

BLACK BEAR MANAGEMENT PLAN

State of New Jersey

Department of Environmental Protection

Division of Fish, Game and Wildlife

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Black Bear Management Plan

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HISTORY OF BLACK BEAR IN NEW JERSEY

The black bear (*Ursus americanus*) was once abundant in every county of New Jersey. That the bear was common is proved by the presence of their bones in the kitchen middens and shell heaps of the Indians and by accounts of early travelers and settlers (Regensburg, 1978). Peter Kalm, a Swedish naturalist writing of New Jersey in 1748 wrote, "Bears are very numerous higher up in the country and do much mischief" (qtd. in Abbott, 1894). Other writers reported that the bear roamed the "pine woods" of south Jersey with its co-inhabitants the panther, timber wolf and bobcat (Thomas, 1977, Harshberger, 1916). It "was said to be so common, that he [the bear] would sometimes be seen sharing a blueberry patch with a lone human berry picker" (Thomas, 1977).

Indians and early settlers valued the bear for its flavorful meat, and its white fat which provided a sweet oil for frying as well as a base for medicinals. The pelts were used for trade and clothing. As settlers entered New Jersey, extensive burning and land clearing took place eliminating wildlife habitat. Black bear were soon pushed into less productive and inaccessible areas. Some bears learned quickly that settlements provided rich stores of food in the form of livestock, gardens and storehouses. Bears were often perceived as or represented a threat to the settlers very existence and were killed indiscriminately throughout the 1800's and early 1900's (McConnell, 1987).

Burning, clearing, grazing, crops and the charcoal industry soon changed the character of New Jersey forests. At the time of original settlement, 80 percent of New Jersey was forested. By the decade of 1850-1860, most forest stands had been cut over; in some areas stands had been cut over three times (Pierson, 1977). Coupled with unregulated hunting, black bear numbers dwindled rapidly. The geologist Abbott wrote in 1868 of black bear, "fast disappearing from the state, now never met in the

central counties, in inappreciable numbers in the northern mountainous districts and not more than a half dozen are annually killed in the southern section of the state" (qtd. in Nelson, 1890).

By 1885 black bear still lingered within New Jersey's boundaries but had been driven into remote mountains and swamps by the continual clearing of land and unrestricted killing. The wolf, elk and beaver had all been exterminated in the 50 years prior to 1885. Bears apparently were eliminated from the central counties first (Abbott, 1894).

Ray reported that "in the winter of 1870, a bear was chased across country from Bear Swamp, Mercer County through Rocky Hill (Somerset County) to Washington Crossing where it crossed the Delaware River on the ice and was lost in Bucks County, Pennsylvania" (qtd. in Rhoads, 1903). This is the last documentation of bears in this area.

Bear survived in the southern New Jersey counties through the 1800s. Beesley wrote in 1857 that bears were quite plentiful in Cape May at certain periods, particularly in the dense cedar swamps in the northern part of the county. Beesley mentioned that five bears had been killed that autumn. Another writer wrote of a bear being killed in Cape May's Long Bridge Swamp in 1878 (qtd . in Rhoads, 1903). A naturalist wrote of encountering a black bear in 1892 near the Egg Harbor River in Atlantic County (Treat, 1892). Pharo in 1893 and Price in 1900 mentioned bears in Shamong, New Lisbon and Manahawkin Swamp (Rhoads, 1903).

Apparently a few bears were able to linger as late as the early 1900's in the southern counties. In 1902, a bear carried off four pigs into the Blackwater Swamp near Newfield in Cumberland County (Rhoads, 1903). In 1907, tracks of a sow and cub were

observed along a swamp road seven miles from West Creek in Stafford Forge, Ocean County (Stone, 1907). This was the last recorded sighting in the southern counties until recent times. Of northern New Jersey, Davison wrote to Rhoads about a bear in Warren County near Delaware Water Gap in 1893. Bears were killed in Port Jervis, N.Y. in 1896-97 and it was assumed that some wandered into northwestern Sussex County on occasion. No bears were reported to Rhoads from localities that he visited in Sussex and Passaic counties in 1896. Bears were occasionally observed crossing the Delaware into Warren and Sussex counties. Pennsylvania bears had fared better than New Jersey's. It was noted that in some counties in Pennsylvania "bears were almost as numerous as ever known to have been" (Rhoads, 1903). Very little information is available on New Jersey's black bear from 1903 to the 1950's.

In 1953 the black bear was given game animal status under Division of Fish and Game regulations. As a game animal, black bear could be taken by licensed archers and firearm hunters. Season length was variable, some years it was one week, other years it was one week in December and a month in Oct./Nov. Between 1958 and 1970*, 46 bears were taken; three by archers, and 43 by firearm hunters (Lund, 1980) (Table 1). Little information is available on the sex, age and county distribution of the harvests that occurred between 1958 and 1970. Information gleaned from a variety of sources indicates that most of the harvest occurred in Sussex County; a few were taken in Warren County and one in Morris County.

Black bear hunting has been prohibited statewide since 1971. The black bear still retains its status as a "game animal".

* Season closed in 1959, 1960 and 1961

Table 1.

Framework of New Jersey Black Bear Hunting Seasons and Harvest 1958-1970

Year	Dates	Bag Limit	Hrs.	Harvest
1958	12/8/58-12/13/58 firearm/long bow	1	7am - 5pm	18
1959	season closed			
1960	season closed			
1961	season closed			
1962	12/10/62 -12/15/62 firearm/long bow	1	7am - 5pm	8
1963	long bow firearm			1 3
1964	10/3/64-11/5/64 long bow	1/year	1/2 hr before sunrise to 1/2 hr after sunset	0
	12/7/64-12/12/64 firearm/long bow			2
1965	long bow firearm			1 4
1966	10/1/66-11/3/66 long bow	1/year		1
	12/5/66-12/10/66 firearm/long bow	"	7am - 5pm	2
1967	10/2/67-11/9/67 long bow	"	1/2 hr before sunrise to 1/2 hr after sunset	0
	12/4/67-12/9/67 firearm/long bow	"	7am - 5pm	0
1968	10/5/68-11/7/68 long bow	"	1/2 hr before sunrise to 1/2 hr after sunset	0

Table 1. (continued).

Framework of New Jersey Black Bear Hunting Seasons and Harvest 1958-1970

Year	Dates	Bag Limit	Hrs.	Harvest
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	12/9/68-12/14/68 firearm/long bow	"	7am - 5pm	1
1969	10/4/69-11/6/69 long bow	"	1/2 hr before sunrise to 1/2 hr after sunset	0
	12/8/69-12/13/69 firearm/long bow	"	7am - 5pm	1
1970	10/3/70-11/5/70 long bow	"	1/2 hr before sunrise to 1/2 hr after sunset	0
	12/7/70-12/12/70 firearm/long bow	"	7am - 5pm	4
<hr/>				
Total bears taken in bow seasons		=	3	
Total bears taken in firearm seasons		=	<u>43</u>	
Total			46	

CURRENT STATUS

Sightings

Black bear are sighted in all of New Jersey's northern counties except Hudson. Unconfirmed sightings of black bear have been reported as far south as Cape May (Figures 1 and 2). The majority of New Jersey's black bear population, however, resides in the four northern counties of Sussex, Morris, Passaic and Warren. Although bears do stray outside this region (primarily subadult males), there are probably few resident bears in other portions of the state, such as the more urbanized central and eastern

counties or in south Jersey. The area of suitable habitat for black bear in the four counties of Sussex, Passaic, Morris and Warren was estimated through the Geographic Information System (GIS). The estimate for available habitat included forested and wetland areas. In the four counties there was 942.8mi² (2441.95km²) of potential habitat for black bear.

Black bear numbers are highest in two regions (Kittatinny, Bearfort) within the four counties. The Kittatinny region consists of western Sussex and northern Warren counties. This region is part of the Appalachian Ridge and Valley geographic province and contains 335.3mi² (868.4km²) of forest and wetlands. The Bearfort region is part of the Highlands geographic province and contains 346.6mi² (897.8km²) of forest and wetlands.

Figure 1.

Number of Black Bear Sightings Reported to New Jersey Division of Fish, Game and Wildlife - Fiscal Years 1976 - 1997

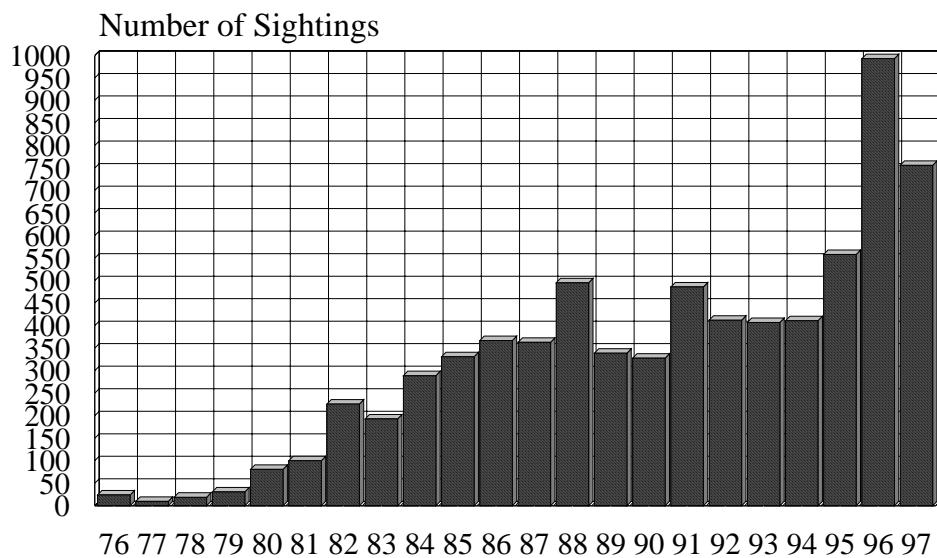
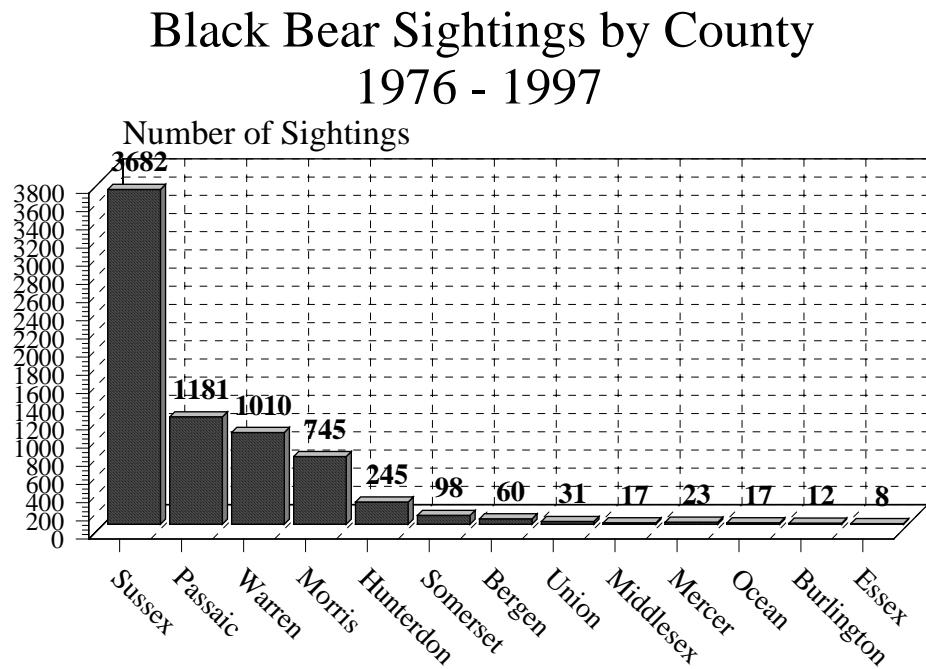


Figure 2.



Cape May, Gloucester, 1 sighting each; Monmouth, 4 sightings; Atlantic, 6 sightings

New Jersey shares a population of black bear with New York and Pennsylvania.

Numbers of black bear in New Jersey can fluctuate through the calendar year due to egress and ingress. Mobility of bears is increased during the breeding season and during years of natural food shortages. Radio-telemetry studies indicate that there is little movement of New Jersey's adult female black bear between New Jersey and Pennsylvania. The Delaware River appears to be a barrier, except in times of drought, to female black bear. Males apparently move back and forth quite freely (McConnell and Garris, 1991). No substantial topographic barrier exists between the New Jersey Bearfort region population and bear habitat in Rockland and Orange Counties, New York. Ingress and egress is more common for both sexes in that area.

New Jersey is one of 42 states that has a black bear population and one of 15 states* that has an estimated population of less than 550 bears**. Only one (South Carolina) of the 15 states with populations estimated at less than 550 bears allow hunting of black bear (Florida, whose estimated population is 1000-1500, does not allow hunting). Most of the 15 states, however, have populations of 200 or less bears (McCracken et al., 1995). New Jersey, Maryland, Nevada and Florida have the largest non-hunted populations of black bear. Maryland's citizens task force recently submitted a permit season recommendation for public comment (Bittner, pers. comm.).

RECENT RESEARCH EFFORTS

Trapping/Tagging

The notable increase in bear sightings and activity that occurred between 1978 and 1981 demonstrated to the Division of Fish, Game and Wildlife that scientific information would be necessary to decide on the future management of black bear in New Jersey.

In November of 1980 a trapping and tagging program was initiated in the western townships of Sussex County. The effort was extended to northern Warren, northeastern Sussex and western Passaic in 1982. A total of 257 (173M:84F) black bear were captured on the research trap lines between November 1980 and June 30, 1997. In the same time frame, 148 recaptures were made on 100 (68M:32F) of the 257 bears. Of the 257 individual black bear, 162 (115M:47F) were captured in the Kittatinny region; 96 (59M:37F) were captured in the Bearfort region. The majority of bears were young. Of the 233 bears captured and aged by June 30, 1996; 145 (62.2%) were less than 3 years old when initially captured on the trap line (Figure 3)*.

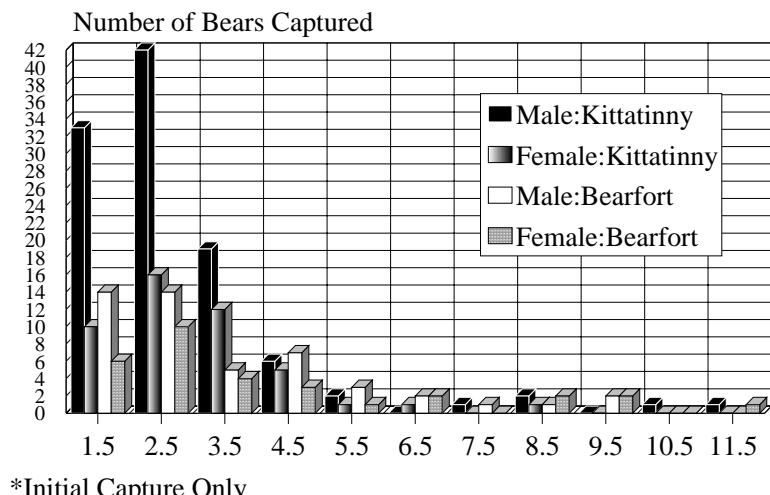
The trapping effort needed to capture a new untagged bear is much greater in the Kittatinny region in recent years than in the Bearfort region: 10.4 trap nights** were expended to catch each new untagged bear in the Bearfort region in 1991. In 1993, 9.85 trap nights were expended in the Bearfort region to catch each new untagged bear. In 1995, 20.3 trap nights were expended to catch each new untagged bear in a 33,000 acre section of the Kittatinny region in spite of a three year hiatus on trapping in the area (McConnell et al., 1996).

* Alabama(40), Connecticut(30), Kentucky(>100), Louisiana(100), Maryland(170), Mississippi(25), Missouri(50-150), Nevada(200-400), New Jersey (350-400), North Dakota (300), Ohio(20), Oklahoma (200), Rhode Island(0-2), South Carolina (300), and Texas (50).

** Based on population estimates provided to Traffic USA survey in 1992.

Figure 3.

Age Distribution of Black Bear Captured* on Research Traplines 1981-1996 By Sex and Region



*Initial Capture Only

*Ages for bears captured in 1997 not available as yet.

**Number of traps set multiplied by the number of nights.

Population Estimates:

Population estimates were calculated in two New Jersey black bear study areas within the Kittatinny and Bearfort regions. Two methods of population estimation were applied to the tag-recapture data gathered from 1982 to 1996; the Jolly-Seber (Caughley, 1977) and the zero-truncated poisson (Caughley, 1977, Yodzis and Kolenosky, 1986). Only female bears were used in these analyses; male bears violate assumptions of mark-recapture models due to their tendency to wander over large areas. In addition, females determine the dynamics of the bear population. The sex-ratio (male/female) of cubs captured in dens, and sex-ratios of adult bears captured on the trap-line were considered to obtain estimates of numbers of male bears in the two regions.

For newborn cubs captured in the den, the sex ratio (male:female) was 0.95:1 in the Kittatinny region and 1.04:1 in the Bearfort region. For trapped bears, the ratio was 3.29:1 for the Kittatinny region and 1.57:1 for the Bearfort region. Adult estimates are biased because male and females differ in catchability. Estimates of adult sex ratio fall within the range of sex ratios measured in other eastern black bear populations (1.42:1 - Carlock et al., 1983). Based on the newborn sex ratio, densities for male and female black bear were calculated in the two regions.

Population and density estimates obtained from the study area were then applied to the entire Kittatinny and Bearfort regions as based on forested and wetland habitat available within the two regions. (Table 2).

Table 2. Density of Black Bear and available habitat in the Kittatinny and Bearfort Regions

	<u>Kittatinny Population</u>	<u>Bearfort Population</u>
Estimated range of density	1 bear/1.75 - 2.1mi ² (1bear/3.1km ² - 5.5km ²)	1 bear/.97mi ² - 1.2mi ² (1bear/2.5km ² - 4.5km ²)
Forested and wetland habitat	335.3mi ² (868.4km ²)	346.3mi ² (897.8km ²)

Average density of bears across the area (Bearfort and Kittatinny regions) is one bear per 1.2 - 1.5mi² (3.2- 3.9km²) of habitat. The population estimate for the two regions is 450-550 black bear.

Densities in the Kittatinneys were lower than those in the Bearforts. This corresponds with the larger average home range for females in the Kittatinneys, 16.47mi² (26.52km²) as compared to 9.97mi² (16.06km²) for females in the Bearforts. Densities for New Jersey black bears fall largely within the range of densities found in other studies of eastern black bear which range from 1 bear/.26mi² (0.67km²) to 1 bear/5.54mi² (14.34km²) (Carlock et al., 1983, Yodzis and Kolenosky, 1986,).

The densest populations of black bear are found in areas such as Shenandoah National Park, Virginia, one bear/.42-.58mi² (1.096-1.49km²) (Garner and Vaughan, 1989) and some areas of Great Smokey Mountain National Park, Tennessee, one bear/.26-1.0mi² (.67-2.59km²) (Pelton, 1977, Carlock et al., 1983).

Estimated densities in neighboring states include one bear/1.3 square miles (3.4km²) in western Massachusetts and one bear/1.04 square miles (2.7km²) in a study area of the Connecticut Valley (Fuller, 1993).

Radio Telemetry

The majority (60/71.4%) of the 84 females captured on the research trap lines have been radio collared. An attempt has been made in recent years to maintain radio collars on 20-25 females annually. Of the 60 females radio collared since 1982, contact was lost with 12 (20.0%); their fate is unknown. The collars were removed from 8 of the 48 females with which contact was maintained. Of the 40 remaining females, 13 (32.5%) are dead (seven illegal kills, three vehicles kills, one drowned, one euthanized, one unknown).

The goal of the telemetry effort has been to document reproduction, first year cub survival and mortality rates and identify important habitat components. An extensive radio telemetry study of 27 bears (18M, 9F) was conducted by Rutgers University masters degree candidate, Cheryl Fimbel, in the Bearfort region between 1987 and 1989. Average home ranges generated from the Bearfort region study indicated that male black bear in New Jersey established annual home ranges that were 10 times, (70.3 sq. mi.) larger than female bears (6.2 sq. mi) (Fimbel, 1990).

Telemetry studies in the Kittatinny region have been of females exclusively. Home ranges for 14 females in the Kittatinny region ranged from three to $18\frac{1}{2}$ square miles and averaged 10 sq. mi.; these regional studies indicate that home ranges of New Jersey female black bear are significantly smaller than home ranges of adult females in Pennsylvania and Massachusetts (McConnell et al., 1993, Alt, 1977, Elowe, 1984, Fimbel, 1990). One probable factor of home range restriction in New Jersey is fragmentation of the habitat by paved public roads. Females are less inclined to cross heavily-used roads than male black bear (Brody and Pelton, 1989).

In some states, female black bear maintain exclusive territories and chase off intruders. However, females usually allow their female offspring to maintain home ranges within the same boundaries (Rogers, 1987). Other states observe overlap among female ranges, however, areas of overlap are used at different times by the different females (Kolenosky and Strathearn, 1987). In both the Bearfort and Kittatinny regions, female black bear demonstrate extensive overlap of home ranges. It is not known how closely related many of these females are.

The studies of interrelated females in the Kittatinny region in the 1980's and early 1990's indicated that adult females were absorbing their female offspring into their own home ranges. Twenty females tagged as newborns during the 1980s and 1990s are known to still be in or adjacent to their mothers home range. Dispersal of female offspring may have occurred from the Kittatinny region in recent years. This is possibly an indication that the habitat is saturated in that area and no significant number of additional females will be accommodated. In 1994, two female siblings tagged as newborns in Frankford Township, Sussex County were recovered. One was recovered (vehicle kill) 11.2 miles southeast and the other (legal N.Y. kill) was recovered 37.6 miles north of their natal dens. Three other females have been recovered some distance from their natal dens; distances ranged between 7.7 and 8.9 miles. Documentation of dispersal is dependent on ascertaining that bears tagged as cubs never return to their natal range after independence. New Jersey's documentation is conditional: these subadult females were not radiocollared; they were sighted, captured or killed and it is unknown if they would have moved greater distances or returned.

Reproduction

Studies conducted in New Jersey since 1982 indicate that New Jersey's female black bear breed at an earlier age and have larger litters than most western and northern black bear populations. (Bunnell and Tait, 1981, 1985).

The studies also indicate that female black bear in the Kittatinny region (western Sussex, northern Warren) are sexually mature at an earlier age than female black bear in the Bearfort region (eastern Sussex, western Passaic, northern Morris). Females in the Kittatinny region have greater access to diverse agricultural crops than Bearfort females. This gives the Kittatinny females (and males) (Figures 4 and 5) a nutritional advantage which is reflected in their body weights. Kittatinny females in June of their second year outweigh Bearfort females by over thirty pounds. This disparity continues through the June weights of bears in their third, fourth and fifth year also. Seven Kittatinny females of known age all produced cubs at three years of age. Two cases have been documented where known age Kittatinny females produced cubs at two years of age. The data from the Bearfort region, though limited, suggests that Bearfort females usually do not produce cubs until they are four years of age.

Figure 4.

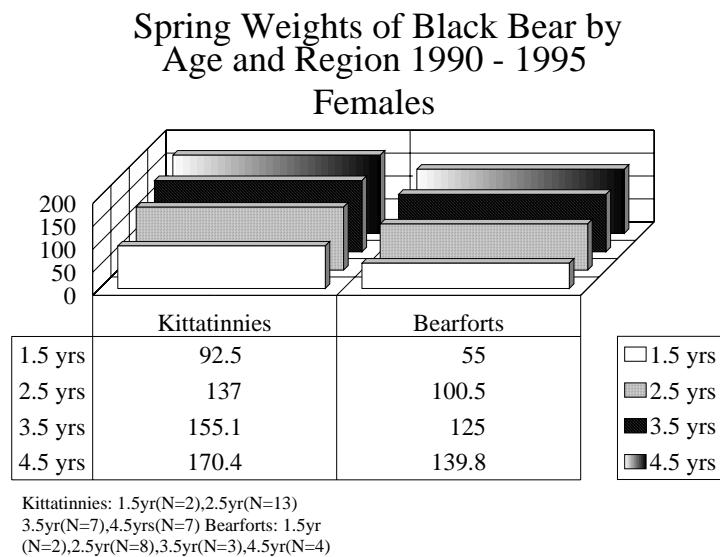
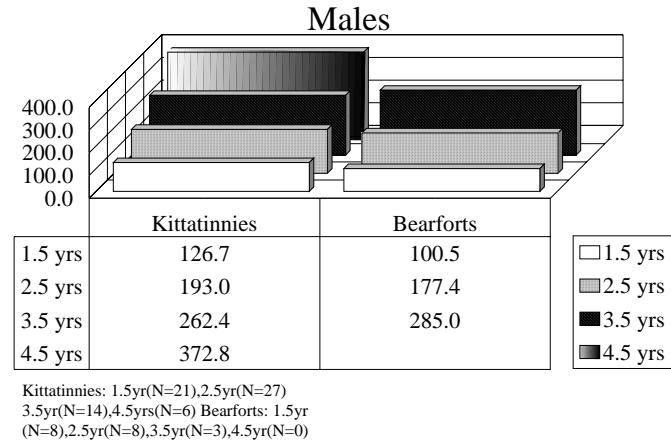


Figure 5.

Spring Weights of Black Bear by Age and Region 1990 - 1995



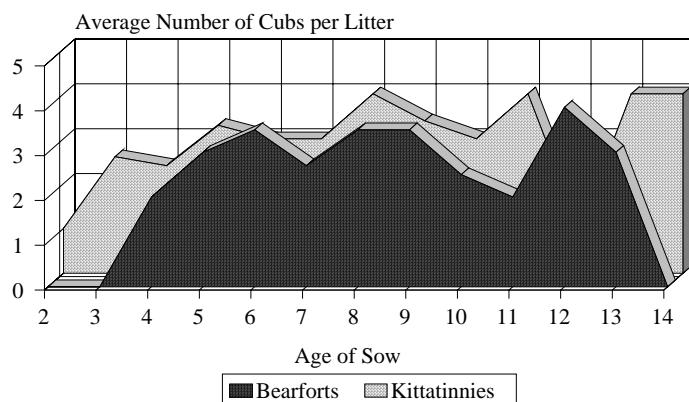
Size of litters however, is similar in both the Bearfort and the Kittatinny females.

A total of 85 litters has been examined in the Kittatinny Region; a total of 246 cubs were produced for a mean litter size of 2.89. A total of 19 litters have been examined in the Bearfort region; a total of 54 cubs were produced for a mean litter size of 2.84.

Litter size is related to both age and condition of the mother. Kittatinny females age 3-4 produced 2.41 cubs per litter on average , females 5-9 produced 3.29 cubs per litter on average and females 10 or older produced 2.85 cubs per litter on average. Bearfort females aged 4-5 produced litters of 2.5 cubs, females 6-9 produced litters of 3.22 cubs and females 10 or older produced litters of 2.5 cubs on average.

Figure 6.

Average Number of Cubs Per Litter



Cubs remain with their mothers for $1\frac{1}{2}$ years in New Jersey. Family groups apparently begin to break up in May/June of the cubs second year. Female black bear breed every other year once they are of breeding age.

Failures of both soft berries and hard mast crops (acorns, hickory nuts, beechnuts, hazelnuts) in other states have led to poor reproduction in those years. Rogers (1976) proposed that the interruption of pregnancy at the beginning of the denning period when fat reserves are insufficient may be a survival strategy of female black bear. Hard mast failures have been observed in New Jersey in the time period of our studies. Soft mast production has been generally good, although in 1995, soft mast production was spotty. Bears in New Jersey have so many alternate food sources available to them (agricultural crops, garbage) that reproductive capacity has remained high throughout the period of study.

Studies in Minnesota and Pennsylvania indicate that growth of young (< 1 year) black bear is influenced by maternal condition and the number of young in the litter (Rogers, 1976, Alt, 1989). Young born in a large litter from a small mother can be underweight. Rogers (1976) reported that lightweight young (< 1.8 kg in late March) suffer four times greater mortality after leaving the den than heavier young. Cubs from a litter of three born to a Kittatinny three year old, 117 pound female weighed 2.5 pounds or less on March 20. None of the cubs survived.

Survival of Young

First year survival of cubs has been documented in New Jersey by capturing each radio collared mother in the den after she has given birth and tagging all her newborn cubs. The female is then tracked to her den a year later and the number of cubs remaining with her counted. Although somewhat variable from year to year and varying from female to female, overall first year survival average is > 70% in New Jersey. A total of 43 family groups were followed through their entire first year in the Kittatinny region between March 1984 and January 1994. Of the 131 cubs in the family groups, 96 (73.3%) were sighted/recovered after one year.

A total of nine family groups were followed for one year in the Bearfort region. Of the 29 cubs in these groups, 19 (65.5%) were sighted after one year. The total number of cubs followed through the first year for both Bearfort and Kittatinny regions was 160; of the 160, 115 (71.9%) were sighted after one year. It was difficult to document the causes of loss that occurred in the cubs that did not survive the first year. Few early losses occurred. However, when they did occur, young mothers and light weight cubs were involved in most cases (cubs weighed \leq 2.5 lbs in late March). Cubs were lost shortly after their mothers emerged from the den. In 1993, eleven females who had produced 35 cubs in January of 1993 were observed in September of 1993 with 34 of the 35 cubs (97.1%). In January of 1994, it was possible to observe 8 of the above eleven females; the eight had given birth to 23 cubs. Of the 23, 19 (82.6%) cubs had continued to survive between September and the 1994 denning period. Losses occurring after September may be due to illegal kills associated with New Jersey's firearm and bow seasons or illegal kills associated with fall feeding nuisance/damage situations.

Black bear are most vulnerable to loss in the first two years of life. Studies in other states indicate that losses after one year and prior to two years range from 15-35 percent (Kolenosky and Strathearn, 1987). Sub adult mortality (ages >1 and <2) rates in New Jersey were estimated by following individual marked animals from one year to the next and calculating the proportion re-sighted in any way (research trapline, den, road mortality, legal/illegal kill) in any subsequent season. Only bears that were marked three years prior to the latest trapping season were used; this limitation gave three years to recapture/re-sight bears so as to limit the number of missed bears. This gives a maximum estimate of mortality, since emigration and missed bears are indistinguishable from mortality. Estimates from these calculations for subadult mortality were 0.42 for the Kittatinneys and 0.50 for the Bearforts. Adult (>=2) mortality was estimated by the same method. Table 3. lists adult mortalities by year and sex for the two populations.

Table 3. Percent Adult (>=2) Mortality Estimates for Black Bears in Two New Jersey Populations (N for each year in parentheses).

Year	Kittatinny Population		Bearfort Population	
	Percent	Percent	Percent	Percent
	Male	Female	Year	Male
1982	50(14)	no est.	1982	0(1)
1983	40(15)	25(4)	1983-1987*	45(11)
1984	45(11)	0(3)	1987	42(12)
1985	29(7)	33(5)	1988	43(14)
1986	44(9)	20(5)	1989	38(8)
1987-1989*	29(11)	7(5)	1990	0(5)
1990-1992*	29(16)	4(13)	1991	44(9)
1992-1994*	47(21)	8(20)	1992	13(8)
				17(6)

* Indicates range of years when trapping was suspended in the region.
Mortalities listed are average per year for the range of years listed.

The average mortality for all years in the Kittatinny population is 39% for adult males and 9% for adult females. All year averages for the Bearforts are 44% for adult males and 24% for adult females.

A second set of mortality estimates was calculated using data from radiocollared bears only. Although sample sizes are smaller, these estimates will be less inflated than those above because radiocollaring minimizes the chance of missing bears. Using this method, estimates of 6.6% mortality for subadult females and 5.9% for adult females were obtained for the Kittatinny region and 20% was estimated for adult females for the Bearfort region. Subadult female mortality for the Bearfort region could not be estimated due to the low numbers of radiocollared subadults.

Cub mortality rates for the Kittatinny region compare to the lowest estimates found in other studies, whereas cub mortality in the Bearfort region is moderate to high in comparison with other studies. Measured mortality rates in hunted populations of black bears range from 25 to 50% for cubs (Bunnell and Tait, 1981, Yodzis and Kolenosky, 1986). Estimates of subadult mortality from both populations are higher than the range listed in the literature (15-35%) when all marked bears are considered, but fall below the reported range when only radiocollared bears are considered. Among adult bears, estimates for adult female mortality rates are comparable to those found in other studies. In Ontario, Yodzis and Kolenosky (1986) found adult female mortality to range from 11-22% for females aged 2-14. After age 14, mortality rates increased significantly, to 70% at age 18. Bunnell and Tait (1981) reported an average mortality rate for adult females of 16.6%. Male mortality rates, as calculated from New Jersey data, are high compared to those found in other studies (Bunnell and Tait, 1981). As subadults and adult males are the most mobile segments of a bear population, missed

bears and emigration may have inflated mortality estimates for these groups in New Jersey.

A high percentage of males disperse from the area where they are born. Male subadult black bear almost always disperse from the area of their birth (Rogers, 1987, Beck, 1991). Rogers (1987) found in Minnesota that no male was known to remain in his mothers territory past 4.0 years of age.

As stated previously, documentation of dispersal is dependent on ascertaining that the cubs never return to their natal range after independence. New Jersey's documentation is conditional: the subadult males were not radiocollared; they were sighted, captured or killed; it is unknown if they moved or would have moved greater distances or returned to/near their natal areas. A total of 32 males tagged as cubs in New Jersey were recovered after independence from their family groups. Distances from natal dens ranged from 7.8 miles for a 3.5 year old male to 57.4 miles for a 1.5 year old. Fourteen of the 32 were recovered/sighted/captured in neighboring states; eleven in Pennsylvania, three in New York. Nineteen of the 32 males are dead which includes twelve of the fourteen known to have moved into either Pennsylvania or New York.

Sources of Mortality

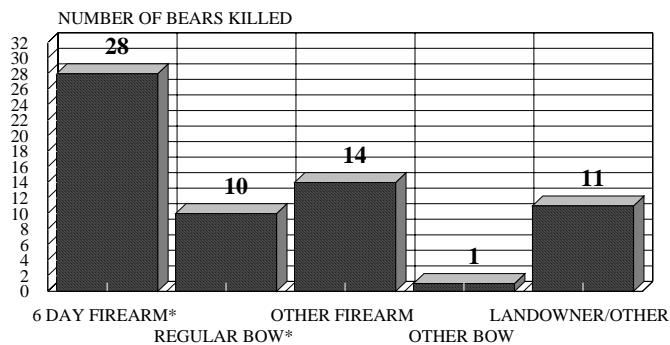
The two most important known mortality factors for black bear in New Jersey are illegal kills and vehicle kills. Illegal kills that have been documented occurred during times of high visibility (i.e. New Jersey's firearm seasons); those individuals perpetrating the illegal kills were either observed or left the bear due to the difficulty of removing the carcass or parts without being observed. In some instances, the only

evidence of an illegal kill was a radio collar left partially or fully intact or transported to other areas.

Sixty-four (43M,16F,5U) illegally killed bears were recovered in New Jersey between July 1, 1977 - June 30, 1997 (Figures 7 and 8). Of the 64, 28 (43.8%) were illegal kills that occurred during the six day firearm deer season. Kills during the six-day firearm season may be over represented in the overall illegal kill because of the difficulty of removing an illegal bear from the woods without being observed/reported by the high number of hunters (estimated 85,000) in the woods during that season. This increases the chances of documentation because the carcass is often left in the woods. Kills during the fall archery season for deer accounted for 10 (15.6%) of the documented kills. Firearm kills associated with other hunting seasons accounted for 14 (21.9 %) of the kills. Illegal kills by landowners and poaching for commercial purposes are the most difficult categories to document and therefore only account for eleven (17.2%) of the documented kills.

Figure 7.

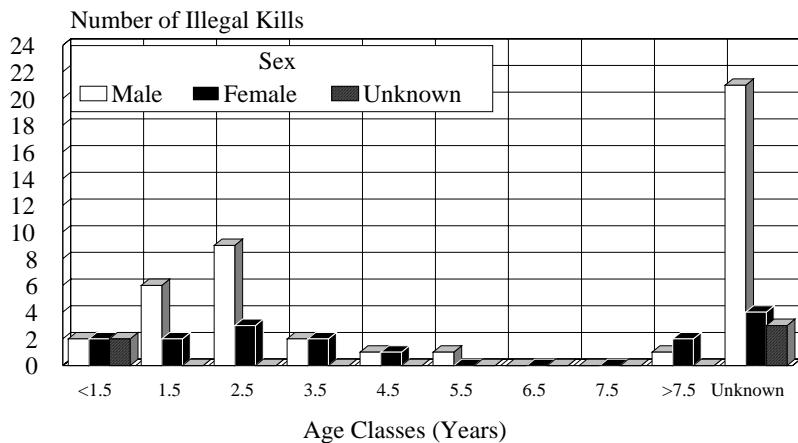
**ILLEGAL BLACK BEAR KILLS IN NEW JERSEY
BY TYPE OF MORTALITY
YEARS 1979 -1997**



*ILLEGALLY KILLED DURING THESE
DEER SEASONS

Figure 8.

**Illegal Black Bear Kills in New Jersey
by Age and Sex Fiscal Years 1977 - 1997**



Vehicle Mortality

The percentage of loss to vehicle kills is greater than documented due to the ability of the black bear to sustain mortal injuries and continue to travel considerable distances from the roadway. There are approximately 10-20 reports each year in New Jersey of bears struck by vehicles where the bears' eventual fate is unknown. Other vehicle strikes go unreported by the driver because there has been no damage to the vehicle. Loss to vehicle kills is higher in males. Studies in other states show that female black bear generally avoid roads but that males used roads in proportion to their availability (Fimbel, 1990). Males have larger home ranges than females and would be more predisposed to crossing roads. Increases in the number of bears, roads, and the number of vehicles on New Jersey's highways and a decrease in available habitat is expected to result in an increase in the annual loss of black bear to vehicle kills. Damage to personal property (vehicles) and the potential for injury to individuals will also

increase. No fatalities are known to have occurred; serious injury was sustained by an individual who collided with a bear while the individual was a passenger on a motorcycle.

A total of 113 (80M:25F:8U) vehicle killed black bear have been recovered in New Jersey during the past twenty-one fiscal years (July 1, 1977-June 30, 1997) (Figure 9). Age was determined for 77 (68.1%) of the bears. Of the 77, 33 (42.9%) were 1.5 years old and 17 (22.1%) were 2.5 years old for a total of 50 (64.9%) in these two age categories. The oldest bear killed was 13.5 years old; only 8 (10.4%) bears were young of the year (< 1 year). Sex was determined for 93 of the bears. The majority (71) were male (76.3%), 23 were female (24.7%) (Figure 10).

Figure 9.

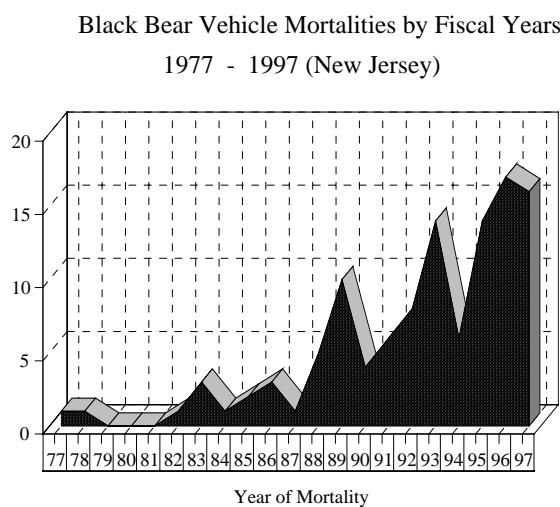
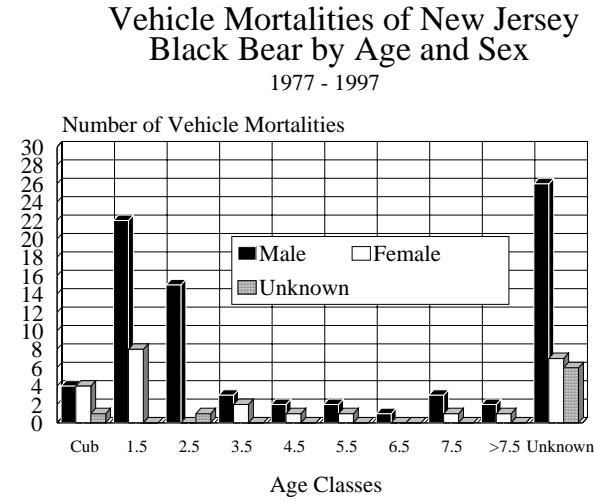


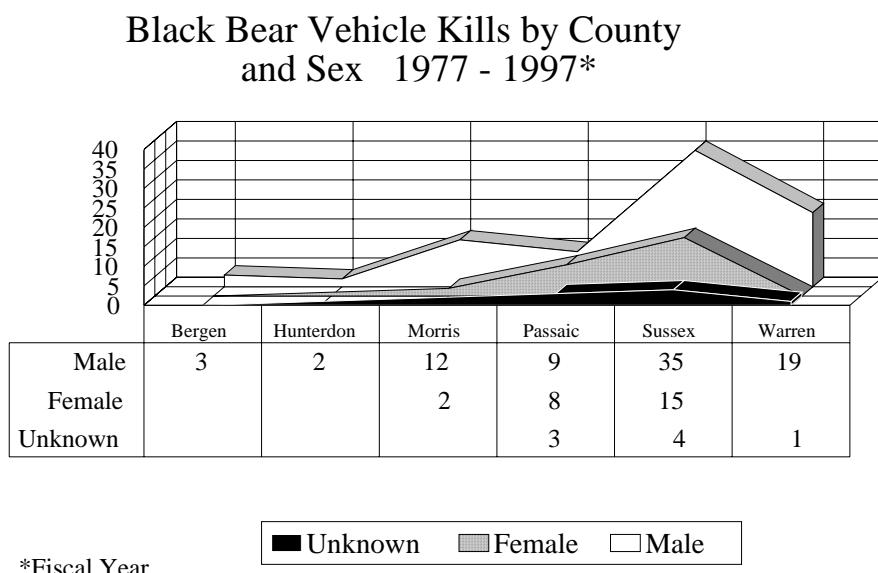
Figure 10.



Almost all of the vehicle mortalities occurred in the northern counties of Sussex, Passaic, Warren and Morris and in that order of importance (Figure 11). This is a reflection of the sighting trends; the above four counties also account for almost all of the sightings of black bear each year. Sussex County has accounted for 54 (47.8%) of the 113

vehicle kills since 1977 and has accounted for 33.7% to 71.3% of the sightings reported annually to the Division of Fish, Game and Wildlife since 1977.

Figure 11.

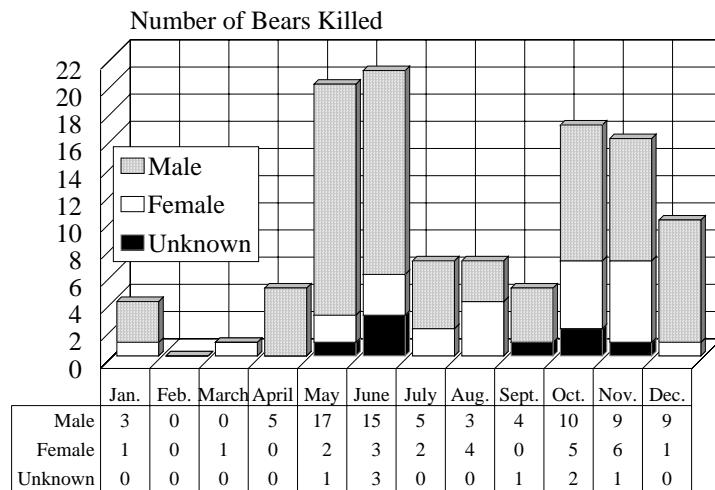


Of the 113 bears killed, it was possible to examine 105 for the presence or absence of tags. Of the 105, 35 (33.3%) were New Jersey tagged bears. This is a percentage similar to that obtained in the sighting reports. Tagged bears generally constitute 15.9% to 52.7% of the sightings received each year from the public.

Black bear vehicle collisions that resulted in recovered mortalities were most common in June (21). Other peak times were May (20), October (17), and November (16) (Figure 12).

Figure 12.

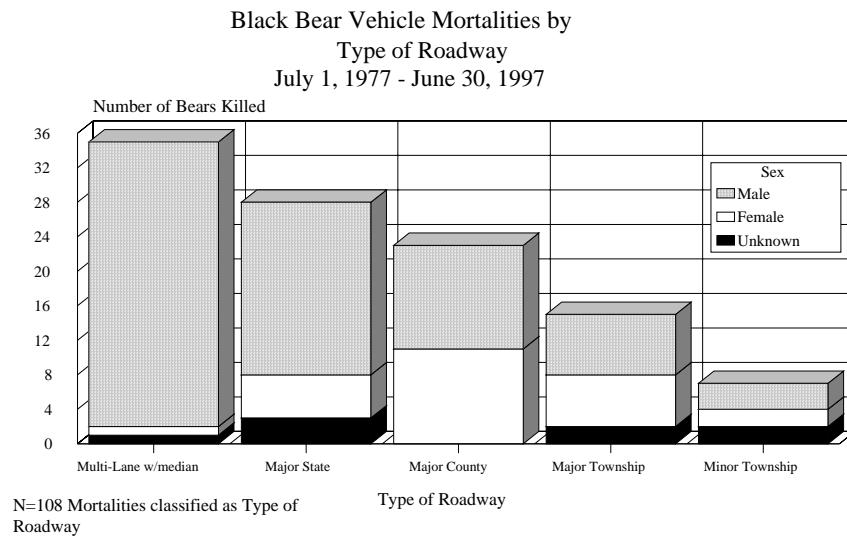
Black Bear Vehicle Mortalities by Month of Occurrence and Sex 1977-1997



The type of roadway was determined for 108 of the 113. Studies in North Carolina on radio collared bears indicated that bears crossed roads less as traffic levels increased. In the Carolina studies, individual bears preferred to cross roads of lighter traffic than those heavily traveled. The studies suggest that bears may actually shift the location of their home ranges as road density and traffic volume increases. Only three bears crossed interstate I-40 in the Carolina study five times even though I-40 intersected 13 seasonal ranges of eight bears (Brody and Pelton, 1989).

It is not known at what rate New Jersey black bear cross the various road types. It is obvious from the data that multi-lane or major state highways produce the highest number of black bear mortalities. Of the 108 vehicle kills documented by roadway, 63 (58.3%) occurred when bears attempted to cross major interstate highways; 35 of the 63 (55.6%) kills were on interstate highways with medians (Figure 13).

Figure 13.



Natural Mortality

Natural mortality causes that have been documented include separation of young from sow or abandonment by the sow, encounters with porcupine, den collapse, one case of rabies, cannibalism and injuries induced by other bears (Table 2). There is some evidence from field studies to support the hypothesis that mortalities caused by other bears may significantly limit population growth in certain circumstances. Cannibalism of cubs by male bears is the primary evidence used to support this hypothesis (Gill and Beck, 1990). Rogers(1987) however questioned whether cannibalism rates were sufficiently density dependent to significantly regulate population growth. Rogers suggested they were not (Miller, 1990). The cannibalism documented in New Jersey was of snared yearling bears (2M,2F) killed and eaten in May/June. In the two cases involving female yearlings, both yearlings were known to still be with their mothers; one mother was being actively followed by a large male. Loss of

cubs/yearlings who are nursing allows the adult female to come into estrus and be available to the male for breeding.

Table 4.

Mortality factors for bears recovered in New Jersey during the period of July 1, 1976 to June 30, 1997

Year	Illegal Kill	Vehicle Kill	Other	Unknown Cause of Death
1977		1M		
1978		1M		
1979	1M			
1980	2M			
1981	3M, 1F, 2U			
1982	3M	1F		
1983	2M	2M, 1U		
1984	2M, 1F	1M	1M	1U
1985	1M, 2F	2M		
1986	3M, 1F, 1U	3M		
1987	4M, 2F	1M		
1988	1M, 1F, 1U	5M	1F	1M
1989	2M	6M, 3F, 1U	2M, 4F	1M
1990	3M	3M, 1F	1M	
1991	1M, 1F	3M, 2F, 1U	1F	
1992	3M, 1F, 1U	6M, 2F	1F	
1993	1M, 1F	9M, 2F, 3U	1U	1U
1994	3M, 1F	5M, 1F	1M, 1F	1U
1995	2M, 1F	10M, 4F	1M, 1F	
1996	3M, 1F	10M, 5F, 2U	2M, 1F	1M, 1F
1997	3M, 2F	12M, 4F	2M	
Total 43M,16F, 5U		80M,25F, 8U	10M, 10F, 1U	3M, 1F, 3U

Denning

Black bear exhibit different times for entry into and emergence from their dens* based on sex, age and reproductive condition (Alt et al., 1976, O'Pezio et al., 1983,

* Dens are locations where free-ranging animals spend an extensive period of time.

Black bear use rock cavities, brush piles, nests, excavations, hollow trees and blow downs.

Fimbel, 1990). Adult males enter the dens as late as mid/late December and emerge as early as mid-March. Pregnant adult females tend to den earlier than other females. The pregnant females enter the den as early as late October, and rarely emerge with their newborn cubs until the second week of April. Food supply affects entry dates in black bear.

Adult females with yearlings enter dens later than pregnant females and may emerge earlier. They also remain more active than males or solitary females throughout November and December. By using radio locations two or more days apart, Alt (1976) found Pennsylvania females with yearlings were quite active throughout January, February and March particularly when weather conditions were not severe. Alt observed that females with yearlings are the one group that continues food consumption and defecation throughout the winter, a common observation in New Jersey, particularly in the mild weather that persisted in the winter of 1994-95.

These differences in the timing of den entry are particularly important when considering harvest schemes. Pregnant females can be given a high degree of protection by seasons that occur late in the calendar year. Females with yearlings would be vulnerable to harvest at any time, due to their prolonged period of activity and high visibility as a family group even when denned because of their common use of open nests. Of a total of 68 dens used by female black bear accompanied by yearling cubs in New Jersey between 1984 and 1996, 40 (58.8%) were open nests. (McConnell et al., 1996)

GIS Mapping

Project personnel have located and classified by type 129 dens occupied by female black bear since 1984. In 1994, work began on assigning coordinates to each den through the use of global positioning units and entering the data into New Jersey's Department of Environmental Protection's (NJDEP) Geographic Information System (GIS). Preliminary research indicated that a relationship existed between the selection of den sites and the presence of roads, occupied dwellings and water corridors.

Coordinates for all the located dens, information regarding the reproductive status of each bear using the den, and human housing, wetlands and road/trail data were entered into the system for analysis. Buffers ranging from 100-500 feet were placed around the roads, dwellings and water to determine how many dens fell within 100-500 feet from these structures.

Analysis of the data is quite complicated due to the number of variables involved and the fact that housing data layers are presently unavailable. Project personnel have collected coordinates on 702 dwellings in proximity to bear dens in Stillwater, Walpack and Montague Townships in Sussex County.

The relationship of dens to roads may be particularly vague because of the volume of roadways in New Jersey. Black bear may not have any latitude in their selection of dens because of the close proximity of roads to any and all potential den sites. Over 70 percent of the dens documented to date are within 500 meters of a road. This may be more a function of the short distances between roads than a function of the black bears tolerance of roadways.

The relationship of dens to dwellings may be more important. Of the 129 dens on the GIS system to date, project personnel have obtained the coordinates for associated

dwellings for 71 dens. Of these 71, 26 (36.6%) are within 500 meters of a dwelling. The initial impression from this data is that New Jersey black bear are far less tolerant of dwellings than roads and intolerant of dwellings overall. This data, however, needs to be analyzed in relationship to wetland data, reproductive status and type of den structure. Once the analysis is completed, the results will be used to project the amount of viable habitat in the state.

The remaining habitat will be fragmented. Fimbel's preliminary analysis of den/dwelling data identified 65 fragments of habitat in the Bearfort Region (Map I). The criteria used to project the habitat fragments was the elimination of all acreage less than 500 meters from a dwelling or road. This criteria was selected after analysis of 28 den locations used by male and female black bear. The fragments ranged from $\frac{1}{5}$ of an acre to 8401 acres in size and totaled 51 square miles (Fimbel et al., 1991). Data from the Bearforts (Fimbel) and the Kittatinneys (current data) will help to identify and target important and large fragments as well as possible travel corridors for protection/preservation.

Map I. Location of 65 fragments of undeveloped habitat > 500m from roads and residential development.



Map of main study area in northern New Jersey showing location of 65 fragments which meet criteria for habitat >500 meters from roads and occupied dwellings. Grid lines are spaced at distances of 3.1 miles (5 km).

Nuisance/Damage Mgmt.

As noted previously, 42 states in the United States have black bear populations.

Fifteen* states do not allow hunting of black bear. None of these states issue permits to kill depredating black bear and technically it is illegal to kill bears in these states (McCracken et al., 1995). In most of these states, however, the right of the landowner to protect their lives or livestock is recognized. The majority of these states investigate any alleged "kill to protect" incidences and prosecute when applicable. Some of the 15 states offer compensation for damage caused by black bear.

States that offer compensation, such as Wisconsin, are changing to an emphasis on bear damage abatement programs that emphasize damage prevention. Between 1939-79 Wisconsin paid \$229,453 on 2,784 black bear damage reports. Funding levels

* Alabama, Connecticut, Florida, Kentucky, Louisiana, Maryland, Missouri, Mississippi, Nevada, New Jersey, North Dakota, Ohio, Oklahoma, Rhode Island, Texas.

were inadequate most years. Landowners were not satisfied and game managers and legislators were concerned over the high costs and the lack of emphasis on abatement measures. A new program initiated in 1983 gives priority to funding of abatement work over payment of claims. This program is funded by a \$1.00 surcharge on all hunting licenses (Hygnstrom and Hauge, 1989).

The emphasis of New Jersey's program is on the prevention of damage through public education, control structures and handling of individual problem bears rather than response to damage. Complaints regarding black bear in New Jersey are of two types; nuisance complaints where there is no monetary loss, and damage complaints where there is damage to structures or livestock injury/kills resulting in monetary loss to the landowner.

Nuisance complaints or perceived threat are the most common complaint. Black bear habitat is very fragmented in New Jersey. Many of the newer developments border important wetland areas heavily used by black bear. Black bear commonly use residential properties to move from one fragment of habitat to another. Use of garbage is a common complaint; bears also use bird feeders extensively. Garbage and bird feeder complaints are most numerous in April/May. Natural foods are in short supply and bears have just emerged from their winter dens. Residents unfamiliar with black bear often perceive that the mere presence of a black bear in residential areas is a life threatening situation.

Nuisance situations are generally handled by an educational effort beginning with the initial phone call into either the Division's research or wildlife control office. Phone calls are followed up by information packets forwarded to each caller. In areas experiencing numerous visitations by black bear, public seminars are held for adults and

school seminars are held for the youth of the community. Public seminars attempt to dispel common myths and to inform the public.

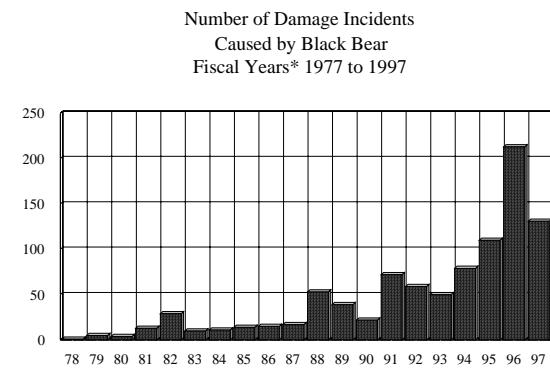
McCullough (1982) notes that "restricting human food availability is the obvious and most important step toward solving bear problems because positive conditioning with food rewards is probably the strongest form of learning in bears". Landowners are constantly urged to maintain garbage and food free environments at their residences.

Many landowners unintentionally bait black bear by their carelessness with garbage, compost piles and bird feeders. Some landowners purposefully feed black bear. The purposeful attraction of bears has increased in New Jersey and has resulted in the creation of serious nuisance situations for some communities.

Education has not proven sufficient to deter individuals who have fed bears for a number of years. The Division of Fish, Game and Wildlife worked closely with the town managers and councils of West Milford and Vernon in north-central New Jersey to resolve the feeding issue in the two communities. The two communities passed bear feeding ordinances which subjected individuals who fed bears to \$1,000.00 in fines and possible jail terms. The individuals identified by the Division of Fish, Game and Wildlife and the town managers have ceased feeding bears.

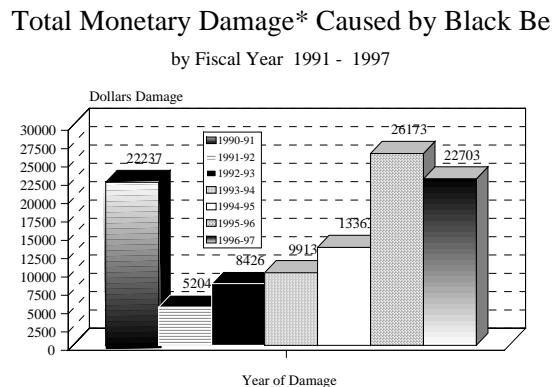
The number of complaints involving monetary loss to the landowner for fiscal year 1996 was the highest on record (Figure 14). The dollar value of losses to black bear was highest in fiscal year 1996 (\$26,173.00) (Figure 15) (McConnell et al., 1996). Many male bears and non-pregnant females remained fairly active during the extremely mild winter of 1994-95. Drought conditions and spotty food supplies throughout the summer and fall of 1995 increased black bear use of human foods.

Figure 14.



*Time Period Covered: July 1, 1977 to June 30, 1997

Figure 15.

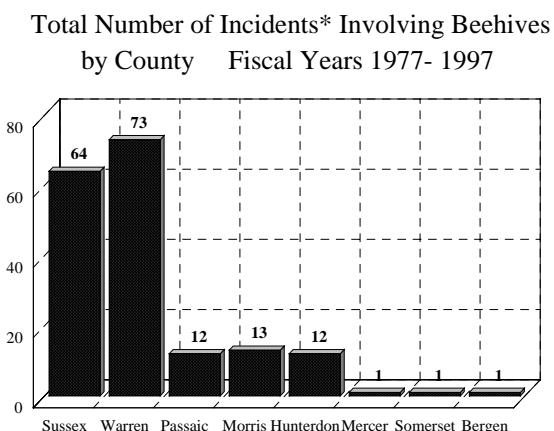


*Obtaining monetary damage estimates from all landowner was initiated on July 1, 1990

Damage to apiaries comprises a significant volume of the structural/monetary

***Obtaining monetary damage estimates from all landowners was initiated on July 1, 1990.**
damage done by black bear. Between July 1, 1977 and June 30, 1997, 177 reports of black bear apiary depredations were received by the Division involving damage to a minimum of 599 hives (Figures 16 and 17). Sussex County accounted for at least 214 of the hives; Warren County accounted for at least 264 of the hives. Almost half, (84, 47.4%) of the reported incidents occurred in April and May. This emphasizes the importance of protecting hives when natural food supplies are scarce.

Figure 16a.



*Incidents involved a minimum of 599 beehives

Figure 16b.

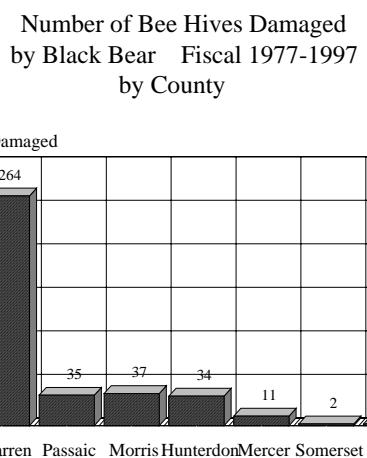
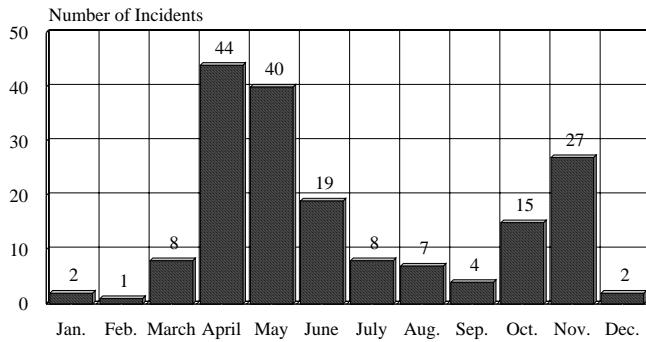


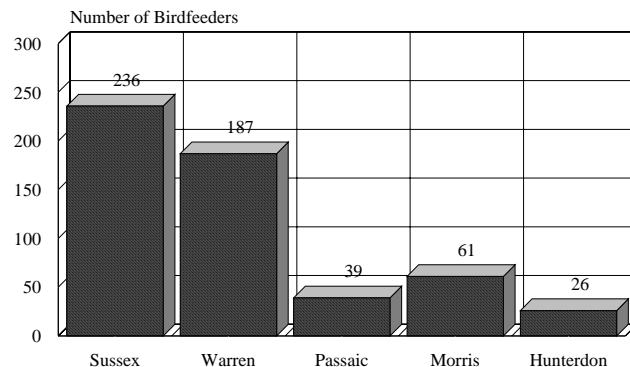
Figure 17. Number of Incidents Involving Black Bear Damage to Bee Hives* Fiscal 1977-1997 by Month of Occurrence



*Incidents involving the damage of a minimum of 599 Hives.

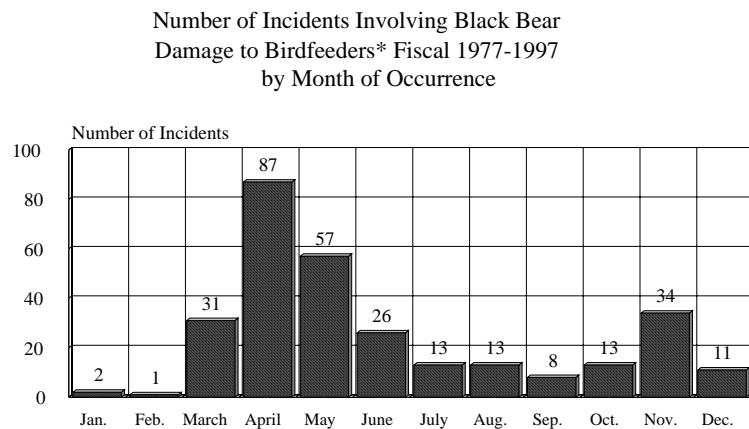
A total of 296 reports of monetary damage to bird feeders has been reported between July 1, 1977 and June 30, 1997. The reports involve damage to a minimum of 549 birdfeeders (Figure 18). Sussex county accounted for the greatest number of birdfeeders lost (236), followed by Warren county (187). Passaic County accounted for 39 birdfeeders; this is lower than expected and is probably due to the extensive public education effort in that area in the last two years.

Figure 18. Birdfeeders Damaged by Black Bear Fiscal 1977-1997 by County



Bird feeder damage was most common in April and May, coinciding with the emergence of black bear from their dens and low natural food supplies (Figure 19).

Figure 19.

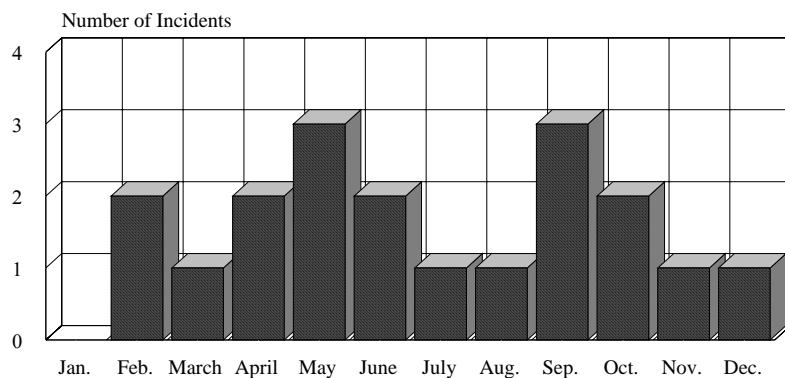


*Incidents involving the damage of a minimum of 549 birdfeeders.

Depredations on large livestock such as sheep, goats or cattle are reported occasionally. Nineteen reports of depredation on sheep have been received by the Division since 1977. Nine (47.4%) of the nineteen occurred in fiscal years 1996 and 1997. A total of 36 sheep have been killed and two have been injured. An adult male bear was implicated in five of the 36 sheep killed. Of the nineteen incidences, nine (25 sheep) occurred in Sussex County and three (five sheep killed) incidents occurred in Warren County. Seven (36.8%) of the nineteen incidents occurred between April 1 - June 30. (Figure 20).

Figure 20.

Number and Annual Distribution of
Black Bear Damage Incidents Involving
Sheep* Fiscal Years - 1977 to 1997



*Incidents involving the killing of a minimum of 36 sheep and 2 injured.

Bears have entered horse paddocks but have been apparently drawn more by the "sweet feed" than the horses. In August 1988 in Sussex County, two horses apparently panicked in response to the presence of a bear and had to be destroyed after entangling themselves in the fencing of their paddock.

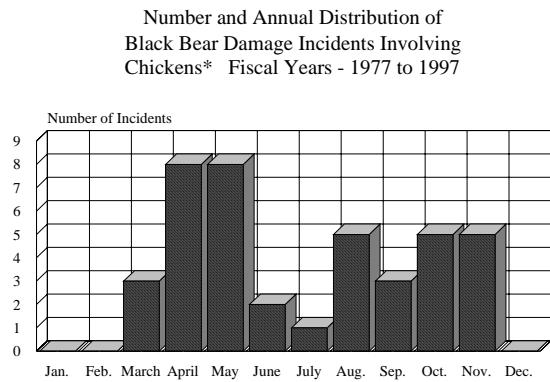
Fourteen reports of depredations involving 17 goats (11 killed, 2 missing, 4 injured) have been received since 1977. Seven (50.0%) of the fourteen occurred in fiscal years 1996 and 1997. The reports were from Morris (two), Passaic (two), Sussex (eight) and Warren (two) counties. Only one suspected calf kill has ever been reported (Passaic County); the calf was not recovered for verification. Other large livestock includes one injury to a pig (Passaic County) and injuries to two llamas, (one in Morris County and one in Warren County).

Small livestock taken by bears usually consists of rabbits and chickens. There have been 36 reports of chicken depredations involving the loss of a minimum of 215 chickens between fiscal years 1977 and 1997. Of the 36 chicken loss reports, 20 (55.6%)

occurred in Passaic County, 7 (19.4%) occurred in Sussex County, 6 (16.7%) occurred in Morris County, 2 (5.6%) in Warren County and 1 (2.8%) in Hunterdon County. Of the 36 reports of chicken depredation, 16 (44.4%) occurred in April/May (Figure 21). Eight reports of depredations on mixed species of small livestock, including pheasants, chukars, geese and ducks have also been received. The reports were from Morris, Warren, Sussex and Passaic counties. Goldfish were taken from a pond in Sussex County and damage to a pond in Warren County caused the loss of ornamental fish.

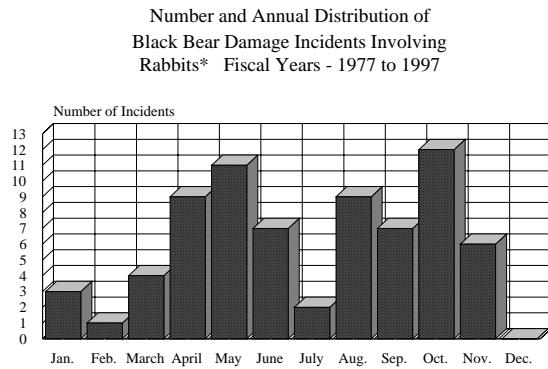
A total of 56 reports have been received of depredations on rabbits since fiscal 1977 and involve a minimum of 145 rabbits (figure 22). Nineteen (33.9%) of the incidents and 71 (49.0%) of the rabbits killed occurred in fiscal year 1996. Of the 56 incidents, 27 occurred in Sussex County, 17 occurred in Morris County and 12 occurred in Warren County. Of the 17 in Morris County, most were apparently attributable to one tagged adult male bear in Sept./Oct. of 1993. This male was destroyed by a landowner during an alleged attack on a llama. This same bear was tentatively identified as involved in a non-fatal goat attack. This demonstrates the propensity of some black bear to target livestock regardless of natural food supplies. Soft mast (berries) was abundant in 1993. Most of the rabbit incidents occurred in October (12) and April (11); a pattern is less obvious on rabbit than chicken .

Figure 21.



*Incidents involving the killing of a minimum of 215 chickens.

Figure 22.



*Incidents involving the killing of a minimum of 145 rabbits.

Domestic pets that have been lost include a cat that was consumed by an adult tagged male bear in Morris County (and assumed to have been killed by the bear) and one cat killed in Passaic County. Seven dogs have been injured; Passaic County (4) Sussex County (2) and Warren County (1). Six dogs were killed; Sussex County (3) Warren County (2) and Passaic County (1). Sows with cubs were implicated in 5 (38.5%) of the 13 dog incidents. All six of the documented dog kills occurred in fiscal years 1996 and 1997.

Male black bear usually predominate in nuisance/damage situations and visiting human residences or panhandling in campgrounds. This is due in part to their larger home ranges, greater dispersal from their natal areas and more aggressive behavior (Davenport, 1953, Rogers et al., 1976, Beeman and Pelton, 1977, Singer and Bratton, 1977). Male panhandler bears are typically young which may be a reflection of a lower survival rate for bears who become involved in panhandling. Removal of adult males by hunting, illegal kills or relocation also contributes to a younger age structure. Subadult males are more likely to encounter opportunities to panhandle due to their

search for areas with few dominant males and plentiful foods (Rogers, 1987, McLean and Pelton, 1989).

Growth, size and fertility are higher in panhandlers due to their access to and consumption of high energy human foods (garbage, corn fields, bird feeders, apiaries) (Alt, 1980, Rogers, 1987, Elowe and Dodge, 1989, McLean and Pelton, 1989). As stated earlier, black bear in the Kittatinny region sexually mature earlier than those in the Bearfort region. Access to corn by the Kittatinny bear population is considered the primary factor.

In a study of radiocollared black bear in northcentral New Jersey, males visited a provision site* less frequently than expected whereas family groups and subadults were more habitual in their use of the provision site (Fimbel et al., 1991). The proximity of humans may provide subadults and females with young refuge and an opportunity to use higher quality foods. Dominant adult males usually limit these opportunities (Mattson, 1990). This may explain why females and females with young were the main segment involved in complaints on dumpsters and campgrounds in Worthington State Forest, Warren County in 1995. Females with young were the main segment of the population observed at the dumpsters located at the Annandale prison unit in Stokes State Forest in Sussex County in the fall of 1995. This use of areas close to humans by females with young of the year is thought to depend on the quality of the food and the females' level of habituation.

Bear populations that rely on human foods do so only in areas where secure

* 75 pounds of dogfood, plus apples, peanut butter and bread daily.

habitat is available. Human foods may be extremely important to the bear population but will not be used unless a refuge area is nearby. Use of human foods increases when native foods of high quality are in short supply. Where reliance on human foods is greatest and competition from other bears significant, bears are more likely to expose themselves to humans in the process of getting human foods (Mattson, 1990). Studies in mixed forest environments indicate that female bears are significantly more active during the day than at night (Laviviere et al.). Bears apparently become more nocturnal in response to interference from humans (Ayres et al. 1986).

Agricultural Trends and Potential Black Bear Impacts

Acreage devoted to farming continues to decline in New Jersey (Figure 23). The state's farm acreage declined from over 1 million acres (1,030,000) in 1981 to 860,000 acres in 1994. The number of farms* decreased from 9,500 to 8,500 (Figure 25). Most of these farms are family owned. Only fifty are owned by non-family corporations. New Jersey's farmland however, is the second highest in value in the nation, averaging \$4,840 an acre in 1994 (Figure 24) (Dept. of Agriculture 1991, 1994).

*earning at least \$1,000 in agricultural products.

Figure 23.

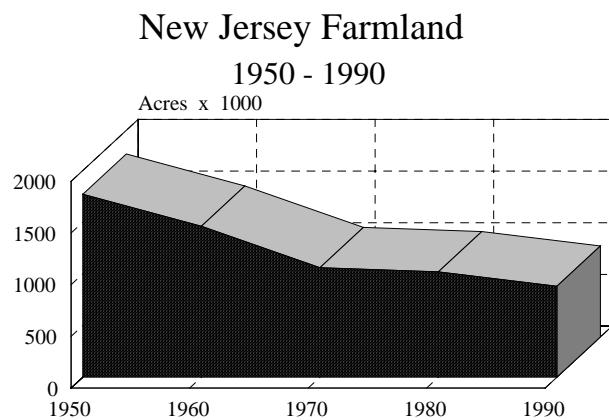


Figure 24.

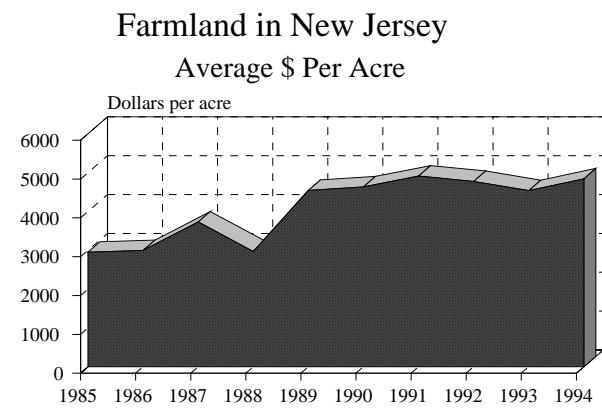


Figure 25.

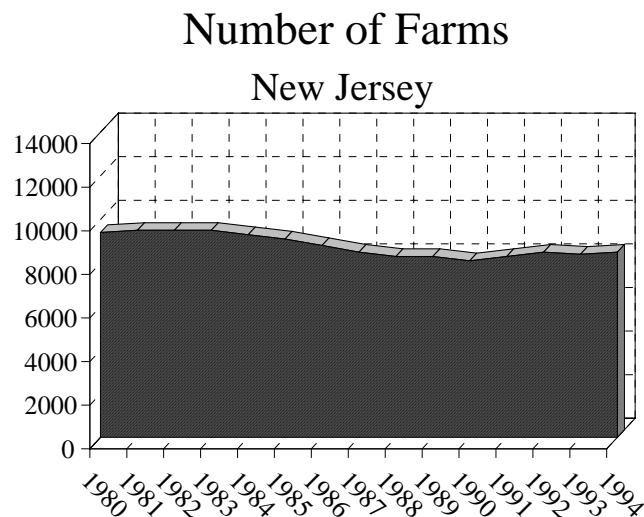
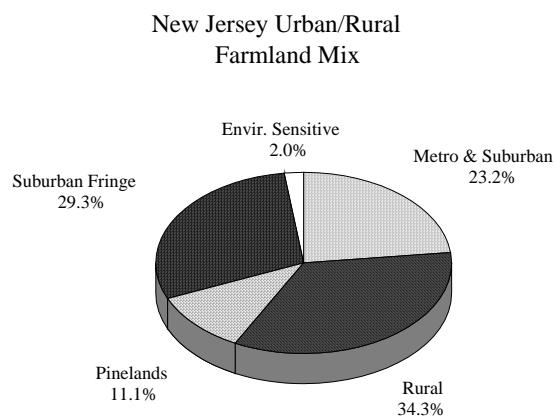


Figure 26.



A fair amount of New Jersey's remaining farmland (23%) is in the metro and suburban areas of the state. It is highly vulnerable to loss to development interests. Almost 30% is within the suburban fringe areas, increasing its vulnerability to development (Figure 26) (National Resources Inventory 1982). The establishment of the \$50 million Farmland Retention and Development Act and the passage of the Agricultural Retention and Development Act in 1983 are proactive measures to preserve farmland. The amount of permanently preserved farmland in the farmland preservation program as of the end of fiscal 1994 was 22,000 acres on 146 farms. Sussex County has

the greatest number of farms (791) however Warren County has the largest number of acres in farmland (87,638) and the largest percentage of its total land acreage in farmland (38.3%). Warren County also has the greatest percentage of its farmland in harvested cropland (50,280 or 87,638 acres or 57.4%). Sussex County has 29,631 of 75,531 acres of farmland in harvested cropland (39.2%) (N.J. Dept. of Agriculture, 1994).

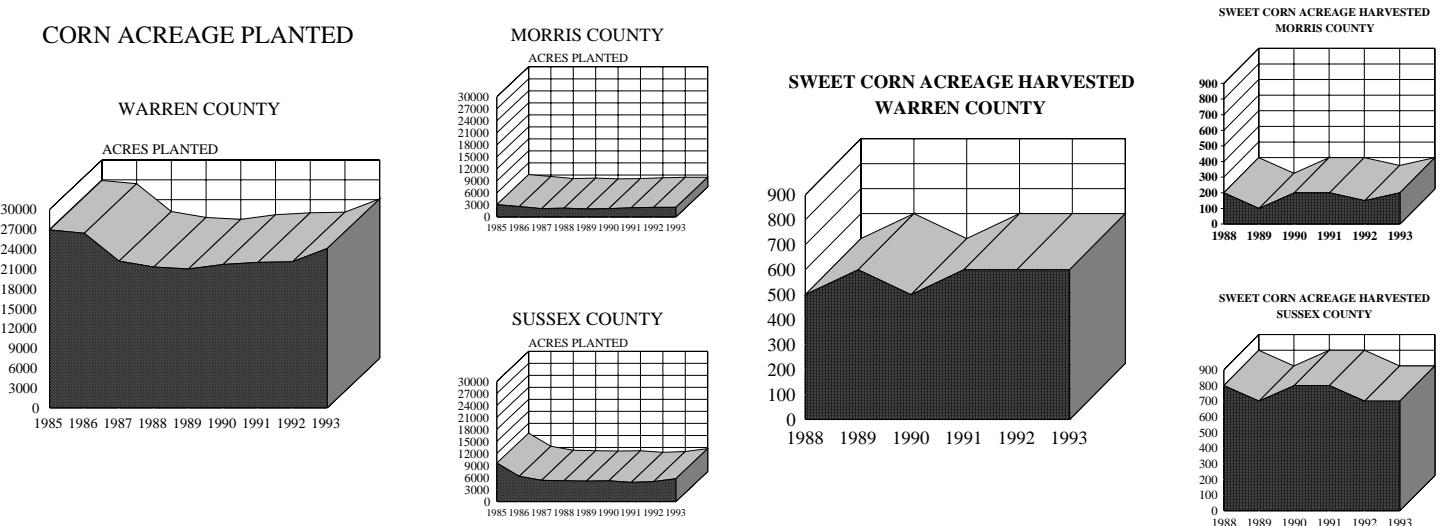
There are a number of agricultural crops/products that are impacted by bears. Of the field crops grown in New Jersey, corn is the only crop known to be damaged by black bear to any extent. Although it is known to occur, black bear corn damage is rarely reported to the Division. Corn is damaged by a variety of wildlife. Many farmers probably attribute bear damage to whitetail deer, raccoon or squirrel. Bears eat corn from the time it reaches the milk stage until harvesting but prefer it just prior to maturity. Bears generally destroy $\frac{2}{3}$ more corn than they consume by crushing the stalks and constantly moving to new spots to feed (Davenport, 1953).

Use of agricultural crops such as corn increases when high quality native foods, particularly acorn and berries are in short supply (Rogers, 1976, Elowe and Dodge, 1989). Bears typically use these alternative food sources at night, but when competition with other bears is high and reliance on crops high, bears become less nocturnal and move greater distances from heavy cover (Mattson, 1990). Bear use of corn is highest where corn is grown adjacent to wildlands such as in Delaware Water Gap National Recreation Area.

Of the four main bear counties, Warren County has the most acreage in corn. Almost 25,000 acres of field corn and 600 acres of sweet corn were planted in 1993. Passaic County has none, and Morris and Sussex have minimal acreage with a little over 5,000 acres of field corn and 700 acres in sweet corn in Sussex and less than 3,000

acres of field corn and 600 acres of sweet corn in Morris County (Figure 27). Because the highest and densest bear populations are in Sussex and Passaic, overall monetary losses to black bear on field corn are anticipated to be insignificant as compared to the total value of field corn produced in Morris, Sussex and Warren. Total value of the field corn crop for the state was \$21,504,000. However, the loss sustained by an individual farmer in a high density bear area may be severe. Sweet corn, however, has a much higher value. The 1993 statewide sweet corn crop was valued at 15.9 million dollars in 1993. A total of 8,800 acres were planted statewide; Sussex, Warren and Morris accounted for 1900 acres or 21.6 percent of the acreage planted (N.J. Dept. of Agriculture, 1994).

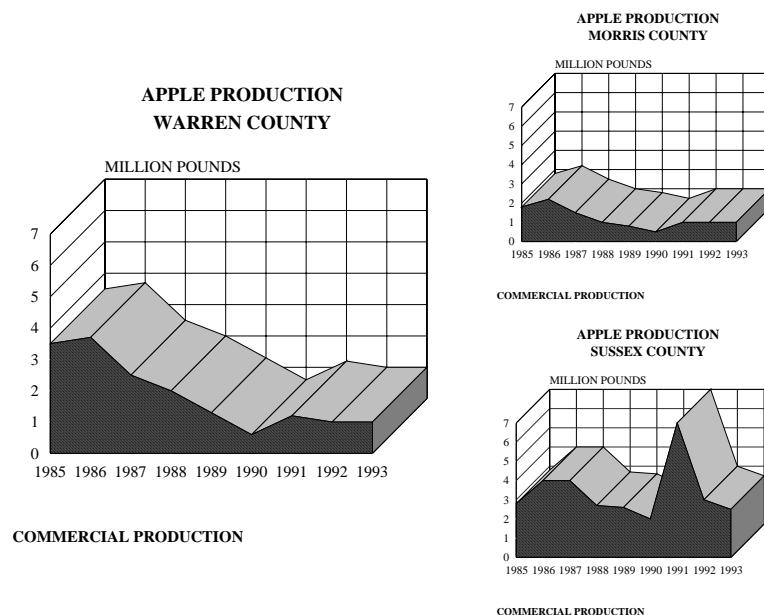
Figure 27.



Of the various fruit crops, apples are used to the greatest extent followed by plums and pears (Mattson, 1990). Bears usually use wild trees and abandoned orchards. Depredations within maintained orchards occur more often when natural foods are in short supply. No significant apple production is recorded in New Jersey's farm statistics

for Passaic County. Apple production in Warren and Morris Counties is stable; apple production is highest in Sussex County (Figure 28).

Figure 28.



Of large livestock raised in New Jersey, depredation by black bear has been reported on sheep, goats, pigs and calves (alleged) and in that order of importance. Sussex County is by far the most important county for sheep production with over 2,000 head reported in 1994, as compared to Passaic, 0; Morris, <1,000, and Warren, 1400. Sheep and lamb inventories are up considerably from earlier years in the 3 counties (Figures 29, 30 and 31) (N.J. Dept. of Agriculture, 1994).

Bears prey on most domestic livestock. Few bears however become stock killers and it is male black bear that are usually involved in this activity (Davenport, 1953). Bears exhibit preferences for the type and age of livestock. Apparently swine are particularly preferred, followed by ewes, lambs and calves. Sheep are killed more consistently and at higher rates than cattle. Research indicates that larger bears prey on larger livestock. Adult male bears take adult and large livestock. Sub-adult bears prey on younger and smaller animals. Female bears are less important predators of domestic

livestock than male bears. Kills on cattle appear to be more related to shortages of natural food supplies than sheep kills (Mattson, 1990). Once a bear acquires the habit of killing livestock it seldom modifies this behavior although the bear may not kill when other foods are abundant (Davenport, 1953).

Goats have been taken by bears in New Jersey; however, goats are not contained in the N.J. Department of Agricultural Statistical reports. The trend in other types of livestock is down; the production of cattle and calves, milk cows, hogs and pigs have all declined. Rabbits and chickens are the most common type of small livestock taken by bears in New Jersey. No commercial rabbit operations have reported losses to bears; backyard rabbit kills are fairly common. These appear to occur mainly where housing developments abut swamps and rabbit hutches are poorly maintained or isolated at the edges of the residences. Rabbit depredations occur mainly in the spring when natural food supplies are low and appears to be an opportunistic event as bears move about the residences utilizing garbage and bird feeders.

The production of egg laying chickens is documented by the Agricultural statistics. However, commercial chicken operations have not reported depredations by bears. Most raids on chickens have been on backyard flocks, and again, as in the case of rabbits, most of the chicken kills that have been documented occurred in areas that border swamp lands and where the chickens are either running loose or are in poorly maintained pens.

Figure 29.

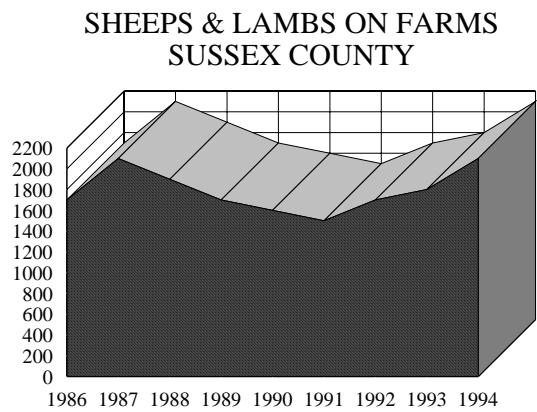


Figure 30.

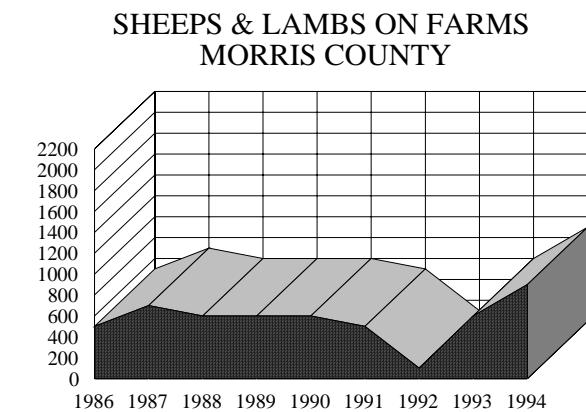


Figure 31.

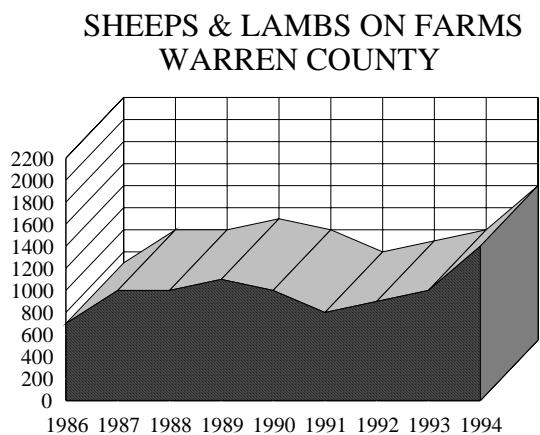


Figure 32.

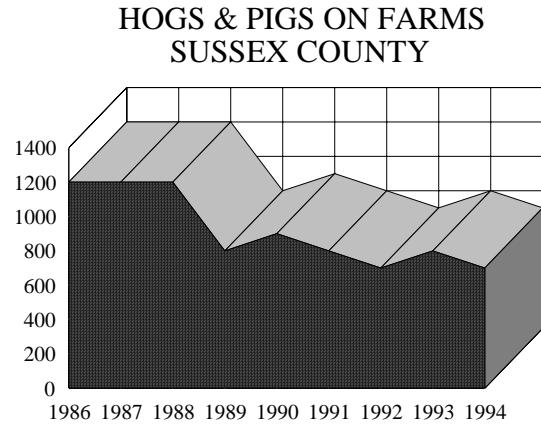


Figure 33.

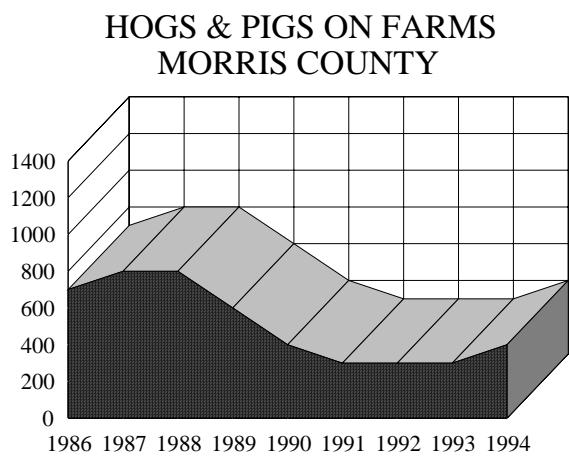


Figure 34.

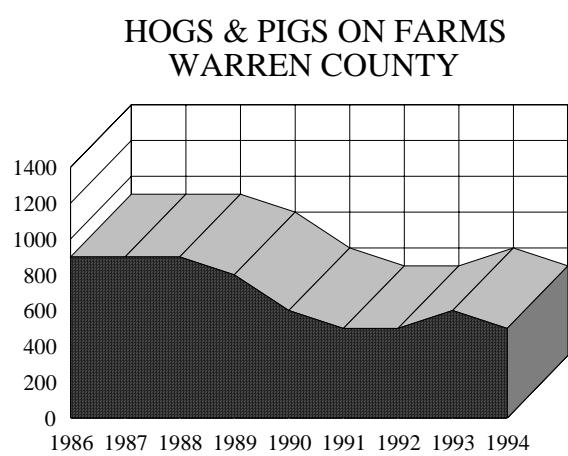


Figure 35.

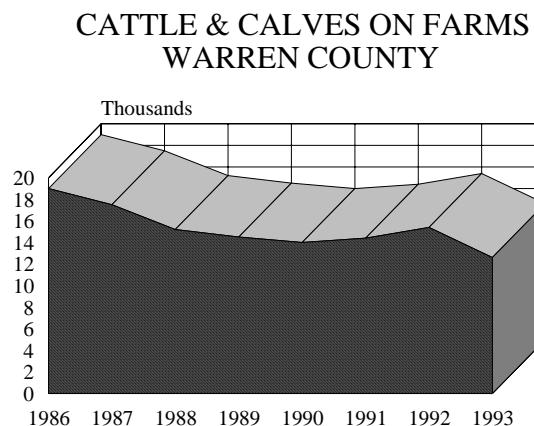


Figure 36.

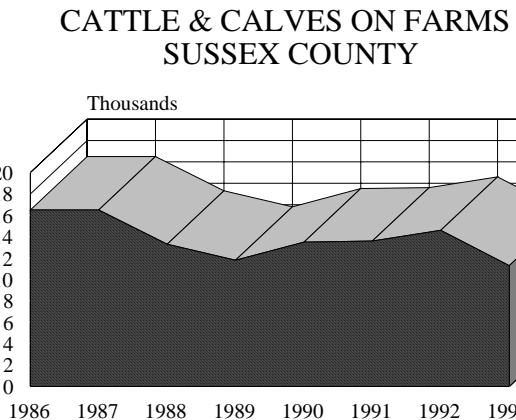
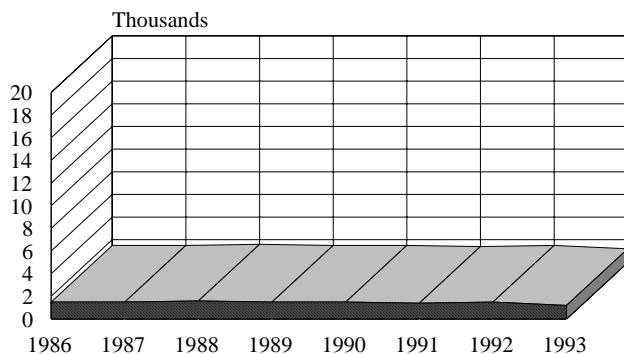


Figure 37.

CATTLE & CALVES ON FARMS
MORRIS COUNTY



Damage to apiaries has comprised from 5.6-41 percent of the monetary damage complaints reported to the N.J. Division of Fish, Game and Wildlife in the past six years. Generally the timing of bear damage on apiaries coincides with peak honey production but is also important in the spring when the hives are a source of protein as well as carbohydrate. Apiaries are located throughout many of the townships of Warren, Sussex, Passaic and Morris Counties (Figure 38) (Stiles, pers. comm.). Passaic County

has the fewest number of apiaries (26): 10 (38.5%) are located in West Milford, an important black bear township (Figure 39).

Morris County has the greatest number of apiaries (108); seven in Jefferson Township and four in Rockaway, the two most important bear townships (9.1%)(Figure 40). Warren County has 96 sites, 19 or 19.8% are in the primary bear townships (Figure 41). Sussex County has the highest potential for damage to apiaries. Black bear are well distributed throughout the county as are the bee yards. Yards that contain large numbers of colonies/supers are found in Branchville, (one yard of 35), Montague (one of 19, one of 16), Byram (one of 21), and Wantage (one of 32, one of 15, one of 12 and one of 11) Townships (Figure 42).

Florida is the leading honey producer in the nation. Most of its important bee yards are within its black bear habitat. Black bear are totally protected; this leads to illegal kills and a hostile attitude towards both the black bear and the game agency. Florida has experienced modest success with snaring (Aldrich spring activated snares)and releasing offending black bear on site (Brady and Maehr, 1982). Of nine bears trapped and released on site, only one bear returned to a beeyard during the study period. Their studies also indicated that beeyards that were unfenced showed a 70% greater probability of bear damage.

Figure 38.

Apiary Yards
Number of Yards

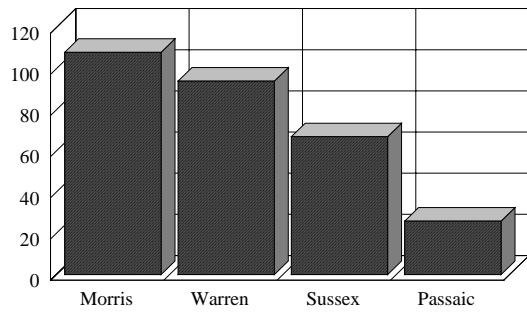


Figure 39.

Passaic County Apiaries

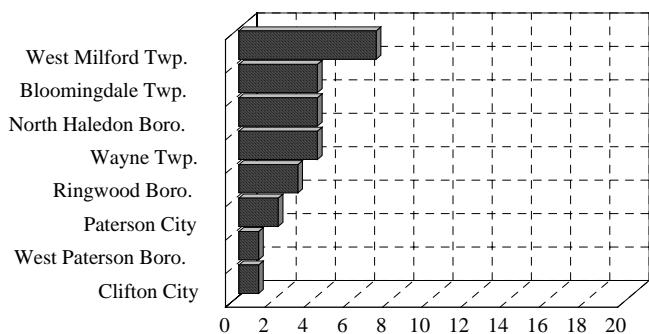


Figure 40.

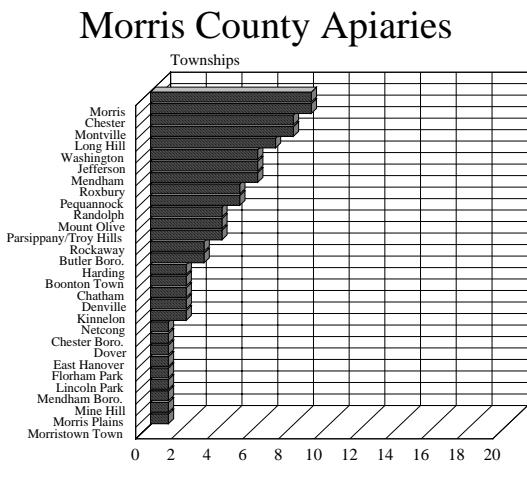


Figure 41.

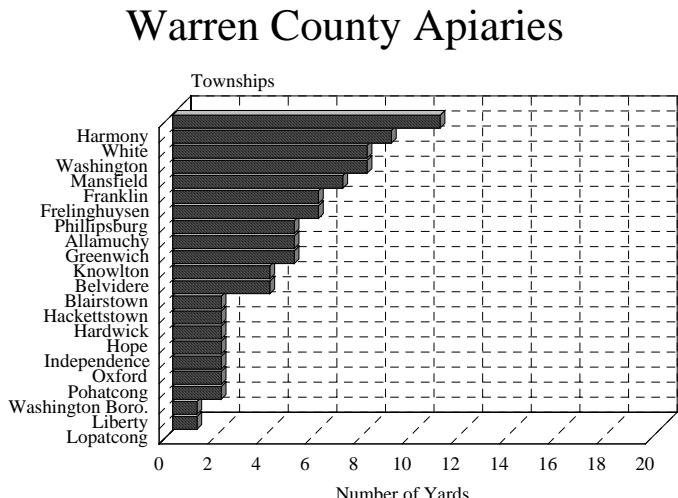
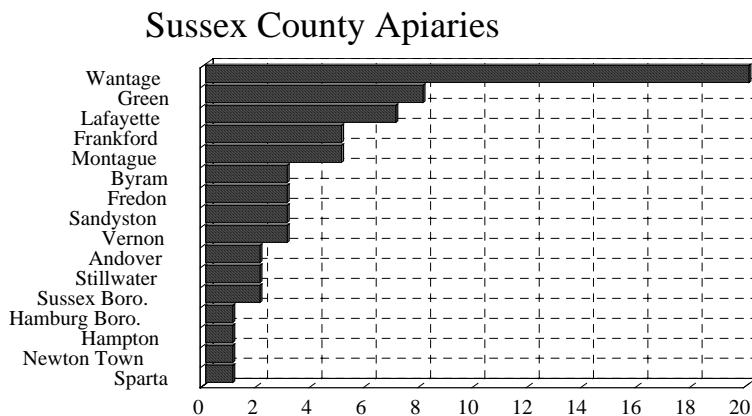


Figure 42.



Summary of Nuisance/Damage Control Efforts

A total of 56 black bear were captured in New Jersey specifically for management/control as opposed to research between April 1, 1981 and June 30 , 1997. Nineteen of the 56 bears were handled in the May/June dispersal/breeding season. It is during this time period that black bear enter or are more visible in highly developed areas, particularly the extreme eastern section of the state. Generally, local animal control agents and police are instructed to leave the bear alone and allow it to pass

unharassed through the community. In the 19 situations, the bear entered confining situations or was harassed by the local citizenry. The nineteen bears were captured by chemical restraint. One male died as a result of internal injuries sustained during the capture. Eighteen (17M,1F) were relocated to a more rural setting. One male was relocated twice. The one female has been successful in establishing a new home range in the area of her relocation. Of the 17 males, subsequent information has been obtained on 11 (64.7%). Five of the 11 were recovered in adjoining states; 3 in Pennsylvania, 2 in New York. All five were killed shortly after relocation; 3 were legal kills, 2 were vehicle kills. Two males returned to their normal home ranges (one bear returned to his birth area; one male returned to the northern section of his home range.). Two of the males created new home ranges (one 14.6 miles south of the relocation site; one 15.3 miles southeast of the relocation site). Two males were sighted shortly after relocation, one was 13.7 miles southwest of the relocation site, the other was 3 miles southeast of the relocation site.

Of the remaining 37 bears, 13 (11M, 2F) were involved in damage situations ranging from beehives to breaking windows in campground vehicles. Ten bears (9M,1F) were captured and relocated (the relocated female had two cubs which were moved with her); two males and one female were aversely conditioned* and released on site. The female with two cubs successfully established a new home range 9.01 miles southeast of the relocation site. However, after several months, she resumed her behavior of breaking into vehicles, entered an occupied house and attempted to enter a second house. She was recaptured and euthanized. Of the nine relocated males,

*Sprayed with Counter Assault (10% solution of oleoresin capsicum), shot with rubber buckshot, hazed with screamer rockets.

subsequent information was obtained on seven. Two of the seven are known to have been killed shortly after relocation. One was a legal New York kill within several weeks of his relocation. A second male was illegally killed in Pennsylvania three months after relocation. Two other males returned to areas near the capture site. One, a livestock killer, was known to have killed livestock in New York several months later. The second male, involved in beehive depredation, has not been reported/identified in other damage situations. Two of the seven males have been successful in creating a new home range which include areas near the relocation site (relocated twice). The seventh male was relocated less than two miles away from the capture site; has not been identified as being involved in beehive damage.

Several bears were handled during damage situations and were relocated/aversely conditioned in an effort to mark and identify the bear causing the damage. These were areas of high bear densities; identification of the offending individual was difficult or impossible. Ten bears (7M,3F) were handled under these circumstances. Of the ten, six (5M,1F) were released on site, four of the males and the female were aversely conditioned. The other four bears (3M, 1F) were relocated. Of the four who were relocated, all returned to the original site within 3-7 days. All were mature adults with established home ranges and relocated less than 25 air miles away.

Ten bears (7M,3F) were handled in an effort to resolve nuisance situations ranging from bears into dumpsters to climbing on decks. In 1982, three males were trapped after becoming neighborhood nuisances; the situation was caused by repetitive feeding by landowners (two of the males were relocated, of which one returned to the site; the third was released on site). Relocation has not been used for this type of

situation since 1982. Public education and encouraging local municipalities to pass anti-feeding ordinances are the preferred methods at present.

One male bear was euthanized. Lack of cooperation from the public who continued to feed the bear near the shoulder of a heavily traveled road resulting in a traffic hazard was the main factor in the need to capture this animal. The three year old male had no use of one front paw and was considerably underweight for his age and area. The male was relocated a short distance away (4.0 miles) in hopes that the local Police Department would remedy the traffic situation. Several days later the bear returned to the site and the traffic problem was unresolved. The animal was considered a poor candidate for relocation into unfamiliar territory and was therefore euthanized.

One male bear was enclosed in an electrified horse pasture, was captured, moved a short distance, and was legally killed in Pennsylvania shortly after. Seven of the eight remaining bears in the nuisance category have been re-involved in panhandling and/or dumpsters. However, none are known to have been re-involved at the same site.

Four bears, all cubs, were rehabilitated in captivity (three were held for two months, one held for three weeks) and relocated to new areas. The three (2M,1F) held for two months are utilizing the area of the relocation site; the fate of the cub (1M) held for three weeks is unknown.

In summary, 56 bears (46M,10F) have been handled for control/management purposes (April, 1981-June, 1997) (Figures 43 and 44). Of the 56, 15 (11M,4F) were tagged on the research trap/den line prior to the control/management capture. Additionally, three of the 56 (three males) were Pennsylvania tagged bears.

One male died of injuries sustained during the capture attempt.

Of the 56, 44 bears (37M,7F) were relocated distances of 1.5-63.2 miles from the original capture site. Of these 44, ten (9M:1F) were known to be involved in monetary damage situations, eight (6M,2F) were involved in nuisance situations and one (1M) caused a traffic hazard. Eighteen (17M, 1F) were "spring wanderers" into developed areas, four (3M,1F) were rehabilitated cubs, and four (2M,2F) were relocated in an attempt to identify problem bears. Four bears (3M,1F) was relocated twice; one relocation was 31 miles away; this bear (a nuisance animal), returned to original capture sites both times, another male, originally a monetary damage complaint bear, was initially relocated 32.5 miles away from the capture site and was recaptured near the area when attempting to return. The third male (a spring wanderer), was removed from a suburban situation and relocated 43.0 miles away. The animal was subsequently captured when it attempted to navigate through another suburban area. The female was relocated 1.5 miles from the capture site and was recaptured upon returning to the original site.

Figure 43.

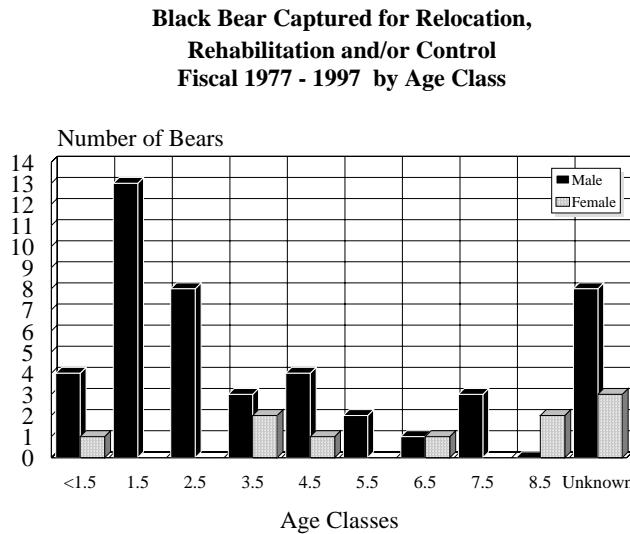
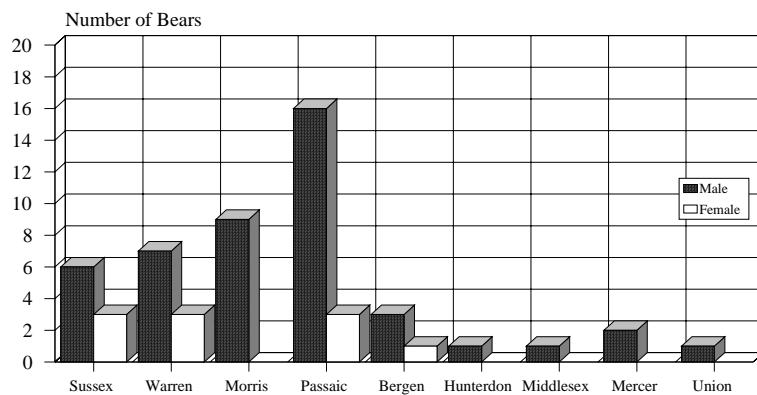


Figure 44.

**Black Bear Captured for Relocation,
Rehabilitation and/or Control
Fiscal 1977 - 1997 by County**



The remaining eleven (8M,3F) of the 56 were released on site. Of these eleven, three (2M,1F) were known to be involved in monetary damage situations, two (1M,1F) were involved in nuisance activities. The other six (5M,1F) were caught in an attempt to identify a problem bear.

Information subsequent to capture has been obtained on 41* of the 56 bears.. Released on Site: of the eleven bears (8M,3F) released on site two (males) are known to be dead and a third is assumed to be dead. Four males and 1 female have been sighted multiple times. Relocations: of the 44 (37M,7F) bears that were relocated, 13 (12M,1F) are dead. Eight** were killed within six months of the relocation. Eleven (9M,2F) of the relocated bears returned to site. Two male bears were in the process of returning and were recaptured within 25.0 and 12.2 miles of the original site and relocated a second time (one of the males is included in the eight killed within six months of relocation).

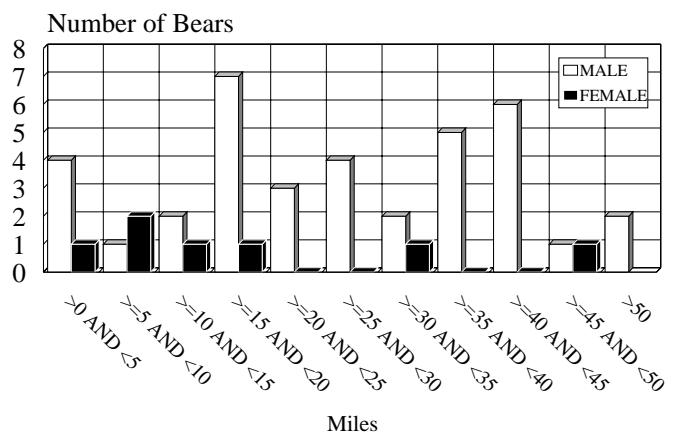
*Does not include 1M, 1F euthanized by the Division, and 1M who died of internal injuries.

** Does not include 1M, 1F euthanized by the Division.

Relocation distances (Figure 45) were highly variable and ranged from 1.5 to 43 miles for the 13 bears who returned or were apparently attempting to return to the original capture/complaint site. Relocation data was analyzed by Rogers (1986) on 179 black bear from 11 states and provinces. He concluded that adult black bear should be relocated >40 miles to assure that less than 50% of them return. Sub-adult males may not return when only relocated ≥ 20 miles, however, he noted that many of the bears who do return either cease their nuisance activity or delay resuming nuisance activity until the following year.

Figure 45

DISTANCE IN MILES FOR RELEASE OF
RELOCATED BLACK BEAR BY SEX



N=44 INDIVIDUALS, CHART INCLUDES 1 FEMALE AND 3 MALES EACH
RELOCATED 2 TIMES

Other researchers have found that relocation of nuisance bears reduces their nuisance activity regardless of the relocation distance. It should be recognized that the stress of placing a subdominant bear in an area where the natural carrying capacity is exceeded may increase mortality (Alt, 1980, Rogers, 1986, Garshelis, 1989).

Relocation distances are severely constrained by available habitat and accessible relocation sites in New Jersey. Whenever possible, adult bears should be relocated the maximum distance recommended (40 miles). Subadult bears should be relocated no less than 20 miles; this distance is obtainable in almost every conceivable situation.

Black Bear Potential for Injury/Fatal Aggression

Dr. Stephen Herrero has studied both grizzly and black bear. He has documented and analyzed encounters between these two species and human beings extensively. According to Herrero's research, black bear injured over 500 people in North America between 1960 and 1980. Over 90 percent of the recorded black bear inflicted injuries were minor. Bears habituated to people and conditioned to eat human foods were implicated in over 90% of these incidences. Usually the incidents involved bears in campgrounds or bears begging for food along the roadsides (Herrero, 1985).

Most of the injuries occurred in national parks.

Black bear/human interactions have been studied extensively in several National Parks. Shenandoah National Park in Virginia has one of the densest black bear population in North America. (1 bear/.42-.58 mi² [1.096-1.49km²]) (Garner and Vaughn, 1989). The park has high road access and many campgrounds, lodges and trails. Between 1970 and 1986, there were a total of 1,461 documented black bear incidents which resulted in 19 injuries; 14 of the 19 injuries occurred between 1970 and 1976, only five injuries occurred between 1976 and 1986. No fatalities have occurred in Shenandoah (Garner and Vaughan, 1989).

The Great Smokies Mountains National Park in Tennessee reported 1,028 black bear incidents (includes bear control actions, property damage and personal injuries)

from 1964 to 1976; 107 people were injured. Thirty-two of the injuries involved people feeding bears; three involved people petting bears (Singer and Bratton, 1980).

Wild free ranging black bear have been known to have directly inflicted two injuries to humans in New Jersey. In 1986, a woman in Franklin, Sussex County received three minor scratches when she encountered a bear in the dark at her residence. In 1996, an individual was bitten on the finger when he extended his hand towards a bear. Neither individual received medical treatment. In 1997, in a third incident, a woman walking a dog was allegedly charged by a bear; upon turning to run, she fell over a rock wall, and required medical attention for an injured arm.

Herrero and Higgins (1995) documented black bear incidences which led to the death of 37 humans between 1907 and 1993. Of the 37 deaths, 25 have occurred since 1969. Fatalities have been more common in less developed/remote areas than in more developed areas. Fatalities are generally associated with three geographic areas; Alaska, Alberta/British Columbia and Ontario/Michigan. The researchers concluded from their investigations into the 37 deaths that black bear rarely kill people due to intrusion on its space or in defense of cubs. A bear that kills is also very rarely a campground or garbage bear. Bears known to have a history of feeding on peoples food or garbage were involved in only three of the 37 attacks. Only two of the 37 fatalities occurred in a national park. Most of the black bears involved in fatal attacks on human beings lived in less developed/remote areas and apparently had little or no prior contact with humans. Predation was the motive in 29 of 34 deaths where the attacking bears motivation could be inferred. Male bears were involved in 18 fatal predaceous attacks where the sex of the bear could be determined. The motivation in fatal attacks by black bear appears to be one of predation; the black bear stalks and kills the human for food, an event that is

extremely rare (Herrero, 1985, Herrero and Higgins, 1995). John O'Pezio, a black bear specialist with New York places perspective on both fatality and injury figures. During the period of 1960 through 1980, he tallied a minimum of 77 million recreation days spent by people in areas occupied by New York's 4,100 black bear. Only three bear-related injuries occurred, all of which were minor (Herrero, 1985).

Table 5. North American Human Fatalities Caused by the American Black Bear

Year	Location	Human Gender
Unk./prior to 1980	Calgary District, Alberta	1 female
Unk./prior to 1980	Chebaygan Co., Michigan	1 male
05/17/07	Red Deer River, Alberta	1 male
11/13/24	Port Arthur Dist., Ontario	1 male
08/30/29	SW of Brightstone, Manitoba	1 female
07/07/48	Sault Saint Marie, Michigan	1 female (3 yr old)
01/ /53	100 miles NW of Anchorage, Alaska	1 male
08/12/58	Jasper National Park, Alberta	1 female (7 yr. old)
06/23/61	Sudbury Dist., Ontario	1 male
08/19/63	160 miles west of Fairbanks	1 male
08/07/67	Vernon, British Columbia (B.C.)	1 female
10/01/68	Atikikan, Ontario	1 male
07/25/71	37 mi. SSW Estes Park Holzwarth Ranch Colorado	1 male
05/ /74	Glenwood, Washington	1 female
07/22/76	State Creek, Alaska	1 male
08/28/76	Henes Creek, Alberta	1 female
05/13/78	Algonquin Park, Ontario	1 male
05/13/78	Algonquin Park, Ontario	1 male
05/13/78	Algonquin Park, Ontario	1 male
06/19/78	Porcupine Mts. Wilderness St. Park, Michigan	1 male
07/18/80	Leo Creek, British Columbia	1 male
08/01/80	Glacier Bay National Monument, Alaska	1 male
08/17/80	Zama, Alberta	1 male
08/21/80	Zama, Alberta	1 female
05/21/83	Canwood Prov. Forest, Saskatchewan	1 male
0525 /83	Nipawin Prov. Park, Saskatchewan	1 male
07/06/83	LaVerendry Wildlife Reserve, Quebec	1 male
05/29/85	85 miles So. of Fort Nelson, B.C.	1 male
08/14/85	Grand Teton National Park, Wyoming	1 female
06/24/87	100 miles E of Stewart, B.C.	1 male

**Table 5. North American Human Fatalities Caused by the American Black Bear
(continued)**

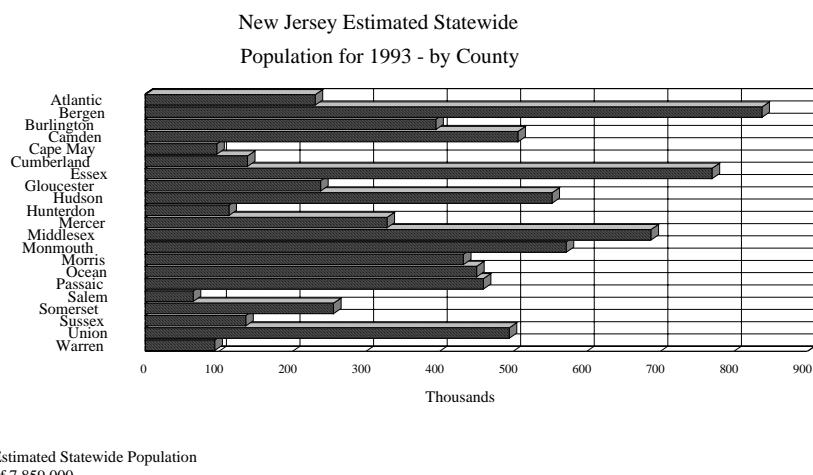
Year	Location	Human Gender
11/11/87	SE of Grande Prairie, Alberta	1 male
05/26/91	Martin River Campground, Alberta	1 male
10/11/91	Algonquin Park, Ontario	1 male
0/11/91	Algonquin Park, Ontario	1 female
06/14/92	Abitibi Lake, Cochrane, Ontario	1 male
07/08/92	West of Glennallen, Alaska	1 female
08/10/93	WAGH Mountain, Colorado	1 male

(Herrero 1985, Herrero and Higgins 1995)

New Jersey Growth Trends: The Human Dimension

The greatest number of New Jersey's residents live in the highly developed counties of Bergen, Essex, Middlesex, Monmouth, Hudson and Union. The least populated counties include Sussex and Warren which are two of the four main counties containing significant numbers of black bear. Morris and Passaic, the other two significant bear counties, are comparable to Union in numbers of people (Figure 46).

Figure 46.

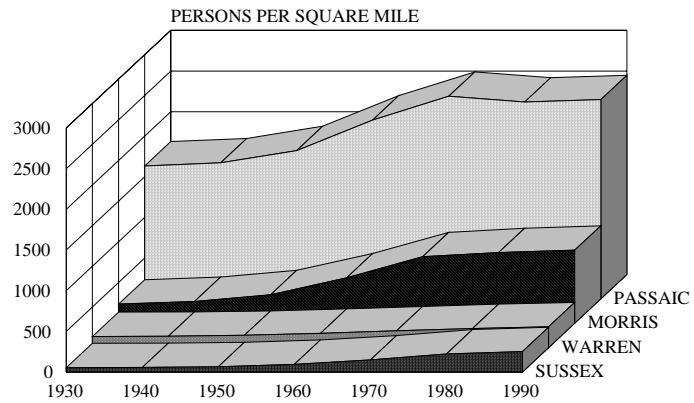


New Jersey's population increased by 18.2 percent between 1960 and 1970. The growth rate decreased to 2.7 percent between 1970 and 1980. Growth is on the rise again and by the year 2000, New Jersey's population is estimated to be 8.0 million people (U.S. Censuses of Population and Housing, 1990).

Sussex County accounts for the highest percentage of New Jersey's black bear population. Accordingly, Sussex County also accounts for the majority of sightings, the majority of vehicle kills and the majority of complaints. Sussex county has the highest acreage (521 square miles) and the lowest number of people per square mile of the four major bear counties (Sussex, Passaic, Warren and Morris) (Figure 47). In 1980, the time period that black bear began a dramatic recovery in New Jersey. Sussex County had 223 people per square mile. Sussex County was emerging at that time as one of the most popular counties for new residential building. In 1970, the density was 149 people per square mile, the 1980 figures are a 50 percent increase over those of 1970. Growth rate slowed somewhat in the decade of 1980-1990. The 1990 density is 12.6 percent higher than that of 1980 (U.S. Censuses of Population and Housing, 1990).

Figure 47.

POPULATION DENSITY 1930-1990

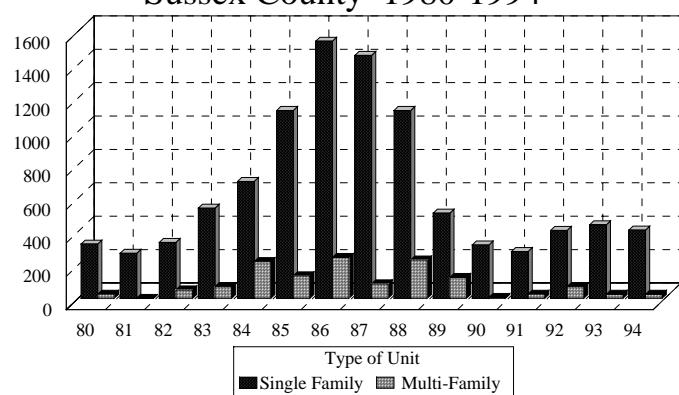


Sussex County has been adding single family housing at the rate of 400 permits per year since 1992. This is a much lower growth rate than observed in 1986 when the number of housing units peaked at almost 1600 new single family units (Figure 48).

Vernon Township (located in the northeast section of Sussex County) accounted for 26.5 percent of all the building permits issued in Sussex County between 1990-1994. Vernon Township has a large black bear population. Sparta Township is located southwest of Vernon Township. Sparta accounted for 19.2% of all building permits issued between 1990-1994 (Sussex County Planning Dept.). Bearfort black bear utilize Sparta Township heavily as a travel corridor connecting the northeast, southwest and southeast areas of the Bearfort region. There is also recent limited evidence that Sparta Township is the travel corridor through which Kittatinny bears disperse to the Bearfort region and vice versa.

The trend in Sparta and Vernon Townships forecasts a continual increase in bear/human conflicts. Habitat loss and increasing fragmentation of habitat will force more bears to travel through residential areas. This may well result in decreased tolerance for black bear.

Figure 48. New Housing Units
Sussex County 1980-1994



Of the four main bear counties, Passaic County has the greatest population density with 2,449 people per square mile in 1990. However, the majority of Passaic County's human population is in the southern townships; the black bear population is found mainly in the northwestern townships of West Milford and Ringwood Boro. Ringwood Boro has shown little expansion. West Milford, however, issued 51 new dwelling unit permits in 1993 and 141 permits in 1994. West Milford was second only to the townships of Wayne and Clifton City in new dwelling permits in the past two years (Passaic County Planning Board.).

The majority of Warren County's black bear population is found north of Interstate 80. Overall, Warren County added over 7600 new housing units between 1980 and 1995. The townships north of Interstate 80, Blairstown, Hardwick, Knowlton, Pahaquarry, Hope and Frelinghuysen accounted for 478 or 6.3% of the new units added between 1980 and 1995. Knowlton Township has experienced the largest percentage of growth of these six northern townships, increasing its housing by 18.9% (168 units) between 1990 and 1995 followed by Hardwick (14.1%) and Frelinghuysen (11.7%) (Warren County Planning Dept.).

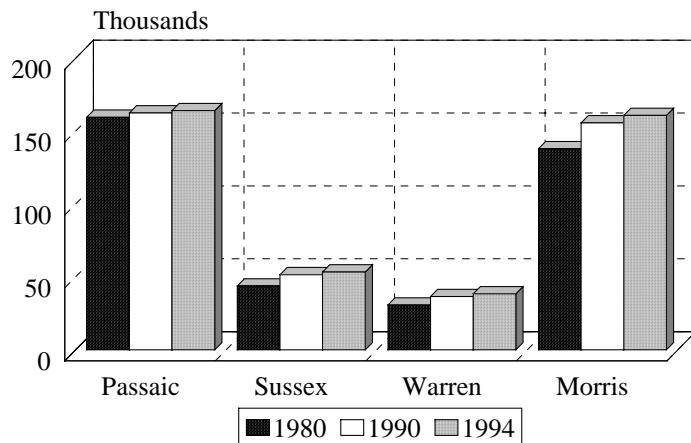
The black bear population in Morris County is located primarily in Jefferson and Rockaway Townships (north of Interstate 80 and west of Rt. 287). Morris County, already quite densely populated by 1980, has shown a less dramatic rate of growth in the last five years than the other three counties. Morris County added 5,106 new housing units between 1990-1994 for a net growth rate of 3.3%. Most of these additions were made in Chatham (250), East Hanover (318), Hanover (280), Montville (729), Morris (408), Pequannock (229) and Randolph (548). Jefferson Township added 145

units and Rockaway added 243 units (Figure 49) (Morris County Planning and Development).

TOTAL HOUSING UNITS

Figure 49.

1980 - 1994



Public Land/Open Space

The few sightings received of black bear in southern New Jersey over the last two decades have not been verified although several are considered highly reliable. The black bear population is concentrated in the northwestern and northcentral areas of the state primarily because the habitat in these areas is contiguous with occupied black bear habitat in New York and Pennsylvania. The proximity of occupied habitat facilitated immigration of black bear to New Jersey.

Immigration of black bear to southern New Jersey is impeded by both the absence of high populations of black bear contiguously and by important physical barriers such as the New Jersey Turnpike and other highly congested multilane highways. As discussed in previous sections, female black bear in particular avoid highly congested thoroughfares.

Southern New Jersey contains quality longterm habitat for black bear. Over 1.1 million acres is contained in the Pinelands National Reserve established by Section 502 of the National Parks and Recreation Act of 1978. The area encompasses portions of the seven counties of Atlantic, Burlington, Camden, Cape May, Cumberland, Gloucester and Ocean counties. The Pinelands contain extensive and dense forests of pine and oak, cedar and hardwood swamps, pitch pine lowlands, bogs and marshes. Of the 1.1 million acres, 933,000 acres within the state planning area established by the Pinelands Protection Act of 1979. Under the state legislation, the Pinelands are further divided into the Protection Area (565,000 acres) and the Core Preservation Area (368,000 acres). Residential and commercial development is limited to low density ventures in the Protection and Core areas.

Of the 1.1 million acres, approximately 1/3 are publicly owned. These public lands are concentrated in the Core Preservation Area. The majority of the Core Area falls within Burlington County and western Ocean County. State owned lands (275,000 acres) in the area include Wharton and Lebanon State Forests and Colliers Mills Wildlife Management Area (Pinelands Commission, 1985).

In 1981, the Division of Fish, Game and Wildlife proposed the reestablishment of a resident black bear population within the Pinelands National Reserve Area. The proposal called for the introduction of 40 black bear (primarily sows with cubs) over 5-6 years, with an initial introduction of two family groups in 1982. The proposal generated extensive media coverage and received little or no support from various agricultural interests, municipalities, individuals and organizations. The Department of Environmental Protection deferred any further action on the proposal in September, 1981.

Statewide, New Jersey has over 805,274 acres dedicated to open space and outdoor recreation. It is a significant increase from the 382,500 acres in public open space that existed in 1961 (the year the Green Acres Program was initiated). The goal of New Jersey's Outdoor Recreation Resource Plan under the Balanced Land Use Guidelines is to acquire over one million acres of public open space/recreational lands. The >1 million acre figure does not include deed restrictions, subdivision open space, nor does it include coastal and freshwater wetlands (N.J.D.E.P. 1989, Petrongolo pers. comm.).

Of the 805,274 acres statewide, federal agencies hold the title to 93,731* acres, state agencies own over 537,994 acres, county and municipal governments own 137,670 acres, the N.J. water authority and reservoir sites account for > 8,000 acres and non-profit organizations own 27,864 acres. The state owned acreage is divided between the Division of Parks and Forests (303,951**), Division of Fish, Game and Wildlife (226,729***) and the Natural Lands Trust (7,313).

The four main black bear counties (Sussex, Passaic, Warren and Morris) have a combined total of 200,226 acres of public or quasi-public land. Sussex County, the largest of the four main bear counties (>343,000 acres), has > 25% of its overall acreage in public or quasi-public ownership, with a total of 86,575 acres (Figure 50). Passaic County has the lowest overall land base with >125,000 acres: almost 34% of its land is in open space >(42,661 acres). Most of the public/quasi-public lands are found in the northwestern townships of West Milford and Ringwood, providing large contiguous

* as of 2/96

** as of 1/96

*** as of 6/95

blocks of undeveloped and quality habitat for black bear. Passaic county also has the highest ratio of coniferous and coniferous mix forest cover types to deciduous forests of the four main black bear counties (Figure 51).

Warren County has over 11.5% of its >230,000 acreage in open space (>26,419 acres); Morris County has 14.5% of its > 307,000 acres in open space (>44,550 acres) (Petrongolo pers. comm.). Warren and Morris counties have a greater percentage of their acreage in non-forest land than Sussex and Passaic counties (Figure 52).

Over two million acres (2.007) of New Jersey is forested (42%). Of the 2.007 million acres, 1.864 million acres or 93% is classified as timberland (commercial forest land). Oak/hickory is the dominant forest-type on New Jersey's timberland and occupies 47% of the acreage. Over 75% of New Jersey's timberland is privately owned.

The majority of timberland acreage is in the southern counties. Burlington, Cumberland, Ocean, Salem, Camden, Gloucester, Atlantic and Cape May account for 1,044,800 acres.

Of the northern counties, Sussex County has the most acreage in timberland (181,800 acres), followed by Morris County (122,500 acres) (DiGiovanni and Scott, 1987).

Figure 50.

Open Space as Compared to Total Land Area (in Acres)

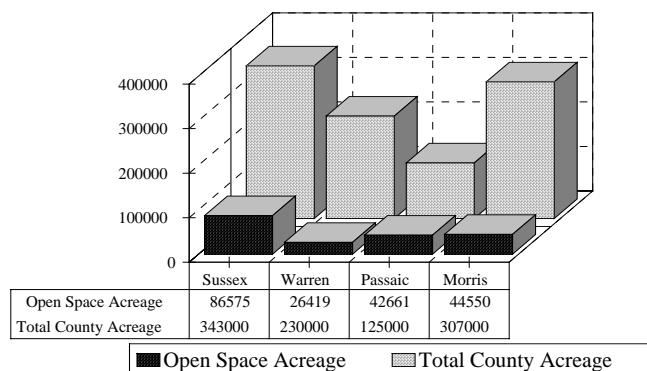


Figure 51.

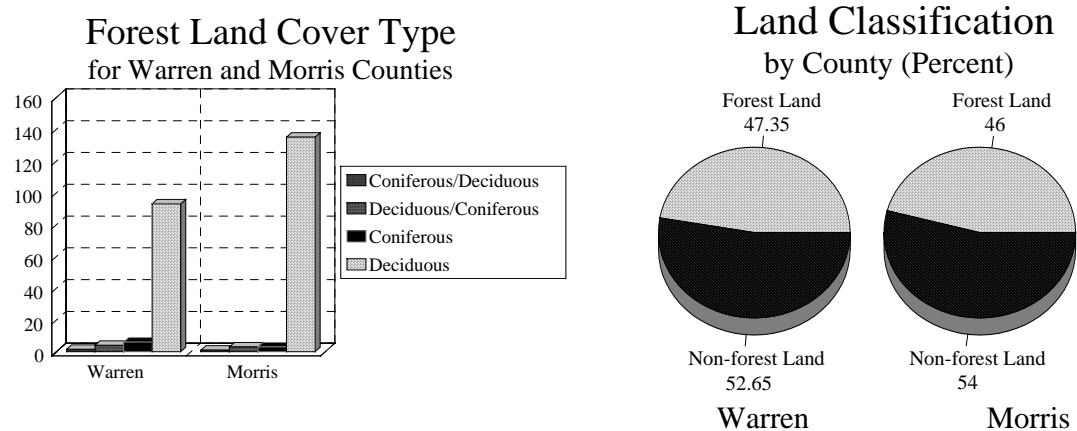
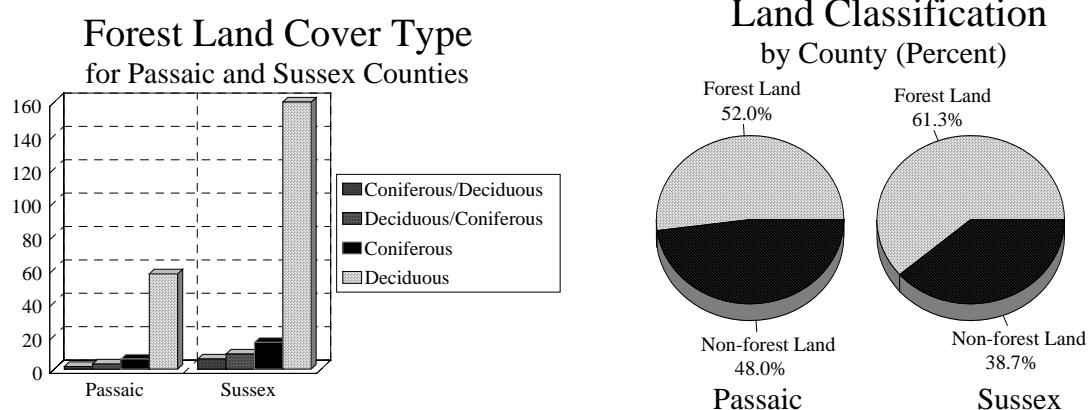


Figure 52.



BLACK BEAR MANAGEMENT:

Premise and Goals

Premise

1. The Division of Fish, Game and Wildlife is committed to maintaining or restoring native species of wildlife to areas of available habitat where negative human impacts can be maintained at manageable levels. The black bear is a native New Jersey species which, though at times low in numbers, has never been totally extirpated from the state. Black bear have been able to reestablish their numbers as a result of the protection and enhancement of habitat, a closed season and emigration of bears from surrounding states. The Division of Fish, Game and Wildlife has never restocked this native species. High quality black bear habitat still exists. Potential and actual human conflicts can be minimized by a combination of management techniques.
2. Public attitudes toward the black bear are generally positive. Many New Jersey residents consider a sighting to be a highlight of their time afield. The black bear in New Jersey is considered by many as a symbol of the few wild places remaining within the state. Some feel that as long as the bear can live here, a quality life for man may be found here also. Other residents of New Jersey view the black bear as a possible threat to their safety and/or express concern about the bears potential for damage to property and agriculture. The management of New Jersey's black bear population is an integral part of maintaining a balance between the number of bears that the human population is willing to tolerate in close proximity (cultural carrying capacity) and the number of black bear that the habitat can support (biological carrying capacity).

3. The black bear has adapted to a relatively high level of human encroachment in its environment.

The Goals of Black Bear Management in New Jersey

1. Maintain a healthy, stable black bear population within suitable habitat at a density that will minimize residential and agricultural conflict.
2. Provide recreational and esthetic opportunities for the citizens of New Jersey.

Objective I. Promote black bears as a historical and integral part of New Jersey's natural environment and inform the public of ways to avoid damage situations.

Strategy A. Educate and Inform: The black bear is subject to much misinformation. The support of the public is essential to the Division of Fish, Game and Wildlife's success in reaching the management goals for black bear. Public education efforts to inform the public about bear biology and behavior has been shown to increase the public's tolerance for black bear and reduce conflict. The NJDFGW has and will continue to utilize the following to increase the public's knowledge and awareness of black bear: slide shows, TV and radio spots, newspaper and magazine articles, films, brochures and public participation/observation of research techniques. It is estimated that over 1,500 individuals have participated as observers during the recovery of radiocollared female black bear from their dens and tagging of their cubs during the winters of 1984-1995. The following information is presented during the above activities.

1. History and present status of black bear in New Jersey.
2. Life history, biology and behavior of black bear.

3. Relationship between habitat and the presence of black bear.
4. Research techniques and results in New Jersey.
5. Response to black bear while hiking, camping, and other outdoor activities.
6. Avoidance of nuisance damage situations involving residential or personal property.
7. Protection of livestock/apiaries.
8. New Jersey's nuisance and depredation policies.
9. Management options and the positive/negatives of each.
10. Impact of loss of habitat, concepts of carrying capacity, black bear as an indicator of the quality of the habitat.

The Division's educational efforts have to be geared to the fact that New Jersey's residents are very mobile. The effort must be frequent and continuous. Between 1985 and 1990, 1,428,225 New Jerseyans changed housing within their county of residence. Another 662,049 New Jerseyans moved to a different county within the state. Almost 1 million residents left the state (763,123). During the same time frame, almost a million new people (569,590 US citizens, 211,417 immigrants) moved into New Jersey. Most of the inflow and outflow was by people between the ages of 20 and 44 years old.

Four counties (Sussex, Passaic, Warren and Morris) contain the majority of New Jersey's black bear population. In those counties during the years 1985-1990, only 57.2 - 59.4% of the people in each county maintained their same residence. Sussex county had nearly 70,000 people maintain their same residence in the 5 year period, 20,000 changed their residence within the county, 30,500 left the county and over 31,200 new people moved into the county (N.J. Dept. of Labor, 1995).

Objective II. Reduce and maintain New Jersey's black bear population at a lower level than presently exists.

New Jersey's black bear population is presently estimated at 450-550 bears. Continual fragmentation of habitat and the projected growth of the human population has made it untenable to continue maintaining a black bear population at its present level (450-550) and density (one bear/1.2-1.5mi²). The level of conflict observed between humans and bears, consisting of perceived threat, nuisance situations and monetary damage in 1995 and 1996 clearly demonstrated the results of a poor to moderate food year on an urbanized, dense black bear population.

The immediate management goal is to reduce the numbers and density of black bear and maintain the population at a lower level (272-340 bear; one bear/2.0-2.5mi²).

Strategy A.: Establish black bear management zones on which to base decisions affecting the future of black bear in New Jersey.

Recognition of differences in development, access, topography, hunting pressure, soil quality, land ownership and food production has been the basis of zone management for many of New Jersey's game and furbearer species. Deer, turkey, beaver, otter, waterfowl and woodcock are examples of wildlife managed under this concept. One of the prime considerations for black bear will be the difference in land ownership. A large percentage of New Jersey's black bear population resides on public land. Publicly owned land often provides the only or largest contiguous tracts of undeveloped forested land. New Jersey's black bear population is also part of a regional population which includes New York and Pennsylvania. The Kittatinny population is primarily affected by ingress and egress from and to Pennsylvania; the Bearfort

population is more influenced by New York. Management decisions in New York and Pennsylvania affect the respective adjacent areas in New Jersey.

Logical zoning boundaries would include separating the Bearfort population from the Kittatinny population and separating contiguous publicly owned land from private land.

Strategy B.: Reestablish a hunting season for black bear to provide recreational opportunity for the sporting public and maintain the bear population at a level consistent with residential and agricultural concerns.

The management of black bear is based on the percentage of the population that can be harvested annually without subjecting this species to overexploitation. Generally, the percentage of the black bear population (> 1.0 year old) that can be annually harvested is 15.9%. An annual harvest of 14.2% can be sustained on the entire population if cub mortality is considered (Miller, 1989).

The following is the percentage of the minimum estimated black bear population that various states allow to be utilized by sport hunting: Minnesota, Pennsylvania, Virginia and Wisconsin allow the harvest of over 20% of their minimum estimated population (Alt pers. comm., Martin pers. comm., Schad 1992, Kohn, 1992, McCracken et al., 1995). Michigan, New York, North Carolina, Vermont and West Virginia allow the harvest of 10.1 - 20%, and Arizona, Arkansas, Colorado, Georgia, Idaho, Massachusetts, New Hampshire, Oregon, Tennessee, Utah and Washington allow hunters to take three to eight percent of their minimum black bear population. Alaska and South Carolina allow the use of less than 3% (McCracken et al., 1995, Berchielli, 1992). The listed states are highly varied in habitat, access, black bear densities, reproductive potential and

management goals. They are also highly varied in the structure of their season and means of take.

New Jersey has a highly productive black bear population. New Jersey's female black bear breed at a young age and have relatively large litters as previously discussed. Because of its high reproductive rate, New Jersey's black bear population should be able to sustain a high mortality rate as compared with other black bear populations. Productive black bear populations can generally sustain annual losses of approximately 20-25% (all forms of mortality) (Kolenosky and Strathearn, 1987).

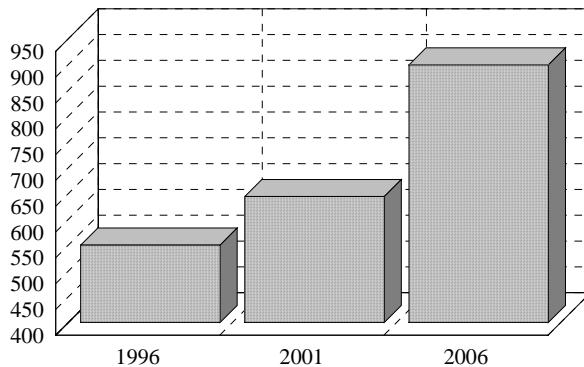
Bunnell and Tait (1985) developed a graphical model of bear populations and used it to determine the percent of the population that could be legally harvested annually without decreasing population size. Using the natality rate and age at first reproduction of New Jersey's bears in Bunnell and Tait's model, it was determined that New Jersey's bear population can sustain an overall mortality rate of 25-27%. The Bunnell and Tait model was reworked to determine what annual harvest rate could be sustained by the adult female black bears in New Jersey. The model was applied to the data from radiocollared females. This predicted a sustainable harvest rate of 19-21% in the Kittatinny region and 2-3% in the Bearfort region.

Objective II of the black bear management plan is to reduce and then maintain the bear population at 272 to 340 bears. Based on the results of modeling, the overall mortality rate should exceed 27% and the harvest on female black bear should exceed 21% in the Kittatinny region and exceed 3% in the Bearfort region in order to initiate a reduction in the size and density of the population.

Given the present mortality rate observed on black bear, New Jersey's black bear population is expected to almost double in size within 10 years unless an additional source of mortality, i.e., hunting, is introduced. (Figure 53).

Figure 53.

Projected Growth of New Jersey's Black Bear Population
1996 - 2006 As Based on Present Mortality Rate



The population models, the projected growth of the population and the harvest estimates above rely on the accuracy of the population density, mortality and reproductive rate estimates, and must be interpreted with caution. In addition, none of the models incorporate density-dependent mortality, which may be an important influence on subadult survival. The models should not lead to overharvest, because the maximum rate for subadult and adult mortality have been used, since these estimates include bears that eluded recapture.

New York State has successfully managed a small subpopulation of black bear in the Catskill region. During the 1950s and early 1960s, the black bear population in the Catskill range was reduced through habitat destruction and over exploitation. Hunting accounted for 90% of the bear mortalities in the region. By 1970, managers believed that careful management of hunting induced mortality and assessment of the

"acceptance capacity" of the public could result in a substantial increase in the number of bears (Decker et al., 1981).

The Catskill region consists of the northern (Ulster, Greene, Delaware Counties) and the southern Catskills (Rockland, Orange and Sullivan Counties). The northern region contained 870 square miles of bear habitat in 1970-1975 and an estimated density of one bear per every 6.1 square miles. The southern region, 400 square miles in size, had an estimated density of one bear per every 7.1 square miles. A large percentage (>40) of land in the northern Catskill range was in public ownership; the southern Catskills was almost entirely privately owned.

Examination of harvest statistics from 1970-1975 indicated that the decline in the bear population was a northern Catskill phenomena; the southern Catskill population was stable. The strategy developed for the Catskills involved regaining a population level comparable to the early 1960s (250 bears) and then allowing incremental increases based on degrees of public tolerance.

To effect an initial increase in the population, the hunting season on black bear in the Catskills was closed in 1976 and 1977. Subsequent seasons were designed to stabilize the bear population at the higher level of 250. In 1978, the season was reopened to hunting with a slight reduction in the area open to hunting. In 1979 the firearm season for black bear was shortened and the opening day delayed until after the first five days of deer season. This strategy reduced hunting pressure and afforded additional protection to adult female black bear. Pregnant females generally den earlier than males or other categories of females. The percentage of females in the harvest dropped from 50.0% in 1978 to 37.8% in 1988 (Berchelli, pers. comm.). The

northern Catskill population was stabilized through the new hunting strategy at 250 animals from 1978-1982.

The average number of bears removed from the population per year during the five years was 58 or close to a 20.2% use rate of the population. Overall sex ratios in the total harvest during those five years was 1.33 males killed per each female killed (Berchelli, pers. comm.).

Following this stable period at 250 bears, landowners were surveyed to determine if their capacity for a higher bear population had been reached after five years of experience with 250 bears. The survey in 1983 and the biological condition of the bears indicated that more bear could be accepted. Additional increases were allowed.

At present, the post-harvest population estimate for the Catskills is 500-600 bears. The harvest between 1990-1995 averaged 121 bears per year; 1.41 males were harvested per each female. Gradual changes in land use in the Catskill region has actually improved habitat condition for bears in many areas, particularly in the southern Catskills. Viable range in that area is now estimated at 1500-1800 square miles, viable range in the north is about 900 square miles. The present post season density of bears for the region is fairly stable at one bear per five square miles (Berchelli, pers. comm., Henry, pers. comm.). The Catskill region continues to be influenced by immigration of bears from Pennsylvania and in more recent years immigration from New Jersey. Tagged bears from Pennsylvania and New Jersey are recovered annually during the New York hunting seasons.

Methods of Hunting

The following are the methods used by various states to hunt black bear as listed by TRAFFIC USA (McCracken et al., 1995).

1. Hunting with bait: baiting is legal in eleven states (Alaska, Idaho, Maine, Michigan, Minnesota, New Hampshire, Oregon, Utah, Washington, Wisconsin, Wyoming) and eight provinces or territories (Alberta, Manitoba, Newfoundland, Northwest Territories, Nova Scotia, Ontario, Quebec, Saskatchewan).
2. Hunting with hounds: The use of dogs is legal in 19 states* and three provinces/territories (British Columbia, Ontario, Quebec).
3. Spring/Fall hunting: Nine of the 27 states (33.3%) that allow hunting of black bear have both spring and fall seasons (Alaska, Arizona, Colorado, Idaho, Montana, New Mexico, Oregon, Utah, Wyoming). Nine of the 10 provinces/territories (90.0%) allowing hunting of black bear have both a spring and a fall season (Alberta, British Columbia, Manitoba, Newfoundland, Northwest Territories, Ontario, Quebec, Saskatchewan, Yukon Territory).
4. Trapping: Maine is the only state allowing trapping; seven provinces (Alberta, Manitoba, Newfoundland, Nova Scotia, Ontario, Quebec, Saskatchewan) allow the trapping of black bear.

Political Environment

Bear hunting has become a national issue for animal rights activists. Animal rights activists were successful in bringing a referendum (Amendment 10) to the statewide ballot in Colorado in 1992 which prohibited certain types of bear hunting. The

* AK, AZ, CA, GE, ID, ME, MI, NH, NM, NC, OR, SC, TN, UT, VT, VA, WA, WV, WI

referendum was supported by 70% of the voters (Loker & Decker, 1995). In 1996, referendums were brought to statewide ballots in Oregon, Massachusetts, Idaho, Washington and Michigan banning the use of dogs and/or bait to hunt bear. The referendums were defeated in Oregon and Michigan but passed in Idaho, Massachusetts and Washington. The organizing force behind these campaigns in Idaho was the Fund For Animals. In Massachusetts and Washington the campaign was allegedly funded by HSUS. Fund for Animals and the Michigan Human Society were behind the unsuccessful attempt to ban dogs and bait in Michigan. It is anticipated that, with increasing success in states that have well entrenched black bear hunting traditions, animal rights proponents may make an even more organized attempt to defeat any season proposal by New Jersey's Fish and Game Council.

Success Rates

There is no previous data from New Jersey to obtain a logical success rate. Success rates can only be examined in states that require a separate permit/license to hunt black bear. Of the Northeastern states that require permits, Wisconsin has one of the highest success rates (46 %). Bait and hounds can be used (Kohn, 1992). Minnesota's hunter success ranges from 30-36% (Schad, 1992).

Massachusetts has a bear population of 1200-1800 animals. Success rate was estimated at 6.5% in 1995 and 3.0% in 1996 (prior to the 1996 referendum). Permit allocation is low; 2063 in 1995, 1844 in 1996. Dogs were allowed for half of the season (Cardoza, pers. comm.). Dogs accounted for 20-35% of the kill; still hunting (no bait) accounted for the remainder (Cardoza, 1992). New Hampshire hunters have success rates of approximately 5-6%. Baiting and hounds are allowed (Orff, 1992). Michigan's

hunter success is 16-19%. Bait and dogs are allowed. Baiters take 83% of the harvest and hunters with dogs 14%; 75% of all hunters use bait and 19% use dogs (Hendrickson, 1992). Georgia has a black bear population of 2000. Success rates are only known on an area where one day (no bait/no dogs) hunts are held. Success rates range from 2.1 to 3.5% (Carlock, 1992).

Maine hunters and trappers have success rates of 16.5-17.7% (snaring , baiting and dogs allowed). Baiters have been so successful that season restrictions were imposed in 1990 to reduce harvest by this method. Baiters now account for about 60-62% of the harvest. Dogs account for 13-14.5% and trappers 2%. Maine requires permits for hunting bears prior to firearm deer season; none are required to take bear during firearm deer season (McLaughlin et al., 1992). Pennsylvania sells approximately 87,000 - 90,000 black bear licenses each year. Hunter success is usually 1.8%; 1995 was the second highest kill on record; success was approximately 2.4%. The use of dogs and bait are prohibited in Pennsylvania (Alt pers comm.).

New Jersey's black bear population is very concentrated. Estimated success rate depends on timing and method chosen. The following harvest is anticipated under varying success rate and percentages of allowable harvest as discussed previously. The black bear population is estimated at 450-550; the 450 estimate has been used in the following; this is the most conservative approach to an initial season. Additionally, the annual loss to other sources is estimated at 30-40 bears, 40 was used for these calculations as the most conservative approach.

Table 6.**Population Estimate 450-550**

Total Mortality Rate	Non-Hunting Mortality	Hunter Use Rate %	Success Rate	# of Hunters	# of Bears to be Harvested
25/30/35	-9%	16/21/26	3.0%	2400/3166/3900	72/95/117
		16/21/26	5.0%	1440/1900/2340	72/95/117
		16/21/26	10.0%	720/950/1170	72/95/117
		16/21/26	15.0%	480/633/780	72/95/117

Strategy C., Option 1.: Explore regulations (Code Amendments) to establish a black bear season by permit.

Black bear are very vulnerable to overharvest. The species is long lived and slow to mature. Reproductive capacity is low because of the low number of cubs produced and the interval between births (two years). Overharvest is difficult to detect in its early period. Long periods of time (10-20 years) are needed for a black bear population to recover from overharvest (Miller, 1989). Knowledge of hunter interest and success rates enable the manager to more effectively predict the results and ensure a more sustained level of harvest.

Requiring a permit would provide necessary base information on interest, hunting pressure and success. If management zones are also used, pressure can be directed to individual areas. Combining quotas with permits would be the most conservative way to reinitiate a harvest season on black bear.

New Hampshire is one state that has witnessed recent results of overharvest. They experienced a 21% decline in their female age composition. In 1979, females six years and older made up 37.8% of their harvest. By 1983, females six years and older

were only 19.6% of the harvest. Their data indicated that 50-60% of their kill during the firearm deer season were female. In an effort to reduce their losses on females, the black bear season was separated from the deer season (Orff, 1985).

Strategy D: Restore the black bear population in southern New Jersey through relocation of bears from northern New Jersey.

As discussed previously under the Public Lands/Open Space section, the Pinelands are divided into two areas, the Protection Area (565,000 acres) and the Core Preservation Area (368,000 acres) for a total of 933,000 acres. Residential and commercial development is limited in these areas which fall mainly within Burlington and Ocean counties. The majority of the Core Preservation Area is state owned lands (275,000 acres). Sites throughout this area, which were historically inhabited by black bear would be surveyed to determine their present suitability for this species. Criteria to be considered includes availability of den sites and food sources, suitability of vegetative cover, and potential for human and agricultural conflicts. Based on general knowledge of black bear habitat, three areas could be considered for the relocation of black bear and these areas will be researched further. These areas are Greenwood Forest Wildlife Management Area in Ocean County, Lebanon State Forest in Ocean and Burlington Counties and Wharton State Forest in Burlington County. All three of these areas fall within the Protection Area and the Core Preservation Area as described above. If a population of black bear is established in these core areas, the black bear will most likely spread out into neighboring areas.

Black bears could be captured during winter den work in March and spring trap-line season in June. Additional bears that wander into residential areas that have the potential of becoming problem bears will be captured also. A total of 10 adult

females will be captured and relocated over a three year period. Females with 2-4 newborn cubs will be obtained during March; solitary adult females will be obtained in June. The black bears will be taken from both the Kittatinny and Bearfort regions.

Re-establishment of a self-sustaining population of black bear in the Pine Barrens of southern New Jersey would give an added measure of interest and wildness to the last wilderness area remaining within our borders. Just knowing that a bear might be in the area would heighten the enjoyment of many Pineland recreationists. Others however may fear black bears and this fear would detract from their enjoyment of the outdoors. There may be concerns for the safety of pets and livestock. The agricultural community may be concerned with potential damage to various crops including blueberries, cranberries and the honey industry would be concerned with damage to hives and the loss of bees and honey. These are some of the same issues the Division is dealing with in the northern counties of New Jersey. The level of tolerance for the black bear may be increased through educational efforts including seminars and media events.

One of the most successful reintroductions of a large carnivore took place in Arkansas. Once known as “the Bear State”, Arkansas’s black bear population was extirpated through exploitation and habitat deterioration by 1940 except for a few scattered individuals (est. 25). Between 1958 and 1968, the Arkansas Game and Fish Commission released 254 black bear captured in Minnesota and Manitoba, Canada into the Ozark and Ouachita Mountain Regions (western and northern Arkansas).

The bears used for relocation were captured in urban areas but were not habitual problem bears and consisted primarily of female and young males. The first 40 bears were released in 1958; and additional bears were released between 1962 and 1968 for a total of 254 bears. Three release sites were used; two sites were predominately oak-

hickory forests within the Ozark National Forest and the third site was a predominately pine forest in the Ouachita National Forest.

A trapping and tagging season was established in 1988. Through mark-recapture efforts the population density was estimated to be one bear per 7.53 km^2 (one bear per 3.0 mi^2) in the Ozark Mountain Region and one bear per 6.40 km^2 (one bear per 2.5 mi^2) in the Ouachita Mountain Region (for a total of one bear per 7.0 km^2 or one bear per 2.75 mi^2). In 1988-1990 the Ozark Mountain Region population was nearly stable and in the Ouachita Mountain Region the population was growing by 26% annually. It was determined that the high percentage of males in the Ozark population resulted in high cub mortality.

The reintroduction project continued for 11 years despite often disappointing early population estimates, and eventually resulted in a very successful population of black bear in Arkansas. The population was estimated to be 600-700 bears in the 1970's and 1200-1500 in the 1980's. There was an increase in bear nuisance complaints. The black bear hunting season, closed since 1927 was re-opened in 1980. Arkansas sought little public input; it is probable that initial public opinions of the project would have been negative. However, in a recent survey of local landowners, over 80% wished to see black bear numbers stabilize or increase in their area of residence. It's possible then, that despite negative opinions in early stages of a similar project in New Jersey, public perception may become more favorable to black bear in the future.

Griffith et al. (1989) provided guidelines for successful translocation projects, six releases of 20-40 animals each over a three year period, into core areas of historical range were recommended. Relocated animals should be released in areas where several areas of excellent habitat exists, translocated animals should be divided among these areas.

Griffith et al., stated that translocation into high quality habitats with relatively few similar competitors had the highest chance for success.

The State of Virginia has initiated a translocation project to augment a low population of black bear in several southwestern counties. Nuisance black bear were captured in northwestern Virginia and were released in the Mt. Rogers National Recreation Area southwestern Virginia. Forty-three black bears were radio-collared. Of these 43 black bears, eleven (25.6%) remained in their release areas (moved < 10 km from release site)(Amly,1994).

Given the productivity of the black bear population in northern New Jersey, southern New Jersey would have a bear density close to that of Arkansas (one bear per 3.0 mi²). This project will have minimal effect on the human environment and in fact is an attempt to replace a species which historically was a natural part of the Pine Barren's ecosystem. If successful, this program could help ensure the survival of the species in New Jersey. It is highly improbable but possible that the Pine Barrens may eventually be reoccupied by black bears as a result of the natural expansion and dispersion of the north New Jersey population. The extensive urban and industrial development separating the north and south is an effective deterrent to southern movement. It is doubtful that the black bear can once again become a part of the New Jersey Pinelands ecosystem without direct human intervention.

Strategy E: Explore the potential use of contraceptive drugs and or vaccines as a means of controlling New Jersey's black bear population.

New Jersey currently has a total of 24 mature female black bear radiocollared. Ages of these productive sows range from three to 16 years old. Of the 24, 22 are in the Kittatinny region, two are in the Bearfort region. Research trap lines in June generally

yield 3-6 uncollared females. The accessibility of a number of females may make contraception a potential population control method. All radiocollared females are recaptured at the winter den sites every two years. Captures are made in the year the female has newborn cubs.

Accelerated research into the development of effective contraceptives for free-ranging wildlife populations has led to the testing of a wide variety of potential agents, with some modest success. To date, the bulk of this research has been conducted primarily through experimentation on captive or semi-captive deer, and on feral and wild equids. These short-term studies have ranged from two to four years in duration. Due to the limited time span of these experiments, little data is available on the physiological and behavioral consequences of prolonged exposure to contraceptives on wild animals.

Three basic methods of contraception can be applied to manage wildlife populations. These are surgical sterilization, synthetic hormone supplementation, and immunocontraceptive vaccination. Surgical sterilization is permanent, expensive, and poses concern for the individual animal both during capture and field surgery. Synthetic hormone supplementation is impractical because it necessitates either daily oral doses, which are impossible to regulate in free-ranging animals; or expensive subcutaneous implants, which also require capture and field surgery.

Immunocontraceptive vaccines can be delivered remotely, which makes their application more practical than the above-mentioned methods. Porcine Zona Pellucida, or PZP, is the most common type of immunocontraception. The vaccine is prepared by adding a protein (the PZP) to an adjuvant, which is a mixture of water, oil, and killed bacterial proteins. The adjuvant is needed to increase the immunological response to the

PZP. Antibody response (titers) is seen after 30 to 40 days (in deer), then drop off, necessitating a booster shot to raise titers again.

To date, PZP has been used with some success in studies on wild horses in Nevada and Assateague Island, feral burros on St. John, and on white-tailed deer in Ohio, to name a few. There is also an ongoing, 5 year study using PZP on African elephants in Kenya, the results of which are pending. Recent literature on experimentation in captive, wild-caught white-tailed deer in Front Royal, Va., shows that administration of the vaccine and booster in captive does produced no offspring in the first year, with 10% of females fawning in the second year; microencapsulated timed-release single doses resulted in a 78% birth rate in the first year, and a 22% birth rate in the second year. Both groups received boosters in the second year (McShea, et. al., 1997). Reversibility of infertility has been documented in addax, ibex, muntjac deer, white-tailed deer, and domestic and wild horses; however, these studies have all been only 1 to 3 years in duration (Kirkpatrick et. al., 1997).

The wild horses showed a steady decline in ovulation rates and in ovarian estrogen production over a 7 year study (Kirkpatrick, et.al., 1997), raising the question of reversing infertility over the long term. PZP peptides caused permanent ovarian damage in mice, hamsters and rabbits, while dogs had multiple problems with their reproductive cycles (Rhim et.al., 1992; Hasegawa et.al., 1992; Skinner et.al., 1984 cited in Nettles, 1997). PZP treated horses exhibited unusually late parturition (Nettles, 1997). Horses and dogs had local abscessation and deer had undefined nodule development at PZP injection sites (Nettles, 1997). McShea, et. al., 1997 showed that bucks engaged in an extended rut, while does exhibited extended estrus, higher activity levels, and significantly later parturition dates than the control group. Supplemental feeding of this

herd prevented determination of the consequences of these behavioral changes on over-wintering.

Current technology is limited by the difficulty of effectively treating a large enough segment of the population to substantially reduce annual recruitment and population growth. The goals and effects of immunocontraception are both long term. Birth control does not remove existing individuals, nor the problems they create. Other problems associated with administering PZP include:

1. Costs of implementing such a program.
2. Preventing/monitoring food chain contamination, from both the scavenging of and decomposition of vaccinated animal carcasses. (While the PZP protein itself is not passed through the food chain, the killed bacterial agents in the adjuvant may be.)

Given all the experimentation and published work to date on PZP, the following concerns are yet to be addressed by future research:

1. Will failure to conceive promote continued estrus in black bear? How might this affect sows' behavior, i.e., late denning, rise in activity levels, etc., and what results would this have on over-wintering?
2. How might continued estrus affect boars' behavioral patterns? Can this result in increased/prolonged aggressive behavior, significant body weight losses prior to hibernation, and an increase in bear-human conflicts as boars roam in search of receptive females?
3. Will long-term exposure to the antibodies result in permanent sterilization?

A review of the scientific literature on wildlife contraception did not provide any information on the use of contraceptive materials on black bears in the wild.

However, there have been limited studies on captive bears using immunocontraceptives, hormone supplementation, and surgical sterilization.

Four captive European brown bears (3 at the Paris Zoo and 1 in Cologne, Germany) were successfully immunocontracepted via 3 initial 130 mcg. doses of PZP, spaced one month apart prior to the breeding season, and an annual booster. Four Malayan sun bears (3 at the Tourarc Zoo, France and 1 in Cologne, Germany) were also successfully contracepted with 3 initial doses of 65 mcg. of PZP and an annual booster. Treatment of 2 Asian black bears at the Paris Zoo using 65 mcg. doses of PZP was not successful; the method of delivery was thought to be the main factor in this failure (J. Frisbie, pers. comm.) The two above-mentioned studies are recent and ongoing, and long-term results are yet to be determined. As previously stated, it is unknown if fertility is reversible in PZP contraception; some bears began cycling after cessation of treatment while others did not. The efficiency, safety and reversibility of PZP has not been demonstrated (Asa, pers. comm.)

Hormone supplementation using Depo-provera has been found to be effective in captive bears, but its adverse effects on bears are not known. The use of this drug has been associated with uterine pathology and mammary gland cancer in canids, felids, and other carnivores. Experts expect that bears exposed annually or continuously to progestins such as Depo-provera will exhibit the same lesions. Depo-provera is not recommended for more than two consecutive breeding seasons (Munson, 1995; Asa, pers. comm.).

MGA (Melengestrol acetate), and implants of MGA, another progestin-based contraceptive, has also been used in captive bears. Implants have been associated with uterine growths and infections, and cancer in other carnivores. Animals must be

checked regularly to monitor uterine health. The current protocol calls for alternating two years of contraception with one year of reproduction to reduce uterine side effects. MGA implant use is not recommended for more than a total of four years (K. DeMatteo, pers. comm.).

An ursid contraceptive safety assessment study has been initiated; however, it will be 3 to 4 years before enough reproductive tracts from captive bears are collected to provide sufficient data. This study will analyze reproductive tracts from female bears treated with both PZP and Depo-provera (Munson, pers. comm.).

Zoos also employ surgical techniques such as lathroscopic vasectomies and tubal ligations for permanent sterilization of captive bears. Ovariohysterectomy is considered the safest method of sterilization for females.

If and when a contraceptive material(s) and delivery procedure(s) is developed and FDA approved which appears to have application in the control of a wild black bear population, experiments should be designed to test its efficacy, both singly and in conjunction with other population control techniques, in the wild.

Objective III. Obtain input from the public relative to the Division's management of black bear.

Strategy A.: Initiate a questionnaire survey to determine public opinion on black bear, NJDFGW policies on black bear, and management strategies.

Actively seeking public input into any final decision on black bear management strategies may be very valuable in preventing opposition to any part of the strategy and provide an opportunity to educate the public regarding the issues involved in maintaining a viable black bear population in an urbanized state.

In an analysis of a recent Colorado referendum prohibiting certain methods of hunting black bears, researchers from the Human Dimensions Research Unit of Cornell University interviewed 369 supporters of the referendum and 346 opponents. Although hunting experience was more common among opponents of the referendum, most supporters of the referendum did not oppose hunting. Concerns for animal rights, hunter ethics or the morality of hunting were not strong influences on voter decisions. Concern for animal welfare, however, did influence decisions. This study suggests that managers should assess current beliefs held by the public about issues that will be controversial and then devise communication strategies to help the public understand the issues (Loker and Decker, 1995).

A random telephone survey of 300 residents of West Milford (98) and the Upper Greenwood Lake area (102) of Passaic County and Vernon Township (100) of Sussex County was conducted by an undergraduate student from Alfred University in August, 1995.

Participants in the survey were asked if their lifestyle has been impacted by the presence of black bear. Of the respondents, 212 (70.7%) answered no. Of the 88 who were experiencing impacts from bears, 49 (55.7%) were concerned for either the safety of their children (26) or their own safety when outdoors (23). Twenty-seven (30.7%) of the impacted residents stated that bears were getting into their own or their neighbors garbage and seven expressed the need to be more careful when they were driving on municipal roads because of bears.

Survey participants were asked if they felt that the local black bear population should be reduced at the present time. Of the 300 respondents, 267 (89.0%) answered no, 28 said yes (9.3%) and five (1.7%) did not know. Of the 28 respondents who felt the

local bear population should be reduced, 15 (53.6%) were in favor of hunting as a means. Six of the 28 thought relocation should be used and six of the 28 thought birth control was a viable option.

Almost all (95.7%) of the participants expressed that they were willing to adopt conservation methods such as careful storage of garbage, birdfeeders and grills as a way to exist in close proximity to bears.

Of the 300 people surveyed, 217 had experienced "encounters" with bears; 185 of the 217 felt that the encounters were positive experiences. The mean age of respondents was 40, minimum age was 16, maximum age was 83. The total sample contained 131 males and 169 females. Most of the participants (70.7%) lived within two miles of a state park or Newark Watershed municipal land (Quillen, pers. comm.).

Objective IV. Minimize bear/human conflicts.

Continue to develop a policy to deal with nuisance/damage black bear.

A comprehensive policy was signed into effect in January, 1994 and revised in January, 1996. The following are strategies to be considered for inclusion/or in addition to the present policy.

Strategy A.: Ban the feeding of black bear statewide.

Options 1. Seek legislation to provide for a statewide ban on the feeding of black bear.

Option 2. Aggressively encourage municipalities to ban the feeding of black bear similarly to the Township of West Milford in Passaic County and Vernon Township in Sussex County.

The black bear has shown an ability to adapt to living in very close proximity to humans. Most black bear are very tolerant of people. A bear that is fed or given access to garbage or other human food, associates the sight and smell of people with food. Bears that are both used to people and feed on or are fed human food have been associated with a number of injuries.

Between 1960 and 1980, black bear injured almost 500 people. Most of the injuries occurred in national parks, in campgrounds and roadside "panhandler" situations. It is important to note that over 90% of the black bear injuries were minor (Herrero, 1985). However, the potential for injury is high and could be lessened with a combination of education and a regulation on feeding. It has been New Jersey's experience that education has not been successful in convincing long term, high volume, "die hard" feeders (75lbs of dog food/day) of the detrimental effects of feeding on both bears and humans. The combination of education, neighborhood peer pressure and the threat of a \$1,000.00 municipal fine finally ended long term feeding by residents of Vernon (Sussex County) and West Milford Townships (Passaic County).

The black bear shows great restraint toward humans most of the time even when fed. The only overt act of aggression that occurred in one New Jersey high volume feeding situation was repeated false charges at the landowner by a mature sow (with cubs) when the landowner attempted to enter her house near the food (dog food). Other bears were quite tolerant of the landowner entering and exiting the door directly beside the feeding area. The landowners did not feed by hand and never attempted to make physical contact with any of the animals. Researchers in Great Smokey Mt. National Park observed 392 instances where roadside bears were fed or bears approached people for food (Table 7). They saw 624 aggressive acts (false charges, woofing, swatting); only

6% (37/624) ended in physical contact by the bear. (There were no major injuries). It is important to note that crowding or attempting to pet the bear preceded 78% (29/37) of the situations that led to contact by the bear (Eager and Pelton as quoted in Herrero, 1985).

Table 7. Apparent precipitating factors for aggressive acts, ranked by frequency of occurrence*

RANK <u>TOTAL</u>	PRECIPITATING FACTOR	FREQUENCY	PERCENTAGE OF
1	Crowding	244	39.10
2	Photographing-Crowding	67	10.74
3	Other (a)	49	7.85
4	Another Bear	40	6.41
5	Harassing-Crowding	30	4.81
6	NPS Personnel	29	4.65
7	Petting	27	4.33
8	Photographer kneeling-Crowding	23	3.69
9	Petting-Crowding	19	3.04
10.5	Harassing	16	2.56
10.5	No apparent reason	16	2.56
12	Three factors (b)	14	2.24
13	Handfeeding-Crowding	13	2.08
14.5	Handfeeding	11	1.76
14.5	Photographing (kneeling)	11	1.76
16	Photographing	6	0.96
17.5	Cessation of feeding	3	0.48
17.5	Toss feeding	3	0.48
19	Toss feeding-Crowding	2	0.32
20	Photographing with flash-Crowding	1	0.16

(a) All factors considered peculiar to a certain panhandling session (e.g., feet dangling over the wall, motorcycle engine revving, etc., and not likely to occur in other sessions were included in this category).

(b) Since combinations of three factors were fairly infrequent, they were all included in one category.

*From Eager and Pelton , 1979 (as cited in Herrero, 1985)

Black bear in Yosemite National Park are particularly tolerant of people. Researchers observed 992 interactions. Bears rarely acted aggressively toward the

people (1.3 percent or 70 out of 5,785 responses). No injuries nor physical contact occurred (Gilbert and Hastings as quoted in Herrero, 1985).

In spite of their restraint and tolerance towards people and the fact that most injuries are minor, the fact remains that the black bear is extremely powerful. A concerted effort must be made to keep bears from depending on humans for food. This is both a human safety and conflict/damage concern.

Strategy B.: Initiate the concept of "Bear Free" zones in New Jersey.

To accept the concept of bear free zones in New Jersey makes the assumption that certain areas in New Jersey are either incapable of providing any viable habitat for black bear or that the existence of black bear will create an unacceptable level of conflict. Many highly developed areas of New Jersey already naturally preclude the existence of black bear except for the occasional and temporary "spring wanderer"; typically a young bear dispersing to new areas. Some of these bears encounter difficulties traversing these urban areas and are captured and relocated as a matter of policy. There are, however, transitional or peripheral areas in New Jersey that have marginal to good habitat for black bear but are so fragmented that the bears logical home range will consist of highly developed areas. Great Swamp National Wildlife Refuge is an example of this type of area. In 1990, a male black bear established a home range; the core of which was apparently the Great Swamp. Indications are that the bear ranged out into most of the contiguous and very urbanized towns of Chatham and Summit until it was captured and relocated following a damage situation.

The criteria for the creation of bear free zones would have to be carefully selected. It should be anticipated that residents of townships that have dense, highly visible black bear populations and who have experienced numerous nuisance situations

may be highly critical of criteria that calls for the exclusion of a bear population from one region of the state and allows it to maintain itself in another. Logical, possible criteria would most likely include number of people per square mile and/or housing units or ratio of urbanized areas to remaining forested land.

Strategy C.: Encourage or seek legislation for public campgrounds in habitat occupied by black bear to install bear proof dumpsters and food boxes.

In recent studies of bears in Yosemite, the behavior of bears who took campers food was significantly altered. Bears were much more frequently neutral and showed much less fear after they had begun to eat campers food. The studies suggested that bears are more difficult to deter once they have obtained campers food (Hastings et al., 1989).

Observations of black bear in Worthington State Forest demonstrated the futility of attempting to correct the long standing behavior of black bear associating the campgrounds with food sources. Bears have free access to open dumpsters. Hazing the bears off the dumpsters by using screamer rockets and irritants did little to deter their use of the dumpsters in Worthington. The bears simply altered their schedules for feeding or retreated until the park rangers left the area.

Making the dumpsters inaccessible to black bear may initially increase bear activity at the camping areas. Bear proof food storage boxes at each campsite are a necessary adjunct to bearproofing the dumpsters. This will prevent damage to vehicles, tents and food supplies.

Studies at Sequoia and Kings Canyon National Parks in California indicated that the approach of removing problem animals in park situations treats only the symptoms

rather than the cause of problems. The current bear management program is now based on the following:

1. elimination of unnatural food sources.
2. education of all park visitors and employees.
3. complete and timely reports of all incidents.
4. enforcement of regulations.
5. positive ID and management of problem bears.

This systematic approach has resulted in increasingly effective bear management (Zardus and Parsons, 1980). Worthington State Forest, as one example, is in the process of incorporating many of the same techniques (1-3).

Studies in the Smokies indicated that information and warnings concerning black bear may be lacking both in quantity and effectiveness. Violations of National Park Service regulations and misconceptions of proper food storage were a major factor in damage incidents (Singer and Bratton, 1980).

Strategy D.: Encourage closed communities to make a bear proof community dumpster facility available to its residents.

Many of the important black bear townships are comprised of lake communities. The residences often have neither garages nor basements that can be used as alternate storage areas for garbage cans. Additionally, garbage collection is usually once a week. The lake communities are situated near wetlands and ridges which leads to extensive interaction between humans and bears. Upper Greenwood Lake is one community which provided a temporary alternate dumpster for residents in 1992 which successfully reduced garbage availability to black bear.

Strategy E.: Proactively target owners of large bee yards in important black

bear townships.

Florida is the leading honey producing state in the United States with much of the honey production occurring within good bear range. In studies of bear/bee yard conflicts in Florida, electric fencing has been shown to be highly effective in preventing hive damage. Study data shows a 70% greater probability of bear damage among unfenced apiaries than among fenced apiaries (Brady and Maehr, 1982). Researchers from North Carolina concluded that electric fencing is the best protection available and is 80-85% effective (Lord, 1979 as quoted in Brady and Maehr, 1982).

Information obtained from the New Jersey Department of Agriculture identifies the location of apiaries in existing bear range in the state. It has been proposed that a demonstration beeyard be maintained on public/private property that contains a high density black bear population (Stiles, pers. comm.). The apiary will be protected and maintained with electric fencing per Division of Fish, Game and Wildlife recommendations. This apiary will be used as an educational exhibit in conjunction with seminars for the operators of apiaries within bear range.

Strategy F.: Require any lessee of land for bee yards on state or federally owned property to erect electric fences around their beeyards.

At present, there is no policy on either Division owned lands or state owned land that specifically prohibits beekeepers from requesting permits to operate beeyards on such properties. In the event that such a request be made and granted, beekeepers should be required to construct electric fences as per Division of Fish, Game and Wildlife specifications. Additionally, regular maintenance of the fence should be a condition of any beeyard lease renewal on public property. Maintenance of the fence is essential to ensuring effectiveness.

Strategy G.: Initiate a permit system to allow landowners to kill depredating black bear/allow landowners to kill black bear under specific circumstances without obtaining a permit.

The majority of states that have resident black bear populations allow landowners to kill nuisance and depredating black bear. The liberal interpretation of a nuisance bear and lack of emphasis on abatement programs have caused concern in several states who experience high nuisance kills. Minnesota is quite liberal; the majority of their bear complaints involve garbage and/or perceived threat of human injury. Total nuisance kill of bears between 1981 and 1987 was estimated at 1,684; in some areas nuisance kills exceed legal harvest (Garshelis, 1989).

Wisconsin required no permits to kill bears causing damage prior to 1957. Permits are now required. This reduced the indiscriminate shooting of nuisance bears. The permits are issued by Wisconsin Department of Natural Resources when trapping is impractical or when bears present a threat to human health and safety.

In Wisconsin, few attempts were made to abate damage to apiaries, livestock, orchards or field crops prior to 1983. Interest increased when they initiated a funded abatement program and developed educational publications that demonstrated the effectiveness of abatement techniques (Hygnstrom and Hauge, 1989).

New Jersey's situation is fairly unique. New Jersey is possibly the only state with a sizable black bear population that contains no true wilderness areas. All of New Jersey's occupied black bear habitat is within 2.3 miles of development. The largest block of contiguous relatively undeveloped publicly owned land is approximately 7.9 miles wide. This virtually eliminates the possibility of a black bear maintaining a home range that does not overlap into residential areas.

A permit to kill should be discriminatory to prevent kills made on bears who frequent residential areas (most do) and use human foods such as garbage, dumpsters and bird feeders, etc. These food items are easily protected by the landowner. The following situations could be considered for kill permits:

1. Entry of black bear into a dwelling (open garages excepted).
2. Black bear depredations on beehives protected by a working/maintained electric fence (electric fencing has not deterred the animal).
3. Black bear depredations on protected livestock (pasture/ paddock protected by electric fence/ does not deter the bear.)
4. Black bear depredation on field crops in excess of \$x,xxx.xx.
5. Black bear depredation on protected orchards.

Strategy H.: Compensate the landowner for losses caused by black bear.

Some northeastern states compensate landowners for damage caused by black bear. Most of the states that have compensation programs allow hunting of black bear except Maryland. Maryland has an emerging black bear population primarily due to the influx of bears from Pennsylvania's population, a situation very similar to New Jersey. Maryland's population is estimated at 200+ and is concentrated in the northwestern mountainous counties. There is no harvest season at present. No kill permits are granted to landowners, however, landowners can kill bears in the act of depredating on livestock. Maryland compensates landowners for losses to beehives, field crops, livestock and managed tree areas. It does not compensate for bird feeders, garbage containers, houses/cars, or damage to domestic pets. Maryland's state agency erects electric fence for beehives. It does not pay compensation caused by other wildlife (i.e., deer).

The citizens task force on black bear in Maryland submitted recommendations for public comment in recent years. One recommendation was to seek legislation for a

limited permit (lottery) hunting season; fees that would be collected for the permit would be used to pay for damage (Bittner pers. comm.).

As described earlier, Wisconsin appears to be a model state for compensation programs with their present Wildlife Damage Abatement Claims program giving priority to the funding of control programs over payment of claims.

Of the states who do not currently have black bear seasons, Louisiana uses a two prong approach to damage problems. It pays no compensation. A citizens group associated with the Nature Conservancy assists with landowner education regarding black bear behavior and damage prevention techniques. The U.S.D.A. animal damage control agents service damage complaints. These are generally handled with electric fencing (installed by U.S.D.A.), trapping, aversive conditioning and, as a last resort, relocation (Shively pers. comm.).

Northeastern state agencies that compensate for damage are New Hampshire (livestock, bees, orchards, growing crops only on lands open to hunting) (Calvert et al., 1992), Pennsylvania, Vermont and Maryland (Bittner, pers. comm. and others).

Objective V. Decrease Illegal Losses of Black Bear

Strategy A.: Create definitive regulations regarding the sale of bear parts and increase fines for illegal killing and/or illegal sales of black bear parts.

The trade of bear gallbladders, paws and other parts has contributed significantly to the decline of many of the world's bear species, the Asian bears in particular. The American black bear, although not generally threatened or endangered, is also being subjected to increasing trade in its parts, especially gallbladders and bile. The primary market for the gallbladders is apparently Taiwan, Hong Kong, China,

Macau, Japan and South Korea. Bladders are also sold in Asian communities in the United States and Canada. Legislation regarding the sale of black bear parts is so variable among the states that it is extremely difficult to prove whether sales of gallbladders are legal or not. (McCracken et al., 1995). New Jersey does not specifically prohibit the sale of parts from bears legally harvested in other states. This oversight may facilitate laundering of bear parts. Prices paid to hunters for gallbladders have ranged up to \$250.00. Retail prices however are high (\$75 - 6,000) and because of this, it is believed that trade will probably expand.

TRAFFIC USA is the trade monitoring program of the World Wildlife Fund, the largest United States private conservation organization working worldwide. TRAFFIC USA is based in Washington, D.C. After an extensive survey of all the bear range states and Canadian provinces, TRAFFIC USA recommendations in 1995 included the development of more consistent restrictions on the sale and trade of bear gallbladders, paws and other products and also recommended the implementation of registration systems for states and provinces allowing the sale of black bear parts.

Twelve states allow the sale of bear gallbladders if legally acquired within that state and 14 states allow the sale of paws if legally acquired within the state (McCracken et al., 1995). New Jersey's regulations need to be clarified. New Jersey needs to either specifically allow the sale of bear parts (either through in-state legal harvest or from out-of-state harvest) or specifically prohibit the sale of any bear parts.

TRAFFIC USA also recommends that penalties for illegally killing a bear or trafficking in parts be sufficient enough to be a deterrent. New Jersey's maximum monetary fines for the illegal killing of a black bear rank with seven other states as the lowest. Of the 41 states that answered TRAFFIC USA's question regarding fines 16 have

monetary fines of \$1000-\$2000, (15) have fines of >\$2000 - 5000 (15). Of the 41 states, 31 states, 31 have maximum jail sentences of three months - one year+ (McCracken et al., 1995).

Objective VI. Analyze New Jersey's data base on the black bear population.

Strategy A.: Continue to subject New Jersey's mark/recapture data to sophisticated statistical analysis (Jolly-Seber) as new data becomes available to obtain the most accurate density and population estimates.

Strategy B.: Continue to develop the simulation model of New Jersey's black bear populations in the Kittatinny and Bearfort regions to evaluate the effect of various harvest schematics and other population dynamics as new data is added to the existing data base.

Objective VII. Identify and protect critical habitat

Strategy A.: Expand the work with the GIS system to predict and identify continuous habitat and travel corridors.

Human development has significantly altered the landscape for black bear. Of particular significance is the increased isolation and fragmentation of bear populations (Mattson, 1990). Habitat available to black bear must be sufficiently large enough that disturbances to habitat can be averaged across the landscape (Pickett and Thompson, 1978 as quoted in Mattson, 1990). The rate of habitat change and human attitudes affect the ability of bear populations to persist in bear habitat (Mattson, 1990).

Fragmentation is extensive in New Jersey. Sixty-five fragments identified in 1990 in the Bearforts region range from $1/5$ of an acre to 8,401 acres in size as discussed

previously. Knowledge of the location, land ownership and possible travel corridors between the most extensive fragments is invaluable. Once available, this information will be transferred to township and county planning boards, other state and federal agencies and conservation organizations.

Objective VIII. Allow the black bear population to attain its own levels.

Strategy A.: Continue the present policy on black bear of total protection.

Habitat and related nutritional factors are assumed to be the ultimate factors operating to control black bear populations. Social intolerance by dominant adult bears with resultant dispersal of subadults is closely related (Bunnell and Tait 1981, Miller, 1990). The adult male black bears response in a high density population is an increase in aggression; the increased aggression takes several forms. Denuded black bears have been cannibalized by large adult bears (Alt, 1984; Tietje et al., 1986). Cannibalism of trapped bears has been reported in New Jersey as well as other states (Alt pers. comm.) Yearlings have been killed while snared in New Jersey. Black bear males have been documented killing and consuming young of the year. The killing of cubs brings a previously non-breeding lactating female into estrus, thereby making her available to the males (Rogers, 1983). As stated previously, there is some evidence to support the hypothesis that this type of mortality could significantly limit population growth under certain circumstances. Other researchers suggest there is not enough evidence to support this hypothesis (Rogers, 1987, Gill and Beck, 1990).

Adult male aggression (non-fatal) toward subadult males results in dispersal of the subadults. This decreases the local density and also may decrease the survival of the

subadults as they disperse to unfamiliar territory and food sources (Bunnell and Tait, 1981, Young and Ruff, 1982).

Adult males may partly regulate the level of habituation and human food use in bear populations. Subadult males typically avoid adult males. An influx of subadult males upon removal of adult males may result in higher densities of subadults with greater use of human foods (garbage, crops, etc.) by the subadults (Mattson, 1990). An unhunted black bear population was manipulated by removing adult male bears for two successive years in Canada (Kemp, 1976). This resulted in a substantial population increase for five to six years due to ingress of subadult bears from a large (5600 km²) and unhunted reservoir area (Miller, 1990). As long as a productive reservoir bear population persists in the surrounding area, a high level of adult bear harvest in agricultural areas may not alleviate and may even aggravate depredation problems by the influx of subadults (Mattson, 1990).

In studies in Minnesota, crowding of the home range occupied by mature females was alleviated by the females adjusting their territories to accommodate their female offspring. Crowding was also alleviated by dispersal of all subadult males and the dispersal of a few subadult females. Immigration of new bears was prevented by resident adults (Rogers, 1979).

MANAGEMENT RECOMMENDATIONS

Recommendation: Use Objective II. Strategies A, C.; Option 1.

Stabilize Population/Establish Hunting Season.

Black bear are more sensitive to hunting pressure than species such as white-tailed deer because of their slow maturity and two year birth cycle (Kolenosky and Strathearn, 1987). Hunting is a major factor influencing the sex and age composition of any black bear population. Males generally predominate in the harvest of lightly hunted populations. Control or reduction of the population is achieved by bringing mature females into the harvest. Once a bear population is overharvested it may need a decade or more to recover (Miller, 1989). To ensure that the population is not overexploited, the majority of the females, must be protected. If the majority of females are protected, a larger proportion of males can be taken. The composition and size of the kill can be regulated by the following methods.

Time of Harvest

1. The timing of a bear season in New Jersey is the most important factor in controlling the percentage of female black bear in the harvest. Females, particularly pregnant females, den before male black bear. A season timed for late November early December allows for the harvest of some mature females particularly females accompanied by young of the year. The majority of these females remain active or above ground in all but the harshest winters. Many of the pregnant females would be denned and therefore protected from harvest.

Timing Recommendation

A one day season during the last week of November or the first week of December is recommended. Zones and permits/quotas should be part of a season proposal.

The method of hunting is a second factor in determining the composition of the harvest. Still hunting and hunting over bait generally results in a larger number of males than females if hunting pressure is light to moderate. The use of dogs and the use of drives increase the possibility that the harvest of males and females will be equal.

Method Recommendation

The initial season on black bear should be still hunting only; no dogs, no bait and no drives. This would allow the establishment of a success participation rate data base. Other methods, if desired, could be included if a higher success rate were preferred in subsequent years. Harvest potential for black bear is low. Simulation modeling exercises and short-term studies of hunted bear populations suggest that bear populations are extremely vulnerable to man-induced mortality (Miller, 1989).

Recommendation: Use Objective IV, Strategy A.

Statewide ban on feeding black bear

New Jersey must deal proactively with the problems associated with the purposeful attraction of bears by feeding. A statewide ban on the feeding of black bear is recommended.

Because of the Division of Fish, Game and Wildlife's limited resources, enforcement of any feeding ban will be mainly the responsibility of the local community.

However, the existence of a ban gives the local community the incentive and structure needed to initiate actions against violators.

Recommendation: Use Objective IV, Strategy B.

Public Campgrounds

Work was begun in 1995 to encourage Worthington State Forest to use bear proof dumpsters. A multifaceted approach is needed to expand on this effort and extend it into other public campgrounds.

Recommendation: Use Objective IV, Strategy D.

Seminars for Beekeepers.

Apiary related losses constitute the major monetary detrimental effect of New Jersey's black bear. Livestock losses are few and birdfeeder losses, although numerous, can be easily avoided by the landowner.

Recommendation: Use Objective IV, Strategy G.

Landowner Kills

A permit system should be initiated to allow landowners to kill bear under specific conditions. Reporting of kills and surrender of the carcass should be mandatory.

Recommendation: Use Objective VI., Strategies A and B.

Continue to analyze New Jersey's data base as new technology and data becomes available.

Recommendation: Use Objective V., Strategy A and Objective VII.,

**Strategy A., Increase protection of black bear
and their habitat.**

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