Bats

Bats in Canada

- locate their prey using echolocation, sending out sound waves to find objects in their path
- for their size have exceptional life spans, with some adults living over 30 years

Little brown bat
Photo: M.B. Fenton

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Description

Nineteen species of bats have been recorded in Canada, and 17 of them are regular residents. In many ways, bats are typical mammals: they are warm-blooded, give birth to live young and suckle them. Their ability to fly sets them apart from all other mammals. Their wings are folds of skin supported by elongated finger, hand, and arm bones. Wing membranes attach to the sides of the body and the hind legs. In Canadian species, the tail is enclosed in the membranes. Resting bats usually hang head downward so that taking flight means just letting go.

With their wings spread, flying bats appear larger than resting ones. But bats are small mammals. For example, an average-sized Canadian bat, the little brown bat *Myotis lucifugus*, weighs about 8 g in summer (the mass of two nickels and a dime) and has a wingspan of about 22 cm. The hoary bat *Lasiurus cinereus* is the largest Canadian species, weighing about 30 g, with a wing span of 40 cm. At about 5 g, the smallest Canadian species are the eastern and western small-footed bats (*Myotis leibii* and *Myotis ciliolabrum*, respectively).

Bats are long-lived mammals, the current record for being a banded little brown bat from a mine in eastern Ontario that survived more than 35 year.

Signs and sounds

Bats are well known for their echolocation behaviour. Most bats — and all Canadian species — use echoes of the sounds they produce to locate objects in their path. Higher frequency sounds have shorter wavelengths and give bats more detailed information about their targets. Most Canadian bat species use echolocation calls that are ultrasonic (beyond the range of human hearing). A notable exception is the spotted bat *Euderma maculatum*, which occurs in the Okanagan Valley of British Columbia and uses lower-frequency echolocation calls readily audible to most people.

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Habitat and habits

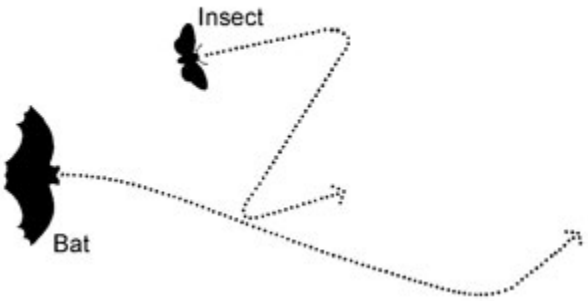
Bats are primarily nocturnal creatures, sleeping during the day and hunting and feeding at night.

Bats are not blind. The eyes of many bats that eat insects are inconspicuous, but bats see very well and use vision for many of the things they do. However, as far as we know, Canadian species use echolocation to locate their prey, and their large ears reflect the importance of sounds in their lives. In echolocation, the difference between the original sound and its echo contains the information used by the bat to locate and identify objects in its path. Echolocation is not a characteristic of all bats, and it also is used by toothed whales, some cave-dwelling birds, and mammals such as shrews.

The ears of many insects, including many species of moths, lacewings, crickets, mantids, and beetles, are sensitive to the echolocation calls of bats. This sensitivity allows these insects to avoid capture by flying away or taking evasive action (as shown in the illustration). The spotted bat is an interesting exception. Most insects cannot detect its lower-frequency echolocation calls, making these bats much more difficult to detect and evade.

Range

The flight path of a bat and an insect were photographed using reflected light. This moth has evaded capture by swerving sharply, warned by the sound waves as measured on an oscilloscope.



In the summer some bat species gather in colonies, while others live alone. The former include species that roost in buildings, such as the little brown bat, big brown bat *Eptesicus fuscus*, and Yuma bat *Myotis yumanensis*. The latter include foliage species (species that roost in trees or vines), such as red bats *Lasiurus borealis*, and hoary bats. Other species, such as the pallid bat *Antrozous pallidus* and the spotted bat, roost in cracks and crevices in cliffs. In the fall in Canada, when weather conditions become harsher and the insect food supply disappears, bats resort to some combination of migration and hibernation. Some common species that roost in buildings, including little brown bats and big brown bats, make long or short migrations to hibernation sites — little brown bats travel up to hundreds of kilometres; big brown bats migrate up to tens of kilometres. Bats usually hibernate underground, often in caves or abandoned mines, where the temperatures are stable and above freezing and the humidity is very high. Other species, such as red bats, hoary bats, and silver-haired bats *Lasionycteris noctivagans*, migrate to more southern locations, where they may hibernate in hollow trees or leaf litter (red bats) or they may remain active.

Like all other mammals, bats are susceptible to rabies, a viral disease that causes progressive paralysis and death. The rabies virus often is found in saliva and can be transmitted by the bites of infected animals. The incidence of rabies in bats in Canada seems to be low, but we lack details about the general incidence of the disease in the bat population. Some species are more often found rabid than others, and there is geographic variation in the incidence of rabid bats. Nobody should ignore a bite from a bat. Anyone who has been bitten by a bat or other mammal should contact a physician and Agriculture and Agri-Food Canada personnel, who can arrange to have the animal that delivered the bite tested for rabies. Even though Canadian bats are small and their bites make small wounds, they can spread rabies. People working with bats typically have pre-exposure vaccinations for rabies to protect them from this disease.

Unique characteristics

Bats differ from all other mammals in their ability to fly. Their wings are folds of skin stretched between elongated finger bones, the sides of the body, the hind limbs, and, in Canadian species, the tail.

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Distribution of the little brown bat

The map shows the distribution in North America of the little brown bat, one of the most common bats in Canada. The summer distribution of the red, hoary, and silver-haired bats is generally similar but probably not as extensive. We must remember, though, that red bats have been found as far north as Southampton Island in the Arctic, and hoary bats also occur in Hawaii and in the Galapagos Islands in Ecuador.

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Feeding

Although some bats in the tropics feed on fish, fruit, nectar, or even blood, bats of Canada feed on insects, usually caught in flight. Bats eat a variety of insects, including moths, beetles, mayflies, caddis flies, and midges. Insectivorous, or insect-eating, species of bats typically consume 50 to over 100 percent of their body weight in insects each night in summer. This is the same as a 60-kg person eating 30 to 60 kg of food in one day. Although one scientist found 145 mosquitoes in the stomach of one little brown bat, Canadian bats probably eat relatively few mosquitoes, preferring larger insects with more calories.

Birds that pursue flying insects often catch their prey in their mouths, but most insectivorous bats scoop up their victims in wing or tail membranes before transferring them to the mouth. Little brown bats can chew their food very rapidly and in the laboratory have been observed catching fruit flies at a rate of 10 per minute.

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Breeding

Early in August, adult males make nightly visits to the caves and mines that will serve as hibernation sites. They arrive at these locations after feeding and spend several hours underground. As August progresses, more and more adult females and young join the males at hibernation sites, and by the middle of August the first matings take place. Most of the mating occurs before the population of hibernating bats builds up in September.

The females store sperm in the uterus over the winter; ovulation and fertilization occur when the females leave hibernation in the spring. Pregnant females of most Canadian bat species (e.g., little brown bats or big brown bats) gather in the warmest available roosts located in buildings or hollow trees in April or May. Several hundred little brown bats may inhabit one colony. These nursery roosts are the sites where young are born 50 or 60 days after fertilization, in the middle of June, and the young are raised there.

Each female little brown bat gives birth to a single baby. Females leave their babies in the roost each night when they go out to forage. On their returns, mothers unerringly select their own baby from the many others waiting in the nursery. Baby little brown bats grow rapidly, increasing their wing area by 10 times in three weeks and starting to fly by the age of 18 days. At this stage, they have shed their milk teeth and begun to eat insects as well as their mothers' milk. The months of July and August are spent in heavy feeding as the females and young build up their fat reserves for hibernation.

We know relatively little about the lives of adult males in summer. They do not live in the nursery colonies with females and babies, and we presume they roost alone or in small groups in cracks and crevices.

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Conservation

A lack of information about the sizes of most bat populations in Canada makes it difficult for biologists to accurately assess their conservation status. Historical records, for the numbers of bats hibernating in some caves and mines, for example, suggest declines in populations, but the accuracy of these data is open to question.

While many animals (including martens, skunks, raccoons, some snakes, domestic cats, and some owls and raptors) are opportunistic predators of bats, there are no records of any predators specializing in bats. Bats appear to be most vulnerable to predators when large numbers are in a roost, arriving at or departing from it.

Disturbance by people is probably one of the main threats to the survival of bats. Disturbances in nursery colonies often result in abandoned young which do not survive the experience. Disturbance during hibernation rouses bats, which in turn forces them to burn energy they otherwise would use in hibernation. One disturbance of this sort costs a little brown bat the energy that would sustain it over 60 days of hibernation. Effective conservation means protecting bat roosts from people.

The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) has determined that for some species in Canada—the fringed bat *Myotis thysanodes* and the Keen's long-eared bat *Myotis keenii*—we lack enough information to make informed judgements about their conservation status; they are designated "data deficient."

Two other species, the pallid bat and the spotted bat, are considered at risk because of their small populations in Canada that are limited to relatively small areas in southern British Columbia. Pallid bats have been assessed as threatened by COSEWIC and are listed under the Species at Risk Act. This means that it is believed that they are likely to become endangered if nothing is done to reverse the factors leading to their disappearance from Canada. Pallid bats take much of their prey from the ground. They occur only in the very southern Okanagan Valley, where they roost in cliff faces and rock crevices.

Pallid bat
Photo: M.B. Fenton

Spotted bat
Photo: M.B. Fenton

Spotted bats are more widespread than pallid bats, but they were only noticed in Canada in 1979. These bats are considered a species of special concern by COSEWIC, and they are under consideration for listing under the Species at Risk Act. (A species of special concern is one that may become threatened or endangered because of a combination of biological characteristics and identified threats.) Like pallid bats, spotted bats roost in cliff faces but hunt flying insects, usually in Ponderosa Pine woodlands. They are conspicuous because their echolocation calls are readily audible to people. Survey data suggest that there are not many more than 100 adult spotted bats in Canada. Pallid bats and spotted bats may migrate to the United States for the winter.

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Resources

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Environment Canada—Species at Risk

Species at Risk Act Public Registry

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Beaver

This animal

- is a superb engineer: it builds impressive dams, canals, and lodges
- can see as well underwater as on land
- is ungainly and slow on land, but is graceful and strong in water
- has influenced the history of Canada more than any other animal

Photo: Tom W. Hall

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Description

The beaver *Castor canadensis* is the largest rodent in North America and the largest rodent in the world except for the capybara of South America. An adult weighs from 16 to 32 kg and, including its 30-cm tail, a large beaver may measure 1.3 m long. Its ancestors were even larger. In the Pleistocene ice age—the era of the mastodons and the mammoths—the giant beavers that inhabited the expanses of Eurasia and North America measured just under 3 m in length, including the tail, and probably weighed 360 kg.

Very compact and rotund, the beaver is ungainly and slow on land. Not so in the water. The beaver is a graceful, strong swimmer, both under water and on the surface, attaining speeds approaching 7 km per hour if it is alarmed.

The beaver's body is adapted in many ways to the animal's watery habitat. The beady eyes see as well in the water as out of it thanks to a specialized transparent membrane that can be drawn over the eyes for protection while diving. The nostrils are small and can be closed for underwater swimming, as can the ears.

The beaver's tail has important uses both in the water and on land. The tail of a large beaver may be 30 cm long, up to 18 cm wide, and 4 cm thick. It is covered with leathery scales and sparse, coarse hairs. Although fat, the tail is flexible and muscular. In the water, the animal can use its tail as a four-way rudder. On land, the tail acts as a prop when the beaver is sitting or standing upright. It also serves as a counterbalance and support when the animal is walking on its hind legs while carrying building materials like mud, stones, or branches with its front paws.

The beaver's hind feet are very large, with five long blunt-clawed toes which are fully webbed, for swimming. In the water, the beaver holds its forepaws close to its body, using only its hind feet to propel itself, with occasional aid from its tail. Its forepaws are small, without webs, and the toes end in long sharp claws suited to digging. These delicate paws are very dextrous—almost like hands—and with them the beaver can hold and carry sticks, stones, and mud and perform a variety of complex construction tasks.

The beaver also uses its paws to groom its coat. The second toe on each hind foot is double-clawed, the claws being hinged to come together like tiny pliers. These specialized claws, along with the front claws, are used for combing the fur, which is brown in colour.

The beaver has several reasons to groom itself. Its fur is very dense, consisting of a mat of fine underfur about 2 cm long and an outer layer of heavy guard hairs about 7 cm long. Through constant preening and oiling, this dense pelt is kept waterproof: even after swimming under water for six or seven minutes the beaver is not wet to the skin. Oil is obtained from two glands near the anus and, like preening, application of oil is done with both front and hind feet. Preening also removes dirt, straightens matted fur and removes mites and other insect parasites. Members of family groups spend considerable time preening each other. The beaver moults in spring and in late autumn.

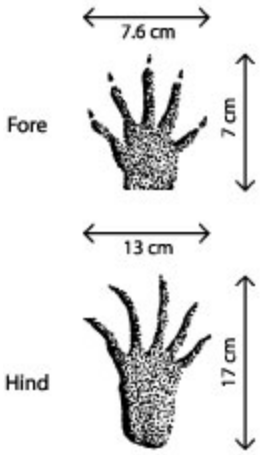
Finally, the animal has exceptional teeth. Its long, sharp, strong incisors grow continuously and are hardened with a dark orange enamel on the forward face. Consequently, as the upper and lower incisors are ground against each other, the outer tips of these teeth are maintained chisel-sharp. With them, a beaver is able to fell very large trees. The lips can be closed behind the incisors, permitting the beaver to gnaw on twigs while under water.

Beavers may live as long as 12 years.

Signs and sounds

Beavers have a system of communication that includes physical markers and noises. They often leave "mud pies" on their trails, on which they leave paw prints and the oily deposit of a musky oil that they secrete. (See Figure 1 for illustrations of their tracks.) They also communicate through low whines and bellows and the pistol-shot-like slap of the tail on water, which warns other beavers that danger is near.

Figure 1: Beaver tracks



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Habitat and habits

Most common in forested areas, beavers also expand into unforested habitats, where there are water-courses bordered by deciduous trees or shrubs.

Each day, beavers alternate periods of activity and rest. They are most active from dusk to dawn. Midday generally finds them in the lodge, be it summer or winter.

Unique characteristics

The beaver's life is inextricably connected to logging—or sustenance and for habitation. This animal cuts down an average of 216 trees a year. It can fell trees up to about 40 cm in diameter. Usually a single beaver cuts a tree, but sometimes two work on a large one.

The beaver is a wonderful builder, and what it builds depends on where it lives. Its best-known structure, the dam, is only built by beavers that need to enlarge the underwater habitat that will be open to them in winter. The dam creates a pond deep enough not to freeze to the bottom, providing storage for winter food and year-round underwater access to the lodge secure from predators.

The beaver begins the dam by laying sticks and rocks in the stream bed at a narrow point in the river where the current is fastest. It embeds some sticks so that the butt ends face upstream, allowing the current to spread the branches more securely on the bottom and pack the stones, roots, and mud that complete the dam into the spaces between the twigs and leaves. Layer upon layer is added, and the result is a very stable earthwork that can withstand great water pressure and erosion. Dams as high as 5.5 m have been discovered.

Dams are maintained throughout the year, but the beavers add most material during periods of high water. Breaks in dams are infrequent, probably because of daily inspection and maintenance.

The beaver also builds a lodge, which may be occupied for many years. Located in the middle of a pond or on the bank of a waterway, this structure is usually built in one month in the autumn. The lodge includes a feeding den, a resting den, a source of fresh air, and usually two underwater entrance tunnels, which allow for a means of escape if a predator enters the lodge through one of the tunnels. The dens are constructed on a platform 10 cm above the water line so that they will remain dry. The beavers create them by gnawing out space in the pile of mud, twigs, and bark that constitute the lodge.

The size of the lodge depends on the size of the family group, number of years of occupation, and fluctuating water levels. Most lodges are about 5 m in diameter and about 2 m high. As freezing weather begins, the beavers, using their front paws, plaster the lodge with mud, except about the air intake near the top, making a concrete-like outer shell which no wolf, wolverine, or lynx can break through.

Another impressive feat of beavers is the building of canals. Canals may extend several hundred metres along the base of a wooded hillside. Often 1.5 m wide and 1 m deep, they provide easy transportation for food supplies. Sometimes canals are dammed to maintain the water level on uneven ground, and occasionally nearby streams are diverted into canals to maintain the water level.

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Range

Distribution of the beaver

Beavers are found throughout Canada, north to the mouths of the Mackenzie and Coppermine rivers on the Arctic Ocean. In the rest of North America, the beaver's range extends throughout southwestern Alaska and most of the states south of the 49th parallel. The beaver has been exterminated in some states, and in practically all of its former range in northern Mexico.

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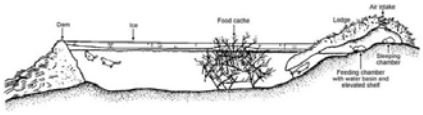
Feeding

Every fall, beavers in northern latitudes construct food caches, or piles, in deep water close to the lodge or bank den they have constructed. Each cache is an accumulation of the beavers' favourite woody food items, and it is meant to sustain the beavers in the winter. With the first frosts of September and October, the animals begin to prepare the cache by clearing trees away from the edge of the water. If the area is relatively free of predators, the beavers take their logging operation farther afield—often 125 m away. They gnaw the trees into short lengths and tote them to the water, along trails that they have cleared, for underwater storage.

The bulk of the edible forage, or food, in the cache is held below the water surface by a thick top layer of small, leafy branches most often cut from trees and shrubs that are not the beavers' most preferred (see Figure 2). The top layer protrudes well above the water surface, where it intercepts snow to provide an insulating cover that prevents water from freezing in and around the stored food.

Figure 2: Beaver lodge, food cache, and dam in water



All winter the beavers bring sticks from their underwater cache into the feeding chamber of the lodge to gnaw the succulent bark. They prefer trembling aspen, poplar, willow, and birch; half a hectare of aspen will support one beaver for a year. They also swim out under the ice and retrieve the thick roots and stems of aquatic plants, such as pond lilies and cattails. During mild winters and warm days in March and early April, adult beavers emerge from their dull aquatic world to feed on fresh woody stems along the shore. On such forays they often fall prey to hungry wolves.

Beavers shift from a woody diet to a herbaceous diet as new growth appears in the spring. During summer, beavers will eat grasses, herbs, leaves of woody plants, fruits, and aquatic plants.

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Breeding

A beaver takes only one mate, which it keeps for life. The family is the basic unit of the beaver's society, and the female is the central figure. The female usually establishes the home site, and if her mate is lost, she remains with her family, and another male joins her in the mating season. If the female is killed and leaves no female offspring, the male usually abandons the site.

Mating occurs in January and February. Shortly before the kits are born, the female drives the male from the lodge the beavers have built, and he moves temporarily into an old lodge or a burrow in the riverbank. One litter, averaging three or four kits, is born each year in May or June following a 100-day gestation period. The young measure about 125 mm long and weigh about 450 g. Although they are well-furred, have teeth already cut, and can see, walk, and swim when born, the kits generally don't move out of the lodge for at least one month. If the kits are threatened, the female will usually carry them in her mouth, under water, to another retreat. The young stay with their parents until they are two and sometimes three years old. They do not work the first summer, but the second season they help with many colony chores, including cutting food, repairing the dam and lodge, and digging channels and canals.

The kits disperse the following spring in response to an innate urge to leave the home colony, and migrate along streams or across country until they find mates and suitable building sites, whereupon they establish their own dams and lodge. These dispersal migrations can vary from just a few kilometres to 250 km.

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Conservation

Although their aquatic habits offer excellent protection from predators, beavers are vulnerable in many ways. Beavers fall prey to wolves, coyotes, bears, lynx, and wolverines when foraging on shore or migrating overland. The river otter is able to enter the den via the water and kill the kits inside; however, an adult or subadult beaver always stays with the kits to offer protection. Sudden fluctuations in water levels can force beavers to leave their den and face danger on shore.

At bay, beavers stand their ground and protect themselves. They face the aggressor, rear up on their hind legs, and loudly hiss or growl before lunging forward to deliver extremely damaging bites.

During the peak of the fur trade era, some 200 000 pelts a year were sold to the European market, most being used to make the then-popular beaver hats. A large adult beaver skin yielded enough fur for 18 hats.

About 100 years ago, the trade in beaver waned, partly with the decline of the beaver hat as fashionable headgear, and partly because the beavers themselves were becoming scarce all over North America. Many large regions were completely without beaver during most of the first half of the 20th century.

The beaver conservation movement began in the late 1930s with the writings and lectures of Grey Owl. A native of England who posed as a Métis, Grey Owl created passionate stories of the plight of the Canadian forests and wildlife, and particularly the beaver. Governments responded by closing the beaver trapping seasons for many years.

More recently, conservation plans have been put into effect by federal and provincial governments, with the co-operation of trappers, and beavers have been reintroduced into many areas that were stripped by early trappers. As a result, there has been a tremendous increase in the number of beavers in Canada, and their population is now a healthy one.

In some areas the problem is not how to protect the beaver population, but how to prevent damage to farmlands, roads, and tree plantations from beavers' damming and cutting practices. A combination of trapping and use of flood control devices is necessary. Beavers maintain water levels, improve habitat for many forms of wildlife, stabilize stream flow, and prevent stream bed erosion, so it is important that they be managed carefully.

No other animal has influenced Canada's history to the extent that the beaver has. When Europeans began to settle in northern North America, beaver pelts were the prize that lured them farther and farther into the wilderness. Canadians now celebrate the beaver as a national symbol on stamps, coins, and emblems; in addition, literally hundreds of Canadian lakes, towns, rivers, and hill ranges bear the name of this interesting rodent.

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Resources

Online resources

Northeast Furbearer Resource Technical Committee

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Beluga whale

Scientific name: *Delphinapterus leucas*
Status: Threatened, listed under SARA

Taxonomy: Mammals
Region: Quebec

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Description

With its pure white skin and prominent, bulging forehead, the beluga whale is easy to spot. Beluga actually means ‘the white one’ in Russian. However, only adult belugas are white; calves are born brown or dark grey and gradually pale to become totally white between six and eight years of age.

Beluga whales have stout bodies, well-defined necks and a disproportionately small head. They have thick skins, short but broad paddle-shaped flippers, and sharp teeth. Unlike other whales, the beluga doesn’t have a dorsal fin. Belugas average 3 to 5 metres in length and weigh between 500 and 1,500 kilograms. Male whales have a marked upward curve at the top of their flippers.

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Unique characteristics

The St. Lawrence beluga represents the southern limit of the species’ worldwide range. All belugas are warm-blooded, air-breathing mammals, and all sport a layer of blubber between 2.5 and 9.5 centimetres thick beneath the skin. This fat serves as both an energy reserve and an efficient insulator that helps maintain body temperature in frigid waters.

Belugas are very vocal animals, making a cacophony of sounds that range from high-pitched whistles to low, repeated grunts. The sounds are probably used for communication. For example, researchers have observed that squawks are emitted with more frequency when belugas are alarmed.

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Range

This beluga lives—as its name suggests—mainly in the St. Lawrence River. Specifically, it is found in Battures aux Loups Marins (about 100 kilometres downstream from Quebec City), and in the Gulf of St. Lawrence (from Natashquan to Sept-Iles along the north shore, and from the Baie des Chaleurs to Cloridorne along the south shore). Individual beluga whales are occasionally found off the north shore of New Brunswick and in the Saguenay River from Chicoutimi to Saint-Fulence.

There are five groups of beluga found in Canadian waters, including the St. Lawrence River population. The other four populations are: the Cumberland Sound population, which is threatened, Eastern High Arctic/Baffin Bay, which is of special concern, and both the Ungava Bay population and the Eastern Hudson Bay population, which are both listed as endangered.

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Feeding

Belugas also have a well-developed sense of hearing and refined ability to detect objects by sound. Called echo-location, this natural sonar is important to a species that lives a good part of its life in dark waters. At depths greater than 100 metres, there is virtually no light and belugas have been seen to make frequent dives to depths of several hundred metres. Visibility in water can be further reduced by silt runoff in river estuaries. To navigate and catch prey, belugas use a series of clicking sounds that bounce off fish and other objects in the water. The resulting echoes enable the belugas to build an accurate picture of what’s around them.

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Breeding

Male beluga whales reach full adulthood at eight or nine years old. Females mature sooner, at four to seven years of age. Female belugas calve only once every three years, between April and June, and research indicates a low reproductive rate. Life expectancy for beluga whales is approximately 16 years, although some have been known to live into their late twenties. Beluga whales travel in pods of two to 10 whales, although larger pods are not uncommon.

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Conservation

Excessive hunting—largely between 1880 and 1950 (when the 400-year Beluga fishery was at its most intensive)—has depleted whale numbers severely. Although the St. Lawrence beluga has been officially protected by the Canadian Fisheries Act since 1979, there has been no noticeable recovery in the population.

A number of factors are thought to contribute to the St. Lawrence River beluga's failure to thrive. Pollution levels in the river are high. Dredging, shipping, industrial activity and environmental pollution have also resulted in a decline in habitat quality and contamination of food supply.

High levels of traffic—commercial and recreational—on the waterway have led to more frequent collisions with boats and exposure to significantly higher numbers of oil spills, further affecting the species' survival. Finally, it has been suggested that the large and growing recreational whale-watching industry may have a negative impact.

The St. Lawrence beluga whale population is listed as threatened and protected under the Species at Risk Act (SARA). The whale is also protected under a number of other Acts, regulations and agreements.

A recovery plan for the St. Lawrence beluga whale was published by DFO in 1995. The long-term goal of the plan is to recover the beluga population to a point where the whale is no longer threatened by natural events or human activities. Ongoing research and monitoring activities include a study of the genetic structure of the St. Lawrence belugas to assess genetic variability and consequences of reduced population size. Data from this study will be used to help draft conservation and management strategies.
The Habitat Stewardship Program for Species at Risk (HSP) has funded a number of recovery and awareness projects.

- The Réseau d'observations des mammifères marins (ROMM)—a marine mammal ecowatch network—has developed a network of cruise and excursion operators to gather marine-mammal data.
- In the summer of 2000, a campaign was conducted to raise the awareness of recreational boaters in prime whale-watching areas.
- The Groupe de recherche et d'éducation sur les mammifères marins (GREMM) hopes to establish an action network to assist marine mammals in difficulty. The network will improve our ability to respond to cases of entanglement and reduce whale bycatch mortality in the Gulf of St. Lawrence and the St. Lawrence estuary.

Beluga whales will get the protection they need only if all Canadians work together to reduce threats. Find out more about beluga whales and be aware of man-made threats. Do your best to reduce these threats wherever possible to better protect the whales' critical habitat. Get involved with the Habitat Stewardship Program for Species at Risk (HSP) or another conservation organization.

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Resources

Aquatic Species at Risk, Department of Fisheries and Oceans Canada
www.dfo-mpo.gc.ca/species-especes/home_e.asp
Beluga whale, Canadian Wildlife Service Species at Risk
St. Lawrence River population
http://www.speciesatrisk.gc.ca/search/speciesDetails_e.cfm?SpeciesID=102

Black Bear

This animal

- has been known to return to a site after it has been live trapped and moved as far away as 80 km
- may wake up from winter hibernation and wander around for short periods
- is tiny when born, compared to its mother's size of 70 kg, weighing slightly more than 225 g
- appears awkward but has been clocked at speeds of up to 55 km per hour

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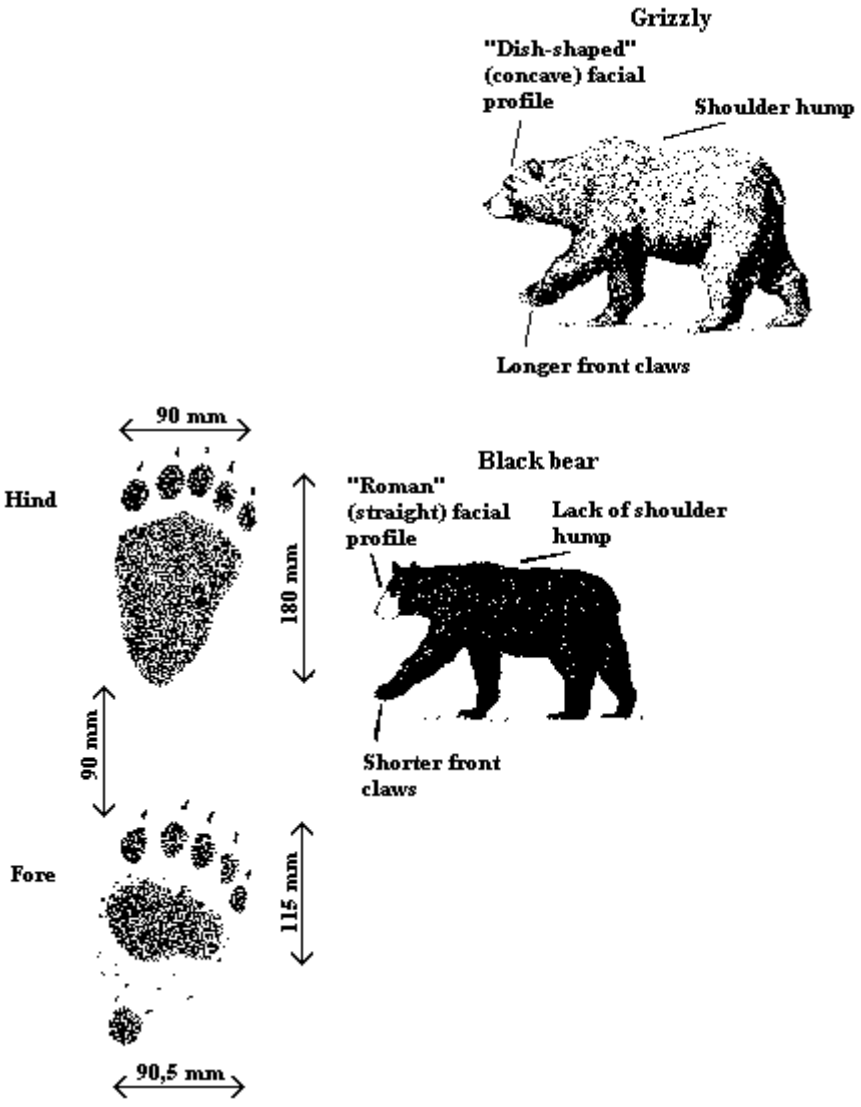
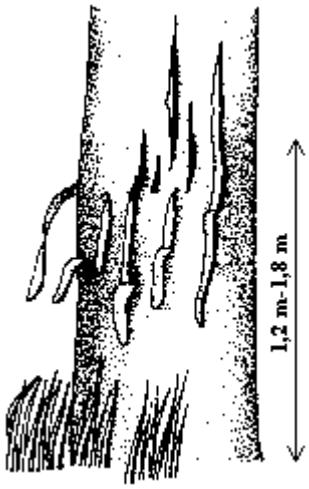
Description





The black bear *Ursus americanus* is one of the most familiar wild animals in North America today. Black bears are members of the family Ursidae, which has representatives throughout most of the northern hemisphere and in northern South America. Other members of this family that occur in North America are grizzly bears and polar bears. Both of these species are considerably larger than the black bear.

The black bear is a bulky and thickset mammal. Approximately 150 cm long and with a height at the shoulder that varies from 100 to 120 cm, an adult black bear has a moderate-sized head with a rather straight facial profile and a tapered nose with long nostrils. Its lips, unlike those of other animals, such as the wolf or bobcat, are free from the gums, and the bear can use them with amazing dexterity. This adaptation and a long manipulative tongue greatly assist the bear when it feasts on tiny blueberries or even tinier ants. The ears are rounded and the eyes small. The tail is very short and inconspicuous.

A black bear has feet that are well furred, on which it walks like a human being with the entire bottom portion of the foot touching the ground. Each foot has five curved claws, which the bear cannot sheathe. These are very strong and are used for digging and tearing out roots, stumps, and old logs when searching for food.

Owing to their compactness, bears often appear much heavier than they really are. Adult males weigh about 135 kg, although exceptionally large animals weighing over 290 kg have been recorded. Females are much smaller than males, averaging 70 kg.

The normal colour is black with a brownish muzzle and frequently a white patch below the throat or across the chest. Although black is the most common colour, other colour phases such as brown, dark brown, cinnamon, and blue-black. Albino, or white, bears also occur but they are rare. The lighter colour phases are more common in the west and in the mountains than in the east. Any of these colour phases may occur in one litter, but generally all cubs in a litter are the same colour as their mother.

Signs and sounds

Biologists think that trees repeatedly clawed and marked by bears serve as a form of communication. Adult males use these trees most frequently, presumably to advertise their presence to potential mates or potential rivals. Most markings are done during the breeding season in late spring or early summer (from mid-June to mid-July).

Although it is rarely heard, the black bear has several distinct calls. These include a growl of anger, a whining call, and sniffs of many sorts. A female with cubs may warn them of danger with a loud *woof-woof* and call them in with a whining or whimpering sound. The cry of a young cub in trouble is similar to the crying of a human baby.

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Habitat and habits

Although found in a variety of habitats, the black bear prefers heavily wooded areas and dense bushland. Maximum numbers probably occur in areas of mixed coniferous deciduous forests. Densities in favourable habitats are one bear to every 3 or 4 km^2. Black bears are difficult to count, because they are shy and secretive. A recent estimate of the continental population is 500 000, give or take 200 000!

Black bears are capable of travelling great distances. Biologists who have live trapped bears and moved them 80 km or more from their home ranges have sometimes been surprised by the bears' return. The home ranges of females are usually quite restricted. Ranges of adult males encompass several female ranges. Like most animals, they have customary routes of travel, which they regularly follow as they move from one area to another. Old time bear hunters took advantage of this and frequently set their traps along these well-used trails.

The activity pattern of black bears varies from area to area depending on a number of factors, including human activities. In wilderness areas they are usually most active from dawn until dark, whereas bears in areas with high human activity may be mainly nocturnal to avoid contact with people. Of course, some individuals solicit human contact in hopes of obtaining a free meal.

In the autumn when days become shorter and temperatures cooler, bears begin to search for a denning site. A suitable site may be under a tree stump or overturned log, or in a hole in a hillside. Most dens are only large enough to accommodate a bear when it is curled up. Generally, females line their dens with grass, ferns, or leaves; males usually do not. Females usually den earlier; males frequently wait until the first snowfall before entering a den.

Recent studies of black bear physiology have demonstrated that denned bears show some characteristics of true hibernators. Although body temperatures are only slightly lower, heart rates are greatly reduced. In addition, unlike many small mammal hibernators, bears do not have to eat or eliminate waste, but subsist entirely on their stored fat. However, black bears are not true hibernators, and most bears can be aroused if prodded sufficiently. If the weather becomes exceptionally warm some bears may wake up and wander around for short periods during the winter months.

With the coming of spring and warmer weather, bears emerge from their dens and search for food. During the winter they may have lost up to 30 percent of their predenning weight. Most bears continue to lose weight during the early summer period until mid-July when quantities of berries start to become available.

Black bears are extremely fond of garbage and frequently congregate at dumps. This habit occasionally leads them into contact with people who enjoy observing the feeding antics of the bears, especially the younger ones. Of course, if the bears demolish some picnicker's lunch, this feeding behaviour is not thought so amusing.

Most bears are extremely shy and retiring and usually avoid direct contact with humans. Incidents of black bears attacking humans have been reported but are extremely rare. These attacks were usually made by bears that had been feeding on garbage or by animals in extremely poor physical condition due to old age, disease, or wounds.

Occasionally bears cause trouble when they prey on livestock or upset beehives in an apiary, or bee farm. Usually incidents of this type are caused by one or two individuals and the problem is solved by removing them.

Unique characteristics

The lips of the black bear, unlike those of other animals such as the wolf or bobcat, are free from the gums and the bear can use them with amazing dexterity. This adaptation and a long manipulative tongue greatly assist the bear when it feasts on tiny blueberries or even tinier ants.

The eyesight of the black bear is relatively poor, but its senses of hearing and smell are well developed. A startled animal will usually attempt to get downwind from an intruder and make an identification by smell. Under favourable atmospheric conditions bears can detect carrion, or flesh of dead animals, which they scavenge, at considerable distances. Frequently, a black bear will stand on its hind legs with its nose in the air and scent the wind for any appealing odours.

Black bears appear awkward as they shuffle along, but can move with amazing speed when necessary. For short distances they have been clocked at speeds of up to 55 km per hour. They are good swimmers and frequently cross rivers and small lakes.

Climbing is second nature to a black bear. Young animals readily take to trees when frightened. They climb with a series of quick bounds, grasping the tree with their forepaws and pushing with their hind legs. When descending they travel backwards, frequently dropping from the tree from heights up to 4.5 m. Once on the ground, they quickly disappear into the underbrush, apparently unshaken by the abrupt descent.

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Range

Widely distributed in North America, the black bear occurs from the east to the west coast, as far north as Alaska and as far south as Mexico. It is not found on Prince Edward Island, in southern Saskatchewan, or in southern Alberta. The map provides a rough outline of its range.

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Feeding

Black bears will eat almost anything available. Most of their food is vegetation, especially in the late summer and autumn when berries and nuts are available. Favourite fruits include blueberries, buffalo berries, strawberries, elderberries, saskatoons, black cherries, and apples. Acorns, hazelnuts, and beechnuts are other preferred foods. Insects such as ants and grasshoppers rate high, and black bears will overturn logs, old stumps, and stones while hunting for food.

Fish, small mammals, and occasionally birds are also on the black bear's menu. In the spring some bears may prey upon newborn moose calves, deer fawns, caribou calves, or elk calves. Carrion, or dead animal flesh, of any sort is highly prized and its attractiveness to a bear increases with its degree of decomposition, or rotting. Of course, a tree containing honey is always a treat. Bears drink frequently and are usually found near water.

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Breeding

Black bears are solitary animals, except for the close bond between females and cubs, and the pairing that takes place during the mating season. Mating is in June or early July, and the cubs are born the following January or February while the mother is still in her winter den.

Generally, two cubs are born, although there may be only one or as many as four. At birth they are 15 to 20 cm long and weigh slightly more than 225 g. Compared to other mammals, this is very small relative to the mother's weight. For example, a woman weighing 70 kg could expect her infant to weigh about 3 kg, 12 times the mass of the newborn bear! The young bears grow rapidly and are quite active by the time they leave the den with their mother in the spring. At one year they weigh from 13 to 27 kg but only slightly more at two years. Normally, young bears remain with their mother until they are 16 to 17 months old. Cubs orphaned during their first summer have about a 30 percent chance of surviving to independence compared to about an 80 percent chance for those with mothers.

Males and females may attain sexual maturity between their third and fourth years in captivity, but often later in the wild. Male bears continue to grow until their seventh year; females cease growth somewhat earlier. Bears have lived for 25 or 30 years, but most animals in the wild would be less than 10 years old.

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Conservation

Although some black bears may live for 20 to 25 years, few bears in the wild become that old. In areas where bears are hunted, legal hunting is one of the major mortality factors, especially for bears two years of age and older. Males are usually shot before females because they are less cautious and travel more widely. Females become more vulnerable with increased hunting pressure. Young bears in both hunted and unhunted populations die from starvation, accidents, and predation. Predators include older bears and occasionally wolves and lynx.

The attitude of people towards bears has always been one of caution, respect, and, in primitive times, even reverence. Many Amerindians have special veneration for the bear, and any hunter who kills a bear commands considerable respect.

In the early days of European settlement, bear hunters made their living hunting and trapping bears, wolves, and cougars because of their presumed danger to livestock and perhaps people. In fact, most black bears kill few large mammals and cannot be classified as predators in the same manner as wolves, weasels, or polar bears. They are now prized as game animals, because they are large and elusive and test the skills of hunters, and also because bear meat, if properly prepared, is considered tasty by many people who enjoy eating wild game.

At this time in Canada and Alaska there are two legal hunting seasons for black bears: spring and fall. However, most jurisdictions in the lower 48 states no longer allow bear hunting in spring because of overharvest.

Some black bears harbour parasites such as tapeworms and roundworms, but these seem to have little effect on the bear's health. In general, wild black bears have remarkably few internal or external parasites. From a public health viewpoint, trichinosis, which is caused by a nematode or roundworm, is probably the most important parasite of bears. Because people can become infected, all bear meat should be cooked carefully before consumption.

Recently, the increasing demand for bear gall bladders, bear paws, and other parts that are believed to have medicinal value or be capable of increasing sexual pleasure has caused concern about increased illegal killing of bears. In certain parts of the world a dried gall from a wild bear may sell for up to $50 000.

In 1992, the 115 countries, including Canada, that were Parties to the Convention on International Trade in Endangered Species (CITES) voted to list the black bear on Appendix II to the Convention. This was meant to limit illegal killing of black bears and international trafficking in gall bladders from wild bears, including endangered Asian bears. Since that date, a hunter wishing to transport any part of a black bear through customs of any country that is a member of CITES has had to obtain a CITES export permit from the exporting country.

When people watch bears in the wild they should never forget that these are wild animals that must be treated with caution. They should not be fed. Most bears will hastily retreat if a person approaches too closely, but one should not take unnecessary chances, as bears, like people, are sometimes unpredictable. They are interesting to observe and photograph, but they can be dangerous at close quarters.

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Canada Lynx

This animal

- has dramatic fluctuations in population, following snowshoe hare populations to a peak, then crashing
- tends to be secretive, and even experienced hunters rarely see one in the wild
- cannot run fast except over short distances, so it stalks or ambushes its prey at close range
- has large feet, which help it to travel over snow

Ear of Canada lynx

Ear of bobcat

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Description

The Canada lynx Lynx canadensis is a beautiful wild felid, or cat, of the boreal forest, or northernmost forest in the Northern Hemisphere. The lynx resembles a very large domestic cat. It has a short tail, long legs, large feet, and prominent ear tufts. Its winter coat is light grey and slightly mottled with long guard hairs; the underfur is brownish, and the ear tufts and tip of the tail are black. The summer coat is much shorter than the winter coat and has a definite reddish brown cast.

Its large feet, which are covered during winter by a dense growth of coarse hair, help the lynx to travel over snow. The lynx, like the snowshoe hare, can spread its toes in soft snow, expanding its "snowshoes" still farther.

The lynx has large eyes and ears and depends on its acute sight and hearing when hunting. The lynx's claws, like those of most other cats, are retractable and used primarily for seizing prey and fighting.

Of the three Canadian members of the cat family (Felidae)—the lynx, the bobcat, and the cougar—the lynx and the bobcat are most alike and are most closely related to each other. They probably both descended from the larger Eurasian lynx. There are small differences in appearance: on average, bobcats are slightly smaller; the bobcat's feet are not as large as those of the lynx, making the bobcat less able to secure food in deep snow; the lynx's tail has a solid black tip, whereas that of the bobcat has three or four narrow black bars and a black spot near the tip on its upper surface; and the bobcat's fur has more pronounced spotting. The cougar is much larger and more powerful than either of them, and can be readily identified by its long tail.

Signs and sounds

The lynx has a variety of vocalizations, like those made by house cats, but louder.

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Habitat and habits

The lynx generally inhabits forested wilderness areas. It favours old growth boreal forests with a dense undercover of thickets and windfalls. However, this carnivore, or meat eater, will populate other types of habitat as long as they contain minimal forest cover and adequate numbers of prey, in particular snowshoe hares. Because hare populations increase in forests that are growing back after disruption by wildfires or logging operations, these regenerating forest ecosystems are often able to support denser populations of lynxes as well.

As long as they are not disturbed, lynxes are remarkably tolerant of human settlement. For example, since the early 1960s, they have occupied the partly cleared mixed-farming district near Rochester, in central Alberta. A few were shot in farmyards, but there was no intensive fur trapping, and lynxes remain in the area.

The size of the home range varies with numbers of lynxes and snowshoe hares in the area, available cover, and season. When there are fewer hares, each lynx needs a larger area on which to hunt. In summer, home ranges are larger than in winter. In Alberta, lynx tracked in winter had home ranges varying from 15 to 47 km^2. On Cape Breton Island, a study that involved radio transmitters attached to adult lynxes measured home ranges of 12 to 19 km^2 in winter and 27 to 32 km^2 in summer. In Canada, scientists have measured daily travelling distances for lynxes ranging from less than a kilometre to 19 km.

The territoriality of these mammals is still poorly understood. Home ranges may overlap, especially where the lynx neighbours are of different ages and sexes. In general, the home ranges of adults do not seem to overlap with other adults of the same sex. The animals urinate frequently to mark their home range.

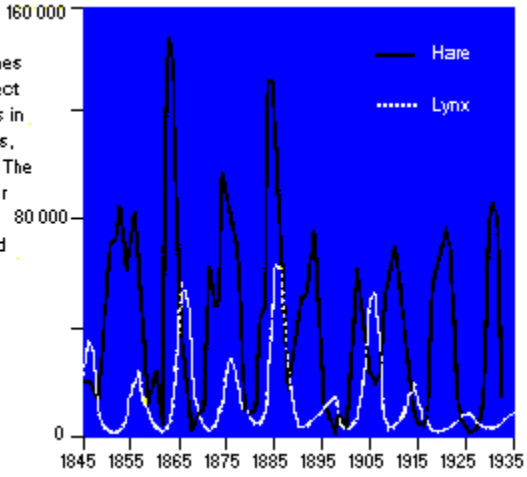
Periodically, there have been conspicuous mass movements of lynxes out of the boreal forest and onto the prairie grasslands. These were well known to early fur traders and trappers, but they ceased in 1925–26. During 1962–63, however, there was once again a notable movement out of the north. Lynxes entered large cities such as Edmonton, Calgary, and Winnipeg; appeared on the open grasslands of southern Alberta, Saskatchewan, and North Dakota; and reached Iowa and southwestern Wisconsin. These same events were repeated during 1972–73. Like so many other aspects of the natural history of the lynx, these movements can be understood by relating them to the cyclical declines in populations of the snowshoe hare, the lynx's main prey. Lynx populations that increase during periods of hare increase must either starve or emigrate when the hares disappear. The absence of any obvious movement between 1925–26 and 1962–63 probably reflected unusually low numbers of lynxes.

Like the cougar and the bobcat, the other two members of the cat family native to Canada, the Canada lynx tends to be secretive and most active at night and, like them, it is rarely seen in the wild. Even for trappers who have spent a lifetime in areas where lynxes are common, encounters with these predators are rare and memorable.

Unique characteristics

Figure 1

Increases and declines in lynx numbers reflect the population trends in its main prey species, the snowshoe hare. The figure is based on fur trapping data from MacLulich (1937) and Elton and Nicholson (1942).



The lynx preys almost exclusively on the snowshoe hare. Since snowshoe hare populations follow a 10-year cycle, lynx numbers also fluctuate dramatically, building to a peak as hare populations increase, and then crashing. Scientists who have examined the fur-trading records of the Hudson's Bay Company have been able to trace closely linked 10-year cycles of growth and decline in populations of the two species over the past 200 years. Figure 1 shows the cyclic fluctuations in the numbers of snowshoe hare and lynx pelts supplied to the company over a 90-year period.

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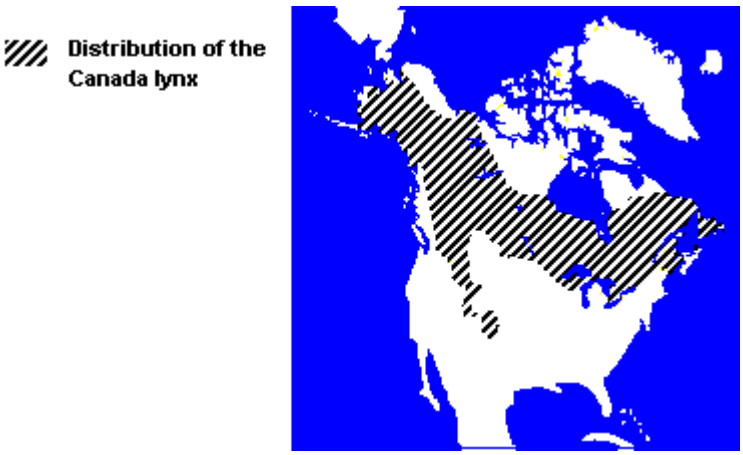
Range



The range of the lynx is essentially that part of North America covered by boreal, or northernmost, forest and occupied also by the snowshoe hare. Between 1900 and the mid-1950s, lynxes became scarce in the southern portions of this range. This was probably due to trapping during periods of snowshoe hare scarcity (low years in the 10-year cycle). At these times lynx numbers are already low and fewer young are surviving to adulthood, so trapping can seriously deplete, or even eradicate, local populations. In the past 25 years, lynxes have reoccupied some of this southern range, and this may be due to tighter legal restrictions on trapping. The northern range expansion of the bobcat in the past century may also have contributed to the overall decline in lynx numbers. When both species compete for the same space and food resources, the lynx most often yields to the more aggressive and adaptable bobcat.

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Feeding

More than 75 percent of the lynx's diet in winter is snowshoe hares, and when they are abundant a lynx may kill one hare every one or two days. In summer the lynx's diet is more varied. But even in summer hares remain the main prey, supplemented by grouse, voles, mice, squirrels, and foxes. A hungry lynx will devour an entire hare in one meal. It may also hide partially eaten prey to finish later. When it is available, lynxes will also supplement their diet with carrion, or dead flesh, from domestic livestock and/or big game animals, such as deer, but they rarely attack large prey. An exception occurs on the island of Newfoundland. After people introduced the snowshoe hare to the island in the 1870s, lynxes began to prey on caribou calves when snowshoe hares became scarce. In the 1960s, lynxes were killing so many calves that wildlife managers removed many of the lynxes found on the calving grounds. Today, the caribou population has increased to the point where lynx predation is not considered a threat.

Lynxes hunt at night. They watch and listen for prey, but they do not seem to track it by smell. Like all members of the cat family, they move silently. Although excellent climbers, they are seldom found in trees. Because they cannot run fast except over short distances, they stalk or ambush their prey at close range. A common strategy is to lie in wait beside the well-used trails, or runways, of the snowshoe hare. Success usually depends on whether the lynx manages to capture the hare at one bound—about 6.5 m or four hops for the hare.

Male lynxes hunt alone, except briefly during the mating season. By autumn, females travel with their kittens, the young learning to hunt, and the family group may stay together until the breeding season, in late February or March. Family groups cooperate to increase their hunting success. The mother and young often travel in single file through habitat where hares are scarce, but will travel abreast when hunting in habitat where hares are plentiful. A hare flushed, or forced out of its hiding place, by one lynx may be caught by another.

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Breeding

Mating occurs during February or March each year, and the young (usually four) are born in April and May, 60 to 65 days later. Although the lynx seldom uses an underground den, young may be born under brush piles or uprooted trees, or in hollow logs, which provide shelter from rain and cold. The kittens, reared solely by the female, look like those of the domestic cat. Female kits may breed for the first time as they approach one year of age, but this depends on the abundance and availability of snowshoe hares and the physical and nutritional condition of the lynx.

Probably starvation following the rapid cyclic declines in snowshoe hare populations is the greatest single source of natural mortality among adult and yearling lynxes. About 40 percent of the total lynx population may starve to death following a crash in the snowshoe hare population. During the following three to four years, when the hare population is starting to rebuild, lynxes breed, but the kittens die before winter. This suggests that an adult female simply cannot support both herself and her litter when hares are scarce.

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Conservation

In Canada, trapping seems to be the only important cause of death besides the decline of populations of the lynx's main prey, the snowshoe hare. Although the wolf is alleged to be the chief natural enemy of the lynx in northern Europe, nothing is known of lynx–wolf interactions in North America. The incidence of diseases, such as rabies and distemper, among lynxes and their impact on populations are also unknown.

Trapping is also the most important influence of people on the lynx. The lynx is easily trapped, and when fur prices rise, trappers take a larger proportion of the lynx population. Intense trapping can remove most lynxes from a given area. Historically, trapping has caused long-term changes in the size of the lynx population in Canada. Lynx populations began to decline after 1900, and the decline continued to the mid-1950s. At that time, garments made of long-haired furs went out of fashion, there was a major depression in fur prices and a decline in trapping, and the lynx population was able to recover. Since the early 1970s, the demand for lynx pelts has risen steadily. The average price paid per pelt went from about $30 in 1970 to peak in the mid-1980s at over $500 per pelt. By 1990, it had fallen to $117.

Today, the lynx is trapped in all provinces and territories except Prince Edward Island, Nova Scotia, and New Brunswick. Trapping is confined to regulated seasons, and wildlife managers can vary the regulations as needed from year to year and among districts within a province. Many jurisdictions have also placed restrictions on the number of lynxes that may be killed. Some biologists have recommended closing trapping seasons entirely during lows in the population cycle. Several provinces are carefully studying the influence of trapping on their lynx populations and adjusting regulations to protect this renewable resource. High fur prices have also stimulated interest in raising lynxes on ranches. It is possible that ranching may one day provide a considerable number of the pelts that enter trade, as is now the case with mink and fox.

In general, human activities do not seem to be threatening lynx populations. Although the lynx is usually considered to be a wilderness animal, human settlement does not seem to have reduced its range. Logging in the boreal forest that results in a good mix of mature conifer stands (for cover and travel) and regenerating stands (in which snowshoe hares abound) may even enhance habitat for lynx. Forestry operations, however, provide roads and ease of access to the trapper. If the regulations governing logging are not conservative and flexible enough, extensive clearcutting that results in the virtually complete removal of conifer forests from large tracts of land is probably harmful to resident lynx populations.

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Caribou

This animal

- is unusual among deer family members in that most females, as well as males, carry antlers
- will sometimes run for many kilometres during the summer to escape harassment by hordes of flying insects
- uses lichens as a primary winter food, which enables it to survive on harsh northern rangeland
- has probably derived its name from the Mi'kmaq word "xalibu," meaning "the one who paws"

Woodland caribou
Photo: Shane P. Mahoney

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Description

Male

Female

In the autumn, the caribou male, or bull, is an imposing animal. It has a rich brown or grey and white coat, a fringe of white hair flowing from throat to chest, and a great rack of amber-coloured antlers. Antler growth starts each year in the spring and is typically complete by late August. Adult bulls generally shed their antlers in November or December, after they have mated. Adult females, or cows, and young animals carry their antlers much longer, often through the winter. The growing antlers have a fuzzy covering, called velvet, which contains blood vessels carrying nutrients for growth. (See Figure 2.)

Four subspecies of caribou occur in Canada: woodland (*Rangifer tarandus caribou*), Peary (*Rangifer tarandus pearyi*), barren-ground west of the Mackenzie River (*Rangifer tarandus granti*), also known as Grant's caribou, and barren-ground east of the Mackenzie River (*Rangifer tarandus groenlandicus*). A fifth subspecies, Dawson's or the Queen Charlotte Islands population of woodland caribou (*Rangifer tarandus dawsoni*), died out in the 1930s and was declared extinct in 1984.

Figure 2: Caribou antlers

Signs and sounds

Caribou are usually quiet, but they may give a loud snort. Herds of snorting caribou may sound like pigs. Especially vocal are the bands of cows and new-born calves, constantly communicating with each other.

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Habitat and habits

There are more than 2.4 million caribou in Canada. Some dwell in forests, some in mountains, some migrate each year between the sparse forests and tundra the far north, and others remain on the tundra all year.

The woodland caribou is the largest and darkest of the caribou subspecies. It is found throughout much of the boreal, or northern, forests from British Columbia and the Yukon Territory to Newfoundland and Labrador. In mountainous areas of western Canada, woodland caribou make seasonal movements from winter range on forested mountainsides to summer range on high, alpine tundra. Farther east, in the more level areas of boreal forest, many woodland caribou occupy mature forest and open bogs and fens, or low-lying wet areas. Some may move only a few kilometres seasonally, while others may wander extensively. A few herds differ from this pattern, making long seasonal movements between forested and tundra habitats. The Leaf River and George River herds in Quebec and Labrador are the largest of these herds. They are also among the biggest caribou herds in North America, at about 600 000 and 400 000 individuals respectively.

Peary caribou

Photo: B.T. Aniskowicz-Fowler

Peary caribou are small, light-coloured caribou found only in the islands of the Canadian arctic archipelago, where they number about 10 000. Peary caribou do not normally have significant migrations, although many move among islands, especially if hard icing conditions force them from their normal ranges.

Barren-ground caribou
Photo: Canadian Wildlife Service

About half of all caribou in Canada are barren-ground caribou. They are somewhat smaller and lighter coloured than woodland caribou. They spend much or all of the year on the tundra from Alaska to Baffin Island. Most, or about 1.2 million, of the barren-ground caribou in Canada live in eight large migratory herds, which migrate seasonally from the tundra to the taiga, sparsely treed coniferous forests south of the tundra. In order, from Alaska to Hudson Bay, these are the Porcupine herd, Cape Bathurst herd, Bluenose West herd, Bluenose East herd, Bathurst herd, Ahiak herd, Beverly herd, and Qamanirjuaq herd. About 120 000 other barren-ground caribou live in smaller herds that spend the entire year on the tundra. Half of these are confined to Baffin Island.

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Range

Distribution of caribou

In Canada, caribou are found from the United States–Canada boundary to northern Ellesmere Island, more than 4 000 km north, and from British Columbia and the Yukon Territory in the west to the island of Newfoundland in the east. The southern limit of caribou distribution has receded northward since European settlement and this recession continues today.

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Feeding

Ground and tree lichens are the primary winter food of caribou, providing a highly digestible and energy-rich food source. The ability of caribou to use lichens a primary winter food distinguishes them from all other large mammals and has enabled them to survive on harsh northern rangeland. Caribou use their excellent sense of smell to locate lichens under the snow, and they dig the lichens out with their wide hooves. In southern coniferous forests they are also able to forage tree lichens.

Although lichens are a good source of energy, they are not a good source of protein (nitrogen). As soon as spring snow melts, caribou are eager to switch to fre green vegetation, which is rich in nitrogen. Cows that have just given birth are especially in need of protein to replenish their protein reserves and produce high quality milk for their calves. At this time of year caribou focus on sedges and newly unfurling leaves of willow and other shrubs. Flowers, plentiful on the tundra, also attract a lot of attention. As summer progresses and the quality of the green vegetation declines, caribou once again turn to lichens, to fatten themselves u for the breeding season. Although not always available, mushrooms are highly sought after in August and September. Mushrooms provide a rich nitrogen sourc late in the summer.

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Breeding

Although all caribou move about for different functions over the course of a year, barren-ground caribou make the most dramatic treks. They are the most efficie walkers of all ungulates in North America, and they are good navigators, unerringly walking hundreds of kilometres from the taiga to their relatively small calving areas on the tundra in spring. They tend to follow frozen lakes and rivers, open snow-free uplands, and eskers, or long narrow hills of soil and rock dumped by glaciers. Caribou are able to keep a steady direction across frozen lakes so large that the opposite shore cannot be seen.

Pregnant barren-ground caribou cows lead the spring migration, followed by juveniles, bulls, and non-pregnant cows, which tend to lag farther and farther behir Barren-ground caribou cows head toward traditional calving grounds, where they gather to calve year after year, even from different wintering areas.

In contrast, to avoid predation smaller woodland herds generally calve in isolation either in rugged terrain or on islands in small lakes.

Caribou cows are usually at least three years old before they can bear young, though 10 to 25 percent of two-year-old cows can also give birth. Cows produce c calf a year, and about 90 percent of adult cows give birth annually. Most of the calves are born during a 10-day period in May or early June. Calving time tends be later the further east in North America the caribou are found.

The calves are well developed at birth and are able to travel within a few hours. They start to graze during their first weeks, but until they are about three weeks old, they can digest only milk. The cows and calves soon move to areas where fresh-growing feed is becoming abundant.

During summer barren-ground caribou are often harassed by hordes of mosquitoes, warble flies, caribou nostril flies and, in some areas, black flies. Sometimes the agitated animals will run for many kilometres, stopping to rest only when exhausted or when high winds temporarily disperse the insects. Running from inse places great energy demands on the caribou and may slow their rate of growth by temporarily reducing their search for food. In large herds, another strategy to reduce harassment of individual animals is to form large gatherings of caribou. These tight groups can number in the tens of thousands.

By late September the herds, fat and in good condition, arrive in pre-rutting (pre-mating) areas. The rut occurs from mid-September to early November dependi on the region. Bulls spar a great deal and sometimes fight for possession of cows. Normally, during the rut, cows will wean their calves, encouraging them to ea food other than their mothers' milk. If the calf is too small, the cow will continue to supply milk into the winter, but this reduces her chances of getting pregnant t autumn.

In the deer family, antler size means dominance. By late winter when conditions are most severe, pregnant females are the dominant members of the herd, because they are the only ones to have retained their antlers. The large bulls lose their antlers after the autumn mating season, and the non-breeders lose thei soon after that. The females' dominance allows them to defend their feeding craters from larger caribou and even displace larger caribou from favoured sites. T is important when conditions are harsh, as the pregnant cows need energy to develop the fetus. Most pregnant females will keep their antlers until after they giv birth in June.

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Conservation

Population status

Despite the large number of caribou in Canada, some subspecies or populations have been determined to be at risk by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC).

Dawson's or the Queen Charlotte Islands population of woodland caribou, found only on Graham Island, British Columbia, has been designated extinct. Little is known of this greyish-coloured subspecies or of the causes of its extinction, but while deterioration of habitat due to climate change may have been a factor, a more important cause was likely overhunting.

Woodland caribou became extirpated from (no longer exist in) Prince Edward Island before 1873 and from New Brunswick and Nova Scotia by the 1920s. Toda only a small, relic herd on the Gaspé Peninsula remains of the maritime woodland caribou population south and east of the St. Lawrence River. This Atlantic-Gaspésie population has been assessed as endangered by COSEWIC and is listed under the federal Species at Risk Act (SARA). A species is considered endangered when it is facing imminent disappearance from Canada or extinction.

The widespread Boreal population of woodland caribou, which occurs in the Northwest Territories, British Columbia, Alberta, Saskatchewan, Manitoba, Ontario Quebec, and Newfoundland and Labrador, has been assessed as threatened by COSEWIC and is listed under SARA. The Southern Mountain population of woodland caribou, which occurs in British Columbia and Alberta, has also been assessed and listed as threatened. A threatened species is one that is likely to become endangered if nothing is done to reverse the factors limiting its survival in Canada.

COSEWIC has assessed the Northern Mountain population of woodland caribou, which occurs in the Yukon Territory, the Northwest Territories, and British Columbia, as being of special concern. It is also listed under SARA. A species of special concern is one that may become threatened or endangered because c combination of biological characteristics and identified threats.

The Peary caribou has been assessed as endangered by COSEWIC. Consultations are underway to determine if Peary caribou should be listed under SARA. Numbers have declined by about 72 percent in the last 60 years, mostly because of severe icing episodes due to changing weather conditions, where ice has covered vegetation and led to caribou starvation.

One population of barren-ground caribou, the Dolphin and Union population in Nunavut, has also been assessed as a species of special concern by COSEWIC and consultations are taking place to determine whether it should be listed under SARA. These caribou migrate between the mainland and Victoria Island; clima change and increased shipping may make this ice crossing more dangerous.

Recovery measures

There are national recovery teams, draft recovery plans, and coordinated recovery actions underway for the Peary caribou and the four populations of woodlan caribou that are at risk: Atlantic-Gaspésie, Boreal, Southern Mountain, and Northern Mountain. Since the range of the Boreal population is so extensive, there a also regional recovery teams in place in each of the eight provinces and territories that have responsibility for “boreal caribou.”

Caribou are susceptible to and recover slowly from population declines because of their low rate of reproduction. The main factors leading to caribou declines a habitat loss, degradation, and fragmentation, as well as predation. Loss of caribou habitat, which is permanent, occurs when forest is cleared for agriculture, fo example. Habitat degradation means a reduction in the amount or quality of caribou habitat, as happens following such events as wildfires or timber harvesting through human disturbance. Habitat fragmentation is the breaking up of habitat areas by roads, timber harvest cut-blocks, pipelines, oil and gas well sites, geophysical exploration lines, and other developments.

Caribou in the boreal forest require large tracts of relatively undisturbed, older forest habitat in order to spread out so they are harder for predators and hunters find, and to avoid the linear corridors that predators and hunters use to gain easier access to their prey. Older forests tend to be richer than younger forests in t lichens caribou depend on. They are also less favoured by moose and deer, which as prey species of the wolf, attract this primary predator of caribou.

A wolf eats a variety of prey but requires food equivalent to 11 to 14 caribou a year. Some wolf packs will follow migrating herds of caribou from summer to wint range and back. Other predators of caribou include grizzly and black bears, cougars, wolverines, lynx, coyotes, and golden eagles.

Partly as a result of habitat changes caused by humans, white-tailed deer have expanded into caribou areas from Manitoba to Quebec, transmitting meningeal brain worm, which is fatal to caribou, although it does not harm the deer. Insects such as warble flies, mosquitoes, and black flies also transmit disease to carib and internal parasites affect their health and condition.

Recently there has also been a lot of concern about the potential impact of climate change on caribou, especially in the north. Deeper snow, faster spring melt, warmer summers, freezing rain, and the high annual variability of all these factors will have an impact on the ability of the species to thrive in its environment.

Cultural and economic importance of caribou

Humans have a long association with caribou. Archaeological work in the Yukon Territory suggests humans have been hunting caribou for more than 13 000 years. Many Aboriginal peoples and Inuit based their culture on the caribou, and could not have survived in the north without them. Some tribes were nomadic, following the herds year-round; others lived on caribou for part of the year. Caribou provided food, clothing, and shelter: bones were made into needles and utensils, antlers into tools, and the sinew into thread; the fat provided fuel and light; the skin was made into light, warm clothing and tent material; and the flesh people and dogs. Wisely used, caribou will continue to be an important social and economic resource in the North.

Wildlife tourism is important in many parts of Canada occupied by caribou. Recreational hunting of forest-dwelling woodland caribou is of economic importance the Yukon Territory, northern British Columbia, and Newfoundland and Labrador. In the north, vast herds of migrating caribou present a wildlife spectacle unequalled on this continent and, as an attraction to naturalists, photographers, and licensed hunters, could contribute to a tourist industry.

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Online resources

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Chipmunk

This animal

- uses its front paws and sharp teeth to prepare food for storage
- starts to emerge from hibernation during the first warm days of March, sometimes burrowing up through a metre of snow
- does not open its eyes until 31 to 33 days of age
- charms campers and hikers by its boldness and its constant busyness

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Description

Chipmunks *Tamias* are easily recognized by the light and dark stripes on the back and head. They can be confused with some of the striped ground squirrels, but chipmunks are smaller, and have facial markings and five dark stripes on their backs, including a distinct, central line that extends forward onto the head. Ground squirrels do not have markings on the head.

The eastern chipmunk is a colourful and attractive rodent with bright russet on its hips, rump, and tail; black, grey, and white stripes on its back; brown, grey, and buff on its head; white underparts; and brown feet. The western chipmunk species are arrayed in shades of grey, brown, reddish, white, and buff and share a distinctive pattern of black, pale grey, and buff stripes, although in the Townsend's chipmunk the colour contrasts of the stripes are masked by a warm brown overall wash. The red-tailed chipmunk is the most brightly coloured of the western species.

The eastern chipmunk is large (up to 125 g) with a relatively short tail (about one-third of the total length from its nose to the tip of its tail), whereas western chipmunks are smaller (about 55 g) with a relatively longer tail (nearly half the total length from its nose to the tip of its tail). The eastern chipmunk is between 20 and 30 cm long, and western species are 16 to 28 cm long.

Signs and sounds

Chipmunks are quite vocal. People walking in the woods do not always realize that they are hearing chipmunks, for some of the cries that chipmunks make are like bird chirps.

Biologists have not yet determined the meaning of all the chipmunk's many calls. For example, when a chipmunk is startled, it runs quickly along the ground giving a rapid series of loud chips and squeaks. Perhaps this sudden burst of noise startles predators, helping the chipmunk to escape. Also, chipmunks frequently call with a high-pitched chip or chuck repeated over and over at intervals of one or two seconds. This scolding noise is often made by a chipmunk watching an intruder from a safe vantage point. Some scientists think that it may also be the mating call of the female chipmunk.

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Habitat and habits

All species of chipmunks in Canada live in forested areas. Most of them live in burrows and gather food on the ground, generally in areas where there are enough rocks, bushes, fallen logs, and piles of brush to shelter them from predators as they scamper about. Immature forests and the edges of forests near clearings, streams, ravines, and logging roads provide ample cover. Stands of tall, mature trees with no plants on the shady forest floor are unsuitable.

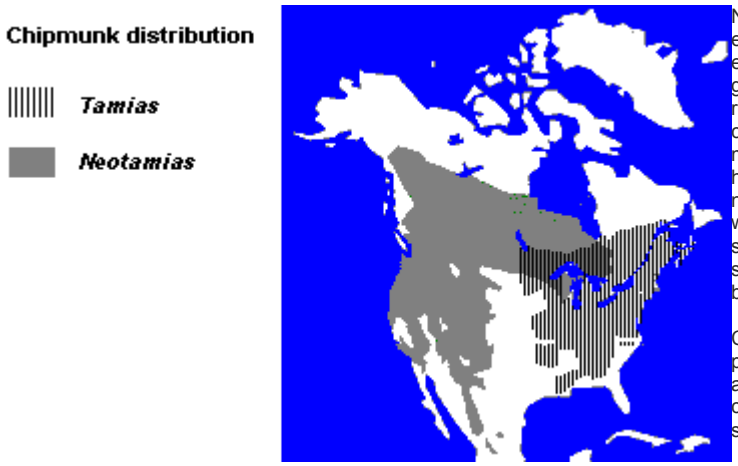
Chipmunks are fun to watch. They charm campers and hikers by their small size, their boldness in search of food, and their constant busyness. They are not hard to approach or photograph. An encounter with a chipmunk often provides a child with a captivating first experience of a wild mammal in its natural setting.

Surprisingly, in animals so quick to befriend curious children and delight all ages, chipmunks are solitary animals. Each chipmunk has its own burrow and ignores its fellows except when conflicts arise or during mating or when females care for their young.

Nevertheless, chipmunks are not territorial in the conventional sense. They use home ranges that overlap broadly (sometimes completely) and trespass repeatedly near each other's burrows. Home ranges vary from 0.04 to 1.26 ha; usually those of adults are larger than those of juveniles and those of males larger than those of females. Boundaries change continually to include seasonally available food sources, but most animals probably maintain approximately the same home range from season to season.

Chipmunks spend most of their time in the part of their home range that includes their burrow, which is called their dominance area. Between these smaller areas there is no overlap. Within them the resident chipmunk is dominant and trespassers avoid interactions with the rightful owner, fleeing immediately if an encounter occurs. The boundaries of dominance areas are more stable than those of home ranges.

Most chipmunks construct tunnels and chambers in the ground. Entrances are well hidden under rocks or tangled bushes. Less typical are those western species that spend a fair amount of their time in trees and sometimes even nest in tree cavities.



Naturalists have dug up only a few burrows, all excavated by eastern chipmunks. Most of these consisted of a single entrance leading to an unbranched tunnel that sloped gradually down to a depth of 45 to 85 cm and ended in a rounded nest chamber, about 15 cm in diameter. In this chamber, the chipmunk had built a nest using insulating materials such as grasses, shredded leaves, or the fluffy seed heads of certain plants. Seeds and nuts stored beneath the nest provided a handy food supply for the coldest part of the winter. In a few cases, biologists unearthed complex burrow systems up to 4 m long with tunnels that branched and led to side tunnels and accessory chambers. In neither type of burrow was evidence of a latrine, or toilet area, found.

Chipmunks are known to be hibernators, even in the southern parts of their range. Near the end of July, they begin to collect and store large quantities of seeds. By October, each chipmunk has accumulated enough seeds to enable it to survive the winter.

With the onset of winter in November, chipmunks disappear below ground. At present, it is not known exactly what happens when chipmunks retire to their burrows for the winter. One view is that they immediately go into a torpid state. (In this state, the body temperature, rate of breathing, and rate of heartbeat drop to very low levels, reducing the amount of energy required to maintain the chipmunk.) Periods of torpor last from one to eight days, and perhaps longer. Between periods of torpor, chipmunks wake up and consume part of their food supply. They have occasionally been seen above ground on warm winter days. A second view is that chipmunks do not actually hibernate until their food supply has been exhausted.

With the first warm days of March, chipmunks begin to emerge, sometimes burrowing up through a metre of snow.

Unique characteristics

In Canada, in most years, chipmunks have only one breeding season and one litter, but in favourable years a small percentage of adult eastern chipmunks produces a second litter in the fall. In the southern United States, the production of two litters per year by both eastern and western chipmunks is not uncommon.

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Range

No species of chipmunk is found north of the treeline in Canada, in the prairie grasslands of North America, in the hot subtropical forests of Florida, or in areas with waterlogged soils. With those exceptions, chipmunks thrive throughout Canada and the United States. Some species of chipmunks even occur above the timber line on mountains and in the semidesert regions of the western United States. Their range extends south into Mexico along the mountains.

Twenty-one chipmunk species occur in North America, including one in eastern Canada and four in western Canada. All these species

belong to the genus Tamias, which is divided into two main groups. The first subgenus, also called Tamias, contains the eastern chipmunk *T. striatus,* found in eastern Canada and the eastern United States. (It also contains the only species of chipmunk from outside North America, *T. sibericus* of China.) The other subgenus, Neotamias, contains 20 species, all of which are native to western North America. Four Neotamias species are found in western Canada. The least chipmunk *T. minimus* is the most common and has the largest range, followed by the yellow-pine chipmunk *T. amoenus* and the red-tailed chipmunk *T. ruficaudus*; the Townsend's chipmunk *T. townsendii* is found in Canada only in the extreme southwestern corner of British Columbia.

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Feeding

A chipmunk spends much of its day collecting and storing seeds, which are its most important source of food. Although most species of chipmunks usually forage on the ground, they all easily climb trees and shrubs to harvest nuts and fruit.

When preparing food for storage, the chipmunk holds fruit and seeds in its dexterous front paws, and with specialized incisors, or sharp cutting teeth, which are especially long and directed forward, it removes seeds from pods. Then it uses its tongue to shift the seeds backwards and stuff them between its teeth and the extensible skin in the cheek area, where they are held while the animal collects more food. The capacity of these cheek pouches increases with maturity. When the cheek pouches become full, the chipmunk deposits the seeds in its nest or buries them in shallow holes that it digs in the ground and then covers with earth, leaves, and other litter.

In spring, chipmunks diligently search the ground for any seeds that remain from the previous summer. As these are usually scarce, the small rodents eat young leaves and shoots until new fruit and seeds become available. Throughout the spring, summer, and autumn, the chipmunk's diet is supplemented with insects, earthworms, flowers, berries, cherry and plum pits, mushrooms, and occasionally eggs or flesh of dead animals. Rare instances of chipmunks preying on birds or small mammals have been observed.

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Breeding

Male chipmunks are the first to emerge in the spring, as soon as patches of bare ground begin to appear through the snow. The females emerge one or two weeks later. Soon after, mating takes place near the female's burrow. Several males may compete for a female, and a male may mate with more than one female during one breeding season. In Canada, the main breeding season is from mid-April to mid-May.

The gestation, or pregnancy, period is about 30 days. When it is over, the female chipmunks rear their litters—usually four to six young—without any help from males. In Canada, in most years, chipmunks have only one breeding season and one litter, but in favourable years a small percentage of adult eastern chipmunks produces a second litter in the fall. In the southern United States, the production of two litters per year by both eastern and western chipmunks is not uncommon.

Young chipmunks are born naked and blind and weigh about 3 g at birth, with some variation by species.In the eastern chipmunk, hair does not become visible to the unaided eye until about 10 days of age, the ears are closed until around the 28th day, and the eyes open at 31 to 33 days of age.

When they are four to seven weeks old, the young chipmunks begin to leave the burrow to forage. At first they are unafraid, but after a few days above ground they are more wary and escape quickly if disturbed. The young grow rapidly during the late summer and reach adult size before the end of September. Most breed in their first spring, but some may wait until their second year.

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Conservation

Chipmunk numbers usually do not vary much from year to year, but local declines and disappearances have been recorded. These declines have never been satisfactorily explained.

Chipmunks must practise constant vigilance to avoid their many predators, including hawks, weasels, coyotes, martens, foxes, and snakes. Occasionally they are hunted by owls, but such incidents are rare as chipmunks are only active by day. Despite these many enemies, there are not enough of these tiny rodents for any predator to depend on a steady diet of chipmunk. It makes more sense for a predator to specialize in mice, which are more abundant and more easily caught. In inhabited areas, chipmunks also fall prey to cats and dogs, and a fair number are killed by automobiles.

Chipmunks can be seriously wounded when they compete among themselves or with large animals, such as red squirrels, for food and space. In addition, some may die as a result of wounds received in fights during the breeding season. Males fight among themselves when competing for females, and females have been observed defending their nests and young against other chipmunks.

Disease and food shortage may also limit chipmunk populations but, once again, little is known about these factors. Seed crop failures are likely to have a significant detrimental effect on chipmunks, which depend on stored food to survive the winter. Disease epidemics have not been reported from chipmunks but are known to occur in populations of mice and other rodents. Parasites, such as botfly larvae, tapeworms, fleas, mites, and probably lice, can have a debilitating effect and, on rare occasions, even cause death.

Chipmunks are important in the dispersal of seeds because of their habit of storing the seeds beneath the layer of decaying vegetation on

the forest floor. Any buried seeds that are not consumed stand a better chance of germinating than those remaining on the surface litter. In this way, chipmunks assist in the spread of shrubs, trees, and other plants.

If chipmunks are very abundant, they can prevent normal reforestation of some trees, especially pines, by eating their seeds. Occasionally chipmunks and other rodents are trapped to ensure adequate germination and growth of seedlings. Poisoning is not an acceptable means of control because of the harmful effects on other wildlife, including gamebirds and songbirds.

Much of the value of chipmunks lies in the pleasure they provide for campers, hikers, and anyone who enjoys the country. Our national and provincial parks and our summer cottages and trailers would be less interesting and less enjoyable without chipmunks dashing across forest trails or boldly helping themselves to food in campgrounds and picnic areas.

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Coyote

This animal

- has such well-developed senses of hearing and smell that a sudden odour or noise can make it change its course in mid-step
- has very strong-smelling urine, which it uses to mark its territory
- is a remarkably hard runner, capable of reaching 64 km per hour
- adjusts its hunting methods to the prey size and food sources available

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Description

The coyote *Canis latrans* is one of the seven representatives of the Canidae family found in Canada. Other members of the family are the wolf, red fox, arctic fox, grey fox, swift fox, and dog.

Slimmer and smaller than the wolf, the male coyote weighs from 9 to 23 kg, has an overall length of 120 to 150 cm (including a 30- to 40-cm tail), and stands 58 to 66 cm high at the shoulder. The female is usually four-fifths as large.

The coyote's ears are wide, pointed, and erect. It has a tapering muzzle and a black nose. Unlike most dogs, the top of the muzzle on coyotes forms an almost continuous line with the forehead. The yellow, slightly slanting eyes, with their black round pupils, give the coyote a characteristic expression of cunning. The canine, or pointed, teeth are remarkably long and can inflict serious wounds. The neck is well furred and looks oversized for the body. The long tongue often hangs down between the teeth; the coyote regulates its body temperature by panting.

The paw, more elongated than that of a dog of the same size, has four toes with nonretractable claws. The forepaws show a rudimentary thumb, reduced to a claw, located high on the inner side. The claws are not used in attack or defence; they are typically blunted from constant contact with the ground and do not leave deep marks.

The fur is generally a tawny grey, darker on the hind part of the back where the black-tipped hair becomes wavy. Legs, paws, muzzle, and the back of the ears are more yellowish in colour; the throat, belly, and the insides of the ears are whiter. The tail, darker on top and lighter on the underside, is lightly fawn-coloured towards the tip, which is black.

The coyote's fur is long and soft and well suited to protect it from the cold. Because it is light-coloured in winter and dark in summer, it blends well with the seasonal surroundings.

Like all Canidae, the coyote has, at the root of the tail, a gland that releases a scent. Such glands also exist on other parts of the body. Scent glands often become more active when the animals meet. The coyote's urine has a very strong smell and is used to mark out its territory. Trappers use the secretions when they set traps to attract the coyote.

Signs and sounds

Like the wolf, the coyote's best-known trait is its yelping and howling cry, a sequence of high-pitched, ear-piercing bayings. The coyote can also bark, growl, wail, and squeal. Although often silent in daytime, it may make itself heard at any time from sunset to sunrise, and especially at dusk and dawn.

If several coyotes are in the same vicinity, the howling of one triggers that of the others, resulting in an impressive concert. Two coyotes howling in unison can create the illusion of a dozen or more. The coyote can also sound farther away than it is.

Scientists are intrigued by the coyote's howling, which seems to be a means of communication. The cry invariably brings a reply, then a sort of commentary followed by another prolonged cry, and finally a volley of raucous yelpings. Is it a cry for food, for a mate, or a proclamation of its territorial claims? Is it just an expression of joy at being alive or of sociability? The coyote is fond of playing with other coyotes, even with its prey before devouring it.

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Habitat and habits

European settlers found the coyote on the plains, prairies, and deserts of central and western North America. It appeared to prefer open or semi-wooded habitats. However, about the turn of the twentieth century, the coyote began a dramatic range expansion that is still in progress.

The reasons for the coyote's expansion are not fully understood but probably include several conditions created by people: the clearing of forests, provision of carrion, or dead animal flesh, from domestic livestock, and the removal of the wolf. The mosaic of grassy fields, brush, and woodlots created by farming areas that were once covered with unbroken forest has provided attractive habitat for the coyote, as well as several other species like the red fox and raccoon.

The coyote has learned to scavenge the carcasses of domestic livestock, much as it still scavenges the carrion left by wolves, where the two species occur together. The removal of the wolf in some areas has meant more to coyotes than the absence of a feared predator. It has meant less competition for many prey animals. For example, in winter, when snow conditions are right, coyotes can kill large ungulates, or

hoofed mammals, such as deer, that multiply in the absence of wolves. Also, in hard winters, when these swollen deer populations run out of food, the deer die of starvation, and the resident coyotes enjoy a food bonanza.

The coyote is one of North America's most controversial animals. It is intelligent and playful, like many domestic dogs, but it is also a predator with a reputation for killing small farm animals.

The name *coyote* is a Spanish alteration of the original Aztec name *coyotl*. The Latin name *Canis latrans*, meaning barking dog, was given to it by Thomas Say, who published a description of the species in 1833. Since 1967, its official name in Canada, in both English and French, has been coyote. In some parts of Canada coyotes are called "brush wolves." Wolves are much larger and characteristically hunt in packs.

Unique characteristics

The coyote's senses of hearing and smell are so well developed that a sudden odour or noise can make it change its course in mid-step. Its agility in this respect is incredible, perhaps unique in the animal kingdom.

The coyote is a remarkably hard runner, galloping along at 40 km per hour, but capable of reaching 64 km per hour. Greyhounds, well known for their speed in running, can catch up with coyotes, but may require quite a long time to do so. If the need arises, the coyote can swim well.

Swift, tough, and wily, the coyote is the best challenge a hunter could wish for. It has only two known weaknesses: it sleeps heavily and looks back while fleeing. It sleeps deeply enough to be approached closely, but the problem is to do so noiselessly because the coyote often beds down in thickets. It also becomes an easy target when it turns while fleeing to look back; it will stop just moments after being shot at to measure its headway over its pursuer. If the hunter is ready, this glance may be the animal's last.

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Range

Smaller than a wolf, and more adaptable, the coyote is one of the few mammals whose range is increasing, despite extensive persecution by people.
In Canada, the coyote still inhabits its traditional habitats, the aspen parkland and short- and mixed-grass prairie in the three prairie provinces. However, it has spread north into the boreal forest, west into the mountains, and east into Ontario, Quebec, and the Atlantic provinces. The progress of this dramatic "invasion" has been carefully charted; for example, coyotes established themselves in Ontario about the turn of the century, in Quebec in the 1940s, and in New Brunswick and Nova Scotia in the 1970s. Most astonishing of all, coyotes have recently been discovered in western Newfoundland, apparently having crossed on the ice from Nova Scotia.

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Feeding

Although primarily a flesh-eater, the coyote will eat just about anything available. Rabbits and hares are typically dietary staples, as are small rodents. Blueberries and other wild fruits are commonly eaten, in quantity, in summer and fall. Coyotes also eat insects, such as grasshoppers, when they become available. Where coyotes and wolves live near each other, coyotes scavenge from wolf kills. Carrion, flesh of dead animals, from livestock and other sources is important too, especially in winter. Coyotes commonly prey on deer fawns in spring and summer; however, they may also prey on adult-sized deer and other large hoofed mammals during certain snow conditions in winter. Coyotes prey on domestic sheep when they are available, and may take beef calves and domestic poultry, too.

Coyotes have flexible social behaviour and adjust their hunting methods to the prey size and food sources available. Coyotes often hunt small prey animals singly, whereas they hunt large prey and defend large carcasses in groups.

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Breeding

Coyotes appear to be monogamous, and couples may remain together for several years. Both sexes can breed at one year of age under good conditions, although both sexes usually breed somewhat later in life. During the mating season, males solicit the females' favours. The mating takes place mainly during February and March; gestation, or pregnancy, lasts from 60 to 63 days.

The coyote uses a den for the birth and early care of its cubs. It may be located at the base of a hollow tree or in a hole between rocks, but usually consists of a burrow in the soil. The coyote prefers to den on the banks of a stream or the slopes of a gorge and usually chooses a concealed spot. It often enlarges an abandoned marmot or badger burrow. The female may prepare alternative lodgings to enable her family to move to another refuge should trouble occur. Earth, pushed toward the entrance, is piled up onto a fan-shaped heap, which the animal skirts when going in or out. The same shelter may be used for several years.

Before the female gives birth, or "whelps," the den is thoroughly cleaned. On average, she bears three to seven pups, covered with fine brown fur, whose eyes remain closed for the first eight or nine days.

The male prowls around and brings food to the entrance as long as the pups do not venture from the den. The adults remove waste as it accumulates. Weaning, or making the transition from the mother's milk to other food, begins about one month after birth. The adults then feed the pups by regurgitating, or bringing up, half-digested food.

At about three weeks of age, the pups begin to romp around under the adults' watchful supervision, first inside the shelter, then outside. If some enemy comes too close, the adult utters a special warning bark, then lures the enemy away.

Later, the adults teach the pups how to hunt. When fall comes, the young coyotes may leave their parents to claim their own territory. If there is an abundant food supply, pups may stay with the adults to form packs, or clans.

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Conservation

Chief among the coyote's numerous foes are people. In some areas, 90 percent of the deaths of coyotes older than five months are caused by people, whether purposefully with guns, poison, and traps, or accidentally with vehicles and farm machinery. Wolves, black bears, mountain lions, and eagles all prey on the coyote. A lynx can kill a coyote but will not attempt to do so unless the odds are in its favour.

Parasites and diseases can sometimes lead to death. Common are outbreaks of sarcoptic mange, an infestation by microscopic mites that causes thickening of the skin, loss of hair, and itching. Heartworm and hookworm are other common parasites of coyotes. Coyotes may also suffer from diseases such as distemper, canine hepatitis, rabies, and parvo virus.

From the time of European settlement, the coyote has been persecuted, because people have blamed it for preying on livestock. It is amazing that the coyote has thrived despite the organized attempts that were made to eradicate it in the first half of the twentieth century. Many governments offered bounties and funded extensive coyote control programs. Farmers often poisoned the carcasses of dead livestock with strychnine and left them in the back pasture for the "brush wolves" to find. A variety of devices and traps were also used to kill coyotes.

Although there are circumstances where predation by coyotes is still a serious problem for livestock producers, most people today realize that the coyote is not the worthless menace that it was once thought to be. The use of poison is now controlled by law. Bounties, or rewards, generally shown to be ineffective, are rare. Predator control is aimed at specific local problems. However, much of the research done on the coyote is still aimed at reducing predation on sheep. Also, respect for coyotes is required in urban areas, where they are increasingly at home. There are recent cases where these wild canines have attacked humans; children have been seriously injured.

Although it sometimes causes problems, the coyote has its rightful place in the animal kingdom. More and more people, including farmers, appreciate its value as a scavenger and a predator of rodents. The coyote's economic importance and its role in nature should be considered in any evaluation of the animal. In areas occupied by people and their domestic animals, local control should be sought rather than a ban on the species as a whole.

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Eastern Grey Squirrel

This animal

- commonly occurs in two colour phases, grey and black
- can lose its tail sheath and some bones to escape a predator's grasp if necessary
- can reach speeds of up to 25 km per hour on the ground
- leaves tracks in the snow that often look like two exclamation marks (!!)

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Description

Eastern grey squirrels *Sciurus carolinensis* commonly occur in two colour phases, grey and black, which leads people to think—mistakenly—that there are two different species. Black is often the dominant colour in Ontario and Quebec, toward the northern limits of the species' range. Farther south the black phase is less common and is not found at all in the southern United States. This may indicate that the gene responsible for black coloration has some cold-weather adaptation associated with it. Albino eastern grey squirrels also occur and in the United States a few small, completely white populations are found. There are rare instances of a reddish colour phase and some animals may also have a combination of colours, for example a black body with a red tail. These individuals should not be confused with the American red squirrel *Tamiasciurus hudsonicus*, which is common to Canada's northern forests, nor with Douglas's squirrel *T. douglasii*, found in British Columbia. Both of these are smaller animals with a rusty red colour on the body, head, and tail.

The squirrel's fur is thicker and longer in winter. The fur colour is grey or black and may change with the seasons. The grey fur is a grizzled salt-and-pepper combination produced by lead-grey underfur, overlain by banded grey and black guard hairs tipped with white. Black individuals are generally a glossy uniform black all over, but the species may show all shades of gradation between black and grey. A litter may contain both black and grey individuals.

The most notable physical feature of the eastern grey squirrel is its large bushy tail. Indeed, the Latin word for squirrel, *sciurus,* is derived from two Greek words, *skia,* meaning shadow, and *oura,* meaning tail. Combining the two means loosely that the squirrel is one that sits in the shadow of its own tail. Many of the common names given to the eastern grey squirrel, such as Bannertail and Silvertail, call attention to this prominent feature.

The tail has many important functions. It acts as a rudder when the animal jumps from high places, as a warm covering during the winter, as a signal to other eastern grey squirrels indicating an individual's mood, and perhaps as a sunshade. Finally, the tail can be used to distract a pursuing predator.

Signs and sounds

There are typical signs that eastern grey squirrels inhabit an area. The gnawed husks and shells of nuts, especially acorns, hickory nuts, walnuts, beechnuts, and pecans, can be found littering the ground around the base of a tree where the squirrels have been feeding. In winter small holes in the snow or ground indicate where squirrels have been digging to find hidden stores of nuts buried earlier in the year.

The tracks of eastern grey squirrels are distinctive: forefeet leave a round print about 2.5 cm long; the hindprints are more triangular, approximately 6 cm long. When the squirrel bounds across the ground the tracks are paired, hindprints slightly ahead of the foreprints. In the snow these tracks often look like two exclamation marks (!!). This bounding stride may be as much as 1 m if the animal is in a hurry.

The eastern grey squirrel's alarm call is a series of rapid clicking sounds—*kuk, kuk, kuk*—which warns all other nearby squirrels of danger. Sometimes several squirrels join together to taunt a predator with a chorus of scolding accompanied by agitated twitches of the tail. In an aggressive encounter between two squirrels, tooth chattering is often heard. A more commonly heard vocalization is a rasping whisk accentuated by a flick of the tail.

A noticeable sign of the presence of the grey squirrel is the large leaf nest, or drey.

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Habitat and habits

The eastern grey squirrel is the largest tree squirrel found in eastern Canada. It is predominantly a nut-eating species and its historic range coincided with the vast tracts of hardwood forests in eastern North America, in particular with oak and hickory trees. The squirrels have been introduced into city parks in western Canada. There is a thriving population in Vancouver's Stanley Park, introduced in 1914, and more

recently animals have been released into parks in Victoria and Calgary.

Eastern grey squirrels have also been introduced into Great Britain and South Africa. Because the western grey squirrel Sciurus griseus does not occur in Canada, the eastern grey squirrel is referred to by most Canadians simply as the grey squirrel.

The eastern grey squirrel spends most of its life in trees, where it moves about with great agility. When it comes to the ground to feed or store food in hiding places to eat later, it also has great mobility and can reach speeds of up to 25 km per hour. In climbing or descending a tree trunk it moves head first, and when danger threatens it sidles inconspicuously around the trunk of the tree, keeping just out of sight of the predator. Another protective device is to remain motionless against the bark, which makes the animal difficult to see.

This species is mostly active during daylight, although it can sometimes be seen feeding by the light of a full moon. In summer, activity is greatest early in the morning and in mid-afternoon. Eastern grey squirrels do not hibernate and in winter are most active around midday, perhaps to take advantage of the warmest temperatures.

The eastern grey squirrel is a tolerant species and exhibits little aggressive behaviour. The dominance hierarchy in both females and males is maintained by a bluffing show of force or chasing rather than by actual fighting. Each animal has a home range where it does most of its foraging for food, makes its nest, and rears its young. The home ranges of males are larger than those of females. There is little territorial behaviour and many home ranges may overlap. Individual squirrels are often seen feeding close to each other without any aggressive activity, and in winter several animals may share the same tree den.

Unique characteristics

If necessary, a squirrel can lose its tail sheath and some vertebrae, or bones in its back, to escape a predator's grasp. It is not uncommon to see an eastern grey squirrel with only a partial tail.

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Range

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Feeding

The eastern grey squirrel is an opportunist when it comes to finding food and can therefore live in a wide variety of habitats. Its diet varies with the seasons, depending on what is available at the time. In early spring the buds of several types of hardwood trees, in particular the maple, are its staple diet. During the summer, the winged seeds of maple (samaras) and elm seeds are the major items in the diet, together with a wide variety of berries and other wild fruits, seeds, nuts, and apples. In the autumn hard nuts, including acorns, hickory nuts, butternuts, walnuts, beechnuts, and pine seeds, are their most important foods. The squirrels become industrious hoarders at this time of year, burying hundreds of nuts and seeds for the winter, when other foods are relatively scarce. If a nut crop fails, the following winter can be a very difficult time for the squirrel.

Contrary to popular myth, squirrels do not find buried nuts by memory but by their highly developed sense of smell. Not all hidden nuts will be found though; some will germinate and grow into new trees. The eastern grey squirrel often takes advantage of bird feeders as a food source in the winter. Squirrels also eat insects, caterpillars, and an occasional nest of birds' eggs or young birds. Individuals consume 400 to 900 g of food a week.

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Breeding

The eastern grey squirrel has two breeding seasons each year, the first in January and February and the second in June and July. Each of the mating periods lasts for about three weeks. Generally, only females over two years of age will breed in both seasons. Courtship behaviour begins when a receptive female begins to call continuously from a tree top with characteristic duck-like calls. Several males soon gather and some fighting may ensue to determine which is the dominant animal. As they congregate, the female becomes agitated and

begins to race through the trees followed closely by all the males. When she is ready she will stop and allow the dominant male to mate with her. The male then has no further role in bringing up the young.

Gestation, or pregnancy, takes 40 to 44 days. An average of three young are born, although the litter size may range from one to six. Litters in summer are usually larger than those of late winter. The female generally gives birth in a warm, sheltered nest that she has prepared in a cavity inside a hollow tree. Sometimes leaf nests are used, especially for a summer litter if a tree den is not available. Although the squirrel prefers to build its nest in a cavity inside a tree, it is often forced to resort to a leaf nest because of the scarcity of suitable tree dens and the unhealthy conditions of these dens after they have been lived in for several months.

Leaf nests are most often built near the tops of large pine, hemlock, maple, birch, and oak trees, where they are lodged in a large crotch or on a limb near the trunk. A platform of twigs forms the base of the nest proper and an outer shell of leaves and twigs makes up the conspicuous outside part of the nest. In most nests an inner shell is also made, consisting of the same material as the outer shell but more closely woven for stability. Mosses, grasses, and shredded bark line the inner chamber and sometimes cloth, paper, vegetation, and bird feathers are also used.

The newborn young are naked and blind and weigh about 15 g. They mature quickly, developing hair by three weeks; at four weeks the tail is well furred. Their ears open by four weeks and the eyes a week later. By eight weeks the young squirrels are venturing out of the nest for short distances. Weaning, or making the transition from the mother's milk to other food, begins at this time and at about 12 weeks the youngsters will be almost adult size and quite independent of their mother. The males reach sexual maturity at 15 to 18 months and the females at 11 months. The average lifespan is normally less than six years, although some wild eastern grey squirrels have been found to be as old as 13 years. Captive squirrels have lived for 15 to 20 years.

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Conservation

The eastern grey squirrel has many mammalian enemies, including mink, weasel, red fox, fisher, lynx, bobcat, and wolf. Young squirrels in the nest are vulnerable to raccoons, snakes, and red squirrels. Numerous myths suggest that the red and the grey squirrels are bitter enemies and that the red will castrate the grey at every opportunity. In reality the even-tempered grey squirrel usually gives way to the more aggressive red in a confrontation, avoiding a fight.

The most dangerous bird predators of the grey squirrel are Northern Goshawks, Red-tailed Hawks, Cooper's Hawks and occasionally Broad-winged Hawks. Grey squirrels occasionally fall prey to Great Horned Owls or Barred Owls. This danger is limited, however, because owls are nocturnal hunters whereas squirrels are most active in the daytime. Northern pike and walleye have also been known to take grey squirrels that were swimming across streams or lakes. In cities, dogs and cats take their toll, although adult squirrels are usually too agile to be caught. In some areas the greatest enemy of the eastern grey squirrel is probably people, who regard it as an important small game species. People have also cleared great tracts of hardwood forest, severely reducing the natural habitat of the squirrel and thus its population. Large numbers of squirrels are killed every year by cars.

The failure of a vital food source can lead to either starvation or a general weakening of the squirrel population, making it vulnerable to diseases and pests. Parasites have a harmful effect on the health and productivity of the eastern grey squirrel. The worst insect pest is the botfly larva. Scabies, or mange, leaves squirrels with patches of bare skin. In the resulting weakened condition, they often succumb to cold or infections, or become easy prey for predators. Other pests that parasitize eastern grey squirrels are ticks, fleas, lice, and round and tape worms.

The economic importance of eastern grey squirrels is limited. Their pelts currently have little value, although the tails can be used for fishing lures. Squirrel pie is considered a delicacy in parts of the United States but is not a staple food. Hunters have to be quick and accurate to shoot the swift and elusive eastern grey squirrel. It is interesting to note that naturalist Ernest Thompson Seton credited these qualities of marksmanship, developed to a high degree by early American squirrel hunters, with helping to defeat the British during the American revolution.

Eastern grey squirrels do not cause significant damage to agricultural crops and indeed are important agents of reforestation. Their habit of burying nuts, many of which are forgotten and later germinate, helps to re-establish the hardwood forests that have been severely reduced by human harvesting.

Grey squirrels can become a nuisance when they invade an attic, cause damage around the house, dig up bulbs in gardens or drive birds away from feeders. This is surely offset, however, by the pleasure they give to numerous city dwellers, campers, and everyone who enjoys the outdoors.

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Lemmings

This animal

- controls the rhythm of animal life on the tundra, because it is an important food for ermines, arctic foxes, Snowy Owls, Gyrfalcons, and jaegers
- remains active throughout the arctic winter without freezing to death
- can reproduce within weeks of its birth
- has roughly four year cycles of drastically fluctuating populations

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Description

Lemmings are mouselike rodents that live in treeless areas of northern Canada. They have short ears, largely hidden in the fur, short legs, and short tails. Adult brown lemmings are about 150 mm in total length, including about 20 mm of tail. Their body weight varies from about 55 g in some years to about 115 g in others. Their fur is a full brown and grey summer and winter. Collared lemmings are the same overall size as brown lemmings but with a shorter tail (about 15 mm). Their colour changes with the seasons (hence their other common name, “varying lemming”). In summer, a collared lemming has a black nose, grey cheeks, tawny ear spots, a chestnut collar, and a more or less prominent black dorsal stripe. With the autumn moult, however, the summer coat is replaced by a solid white winter one and the front feet develop two greatly enlarged claws, presumably to help dig through the hard-packed tundra snow.

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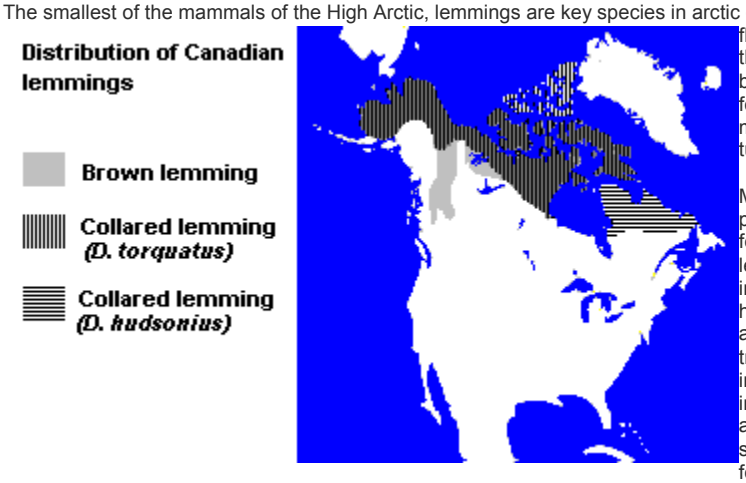
Habitat and habits

The smallest of the mammals of the High Arctic, lemmings are key species in arctic ecosystems. For unknown reasons, lemming populations fluctuate drastically, peaking about every four years and then crashing almost to extinction. Because the small bodies of lemmings are important food for ermines, arctic foxes, Snowy Owls, Gyrfalcons, and jaegers, this mysterious cycle controls the rhythm of animal life on the tundra.



Most of the range occupied by lemmings is underlain by permafrost, or soil that is always frozen, often within a few centimetres of the surface. This means that the lemmings are unable to dig deep burrows for shelter even in summer. Where the soil contains much water, however, seasonal freezing and thawing creates ridges and depressions that lemmings use for burrows and as travel routes, respectively. Brown and collared lemmings in the same general area tend to choose different habitats in summer. Collared lemmings use higher and drier sites, and brown lemmings the lower and wetter ones. This segregation coincides with the distributions of preferred forage; for example, depending on what is available, collared lemmings might seek out willows and cranberries, and brown lemmings prefer sedges, arctic cotton, and certain mosses. In winter, the habitat segregation tends to break down as collared lemmings move to lower ground where the snow is deeper and provides more shelter.

The long arctic winter is a critical time for lemmings because, unlike many species of temperate rodents, they do not hibernate. It is amazing that these small, warm-blooded animals remain active throughout the arctic winter without freezing to death. Their short appendages (ears, legs, tails) are an adaptation to reduce heat loss, and their winter fur is thicker than that of summer. As winter approaches, lemmings make large, globular nests of finely shredded grasses and sedges on the surface of the ground, which provide additional insulation when they are not out hunting for food. Snow provides critical insulation. Lemmings forage in the space that forms between soil and snow, known as subnivean space, almost never appearing on the surface. In the High Arctic, temperatures at the soil-snow interface are not exactly warm (-25°C), but they are better than those above the snow, and the difference is a key to lemming survival.

Unique characteristics

Lemming populations have long been known to fluctuate drastically. Peak numbers tend to recur about every four years. Furthermore, numbers are high over a huge area: for example, 1960 was a "lemming year" for almost all of the Canadian Arctic. All sorts of reasons for the cycles have been suggested, from changes in the number of sunspots to snow conditions. Weather is a likely, but still unproven, trigger. Winter creates problems for lemmings, the amount and timing and distribution of snow mitigate those problems, and peak numbers occur only following winter breeding. Unfortunately, no one has yet studied the role of snow cover in sufficient detail to prove that it causes the cycle. We do know that on Devon Island in Nunavut, collared lemmings bred during winter 1972–73, when the temperature under the snow fell below -20°C, and their population peaked the following spring.

A remarkable feature of the lemming cycle is the extreme scarcity of individuals at the "low point" of the cycle. Although several species of small rodents that live in temperate climates also reach peaks of abundance about every four years and some of them reach much higher densities at the peak than lemmings do, none can equal the extreme scarcity of lemmings at the low point. Such extreme scarcity raises the possibility of extinction. But passing through a population "bottleneck" probably strongly favours the individuals best adapted to survival in harsh arctic conditions. The cycle of every four years or so may be a device to keep selection abreast of the changes continually going on in the Arctic.

An early theory was that regular cycles of scarcity and abundance resulted from the interaction between a predator and its prey. When the prey became numerous, the predators brought down their numbers, which then resulted in death by starvation for the predator. However, the shoe now seems to be on the other foot. We know that nesting success of Snowy Owls and survival of arctic fox pups are both related to lemming abundance. Both owls and foxes produce very few, if any, surviving young except in "lemming years." The generation of foxes born in a "lemming year" sustains the fox population, even though its numbers gradually decline, until the next lemming peak.

Another early theory was the obvious one of epidemic disease periodically sweeping through the lemming population. The larger the population and the more contact between individuals in overcrowded conditions, the easier the spread of an infection. Unfortunately, no one has found a disease that is rampant in all declining lemming populations. During some declines disease is virtually absent.

Another obvious candidate is the interaction between lemmings and their food supply. As lemming numbers increase so does damage to the vegetation. Ultimately, the food supply is no longer able to sustain the population. Following a massive die-off of lemmings, the vegetation is able to recover, which sets the stage for a new cycle. The quantity and quality of available food are known to vary with the stage of the lemming cycle, but proof of cause and effect is still lacking.

In recent years, researchers have focused on changes in the animals themselves. The first measurable evidence came from noting changes in average weights of individuals in different phases of the cycle. In a number of species of small mammals, the largest individuals are found in the spring of the peak year. Researchers are now looking for more subtle changes. For example, increasing density produces more social interaction between individuals, which induces stress, which results in altered hormone levels, which may interfere with reproduction or alter behaviour. Stress itself may lead to increased mortality. Lemmings tend to be aggressive toward one another. If the behavioural alteration were in the direction of an increase in aggression, fewer lemmings would be born and more would be killed by their own kind.

In Scandinavia, lemmings become restless in years when their populations are high. In the mountainous terrain of Norway, for example, when lemmings begin to move they tend to go downhill and get funneled into valleys. The result is that large numbers eventually reach the sea or a large lake. They may proceed onto sea or lake ice or jump into the water, which has given rise to the popular conception that they

are committing mass suicide to relieve a problem of overpopulation. There is, however, no authentic account from the North American Arctic to back up such a belief. Most of our Canadian lemmings live on rather flat terrain and too far from the ocean to make such migrations possible. The Inuit have no legends about migrating lemmings and it is difficult to believe that they would have overlooked such an event, especially if it occurred repeatedly.

It is certainly true that in the spring of a high population year individual lemmings will often be seen on lake and sea ice, but they do not move in an orientated manner, all going north or all going south like migrating birds, and large groups are never seen. Once on the ice, individuals run rapidly and tend to move in straight lines. Lemmings have been seen on sea ice as far as 55 km from the nearest land. We do not understand why lemmings would move onto sea and lake ice in the spring of peak years, but spring is a time of social upheaval caused by the environmental changes associated with snow melt, and the physiological changes associated with onset of the breeding season.

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Range

There are three lemming species in the Canadian Arctic. Two species occur on the mainland tundra west of Hudson Bay and in the southern part of the arctic archipelago: the brown lemming *Lemmus sibiricus*, whose range extends southwards in mountainous areas (see map), and the collared (or varying) lemming *Dicrostonyx torquatus*, which has colonized the Queen Elizabeth Islands right to the northern tip of Ellesmere Island. The collared (or varying) lemmings that inhabit the Ungava Peninsula are usually considered to be a separate species *Dicrostonyx hudsonius*.

Similar lemming species are found in other circumpolar countries, such as Norway, Greenland, and Russia. In taxonomy, or the science of classifying organisms, brown and varying lemmings are classified as microtines, along with the muskrats, bog lemmings, and voles of southern Canada.

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Breeding

Lemmings of both sexes are able to reproduce within weeks of their birth. The proportion that reproduces in the summer of their birth varies widely from year to year, and seems to be related to population density. After a year, a female is capable of producing three litters of young even in the short arctic summer, but most fail to do so. The length of the summer breeding season is related to population density. When numbers are low, breeding continues into September; when numbers are high, breeding may end in July.

Lemmings sometimes breed in the winter, but there is always a pause in spring and fall separating summer and winter breeding. How such a small mammal, already under a severe thermal stress, can muster enough energy to breed in an arctic winter, and what factors determine when winter breeding will occur, are still mysteries.

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Conservation

Although lemmings have lived for up to three years in captivity, probably no lemming survives more than one winter in the wild. Wild predators likely kill most of them (except perhaps during major die-offs, when other factors, such as starvation, may come into play). In the snow-free season, arctic foxes, ermines, Snowy Owls, jaegers, and Gyrfalcons all take their toll. Wolves may take the occasional individual, and even caribou and fish have been known to prey on lemmings. Although life is more secure under the winter snow, several investigators who were on the tundra when the snow was melting have discovered remains of lemming nests that showed signs of ermine predation. The ermine is completely at home under the snow. Researchers who spent four winters in the early 1970s on Devon Island, in today's territory of Nunavut, found that between 5 and 16 percent of lemming nests had been attacked by ermines. Even higher rates of predation by ermines have been recorded on Banks Island in the Northwest Territories and in Alaska. Snowy Owls, the only raptors, or birds of prey, present in winter, are poorly equipped for digging through snow, so an owl could only strike a lemming on the snow surface. The small arctic fox can dig through the wind-packed tundra snow, but the energy cost is high for such a small meal.

In general, lemmings are not threatened by human activity except locally around villages, mines, oil wells, and other industrial sites. Adverse weather conditions probably kill a fair number. In fall, early onset of low temperatures in the absence of snow is potentially lethal. And in spring, during snow melt, when the insulating quality of snow declines, lemmings can find themselves at the mercy of the elements if the weather turns nasty. Winter nests may be full of water, and summer burrows plugged with ice due to refreezing of the melting snow. Although lemmings are known to suffer from a number of infectious diseases and to harbour a variety of parasites, relatively few lemmings die of diseases or parasites.

Inuit do not eat lemmings, nor do they make any use of their small skins. However, those Inuit who support themselves in whole or in part by trapping benefit indirectly from the "run" of arctic foxes that follows each lemming peak.

One of the Inuit names for the collared lemming is kilangmiutak, which means "one-who-comes-from-the-sky." The legend of lemmings falling from the sky is common to Inuit all across the North American Arctic and Scandinavia. It probably arose because of the sudden appearance of lemmings when the snow melts following a winter of intensive reproduction. Lemmings, particularly the collared lemming with its presumed origin from the sky, were sometimes used by shamans as a source of supernatural powers.

Lemmings are a vital part of the rather simple web of life on the tundra, and they help to teach us how intricate even that simple ecosystem

is. Their burrowing changes the arctic soil. Their feeding habits influence the composition of the plant community on the tundra. And trappers appreciate them for another reason. Because arctic fox numbers rise and fall according to the abundance of lemmings, the income of people who depend on fox trapping for a livelihood is linked to lemmings. The influence of lemmings extends far beyond the Arctic. A lemming population decline may produce a surplus of Snowy Owls that will, for a time, flood into southern Canada to the delight of bird watchers. Meanwhile, the tundra ecosystem is gathering its resources in preparation for the outburst of energy that will come with the next lemming year.

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Marten

This animal

- is active about 16 hours a day during the spring and summer
- is an agile climber but takes almost all its prey on the ground
- exemplifies the curiosity, ferocity, and lightning-fast reflexes of the weasel family
- has a beautiful coat that is marketed as Canadian or American sable and generally commands a high price

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Description

The marten *Martes americana*, a small predator, is a member of the weasel family, Mustelidae. It is similar in size to a small cat but has shorter legs, a more slender body, a bushy tail, and a pointed face. The fur varies from pale yellowish buff to dark blackish brown. During winter, the marten has a beautiful dark brown fur coat and a bright orange throat patch. The summer coat is lighter in colour and not nearly as thick. Males are the larger sex and weigh about 1 000 g, whereas females weigh about 650 g.

The Mustelidae family also includes several other more familiar animals such as the ermine, skunk, and mink. It is thought that martens entered North America from Asia about 60 000 years ago. There are several species of martens worldwide and perhaps the most famous is the Russian sable, which is well known for its luxurious fur.

Signs and sounds

In winter, the soles of a marten's feet are covered with fur and the toes are not distinguishable in the tracks. Tracks are about 3.7 cm long and form two ovals that overlap by about one third. This happens because martens travel with a loping sort of gait, and the hind feet land in the tracks left by the front feet. Loping is common among mustelids, and it takes some practice to be able to distinguish the tracks of the various species.

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Habitat and habits

Martens prefer old growth coniferous or mixed woods forest, although they may seek food in some open areas. However, the amount of undisturbed forest is continually diminishing, and new-growth forests do not support as many marten as the original forest did. In northern Ontario, for example, the density of marten in forests logged 10 to 50 years ago is only 10 to 30 percent of the number in uncut areas. Loss of habitat has contributed in a major way to the decline in abundance of this species in North America. There is some indication that martens may tolerate partial logging of their habitat, but this needs more study and a cooperative multiple use management program for forested lands.

The marten is a solitary animal. Adults will maintain living areas—called home ranges—by keeping out other members of the same sex while tolerating members of the opposite sex. Males and females spend time together only during the mating season. Home ranges vary in size with changes in both the marten population and the abundance of food. When food is abundant a male's range is about 3.5 km; if food is scarce this size may double. Females require only about half the area needed by males. Home ranges in logged areas are also much larger than those in uncut forest.

Marten hunt at all times of the day in spring and summer and are most active at daybreak and dusk. During these seasons they are active for about 16 hours a day. Females with young in the den are only active during the day for about six to eight hours. As the temperatures drop, marten are increasingly less active at night. During the coldest months they may hunt for only a few hours in the warmest part of the day. If the weather turns stormy and very cold they may even den up for several days.

Unique characteristics

Curious and excitable, martens hunt by investigating underneath downed trees and stumps, inside hollow trees, and in dense clumps of young conifers. In winter, they are known to hunt beneath the snow in tunnels created by red squirrels or under snow-covered logs. Loggers often see them near their camps, and a stolen lunch bag is not unheard of. The marten exemplifies the curiosity, ferocity, and lightning-fast reflexes of the weasel family.

Most people who have studied martens have noted that they are not fond of water. However, swimming martens have been seen, although they travelled only a short distance.

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Range

Distribution of the marten

A century ago martens were common in the extensive forests that covered much of North America. Unfortunately, land clearing and trapping have taken their toll, so that today the species has been eliminated from much of the southern portion of its former range. Martens no longer occur in Prince Edward Island and were eliminated from but later reintroduced into Nova Scotia and several American states. They are classified as an “endangered” species in Newfoundland and Labrador, where they have had protected status since 1934. Elsewhere, they occur in forested areas of central and northern Canada, the northern United States, and southwards in the Rocky Mountains.

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Feeding

The marten is often described as an "arboreal predator," but this is inaccurate. The misconception probably arose from the fact that martens are seen in trees where they have climbed to escape an intruder. Martens are agile climbers but take almost all their prey on the ground. They have an extremely varied diet and are classed as generalized predators; that is, they will eat whatever they can catch. Mostly they feed on red-backed voles, deer mice, field voles, varying hare, grouse, squirrels, and shrews. They are also known to take birds’ eggs and amphibians and make extensive use of berries, especially raspberries and blueberries.

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Breeding

Male and female martens spend time together only during the mating season in late July and early August. The female rears the young alone. Litter size is reported to range from two to six but is most often three, and the young are born in March or April, eight or nine months after mating.

This is an abnormally long gestation, or pregnancy, period for a small mammal and results from a phenomenon known as delayed implantation. After mating and fertilization, development of the embryo stops at a very early stage. Implantation into the uterus wall does not take place until February. Delayed implantation occurs in several other members of the Mustelidae family as well.

The young are born in a den, usually located inside a hollow tree. At birth, they weigh about 30 g, are blind, and are covered with a very fine fur. The female nurses the young well into the summer, spending little time away from the den until the young leave with her in June or July. Raising the young is an extremely energy-demanding task, and the female may lose considerable weight during this period. The kits apparently stay with their mother until late August or September, when they disperse. Females may breed in their first year, but most do not breed until they are two years old. Males are probably not capable of breeding until their second year either.

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Conservation

Marten have few natural enemies, but other mammalian predators, as well as hawks and owls, have been recorded as preying upon an unwary marten. Marten populations are probably limited by the amount of food available. That is, as natural factors such as disease and lack of food reduce the populations of the species they prey on, marten populations also decline. The great enemy of marten is the human being, and overtrapping has occurred in the past.

Pelts of marten are marketed as Canadian or American sable and generally command a high price. It was this high price that led, in part, to drastic declines in the numbers of marten since European colonization of North America. Annual harvests of over 100 000 martens were common in the mid-1800s. Trapping pressure was so heavy that martens were extirpated from many forested areas.

It became necessary to place martens and other furbearers under strict regulation to allow populations to recover. Even so, this was not always sufficient, and restocking programs had to be initiated. Many of these have been successful, and trapping on a limited basis has begun again in some formerly depleted areas. In the 1983–84 season, over 150 000 martens were taken by trappers in Canada, and recent levels are the highest ever recorded. This does not mean that martens are now extremely abundant, but more likely that as forests have become increasingly accessible because of more roads and improved bush vehicles, marten are now regularly trapped in areas that were previously harder to reach.

Efforts have been made to raise martens on fur farms, as has been done successfully for foxes, mink, lynx, and a few other species. Martens are difficult to raise and so far little success has been achieved.

Management of this species is especially difficult because there is no easy and inexpensive way to census a marten population. Experience has shown that if sufficient breeding stock exists in areas where there is no trapping, dispersal of martens into surrounding areas where trapping does occur may help trapped populations rebuild, if trapping pressure is reduced. However, if there is easy access to a tract of land, such as that provided by forest access roads, then overtrapping can occur and a population can be rebuilt only if trapping is curtailed entirely for several years.

A registered trapline system, such as in Ontario, provides a biologist with some opportunity to control trapping pressure. Because logging has been a factor in marten declines in the past, it is urgent that land managers recognize the need for multiple use of forested areas. The biologist, forester, and land planner must work in closer cooperation to manage all resources simultaneously.

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Moose

This animal

- is a powerful swimmer within days of birth
- can dive more than 5 m for food on a lake bottom
- has extremely poor eyesight
- gains weight as a calf faster than any other big-game animal

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Description

A bull moose in full spread of antlers is the most imposing beast in North America. It stands taller at the shoulder than the largest saddle horse. Big bulls weigh up to 600 kg in most of Canada; the giant Alaska-Yukon subspecies weighs as much as 800 kg. In fact, the moose is the largest member of the deer family, whose North American members also include elk (wapiti), white-tailed deer, mule deer, and caribou.

Moose *Alces alces* have long, slim legs that end in cloven, or divided, hooves often more than 18 cm long. The body is deep and massively muscled at the shoulders, giving the animal a humped appearance. It is slab-sided and low-rumped, with rather slender hindquarters and a stubby, well-haired tail. The head is heavy and compact, and the nose extends in a long, mournful-looking arch terminating in a long, flexible upper lip. The ears resemble a mule's but are not quite as long. Most moose have a pendant of fur-covered skin, about 30 cm long, called a bell, hanging from the throat.

In colour the moose varies from dark brown, almost black, to reddish or greyish brown, with grey or white leg "stockings."

In late summer and autumn, a mature bull carries a large rack of antlers that may extend more than 180 cm between the widest tips but that are more likely to span between 120 and 150 cm. The heavy main beams broaden into large palms that are fringed with a series of spikes usually less than 30 cm long. The antlers are pale, sometimes almost white.

A bull calf may develop button antlers during its first year. The antlers begin growing in midsummer and during the period of growth are soft and spongy, with blood vessels running through them. They are covered with a velvety skin. By late August or early September the antlers are fully developed and are hard and bony. The velvet dries and the bulls rub it off against tree trunks.

Mature animals usually shed their antlers in November, but some younger bulls may carry theirs through the winter until April. Yearling bulls usually have spike antlers, and the antlers of two-year-olds are larger, usually flat at the ends. Moose grow antlers each summer and shed them each autumn.

Signs and sounds

The voice of a newborn calf is a low grunt, but after a few days the calf develops a strident wail that sounds almost human. During the breeding season, or rut, the cow moose entices a mate with a nasal-toned bawling. The bull responds with a coughing bellow.

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Habitat and habits

Moose are found on the rocky, wooded hillsides of the western mountain ranges; along the margins of half a million lakes, muskegs, and streams of the great boreal forest; and even on the northern tundra and in the aspen parkland of the prairies.

Moose tolerate cold very well but suffer from heat. In summer, especially during fly season, moose often cool off in water for several hours each day. In fact, moose are quite at home in the water. They sometimes dive 5.5 m or more for plants growing on a lake or pond bottom. Moose have been known to swim 19 km. Of all North American deer, only the caribou is a more powerful swimmer. A moose calf is able to follow its mother on a long swim even while very young, occasionally resting its muzzle on the cow's back for support.

Unique characteristics

The eyesight of the moose is extremely poor, but its senses of smell and hearing compensate.

With their tremendous physical power and vitality, moose can travel over almost any terrain. Long legs carry them easily over deadfall trees or through snow that would stop a deer or wolf. Their cloven hooves and dewclaws spread widely to provide support when they wade through soft muskeg or snow. When frightened they may crash noisily through the underbrush, but in spite of their great size even full-grown, antlered bulls can move almost as silently as a cat through dense forest.

Before bedding down, a moose usually travels upwind for a time and then swings back in a partial circle. Thus predators following its track will have to approach from the windward direction. Skilled hunters know when to leave the track and work their way upwind to the hiding-place of their quarry.

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Range

Distribution of the moose in North America

Moose are found in Canadian forests from the Alaska boundary to the eastern tip of Newfoundland and Labrador. It is estimated that there are between 500 000 and 1 million moose in Canada. Since the beginning of settlement in Canada there have been considerable shifts in the distribution of moose. They are found in many regions which had no moose in presettlement days. There are now large moose populations in north-central Ontario and in the southern part of British Columbia, where moose were previously unknown. They have only recently spread to the Quebec North Shore, north of the Gulf of St. Lawrence. The island of Newfoundland, which had never been occupied by moose, was "seeded" with a few pairs in the early 1900s and now has large populations. Moose are constantly spreading northwards through the sparse transition forest that extends to the open tundra.

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Feeding

In summer the moose's diet includes leaves, some upland plants, and water plants in great quantity where available. A large adult moose eats from 15 to 20 kg, green weight, of twigs each day in winter, and in summer eats from 25 to 30 kg of forage—twigs, leaves, shrubs, upland plants, and water plants. They also dip their heads under the surface of the water to feed on the lilies and other water plants.

In June and July, moose gather around salt licks, usually low-lying areas of stagnant, mineral-rich water. At that season, when they feed heavily on leaves and other lush plant growth, they seem to require the supplementary minerals that the salt licks provide. Moose drift to the willow-rich valleys or other areas where good forage exists close to forest cover.

During the winter months, moose live almost solely on twigs and shrubs such as balsam fir, poplar, red osier dogwood, birch, willow, and red and striped maples. Winter is a time of hunger for moose. They restrict their food intake and limit their activity to save energy. When food becomes scarce, as it often does toward spring, moose will strip bark from trees, especially poplars.

Before settlement, the large supplies of woody twigs needed by moose were provided by young forest regrowth in the wake of forest fires. Now that wildfire has been largely controlled, the moose's source of food is often areas that are growing again after clear-cut logging.

Where predation and hunting are limited, moose numbers may increase to the point where food is inadequate. Under these conditions, many animals starve while all are malnourished and more likely to be killed by predators or disease. Concentrations of up to 135 animals per 10 km^2 have been seen in Wells Grey Provincial Park in British Columbia.

Deer, elk, rabbits, and even beaver compete with the moose for food.

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Breeding

The breeding season, or rut, begins in mid-September. Moose sometimes take more than one mate, but usually a bull stays with a particular cow during most of the breeding season.

A good food supply improves breeding success. On good range, more than 90 percent of the cows become pregnant and up to 30 percent bear twins. Very rarely, triplets are observed. However, when the food supply is poor, rates of pregnancy can drop to 50 percent, and the twinning rate almost to zero.

At birth a calf moose is a tiny, ungainly copy of its mother. If it is one of twins it may weigh 6 kg; if born singly, between 11 and 16 kg.

Calves are helpless at birth. The mother keeps them in seclusion for a couple of days, hidden from their many enemies in a thicket or on an island.

Of all North American big-game animals, the moose calf gains weight fastest. During the first month after birth it may gain more than half a kilogram a day, and later in the summer may begin to put on more than 2 kg a day for a time. At the age of only a few days a calf can outrun a human and swim readily.

Calves stay with the cow until she calves again the following spring. At that time she drives off her yearlings—no doubt a difficult experience for the "teenage" moose.

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Conservation

Bears and wolves prey on moose. Black and grizzly bears have been known to prey heavily on moose calves during the first few weeks of life, and grizzly bears can easily kill adult moose.

Throughout most wolf range in Canada, moose are the principal prey of wolves. Wolves kill many calves and take adult moose all year. Hunting healthy adult moose is a difficult and often dangerous business for wolves. The flailing hooves of a cornered moose frequently cause broken bones and even death, and only about one confrontation in 12 ends with the wolves successfully killing a moose. In winter, wolves usually hunt in packs. In deep crusted snow, or on smooth ice, a pack can easily bring down a moose. They usually run up beside their quarry and rip the tender flanks until the moose is weakened from loss of blood. In the end, wolves get almost every moose.

Wolverines also prey on moose calves occasionally. Where they coexist with moose, cougars take a substantial number of moose calves and yearlings. Few moose die of old age.

Ticks are common on moose, especially in late winter, and may weaken animals seriously both by sucking blood and by causing the affected moose to rub off much of its hair, causing substantial heat loss. Internal parasites such as the hydatid—a tiny tapeworm—affect moose, especially when lack of forage and a heavy tick infestation lower their resistance.

Another serious parasitic disease of moose is caused by the meningeal worm, so called because it attacks the meninges, or membranes, surrounding the brain and spinal cord. Meningeal worm is a parasite of white-tailed deer, which are adapted to it. However, in moose it is deadly, and there is a long history of moose dying in regions where the two species overlap.

Moose are an important economic resource in Canada. Moose hunting generates over $500 million in economic activity annually and provides large amounts of food for aboriginal and other rural people. Moose are a major element in the complex of wildlife attractions that draw visitors to parks and other wildlands to view and study nature.

Populations must be kept within the limits set by the food supply to prevent starvation, disease, and serious damage to vegetation. Foresters in areas that are overpopulated by moose find that the regeneration of forest trees is harmed significantly. This may seriously reduce future timber crops as well as the breeding habitat of songbirds that nest in deciduous shrubs.

Moose respond well to management of their habitat by logging or controlled burning if these activities maintain a diversity of open areas and patches of larger trees for cover. Today, moose management in Canada is soundly based on aerial counts, habitat inventories, and scientific studies of reproductive rates and calf survival. Moose have adapted well to human activities, and with appropriate management, they will always be part of the Canadian scene.

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Muskrat

This animal

- is basically a large field mouse that has adapted to life in and around water
- has large hind feet that act like paddles during swimming
- can find its food during the winter under a metre of ice and snow, in ice-cold water and almost total darkness—a truly a remarkable feat
- has specially evolved teeth that protrude ahead of the cheeks and lips that can close behind them, permitting it to chew on stems and roots under water "with its mouth closed"

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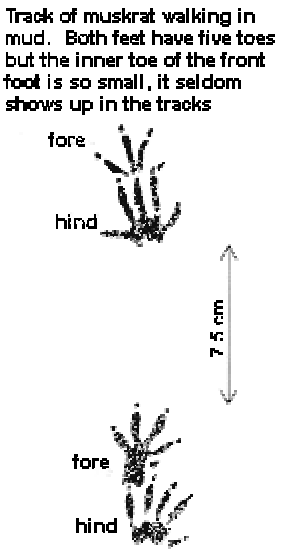
Description

The muskrat *Ondatra zibethicus* is a fairly large rodent commonly found in the wetlands and waterways of North America. It has a rotund, paunchy appearance. The entire body, with the exception of the tail and feet, is covered with a rich, waterproof layer of fur. The short underfur is dense and silky, while the longer guard hairs are coarser and glossy. The colour ranges from dark brown on the head and back to a light greyish-brown on the belly. A full-grown animal weighs on the average about 1 kg but this varies considerably in various parts of North America. The length of the body from the tip of the nose to the end of the tail is usually about 50 cm. The tail is slender, flattened vertically and up to about 25 cm long. It is covered with a scaly skin that protects it from physical damage.

Only a minimal amount of hair grows on the feet. The hand-like front feet are used in building lodges, holding food, and digging burrows and channels. Although the larger hind feet are used in swimming, they are not webbed like those of the beaver and otter. Instead, the four long toes of each foot have a fringe of specialized hairs along each side, giving the foot a paddle-like effect. The rather small ears are usually completely hidden by the long fur. The four chisel-like front teeth (two upper and two lower incisors), each up to 2 cm long, are used in cutting stems and roots of plants.

The muskrat's name is derived from the fact that the animal has two special musk glands—also called anal glands—situated beneath the skin in the region of the anus. These glands enlarge during the breeding season and produce a yellowish, musky-smelling substance that is deposited at stations along travel routes used by muskrats. Common sites of deposition are "toilets," bases of lodges, and conspicuous points of land. The biology of musk glands has not been studied extensively, but the odour produced is believed to be a means of communication among muskrats, particularly during the breeding season.

Signs and sounds



In the spring, during the mating season, sharp whining noises and occasional sounds of fighting may be heard.

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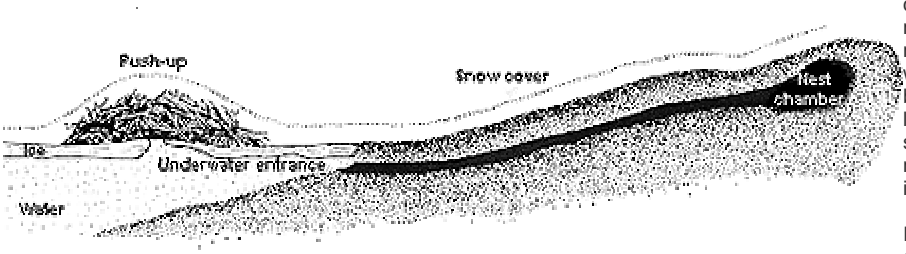
Habitat and habits

Muskrats typically live in freshwater marshes, marshy areas of lakes, and slow-moving streams. The water must be deep enough so that it will not freeze to the bottom during the winter, but shallow enough to permit growth of aquatic vegetation—ideally between 1 and 2 m. Areas with good growths of bulrushes, cattails, pondweeds, or sedges are preferred.

Compact mounds of partially dried and decayed plant material can frequently be seen scattered among the cattails and bulrushes. These dead-looking heaps are homes of the muskrat. Bulrushes and cattails are most important, particularly in lakes. As well as being eaten, they are used as building material in the construction of lodges and feeding stations, and as shelter from winds and wave action. In northern regions, horsetails can be important in muskrat habitat.



If bulrushes or cattails are not available, muskrats dig burrows in firm banks of mossy soil or clay. Because muskrats require easy access to deep water, water depths must increase fairly rapidly from the shore where burrows are situated. This provides muskrats with an opportunity to escape from predators, and with a food supply under the ice during the winter.

Some people refer to muskrats as "house rats" and "bank rats" because the animals build lodges in certain areas and bank burrows in others. Often, these names are used in a way that suggests that these two "types" of muskrats possess inherited biological differences. This is not the case. The type of habitation used is simply a response to local conditions.

With the shortening of days and the coming of colder weather in September, preparations for winter begin. The fall is spent building and reinforcing lodges for winter occupancy, and, in some regions, storing food for winter use. Lodge building behaviour is an extremely important aspect of the ecology of muskrats. The lodge permits them to live in areas surrounded by water, far away from dry land. It protects them from enemies and gives them shelter from the weather.

A muskrat builds a lodge by first heaping plant material and mud to form a mound. A burrow is then dug into the mound from below the water level, and a chamber is fashioned at the core of the mound. Later, the walls of the lodge are reinforced from the outside with more plants and mud. A simple lodge of this type is about 0.5 to 1 m high and 0.5 to 1 m in diameter. It contains only one chamber and has one or two plunge holes, or exit burrows. More complex lodges, containing several separate chambers and plunge holes, may be up to 1.5 m high and 1.8 m in diameter.

Shortly after freeze-up, muskrats chew holes through the ice in bays and channels up to 90 m away from the lodge to create "push-ups." After an opening has been created, plant material and mud are used to make a roof over it, resulting in a miniature lodge. Typically there is just enough room for one muskrat in the push-up. It is used as a resting place during underwater forays, and as a feeding station.

The winter is a period of relative inactivity. The muskrat is safe from the cold and from most predators. It spends most of its time sleeping and feeding until breeding activities begin after spring break-up.

The muskrat is well adapted to a semi-aquatic life style. Although fully functional on land, it has evolved characteristics that make it at home in the water. At three weeks of age it is a capable swimmer and diver. As an adult, it swims effortlessly and can do so for long periods of time. This ability is greatly facilitated by the buoyant qualities of the thick waterproof fur. When swimming on the surface, the muskrat tucks its front feet slightly forward against the upper chest while using the back feet in alternate strokes to propel the body. The tail is used at most as a rudder. When the muskrat is swimming under water, however, the sculling action of the tail probably provides as much propulsive force as do the hind feet.

In the late evening during ice-free periods of the year, muskrats can be seen swimming, sitting at feeding stations such as logs or points of land, and busily improving lodges.

Although the muskrat builds lodges near the water and is an accomplished swimmer, it is not a close relative of the beaver, as is sometimes thought. Nor is it a true rat. Instead, it is basically a large field mouse that has adapted to life in and around water.

Unique characteristics

The muskrat, together with the beaver and several other mammals, is capable of remaining submerged up to 15 minutes if in a relaxed state. Non-aquatic mammals cannot do this because they need a constant supply of oxygen and must continually expel carbon dioxide. The muskrat is able to partially overcome this problem by reducing its heart rate and relaxing its muscles when submerged; this reduces the rate at which oxygen is used. Also, it stores a supply of oxygen in its muscles for use during a dive and is less sensitive to high carbon dioxide levels in the blood than are non-diving mammals. This ability for extended dives is important in escaping enemies, digging channels and burrows, cutting submerged stems and roots, and travelling long distances under the ice.

The muskrat's front teeth are especially modified for underwater chewing. Non-aquatic mammals such as dogs or humans would have great difficulty in trying to chew on a large object under water, because water would enter the mouth, throat, and nasal passages. This problem has been overcome in the muskrat through the evolution of incisors, or cutting teeth, that protrude ahead of the cheeks and of lips that can close behind the teeth. This adaptation permits the muskrat (and the beaver) to chew on stems and roots under water "with its mouth closed."

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Range

The muskrat is more widely distributed in North America than almost any other mammal and in this respect is a very successful species. It is found from the Arctic Ocean in the north to the Gulf of Mexico in the south and from the Pacific Ocean in the west to the Atlantic Ocean in the east. This broad distribution is closely related to the muskrat's use of aquatic environments, which are common in North America. Human activities in North America during the last two centuries have not significantly affected the distribution of muskrats. In some cases, however, the draining of marshes or swamps for agricultural or other purposes has completely exterminated local populations. In others, the building of irrigation ditches and canals has increased populations.

Until the early part of this century, muskrats occurred only in North America. In about 1905, they were introduced to Europe, where they quickly established themselves as permanent residents. They spread northward and eastward, and today are common in Europe and northern Asia.

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Feeding

Of all plants available in marshes, cattails are most preferred as a food item. However, muskrats appear to thrive equally well on a diet of bulrushes, horsetails, or pondweeds, the last two constituting the basis of the diet in northern latitudes. They also eat a variety of other plants, including sedges, wild rice, and willows.

During the winter a thick layer of ice restricts the muskrat to the interior of the lodge or burrow and the watery environment beneath the ice. The animal's highly developed diving abilities and its use of push-ups become critical in procuring food under those conditions. It covers considerable distances under the ice searching for food. When the muskrat reaches a feeding area it chews off portions of plants and carries them to the nearest push-up, where it eats. This foraging activity under perhaps a metre of ice and snow, in ice-cold water and almost total darkness, is truly a remarkable feat.

When their normal food items are scarce or unavailable, and food of animal origin is abundant, muskrats are known to be highly carnivorous, or meat-eating. Under these circumstances muskrats most commonly consume animals such as fish, frogs, and clams. However, muskrats rarely do well on this type of diet and consuming such foods is generally taken to be evidence of hard times.

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Breeding

Mating activity occurs immediately following spring break-up in March, April, or May. Mating pairs do not form lasting family ties; instead, the muskrat appears to be promiscuous, or have many mates. Males compete fiercely for females. The birth of the litter, containing five to 10 young, occurs less than a month after the female has been mated. The same female normally has another litter a month after the first, and sometimes yet another a month after the second.

The young at birth are blind, hairless, and almost completely helpless, but they develop rapidly. They are covered with thin fur at the end of the first week, their eyes open at the end of the second week, and they normally begin leaving the lodge on short trips at about two to three weeks of age. Weaning, or making the transition from the mother's milk to other foods, occurs at about three weeks, and juveniles are essentially independent of their parents at six weeks.

Breeding continues throughout the summer, with the last litters born about August. Food is plentiful during the summer and the young grow rapidly.

Few rodents live to old age; they are usually killed by other animals while still quite young, or they die accidentally. The limited information available suggests that muskrats become old at three or four years of age. When they reach this age, they lose much of their natural alertness and fall easy prey to mink, foxes, and other predators.

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Conservation

The muskrat is a vicious fighter when provoked. It stands its ground courageously if an escape route to deep water is not available and can inflict considerable damage on an attacker with its long incisors, or cutting teeth. In spite of this, it is often preyed upon by other species. The mink occupies much of the same habitat as muskrats and can be the cause of heavy mortality among juveniles under certain conditions. Mink use the same burrow systems, dig into muskrat lodges, and may enter lodges through plunge holes. The snapping turtle and the northern pike also inhabit marshes and prey on the muskrat. When muskrats wander on dry land in search of new habitat, they are subject to predation by members of the dog family—wolves, coyotes, foxes, and domestic dogs—as well as by typical predators such as badgers, wolverines, fishers, racoons, and lynx.

The muskrat has long been hunted by humans, probably the major enemy or predator of this species. Prior to the colonization of North America by Europeans, it was hunted occasionally for food. With the coming of the early settlers and the introduction of guns and traps, the muskrat was hunted intensively for its fur. This activity has persisted to the present day—muskrat fur is still in demand. Also, the muskrat is still used as food by people in some parts of North America.

Muskrats, like many other wildlife species, show large fluctuations in numbers that follow what appears to be a regular pattern. In the case of the muskrat, numbers decrease drastically about every seven to 10 years. At such times, few or no muskrats can be found where two or three years earlier there had been thousands. These catastrophes are often blamed on predators or on over-trapping. However, scientists do not believe that these are the real causes. Instead, for some as-yet-unknown reason, the health of individuals deteriorates, causing widespread death and reproductive failure. Reproductive and death rates return to normal one or two years following such a population decline, leading to an increase in muskrat numbers once more.

The muskrat contributes more to the total combined income of North American trappers than any other mammal. Because of its important role in the trapping industry, it has been studied extensively. The first major studies were conducted by the Canadian Wildlife Service on the Mackenzie River Delta in the far north and the Athabasca–Peace Delta in northern Alberta during the late 1940s. A thorough understanding of habitat requirements, food habits, reproduction, longevity, causes of mortality, long-term changes in numbers, and the effect of weather on all these factors is essential to put management procedures on a sound scientific basis. The single most important contribution to our understanding of the biology and ecology of the muskrat was Paul Errington's Muskrat Populations (1963), which combined the results of years of study by the author with information on the muskrat throughout North America. More recent studies in eastern Canada and central and eastern United States have augmented what is now a comprehensive body of knowledge on the dynamics and management of muskrat populations.

There are two major methods of managing muskrat populations: the first is to improve habitat, and the second is to regulate the commercial harvest by trappers. The most common method of improving habitat is to regulate water levels between about 1 and 2 m of depth over large areas by building dams at strategic points in lake outlets and streams. Sometimes this occurs as a natural side effect of beaver dams.

Regulation of commercial harvest is based on current population sizes and future population trends. Usually the harvest is maintained at the highest possible level that will not adversely affect population sizes and harvests in future years.

The future of the muskrat in Canada is bright. In spite of heavy trapping pressure, the draining of marshes for agricultural purposes, and unprecedented industrial activity, the species has never been endangered in Canada. Indeed, population numbers today are probably almost as high as they were a thousand years ago.

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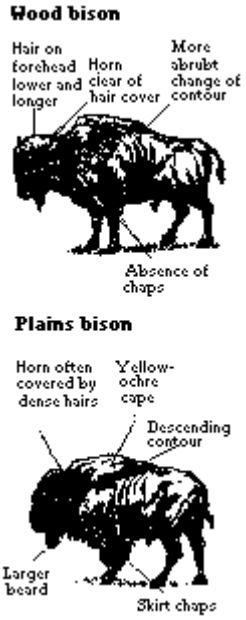
North American Bison

This animal

- can distinguish smells from 3 km away
- at one time used traditional migration routes across the prairies that are still visible from the air as deep, worn paths
- roamed free in North America, between 30 million and 70 million strong, in the 1800s
- is today considered a "threatened" species in Canada



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Description

The North American bison, or buffalo, is the largest land animal in North America. A bull can stand 2 m high and weigh more than a tonne. Female bison are smaller than males.

A bison has curved black horns on the sides of its head, a high hump at the shoulders, a short tail with a tassel, and dense shaggy dark brown and black hair around the head and neck. Another distinctive feature of the buffalo is its beard.

There are two living subspecies of wild bison in North America: the plains bison *Bison bison bison* and the wood bison *Bison bison athabascae*.

The drawings show some of the features that biologists look for if they wish to identify a bison by subspecies. In general, the plains bison is lighter in colour than the wood bison. The wood bison is taller, longer legged, and less stockily built than the plains bison, but it is heavier.

Signs and sounds

During the mating season, from July to mid-September, "bull roarings" are heard for kilometres, day and night, as bulls challenge each other in the rutting ritual of the mating season.

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Habitat and habits

Historically, bison were known to make movements of up to hundreds of kilometres to take advantage of the changing availability of food plants in different seasons. These movements were most pronounced on the Great Plains, where large herds moved long distances along traditional routes. Some of these routes are still visible from the air in the form of deep paths worn over the years in the prairie soil by millions of passing hooves. In contrast, the wood bison in the Mackenzie Bison Sanctuary in the Northwest Territories make only local movements during the year, moving between open meadows and the surrounding forest, in patterns established through traditional use.

Most bison live in mixed herds of cows, calves, yearlings, subadults, and a few bulls. The other bulls form groups of their own.

The most dangerous season for wild bison is the spring, with the melting of lake and river ice. The buffalo habit of bunching tightly together, safe enough on hard winter ice, often proves fatal in spring conditions, and enormous numbers died when great herds were common. On one day in 1795, a fur trader counted 7 360 drowned individuals in a tributary of the Red River, west of Winnipeg. In recent decades large numbers have drowned in the Peace-Athabasca Delta region of Wood Buffalo National Park.

As summer approaches, buffalo shed their thick winter coats. It is two months before the new coat appears. During this interval, which is the peak of the fly season, the buffalo wallow in marshes or dust bowls to escape from flies.

Fall is the best season for the buffalo. The flies are gone and the animals fatten rapidly as they prepare for the long cold season ahead. Winter poses few problems for bison. Their winter coats, reinforced by a heavy mane over the vital organs, protect them from the cold, and they can find nourishing grasses and sedges by swinging their heads from side to side to push away the snow. The buffaloes' instincts protect them in blizzards, as they move into the wind instead of drifting with it like domestic cattle (which are sometimes crushed against fences and killed).

Unique characteristics

In the days when they grazed on the grasslands in huge numbers, plains bison greatly influenced the ecology of their habitat. Their wallows became temporary ponds in spring and home to a variety of water-loving creatures, such as ducklings and frogs. Their grazing encouraged the growth of grasses that flourish when the vegetation is short. Their heavy grazing coupled with dung production may have been a major factor in building the deep, rich organic soils of the prairies.

Bison herds are alert and quick to detect changes in their environment. Bison have keen senses of smell and hearing; they can distinguish smells from 3 km away.

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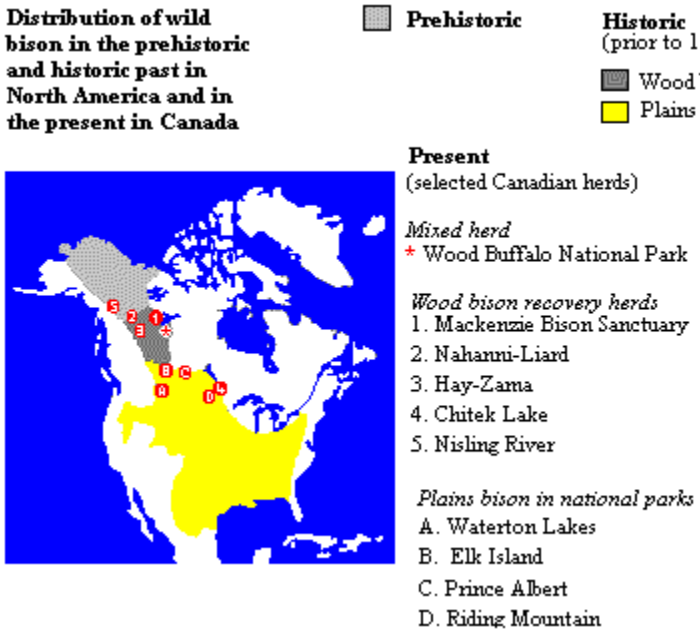
Range



The map shows the bison's present, historic, and prehistoric distribution.

Two hundred years ago, the plains bison was by far the more common of the two subspecies. It was the dominant grazing animal of the interior plains of the continent, and it often occurred in large herds. A smaller population occurred east of the Mississippi.

Today, there are comparatively few plains bison. A herd of about 600 is fenced in at Elk Island National Park, 64 km east of Edmonton. There are small numbers at Prince Albert National Park in Saskatchewan, Riding Mountain National Park in Manitoba, and Waterton Lakes National Park in Alberta. There are at least 25 herds of plains bison in national and state parks and wildlife refuges in the United States, numbering more than 10 000 animals. There are more than 140 000 in private collections and on a large number of commercial ranches in both Canada and the United States.

The wood bison has always lived to the north of its prairie cousin. In historic times its range was centred in northern Alberta and the adjacent parts of British Columbia, the Northwest Territories, and Saskatchewan. Herds made use of aspen parkland, the eastern slopes of the Rocky

Mountains, the lowlands of the Peace and Slave rivers, and the coniferous forests and wetland meadows of the upper Mackenzie Valley. The wood bison was never as abundant as the plains bison, probably numbering no more than 170 000 at its peak.

In April 1994, there were approximately 3 000 wood bison in Canada, most in five "free-roaming" herds, the largest of which consists of more than 2 000 animals in the Mackenzie Bison Sanctuary near Fort Providence, Northwest Territories. The source herd of 350 animals for the recovery program is at Elk Island National Park. The total population is small enough that the wood bison is considered threatened by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC).

The other large free-roaming herd of bison is in Wood Buffalo National Park, on the Northwest Territories–Alberta border, where there are about 2 000 animals, descendants of mixed plains and wood bison stock.

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Feeding

The grazing habits of bison are similar to those of domestic cattle. Bison eat grasses, sedges, and other ground-growing plants. In the days of free-roaming herds, the plains bison fed on a variety of native grasses, which had great nutritional value. In northern areas, the wood bison fed on a wide variety of grasses and wild forages, but mainly on meadow sedge, an abundant lowland forage, or food suitable for livestock. In winter, they would also eat the tender twigs of scrubland bushes.

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Breeding

During the mating season, from July to mid-September, the herds move restlessly as bulls challenge each other in the rutting ritual of the mating season.

Most calves are born in May and June, one to each adult female every one or two years. The newborns are tawny yellow with only a faint suggestion of the shoulder hump. Both parents care for their calf to a certain extent, but in the face of danger the calf may be abandoned. The calves, however, rapidly gain in strength and agility, and by autumn they are able to keep up with the herd.

Buffalo take about eight years to mature and can live for up to 20 years in the wild. A few have survived past 30 years in captivity.

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Conservation

Two hundred years ago, anywhere from 30 to 70 million bison roamed free in North America. The aboriginal people who lived on the Great Plains relied on these wild mammals for food, clothing, and shelter.

When buffalo were still plentiful, the Plains Indians ate buffalo meat and made their clothing and their tepees from buffalo hides. The native hunters took advantage of the bisons' stampeding behaviour. They drove them over cliffs and into canyons. They often killed 50 or 60 at a time, for it was practically impossible to cut out the needed few from the tightly massed herd. Nevertheless, buffalo remained abundant.

The arrival of European settlers destroyed this way of life. During the late 1800s, commercial hide hunters, settlers, and thrill seekers shot millions of bison. In those days of unlimited hunting, bison herds were seen to smother in snow in their efforts to escape from humans. Panic-stricken by their enemies, the herds would also stampede over steep banks or into swamps.

The destruction of the vast free-ranging bison herds on the prairies brought the species to the verge of extinction[Hyperlink to the glossary.]and with it the collapse of the civilization of the Plains Indians. In so doing, it cleared the way for prairie agriculture.

Since about 1900, the population of bison in North America has increased, but not to anything near its original numbers. Two measures in particular have helped the plains bison recover to a certain extent: legal protection from hunting and ranchers' raising of bison as livestock.

Strictly regulated hunting is a useful management tool. Recreational hunting of wild bison bulls is allowed in the Mackenzie Bison Sanctuary, and long-time territorial residents can obtain a licence to hunt bison anywhere in the Northwest Territories except in Wood Buffalo National Park.

Because domesticated bison coexist more easily than wild ones with modern prairie life, many bison on the prairies exist on ranches, as livestock. Farmers appreciate the fact that bison are better adapted to prairie droughts and harsh winters than European cattle. Some farmers may also recognize that, because plains bison evolved as part of prairie grassland ecosystems, domesticated bison are potentially more compatible than beef cattle with the region's other native animals and plants. Whether efforts to halt the decline of biodiversity and restore functioning native mixed-grass ecosystems on the prairies will eventually lead to the restoration of herds of wild and semi-wild plains bison to more of their former ranges remains to be seen.

North American bison are still under threat from other sources. Grizzly bears, black bears, grey wolves, and cougars have been known to prey on bison. The grizzly bear was and would still be a deadly enemy, but neither it nor the formidable cougar are numerous in buffalo territory today. Wolves are a danger chiefly to the young, the sick, and the old, because a buffalo in its prime is usually a match for wolves.

Many bison in northern Canada range freely in protected areas. Unfortunately, the wild bison in and around Wood Buffalo National Park (an area that includes over 40 percent of the wood bison's former range) are infected with bovine tuberculosis and brucellosis, making it impossible to re-establish healthy wood bison herds in this habitat.

Bovine tuberculosis and brucellosis are diseases that were brought to North America by European cattle and passed to their relatives, the bison. The first evidence of tuberculosis in plains bison in Canada was at the Buffalo Park near Wainwright, Alberta, in the 1920s. When that park became overcrowded, 6 673 plains bison were moved north to Wood Buffalo National Park between 1925 and 1928. These animals apparently carried both brucellosis and tuberculosis, which continue to affect the free-ranging herds of mixed wood and plains bison in and around Wood Buffalo National Park.

These herds, and the wood bison in the Mackenzie Bison Sanctuary, have also experienced sporadic outbreaks of anthrax, a disease caused by a bacterium that can survive in the soil for decades. Animals that become infected usually die, but anthrax is not carried or harboured by the bison themselves, except during outbreaks of active infection.

When infected animals stray away from the vicinity of the park, these diseases can be transmitted to other disease-free wood bison and to cattle. Cattle ranchers, park officials, aboriginal people, environmental groups, and government agencies with responsibilities for wildlife are trying to work out how best to conserve wild bison and protect the livelihood of the ranchers.

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Committee on the Status of Endangered Wildlife in Canada

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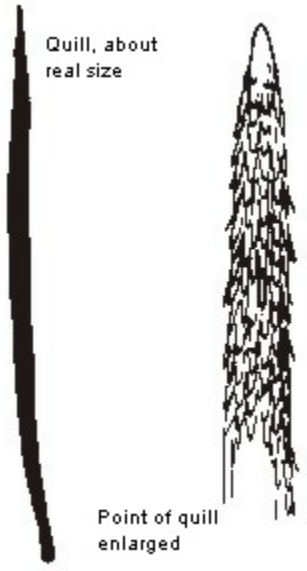
Porcupine



This animal

- is believed to have over 30 000 quills
- lashes its tail threateningly when disturbed, possibly detaching loose quills, which fly through the air as though they were thrown
- chews on a variety of objects, including wood, leather, bones, and cast-off antlers, perhaps to satisfy a craving for salt and the need to hone continuously growing teeth
- is a solitary animal for much of the year

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Description

The porcupine *Erethizon dorsatum* is one of Canada's best-known mammals, both in life and in legend. Its fame stems from its coat of quills, which keeps most enemies at a respectful distance.

When sitting hunched high up in a tree, a porcupine could be mistaken for the nest of a squirrel or a crow, but close to the ground it is easily recognized. It has a short, blunt-nosed face with small eyes. The ears are small and round, almost concealed by the hair, which also covers the spines. The shoulders are humped, making the back look arched. The short legs are bowed, and the animal stands bear-like with its entire foot planted firmly on the ground. The claws are long and curved. On the hind feet the first digit is replaced by a broad movable pad that allows the animal to grasp branches more firmly when climbing. The muscular tail is thick, short, and rounded at the tip.

The porcupine's coat consists of a soft, brown, woolly undercoat and coarse, long guard hairs. At the base, each guard hair is brown, becoming darker near the tip, which may be white in eastern populations and yellow in the western ones. The guard hairs conceal the quills until the porcupine is aroused. The quills are longest on the back and tail and when raised push the guard hairs forward, forming a crest. On the face the quills are about 1.2 cm long; on the back they may be up to 12.5 cm in length. There are no quills on the muzzle, legs, or underparts of the body.

Each quill is hollow and embedded in the skin, where it is attached to a small muscle that pulls it upright in the fur when the animal bristles with alarm. About 0.6 cm from the tip, the quill tapers to a fine point closely covered by several dozen small black barbs. These barbs feel only slightly rough to the touch, but when they are moist—as when embedded in flesh—they swell, working the quill farther in. The quills have black tips and yellow or white shafts.

It has been estimated that the porcupine has over 30 000 quills, so it is not incapacitated by a single encounter with an enemy, when several hundred quills may be dislodged. As the quills are lost they are replaced by new ones, which are white and sharp and which remain firmly anchored in the skin until they are fully grown.

The porcupine is Canada's second largest rodent, next to the beaver. Adult males reach an average weight of 5.5 kg after six years; the females reach 4.5 kg. The total length averages 68 to 100 cm, and the height at the shoulders is about 30 cm.

Signs and sounds

When in a den or up a tree, a porcupine is not always easy to see, but noisy chewing, cut twigs, and missing patches of bark may advertise its presence. Around feeding trees and especially outside the winter dens, scats, or droppings, are often visible. In the winter, these are

rough and irregular in shape; in summer they tend to be rounded and soft turning from greenish brown to dark brown as they age.

In winter, the tracks can be recognized by the firm print of the whole sole placed heavily on the ground, the long claw marks, and, sometimes, marks where the tail has dragged. If the snow is soft and deep, the porcupine trail becomes more of a trough through the snow.

In fall, and to a lesser extent at other times of the year, porcupines may be called by a low puppylike whine repeated up and down the scale.

During confrontations, a porcupine will chatter its teeth. Otherwise porcupines are mainly uncommunicative animals. The female may nose her young with subdued grunts and whines. Only in the mating season do porcupines become noisy, creating a variety of moans, screams, grunts, and barks.

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Habitat and habits

Although the species of porcupine found in North America always lives among trees, it does not always live in mature forests and may be found in alder thickets along rivers and in dwarfed pine scrub along ridge crests. It is most common where there are rocky ledges and rock piles suitable for dens and stands of aspen, hemlock, and other trees.

Being shortsighted and slow moving, the porcupine is not too difficult to approach once found.

The defensive behaviour of the porcupine is well known though sometimes misinterpreted. If on the ground when danger threatens, the porcupine will make for the nearest shelter, under a rock or log or up a tree, even forsaking its slow walk for a clumsy gallop. If thwarted in such a retreat, it will hump its back, tucking its unprotected head between its shoulders. With all the quills erected, the porcupine will pivot on its front feet and keep its back to the enemy. As it stomps its back feet, it also lashes its tail threateningly. The momentum of the tail may detach loose quills, which fly through the air, giving the impression that they were thrown.

When caught in a trap, a porcupine may, in its struggles, embed its own quills in itself. It removes these quills—or foreign quills from another porcupine—with considerable dexterity using teeth and front paws.

A treed porcupine will survey danger with an air of unconcern, but should the enemy start to climb the tree, the porcupine will back down flicking and lashing its tail.

For much of the year the porcupine enjoys no social life and leads a solitary existence. Porcupines group together for winter denning or food rather than social reasons. Several porcupines may gather around a favoured food, and up to a hundred have been found in large rock piles in winter. At these times they are usually tolerant and ignore each other totally, although there may be some teeth chattering over food. Young porcupines are often playful and shadowbox using their tails. Sometimes even the normally rather sedate adults are known to play.

During winter the porcupine does not hibernate. However, it does not usually move far and feeds within 100 m of its den. During snow or rain it will remain in the den or, if outside feeding, will sit hunched in a tree, even during subzero weather, until the rain or snow stops. When the weather is dry in winter it will feed at any time of the day or night, but during the rest of the year it is nocturnal despite the weather. In summer the porcupine ranges farther from the den, often searching for food up to 1.5 km away. As well as these daily movements within the home range, there may be seasonal movements between winter denning areas and the summer feeding areas. In mountainous country, the porcupines will often descend during the winter along well-defined routes marked by debarked trees. In the spring, they return up the mountainside to summer feeding areas.

Unique characteristics

Aboriginal people dye porcupine quills and use them in decorative work. Before the Aboriginal people moved to reservations they ate a lot of porcupine meat, especially in winter, and later they hunted the porcupine’s worst enemy, the fisher, for its fur.

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Range

The distribution of the porcupine in North America

The porcupine occurs in North America in a wide range of vegetation types from semi-desert to tundra. Porcupines also occur in Africa and Asia, but Old World porcupines do not belong to the same family as New World porcupines.

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Feeding

The porcupine feeds largely on the inner bark of trees in winter, but it will also feed on a variety of other plants. During winter, although the needles and bark of most trees are acceptable, there are clear favorites: yellow pine in the west, white pine in the Great Lakes area, and hemlock in the northeast states. When the sap rises in spring, the bark of maples is favoured along with the catkins and leaves of alder, poplar, and willow. As more plants come into leaf, the porcupine will eat the leaves of herbs and shrubs, such as currant, rose, thorn apple, violets, dandelion, clover, and grasses. Particularly sought after are the succulent leaves of water lily and arrowhead, for which the porcupine will wade out into streams and even swim, its air-filled quills helping it to keep afloat. In the fall, it will eat beechmasts, or beech tree nuts, and acorns and is not averse to raiding cornfields and orchards.

One of the porcupine's best-known and least-liked eating habits is that of chewing wood and leather in and about camps. It gnaws both salty and non-salty objects, which indicates the habit may stem not only from a craving for salt, but also from a need to hone the continuously growing teeth. When human-made objects are not available, the porcupine will chew bones and cast-off antlers.

The porcupine is a slow and deliberate feeder, relying on its nose rather than its eyes to guide its selection of plants. This has sometimes led people to believe that porcupines are stupid. However, porcupines are said to have good memories and to be intelligent animals that are capable of learning quickly.

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Breeding

Porcupines first breed when they are one or two years old. In the southern part of their range they mate in September, but in the more northerly latitudes, in late October to November. The male will follow the female during this period and serenade her with grunts and humming. The female is in heat, or sexually receptive, for only eight to 12 hours and frequently initiates courtship. When she is ready to mate, she indulges in a kind of dance with the chosen male, where they both rise on their hind feet to embrace, all the while whining and grunting. Sometimes they place their paws on each other's shoulders and rub their noses together; then they may cuff each other affectionately on the head and finally push one another to the ground. Mating used to be the subject of considerable speculation and ingenious theories, but the explanation is simple. The female flattens her quills and twists her tail out of the male's way so he can mount in the normal fashion. Mating finishes abruptly and either one of the partners then climbs a tree and screams at the other if further approaches are made.

The gestation, or pregnancy, is about 30 weeks; birth occurs sometime between March and May depending how far north the porcupine is located. The female makes almost no preparations for the birth and does not seek out a nesting den or bed. The solitary baby (twins are almost unknown) may be born in a rock pile, under a log stump, or under a brush pile.

The baby porcupine is well developed at birth: its eyes are open, and the blunt incisor teeth and molars are already exposed. About 30 cm long, it weighs approximately 0.4 kg and is covered in dense black hair. The sharp barbless quills are soft and concealed in the hair. Within hours of birth the quills harden and can be erected. After a couple of days, the baby porcupine can climb, although it tends to spend more time on the ground. After a week or so, the female leaves the baby for longer and longer periods while she feeds on the emerging green plants. Weaning, or making the transition from mother's milk to other food, takes seven to 10 days, although in captivity it may take longer. By the fall, most young porcupines live apart from their mothers.

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Conservation

Being slow moving, the porcupine is a frequent victim in forest fires and on roadways. Injuries from climbing are not uncommon, and diseases, especially rabbit fever, take their toll. External parasites, such as ticks and lice, and internal parasites, round worms, tape worms, and thread worms, are plentiful, although they apparently have no ill effects on the porcupine.

Porcupine quills have been found embedded in several predators, including the coyote, cougar, bobcat, red fox, lynx, bear, wolf, fisher, and Great Horned Owl. Some more experienced predators learn to avoid the quills and kill the porcupine by biting its head or by flipping the porcupine onto its back to expose the unprotected belly. The fisher is the best-known porcupine hunter. It was successfully introduced into some areas of New England to reduce porcupine populations.

European colonists caused a decrease in the fishers, by trapping them and deforesting the southern part of their range. The consequent increase in the number of porcupines coupled with the fact that porcupines damage and even kill some trees led to their being branded as pests. However, a study in a red spruce area in Maine, with 20 to 28 porcupines per 2.5 km^2, showed the loss of trees was only 0.5 percent. They are also considered to be pests because of their habit of gnawing buildings around camps. In areas where porcupines are a problem, they are shot, trapped, or poisoned using salt baits. However, not all that the porcupine eats is upsetting to humans. For example, mistletoe, a parasite on trees, is a favoured food. Also the porcupine's habits of thinning out dense stands of saplings and of killing weed trees are considered to be good forestry practices.

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Raccoon

This animal

- conserves energy during winter through inactivity, not hibernation
- gets its English name from the Algonquian Indian word arakun, meaning "he scratches with his hand"
- develops its familiar facial mask by about 10 days of age, usually before the eyes are open
- is one of the few creatures that appears capable of making the adjustment from family pet back to wild animal

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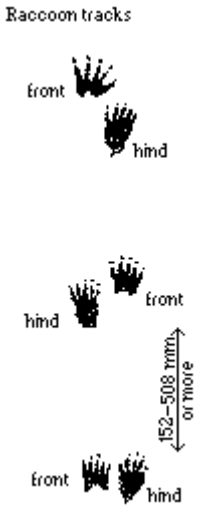
Description

The common raccoon *Procyon lotor* is probably best known for its mischievous-looking black face mask. Raccoons are usually a grizzled grey in colour with a tail marked by five to 10 alternating black and brown rings. Body coloration can vary from albino, (white) to melanistic (black) or brown. An annual moult, or shedding, of the fur begins in the spring and lasts about three months.

The head is broad with a pointed snout and short rounded ears measuring 4 to 6 cm. The eyes are black. Total body and tail length for adults averages 80 cm; males are generally 25 percent larger than females. Raccoons in northern latitudes tend to be heavier (6 to 8 kg) than their southern counterparts (4 kg). However, fall weights for adults have reached 28 kg in some areas.

Signs and sounds



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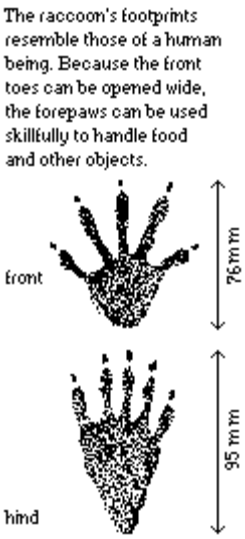
Habitat and habits

Raccoons are able to live in a wide range of habitats. The only apparent requirements are a source of water, food, and a protected area for denning. The best habitats are hardwood swamps, floodplain forests, fresh- and saltwater marshes, and farmland, both cultivated and abandoned. On the prairies, raccoons are most abundant in woodlot and wetland areas. This highly adaptable animal is also very common in many cities of North America.

Movements and home ranges of raccoons vary greatly depending on habitat, population density, and food supply. The home range is the area used by an animal for food, water, and shelter in its normal, day-to-day movements. In rural agricultural areas of eastern North America, home ranges between 1 and 4 km^2 are common, whereas in prairie habitat, raccoons have used areas as large as 50 km^2. At the other extreme, the area used by urban raccoons has been documented at less than 0.1 km^2. Generally, home ranges of individual raccoons overlap, and there is little evidence of territoriality, especially in urban areas.

As with home ranges, raccoon densities vary significantly depending on the type of habitat. Estimates of five to 10 raccoons per square kilometre are common in rural agricultural areas. In urban areas, exceptional numbers of raccoons, as high as 100 per square kilometre, have been recorded. However, densities as low as one per square kilometre may occur in prairie habitat.



In the northern United States and southern Canada, the annual life cycle of raccoons consists of a breeding period during late winter and early spring, a growth and fattening period during the summer and fall, and a winter denning period. In more southern latitudes, winter denning occurs only during periods of poor weather.

Winter denning allows the raccoon to conserve energy in the form of fat reserves when food is not available. This is not hibernation, but a period of inactivity. The body temperature does not drop, and the animal's activity appears to be governed by the air temperature. Preferred denning sites include hollow trees, stumps, logs, caves, vacant groundhog or fox burrows, and buildings such as barns. In city areas, denning sites include residential chimneys, sewers, garages, attics, trees, and culverts. Adult males usually den alone, but the family unit often dens together during the first winter. Communal dens containing as many as 23 raccoons have been reported; however, four to five is more common. Although usually one den is used during the winter, several different dens provide sanctuary during other seasons.

Unique characteristics

The name *raccoon* is derived from the Algonquian Indian word *arakun*, meaning "he scratches with his hand." The species name, lotor, refers to the raccoon's supposed habit of washing food with its front paws. This activity, however, is probably associated with the location and capture of aquatic prey such as crayfish. The behaviour is no doubt innate, because captive raccoons have been observed attempting to "wash" their food in the absence of water.

Because the raccoon can be easily tamed when young, many people have had their lives enriched by a close association with this intelligent, inquisitive animal. Males, however, may become aggressive as they mature and usually end up being returned to the wild. The raccoon is one of the few creatures that appears capable of making the adjustment from family pet back to wild animal.

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Range

Six species of raccoons occur in North, Central, and South America as well as on some of the Caribbean Islands. However, *Procyon lotor* is found only in southern Canada, portions of the United States, and Central America.

The species inhabits all provinces of Canada except Newfoundland and Labrador and is gradually expanding its range northward as land is cleared for agricultural purposes. During the 1930s the raccoon was successfully introduced into Germany and the Soviet Union. Today, its range has expanded to include Luxembourg, West Germany, the Netherlands, and France.

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Feeding

Raccoons are omnivorous and will consume practically any food item, plant or animal. They prefer corn, crayfish, fruits, and nuts, but there is a seasonal shift in diet depending on availability of food items. During the spring, animal matter, including invertebrates, or small animals without backbones, and insects, makes up the major portion of the diet. While they prefer crayfish, raccoons also consume muskrats, squirrels, rabbits, waterfowl eggs, and freshwater clams. In the summer, plant material, including fruits and nuts, becomes more important. Wild cherries, gooseberries, elderberries, wild grapes, strawberries, and garden items such as potatoes and sweet corn are relished. They also eat frogs, small fish, turtles, beetle grubs, grasshoppers, earthworms, crickets, and snails during the summer.

Corn is the mainstay of the fall diet in most areas where it is available; however, acorns, beechnuts, hazelnuts, and grapes are also consumed. Raccoons raid the nests of insects, including hornets, bumblebees, termites, and ants, mainly for the larvae, or immature stage. The raccoon's thick fall and winter coat protects it from the stings of irate adult hornets or bees.

The fall diet is extremely important for raccoons in northern latitudes because they must accumulate sufficient fat reserves to sustain them during winter denning. The raccoon builds up fat over its entire body, even around the tail bone. It may be 2.5 cm thick on the back. In fact, by late fall about half of the animal's total body weight may be fat. In northern areas the raccoon lives on its stored body fat during the winter, but farther south where nuts and corn are plentiful it continues to hunt for food year-round. In suburban areas, raccoons often raid garbage bins or hunt for earthworms, beetles, and grubs on residential lawns. Raccoons can also be a menace to farmers because they may eat domestic fowl and eggs.

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Breeding

The breeding season generally begins in late January or early February in the northern parts of the raccoon's range. Mating tends to take place in March in most areas. Birth of offspring peaks during May, although births have been recorded as early as March or as late as September. Year-round breeding has been reported for raccoons in southern areas.

Male raccoons are polygamous, or will mate with several females in succession. Females, however, are monogamous, and will mate with only one male and will not tolerate other males after mating has occurred. Juvenile females often breed during their first year. Juvenile males, although capable, usually do not have the opportunity to mate until their second year because of competition from adult male raccoons. Litter sizes tend to be larger in the northern part of the range. Between three and seven young per litter are common in northern latitudes; however, litters of two or three young are usually the rule in southern areas. The gestation, or pregnancy, period averages 63 days.

Raccoons are born without teeth and with eyes closed, and they weigh approximately 75 g. The eyes open at two weeks of age, and the teeth erupt at about 19 days. By about 10 days of age the young are already sporting the familiar facial mask and colour patterns typical of the species. The young remain in the maternity den for about eight weeks and then leave to hunt for food with the female, although they still nurse from time to time for almost two months. The adult male plays no role in raising the young.

The family group, which consists of the adult female and young, is quite sociable, hunting for food together during the night and denning together during the day. The mother teaches her young to climb, hunt, and swim during their first summer. The family unit generally remains together until the adult female has her next litter, usually the following spring. Juvenile males often disperse from the adult female's home range, although juvenile females may remain within the vicinity of the mother's range.

The life span of raccoons in the wild is estimated at three to five years; most populations are completely replaced over seven years. However, longevity records of 12 and 16 years have been noted in captivity and in the wild, respectively.

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Conservation

Humans are the major predator of the raccoon. They prize its fur and take between 2 and 4 million pelts annually in North America. As well, automobiles kill thousands of raccoons each year. Another major source of mortality is disease. Since 1983, several thousand raccoons have succumbed annually to rabies in the mid-Atlantic and southern United States. The disease is currently spreading north toward Canada. As well, thousands of raccoons die annually from canine distemper, particularly in eastern Canada and the United States. Parasites such as lice, fleas, and ticks are often found on raccoons, but do not appear to be a significant source of mortality.

Other raccoon predators include pumas, bobcats, coyotes, foxes, dogs, wolves, Great Horned Owls, and fishers. However, they are only a minor source of mortality. Malnutrition and harsh winter weather play a greater role in limiting raccoon populations, especially juvenile animals.

Although some records show that raccoons may be long-lived in the wild, many animals succumb during the first year of life to disease, starvation, wild predators, and trappers. In some areas annual mortality rates for raccoon populations have been estimated at 50 to 60 percent.

Some people see the raccoon as a wily and persistent pest. Raccoons often cause significant damage to agricultural crops such as corn and lesser damage in orchards, vineyards, melon patches, and poultry yards. They are considered undesirable in areas being managed for waterfowl or upland game birds because they destroy nests and eat young. In urban areas considerable damage to residential roofs, garages, gardens, and lawns has been blamed on raccoons. Often the only solution is to remove the offending animals by trapping or hunting. Problem animals are often live trapped and moved to other localities. This practice, however, may contribute to disease transmission. Recent studies have shown that relocated raccoons travel long distances in short periods and are thus an ideal vehicle for transmitting contagious diseases such as rabies.

Habitat improvement for raccoons should include the provision of denning sites such as hollow trees and logs and the planting of crops such as corn as a source of food. However, in city areas little habitat management is needed because the raccoon adapts readily to human-made structures for shelter or sanctuary. Raccoon populations are thriving in most areas, and the species appears secure from any population decline in the foreseeable future.

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Snowshoe Hare

This animal

- can advance up to 3 m in one bound and travel as fast as 45 km an hour
- has up to four litters of young each year
- can reach great numbers—as many as 500 or 600 per square kilometre
- lives in every province and territory in Canada

Photo: Gordon Court

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Description

The snowshoe hare *Lepus americanus*, one of our commonest forest mammals, is found only in North America. It is shy and secretive, often undetected in summer, but its distinctive tracks and well-used trails ("runways" or "leads") become conspicuous with the first snowfall.

Snowshoe hare hind foot

Well-adapted to its environment, the snowshoe hare travels on large, generously furred hind feet, which allow it to move easily over the snow. In soft snow, the four long toes of each foot are spread widely, increasing the size of these "snowshoes" still more. A seasonal variation in fur colour is another remarkable adaptation: from grey-brown in summer, the fur becomes almost pure white in midwinter. The coat is composed of three layers: the dense, silky slate-grey underfur; longer, buff-tipped hairs; and the long coarser guard hairs. The alteration of the coat colour, brought about by a gradual shedding and replacement of the outer guard hairs twice yearly, is triggered by seasonal changes in day length.

The snowshoe hare moults twice a year, beginning in August or September and in March or April. Generally, the hind feet retain patches of white fur into the summer. In the humid coastal zones of southwestern British Columbia, Washington, and Oregon, where snow is infrequent, snowshoe hares remain brown throughout the year.

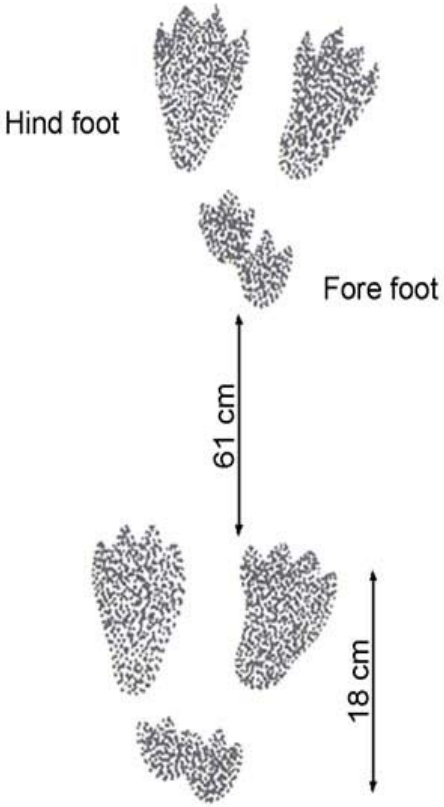
The snowshoe hare's ears are smaller than most hares'. The ears contain many veins, which help to regulate body temperature; for example, desert hares have very large ears with almost no fur, so the blood can cool in the slightest breeze. Because snowshoe hares live in cold environments, they do not need such big ears to help lower their body temperatures.

Jackrabbit hind foot

Female snowshoe hares are often slightly larger than males. Adult snowshoe hares typically weigh 1.2 to 1.6 kg; the hares are usually heaviest during the peak and early decline of the population cycle.

Signs and sounds

Snowshoe hares are generally silent, but they can show annoyance by snorting. On the rare occasions when they are caught, they utter a high-pitched squeal, which sometimes causes surprised hunters to drop them. During the breeding season, bucks and does (males and females) make a kind of a clicking noise to each other. Does also use this sound to call their young to them for nursing.



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Habitat and habits

The snowshoe hare lives in boreal forest, the northernmost forest in the Northern Hemisphere. Its range also extends into mountains in the United States. In eastern Canada and mountainous areas, the forest is predominantly coniferous (spruce and fir), whereas over large expanses of Alberta, Saskatchewan, and Manitoba, the forest is mainly deciduous (aspen and balsam poplar). Snowshoe hares use many forest types. Overall, they prefer areas with a dense understory, or layer of plants below the main canopy of the forest, whether that is formed by young trees or by tall shrubs. This cover helps to protect them from predators and provide them with food.

The home range of a snowshoe hare—the area within which it normally lives—is approximately 6 to 10 ha. Within that range, the hare has an intricate network of trails that criss-cross its territory. These trails, which take the hares between feeding and resting places, are well-travelled, both by the hares and by other species, like squirrels, porcupines, and skunks. Major runways follow the same routes in summer and in winter, and the snowshoe hares keep the trails well-maintained, quickly clipping off stems and leaves which begin to block the runways; they may need these routes to escape predators.

Snowshoe hares are very active between sundown and dawn, and they remain active all winter. Rain, snow, or wind often markedly reduce the hares' activity. During the daytime, the snowshoe hare rests quietly in sheltered spots called "forms," under a bush, stump, or log. It dozes fitfully and grooms itself by licking its fur, but it is always alert.

If it is threatened, the snowshoe hare may freeze to take advantage of its camouflaging coloration, or it may flee. Snowshoe hares younger than two weeks, which cannot yet move swiftly, remain immobile. Older snowshoe hares are likely to flee; often, they will see predators before being seen, and can move away undetected. They travel by bounding, sometimes covering 3 m at a time, and they can travel as fast as 45 km/h. This is one way in which hares differ from rabbits—while hares are likely to run to escape predators, rabbits will dash to underground warrens and hide in them; hares rarely go underground. Linked to this difference in behaviour are some anatomical differences, including the hare's bigger heart, which helps it run.

Unique characteristics

The spectacular cyclic fluctuations of snowshoe hare populations are well known. These remarkably regular fluctuations, which are about 10 years long, can be traced back over 200 years in the fur records of the Hudson's Bay Company. At the population peak, hares can be extremely abundant, reaching densities of 500 to 600 hares per square kilometre. Population peaks occur roughly at about the same time, throughout the snowshoe hare's range, although the timing of peaks may vary by one to three years between regions. Population declines are largely caused by predation.

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Range

Distribution of the snowshoe hare

The snowshoe hare is found in every province and territory in Canada. It lives in the boreal forest and the southern extensions of this forest, along the Appalachian Mountains in the east and the Rocky and Cascade mountains in the west. The snowshoe hare is found as far south as North Carolina, New Mexico, and California. To the north, it reaches the Arctic Ocean in the willow swales, or depressions, of the Mackenzie River delta.

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Feeding

Snowshoe hares consume a variety of herbaceous plants during the summer, including species like vetch, strawberry, fireweed, lupine, bluebell, and some grasses. They also eat many leaves from shrubs. Their winter diet consists of small twigs, buds, and bark from many coniferous and deciduous species. Their geographic range is so large that snowshoe hares in different regions may have completely different diets, depending entirely on the local forest type.

The hares often stand to clip shrubs up to 45 cm from the ground, and as the snow builds, they can clip higher and higher. In peak population years, snowshoe hares may kill saplings and shrubs by girdling, or taking rings of bark from the plants. Snowshoe hares occasionally scavenge meat from the carcasses of other animals. Most small herbivores, including mice, voles, and rabbits, will eat meat occasionally if it is available—good sources of protein are rare in plant foods, so most herbivores eat meat when they can.

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Breeding

Snowshoe hares start breeding during the spring after their birth. The breeding season begins about mid-March with courtship parades. Each female is receptive to males for about 24 hours, first in March, and then the day after giving birth to each litter—two to four times during the summer. During that day, females and males often travel together while foraging, with interludes of active chasing and jumping over each other. Females often breed with several males.

The first litter is usually born in May after a 36-day gestation period. