# Seasonal Movement Patterns and Feeding Habits of Large Adult Male Black Bears in Algonquin Provincial Park, Ontario

*Jeremy E. Inglis, and Mike L. Wilton*
*Ontario Ministry of Natural Resources, Whitney, Ontario, Canada, K0J 2M0.*

## Abstract

A five year study from 1992-97 of large adult male black bears (*Ursus americanus*) in Algonquin Provincial Park (APP), Ontario, Canada, yielded much information concerning seasonal feeding habits, movement patterns and intra-specific interactions. In excess of 1000 aerial and ground fixes were used to determine accurate estimates of breeding, mid-summer and late summer-fall ranges as well as denning locations of eight bears. Breeding territories range from 19.3 $km^2$ to 87.6 km), implying that there could be as many as 191 large males breeding within unhunted Algonquin Park annually. Twelve of 15 known den sites occurred within established breeding ranges. Predation by black bears on as many as six moose (*Alces alces*) and one black bear was documented during this study. Post breeding movements of collared bears to areas outside Algonquin Park were generally to lower elevations and may be learned, or coincide with either plant phenology and species abundance, or the presence of garbage dumps. Linear post-breeding movements varied between 18.8 km and 73.8 km and were repeated in successive years by four of six bears which implies directed rather than random movement. No collar related mortality occurred, although six of 18 bears lost their collars. Movements out of Algonquin Park occurred between July 4 and August 17 and lasted between 15 and 251 days. Return fall movements to breeding/denning range occurred between September 9 and October 17. Six of 11 collared bears that exited Algonquin Park died as a result of hunting. The importance and availability of various seasonal habitat needs – for example soft and hard mast – are discussed.

## Introduction

Adult male black bears are usually responsible for the rare attacks on humans. Few studies in the past have concentrated on the behavioural aspects and feeding habits of the adult male segment of black bear populations in North America, and no black bear studies have previously been conducted in Algonquin Provincial Park. Inglis and Wilton (1994) and Wilton and Inglis (1996) discuss aspects of human fatalities caused by black bears. The objective of the study reported here was to examine the movement and feeding patterns of large adult male black bears in APP.

## Study Area

Algonquin Provincial Park, located on the southern edge of the Canadian Shield in south central Ontario comprises an area of approximately 7,800 $km^2$. Most of the park is closed to hunting, although two townships of approximately 332 $km^2$ are open to limited hunting. A hunting agreement with the Golden Lake Native Band allows a limited harvest of moose in the eastern portion of the park, while the harvest of bears is considered negligible.

Park visitation averages approximately 600,000 people annually, with the majority of visitors concentrated along the Highway 60 corridor. The interior of the park is accessible only through hiking or canoeing and receives less visitation.

Algonquin Park contains two distinct habitat types. The western two-thirds of the park is made up of rolling hills of mainly deciduous forest, while the eastern third of the park is typically flat with a conifer/deciduous mixed forest. Elevations in the west commonly exceed 500 m while the eastern portion drops below 200 m. Hills in the west are comprised largely of glacial till while the east is made up of sandy outwash plains (Strickland, 1989). Because the elevation is higher on the west side of the park, it is cooler, with 84 frost-free days, compared to 105 on the east side. The west side also receives more precipitation with 100 cm of precipitation annually (33% as snow), as opposed to 90 cm (26% as snow) on the east side (Strickland, 1989). Snow typically remains on the ground from early December to early April.

Forests in the west consist of sugar maple (*Acer saccharum*), yellow birch (*Betula alleghaniensis*), American beech (*Fagus grandifolia*), eastern hemlock *(Tsuga canadensis*), and white spruce (*Picea glauca*). White pine (*Pinus strobus*), red pine (*Pinus resinosa*), jack pine (*Pinus banksiana*), white birch (*Betula papyrifera*), largetooth aspen (*Populus grandidentata*), trembling aspen (*Populus tremuloides*) and red oak (*Quercus rubra*) predominate in the park's east side (Strickland, 1989).

