Backgrounder on Black Bears in Ontario

Ontario Ministry of Natural Resources
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Cette publication hautement specialisée Backgrounder on Black Bears in Ontario n'est disponible qu'en Anglais en vertu du Règlement 411/97 qui en exempte l'application de la <u>Loi sur les services en français</u>. Pour obtenir de l'aide en français, veuillez communiquer avec Linda Maguire au ministère des Richesses naturelles au linda.maguire@ontario.ca.

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INTRODUCTION

Black bears (*Ursus americanus*) are a valuable provincial resource. They have gradually assumed increasing importance as a hunted big game species by both resident and non-resident hunters while, at the same time, also being harvested at low levels by trappers for their hides. Additionally, many residents and visitors to the province enjoy viewing black bears in their natural habitat. Ontario manages black bears as an important and integral part of natural ecosystems.

Black bears were considered a vermin species (unprotected and bountied) until 1960. In 1961, they were classified as a managed game species under the *Game and Fish Act* and the provincial bounty was revoked. The value of black bears has increased over the last decades, and the level of management has intensified accordingly.

Black bear populations are vulnerable to over-harvest because they are a long-lived animal, reach sexual maturity relatively late in life, have a low reproductive rate that is physiologically dependent upon environmental conditions (food), and are most sensitive to changes in adult survival, particularly survival of adult females. For these reasons, their harvest must be managed carefully.

Black bears can cause property and crop damage as well as occasional concern for human safety. Public education and prevention efforts attempt to minimize human-bear conflicts. The provincial Bear Wise initiative was launched in 2004 to reduce human-bear conflicts based on 4 cornerstones of reporting, response, prevention and awareness, and education through partnerships with communities, police and individuals.

HISTORIC AND PRESENT IMPORTANCE

Ecological Importance

Black bears are a natural part of forested habitats and an integral component of healthy ecosystems. The presence of black bears is an indication of reasonably functioning terrestrial and watershed ecosystems. A landscape that can support the habitat requirements of one of the largest terrestrial carnivores can support a variety of other plant and animal species.

As omnivorous carnivores, black bears use a variety of natural foods that allow them to live and thrive over a wide range of climatic and habitat types (Kolenosky and Strathearn 1987a).   Black bears are primarily inhabitants of forested areas where they are best able to meet their needs for cover, food and security from predators including other bears (Nuisance Bear Review Committee 2003).

Black bears have relatively short, unspecialized digestive systems, much like humans. Vegetation is the principal component of their diet, but they also consume some animal protein through scavenging and predation on insects, mammals and fish. Bears can be a predator of young and adult large mammals such as moose (*Alces alces*) and white-tailed deer (*Odocoileus virginianus*).

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Their navigational skills, memory and intelligence allow them to migrate more than 100 km to blueberry patches in the summer (Obbard and Kolenosky 1994) or to oak and beech stands in the fall (Kolenosky and Strathearn 1987a), and to return to their home range in a matter of days after being relocated great distances (Rogers 1986, Landriault 1998).

Black bears have a fascinating life history. Despite feeding selectively on easy to digest foods, they are able to nearly double their body weight during the 4-5 months of summer and fall. The stored fat sustains them up to 6 months of hibernation. Adult females have a delayed implantation reproductive system that allows the delay of active gestation until the fall, dependent on body condition. During the winter months in the dens, female black bears give birth and nurse a litter of cubs fueled by stored fat. The ability to avoid the build up of toxic compounds (e.g., urea) in their bodies and the loss in bone mass while in hibernation are phenomena still being studied for possible medical applications.

Aboriginal Significance

Black bears have fascinated both primitive and modern cultures with physical attributes that include strength, imagined ferocity, secretive behaviour and method of walking. Because they walk on the entire soles of their feet, bears have often been described as 'the beast that walks like a man' (Kolenosky and Strathearn 1987a) or 'half-human' (McGee 1987).

Aboriginal people everywhere revered bears. For some groups, this was simply because of the bear's potential danger to humans. For most groups, it was because they were considered amongst the most spiritually powerful animals (McGee 1987). Today, the black bear continues to be used as a clan totem by many groups.

There is, and continues to be, a great deal of variation in customs involving the consumption of bear meat and the use of hides. These items were and are favoured by some First Nations people, of no interest to some, and avoided by others (McGee 1987). There are a number of aboriginal trappers who hunt bears under their trapping licences, and a small number of aboriginal bear operators who offer hunting services to non-residents. Aboriginal peoples are accustomed to handling problem bears for their personal protection and that of their communities.

Social Importance

Black bears were feared and persecuted by European settlers. Human encroachment into bear habitat (forests) and human-bear conflicts in agricultural areas resulted in bears being viewed as hindrances to agricultural development and a public safety threat. The provincial government encouraged their eradication through the incentive of public bounties from 1793 until 1960.

Public opinion about black bears has changed in the past several decades due to increasing awareness of the bear's ecological role and an increased appreciation for the intrinsic value of the species. However, attitudes about bears continue to be polarized.

Recreational hunting has been a long-standing activity in Ontario, and black bears are valued by both resident and non-residents as a big game species. In 2007, 22,730 people (15,554 residents

and 7,176 non-residents) purchased bear hunting licences. Interest in bear hunting by residents has show a small but steady increase in recent years.

More recently, there has been renewed interest and concern about the status of black bears. Some contend that bear populations need to be sustained and harvest controlled because they are a long-lived species with low reproductive potential and a high sensitivity to changes in adult survival. Others maintain that increased numbers of bears, particularly since the cancellation of the spring open season in 1999, are causing unacceptable levels of predation on wild species (e.g., moose), domestic livestock and agricultural crops, and pose a threat to property and public safety when they are attracted to communities in search of food.

Almost all of Ontario has habitat that supports populations of black bears. Considering the rate and extent of change in land use patterns within bear range, as well as natural restoration of suitable habitat at the southern end of bear distribution, there is a need to develop an enhanced management program that will ensure the sustainability of black bears while minimizing threats to property and public safety.

Economic Significance

In addition to the less tangible intrinsic and social benefits, there are also economic benefits derived from black bear hunting and trapping. OMNR uses periodic mail surveys of hunters to evaluate the direct economic effects of bear hunting.

Black bear hunting, particularly by non-residents who are required to use licenced bear tourist operators, contributes significantly to tourism benefits. In 2002, resident hunters spent an estimated $8.9 million and non-resident hunters spent $18.1 million on new equipment, travel, accommodation and other expenditures associated with bear hunting activities in Ontario (OMNR data). These combined expenditures of about $27.0 million yielded a contribution to Ontario's gross provincial income of $32 million in 2002 (OMNR data). In addition to tax revenues, Ontario also collects annual revenue from the sale of various bear hunting licences, export permits and Crown land use fees. In 2007/08, this amount totaled over $2.44 million (data from the Ontario Government's Consolidated Revenue).

In 2007, about 550 bear tourist operators provided bear hunting services to non-resident hunters. Their activities bring a significant amount of economic benefit to northern communities generated through the purchases of goods and services, induced effects and employment.

Hunters and trappers are permitted to sell untreated hides of harvested black bears with head and claws attached. The price of Ontario bear hides averaged $82.50 in 2007/08, based on sales at the two Ontario fur auction houses. Hide prices vary from year to year. For example, the average price in 2000/2001 was $158.07. Based on average price, in 2007/08 about $5,197.50 in gross revenue was generated from the sale of Ontario bear hides.

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GENERAL ECOLOGY

Description

Black bears are large, heavily boned mammals. Adult males weigh from 120 kg to 300 kg (250-650 lbs.), and are 130 to 190 cm (4-6') in length from the tip of the nose to the tip of the tail. Adult females are smaller, weighing from 45 to 180 kg (100-400 lbs.) and measuring 110 to 170 cm (3½-5 ½') in length. Adult females reach maximum height and length at about five years of age. Adult males reach their maximum height and length when they are seven or eight years old (Kolenosky and Strathearn 1987a). Most black bears in Ontario have a black coat colour although a small proportion (less than five percent) are dark brown to light brown.

Body weights of adult bears vary dramatically throughout the year, and from one year to the next, depending on food availability. In Ontario, adult bears lose weight from the time they enter the den in the fall until well after they emerge from the den in spring. In early July, berries and other soft fruits start to become available and adult bears begin to gain weight. When food is abundant, bears can gain up to 1 kg per day and can double their weight by fall.

Distinguishing Age and Sex Classes

Adult male bears have heavily muscled necks, shoulders and forelimbs, and have well developed muscle masses on top of their heads. Males also have broad snouts and their ears appear to be small because of the size of the head. If a male bear stands up and faces an observer, it is generally easy to see the penis (Obbard 2001, Obbard et al. 2008). If a male bear is observed in a side view, long hairs hanging down from the penis can be seen in front of the thigh as it walks (Landriault et al. 2000).

Adult females are more slightly built than males; they have small necks and have smaller frames. If a female bear stands up and faces an observer, it is generally easy to see the nipples (Obbard 2001). The long hairs that hang down from the vulva can be seen from behind as she walks (Landriault et al. 2000).

Cubs of the year weigh about 5 kg by late June (the size of a small house cat). They grow to 15 to 30 kg (35 to 65 lbs.) by fall.

Yearlings weigh 20 to 30 kg (45 to 65 lbs.) by late June (similar to a medium sized dog), and by fall may be 40-45 kg. Body growth in bears is highly dependent on the available food supply. Young bears in the boreal forest grow more slowly than young bears in the deciduous forests of southern Ontario (Obbard, unpublished).

Distribution and Habitat

Black bears are found throughout most of Ontario, from close to Lake Ontario in the south to the Hudson Bay coast in the north, although they are sparsely distributed in the far north (Fig. 1). Throughout most of this range, bears have access and genetic connectivity to neighbouring areas; however the bears on the Bruce Peninsula seem to be isolated from the black bears found east of Georgian Bay (Mills 2005).

Figure 1. Estimated black bear distribution and density in Ontario.
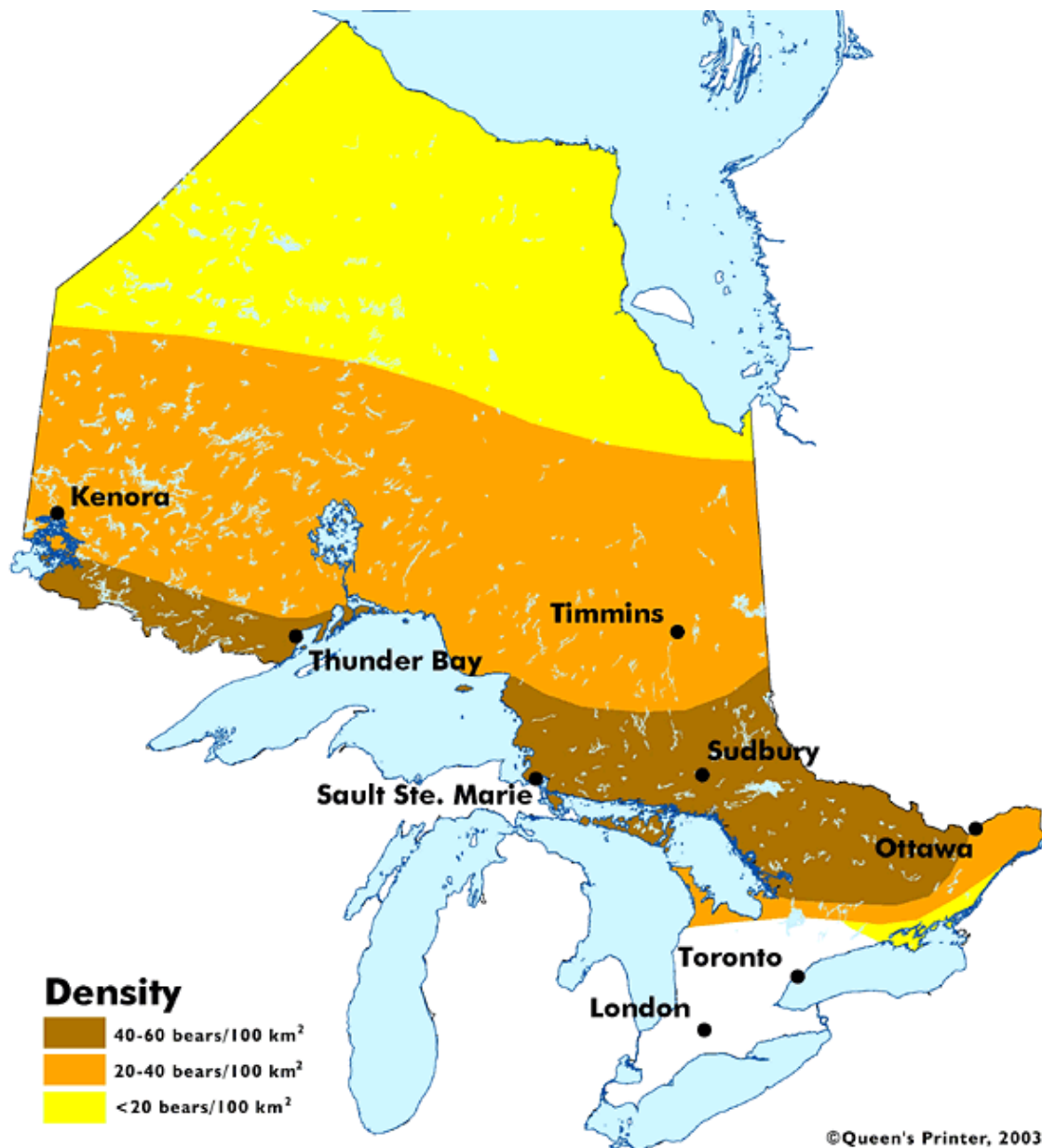
The highest densities of bears in Ontario (more than 60 bears/100 km^2) are found in areas such as the Chapleau Crown Game Preserve and Algonquin Provincial Park where bears are protected from hunting. By comparison, in parts of the province where bears are hunted, the highest densities recorded are closer to 40 bears/100 km^2. The highest potential population growth rates are reached in the Great Lakes-St. Lawrence forest zone of southern Ontario where bears have access to hard mast (acorns and beechnuts) in fall (Yodzis and Kolenosky 1986). The population appears to be slowly expanding its range in the southern most parts of southern Ontario. This is believed to be due to an improvement in habitat resulting from abandoned farmland returning to old field and forest. This expansion will likely be limited by human settlement.

