a 1975 symposium on endangered species in North Carolina, concern over declining bear populations was indicated by them being declared a "species of special concern" (Carlock et al. 1983). This designation was based on population estimates and occupied range (bears were considered to be rare), the potential for exploitation (illegal gall bladder trade), vulnerability to specific pressures (development and loss of habitat), and other criteria. In a re-evaluation of mammals by the North Carolina Museum of Natural History in 1987 reported that "Black Bear populations have declined in North Carolina in direct relationship to the extent of their interactions with humans" and that "we should anticipate that Black Bears and humans will not be able to share habitat extensively in North Carolina in the future" (Powell 1987). Even though conclusions about their status and concerns about the future of bears in North Carolina were expressed in 1975 and 1987, there was no formal or recognized process for officially designating the status of bears or other wildlife in North Carolina until the passage of the North Carolina Endangered Species Act in 1987 (NC General Statute Chapter 113, Article 25; Powell 1987). Black Bears have never been legally designated as endangered, threatened, or as a species of special concern under the North Carolina Endangered Species Act.

B. Early Protection: The first real protection for bear populations in North Carolina began with the establishment of the Great Smoky Mountains National Park (GSMNP) in 1936 and the creation and expansion of National Forests in North Carolina beginning in the 1930's and 1940's. The GSMNP was the first bear sanctuary in the state with over 300,000 acres of habitat (on the North Carolina side) protected from hunting, logging, settlement, and development. Although National Forests continued to be hunted, vast areas of habitat were protected, and the forests that had been decimated by extensive logging began to recover.

C. Early Regulations: Hunters were responsible for initiating regulations to protect and manage bears in North Carolina. The first statewide hunting season for bears was established in 1927, and ran from October 15 to January 1 with no bag limit. Since that time, several regulations and statutes have been enacted and/or modified, with several of these occurring in to better address bear management goals.

D. Creation of the Sanctuary System: One of the most important developments in the recovery of black bear populations in North Carolina began in 1971 with the creation of a bear sanctuary system. Twenty-eight bear sanctuaries were established to close approximately 800,000 acres of habitat to bear hunting. The idea behind the sanctuary system was to protect core areas of habitat that encompassed the relatively small home ranges of breeding females. The females would reproduce in the sanctuaries, and bear populations would increase and expand into surrounding areas. The bear sanctuary system, which North Carolina was the first North American jurisdiction to implement, has been one of the most successful and important innovations in the history of bear management in North America and has been a primary factor in the recovery of bear populations in this state.

E. 1981 Bear Management Plan: The 1981 Black Bear Management Plan contained sections addressing nine topics: 1) History, Status, and Distribution, 2) Surveys for Black Bear, 3) Research Needs, 4) Population Management, 5) Habitat Management, 6) Conservation Education, 7) Sportsman Interaction, 8) Management Policy, and 9) Management Priorities.

Many of the specific recommendations addressed in the 1981 Plan have been implemented by the NCWRC and are now considered a normal part of our statewide Black Bear Program. For example, we annually collect teeth and reproductive tracts to analyze age structure and reproductive output. The plan listed 14 management priorities (Table 3). Looking back 26 years after the completion of the 1981 plan, it is clear that many of these recommendations have been met successfully while the priority of others may have changed. In our 2007 BBMP, we build upon the concepts developed in 1981 and identify objectives appropriate for black bear management in the 21st Century.

Table 3. Management priorities identified in North Carolina's 1981 Black Bear Management Plan.

Listed in Order of Importance
1) Preserve key habitat types such as pocosins, Carolina Bays and hardwood swamps.
2) Continue to monitor the population with appropriate surveys.
3) Establish seasons in several eastern counties.
4) Complete sanctuary evolution study in process.
5) Formulate procedures for handling bear-human conflicts and depredation problems.
6) Prepare an annual Big Game harvest report.
7) Continue to stress habitat manipulation.
8) Review and improve the Wildlife Cooperator Agent Program.
9) Determine the effects of human disturbance on bear populations.
10) Review cub and baiting laws.
11) Revise life history and management slide program and hunting pamphlet.
12) Determine need for restoration areas and formulate guidelines for establishment.
13) Complete a life history and management pamphlet in 1981.
14) Complete a bear range map in 1981.

F. Occupied Range and Current Population Status:

1) Occupied Range: The WRC defines black bear range as a geographic area capable of supporting black bears throughout all seasons of the year and is considered to be occupied when there is evidence of reproducing females. Although the seasonal and incidental range of the black bear population fluctuates annually, the occupied range moves at a slower pace as females expand or move home ranges.

   The occupied range of the black bear in North Carolina has continued to expand since the inception of management strategies in the early 1970s and black bear populations were recovering by the late 1980's and early 1990's. Harvest reports, vehicle mortality, and bear range surveys indicates that the number of bears has increased and occupied range continues to expand (Figures 2 and 3). Today's occupied range probably represents the largest geographic distribution of black bears in the State in over 150 years.

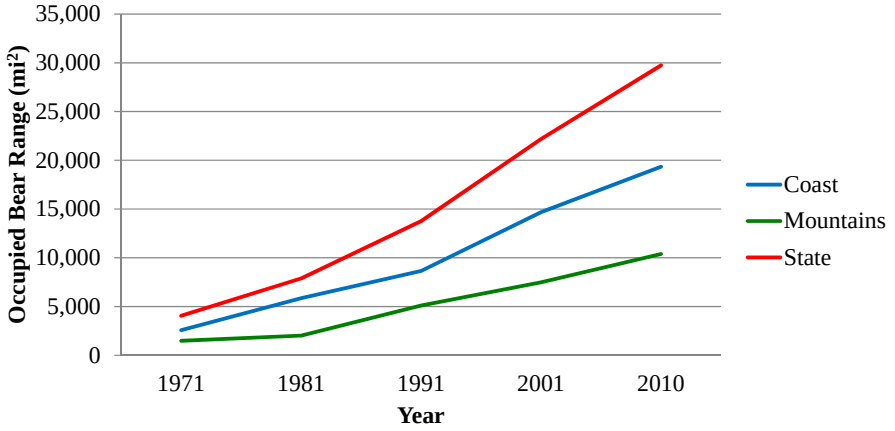


Figure 2. Occupied Black Bear Range in North Carolina (mi^2), 1971-2010.

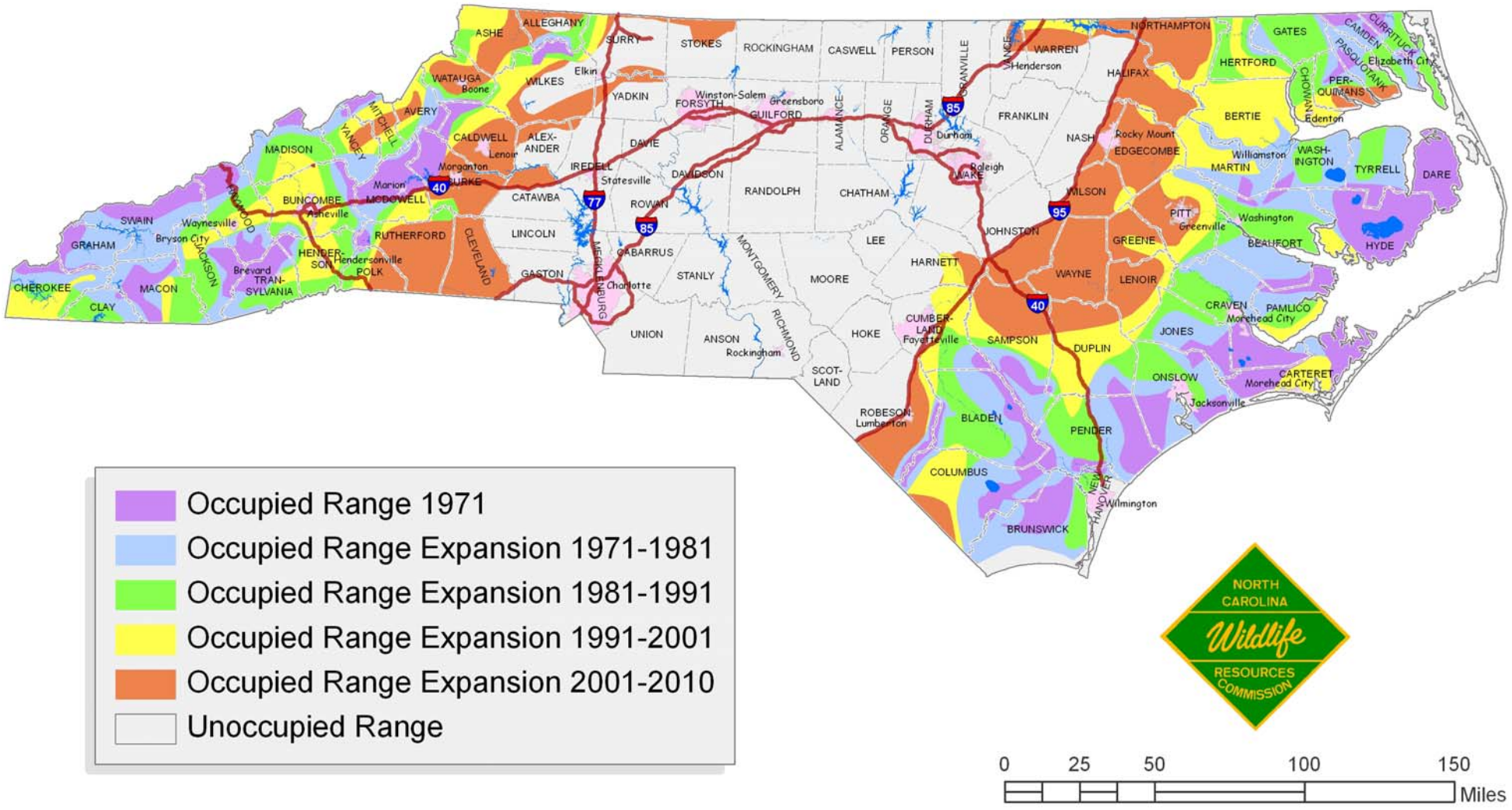


Figure 3. North Carolina Occupied Black Bear Range, 1971-2010.

2) Population Status: Success of the bear sanctuary program and management efforts began to yield benefits as harvest numbers increased each year, and bear range maps prepared by NCWRC biologists began to indicate an expanding population. Bear populations in North Carolina began to rebound in the mid-1980s (Figure 4). By the mid-1990's, the number of bear-human conflicts began to increase, and it became apparent that black bears were much more adaptable to the presence of humans than anyone had anticipated (Figure 5).

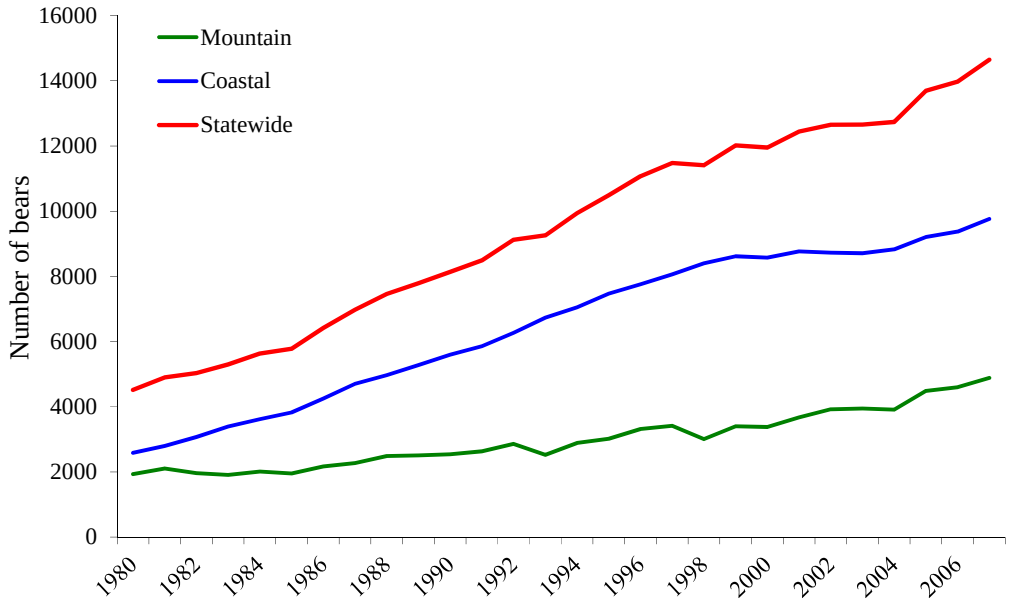


Figure 4. Estimated Black Bear Population in North Carolina, 1980-2007

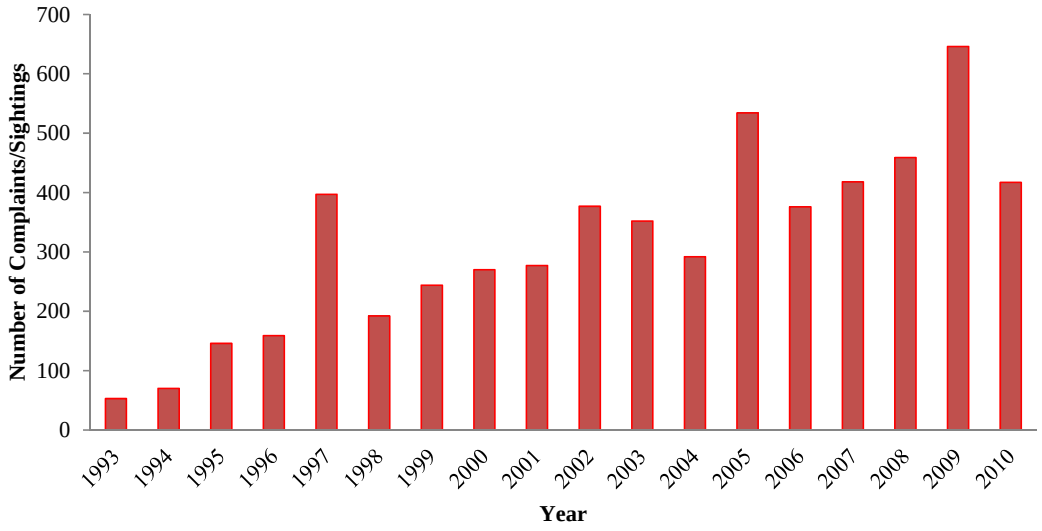


Figure 5. Number of bear complaints and observations recorded by NCWRC District Wildlife Biologists in North Carolina, 1993-2010.

Bear populations in North Carolina in 2012 continue to thrive in many areas and expand their populations into previously unoccupied habitats. Loss of habitat and increased human development continue to be the most critical concerns for the future of bears in North Carolina. Social Carrying Capacity (SCC; i.e., how many bears are people willing to tolerate) is now considered to be the primary limiting factor for bears in many areas of the state.

Many of the old beliefs that bears could not adapt to human development and increasing numbers of roads and highways began to fade as bears started to appear in areas of high human activity. Human-bear conflicts began to rise substantially in the 1990s, primarily in residential areas of western North Carolina. Bear mortality from vehicular accidents also began to increase, primarily in eastern North Carolina, because of the combined effect of more bears, more roads, and more traffic. Residential developments became, in effect, small bear sanctuaries because hunting was not allowed or was unfeasible. Bears that grow-up in protected areas without experiencing the negative behavioral effects of being chased by dogs and exposed to hunting often lose their fear of people. Loss of habitat to residential, suburban, and urban development is the most critical problem facing black bear populations in North Carolina today. Protection of additional large blocks of habitat through public land acquisition and conservation easements is essential for the future of bears in the state.

North Carolina's mountain and coastal bear population growth is stabilizing to slightly increasing. Both populations continue to move into previously unoccupied habitats on the periphery of traditional core habitat areas. There are probably more bears in North Carolina today than there have been at any time in the last 100 years. NCWRC biologists now view bear managements' critical questions in terms of SCC rather than biological carrying capacity (i.e., how many bears habitats can support). Based on the increase in human-bear interactions reported in western North Carolina, some areas of the state may have already reached or exceeded SCC. Educating the public on issues relating to bear/human interactions is a very important aspect of bear management today, but the challenge for biologists of the future may rest on finding ways to stabilize or reduce bear populations in and around areas of high human population.

G. Summary of Research Studies: The results of a status survey in 1967 prompted the NCWRC to initiate the first bear research study in 1969. The study was initiated by the WRC to collect biological information upon which to examine the steadily declining bear population. North Carolina State University (NCSU) was a cooperative partner in these early research efforts. At the time, the only biological information, such as bear age, was available in VA and PA. Bear range, reproduction, mortality data (i.e. sex ratios, age, weight, etc…), and harvest statistics were among the research topics examined. Several of the studies initiated in 1969 continue today.

In 1972, cooperative studies with NCSU were initiated to analyze black bear movements and home ranges at Camp Lejeune and to study habitat suitability in known bear range. Bears were radio-collared and tracked at Camp Lejeune, and scats were collected in Bladen and Dare counties and analyzed to determine food habits and habitat suitability. Over the years,

the NCWRC has entered into cooperative agreements with NCSU, the University of Georgia (UGA), the University of Tennessee (UT), and Virginia Tech (VT) to conduct major research projects on the biology and management of black bears in North Carolina. Additionally, researchers from Auburn University have worked under a permit from the NCWRC on the Pisgah Sanctuary in western North Carolina.

Although the bear sanctuary system had been established and biologists in North Carolina were continuing efforts to monitor bear populations, there was still much concern over the status of bears in 1976. John Collins reported, "populations of black bear in North Carolina have declined drastically in past years" (1976 NCWRC Annual Report). It was generally recognized that bear populations in western North Carolina were not confined by state lines but were part of a larger population that included bears and bear habitat in several states in the southern Appalachians. North Carolina entered into a cooperative relationship with Georgia and Tennessee, coordinated by UT and involving UGA, known as the Tri-State Bear Study in 1976. The purpose of the study was to characterize bear populations and habitats in the tri-state area and provide better information for making sound biological and management decisions on a regional basis. Each of the members involved in the Tri-state study were assigned different job segments with respect to processing specimens, compiling data, and preparing reports. Data were collected from 1976-1980, and the final report, published in 1983, provided a wealth of information to the member states for the purpose of formulating plans and regulations to better manage shared bear populations. The study also led to a continuing long-term research project by UT to monitor bear populations in the GSMNP. Although the Tri-state Bear Study was formally completed in the 1980's, the cooperative relationship among the original members continued with the formation of the Southern Appalachian Black Bear Study Group (SABBSG). South Carolina and Virginia state agency biologists began to participate, and other cooperators from Federal and State agencies occasionally attend meetings. The SABBSG continues to meet twice each year to discuss issues related to bear biology and management and coordinate research efforts. Georgia, North Carolina, South Carolina, and Tennessee form the current SABBSG with participation from UT, GSMNP, Big South Fork National Recreation Area, and other invited guests. States in the central Appalachians formed a mid-Appalachian Black Bear Study Group comprising Maryland, Ohio, Pennsylvania, Virginia, and West Virginia and coordinated with assistance from Virginia Tech.

Another study that began in 1976, "An Analysis and Evaluation of a Black Bear Sanctuary in North Carolina", was a cooperative effort between the WRC and NCSU to gather basic biological data on bears and bear habitat and compare "utilization" of habitats in sanctuary and non-sanctuary areas in western North Carolina. The NCSU effort also developed into a long-term research project and provides valuable information for managing black bears in North Carolina.

Since the early 1970's, there have been over 20 bear studies have been conducted partially or entirely in the state of North Carolina. The WRC's biological staff uses information from research projects to provide a basis for making sound management decisions and adopting regulations to benefit bear populations and bear habitats throughout the state.

H. Monitoring Activities: NCWRC biological staff can assess the status of the bear population through various monitoring indices derived from harvest, non-harvest mortality, scent stations, nuisance activity, and bear observations. Population estimates and growth rates are based on a population reconstruction model (Downing 1980), which estimates the population three years prior to collection of biological data from harvested bears. The information derived from these monitoring activities help NCWRC track trends in the bear population and provides for science-based decision making and biologically-sound management principles,

1) Documentation of Bear Range: Since 1971, WRC biological staff has monitored the areas of North Carolina that are occupied by black bears (Figure 2 and 3). Occupied black bear range is defined as a geographic area capable of supporting black bears throughout all seasons of the year and is generally considered to be occupied when evidence of reproducing females is found. Black bear range maps are updated every ten years using non-harvest mortality reports and bear observations.

2) Human-Bear Interactions: Since 1993, WRC biological staff have recorded human-bear interaction reports and recorded bear observations that occur outside the established bear range (Figure 6 and 7). A human-bear interaction includes both bear observations and conflicts with bears. This information not only aids in tracking bear population trends, behavior and occurrences, but helps the WRC predict when most interactions may occur (Figure 7 and 8) and identify common sources of conflict so that we can properly address human-bear interactions and provide effective technical guidance to resolve conflicts.

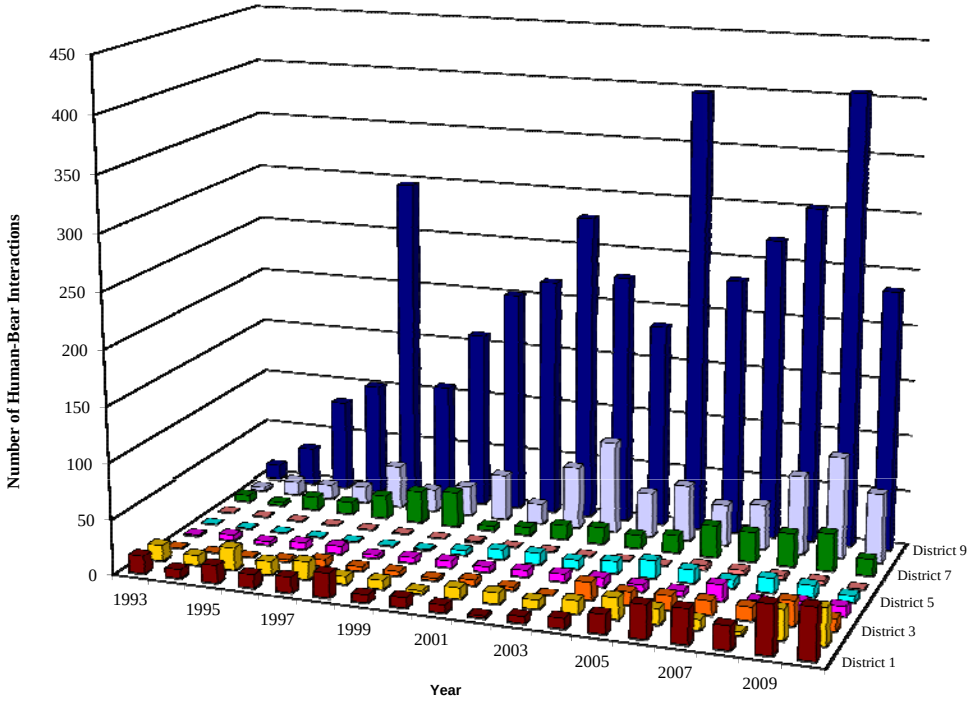


Figure 6. Number of human-bear interactions by district and by year in North Carolina, 1993 through 2010.

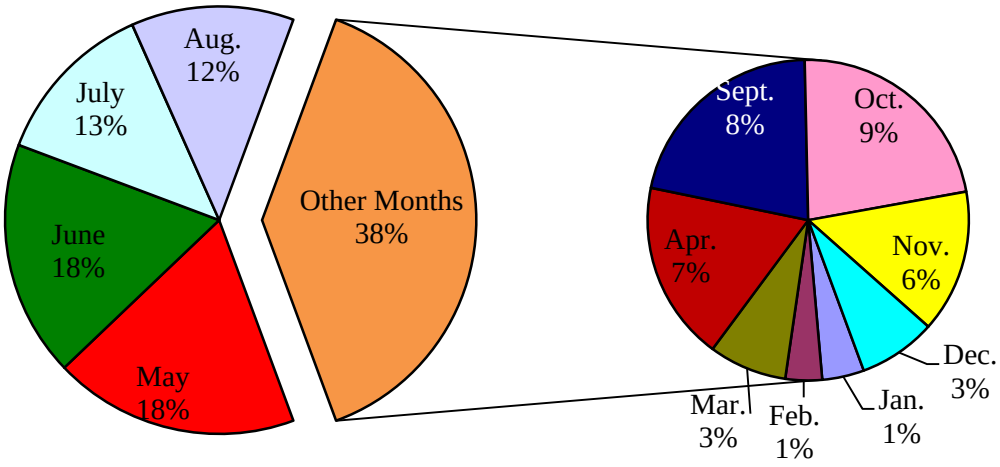


Figure 7. Percentage of human-bear interactions reported to WRC District Wildlife Biologists by month in North Carolina, 1993-2010.

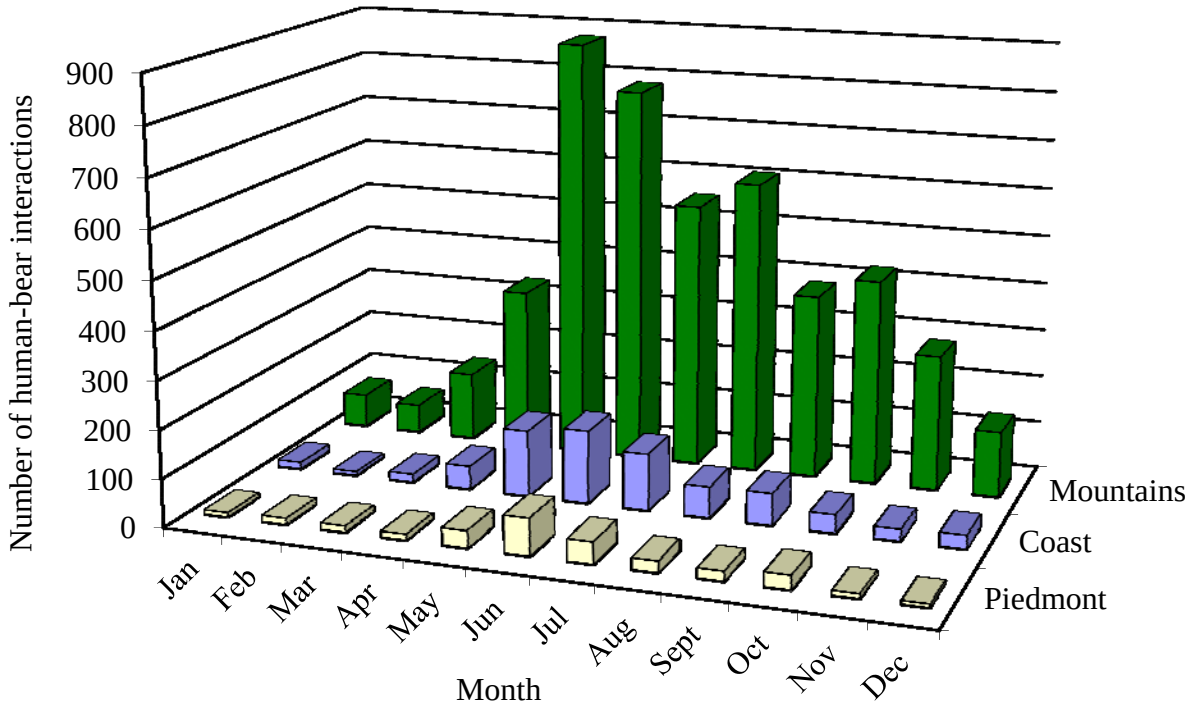


Figure 8. Number of human-bear interactions by month and region in North Carolina, 1993 through 2010.

3) Bear Cooperator Program: Mortality information from harvested bears, including the collection of premolar teeth and reproductive tracts, began in 1969. NCWRC biologists and technicians continue to work closely with bear hunters to collect biological data from harvested bears. Age, sex, and reproductive information gathered from biological samples are used for analyzing the age structure (Figure 9) of the harvested population and for population reconstruction modeling (Figure 4).

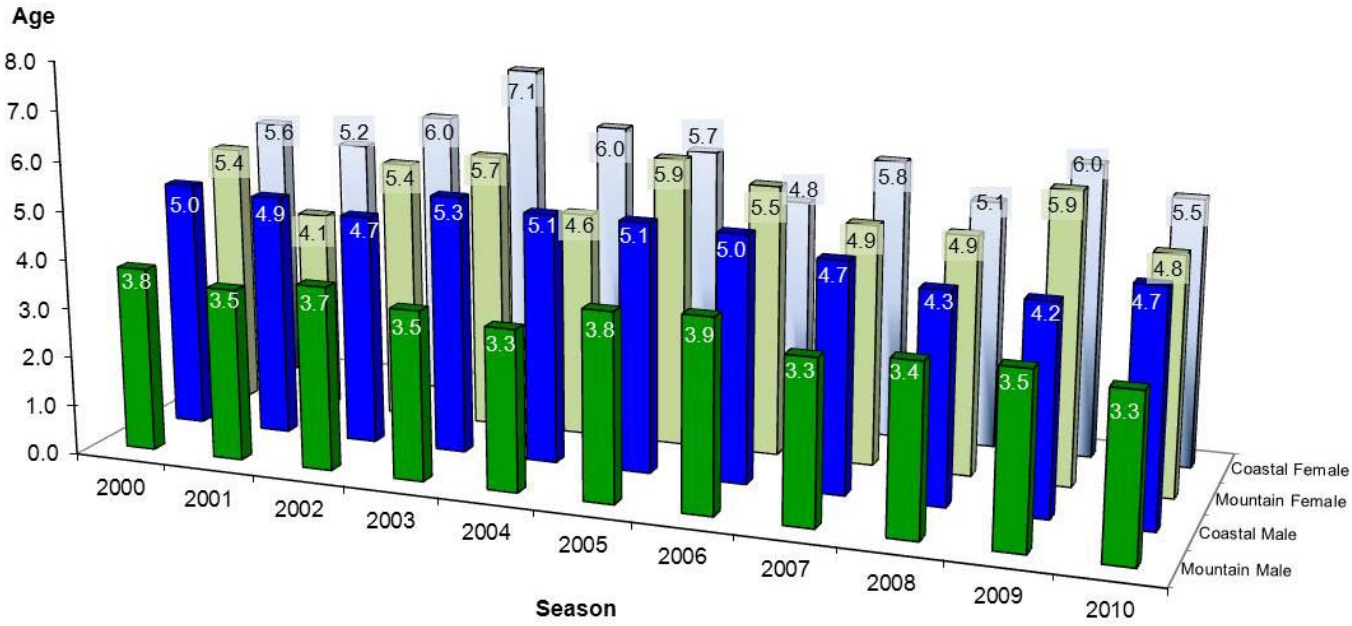


Figure 9. Average age of harvested bears sampled in North Carolina, 1998-2010.

The oldest bear documented in North Carolina was a 26.75 year-old female bear harvested in McDowell County in 2003 by a still hunter. The oldest male documented was 23.75 years old and was harvested in Bertie County in 2005 by a still hunter. Information collected from this program also allows the NCWRC to monitor the weights of the harvested bear population (Table 4 and 5; Figure 10).

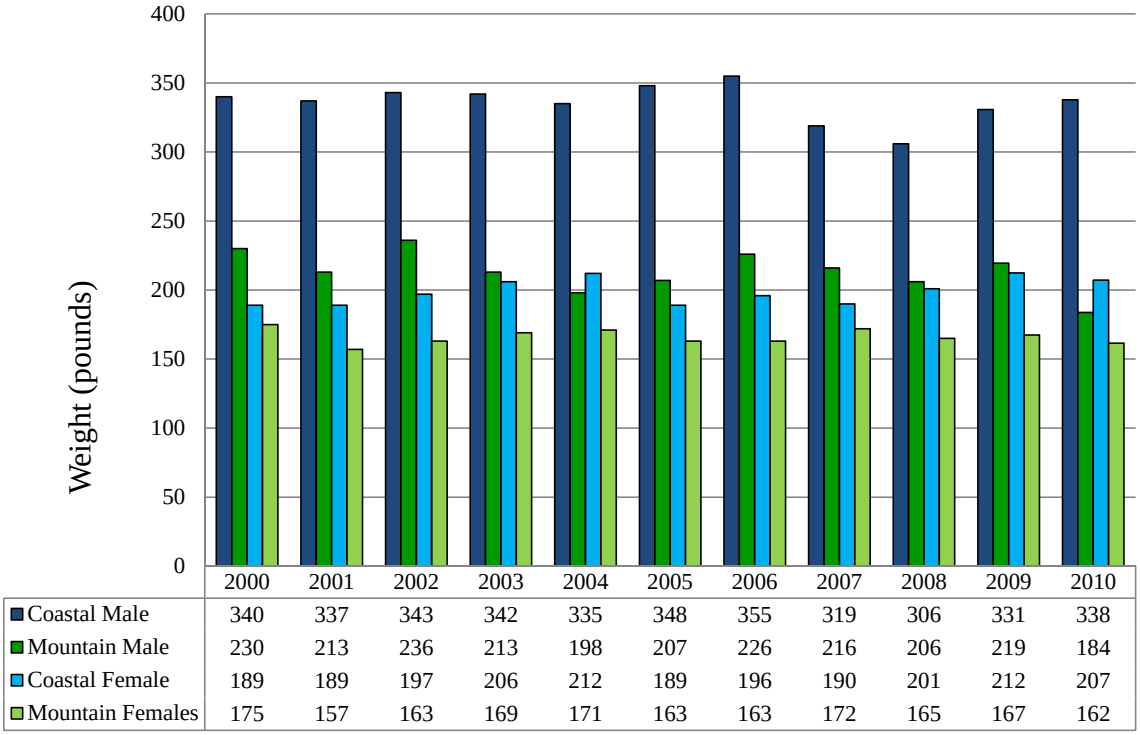
The CBMU has gained a reputation nationwide for its producing “trophy” bears (>500 lbs.) and all but one of the estimated 18 bear outfitters in North Carolina conducts their guide activities in the CBMU (Table 4 and 5). While the NCWRC does not manage for quality bears, the production of “trophy” bears is an outcome when harvest pressure allows for bears to grow old enough to achieve weights over 500 lbs.

Table 4. Top ten bear weights recorded by NCWRC during the bear hunting seasons in North Carolina, 1969-2010.

Rank	Year	County	Region	Type of Hunt	Weight	Sex	Age
1	1998	CRAVEN	C	DG	880	M	10.75
2	2009	HYDE	C	ST	760	M	6.75
3	2007	DARE	C	ST	752	M	7.75
4	2001	GATES	C	DG	742	M	9.75
5	2001	BEAUFORT	C	DG	740	M	13.75
6	2003	HYDE	C	DG	725	M	9.75
6	2009	BERTIE	C	DG	725	M	8.75
7	1990	BEAUFORT	C	ST	720	M	8.75
7	2005	CRAVEN	C	DG	720	M	12.75
8	2010	BERTIE	C	ST	711	M	7.75
9	2010	DARE	C	ST	708	M	N/A
10	2002	HYDE	C	DG	705	M	10.75

Table 5. Number of harvested male bears weighing over 500 lbs. in North Carolina, 1969-2010.

Weight Category	Total bears	Mountains	Coast
> 500 lbs.	793	32	761
> 600 lbs.	154	3	151
> 700 lbs.	11	0	11
> 800 lbs.	1	0	1



	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Coastal Male	340	337	343	342	335	348	355	319	306	331	338
Mountain Male	230	213	236	213	198	207	226	216	206	219	184
Coastal Female	189	189	197	206	212	189	196	190	201	212	207
Mountain Females	175	157	163	169	171	163	163	172	165	167	162

Figure 10. Average weight (pounds) of harvested bears sampled in North Carolina, 1998-2010.

4) Hunter Harvest Survey: Approximately every 3 years since the 1950s, the NCWRC has conducted a mail survey of licensed hunters to estimate population numbers of hunters for specific game species, hunter effort and hunter harvest. From 1976 through 2001, the survey did not ask bear-related questions. However, starting with the 2005-06 survey, hunters were asked if they hunted bears and for how many days.

   The latest survey was conducted after the 2007-2008 season. Commission staff mailed questionnaires to a random sample of 2% of the licensed hunters. The initial frame size was 482,588 licensed hunters and the initial sample size of potential hunters to be contacted was 9,652 hunters for a target of a 2% initial sample. An increase in bear hunter success was observed between 2005 and 2007, while there was no change in kill per unit effort (Table 6). Kill per unit effort remained at 0.02 for both survey years. However, there was very high variability in both surveys due to under-sampling of bear hunters. In the 2007-08 hunter harvest survey report, the authors reported that good precision could occur if standard error was less than 10% of the estimate. The standard error for estimated harvest and number of hunting days exceeded 10%. To improve on precision and reduce standard error, the authors suggested implementing a system to identify species hunters (e.g. turkey hunters, bear hunters) so that a smaller specialist framework would be available to survey.

Table 6. Results of the 2005-6 and 2007-08 Hunter Harvest Survey conducted by the NCWRC.

	Bear Hunters	Hunting Days	Bears Harvested[1]	Kill per Unit Effort[2]	Success Rate
2005 season	17,369	112,633	2,290	0.020	13.2%
2007 season	18,393	132,031	3,148	0.024	17.1%

[1] Bears harvested based on harvest survey and reflects non-registrations.
[2] Kill per unit effort calculated by dividing the number of bears harvested by the number of hunting days.
[3] Success rate calculated by dividing the number of bears harvested by the number of bear hunters.

5) Harvest Mortality: Hunters who harvest a bear are required to report and register the bear with the NCWRC. We use this opportunity to collect data on the date and county of harvest, as well as the sex of the bear harvested. Starting in 2009, we used the registration system to collect data on weapon used and whether dogs assisted in the harvest. This was initiated so that we could increase our understanding of method of harvest in different regions of North Carolina. There has been an increasing trend in the registered harvest, likely reflecting an increasing bear population (Figure 11). A majority of the bear mortality documented in North Carolina is due to hunter harvest (Figure 1). Unlike the other sources of bear mortality, the NCWRC can manage the level of harvest mortality through the timing, location and length of our regulated bear season, thus allowing us to also actively manage the bear population.

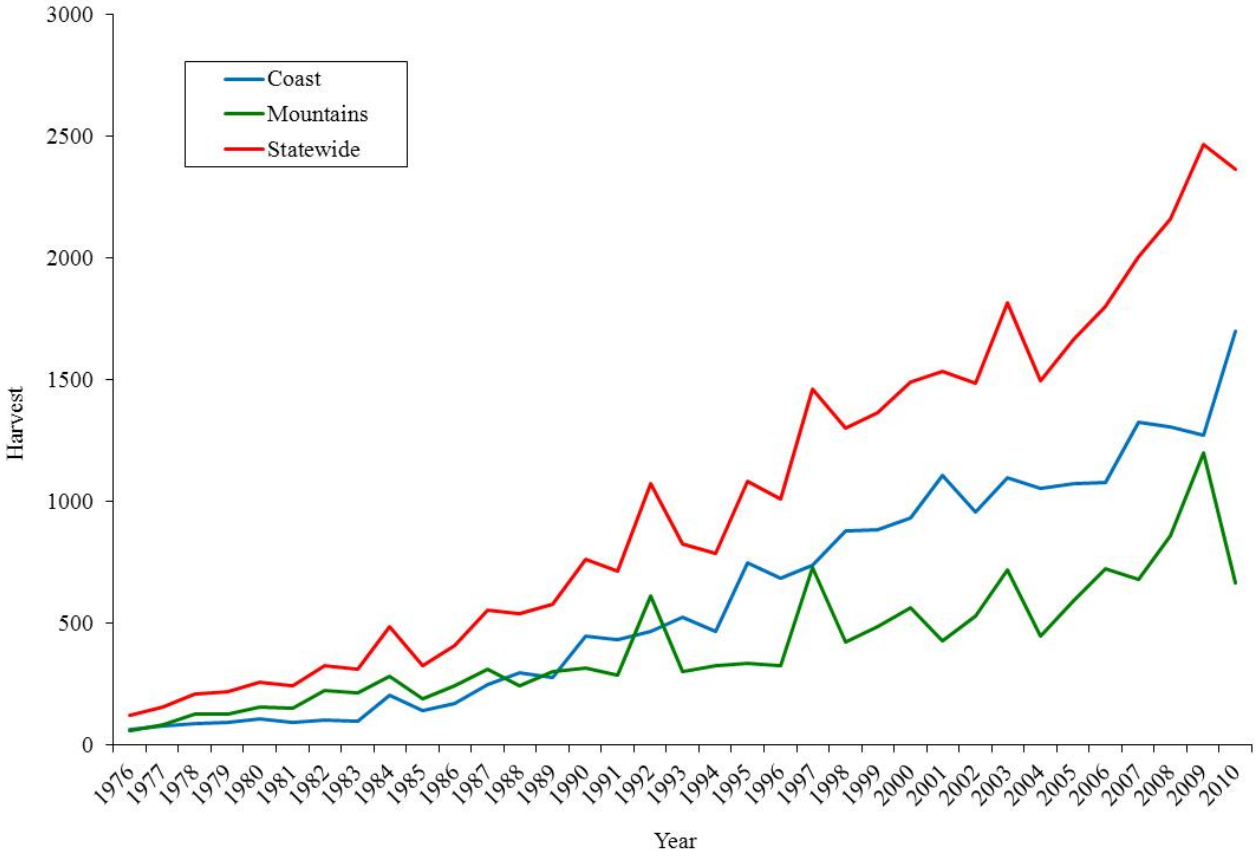


Figure 11. Statewide harvest of black bears in North Carolina, 1976 through 2010.

6) Non-Harvest Mortality: The NCWRC collects biological data from bears killed for other reasons besides legal hunting (e.g. highway mortality, depredation). The data helps us estimate the amount of non-harvest mortality occurring in the bear population (Figure 12 and 13) and identify areas along roadways that are more prone to bear-vehicle collisions. The data also helps us document the occurrence of bears outside established bear range.

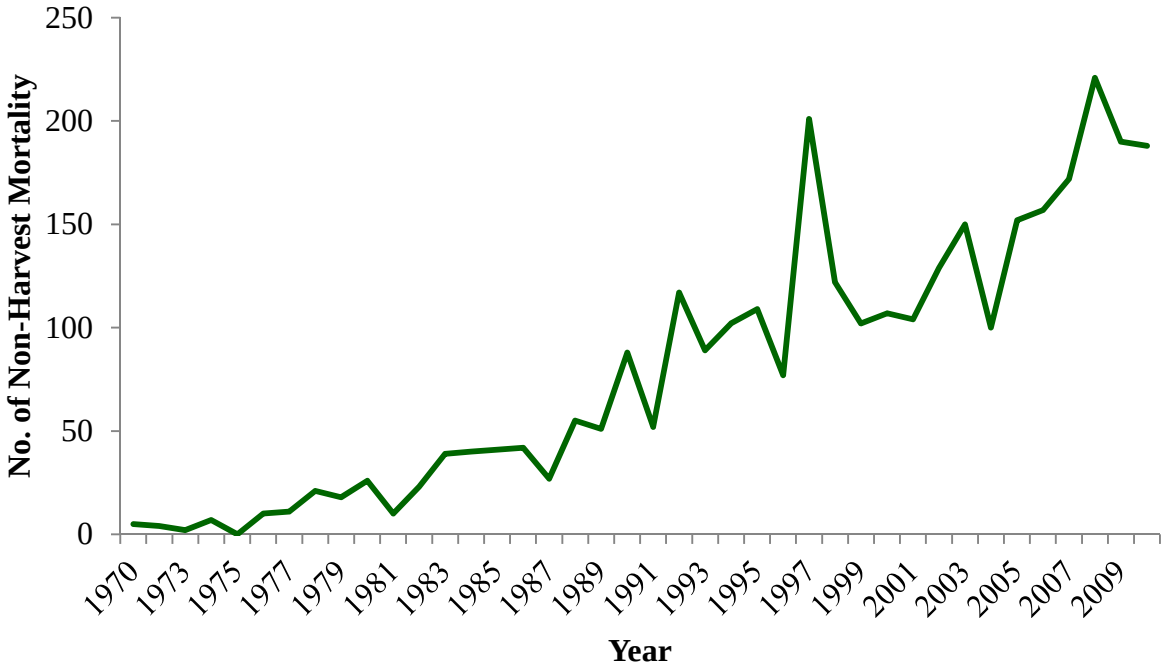


Figure 12. Number of non-harvest bear mortalities documented by NCWRC, 1970-2010.

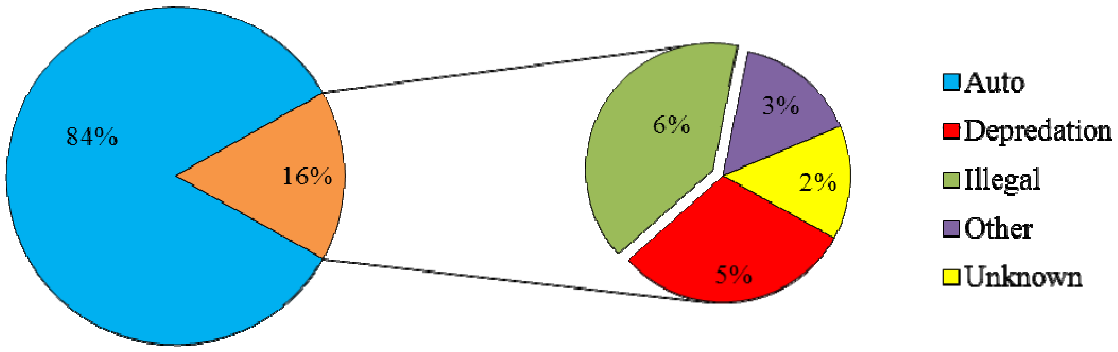


Figure 13. Cause of non-harvest mortalities in North Carolina, 1970-2010.

7) Bait Station Surveys: The NCWRC's mountain bait station survey is the only current survey technique to assess relative changes in bear numbers over time. The NCWRC began conducting bait station surveys in 1981 in the Harmon Den area of western North Carolina as part of a regional effort to establish an index for monitoring bear populations. Additional survey routes have been added since 1992, and as of 2009, almost 800 bait sites were used to

evaluate bear population trends in western North Carolina (Figure 14). Although useful as a tool to monitor changes in relative densities and complement our population reconstruction, this survey only provides an index (percent visitation to baits) to population trends. This trend information should not be evaluated alone, but compliments other data we collect. A coastal bait station survey was discontinued in 1999 because of a lack of statistical power to detect a change in the coastal population using available levels of manpower in the region.

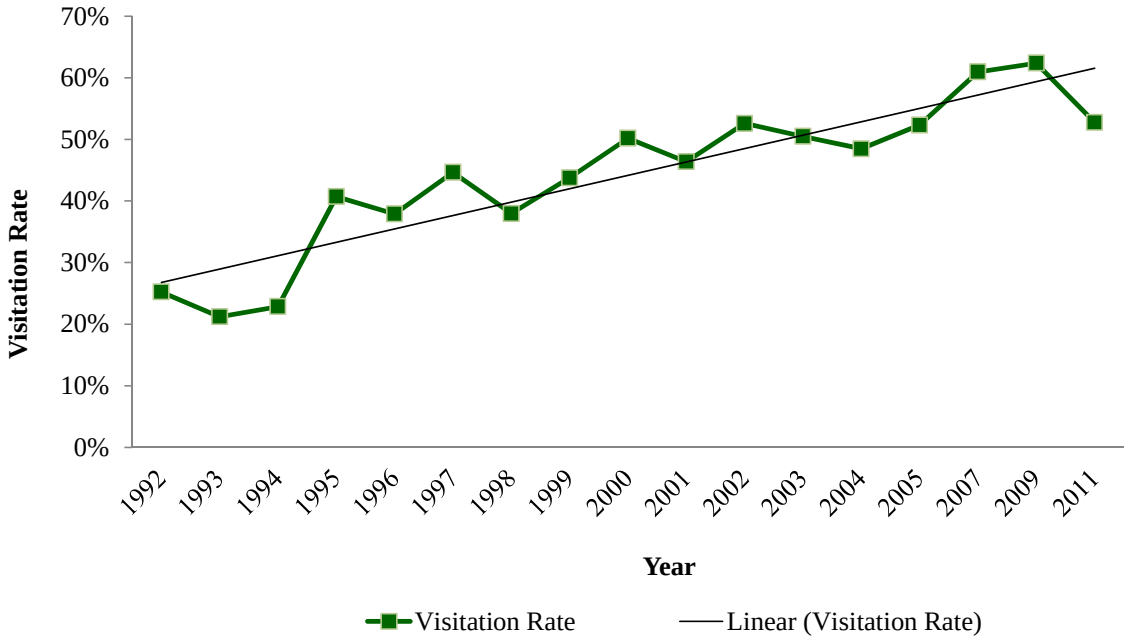


Figure 14. Black bear visitation rates to bait stations in the Mountain region of North Carolina, 1992-2011.

8) Mast surveys: Surveys of soft and hard mast began in 1982 to monitor long-term trends in food availability (Table 7 and 8). Current mast surveys are restricted to the Mountain region where mast has more of an impact on bear condition, productivity, hunter success, and bear-human conflicts.

   Our hard mast survey follows the technique originally described by Whitehead (1969) and modified by Wentworth (1992). Beginning with the 2006 survey, we are using a new protocol and formula for determining mast indices (Greenberg and Warburton 2007). The new protocol only requires simple calculation of percent crown with acorns in the field. In order to maintain consistency with the old technique, the new technique uses statistically verified equations to convert mast index values to numbers previously used with the Whitehead (1969) method. All state game and fish agencies in the southern Appalachian region along with the GSMNP currently utilize the same survey technique. Our historical data and management experiences indicate that in years of hard mast failures there is an increase in bear harvest coupled with a decline in bear condition and reproduction. Bear-human conflicts increase following a mast failure, and cub survival

declines. This situation may be altered and somewhat buffered by good quantities of soft mast (both summer and fall producing types).

These surveys continue to be an important measure of fall food production for bears and are useful when compared to reproductive data, hunter and vehicle mortality rates, denning behavior, and bear-human conflicts.

Table 7. Results of Mountain Summer Soft Mast Surveys, 1993-2011[1].

Year	Blueberry	Huckleberry	Blackberry	Pokeberry
1993	3.20	3.60	3.80	2.40
1994	3.20	3.50	3.50	1.40
1995	1.90	2.50	3.10	1.20
1996	2.00	2.00	3.40	1.50
1997	2.80	3.00	3.80	2.00
1998	1.90	1.20	3.30	2.33
1999	2.72	2.45	2.90	1.78
2000	2.70	2.72	2.99	1.64
2001	2.27	2.73	2.87	0.87
2002	1.87	2.22	3.55	1.32
2003	2.27	2.74	3.20	1.02
2004	1.67	1.61	4.25	1.41
2005	1.57	1.41	4.07	1.48
2007	2.11	1.23	2.48	1.84
2009	2.08	2.06	2.78	1.09
2011	1.69	1.53	3.28	1.37
Average	**2.24**	**2.27**	**3.31**	**1.53**

[1] After 2005, summer soft mast surveys are conducted every two years.

Numerical Rating = Crop Quality

0.0 to 2.0 = Poor	2.1 to 4.0 = Fair
4.1 to 6.0 = Good	6.1 to 8.0 = Excellent

Table 8. Hard Mast Survey Results for Western North Carolina, 1983-2011.

Year	White Oak	Red Oak	All Oaks	Hickory	Beech	Total
1983	1.43	2.59		1.99	5.51	2.25
1984	1.08	2.73		3.05	4.28	2.30
1985	2.01	3.66		0.80	3.06	2.80
1986	1.32	1.98		2.25	5.22	1.90
1987	1.16	0.56		3.57	5.75	1.31
1988	3.16	4.07		2.04	4.25	3.57
1989	0.43	4.89		2.78	6.44	3.14
1990	1.85	2.62		1.20	1.89	2.17
1991	2.38	1.93		3.75	6.89	2.43
1992	1.07	2.45		0.72	1.17	1.78
1993	0.65	3.58		2.43	4.77	2.48
1994	2.06	3.48		2.02	6.20	2.85
1995	2.80	5.60		2.48	0.36	4.22
1996	3.70	1.99		2.81	4.31	2.72
1997	0.53	1.79		1.17	2.35	1.29
1998	2.26	4.68		3.27	4.70	3.69
1999	3.28	2.76		2.80	6.22	3.05
2000	0.50	2.11		2.73	5.71	1.82
2001	2.83	4.92		2.88	3.97	3.98
2002	1.90	3.01		1.75	3.44	2.47
2003	1.24	0.68		3.58	5.42	1.33
2004	3.99	2.93		1.32	1.65	3.09
2005	0.70	3.11		1.86	4.30	2.14
2006	1.70	1.40	1.50*	3.20	4.10	1.80
2007	3.02	1.19	2.04	0.73	2.71	1.90
2008	1.01	2.40	1.76	3.82	4.34	2.06
2009	0.48	2.47	1.55	1.72	5.58	1.67
2010	3.46	3.97	3.75	3.50	0.87	3.66
2011	1.17	2.22	1.74	1.30	4.96	1.76
Average	**1.83**	**2.82**	**2.06**	**2.33**	**4.15**	**2.47**

Numerical Rating = Crop Quality	
0.0 to 2.0 = Poor	2.1 to 4.0 = Fair
4.1 to 6.0 = Good	6.1 to 8.0 = Excellent

* Not reported for prior years.

9) Other Population Surveys: Previous camera-resight studies that were conducted by the NCWRC in both the Mountains and Coastal Plain (Jones et al. 2001) demonstrated the potential for utilizing new techniques to estimate bear numbers. Current research that also is being supported by our agency involves examining the potential use of hair DNA with standard mark-recapture techniques to estimate bear numbers. This technique shows much promise for obtaining periodic estimates of bear densities and potentially may work in both regions of the state. Studies to evaluate the use of this method for monitoring bear population densities are being conducted on several sites in the Coastal Plain, viz. the Highway 64 study (UT/NCWRC, Kindall 2004, Thompson 2003), the Hyde County study (NCSU/NCWRC, Langer 2006), and the study on National Wildlife Refuges in northeastern NC (VT) and the Mountains (Settlage 2005).

10) Stakeholder Surveys: By understanding how our constituents view bears and bear management, we can more effectively manage North Carolina's bears. In order to improve this understanding, we conducted studies focusing on two groups of stakeholders in 2005. The first study assessed the views of bear hunters regarding season frameworks, bear quality and abundance, hunter densities, etc. The second study assessed the views of North Carolina residents regarding bears and bear management. We also gained insight into the bear population levels that are tolerated by various stakeholder groups as a measure of SCC. Currently, conducting more frequent surveys of bear hunters is difficult, because the NCWRC has no method for identifying bear hunters using the NCWRC license database.

I. Management Activities: The modern era of black bear management in North Carolina began in 1969. The NCWRC became the forerunner in bear research and management in the United States. Biologists John Collins, A.E. Ammons, Ted Mitchell, and Daniel Benfield were assigned to conduct a four year study of the status of black bears in North Carolina. A literature search was conducted to compile a list of articles and reports relating to bear research and management. Projects were initiated to study the biology of captive bears, inventory bear range in North Carolina, interview bear hunters, collect bear data (stomach samples, reproductive tracts, and canine teeth for aging), and monitor bear harvest in the state. Sample analyses were conducted in a cooperative effort with NCSU. These efforts initiated a long term program to monitor bear populations using scientific data, and this program continues today.

1) Role of hunting in bear management: North Carolina has a strong black bear hunting heritage dating back to colonial times. Early colonists relied on bears for food and hides to feed and clothe their families. Bear hunting was unregulated until the 1930's when hunters and conservationists pushed for bear hunting regulations and for the creation of a state wildlife agency to manage wildlife and enforce wildlife laws.

   Hunting has proven to be the only successful management tool for controlling bear populations. NCWRC biologists monitor the impacts of season lengths, harvest sex ratios, and reproductive rates to ensure the resource is properly managed through hunting. Aside from being the only population management tool, hunting also serves as a

traditional activity where groups of friends or families partake in the ritual and social aspects of the hunt.

a. **Hunting Methods**: Two types of hunting are utilized, still and dog hunting. The use of dogs to "strike" and "tree" bears has been a technique that goes back centuries. North Carolinians developed a strain of hound to hunt bears, known as the Plott Hound, which has been designated by the Legislature as the official state dog of North Carolina. Still hunting or stand hunting is also an important hunting method. This is a technique whereby hunters place stands on either trails, field edges, or in areas frequented by bears to feed.

   Recent bear hunter surveys indicate that dog hunting is still a very popular method to hunt bear (Palmer 2006) and more likely to be the main form of hunting in the mountain region. More mountain hunters (43%) than coastal hunters (21%) used only dogs to harvest bears. In contrast, coastal hunters (50%) were more likely to only still hunt bears than mountain hunters (31%). Twenty-six percent and 29% of mountain and coastal hunters, respectively, hunt bears using both methods. In 2009, the NCWRC started collecting data on method of harvest when licensed hunters registered their bears. Dog hunting is the main method of harvest in both the coast and mountain regions (Table 9). This data only reflects harvest method of successful hunters; it may not be representative of the hunting method used by all licensed hunters who attempted to harvest a bear or participate in hunting parties.

Table 9. Method of harvest by region, based on 2009[1] and 2010 registered harvest.

	Coastal Plain			Mountains			Piedmont	
Year	**Still**	**Dog**	**Unknown**	**Still**	**Dog**	**Unknown**	**Still**	**Dog**
2009[1]	39%	59%	1.7%	33%	66%	0.3%	100%	0%
2010[2]	36%	64%	0.1%	15%	84%	0.3%	0%	0%

[1]In 2009, the big game registration system started collecting information on method of hunting on all three registration methods (i.e. on-line, telephone, big game cooperator sheets).
[2] In 2010, method of harvest on the big game cooperator sheets was refined to improve data collection.

b. **Attitudes towards bear hunting**: The general public, when surveyed about bear hunting, indicated that a majority (63%) of respondents agreed that bear hunting, when properly managed, is compatible with viable bear populations, and 44% agreed that it is important for people to have opportunities to hunt bears in North Carolina. Respondents' support for regulated bear hunting increases (74%) if wildlife managers determined it was necessary. The survey indicated that 58% of the respondents agreed that they generally support NCWRC bear management. Seventy two percent of bear hunters agreed that they generally support how the NCWRC is managing bears.

   These survey results, along with economic benefits of bear hunting, North Carolina's strong hunting tradition, and the best available biological information, all point to the continued need for bear hunting as the primary means of managing populations in the state well into the foreseeable future.

2) Changes in Regulations and Statutes: Hunters were responsible for initiating regulations to protect and manage bears in North Carolina. The first statewide hunting season for bears was established in 1927, and ran from October 15 to January 1 with no bag limit. Since that time, several regulations and statutes have been enacted and/or modified, with several of these occurring in to better address bear management goals.

   a. **Licenses**: As of 2010, an annual Sportsman License, Lifetime Sportsman License, or Big Game Hunting Privilege License was required to legally hunt bear. Because these licenses allow the purchaser to harvest deer, bear and turkey, we are unable to identify our bear hunters on an annual basis.

      A non-resident bear/wild boar hunting license was established in 1995 for non-residents hunting bears and/or wild boar in North Carolina at a cost of $125.00 per year, in addition to other required non-resident hunting licenses.

   b. **Guides and Outfitters**: In order to serve for hire as a hunting guide, a Hunting and Fishing Guide License must be purchased. There are no restrictions or requirements to purchase a guide license.

   c. **Registration**: In 1974, the NCGA enacted legislation granted the WRC authority to require that bears harvested be registered. A hunter harvesting a bear is required by law to validate, register and report the kill through a wildlife cooperator agent (WCA), by telephone, or by the online reporting system (Figure 15). A regulation requiring the mandatory tagging of hunter-killed bears was passed in 1975.

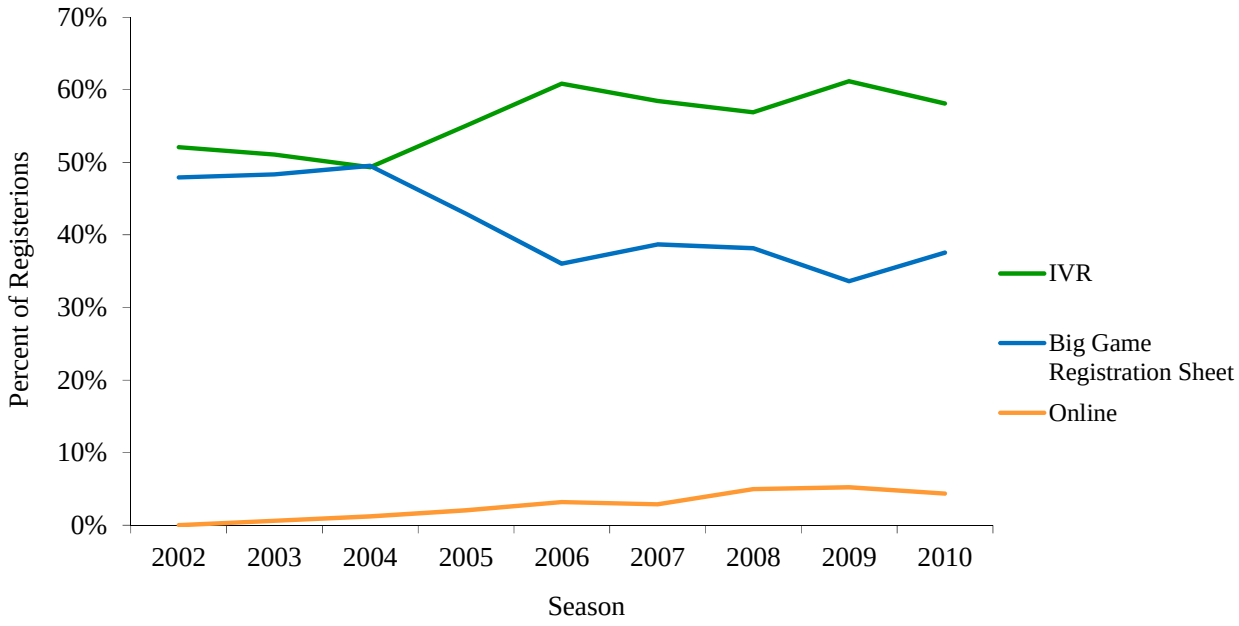


Figure 15. Percent of bears registered by reporting system in North Carolina, 2002-2010.

d. **Seasons**: The first statewide hunting season for bears was established in 1927, and ran from October 15 to January 1. In 1969, Gates County temporarily closed the portion of the county west of Highway 32 to bear hunting. During the 1970's, ten counties in eastern North Carolina closed their counties to bear hunting season by local legislation, due to concerns for the status of the bear population and due to conflicts between landowners and bear hunters. These counties were: Beaufort, Camden, Chowan, Currituck, Dare, Hyde, Pasquotank, Perquimans, Tyrrell, and Washington counties. In 1981, Camden County reopened their bear hunting season, followed by Hyde County in 1985. From 1987 through 1995, most of the remaining eastern counties had repealed the local legislation that had closed their county to bear hunting. In 2006, Perquimans County regained a bear hunting season through regulations promulgated by the WRC.

As of 2012, there are five bear hunting seasons in North Carolina, comprising seventy-two counties (Figure 16).

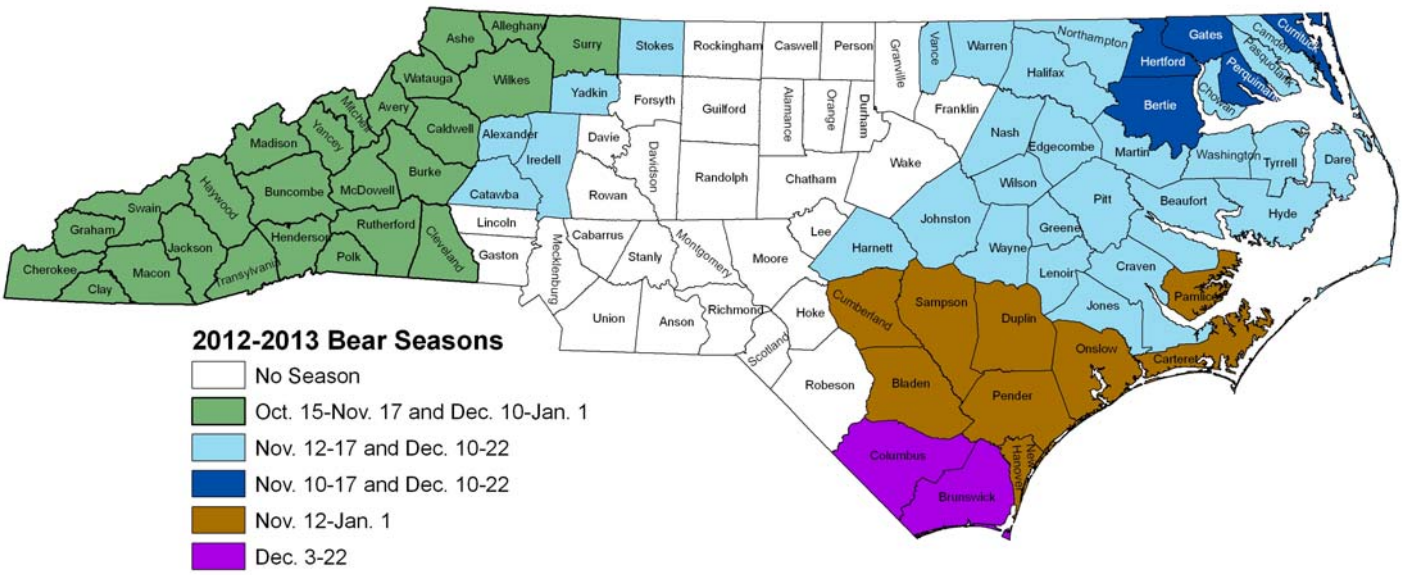


Figure 16. 2012-2013 bear hunting seasons in North Carolina.

e. **Bag limits**: Until the mid-1930's, there were no bag limits on bears (Table 10). Presently, the legal limit is one adult bear per hunter per year. In 1936, the first bag limit was set at two bears. After the NCWRC was established in 1947, the bag limit for bears was set at 1 per day, 2 in possession, and 2 per season for the 1948 hunting season. In 1971, the bag limit for bears was changed to 1 per day, 1 in possession, and 1 per season. The bag limits implemented in 1971 continue today and has the support of bear hunters. In a 2005 survey, 68% of bear hunters were satisfied with the current bag limits and 50% were opposed to any proposal to increase the season bag limit.

Table 10. History of black bear hunting season bag and possession limits in North Carolina, 1927 -2012.

Year	Daily Bag Limit	Possession Limit	Season Limit	Region
1927-1935	No Limit	No Limit	No Limit	Statewide
1936-1946	2		2	Statewide
1947	No Limit	No Limit	No Limit	Statewide
1948	2	2	2	Statewide
1949-1955	2	2	No Limit	Eastern NC
	1	2	2	In and west of Alleghany, Wilkes, Caldwell, Burke, Rutherford
1956-1966	2	2	No Limit	In and east of Surry, Yadkin, Alexander, Catawba, and Cleveland
	1	2	2	Western NC
1967 and 1968	1	2	2	Statewide
1969 and 1970	1	1	2	Statewide
1971-Present	1	1	1	Statewide

f. **Method of harvest**: Bear hunters can either use pursuit hounds or still hunt. It is illegal to harvest a bear using traps. The most popular hunting technique involves the use of dogs either treeing a bear or baying it on the ground in dense vegetation. As bears inhabit large areas of undeveloped land in relatively remote areas, sometimes with poor access and difficult terrain, bear hunting with dogs is normally a group effort. Still hunting is popular in many coastal counties where bears can be hunted adjacent to agricultural crops.

g. **Bear-dog Training Season**: It is legal to train bear dogs year-round. It is unlawful to train dogs or allow them to run unleashed between March 1 and the Monday on or nearest October 15 on bear sanctuaries in Alamance County south of I-85; Orange County south of I-85; Chatham County; Lee County; Wake County south of NC 98; and in and west of Rockingham, Guilford, Randolph and Montgomery Counties and that part of Anson County west of NC 742.

   While training or running bear-dogs, it is unlawful to possess firearms, axes, saws or tree-climbing equipment during the closed season.

h. **Protection of cubs**: Regulations in the 1940s made it unlawful to kill a female bear with a cub or cubs at its side. An additional regulation was passed in 1950 that made it illegal to kill a cub bear, and in 1952, it became illegal to kill a cub weighing less than 50 pounds.

i. **Wildlife Management Areas (WMAs)**: WMAs were established throughout the state and managed intensively for small game and big game species. Area managers assigned to the WMAs were responsible for managing habitat, enforcing wildlife regulations, and conducting strictly controlled hunts on the areas. Bear hunts consisted of separate dog hunts and still hunts, but harvest numbers on the controlled

hunts were low. Not much is known about bear harvest numbers outside of the management areas.

j. **Baiting**: During the 1986-87 hunting season, it became unlawful to take a bear with the use or aid of bait. However in 2007, the NCGA enacted new legislation that allows dogs to be released in the vicinity of any unprocessed food product.

k. **Possession of bear or bear parts**: It is illegal to possess a live black bear; unless the WRC has issued a captivity license to the institution or individual. To be issued a captivity license, the individual or institution must meet several requirements, such as minimum holding facilities and justification for possessing the bear.

It is illegal to trade in bear viscera or parts, including bear pelts. It is illegal for a person to possess any bear parts unless that owner legally harvested the bear or was granted a collector's permit from the WRC. However, residents may purchase bear parts and pelts from states where it is legal to sell such items.

2. Human-Bear Conflict Management: Each year, the NCWRC receives numerous requests from concerned citizens, local law enforcement authorities, and government agencies for assistance with human-bear conflicts. These problems include bears frequenting areas outside their normal range, destroying and raiding bird feeders, raiding garbage disposal areas, damaging bee hives and agricultural crops, being hit by vehicles, and other miscellaneous complaints.

The general policy of the NCWRC is not to trap bears unless human safety is threatened. Simply catching and relocating every bear that someone sees is not an option; we have few remote places left to relocate bears where they will not come into contact with humans. Resolving conflicts by moving bears perceived as a problem sends the wrong message about learning to live with bears. Additionally, the process of catching bears is difficult, and can be more dangerous for the bear, the public, and those involved.

Bears will not be trapped because they are perceived as a nuisance or as creating a problem. In many cases, people are the cause of the problem, and the best solution simply may involve a combination of public education and removal of attractants rather than trapping and destruction of the bear. This general policy addresses the goal of long-term maintenance of our bear population as well as issues of public safety.

a. **Guidelines for preventing and resolving conflicts**: WRC biological staff and Wildlife Enforcement Officers (WEOs) developed several guidelines for preventing and resolving bear conflicts.

1) "Guidelines for WRC Staff in Responding to Bear Conflicts with Humans"

These guidelines were developed for NCWRC personnel to address the challenges of managing bears and humans in an effective and professional manner (Appendix D).

Included in the document are guidelines for the following:

- Transient Bears
- Bears treed or within developed areas.
- Bears in public use areas, campgrounds and picnic areas
- Bear breaking into unoccupied dwelling
- Bear breaking into occupied dwelling
- Injured bears
- Bear makes contact with a person
- Capture and transport of a bear
- Depredating bears
- Bear carcass disposal
- Handling orphaned bear cubs and bears held illegally

2) "Guidelines for NCWRC Response to a Bear Attack Resulting in Serious Human Injury or Death"

Black bear attacks on humans are rare across the U.S. and in North Carolina. Black bears are rarely aggressive and most attacks result in minor injuries to people. However, numerous serious and fatal attacks have occurred in North America and two fatal attacks have occurred in Tennessee since 2000. While these serious and fatal attacks are the exception rather than the rule, it was imperative that NCWRC develop guidelines for responding and handling an attack should one occur in North Carolina (Appendix E).

3) "Guidelines for Local Law Enforcement for Responding to Bear Observations and Conflicts with People"

These guidelines were developed by WRC biological staff and WEOs to help law enforcement effectively address bear situations that may occur in their jurisdiction (Appendix F). Because local law enforcement are usually the first point of contact with the public and are often the first to arrive on the scene, this document will help address basic questions about bears in developed areas, as well as help establish guidelines for dealing with bears and improve their understanding of the legal aspects of taking bears.

b. **Education**: Due to a large influx of people to North Carolina, human-bear interactions will continue to rise. In a 2005 survey, 31%-44% of respondents expressed concern about potential conflicts with bears; the range in response was due to different types of conflict categories offered to respondents, such as public safety threats, bear/vehicle accidents, threats to pets, and property damage. Education will be the ultimate tool to acclimate both new and long-term residents to living in bear country.

Based on human-bear interaction reports received by WRC biological staff, a majority of these reports can be resolved through education and removing items that attract bears, such as garbage and bird feeders. Because education has proven effective and efficient at solving most bear complaints, the NCWRC has developed several educational tools to inform the public.

1) Preventing and Resolving Conflicts with Bears section on NCWRC internet site:

2) *The Bear Facts, The Story of a North Carolina Treasure* documentary: In 2004, Black Bear Project personnel completed a documentary, *The Bear Facts, The Story of a North Carolina Treasure* (Appendix H). This documentary features information on how people can coexist with bears and hunting's role in managing for conflicts.

3) *The Bear Facts, Interactive Educators Edition*: In 2007, the Black Bear program released *The Bear Facts, The Story of a North Carolina Treasure, Interactive Educators Edition* (Appendix H). The goal of this interactive DVD is to inform educators and students about black bear issues in North Carolina, to provide bear safety tips, to explain bear management, and to clear up myths about this natural treasure

4) *Black Bear Wildlife Profile*: The *Black Bear Wildlife Profile* (Appendix I) was updated in 2009 with more information on human-bear interactions and how to prevent them.

2. Habitat Management: Black bears are tied to forested areas and in the southeastern United States, forest distribution matches the distribution of bears very closely (with some exceptions). In many parts of the region, bears are dependent on oak trees with their energy-rich acorns and on a diversity of soft mast species. In other parts of the region, where Oaks are not the dominant species, other mast producing hardwoods are critical. Bears are opportunistic omnivores and find a variety of foods in both young and mature forests and in different forest types. Therefore, a diversity of forest types and ages is important for black bears.

   a) Habitat Management on Game Lands (GL): Habitat management on GL adheres to a three prong approach of protection, acquisition, and enhancement. Protection involves the protection of current lands that are critical to black bear populations and habitats. Habitats are primarily protected by incorporation into the GL and/or Bear Sanctuary Programs (BSP). Under the BSP program, activities can be managed to benefit bear populations. Regulations can control or limit hunting, set season restrictions, establish permit hunts, and implement restrictions on activities such as dog training.

   The second prong of management involves the acquisition of privately owned tracts that offer benefits to black bears. Through the purchase of large, unfragmented tracts

of oak-hickory forests, pocosins, Carolina Bays and oak/gum stands, important components required by bears can be placed into state ownership and protected for perpetuity. Once purchased, the tract, if appropriate, can be moved into the sanctuary program under NCWRC authority.

The third prong of management involves habitat enhancement of NCWRC tracts. Several practices are utilized to improve areas and habitat for bears. Direct habitat improvements include the use of prescribe fire, management of soft mast species, timber stand improvements, food plot plantings, and access control.

i. **Prescribed Fire**: Burning on game lands is generally conducted on a 2-3 year rotation. Within this time frame, most upland sites will be scheduled to be prescribed burned either using a dormant or growing-season fire. Large pocosin areas are not burned due to liability issues that arise from smoke and fire control. However, during wildfire events, every opportunity will be used to allow these areas to burn without endangering private property or life.

ii. **Soft Mast Management**: Management of soft mast species along road-sides, trails, and openings is employed to produce species that provide summer and fall foods for bears. Particularly, blackberries are encouraged to spread along road-sides, and these species are fertilized and omitted from mowing. Other species such as grapes (*Vitis rotundifolia),* pokeberry (*Phytolacca americana),* devils walking stick, elderberry, (*Sambucus canadensis)* gallberry, and wild cherry (*Prunus serotina)* are all excellent bear foods and are encouraged to grow and produce fruits.

iii. **Food Plots**: On selected game lands, numerous wildlife openings are planted in annuals and perennials that benefit many species of wildlife. Many of these plantings focus on providing improved brood conditions for turkeys and bobwhite quail and to attract deer for hunters. However, many of these plantings are utilized by bears at different times of the year. Clover stands for example, an important source of protein, are utilized by bears in the spring following den emergence.

iv. **Access**: Access control is another technique used in managing bears. With uncontrolled access, local bear populations can be harvested to low levels in a short period. The use of gates and access control to prevent over-harvest is an extremely beneficial tool in managing harvest levels.

A major goal of GL bear management is to provide access to allow hunters the opportunity to enjoy their sport without hurting the resource. Most (64%) bear hunters spent 0-20% of their time bear hunting on Game Lands during the past three years. Mountain hunters (40%) were significantly more likely and Coastal Plain hunters (6%) significantly less likely to have bear hunted over 80% of the time on Game Lands. In 2008, 48% of mountain hunters harvested their bear on a Game Land, whereas only 6% of coastal hunters did the same (Figure 17). This difference is likely due to the greater amount of large tracts of public lands available in the mountain region in comparison to the coast.

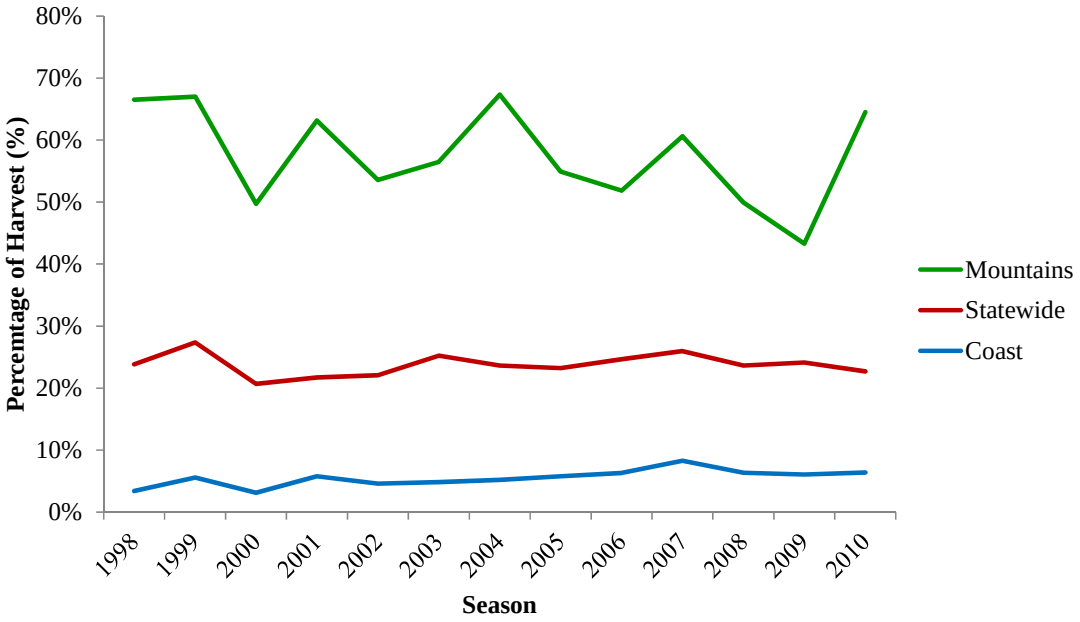


Figure 17. Percentage of bears harvested on Game Lands in North Carolina, 1998-2010.

b) Habitat Management on National Forests: The NCWRC, in conjunction with the SABBSG, developed a document titled *Forest Management Prescriptions For Black Bears in the Southeastern United States* (Appendix J). These guidelines promote the use of sound silvicultural practices to foster oak forests while promoting sufficient soft mast production and will be used to guide timber prescriptions and evaluations of timber management activities on U.S. Forest Service lands in western North Carolina. These guidelines were sanctioned by the Southeastern Association of Fish and Wildlife Agencies Directors in 2005.

c) Habitat Management in coastal North Carolina: In coastal North Carolina, bear habitat consists of agricultural cropland, loblolly pine plantations, bottomlands, mixed hardwoods, upland hardwoods, and pocosins. The majority of occupied bear habitat in this region as well as the rest of the Atlantic Coastal Plain is concentrated on private lands (Wooding et al. 1994). With this ownership pattern, management objectives should be directed in working with corporate and private interest groups to benefit bears.

Based upon research conducted by Jones and Pelton (2003), the management of intensive pine plantations will have a significant impact on North Carolina's coastal bears. Intensively managed pine plantations lack the cover and foods preferred by bears (Jones and Pelton 2003). However, clear cuts helped to compensate for lack of thick cover and soft mast (Jones and Pelton 2003). The interspersion of clear cuts across the loblolly pine plantation landscape will provide critical habitat preferred by bears and is recommended. Clear cuts should be dispersed and <200 acres in size. In addition to clear cuts, timber management that promotes open canopies that allow light penetration to promote soft mast production and cover should be employed.

Conversion of wetland forest types and pocosin has degraded the quality of habitat available for bears. Efforts should be made to restore pocosin and wetland forest types when practical (Jones et al. 1998, Jones and Pelton 2003). During this process, species selection should be considered that mimics the natural ecosystem to benefit bears. In addition, the use of broad spectrum herbicides to reduce competition in pine plantations may eliminate the soft mast plants that bears depend on from spring through early fall.

Where possible, attempts should be made at the planning level to keep large blocks of habitat within the landscape free of human development (Jones et al. 1998). With increased development and improved road access, large corporate ownerships should consider limiting human activities to certain areas or zones and allowing other areas to remain free of human activities.

d) Corridors: Black bears move extensive distances during certain times of the year. It is important for movement to occur between the various subpopulations of bears across the state to help maintain bear numbers and genetic connectivity and allow bears to repopulate suitable but unoccupied range. As such, corridors for movement are important. Within the mountains and coastal plain of North Carolina, significant growth has and is continuing in areas once inhabited by black bears. Development, especially along major highways and interstates, results in habitat degradation to large unaltered landscapes. Development activities such as residential subdivisions, road construction, and retail development have and will continue to displace black bears and place bears in closer contact with humans.

   NCWRC efforts should continue to identify key movement corridors and to work either through acquisition, easements, or agreements to conserve these areas. It should be noted that bears do have the ability to move across fairly "hostile" and open areas. As such, efforts to reduce bear-human conflict may be important in allowing bears to cross through residential areas and other areas of human occupation.

e) Highway Development: Highways can impact wildlife in 5 basic ways: (1) habitat fragmentation, (2) associated human development, (3) direct mortality, (4) direct habitat loss, and (5) displacement and avoidance (Ruediger 1998). Furthermore, animals such as black bears and white-tailed deer (*Odocoileus virginianus*) can have an economic impact due to vehicle collisions and be a direct threat to human safety.

   i. **U. S. Highway 64 Research**: The NCWRC Black Bear Program has taken a lead role in addressing these issues. In 1999, the BBP studied movement patterns of black bears, white-tailed deer, red wolves (*Canis rufus*), and coyotes (C. *latrans*) along the proposed route for U.S. Highway 64 (US64) in Washington County. The results of this study (Schieck and Jones 1999) became the basis for locating three wildlife underpasses along a section of new highway constructed in Washington County spanning approximately 19.3 km (12 miles).

In 2000, as part of the long-term research on US64, researchers from the University of Tennessee began work under contract with NCWRC to monitor the effects of the new highway and measure the potential benefits of the wildlife underpasses (van Manen et al. 2001). The study design involved the monitoring of radio-collared black bears as well as the use of DNA technology to measure bear population characteristics and includes a control area where no road construction is scheduled to occur to allow for statistical comparison to the proposed highway study area. Work has also included pre-construction and post-construction research. All pre-construction bear research was conducted from 2000-2002 and summarized by Thompson (2003) and Kindall (2004). Research into the post-construction issues along US64 was conducted from 2006-2007 and summarized in final reports in 2009.

Overall, the studies concluded that the wildlife underpasses and fencing along sections of the highway were effective in facilitating genetic and demographic connectivity and reducing animal-vehicle collisions (primarily deer; McCollister 2008, Nicholson 2009). However, there were changes in bear habitat use and activity patterns as a result of the new highway. Bears were closer to the road and more active in the morning when highway traffic was low. Another conclusion of the study was that the bear population declined in the area where the new highway was built, likely due to displacement during highway construction and bear-vehicle mortality occurring on the new highway. The researchers cautioned that the impacts of new highways on bear population abundance should be an important consideration for transportation infrastructure planning.

f) Acquisitions and Easements: Within North Carolina, federal (U.S. Forest Service - USFS, U.S. Fish and Wildlife Service - USFWS, Department of Defense – DOD), state (NCWRC, North Carolina State Parks - NCSP, North Carolina Forest Service - NCFS) and private (Coastal Land Trust - CLT, The Nature Conservancy - TNC, North Carolina Forestry Foundation – NCFF, Weyerhaeuser) ownerships of large contiguous tracts of land provide important and stable habitat for black bears.

In addition to present ownerships, the NCWRC land acquisition program, funded by state, private and federal sources has helped to obtain large tracts that are important to black bears. Supporting acquisition efforts, groups such as the Onslow Bight and Cape Fear Arch play a vital role in forming cooperative collaborations to identify and assist in protecting bear habitat.

i. **Current ownership**: The NCWRC owns 196,766 acres within the coastal portion of North Carolina and 80,000 acres in the mountains that can be considered important to black bears. In addition, U.S. Forest Service lands contribute over 1.1 million acres of important bear habitat primarily in the mountains. Nearly all game lands located within the coastal and mountain regions are located within black bear range.

Large GL such as the Pisgah, Nantahala, and Croatan National Forests plus smaller areas like Suggs Mill Pond, Columbus County, Holly Shelter, Angola Bay, Goose

Creek, Van Swamp, Gull Rock, Bachelor Bay, North River, Roanoke River, and Chowan Swamp provide crucial habitat needs and function as core areas, corridors, or sanctuaries.

ii. **Coastal Plains**: In 2004, Coastal biologists met to identify important wildlife corridors and potential acquisition boundaries to guide future acquisition projects (Figure 18). During this process 9.1 million acres were identified with a major emphasis placed on creating corridors that would create bridges to large areas of protected habitat. With black bears in mind as an "umbrella species" to provide habitats for diverse wildlife species, the "bridge" concept would provide linkages for many species to use to travel between core habitat areas.

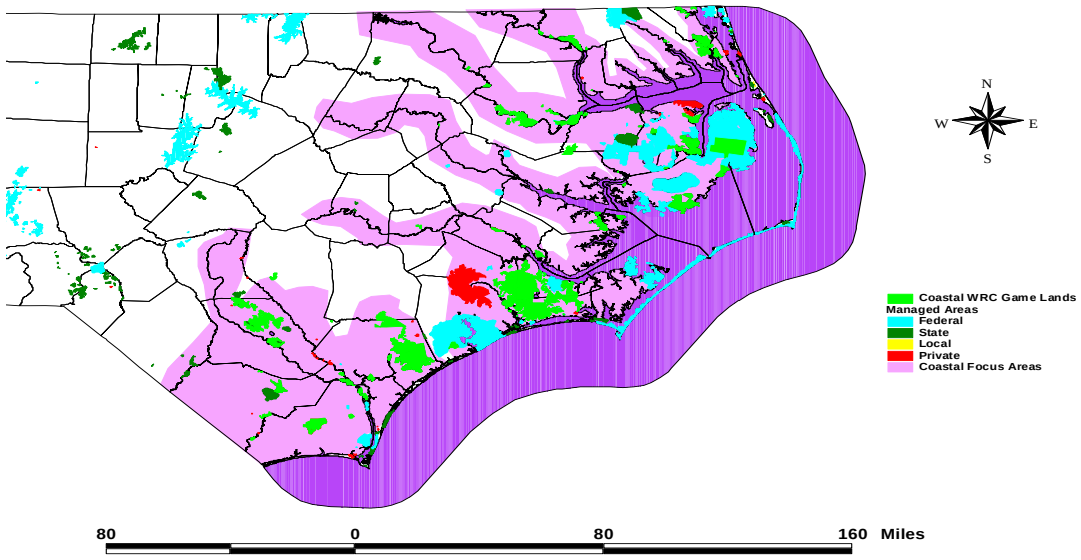


Figure 18. Coastal Region Black Bear Focus Areas.

Future acquisition efforts continue to fall within the broad boundaries of this focus area. Continued funding will play a critical role in the NCWRC's ability to acquire key areas for black bears and other species. Priority acquisitions should be focused on areas where bear populations are well established and expansion of core habitat is possible.

Using this as a guideline, emphasis should be placed on acquiring lands near Suggs Mill Pond Game Land, Colly Swamp, Green Swamp Bear Sanctuary, Holly Shelter/Angola Bay Game Lands Complex, Neuse/Pamlico peninsula, linking Hoffman Forest to Croatan National Forest, Albemarle/Pamlico peninsula, and the North River Game Land.

iii. **Mountains**: In the mountains, efforts have focused on acquisitions along the escarpment between the Blue Ridge Mountains and the Piedmont. Key areas for acquisition include: 1) the areas surrounding Thurmond Chatham south to the

USFS lands and North to the VA line, 2) providing connections between South Mountain Game Land and Green River Game Land, and 3) providing corridors from USFS lands in Burke and Caldwell to the areas near Lake Rhodhiss. All of these efforts will promote bear habitat and corridors for bear movements.

J. Education: In 2006, a series of meetings were held with focus groups to test a draft of a survey instrument. The mail survey was conducted to obtain information on a wide range of subjects dealing with the SCC concerning bears in the general public's view. One question surveyed the respondents' knowledge of black bears. While nearly 100% of the respondents were aware that there were black bears in North Carolina, the lack of knowledge about bears was rather high with 65% having very little or some knowledge of black bears. Eight-five percent of respondents indicated that having black bears in North Carolina was important. This means that bear conservation efforts in North Carolina are likely to be supported by most North Carolinians.

Since the 1970's, NCWRC staff have produced numerous publications on black bears in North Carolina. These publications range from pamphlets, a booklet, hand-outs, news articles, Wildlife in North Carolina articles, and, within the last 10 years, information on the NCWRC website. The following are examples of educational efforts made by NCWRC staff within the past ten years.

1) Black Bears of North Carolina section on NCWRC website: In 2009, the NCWRC website was reformatted, which allowed for greater content and easier navigation. With this change, the Black Bear Project Leader was able to edit the bear section on the website in order to add addition information on black bear populations, human-bear interactions and the black bear program activities and reports.

   The following main topics can be found in the bear section:

   a. The Bear Facts: Black Bear Wildlife Profile
   b. Preventing and Resolving Conflicts
   c. North Carolina's Black Bear Population and Occupied Range Expansion
   d. Monitoring and Estimating Black Bear Populations
   e. North Carolina's Black Bear Hunting Heritage
   f. Monitoring Quality Bears
   g. NCWRC's Bear Management
   h. Bear Reports and Surveys
   i. Documentary: The Bear Facts: The Story of a North Carolina Treasure

2) *Management and Harvest of Black Bears in North Carolina* brochure: Since 2001, the Black Bear Project Leader has created an annual brochure that provides information on bear population estimates and harvest statistics. Since that time, additional information has been provided in the brochure, such as North Carolina's hunting heritage, bear facts, and on-going research projects.

Until 2009, the brochure was distributed only to bear hunters that NCWRC biological staff encountered during the bear harvest seasons. In 2009, it was recognized that the brochure would be educational to a wider audience, especially the non-hunting public. Starting in 2009, the brochure was distributed to the NCWRC's three Wildlife Education Centers and is available under the "Reports and Surveys" section of the bear section website.

3) *Black Bear Wildlife Profile*: The *Black Bear Wildlife Profile* (Appendix H) was initially created in the early 1990's, along with several other species-specific profiles. The profile's intent was to provide a brief review of the following main topics: Population Status, Habitat and Habits, Range and Distribution, and People Interactions. In 2008, the NCWRC's Conservation Education section, working in cooperation with the Black Bear Project Leader, updated the profile in order to address the expanded occupied range of the bear and increases in human-bear interactions.

4) *The Bear Facts, The Story of a North Carolina Treasure* documentary (Appendix I): Black Bear Project personnel completed a documentary, *The Bear Facts, The Story of a North Carolina Treasure*, in 2004. This documentary features segments on bear history and biology, NCWRC research and monitoring, information on how people can coexist with bears, North Carolina's hunting traditions, and the future of bears in our state. It has aired on numerous television stations in cities including Asheville, Raleigh, and Wilmington as well as on UNCTV's system of 19 statewide affiliates.

5) *The Bear Facts, The Story of a North Carolina Treasure, Interactive Educators Edition* (Appendix I): In 2007, the Black Bear program released *The Bear Facts, The Story of a North Carolina Treasure, Interactive Educators Edition*. This product, based on the made-for-TV documentary, offers the original documentary plus eight additional interactive functions for students to enjoy. The DVD is accompanied by a CD containing lesson plans, bear-related activities, maps, and a wealth of educational materials suitable for grades K-12.

   Educators across the Tar Heel state can request the new and unique learning tool for children at no cost from NCWRC. In addition to public and private school teachers, the package is available to church groups, wildlife clubs, Boy and Girl Scout troops, museums and state parks, and other educational groups. The free resource can be easily applied to subjects like geography, history and math, in addition to the sciences. The offering is available through a funding grant provided by the Wildlife Resources Commission and a private foundation. The product was screened and approved by a panel of 80 educators from across the state. More than 1,500 teachers have already received the free learning tool. Educators can request this information from NCWRC's website at www.ncwildlife.org. This program should be expanded, and NCWRC should make this and similar educational initiatives a high priority involving support from the Division of Conservation Education.

6) Black Bear Powerpoint Presentation: The BBPL has developed a powerpoint presentation that is available to all NCWRC biological staff. The presentation covers various aspects

of the BBP, such as management, monitoring and research activities, harvest statistics, bear population estimates and bear life history.

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