Other plant species found throughout the park that produce hard and soft mast important to bears are pin cherry (*Prunus pensylvanica*), choke cherry (*Prunus virginiana*), beaked hazel (*Corylus cornuta*), blueberry (*Vaccunium angustifolium*), red raspberry (*Rubus strigosus*) and wild strawberry (*Fragaria virginiana*).

Limited logging occurs in the park under a selective or uniform shelterwood cutting system, resulting in a harvest of approximately 1% of the forest annually (Mihell, pers. comm.,1994).

## Methods

Trapping effort commenced in the fall of 1992 and has continued, primarily in the spring and fall until the present time, utilizing the protocol accepted by the OMNR Animal Care Committee. Bears captured in trailer-drawn culvert traps were immobilized with a 2:1 ratio of ketamine hydrochloride and xylazine hydrochloride (Addison and Kolenosky, 1979). Drug delivery was accomplished using a jab stick or a Cap-Chur rifle with a brown charge only. Barbs on darts were filed down for easy removal and minimal injury to bears.

Immobilized bears were weighed and sexed. Any physical markings or abnormalities were noted. A premolar was removed for aging purposes (Willey, 1974). Since 1995, hair samples from individual bears were collected for DNA analysis. All bears were tagged in both ears with yellow plastic rototags with an identifying number on each. Appropriate bears – i.e., males weighing more than 120 kg – were fitted with motion indicator radio collars (Lotek Engineering Inc.,

Newmarket, Ontario). Immobilized bears were given an intramuscular injection of the reversal agent yohimbine hydrochloride at dosages of 0.4 mg/kg.

Radio-tracking of collared bears was conducted at least three days per week from den emergence to den entry, at random times throughout both day and night. Hand-held two-element Yagi antennas with portable receivers of 150.0 - 151.9 megahertz (Suretrack - Lotek Engineering, and ATS - Insanti, Minnesota, USA) were used for ground locating collared individuals. Triangulation from known ground locations was used to locate a bear's position on 1:10,000 Ontario Base Maps or 1:50,000 topographic maps.

Aerial telemetry was accomplished primarily from a Luscombe 8-E fixed-wing aircraft utilizing a VHF radio antenna. Other aircraft used were a Turbo Beaver fixed-wing and a Bell Long Ranger helicopter, both tracking with two mounted Yagi antennas and a switchbox.

Breeding range analysis was accomplished using the minimum convex polygon method (Mohr, 1947). Post-breeding movements were extremely extensive and variable and therefore not included as part of a bear's regular territory.

Food sources were investigated by walking into areas frequented by collared bears for two or more days. Several observers walked transects looking for signs such as tracks, scats and beds or obvious sources of food. Den locations were confirmed by walking in on suspected denning bears.

## Results

Eighteen large adult male black bears have been radio-collared, and more than 1000 aerial and ground fixes have been used to determine accurate estimates of breeding, mid-summer and late summer/fall ranges for those individuals. Ages of collared bears range from seven to 17 years ($x = 10$ years, $n = 9$) with weights from 130 to 185 kg ($x = 148$ kg, $n = 11$). Adult males greater than five years of age comprised 66.6% of all collared and uncollared captured males ($n = 24$), with a mean age of 8.8 years. Four collars were pulled off at 13, 45, 83 and 93 days after collaring. One collar was broken off and found in the den the following spring. Another collar was found broken beside the remains of a moose calf. It was presumed that a cow striking it with a hoof in an unsuccessful attempt to protect her calf from the bear broke this second collar.

Bears emerged from dens from late March to early April and started to wander within breeding ranges. One bear stayed in close proximity to his den for two to three weeks after emerging in early April. Most bears oriented to clearings where they were observed feeding on freshly emerging grasses. These areas were the most successful trapping locations in the spring. Bears also fed on poplar catkins and leaves. Another food source in May was white suckers (*Catostomus commersonni*) spawning in shallow creeks throughout APP. Numerous uncollared bears were observed feeding on suckers, and three collared bears spent between two and ten days at creeks containing spawning suckers.

Five cases of black bear predation on moose calves were observed as well as six eye-witness accounts of bears pursuing cow/calf groups in the past five years in APP. Shortly after den emergence, bear #985 proceeded to an area where he

remained for approximately three weeks. Investigation of the area revealed the carcass of a cow moose almost entirely consumed. Evidence of the carcass was virtually undetectable beyond a 50 m radius. The cow was in poor condition with red, jelly-like marrow and was quite old, as observed by tooth wear.

In July, investigation of the stationary location for three days of a nine year old collared male revealed the remains of a bear. Close examination of the area indicated that the collared bear pursued another bear of unknown sex and age approximately 15 m up a black ash (*Fraxinus nigra*) tree. As indicated by extensive claw marks some 3 m long and 1.5 cm deep, it then dragged the bear down, killed it and partially consumed it. A bed was located 8 m from the carcass and scats containing hair confirmed that a bear had eaten the carcass. The bear killed was determined to be a nine year old adult.

In early October 1995 – a particularly bad year for natural food – some forestry workers observed a large bear eating another bear. When we investigated the site several days later, all that remained of the carcass was the upper and lower jaw, some broken bones, and some claws. Although numerous bear scats containing hair were found around the remains, we were unable to determine whether it was a case of predation or scavenging.

Bears remained in well-defined breeding ranges from den emergence until July or August. Breeding territories ranged from 19.3 $km^2$ to 87.6 $km^2$ ($x$ = 40.4 $km^2$, $n$ = 7). Territorial overlap of approximately 50% occurred in the breeding ranges of only two of the collared bears. Both were approximately ten years old. In another case, upon the death of bear #965, neighbouring male #954, moved more extensively and spent more time in the vacated. All large, adult males possessed some degree of facial scarring, with fresh wounds observed only during the breeding season.

Post-breeding movements out of breeding ranges by individual males ($n$ = 12) occurred between July 4 and August 17 ($x$ = July 25, $n$ = 14), and lasted between 15 and 251 days ($x$ = 82.7) (Figure 1). As an exception, bear #954 left his breeding territory in early September 1994, spent the winter at an unknown location, and returned in mid-May (1995). Bears left breeding territories earlier then normal in 1997 with an average date of dispersal of June 28 ($x$ = 5). All such movements except two took bears outside the boundaries of APP (Figure 2). Linear distances moved from breeding territories ranged from 18.8 km to 73.8 km ($x$ = 46.1 km, $n$ = 11). Once out of the park, some males moved considerable distances (over short periods of time) with one bear moving 91 km in seven days. Movements from breeding territories were most often to lower elevations, with a mean elevational descent of 145.6m ($n$ = 11) (Figure 3).

Natural food sources found in areas frequented by collared bears in summer and fall included soft mast such as wild strawberry, red elderberry (*Sambucus pubens*), red raspberry, blueberry, skunk currant (*Ribes gladulosum*), choke berry (*Aronia melanocarpa*), spikenard (*Aralia racemosa*), pin cherry, choke cherry and Juneberry (*Amelanchier canadensis*). These were found at lower elevations outside APP to the southeast. Hard mast species utilized in late summer and fall include beaked hazel, American beech and northern red oak. In the fall of 1993, coinciding with a beechnut failure, three collared males moved to oak stands containing a bumper crop of acorns. One bear moved more than 60

km east of his breeding territory. When beechnuts were available in or close to territories, males returning from summer feeding forays would spend an additional two weeks to a month feeding in beech stands. Bear #44, an uncollared five year old male captured in such a stand at the end of September weighed 97 kg at that time. When recaptured 17 days later the bear weighed 115 kg, a gain of 18 kg or 0.94 kg per day. Numerous other bears, including females with cubs, also utilized beech stands.

Nine of 15 males that exited APP utilized garbage dumps as a food source. Scats found around dumps contained mainly refuse remains but also contained seeds from various soft mast species. Bears travelled 21 km to 73.8 km (x = 48.7 km) from breeding territories to utilize dumps scattered around the entire perimeter of APP. Three collared males returned to and utilized the same dumps they had used the previous summer. Movements to dumps were sudden and direct. Bear #965 was still in his breeding territory at 1100 hours on August 8 but was observed at a dump 21 km away on August 9 at 2000 hours. Similarly, bear #994 was still in his territory on July 6 but had moved 56 km east to a dump by July 10. Smaller bears tended to utilize dumps diurnally, while large males tended to dominate dumps nocturnally. Females, solitary or with cubs, and smaller bears were not observed at dumps where large males were present. As many as ten large males could be observed feeding at one time. Although no direct physical contact was observed, much vocalizing, jaw-popping and ground slapping occurred between bears, with the largest bears usually maintaining dominance. During the days, collared males moved from 0.5 to 2.0 km (x = 1.25 km) away from dumps to bed down or feed on naturally occurring foods. Feeding at dumps usually ceased in early September when bears either returned to breeding territories to den or moved to areas of hard mast to feed.

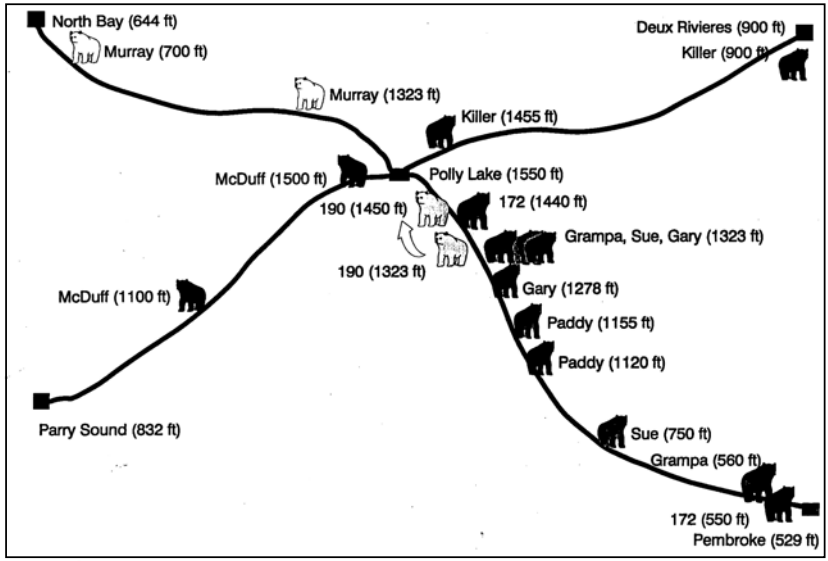


Figure 1: Elevation changes from breeding ranges to post-breeding locations of adult male black bears from Algonquin Provincial Park.

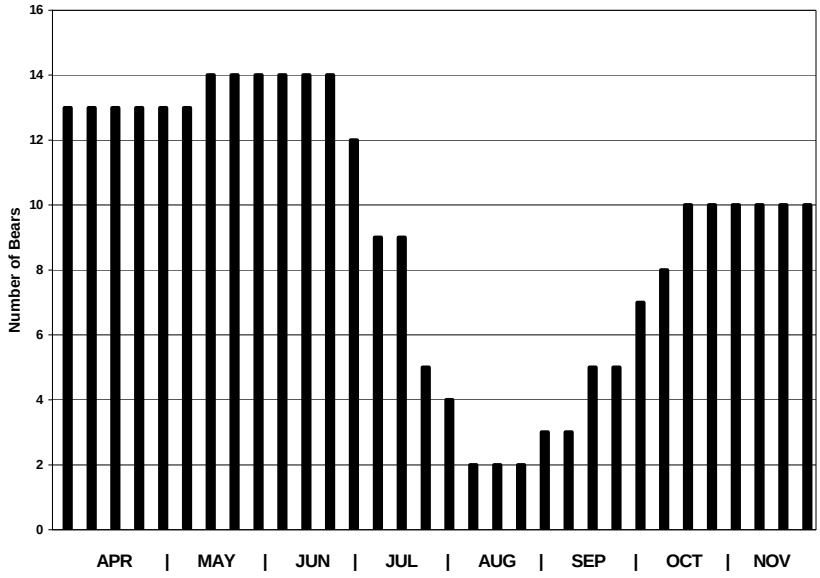


Figure 2: Frequency of radio-collared adult male black bears in Algonquin Provincial Park (result of annual out-of-Park movements).

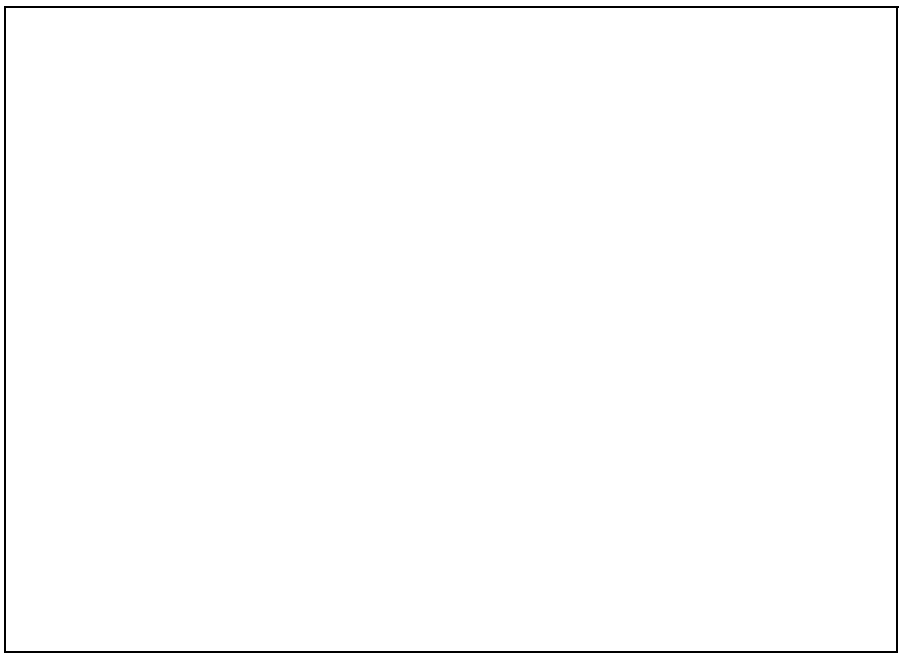

Figure 3: Post-breeding movements of adult male black bears from Algonquin Provincial Park

Following late summer/fall foraging, males returned to breeding ranges in all but one case. Return movements occurred between September 9 and October 17 (x = Sept 29). Twelve of 15 known den sites were located within established breeding ranges. Bears prepared and entered dens soon afterward, unless an abundance of food such as beechnuts was available within breeding ranges.

Hunting mortality occurred in 6 of 11 (54.5%) collared bears. Bear hunting seasons open on September 1 on the east and south sides of APP and on September 15 on the west and north sides of the park. Three bears were shot over baits – a legal spring/fall hunting practice in Ontario. One was fatally shot twice by a rifle hunter in an oak stand 55 days after being hit with an arrow; and one was shot on a trail, possibly over bait, leading to a dump. The latter case and another bear shot over a bait were both within 1 km of dumps.

## Discussion

The age structure of the APP male black bear population suggests a relatively unexploited population, based on mean ages of other unexploited populations. Lecount (1982) found a mean age of 8.1 years for adults (i.e., >3 years) and 51.3% component of adult males in a self-regulating population in Arizona. Young and Ruff (1982) reported a mean age of 11.3 years for adult males (i.e., >4 years) in an unhunted population in Alberta.

Extrapolation based on a mean breeding range size of 40.4 $km^2$ indicates that there may be up to 191 adult males in excess of 120 kg within unhunted APP (7,730 $km^2$) annually. Breeding ranges of adult males in APP are similar in size to those found in Tennessee where an average home range size was 42 $km^2$ for adult males (Garshelis and Pelton, 1981). Adult home ranges found elsewhere were substantially larger: 75 $km^2$ in Minnesota (Rogers, 1987); 119 $km^2$ in Alberta (Young and Ruff, 1982); and approximately 100 $km^2$ in Ontario (Kolenosky and Strathearn, 1987). However, ranges in APP that include post-breeding movements exceed 1,000 $km^2$ for several males that wandered after the breeding season. Similar movements were recorded with adult males in the North Bay area of central Ontario (Kolenosky and Strathearn, 1987). Smaller breeding ranges may have been a result of greater competition for breeding females. The extent of scarring on large adult males would indicate fighting over available mates and/or territory, as was evident in other unhunted populations (Lecount, 1982; Young and Ruff, 1982).

Although the importance of white suckers to bears was not found in the literature, spawning salmon are very important to some black bear populations in western Canada (Russell, 1994). This implies that fish are a valuable food source at a critical time of year, for example spring, for APP bears.

The predator/prey relationship of black bears and moose calves is suspected to be significant from mid-May to mid-June in APP (Wilton, 1983; Inglis and Wilton, 1994). Black bear predation on moose calves has been well documented elsewhere, particularly in Alaska (Franzmann et al., 1980; Franzmann and Schwartz, 1986; Ballard et al., 1990; Schwartz and Franzmann, 1991). Instances of predation are difficult to detect with radio-collared bears due to the remoteness

of stationary individuals, forest cover, the short time in which a moose calf is consumed and the concentration of signs only in close proximity to the kill.

Cases of intra-specific predation and cannibalism are apparently rare in most areas where hunting mortality is a significant cause of death of adult males (Rogers, 1983). However, in APP, where large numbers of adult males exist, predation of other smaller bears may still occur. This is the case particularly in a bad year for natural food from plants, as was the case in 1995.

Soft mast does not become available until mid-June in APP, when wild strawberries and red elderberries ripen. Ants also become available at this time. From late June to late August, bears consume other berries and fruits such as red raspberry, pin and chokecherries, blueberries, spikenard and Juneberries. Plant phenology and species diversity, affected by temperature and precipitation, may induce the post-breeding movements of adult males in July to lower elevations. Juneberry, for example, is scarce within the study area's breeding territories but is found in abundance at lower elevations in southeast APP. Blueberries are found in greater abundance in the eastern and southern portions of APP. Collared bears were frequently located in areas where Juneberry and blueberries were abundant. Elevation shifts by black bears were found in Great Smoky Mountains National Park, Tennessee, from spring (x = 1,300 m) to fall (x = 700 m) and were believed to be caused by greater mast abundance and diversity, particularly oak (Garshelis and Pelton, 1981).

Hard mast, particularly red oak acorns and beechnuts, becomes very important to bears in APP in early September, resulting in large, rapid weight gain. An abundance of mast provides similar weight gains in males in other areas of Ontario (Kolenosky and Strathearn, 1987). Bears with home ranges in the western and central portions of the park, where climatic conditions are unsuitable for red oak growth, may be forced to leave the boundaries of APP to seek acorns. This is particularly common when there is a failure of beechnut production and an abundance of acorns, as was the case in 1993. Late summer and fall movements of black bears are a common phenomenon throughout their range where various natural food sources and critical weight gain govern such foraging (Garshelis and Pelton, 1981; Kolenosky and Strathearn, 1987; Rogers, 1987; Kolenosky and Obbard, 1991; Paquet, 1991).

Although some bears seemed to utilize only natural foods, 54.4% of males that exited the park and also descended in elevation used garbage dumps as a significant, if not main, source of food. In contrast to bears using dumps in Minnesota (Rogers, 1987) and Newfoundland (Payne, 1977), bears from APP used only one dump per season, even though other dumps were located within 10 km of each other. All feeding at dumps by large males was crepuscular or nocturnal. Five radio-collared adult males utilizing a dump in Manitoba did so between 21:30 and 5:00 hours, 90% of the time (Paquet, 1991). Similar to sex ratios at Algonquin dumps, in Minnesota Rogers (1987) noted that females outside their territories avoided unfamiliar adult males or congregations of males, even though an abundant food source was present. Females and smaller bears avoiding dumps is a common occurrence (Rogers, 1987; Stringham,1989; Paquet, 1991) except perhaps when large males have been removed through hunting and poaching (Young and Ruff, 1982). Collared males bedded down during the day an average distance of 1.25 km from dumps. Similarly, in

Minnesota during a particularly poor year for natural foods, a garbage-habituated male was found within 2 km of a dump on 11 of 12 occasions (Rogers, 1987). In Manitoba, adult males using dumps concentrated their activities within 1 km of the dump (Paquet, 1991). Examination of scats indicates that dumps are not the sole source of food, as Rogers (1987) found in Minnesota.

All of 11 males that exited APP were still located outside the park when bear hunting seasons opened. This resulted in the death of six (54.5%) of those bears. Three of these bears were shot over baits and two were shot within 1 km of a dump. Hunting of bears is prohibited within 400 m of a Crown (provincial) dump. In Manitoba, where baiting is also permitted, 18 (72%) of 25 human-caused mortalities among black bears in and adjacent to Riding Mountain National Park were a result of bears killed while hunting over baits (Paquet, 1991). Hunting pressure is considered high in areas adjacent to APP, where spring and fall black bear hunts take place (Strickland, 1992). In addition, First Nation hunters now acknowledge fall harvest of black bears in APP. Because APP adult males remain in breeding ranges throughout the spring hunt (April 15 to June 15) their vulnerability to hunting mortality remains low at that time, although bears with territories close to the park boundaries may be unprotected. In May 1997, bear #597, one of two bears whose territory extended beyond the park's boundaries, was the first bear in the study to be shot during the spring bear hunt. Other parks and reserves also have increased hunting mortality at various times. Garshelis and Pelton (1981) noted increased mortality due to hunting when bears wandered out of Great Smoky Mountains National Park foraging for food during the fall.

Loss of resident adult APP males through hunting prompts questions regarding the effects of hunting on the total APP population. Presumably, high bear densities in the park are thought to support a high harvest rate outside the park through emigration (Strickland, 1989), even though a total population estimate does not exist. Garbage dumps, plant phenology and species abundance will continue to draw bears from APP. The effects of mortality of adult males on social structure and maintenance of dominant genetic integrity are poorly understood and warrant further study of the black bear population of Algonquin Provincial Park.

## Acknowledgements

We would like to thank the following who provided funding, support, and dedication to this study: Algonquin Eco Watch, Buckshee Airlines, The Friends of Algonquin Park, the Ontario Ministry of Natural Resources, and the World Wildlife Fund. The typing, preparation of diagrams, and review of this manuscript by C.A. Hooper and N.Checko is also greatly appreciated.

## References

Addison, E. M., and G. B. Kolenosky. 1979. Use of ketamine hydrochloride and xylazine hydrochloride to immobilize black bear (*Ursus americanus*). J. Wildl. Dis. 15: 253-258.

Ballard, B. B., S. D. Miller, and J. S. Whitman. 1990. Brown and black bear predation on moose in south central Alaska. Alces 26: 1-8.

Franzmann, A. W., C. C. Schwartz, and R. O. Peterson. 1980. Moose calf mortality in summer on the Kenai Peninsula, Alaska. Journal of Wildlife Management 44: 764-768.

___, and C. C. Schwartz. 1986. Black bear predation on moose calves in highly productive versus marginal moose habitats on the Kenai Peninsula, Alaska. Alces 22: 139-153.

Garshelis, D. L., and M. R. Pelton. 1981. Movements of black bears in the Great Smoky Mountains National Park. Journal of Wildlife Management 45: 912-925.

Inglis, J. E., and M. L. Wilton. 1994. Some behavioural aspects and their possible role in attacks on humans by adult male black bears. Proceedings. 12th East. Black Bear Workshop. In press. Gatlinburg, Tenn.

Kolenosky, G. B., and S. M. Strathearn. 1987. Black Bear. In M. Novak, J. A. Baker, M. E. Obbard, and B. Malloch, eds. Wild furbearer management and conservation in North America. North Bay, Ontario Trappers Association: 442-454.

___, and M. E. Obbard. 1991. Black bear studies in the Chapleau Crown Game Preserve 1989-1990. Unpublished report. Ontario Ministry of Natural Resources.

Lecount, A. L. 1982. Characteristics of a central Arizona black bear population. Journal of Wildlife Management 46:861-868.

Mohr, C. O. 1947. Table of equivalent populations of North American small mammals. Am. Midl. Nat. 37: 223-249.

Paquet, P. C. 1991. Black bear ecology in the Riding Mountains. Final Report. Prepared for Manitoba Natural Resources and Canadian Park Service by John/Paul and Associates. Winnipeg.

Payne, N. F. 1977. Hunting and management of the Newfoundland black bear. Wildlife Society Bulletin. 6.

Rogers, L. L. 1983. Effects of food supply, predation, cannibalism, parasites, and other health problems on black bear populations. In F. Bunnell, D. S. Eastman, and J. M. Peek. eds. Symposium – Natural Regeneration of Wildlife Populations. For Wildl. and Range Exp. Stn. Proc. 14 Univ. Idaho, Moscow: 194-211.

___. 1987. Effects of food supply and kinship on social behaviour, movements, and population growth of black bears in northeastern Minnesota. Wildl. Monogr. 97.

Russell, C. 1994. Ghosts of the rain forest. Canadian Geographic 114(1): 18-29.

Schwartz, C. C., and A. W. Franzmann. 1991. Interrelationship of black bears to moose and forest succession in the northern coniferous forest. Wildl. Monogr. 113.

Strickland, D. 1989. Trees of Algonquin Provincial Park. The Friends of Algonquin Park, Whitney, Ont.

Strickland, M. A. 1989. Black bear (*Ursus americanus*) hunting and harvest trends in Algonquin region (WMU 46-60) 1981-1987. Unpub. report. OMNR, Algonquin Region.

___, 1992. Status report on black bear in Algonquin region 1981 to 1990. Unpublished report. OMNR, Algonquin Region.

Stringham, S. F. 1989. Demographic consequences of bears eating garbage at dumps: an overview. In M. Bromley, ed. Bear-people conflicts: Proc. of a Symposium on Management Strategies. Yellowknife, NWT: 35-42.

Willey, C. H. 1974. Aging black bears from first premolar tooth sections. Journal of Wildlife Management 38: 97-100.

Wilton, M. L. 1983. Black bear predation on young cervids – a summary. Alces 19: 136-146.

___, and J. E. Inglis. 1996. Some possible causes of fatal attacks on humans by large adult male black bears. Poster presentation. Proc. 13th East. Black Bear Workshop. In Press.

Young, B. F., and R. L. Ruff. 1982. Population dynamics and movements of black bears in east central Alberta. Journal of Wildlife Management 46: 845-860.