Unlike brown (grizzly) bears (*Ursus arctos*) and polar bears (*Ursus maritimus*), black bears are primarily inhabitants of forested areas where they are best able to meet their needs for cover, food, and security from predators (including other bears). On the Bruce Peninsula, black bears preferred dense mixed and dense deciduous forests (Coady 2005). Black bears have well developed navigational abilities, though the specific mechanisms that they use are unknown (Rogers 1987). Bears use these skills in summer and fall when they may migrate more than 100 km to blueberry patches (Obbard and Kolenosky 1994) or to oak and beech stands. Apart from seasonal migrations, home ranges of adult female bears average 15 to 25 km^2 (Schenk et al. 1998). Home ranges of adult males can be 10 times the size of female home ranges. Neither sex is territorial where food is abundant (Horner and Powell 1990) and the home ranges of many bears can overlap (Schenk et al. 1998), though where habitat productivity is low females may show territoriality to other females (Powell 1987)

Foods Eaten

Black bears have a keen sense of smell that enables them to locate food sources, including many that are not obvious to humans. They are omnivores (i.e., they eat both plants and animals), but the bulk of their diet is plant material. Generally, bears are opportunists. Their preferred foods are most abundant in uneven-aged mixed coniferous/deciduous forests that contain numerous shrub species. They consume a variety of food items as they become available throughout the year.

In spring, bears feed on willow catkins, grasses, dandelions, clover, and aspen leaves. Leaves and flowers are preferred when they are highest in protein content (shortly after leaf burst or flowering), before the cell walls build up lignin and cellulose and become more difficult to digest (Romain 1996). Important sources of protein in the spring may include winter-killed or live adult deer or moose (Austin et al. 1994), spawning suckers, and newborn deer fawns or moose calves (Ozoga and Verme 1982, Ballard 1992). Preying on newborn moose calves may occasionally be dangerous for black bears because moose cows will aggressively defend their calves (Obbard et al. 2000).

In summer, ant colonies and nests of bumblebees and wasps are excavated and eaten, providing major protein sources. Berries and other soft mast are eaten as they become available throughout the summer. These include fruits of various currants, wild sarsaparilla, dogwoods, strawberries, raspberries, pin and chokecherries, blueberries, and bristly sarsaparilla (Romain 1996).

In fall, hazelnuts, mountain ash, acorns and beechnuts are favoured foods. Black bears will also prey on livestock and are attracted to agricultural crops such as grains and orchards during the summer and fall.

Predation on Wild Prey

Although not a major component of their diet, black bears have been known to opportunistically target and prey on young white-tailed deer and moose.

There has been little assessment of black bear predation on wild cervids in Ontario. Wilton et al. (1984) investigated 296 intestinal tracts from black bears for cervid hair. They found moose and/or deer hair in 29.7% (88) of the samples. Of the samples containing cervid hair 22.7% (20) contained moose hair, 71.6% (63) contained deer hair and 5.7% (5) contained both moose and deer hair. Of the 296 samples, 13.1% contained adult cervid hair, 5.1% adult and neonate hair, and 11.5% only neonate hair. The authors had no way of determining whether the cervid hair found in intestinal tracts was from scavenged animals or due to predation. .

Garner (1994) studied survival of 63 calves (47 collared and 16 non-collared calves of collared adult females) in Algonquin Provincial Park. He found that annual calf survival was 61%, a high survival rate compared to other areas where both black bears and wolves are found. Of the 63 calves studied, 24 (38%) calves died during the study with predation being the largest mortality factor (7 of 24 mortalities (29%)). Overall, 7 of 63 (11.1%) calves died from predation, 5 (7.9%) died due to black bears and 2 (3.2%) died due to wolves.

Austin et al. (1994) reported an incident of an adult cow moose killed by a collared adult male black bear in the boreal forest near Chapleau. They concluded that some adult male black bears are capable of killing adult moose, but it was very rare. Obbard et al. (2000) also found an adult female black bear killed by a moose in the boreal forest near Chapleau. It was concluded that moose are dangerous prey for black bears, at least adult females.

Ballard (1992) conducted a review of other recent North American studies of black bear predation on moose. He related a study involving 17 radio-collared black bears that found that the bears killed 1 calf/40 bear-days (range 0/29 to 1/5.7 bear-days). In this study no adult moose were killed, no kills occurred during summer and it appeared that, although not significantly different, male bears had higher predation rates on moose calves.

Ballard's review showed that moose calf mortality due to black bear predation is highly variable. In an east-central Alaska study (Boertje et al. 1985) 23 of 33 calves were killed by predators in the first year though only 3% (1 of 33) were killed by black bears (52% by brown bears; 15% by wolves). In a study in two areas of the Kenai Peninsula, Alaska 18% (22 of 121) of collared calves were killed by black bears (Franzmann and Schwartz 1986). In a south-central Alaska study 8.7% (4 of 46) of collared calves were killed by black bears (Ballard et al. 1990) and in a New Brunswick study 9% (1 of 11) of collared calves were killed (Boer 1988). In a Newfoundland study, 30% of calves (26 of 88) died—black bears were the only predator during the study and though cause of mortality was not always definitively determined it was assumed to be due to predation (Mahoney and Mercer, pers. comm.). The impact of black bear predation on moose will vary.

Food Availability

Items eaten in spring are generally predictable in timing of availability, and do not vary greatly in abundance from one year to another. Nevertheless, many bears lose weight while feeding on these foods. At best, bears will maintain their weight in the spring. Summer and fall food items vary greatly in timing of availability and in abundance from one year to another. For example, blueberries can vary from less than 10 kg/ha to more than 1000 kg/ha (Obbard, unpublished). Bears can double their body weight in years when fruits are abundant. It is the abundance of summer and fall foods that has the greatest effect on survival and on the proportion of adult females that reproduce successfully.

The potential for problem bear activity increases in years when berry crops fail and bears search for alternate food sources. The behaviour may also be apparent the following spring when animals emerge from their dens in poor condition. Survival of the current year's cubs can be low following berry crop failure, and few females will produce cubs the following year. Berry crop failure may occur as a result of a late spring frost that kills blossoms (usually in early June), or a summer drought that causes the berries to shrivel (generally in July or August).

Life History

Mating

Mating generally occurs in June and July. After mating, fertilized eggs do not implant in the wall of the uterus immediately (Wimsatt 1963). The fertilized egg floats free in the uterus until the female is ready to enter the den, typically early to mid- October in Ontario. At that time, if the female has attained a body weight of at least 70 kg then implantation occurs and the active gestation of about 60 days begins. If pregnant females do not gain enough weight in summer and fall, then implantation does not occur and the female's body absorbs the fertilized eggs. Because there is a long delay between conception and active fetal development (known as delayed implantation), the mating season is not focused in a short time period as it is for other wildlife such as moose.

Although the entire mating season may span almost two months, an individual female is in estrus (ready to ovulate, receptive to males, and able to become pregnant) for fewer than five days. During that five-day period, the pair may mate several times. The male will also attempt to keep other males away from the female. During the mating season, male black bears travel extensively searching for receptive females and often fight vigorously for mating opportunities. After the breeding season ends, most large males have recent wounds and scars on their heads and elsewhere on the body. Genetic research conducted as part of OMNR's studies near Chapleau showed that more than one male may be the father of cubs from the same litter, and that males may be the father of cubs in more than one litter in a single year (Schenk and Kovacs 1995). It is likely that larger, older males are more successful in obtaining mating opportunities (Kovach and Powell 2003).

Birth

Cubs are born while the female is in the den, generally in early January but occasionally as late as early February (Alt 1983). The timing of birth depends upon when the female enters the den. If the female enters the den late (generally in response to abundant fall foods) then the cubs are born later. Newborn cubs weigh 200 to 300 grams, which is less than 1/300th of the female's weight. Cubs grow rapidly on milk that has higher fat and protein contents than human or cow's milk (Oftedal et al. 1993). By six weeks of age, cubs weigh 2 to 3 kg (4 to 7 lbs.). By the time the bears leave the den in late April or early May, the cubs weigh about 5 kg (about 10 lbs.).

Litter size varies from one to four cubs in Ontario, with most litters having either two or three cubs (average litter size is 2.4) (Kolenosky 1990).

Reproductive Output and Offspring Survival

Except for the muskox (*Ovibos moschatus*), bears have the lowest rate of reproduction of any land mammal in North America (Jonkel and Cowan 1971). Female black bears in Ontario may produce their first litter when they are five years old, but the average age of first reproduction is about six in southern Ontario (Kolenosky 1990), and seven in a hunted population in northern Ontario (Obbard and Howe, 2008). Age at first reproduction averaged eight in a non-hunted population in the northern Ontario study (Obbard and Howe 2008). Average litter size in central Ontario was 2.45 (Kolenosky 1990). In northern Ontario mean litter size of females greater than 7 years of age was 2.40 following food shortage years and 2.48 following other years; mean litter size for females 5-7 years of age was 2.0 in years following food shortages and 1.82 in other years (Obbard and Howe 2008). Sample sizes of litters in years following food shortages were low because most females did not produce litters in years following food shortages.

Cubs stay with females throughout the year of birth, and den together the following fall. Females with cubs of the year may become problem bears in late June when the nutritional demand of milk production peaks and the berry crop is not yet ripe. At the end of their first year together, females and cubs enter a den for a second winter.

Females and cubs separate the following May or June when the cubs (now yearlings) are 17 to 18 months old. This is the point in the reproductive cycle at which the female is in the poorest condition. The need to quickly gain enough weight to reproduce successfully may make females more likely to become problem bears at this time.

Following break-up of the group a new breeding cycle begins as the adult female comes into estrus and becomes receptive to males again. Female black bears cannot breed successfully more than once every two years. In the Great Lakes-St. Lawrence forest zone, most females are able to produce litters every second year (Kolenosky 1990). However, in the boreal forest where food is less abundant and food failure events are more common, most females cannot produce cubs every second year. In this region, the interval between litters is often three or four years (Obbard and Howe 2008). In southern Ontario about 75 % of cubs survive their first year, and about 75% of yearlings survive to two years (Kolenosky 1990). By comparison, in northern Ontario about 45% of

cubs survive to one year of age, and about 75-80% of yearlings survive to two years; survival of cubs, yearlings and subadults was lower during years of food shortages (Obbard and Howe 2008).

Seasonal Patterns

Emergence from Den

In most years black bears emerge from their winter dens from early to mid-April in southern Ontario (Kolenosky and Strathearn 1987b), and between mid-April and early May in northern Ontario (Obbard unpublished), although they may emerge sooner in early springs. Typically, adult males are the first to emerge, followed by sub-adult males and females, females accompanied by yearlings and, finally, females with cubs of the year (Kolenosky and Strathearn 1987b). Adult males often wander considerably at this time, and will feed on winter-killed moose and deer. Females with young, especially females with cubs of the year, often spend a week or longer in the immediate vicinity of the den after emerging in the spring.

In the fall, pregnant females often prepare for the following spring by choosing den sites that have large trees (more than 25 cm diameter) within 30 m of the den. These large trees are referred to as 'sanctuary' or 'refuge' trees (Rogers and Lindquist 1992), and are typically large-diameter white pines or hemlocks in southern Ontario (Obbard, unpublished), and white spruce or cedars in northern Ontario (Obbard, unpublished). Sanctuary trees function as escape cover for the young cubs in the period after emerging from the den (Kolenosky and Strathearn 1987b), and females will cache their cubs in such trees while foraging.

Early spring/Early Summer

At this time of year, black bears frequent openings in the forest and road edges where new green vegetation first appears. Later they may travel to streams to feed on spawning white suckers (*Catostomus commersoni*). Bears are also frequently found along roadsides where they bend down young trees to strip the new leaves from the branches. After aspen leaves emerge, black bears may be found high in mature trees feeding on the new leaves.

In spring and summer, black bears are generally active from about an hour before sunrise to about an hour after sunset. On hot afternoons bears are often found near water bodies.

Summer/Early Fall

In northern Ontario, the timing of seasonal movements by black bears is closely linked to the availability of blueberries. If fruits are available early the bears leave their home ranges early, and if fruits ripen late the bears delay their foraging trips. Black bears appear to sample the blueberries available in their home range, and then move to patches with more berries when fruits are mature. In most years bears begin to leave their spring range in early July and travel in search of blueberry patches. Blueberry patches are often found in regenerating jack pine plantations; old burns are also visited. Bears studied near Chapleau traveled an average of about 50 km to good blueberry patches, though some females traveled as far as 100 km (Obbard and Kolenosky 1994).

In southern Ontario and parts of northwestern Ontario foraging trips by black bears are linked to the availability of acorns or beechnuts. Thus, seasonal movements in southern Ontario are more likely to occur in fall than in summer. In years when major food crops fail, black bears wander more widely and can remain away from their spring ranges for 3 to 4 months.

By early September most bears in northern Ontario return to the home range used in spring and early summer, and begin to search for a suitable den site. They feed on hazelnuts and mountain ash fruits if available, but also frequent road edges where they feed on fall growth of grasses and clovers.

By mid-October most bears will have selected a site and be in the process of constructing a den, though they will continue to forage as long as food is available. As the days shorten their daily cycle of activity slows, and they are often not active until mid-morning. Yearlings are the first bears to enter their dens, followed by pregnant females and solitary females, females accompanied by cubs of the year, adult males, and finally sub-adults (Kolenosky and Strathearn 1987b). In most years all bears, except perhaps for adult males, will be in dens by early November and will not leave until the following spring. Actual timing of entry into dens appears to be influenced by a variety of environmental signals including availability of food, change in day length and snow cover. Of these, the most important signal is food availability; in years when mountain ash fruit is available in northern Ontario in the fall bears will enter their dens two to three weeks later than in other years.

HUMAN IMPACTS

Harvest Mortality

The provincial sustainable harvest rate is about 10% of the population. The current rate of bears harvested by hunters and trappers is about 6-8% of the population based on a provincial population estimate of 75,000-100,000 bears. The harvest is not evenly distributed across bear range as harvest effort is not consistent in some parts of the province

Hunting

The annual number of bear hunting licences purchased by residents has remained relatively stable in recent years (Fig. 2). The number of licences purchased annually by non-residents was relatively stable until 1998, and decreased by about 43% (5,000 licences) in 1999 following the cancellation of the spring open season. Overall, total hunter numbers appear to have increased since 1999 due to a slight increase in resident hunter numbers and, while they are still well below the high numbers of the mid 1980s, they are comparable to the few years immediately prior to 1999.

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Figure 2. Annual number of black bear licences purchased by resident and non-resident hunters.
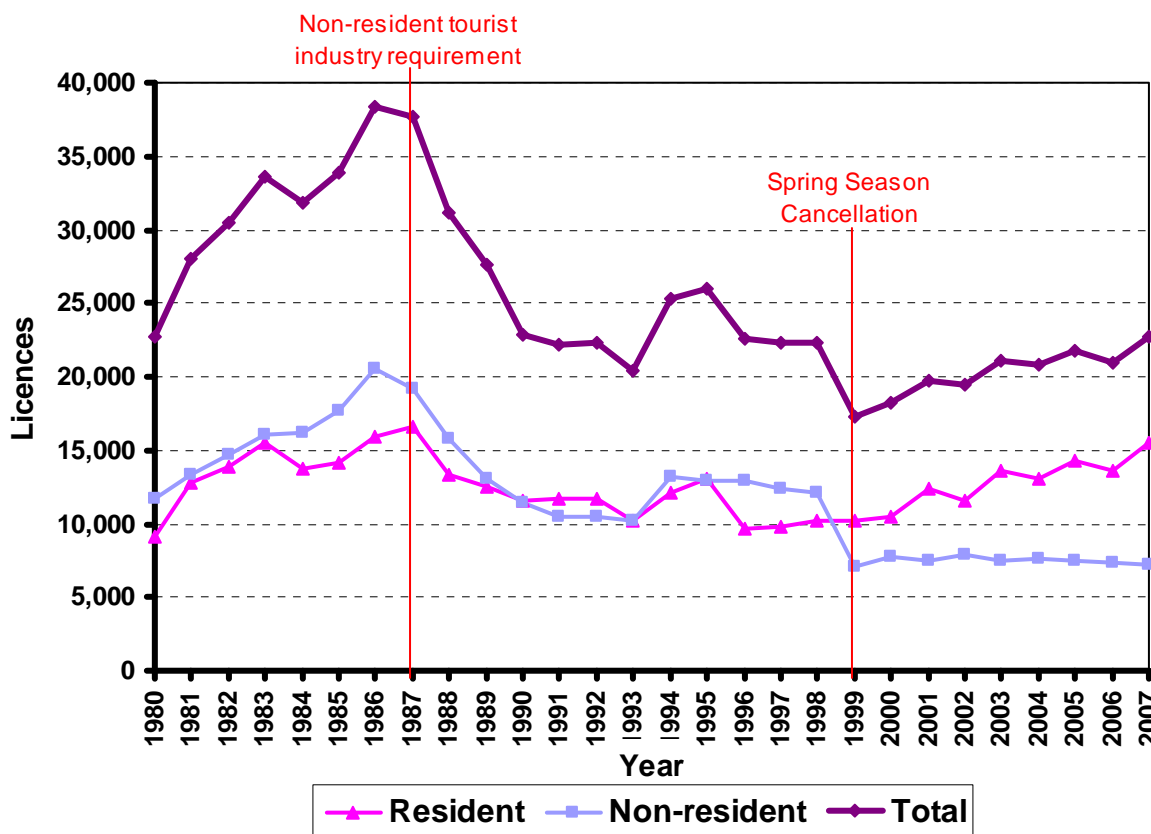
Data Source: Provincial Consolidated Revenue

Since 2004, licenced resident bear hunters have been able to purchase a second black bear game seal in WMUs with no sustainability concerns. The seal allows the hunter to harvest a second bear. In 2007, 134 second seals were purchased.

An estimated average of 6,783 bears was harvested annually by hunters across Ontario between 1990 and 1998. On average, 60% (4,005 bears) of the annual harvest was taken during the spring hunting season, and 40% (2,688) during the fall. About 76% of the total average annual harvest was taken by non-residents. Since 1999, an annual average of 5,253 bears has been harvested, with about 66% of the overall harvest taken by non-residents. An estimated 6,204 bears were harvested in 2007 (Fig. 3).

Figure 3. Annual number of black bears harvested by resident and non-resident hunters.
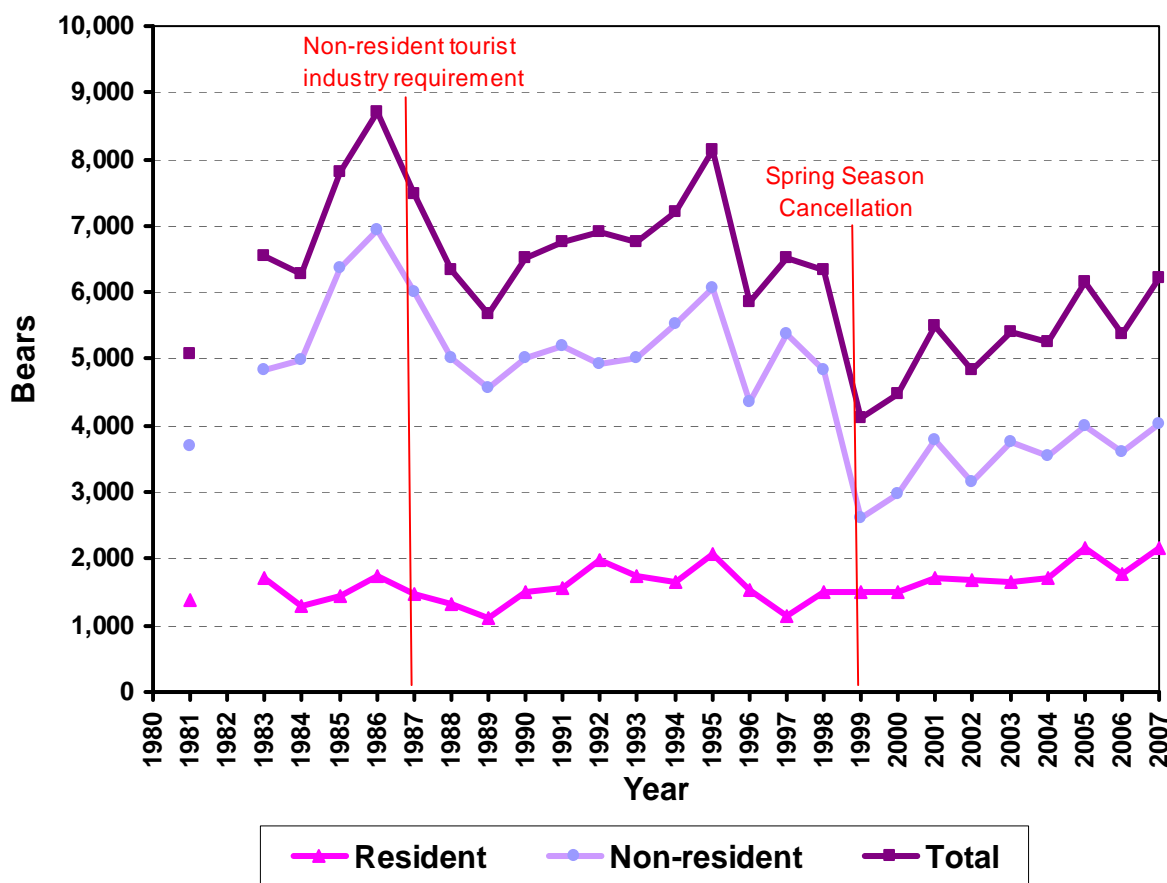
Sources of data: Provincial socio-economic survey, resident postcard survey, resident mandatory questionnaire (2005-2007) and non-resident mandatory report, OMNR

Non-resident success rate is generally higher than that of resident hunters (17% for residents and 57% for non-residents in 2007) as, with a few exceptions, most non-residents are required to use a tourist operator licenced by OMNR to provide bear hunting services.

In 2002, residents reported still-hunting (66%) as their preferred method of hunting bears in up to 3 Wildlife Management Units (WMUs), likely reflecting the hunting of bears during the concurrent deer and moose seasons (OMNR data). Other methods used by residents included baiting (32.8%), stalking (27%), road driving (21%) and dogs (9%). The use of hunting dogs remains the most popular method of hunt by residents in parts of southern Ontario. Non-residents reported the use of bait as their preferred method of hunt used (93%), followed by still hunting (9%), stalking (5%), use of dogs (3%) and road driving (2%).

Rifles were reported as the most popular firearm used in bear hunting by residents (92%) and non-residents (56%). As in other jurisdictions, archery has increased in popularity with both residents

and non-residents in Ontario during the past decades.   In 2002, 16% of residents and 39% of non-residents reported using archery equipment in bear hunting.   Other firearms used by both groups included shotguns and muzzle-loaders, with muzzle-loaders being the least common.

Trapping

Trappers can harvest bears under a licence to trap but their annual harvest is low (Fig. 4). Trappers reported a harvest of 63 bears in the 2006-07 trapping season. Mandatory reporting has been in place since the 1998/99 trapping season. Prior to then, information were collected only on hides sold by trappers, with some additional information collected through voluntary reporting at the time that the pelts of furbearers were sealed.

Figure 4. Trapper harvest in relation to average hide price.
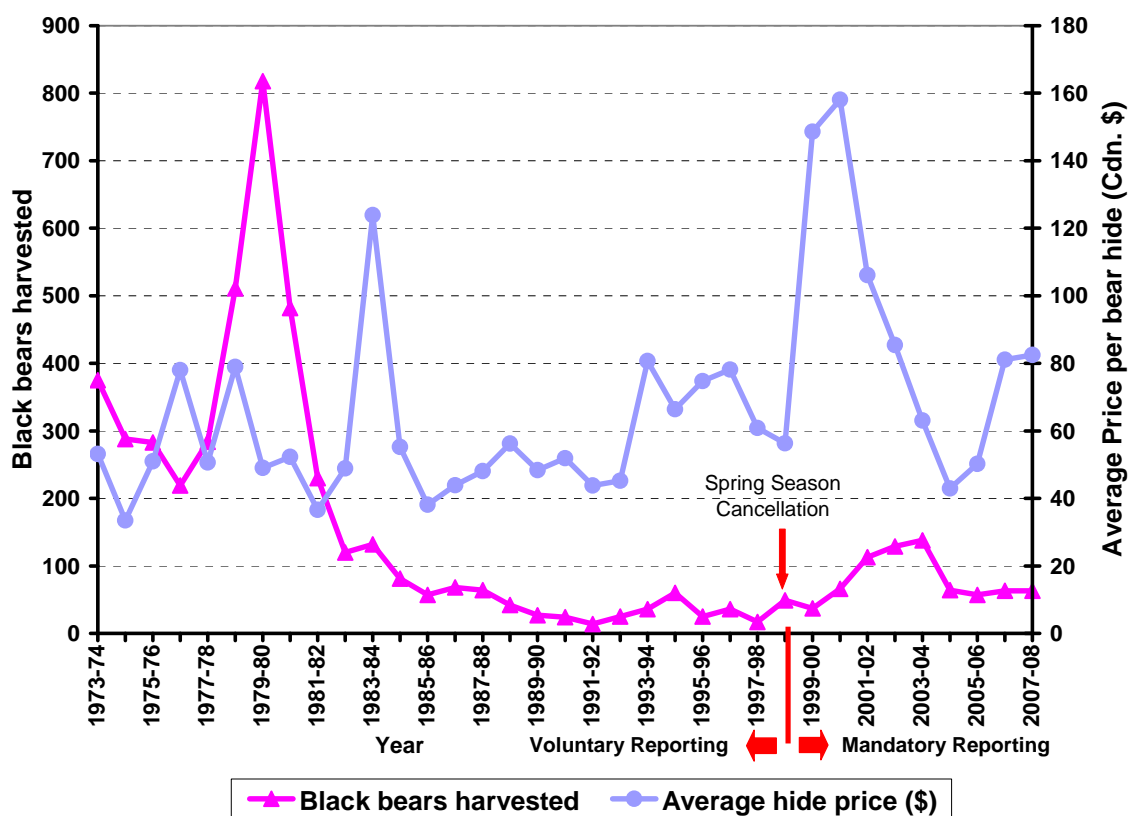
Source of Data: Voluntary and mandatory trapper reports, OMNR

Human-bear Conflicts

The overlap of human and bear range across Ontario, and the life history of black bears that requires them to consume large quantities of food during the non-hibernation period, can lead to human-bear conflicts. Interactions of people with bears range from simple bear sightings, to bears passing through properties, to human-bear conflict such as minor damage associated with bears feeding on residential and commercial garbage, bird seed, pet food, dirty barbeques and fruit trees, to physical property damage, and to potential human injury or death. It is important to note that there are many thousands of interactions between bears and humans in Ontario on an annual basis without conflict. Most bears avoid humans.

Problem Bears and Agriculture

Black bears can affect commercial enterprises through damage to bee hives and colonies, crops such as oats, corns and wheat, fruit trees, or injury or killing of livestock. The Ontario Ministry of Agriculture and Food currently provides financial assistance to farmers in cooperation with municipalities for bear damage to bees/beehives under the *Livestock, Poultry and Honey Bee Protection Act* and for livestock under the *Bear Damage to Livestock Compensation* Program (Table 1). The value of livestock loss is calculated by municipal valuers based on the estimated market value (weight and current market price) of the animal up to a maximum amount of compensation established for each species under each program (e.g., $200 per sheep/goat/swine, $1,000 per head of cattle/horse). Compensation is not paid where carcasses are removed by the predators preventing evaluation of the extent of damage.

Table 1. Compensation paid for damage caused by black bears.

Fiscal Year	Livestock killed or injured		Beehives/colonies destroyed		Total Compensation ($)
	(#)	($) [a]	(#)	($) [b]	
2000/01	21	8,694	622	59,351	68,045
2001/02	78	26,137	841	59,351	71,733
2002/03	*135	27,055	492	37,857	64,912
2003/04	73	22,384	562	48,724	71,108
2004/05	88	25,772	363	30,629	56,401
2005/06	82	24,041	394	37,152	61,193
2006/07	51	26,998	389	32,223	59,221
2007/08	96	36,584	425	38,488	75,072

* includes 75 chickens
[a] Compensation paid under the *Bear Damage to Livestock Compensation Program*
[b] Compensation paid under the *Livestock, Poultry and Honey Bee Protection Act*

Source of data: Ontario Ministry of Agriculture, Food and Rural Affairs

No financial assistance is currently provided for loss or damage of non-traditional livestock, such as deer and elk, or for field crops and fruit trees.

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Problem Bears and the Public

From 1996 to 2003, problem bear management on private property was carried out by various agencies. Direct delivery of services in some parts of Ontario occurred through informal partnerships with municipalities, trapper councils and independent control agents. OMNR provided assistance in the development of effective problem bear control programs by authorizing and establishing minimum operating standards for agents, providing agents with training on bear trapping, relocation and chemical immobilization of wildlife, and developing education materials directed at minimizing conflicts with bears.

Public awareness of bears and potential human-bear conflicts has been high in recent years, particularly since 1999 and the initiation of the Bear Wise program in 2004. Bear sightings and problems have received significant public and media attention. This is likely in part due to the effect of a number of factors on the availability of natural foods for bears, including:
- 2-4 week delays in the 2000, 2004 and 2008 summer berry crops due to cool, wet weather
- total failure of summer and fall mast crops in southern Ontario in 2001 due to a severe (1 in 100-year) mid-summer drought
- hottest summer on record and low precipitation in many areas of Ontario in 2005, including 1 in 50-year droughts in some areas, and
- drought conditions in northwestern Ontario in 2006 and in areas of northeastern and southern Ontario in 2007.

In 2002, the Nuisance Bear Review Committee was established to undertake an independent review of information related to the problem bear issue. The independent committee examined a number of factors, including biological, geographic and socio-economic factors related to the perceived increase in bear problems. The committee also took into consideration municipal impacts, and compared the effects of bear harvesting among jurisdictions. The committee solicited public input before finalizing a report in 2003 (Nuisance Bear Review Committee 2003). Their recommendations included enhancing bear harvest management, additional research needs, and measures to mitigate problem activity. The Committee's report is available on the OMNR web site at http://www.mnr.gov.on.ca/254550.pdf.

In 2004, OMNR introduced the Bear Wise program. The program is based on four pillars - education and awareness, prevention, reporting and response - as the best way to reduce problem bear activity. Under the Bear Wise program, OMNR has the lead role to manage and mitigate human-bear conflicts in collaboration with municipalities, aboriginal and unorganized communities, police, stakeholders and individuals. Components of the program implemented since 2004:
- creation of a Bear Wise web site http://www.mnr.gov.on.ca/en/Business/Bearwise/index.html
- establishment of a Bear Reporting Centre and a 24-hour, seven days a week toll-free phone line (1-866-514-BEAR (2327) to report bear problems. Trained staff handles calls and determine the appropriate response to the call. OMNR responds to non-emergency bear calls, but police or 911 should be called in emergencies.
- establishment of a Bear Incident and Response Tracking Application (BIRTA) that allows OMNR to track bear occurrences and their response.

- expansion of education efforts on bear management, and implementation of a comprehensive communication and public awareness program to reduce situations and items that attract bears and provide information on how to behave in bear encounters.
- development of common training protocols for OMNR staff, service providers and agents.
- meetings with more than 200 communities across Ontario and the Ontario Association of Chiefs of Police to discuss ways of working together to prevent bear problems, and working with the Ontario Provincial Police and municipal police services through a protocol to respond to bear incidents.
- development and delivery of a community-based bear prevention program that supports community-based strategies aimed at reducing bear attractants through various effective measures such as bear-proof dumpsters and electric fencing.   The program includes providing community support and a community funding program. In 2007, 50 communities received an estimated $700,000 to conduct 60 projects related to hazard assessment, education & awareness and prevention.
- creation of a Bear Wise e-book for children (and appropriate for adults) and a school curriculum on bears for Grades 2, 4 and 7, and
- establishment of a number of pilot studies, including the effect of aversive conditioning on black bears and the use of electric fencing as an exclusion method.

OMNR has also developed effective problem bear control programs by authorizing and establishing minimum operating standards for OMNR staff , OMNR service providers and agents of landowners, and providing training on bear handling including the trapping, chemical immobilization, aversive conditioning and dispatching of bears.

OMNR authorizes agents of landowners to trap and relocate problem bears under the *Fish & Wildlife Conservation Act* through an "Authorization to trap black bears (protection of property)" (Form FW2012). Provisions under the Act allow property owners, or their agents, to remove or destroy bears that are damaging, or that they fear are about to damage, their property. Regulations under the Act require the immediate reporting of all bears killed in protection of property to OMNR.

Bears may also be killed in self-defense. Police agencies have a primary responsibility for emergencies, and provide assistance in situations of concern about human safety.

In the past, OMNR offices did not maintain consistent records on black bear complaints. Table 2 illustrates data on calls received in 2004-2007 recorded in the Bear Incident and Response Tracking Application (BIRTA) from the toll-free line and OMNR offices that involved some form of response. Data may include calls about sightings and/or cases where no actual problems were identified. In general, the largest numbers of occurrences occur in the Great Lakes-St. Lawrence forest zone, followed by the boreal east, with occurrences in the boreal west being the lowest. Since 2007, BIRTA also contains data on all reported black bear non-hunting mortality including bears destroyed in protection of property by ministry employees, service providers, police and the public, and bears killed by vehicles or that are found dead from natural causes.

Ontario

Table 2. Overview of provincial black bear occurrences.

Year	Occurrences [a]	Bears trapped [b]	Bears immobilized and relocated [c]	Bears reported euthanized [d]
2004	8,547	337	75	70
2005	10,500	803	279	283
2006	7,016	353	114	140
2007	12,645	637	289	293
2008	9,745	432	182	130

[a]   Calls received by a live operator that involved a response (e.g., phone call, site visit, hazard assessment, advice provided or removal of animal) by MNR staff or service providers

[b, c] Some bears may have been both trapped and chemically immobilized and relocated

[d]   Bears euthanized by OMNR, service providers, and police or by landowners and their agents acting in protection of property.

Source of data: OMNR's Bear Incident and Response Tracking Application (BIRTA)

Large numbers of solitary cubs were received for rehabilitation by authorized wildlife custodians in 2001, 2003, 2005, and 2007. Over 50 solitary cubs were also recorded in the Pembroke area in 2003, but most were re-released into the wild as they appeared to be in good condition and were expected to hibernate successfully. It is likely that many of the cubs were orphaned when females were killed in protection of property or by cars and trains following the severe droughts that affected central and parts of north eastern Ontario in the summer and fall of those years (e.g., 100-year mid-summer drought destroyed natural foods in central/southern Ontario in the summer and fall of 2001). The increase in vulnerability of adult females to harvesting during food failure years may also result in some orphaned cubs during the fall. In addition, it is possible that some cubs were abandoned by the energetically stressed females in those years.

Reliable information on the number of cubs received for rehabilitation has been available only since 1999 when wildlife custodians were regulated and required to report to OMNR the annual number of animals received for rehabilitation. The numbers of cubs received for rehabilitation were 32 in 1999, 20 in 2000, 195 in 2001, 24 in 2002, 93 in 2003, 17 in 2004, 63 in 2005, 16 in 2006, and 99 in 2007. Numbers for 2001 and 2003 include cubs that were received for rehabilitation from neighbouring provinces.

APPLIED RESEARCH

A long-term study of black bears in the Great Lakes-St. Lawrence forest zone was conducted northeast of North Bay from 1969-1983. Papers were published on many aspects of this study including evaluation of chemical immobilization drugs (Addison and Kolenosky 1979), development of expandable radio-collars for young bears (Strathearn et al. 1984), estimating harvest rate from age and sex data (Fraser et al. 1982), and winter denning (Kolenosky and Strathearn 1987a and b). Several papers were published on aspects of the population dynamics of black bears in the Great Lakes-St. Lawrence forest zone including a population dynamics model (Yodzis and Kolenosky 1986), effects of hunting on a population (Kolenosky 1986), and reproductive biology (Kolenosky 1990). Results of this long-term study contributed to the sustainable management of black bears in the province.

Following the completion of the Great Lakes-St. Lawrence forest zone study, it was recognized that the population parameters of a black bear population in the boreal forest zone might be sufficiently different from those of the population in the Great Lakes-St. Lawrence forest zone due to differences in food availability and landscape productivity. If so, a different management regime might be needed. To respond to this concern, an intensive research study was conducted from May 1989-July 2000 to determine the effects of hunting on a population of black bears in the boreal forest zone and to make recommendations on sustainable harvest levels for the this zone. Two M. Sc. theses (Usui 1994; Romain 1996) and one Ph.D. thesis (Schenk 1994) were completed as components of the research program. Papers have been published on many aspects of the study including black bear mating system and genetic relatedness (Schenk and Kovacs 1995, 1996; Schenk et al. 1998), hibernation physiology (Wright et al. 1999, LeBlanc et al. 2001), relationships between black bears and moose (Austin et al. 1994, Obbard et al. 2000), pollination ecology in the boreal forest (Kevan et al. 1993, Usui et al. 2005), composition of wild fruits (Usui et al. 1994), evaluation of GPS collars on black bears (Obbard et al. 1998), and population demography (Obbard and Howe 2008).

Other research examined the hit rates at bait stations lines (a population trend estimator system) using DNA fingerprinting to determine the degree of auto-correlation in the data (Obbard et al. 2002), and evaluated the effectiveness of suspended baits in enabling hunters to discriminate between male and female bears (Obbard 2001, Obbard et al. 2008). The use of barbed-wire hair traps as a mark-recapture technique (Woods et al. 1999) was investigated over several years in several regions of the province. A refinement of this approach to a 1-year sampling period was conducted on the Bruce Peninsula in 2001 (Zorn and Quirouette 2003), and this research led to the implementation of a 7-10 year inventory cycle for bear populations in WMUs within black bear range in the Ontario. Additional collaborative research developed an unbiased index for evaluating body condition in bears (Cattet et al. 2002) and a statistical technique to treat auto-correlated data in home range analyses (Hines et al. 2005). Several additional aspects of the boreal forest study are currently being analyzed, including habitat selection.

A stochastic population modeling package, RISKMAN, designed to model species that reproduce multi-annually and provide care to young (e.g., bears) was developed in collaboration with the

Nunavut Department of Sustainable Development (Taylor et al. 2003). This population model can be used by local managers to predict the population consequences of changes in harvest structure.

A cooperative project between Parks Canada and OMNR to study an isolated population of black bears on the Bruce Peninsula was conducted from 1998 to 2004. Publications from this study include an evaluation of the population viability of black bears on the Bruce Peninsula (Howe 2002, Howe et al. 2007), the use of the new distance-based approach (Conner et al. 2003) to examine seasonal habitat use and den site selection on the peninsula (Coady 2005), and an investigation of the genetic structure of black bears on the peninsula (Mills 2005).

In 2006, a cooperative moose-bear-wolf study involving Trent University, the Universities of Toronto and Massachusetts, and OMNR was initiated in Algonquin Provincial Park and the Parry Sound area to investigate the factors influencing the southern distribution and abundance of moose in south central Ontario. The research study will investigate, among other objectives, the effect of black bear predation on moose calf survival. In addition, data from GPS-collared bears will be used to evaluate the effects of roads on landscape level habitat use by bears. The study will also attempt to evaluate the recently developed habitat model for black bears in the Great Lakes–St. Lawrence forest that is part of the landscape guide for forest management planning currently under development. Also to be investigated is the current distribution of beech bark disease, how this distribution might change in the future with climate warming, and what the impacts will be on bear populations.

LEGISLATIVE CONTEXT AND SUPPORTING STRATEGIC DIRECTIONS

International

Convention on the International Trade in Endangered Species (CITES)

Canada is a party to CITES, an international agreement among 169 governments seeking to ensure that trade in animals and plants does not threaten their survival. Black bears are listed in Appendix II in CITES, and international trade is allowed between signatory countries but is controlled. Black bears are included, not because of concerns for their survival, but rather because their parts are difficult to distinguish from those of endangered bear species in other parts of the world. A CITES permit is required to export a black bear from Canada, and some countries require import permits.

Since 1999, U.S. citizens returning to the U.S. and Canadian citizens traveling through the U.S. en route to another part of Canada are no longer required to obtain a CITES permit when exporting their hunted bear if it is in a fresh, frozen or salted condition and is part of the hunters' accompanying personal baggage. This exemption does not apply to taxidermy products.

National

Species at Risk Act

The national status of the black bear was assessed by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) in April 1999, and was found to be 'Not at Risk'. Based on this designation, black bears receive no special protection under the federal *Species at Risk Act, 2003* (SARA).

Provincial

Fish and Wildlife Conservation Act

Black bears are currently classified as Game Mammals under the *Fish and Wildlife Conservation Act, 1997* (FWCA), and are treated as a big game species. They are hunted under a Licence to Hunt Black Bear, but can also be taken by trappers under a Trapper's Licence during the open season. There is legislative authority to implement trapping quotas if they should become necessary, and a small number of OMNR offices in southern Ontario have done so on a case-by-case basis.

Resident and non-resident hunters can purchase one bear licence per year, and the bag limit is one bear. Resident hunters have been able to purchase a second game seal in Wildlife Management Units (WMUs) where there are no sustainability concerns since 2004.

Open season dates vary by WMU: in northern WMUs the season opens on August 15 and closes on October 31; in southern WMUs the season opens on September 1 or the Tuesday following Labour Day and closes on November 30 (Fig. 5). There is no special archery seasons for black bear, but archery equipment can be used during the regular hunting season. In the Alneau Peninsula in northwestern Ontario (i.e., WMU 7A) only archery equipment, flint-lock or percussion cap muzzle-loading guns can be used for hunting black bear and other big game.

Resident hunters have been required to report their hunting effort and harvest by December 15 of the year of the hunt since 2005. Mandatory reporting has been in place since 1987 for non-resident hunters and since the 1998-99 trapping season for trappers.

Non-resident hunters are required to use the hunting services of bear operators licenced by OMNR to provide these services, and obtain a Non-resident Hunting Licence Validation Certificate required to validate their hunting licence from their operators. Non-residents who own property in Ontario or who are hunting with an immediate resident relative licenced to hunt black bear are not required to use a bear operator, and may obtain their certificates from OMNR. Only one certificate is issued per property per year. About 100 validation certificates are issued annually directly by OMNR.

Ontario

Figure 5. Black bear open hunting and trapping season by Wildlife Management Unit (WMU).
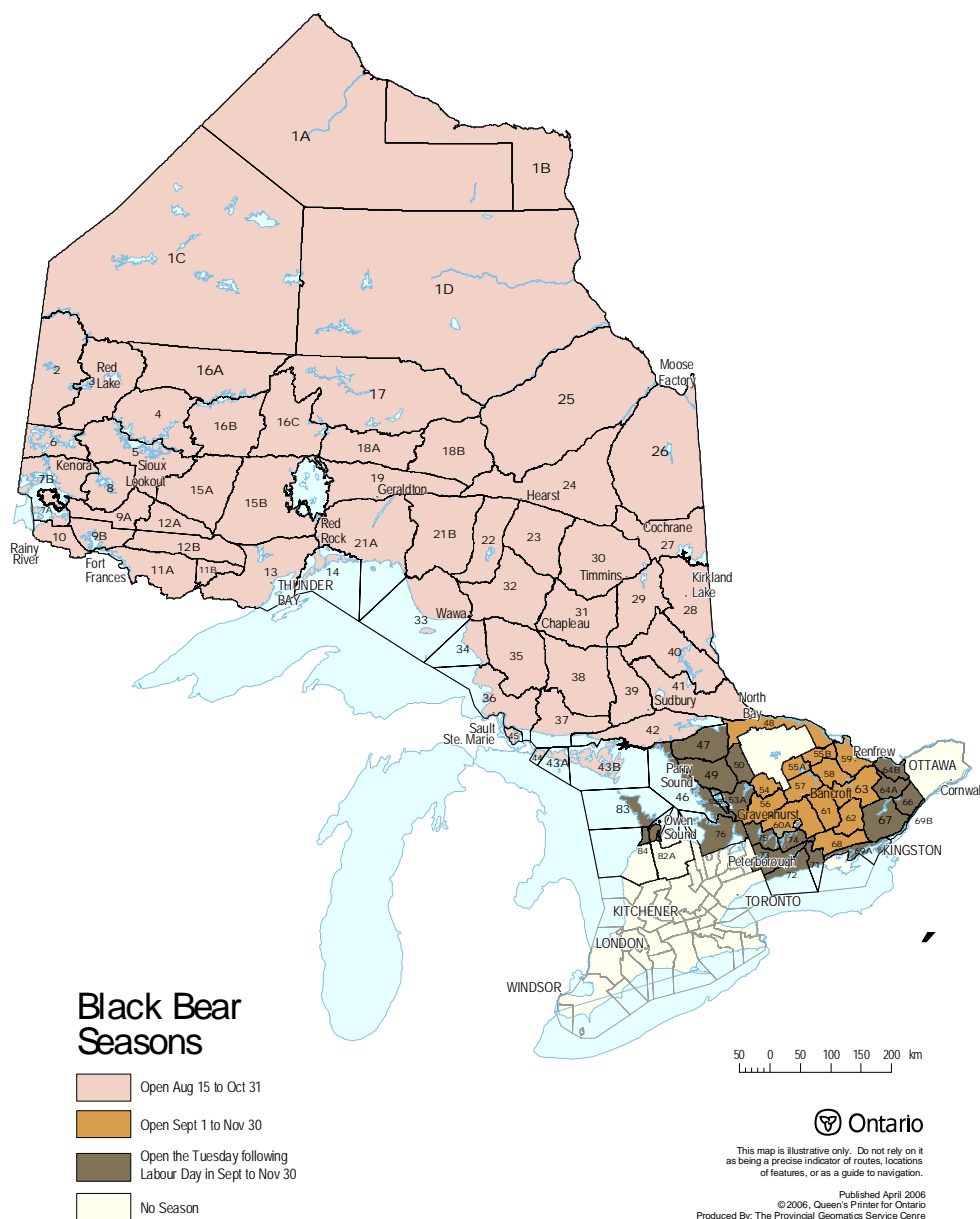
Operators providing hunting services to non-resident clients are required to operate in the Bear Management Areas (BMAs) or private land listed on their annual Licence to Provide Bear Hunting Services. Operators have exclusive commercial use of the BMAs assigned to them. With landowner's permission, operators can provide services on private land located within their assigned BMA(s), and on land located outside of their BMA(s) that is not within a BMA assigned to another operator. Resident hunters can hunt anywhere on Crown land that has an open bear hunting season. Operators providing hunting services to resident hunters are not licenced or limited on their use of Crown or private land (i.e., are not required to have an assigned BMA).

The FWCA recognizes the right of a landowner to protect property from wildlife, and allows the landowner or his or her agent to harass, trap or kill a bear that has or is about to destroy property.

Only persons specifically authorized by OMNR are permitted to live-trap a bear in protection of property.

The hunting of bears while they are swimming, disturbance or destruction of dens, and shooting of bears within 400 meters of a garbage disposal site are prohibited.

The purchase, sale and possession for the purpose of trade of most bear parts, including gallbladders and claws, are illegal. Possession of a gallbladder separate from the carcass is also prohibited. Trade in untreated bear hides that have the skull and claws attached is permitted under a special licence. Maximum fines for commercialization of wildlife range up to $100,000 and/or imprisonment of up to 2 years.

Resident and non-resident hunters are required to obtain export permits to export a bear from Ontario.

Since 1997, all bear hunters have been required to wear hunter orange except when hunting from a tree stand.

Crown Forest Sustainability Act

The *Crown Forest Sustainability Act* guides the planning and conducting of forestry operations on Crown land. Although a number of wildlife habitat guidelines are in place, black bear habitat is not generally managed directly with the exception of the protection of mast and sanctuary trees in some areas of the Great Lakes-St. Lawrence forest region.

A new approach to habitat guidelines is currently being developed for use in the forest management planning process. Landscape and stand/site guides are being developed to provide broad guidance on habitat management, integrating the direction from many earlier species guidelines. Guidance from the landscape guide will attempt to create landscape mosaics that follow natural ranges of variability in forest structure and function at the eco-regional scale. It is expected that habitat for black bears, and for many other wildlife species, will be adequately provided through application of the landscape guides and the more specific stand and site guides. Consultation on the new Forest Management Guide for Great Lakes-St. Lawrence Forest Landscapes (Landscape Guide) and the Forest Management Guide for Conserving Biodiversity at the Stand and Site Scales (Stand and Site Guide) has been carried out, and they are expected to be finalized in 2009. The guides for the boreal forest are currently under development.

Currently, foraging and fall habitat for black bear is evaluated and tracked on a Forest Management Unit basis during the forest management planning process using the Sustainable Forest Management Model (SFFM). The selected forest management alternative attempts to maintain habitat for selected wildlife species in consideration of other objectives to produce the desired forest and benefits. Black bear habitat supply is not a major consideration in the selection of the desired management alternative.

Ontario

Species Status

The provincial status of black bears in Ontario was assessed by the provincial Committee on the Status of Species at Risk in Ontario (COSSARO) in April 1999. Based on that assessment, black bears in Ontario are listed provincially as 'Not at Risk' on the Species at Risk in Ontario List (SARO). Accordingly, they do not receive protection under the *Endangered Species Act* (ESA), or regulations and policies under the Act.

Planning Act

Under this Act, the province provides direction to municipalities on the interests to be considered in land use decision-making, and municipalities have responsibilities for land use planning as led by provincial policy through the *Provincial Policy Statement* (PPS) (2005).   The PPS indirectly considers black bear habitat needs through general provisions for the protection of natural heritage features including important wooded areas and wetlands. Other "significant" wildlife habitat is to be protected from development and site alteration that will have a negative impact on their natural features or ecological functions.

Livestock Poultry and Honey Bee Protection Act

The Ontario Ministry of Agriculture and Food (OMAF) provides compensation for bear damage to bee colonies and hives by bears under the *Livestock Poultry and Honey Bee Protection Act*. OMAF also provides compensation for predation by bears on livestock under the *Bear Damage to Livestock Compensation Program.* Annual compensation totals are indicated in table 1 of this document.

Environmental Assessment (EA) Act

The purpose of the *Environmental Assessment Act* is to ensure the protection, conservation and wise management of the environment. OMNR supports the purpose and requirements of the EA Act. Exemption Order MNR-42 "wildlife population and habitat management activities as conducted by MNR" provides EA Act coverage for wildlife population and habitat management activities as conducted by or on behalf of OMNR outside of Provincial Parks and Conservation Reserves, including but not limited to:

- population control through the establishment and enforcement of bag limits, and hunting seasons for game species,
- protection of game and non-game species by relocation, controlled access and propagation and,
- habitat improvement including the planting and cutting of vegetation.

Strategic/Policy Framework

A variety of strategic directions, at the provincial, national and international levels, directly and indirectly influence OMNR's wildlife planning and management. A key source of provincial policy direction is formal strategic-level policy normally intended to last for a longer term, and that has been approved by either the government or OMNR and has been developed with public input.

Our Sustainable Future

Our Sustainable Future (2005b) sets OMNR's long- and short-term strategic directions and priorities for the management of natural resources on the landscape, including ecological sustainability, the conservation of biodiversity, the use of natural resources in a sustainable manner, economic growth, public health and environmental safety, stewardship and community involvement, etc. The enhanced black bear management program will address bear management challenges consistent with OMNR's strategic directions.

OMNR's Statement of Environmental Values

OMNR's *Statement of Environmental Values* under the *Environmental Bill of Rights* (EBR) (2008) is based on strategic directions and explains:

- how the purposes of the EBR are to be applied when decisions that might significantly affect the environment are made in the ministry; and
- how considerations of the purposes of the EBR will be integrated with other considerations, including social, economic and scientific considerations, that are part of decision-making in the ministry.

Black bear management is consistent with OMNR's *Statement of Environmental Values*, and OMNR integrates considerations of the purposes of the EBR with other considerations such as social, economic and scientific factors when making decisions that might significantly affect the environment at the landscape level.

Ontario's Biodiversity Strategy

The document *Protecting what Sustains Us - Ontario's Biodiversity Strategy* (2005a) aims to conserve the province's plants, animals and ecosystems. It identifies the following biodiversity conservation goals for Ontario:

- to protect the genetic, species and ecosystem diversity of Ontario, and
- to use and develop the biological assets of Ontario sustainably and capture benefits from such use for Ontarians.

An enhanced black bear management program will contribute to the ecologically based sustainable management of bears on the landscape and their habitat and, in doing so, assist Ontario in achieving biodiversity conservation and sustainable use goals and objectives. To enable Ontario to achieve biodiversity conservation goals, the strategy document identifies a number of strategic directions

and specific recommended actions by government, non-government and private sector organizations to protect and preserve our natural heritage and variety of life. An enhanced black bear program is consistent with the following strategic directions and recommended actions:

- Improve Understanding, Action 30 - Continue to review new monitoring information and knowledge to ensure that the use of biological assets (e.g., forests, wildlife, fish and water) is sustainable, biodiversity is conserved and biological integrity is maintained, and
- Reviews, Actions 36 and 37 - Review relevant legislation and regulations and other relevant resource management and planning policies to identify gaps and issues and the need for potential changes for the conservation of biodiversity (protection and/or the sustainable use of natural resources).

Ontario's Landscape and Ecologically based Approach to Wildlife Management

Over the past number of years, Ontario has moved towards a more landscape and ecologically based approach to wildlife management. Wildlife is managed within an ecosystem context with consideration of the influences of one species on the broader ecosystem as part of the decision-making process, and done in accordance with legislation and public policy.

Framework for Enhanced Black Bear Management in Ontario

The OMNR has been developing and refining the provincial black bear management program in Ontario for several decades. Much has been learned as the province has moved forward in the areas of harvest assessment, population management, allocation, population inventory, communication, resolution of human-bear conflicts, and science and research.

The *Framework for Enhanced Black Bear Management in Ontario* outlines the province's current approach and sets out the future direction with regards to landscape and ecologically based black bear management. It forms an important step in the province's progress toward an ecosystem management approach for the management of black bears and has the potential to enhance associated recreational opportunities where sustainable black bear populations permit. This Framework supports a more transparent and collaborative approach to black bear management in the province and is supported by management tools that build on new science to support management decisions.

POPULATION MANAGEMENT

Management History

Until 1960, black bears were afforded no legislative protection or management system. They could be taken without licences, there was no closed season, and their killing was encouraged through the payment of a provincial bounty. In 1961, black bears were classified as a game species under the former *Game and Fish Act*, closed hunting and trapping seasons were established, and hunting and trapping licences were required. Single-species bear hunting licences were introduced in 1980 allowing improved monitoring of hunter activity and harvest. Hunter harvest/socio-economic surveys were initiated in 1981.

A long-term research study in the Great Lakes-St. Lawrence forest zone conducted from 1969-1983 provided first hand knowledge on bear biology and the effects of hunting pressure on bear populations. The results of this study indicated that black bear populations at this latitude have very low productivity and can be very sensitive to hunting pressure. Females must be at least 5 years old before they produce cubs. Based on this work, a conservative provincial harvest density of 10% of the population was established.

During the early 1980s, bear hunting by both residents and non-residents gained popularity in Ontario leading to concerns about the sustainability of populations in parts of the province. To address these concerns and incorporate the new ecological knowledge into management, the basis for the current black bear management direction and activities was established by the 1986 Management Policy and Program for Black Bears in Ontario (revised in 1990). This direction set in motion a number of improvements to bear management in Ontario.

A crest program was established in 1982 as an incentive for hunters to provide premolar teeth of harvested bears to assist in the assessment of the age structure of the harvest. The percentage of adult females in the harvest is one of the key benchmarks in bear management.

In 1987, a number of regulatory changes were implemented that raised the status of black bears to that of game animals in Ontario. Among these was the requirement that non-residents use the hunting services of bear operators, a moratorium was placed on bear operators, mandatory reporting of hunting effort and harvest by non-residents was required, hunting cubs and females accompanied by cubs during the spring season was prohibited, the use of dogs in bear hunting was restricted, and the shooting of a bear in a den and or within 400 m of a waste disposal site on Crown land were prohibited.

In 1989, the Bear Management Area (BMA) program was introduced to encourage bear operators to manage bear harvest on Crown land in a sustainable manner, and address the increasing level of commercial competition for the resource. Operators have exclusive commercial right to offer bear hunting services to non-residents within their assigned BMAs.

In 1996, legislative changes restricted hunters to one bear licence per year, and extended the controls on trade in Ontario bears to all bears regardless of origin.

Trappers have been required to report bears harvested under a trapping licence since the 1998-99 trapping season. Prior to this, some trappers reported their harvest, although there was no requirement for bear hides to be sealed as required for furbearing species.

In 1999, additional provisions were implemented under the new *Fish and Wildlife Conservation Act* and regulations. The legislative changes included mandatory reporting of problem bears destroyed in defence of property, licencing of tourist operators providing bear hunting services, authorization of agents to live-trap bears on behalf of landowners, licencing of dogs used in bear hunting, and an increase in maximum fines for commercialization of wildlife to $100,000 and/or imprisonment of up to 2 years. The hunting of bears while swimming; disturbance or destruction of dens; shooting of bears within 400 meters of any garbage disposal site, and possession of a gallbladder separate from the carcass were prohibited.

In 1999, the spring open season was cancelled to address concerns about the potential orphaning of cubs during the spring at a time when they are very dependent. The fall hunting season was expanded by up to two weeks across much of the province to provide additional sustainable recreational hunting opportunities and increased economic benefits.

In 2004, the fall open season was expanded in parts of northern Ontario by an additional two weeks, and second game seals were made available to resident hunters in WMUs with no sustainability concerns to provide additional hunting opportunities.

In 2005, reporting of hunting effort and harvest by resident hunters became mandatory.

Management Challenges

While black bears are recognized as a valuable game species and an integral part of natural ecosystems, they are also potentially destructive to human property and can pose a threat to human safety. Management decisions associated with the species are subject to intense public scrutiny, and strong opinions exist between the need to protect bears and the promotion of harvest.

Black bear populations are sensitive to over-harvest due to the unique life history characteristics of late maturity, alternate year reproduction, and low recruitment. Population growth rate is most affected by mortality/survival rates of adult females.

Concern has been expressed about inconsistency in bear management practices across the province. The Framework for Enhanced Black Bear Management in Ontario (OMNR 2009) will provide a common landscape and ecologically-based planning framework that will include elements such as a common planning process, ecologically-based decision support tools, opportunities to consider social and economic factors in the development of local bear management objectives, tourism enhancements and communication and outreach with a broad range of stakeholders.

The large ranges and solitary nature of black bears make them difficult to inventory. Efforts are underway to enhance bear inventory data. In addition, the life history traits of black bears make it

difficult to assess the effectiveness of landscape level management actions and the ecological sustainability of populations. The adequacy of inventory, monitoring and assessment activities to support management decisions needs to be routinely reviewed to ensure that black bear populations are sustained and that there is an appropriate landscape and ecologically based allocation of the black bear resource amongst users.

The illegal hunting or poaching of bears for commercialization of their parts is not considered to be a significant management issue in Ontario.

Bear Harvest Management Assessment

The assessment of bear management effectiveness will be based on the achievement of local bear management objectives that consider ecological, social and economic considerations. A number of landscape and ecologically based decision support tools are being developed to support decision makers in this regard. The tools include the development of a common planning process where regional and local wildlife managers collaborate on the setting of landscape and ecologically-based management objectives that reflect a broad range of ecological, social and economic considerations. These objectives are to be developed in consultation with a broad range of interests. Decision support tools include the use of a population model (Taylor et al. 2003) to assess different harvest strategies in meeting objectives using ecologically based sustainability criteria relating to harvest density and the % females and % adult females in the harvest (McLaren et al. 2008)

Note: OMNR will be developing black bear ecological zones as part of the implementation of the *Framework for Enhanced Black Bear Management in Ontario* to support this planning process. These ecological zones and the framework will provide the basis for landscape level bear management objectives and harvest considerations.

Harvest Assessment

Historically, harvest statistics have been used as the primary means of monitoring the bear population trend and sustainability. An evaluation of trends in sustainability indicators provides a very useful indication of the potential stress on a population at the WMU level based upon relative harvest levels.

Prior to 2004, hunt information from resident hunters was collected using voluntary annual surveys. Mandatory reporting of bear hunting effort and harvest by resident hunters was implemented in 2005. Non-resident hunters have completed annual mandatory hunt reports since 1987, and trappers have been required to report their annual bear harvest since the 1998/99 trapping season.

Data on the numbers of bears harvested (Fig. 2) and sex ratios are collected from mandatory hunt reporting by resident and non-resident hunters. Female bears comprised an average of 34% of the harvest between 1990 and 1998, with an annual range of 32-39% females. From 1999 to 2007, females comprised an annual average of 35% of the harvest, with an annual range between 32-40%. The management of black bears, as with other wildlife, is driven by management objective.

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Research has shown that no more than 40% of female bears should be represented in the annual harvest if the management objective is to maintain current population levels (Yodzis and Kolenosky 1986, Howe et al. 2007, McLaren et al. 2008). Potential harvest densities also directly relate to the management objectives that consider ecological, social and economic factors. Note: Harvest densities can be varied where the objective is to reduce or to increase the local bear population or where local conditions require a different harvest strategy or management response (e.g., adjacent to non-hunted or high harvest areas).

In order to assess the age composition of bears in the annual harvest, the premolar teeth of bears are collected through a hunter crest incentive program. On average about 2,000 teeth (about 36% of the annual harvest) were aged annually between 1990 and 2001. Voluntary submission of bear teeth has improved since 2004 through improved communication to hunters and licenced operators of the value of this information for management. From 2005-2007, an average of 2,598 teeth was aged annually (about 44% of the harvest). Adult female bears (5 years or older) comprised 12-16% of the annual harvest between 1990 and 1998, and 12-22% between 1999 and 2007. The higher percentages of adult female bears in the harvests coincide with years of poor or failed natural foods in areas of Ontario (e.g., 1995, 2001 and 2007). Where the management objective is to maintain populations at current levels, no more than 20% adult females should be represented in the annual harvest (Yodzis and Kolenosky 1986, Howe 2002, McLaren et al. 2008). The distribution of aged teeth indicates that a large year class was born in 1997, likely a result of synchronization of female reproduction by the provincial natural food failure in 1995. This synchronization appears to have persisted in southern Ontario due to the 2001 natural food failure which further synchronized reproduction in this area. As a result, large year classes have been born in odd years since 1997.

Additional information on bear mortality is collected through trapper harvest and non-hunting mortality reporting (e.g., problem bears killed in protection of property, road-killed bears, etc.).

Spatial Scale of Assessment

Consistent with strategic direction in OMNR's *Our Sustainable Future* (2005b) and *Ontario's Biodiversity Strategy* (2005a), Ontario is moving towards a more landscape level, ecologically-based wildlife management program to provide better context and policy direction for local decision making. The setting of strategic wildlife management objectives at a broad landscape level will significantly assist local managers in the setting of more local level management objectives. As such, OMNR will be developing black bear ecological zones as part of the implementation of the *Framework for Enhanced Black Bear Management in Ontario*. These ecological zones and the framework will provide the basis for landscape level bear management objectives and harvest considerations.

The scale of assessment for black bear populations should be relevant to management, and should be large enough to be biologically meaningful but also small enough to reflect regional differences. Bear Management Areas (BMAs) are the current tool for allocating and distributing harvest by non-resident hunting clients of bear operators across the landscape.

The WMU has been used in the last two decades as the spatial scale for a technical assessment of harvested wildlife populations, including black bears.   Resident harvest is collected at the WMU level. Non-resident harvest from BMAs and trapper harvest from the registered traplines can be rolled up to WMU level.

Temporal Scale of Assessment

Any assessment of the status of any wildlife population is a point-in-time report. However, current population status is influenced by events of previous years and, for black bears in particular, environmental factors such as the availability of natural foods can strongly influence both recruitment and the harvest in any specific year that, in turn, can affect indicators in the harvest across the landscape. Because there can be substantial year-to-year variability in the indicators, the use of a 3-year running average is recommended for harvest assessment so that the effect of unusual conditions is smoothed.

Allocation of Harvest

Resident bear hunting is managed under a partially controlled allocation system. Licensed resident hunters can hunt one bear in any WMU with an open bear season. Second bear seals for resident hunters may be available, and are allocated by WMU according to the harvest status of the WMU.

Non-resident bear hunting opportunities can be managed through the number of Black Bear Licence Hunting Validation Certificates allocated to bear operators for their non-resident clients. Districts determine the allowable harvest of bears based on achieving landscape and local level management objectives.

Population Inventory and Monitoring

Black bears are a difficult species to inventory. There is no feasible method to directly survey the number of black bears across the landscape. The population is conservatively projected at 75,000-100,000, an estimate derived by extrapolating bear densities obtained from the two long-term mark-recapture research studies conducted in hunted areas in the mixed forest Great Lakes-St. Lawrence forest zone of southern Ontario and the boreal forest zone of northeastern Ontario.

Long-term landscape level population trends are assessed using harvest data and the Black Bear Population Index Network (BBPIN). The network consists of a series of bait station lines established at the WMU level using provincial standards and guidelines (OMNR 1998). The network was initiated in some areas of the province in the late 1980s and early 1990s.   In 1997, a permanent province-wide index network was established with at least one line set up in most WMUs within bear range. Over 100 index lines are run across the province. The index was also conducted in the 3 study areas within the boreal forest mark-recapture research study in 1989-2001 to investigate whether there was a relationship between local hit rates and population densities.

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In 2004, OMNR initiated a program that uses barbed-wire hair traps and DNA-fingerprinting to estimate local bear abundance. The method uses DNA as a mark-recapture technique, allowing the determination of an estimate which could then be extrapolated to the rest of the WMU. Pooling of bear abundance estimates from the various WMUs will provide a more precise broad-scale population estimate for Ontario bears. This work will also attempt to determine the relationship between abundance estimates and hit rates obtained through BBPIN.

HABITAT MANAGEMENT

Black bears are habitat generalists that can live in a wide range of habitats, although the combination of early successional forest, open areas, edge and some mature forest is preferred. Bear habitat selection is dependent to a large degree upon food availability (both quality and quantity). Both hard mast (e.g., acorns and nuts) and soft mast (e.g., berries, cherries) are important food items in the annual cycle of the black bear.

Habitat Management

Black bear habitat is generally provided for through land and resource planning processes (e.g., forest management planning, Crown land use planning, proposed land use planning for the Far North, and municipal land use planning, protected areas planning, private land or agency stewardship initiatives).

On Crown lands within the Area of the Undertaking, habitat management in forested ecosystems is primarily conducted through the forest management planning process (i.e., preparation of forest management plans and use of forest management guides). OMNR is moving towards a coarse and fine filter approach for forest management at landscape and stand and site scales. The *Forest Management Guide for Great Lakes-St. Lawrence Forest Landscapes (Landscape Guide)* and the *Forest Management Guide for Conserving Biodiversity at the Stand and Site Scales (Stand and Site Guide)* will provide broad guidance on habitat management and will integrate the direction from many earlier species guidelines. Guidance from the *Landscape Guide* will attempt to create landscape mosaics that follow natural ranges of variability in forest structure and function at the eco-regional scale. Wildlife habitat will be adequately provided for through application of the landscape guide and the more specific stand and site guides. For example, forestry operations may leave mature forest patches and create forest openings and edge resulting in early successional forest that supports a variety of plants, insects and animals important as habitat and food for wildlife, including black bears. The new *Landscape Guide* and *Stand and Site Guide* are expected to be finalized in 2009.

Silvicultural guidelines have been developed under the Vegetation Management Alternative Program (VMAP) to guide herbicide application of reforested areas. These guidelines can support bear habitat by ensuring that herbicide spraying only occurs where necessary for regeneration purposes (Wagner 1992). This is especially important in areas where forest cover prior to harvesting was dominated by jack pine (*Pinus banksiana*) – in such areas fruit production in lowbush blueberry (*Vaccimium angustifolium*) and in velvet-leaf blueberry (*V. myrtilloides*) was significantly reduced by the application of herbicides (Moola et al. 1998).

On private and municipally-controlled land the *Provincial Policy Statement (2005)* provides direction to municipalities on the interests to be considered in land use decision-making. Provincial interests include protection of "*significant*" wildlife habitat that will benefit wildlife. The *PPS* considers bear habitat needs through general provisions for the protection of natural heritage features including important wooded areas and wetlands. Other "*significant*" wildlife habitat is protected from development and site alteration that will have a negative impact on their natural features or ecological functions.

Habitat Inventory

A broad inventory and evaluation of black bear habitat is not considered necessary at this time as adequate habitat exists within bear range. There is some value in understanding the status of food availability and quality in bear range across the landscape. This information is of value for predicting bear productivity, as well as the potential occurrence of problem bear situations.

OMNR is working towards the establishment of a standard protocol for wildlife food surveys for the qualitative assessment of annual production of hard (nuts) and soft mast (berries).   The wildlife food survey was conducted in the Great Lakes-St. Lawrence forest region in southern Ontario from 1989-1992, expanded to all OMNR districts in southern Ontario in 1999 (McLaren 2005), and has been gradually expanding to districts in northeastern and northwestern Ontario in recent years. The timing of these surveys varies dependent upon the type of forage being assessed.

LITERATURE CITED

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

Alt, G. L. 1983. Timing of parturition of black bears (*Ursus americanus*) in northeastern Pennsylvania. J. Mammal. 64:305-307.

Austin, M.A., M.E. Obbard, and G.B. Kolenosky. 1994. Evidence for a black bear, *Ursus americanus*, killing an adult moose, *Alces alces*. Can. Field-Nat. 108:236-238.

Ballard, W.B. 1992. Bear predation on moose: a review of recent North American studies and their management implications. Alces Supplement 1 (1992): 162-176.

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

Boer, A.H. 1988. Mortality rates of moose in New Brunswick: a life table analysis. J. Wildl. Manage. 52(1): 21-25.

Boertje, R.D., W.C. Gasaway, S.D. DuBois, D.G. Kelleyhouse, D.V. Grangaard, and D. J. Preston. 1985. Big Game Investigations: Factors Limiting Moose Population Growth in Game Management Unit 20E. Unpublished Wildlife Progress Report, Alaska Department of Fish and Game. 55 p.

Cattet, M.R.L., N.A. Caulkett, M.E. Obbard, and G. B. Stenhouse. 2002. A body-condition index for ursids. Can. J. Zool. 80: 1156-1161.

Coady, M. B. 2005. A distance-based analysis of seasonal habitat use and den site selection by American black bears (*Ursus americanus)* on the Bruce Peninsula, Ontario. M. Sc. thesis, Trent University, Peterborough, ON, Canada. 143 p.

Conner, M. L., M. D. Smith, and L. W. Burger. 2003. A comparison of distance-based and classification-based analyses of habitat use. Ecology 84:526-531.

Franzmann, A.W., and C.C. Schwartz. 1986. Black bear predation on moose calves in highly productive versus marginal moose habitats on the Kenai Peninsula, AK. Alces 22: 139-154.

Fraser, D., J.F. Gardner, G.B. Kolenosky, and S. Strathearn. 1982. Estimation of harvest rate of black bears from age and sex data. Wildl. Soc. Bull. 10:53-57.

Garner, D. L. 1994. Population ecology of moose in Algonquin Provincial Park, Ontario, Canada. Ph. D. thesis, State University of New York, Syracuse, NY 84 p.

Hines, W.G.S., R.J. O'Hara Hines, B. Pond, and M.E. Obbard. 2005. Allowing for redundancy and environmental effects in estimates of home range utilization distributions. Environmetrics 16: 33-50.

Horner, M.A. and R.A. Powell. 1990. Internal structure of home ranges of black bears and analyses of home-range overlap. J. Mammal. 71:402-410.

Howe, E. J. 2002 Population viability analysis for black bears (*Ursus americanus*) on the Bruce Peninsula, Ontario, Canada. M. Sc. thesis, Trent University, Peterborough, ON, Canada.   217p.

Howe, E. J., M. E. Obbard, and J. Schaefer. 2007. Extirpation risk of an isolated black bear population under different management scenarios. J. Wildl. Manage. 71:603–612.

Jonkel, C. J. and I. McT. Cowan. 1971. The black bear in the spruce-fir forest. Wildl. Monogr. 27. 57p.

Kevan, P.G., E.A. Tikhmenev, and M. Usui. 1993. Insects and plants in the pollination ecology of the boreal zone. Ecological Res. 8: 247-267.

Kolenosky, G.B. 1990. Reproductive biology of black bears in east-central Ontario. Int. Conf. Bear Res. and Manage. 8:385-392.

Kolenosky, G.B. 1986. The effects of hunting on an Ontario black bear population. Int. Conf. Bear Res. Manage. 6: 45-55.

Kolenosky, G. B., and S. M. Strathearn. 1987a. Black Bear. Pages 443-454, in M. Novak, J. A. Baker, M. E. Obbard and B. Malloch, eds. Wild Furbearer Management and Conservation in North America. Ontario Ministry of Natural Resources, Toronto, Ontario and Ontario Trappers' Association, North Bay, ON, Canada.

Kolenosky, G. B., and S. M. Strathearn. 1987b. Winter denning of black bears in east-central Ontario. Int. Conf. Bear Res. and Manage. 7:305-316.

Kovach, A.I., and R.A. Powell. 2003. Effects of body size on male mating tactics and paternity in black bears, Ursus americanus. Can. J. Zool. 81:1257-1268.

Landriault, L. J. 1998. Nuisance black bear (*Ursus americanus*) behaviour in central Ontario. M. Sc. thesis, Laurentian University, Sudbury, ON, Canada. 95p.

Landriault, L. J., M. E. Obbard, and W. J. Rettie. 2000. Nuisance black bears and what to do with them. Ontario Ministry of Natural Resources, Northeast Science and Technology Technical Note TN-017. 20p.

LeBlanc, P.J., M.E. Obbard, B.J. Battersby, A.J. Felskie, L. Brown, P.A. Wright, and J.S. Ballantyne. 2001. Correlations of plasma lipid metabolites with hibernation and lactation in wild black bears *Ursus americanus*. J. of Comparative Physiology B 171: 327-334.

Ontario

McGee Jr., H. F. 1987. The use of furbearers by native North Americans after 1500. Pages 13-19, in M. Novak, J. A. Baker, M. E. Obbard and B. Malloch, eds. Wild Furbearer Management and Conservation in North America. Ont. Ministry of Natural Resources, Toronto, Ontario and Ontario Trappers' Association, North Bay, ON, Canada.

McLaren, M.A. 2005. Wildlife food survey – 2005. Unpubl. Ont. Min. of Natural Resources Report. Bracebridge, ON, Canada. 20p.

McLaren, M.A, L. Dix-Gibson, T. Armstrong, N. Dawson, M. Obbard, L. Landriault, M. de Almeida, P. Dodwell, R. Black, G. Martin and B. Radford. 2008. An Approach to Assessment of Harvested Black Bear Populations in Ontario - Technical Recommendations. Ontario Ministry of Natural Resources.

Mills, K. 2005. Genetic analysis of the black bear (*Ursus americanus*) in Ontario. M. Sc. thesis, Trent University, Peterborough, ON, Canada. 120 p.

Moola, F.M., A.U. Mallik, and R.A. Lautenschlager. 1998. Effects of conifer release treatments on the growth and fruit production of *Vaccinium* spp. in northwestern Ontario. Can. J. of Forest Res. 28:841-851.

Nuisance Bear Review Committee. 2003. Committee report and recommendations. Ont. Ministry of Natural Resources, Peterborough, ON, Canada. 63 p.

Obbard, M.E. 2001. Do suspended baits enable hunters to better discriminate between male and female black bears? Eastern Workshop Black Bear Res. and Manage. 16:109.

Obbard, M. E., G. D. Campbell, and A. Schenk. 2000. Evidence for fatal injury inflicted on a female black bear by a moose. Northeast Wildlife 55: 57-62.

Obbard, M. E., A. Granacki, and P. Wilson. 2002. Validation of bait station surveys using DNA fingerprinting of hair samples. Eastern Workshop Black Bear Res. and Manage. 15:155.

Obbard, M. E. and E. J. Howe. 2008. Demography of black bears in hunted and unhunted areas of the boreal forest of Ontario. J. Wildl. Manage. 72:869-880.

Obbard, M. E., and G. B. Kolenosky. 1994. Seasonal movements of female black bears in the boreal forest of Ontario in relation to timber harvesting. Int. Conf. Bear Res. and Manage. 9:363.

Obbard, M.E., B.A. Pond, and A. Perera. 1998. Preliminary evaluation of GPS collars for analysis of habitat use and activity patterns of black bears. Ursus 10: 209-217.

Obbard, M.E., B. A. Pond, A. Schenk, R. Black, M.N. Hall and B. Jackson. 2008. Suspended baits: can they help hunters distinguish male from female American black bears? Ursus 19(1):33-41.

Oftedal, O.T., G.L. Alt, E.M. Widdowson, and M.R. Jakubasz. 1993. Nutrition and growth of suckling black bears (*Ursus americanus*) during their mothers' winter fast. British J. of Nutrition 70:59-79.

OMMAH. 2005. Provincial Policy Statement. Toronto, Ontario. 37 p. Online: http://www.mah.gov.on.ca/Asset1421.aspx

OMNR. 2009. Framework for enhanced black bear management in Ontario. Wildlife Section, Fish and Wildlife Branch, Ont. Ministry of Natural Resources, Peterborough, ON, Canada. http://www.mnr.gov.on.ca/254265.pdf

OMNR. 2008. Statement of Environmental Values - Ministry of Natural Resources. http://www.ebr.gov.on.ca/ERS-WEB-External/content/sev.jsp?pageName=sevList&subPageName=10002

OMNR. 2006. Black Bear. Pages 73-80 in Ontario's Wildlife Management Manual V.2.0. Wildlife Section, Fish and Wildlife Branch, Ont. Ministry of Natural Resources, Peterborough, ON, Canada. 154p.

OMNR. 2005a. Protecting what sustains us – Ontario's Biodiversity Strategy. Fish and Wildlife Branch, Ont. Ministry of Natural Resources, Peterborough, ON, Canada. 44 p. Ontario Government Publication 51950, ISBN 0-7794-7981-5 http://www.mnr.gov.on.ca/en/Business/Biodiversity/2ColumnSubPage/243483.html

OMNR. 2005b. Our sustainable future – Strategic Directions. Fish and Wildlife Branch, Ont. Ministry of Natural Resources, Peterborough, ON, Canada. 22p. Ontario Government Publication 51929, ISBN 0-7794-7520-8. http://www.mnr.gov.on.ca/en/About/2ColumnSubPage/200238.html

OMNR. 1998. Standards and guidelines for conducting black bear population index lines in Ontario. Wildlife Section, Fish and Wildlife Branch, Ont. Ministry of Natural Resources, Peterborough, ON, Canada. 18 pp.

OMNR. 1990. Management policy and program for black bears in Ontario. Wildlife Section, Fish and Wildlife Branch, Ont. Ministry of Natural Resources, Peterborough, ON, Canada. (Approved January 1987, revised September 1990). 11 p.

Ozoga, J. J., and L. J. Verme. 1982. Predation by black bears on new-born white-tailed deer. J. Mammal. 63:695-696.

Powell, R.A. 1987. Black bear home range overlap in North Carolina and the concept of home range applied to black bears. Int. Conf. Bear Res. and Manage. 7: 235-242.

Rogers, L.L. 1987. Navigation by adult black bears. J. Mammal. 68:185-188.

Ontario

Rogers. L. L. 1986. Effects of translocation distance on frequency of return by adult black bears. Wildl. Soc. Bull. 14:76-80.

Rogers, L.L. and E.L. Lindquist. 1992. Supercanopy white pine and wildlife. Pages 39-43 in R.A. Stine, editor. White pine Symposium: history, ecology, policy and management. Minnesota Extension Service, University of Minnesota, St. Paul, MN.

Romain, D. A. 1996. Black bear (Ursus americanus) food habits and the nutrition of reproductive females in northern Ontario. M. Sc. thesis, University of Guelph, Guelph, ON, Canada. 170 pp.

Schenk, A. 1994. Genetic relatedness, home range characteristics and mating patterns of black bears (*Ursus americanus*) in northern Ontario, Canada. Ph. D. thesis, University of Waterloo, Waterloo, ON, Canada. 145 pp.

Schenk, A., and K.M. Kovacs. 1996. Genetic variation in a population of black bears as revealed by DNA fingerprinting. J. Mammalogy 77: 942-950.

Schenk, A., and K. M. Kovacs. 1995. Multiple mating between black bears revealed by DNA fingerprinting. Anim. Behav. 50:1483-1490.

Schenk, A., M. E. Obbard, and K. M. Kovacs. 1998. Genetic relatedness and home-range overlap among female black bears (Ursus americanus) in northern Ontario, Canada. Can. J. Zool. 76:1511-1519.

Strathearn, S.M., J.S. Lotimer, and G.B. Kolenosky. 1984. An expanding break-away radio collar for black bear. J. Wildl. Manage. 48: 939-942.

Taylor, M., M. Obbard, B. Pond, M. Kuc, and D. Abraham. 2003. A guide to using RISKMAN: Stochastic and deterministic population modeling RISK MANagement decision tool for harvested and unharvested populations, Version 1.9. © Government of Nunavut and Queen's Printer for Ontario (available online at http://www.nrdpfc.ca/RISKMAN/riskman2.htm).

Usui, M. 1994. The pollination and fruit production on plants in the boreal forest of northern Ontario with special reference to blueberries and native bees. M. Sc. thesis, University of Guelph, Guelph, ON, Canada. 277p.

Usui, M., Y. Kakuda, and P.G. Kevan. 1994. Composition and energy values of wild fruits from the boreal forest of northern Ontario. Can. J. Plant Science 74: 581-587.

Usui, M., P. G. Kevan, and M. Obbard. 2005. Pollination and breeding system of lowbush blueberries, *Vaccinium angustifolium* Ait. And *V. myrtilloides* Michx. (Ericaceae), in the boreal forest. Can. Field-Nat. 119: 48-57.

Wagner, R.G. 1992. Timber management guidelines for the use of herbicide in the Crown forests of Ontario. Unpublished report, Ont. Forest Res. Institute, Ont. Ministry of Natural Resources, Sault Ste. Marie, ON, Canada. 4 p.

Wilton, M. L., D. M. Carlson, and C. I. McCall. 1984. Occurrence of neonatal cervids in the spring diet of black bear in south central Ontario. Alces 20: 95-105.

Wimsatt, W. A. 1963. Delayed implantation in the Ursidae with particular reference to the black bear (*Ursus americanus Pallas*). Pages 49-76 in A. C. Enders, ed. Delayed implantation. Univ. Chicago Press, Chicago, IL.

Woods, J.G., D. Paetkau, D. Lewis, B. N. McLellan, M. Proctor, and C. Strobeck. 1999. Genetic tagging of free-ranging black and brown bears. Wildl. Soc. Bull. 27:616-627.

Wright, P.A., M.E. Obbard, B.J. Battersby, A.K. Felskie, P.J. LeBlanc, and J.S. Ballantyne. 1999. Lactation during hibernation in wild black bears: effects on plasma amino acids and nitrogen metabolites. Physiological and Biochemical Zoology 72: 597-604.

Zorn, P. and J. Quirouette. 2003. Black bear (*Ursus americanus*) population estimate 2001 - Upper Bruce Peninsula. Unpublished report, Ecological Integrity Monitoring Program, Parks Canada, Ottawa, ON, Canada. 22 p.

Yodzis, P. and G. B. Kolenosky. 1986. A population dynamics model of black bears in eastcentral Ontario. J. Wildl. Manage. 50: 602-612.

Ontario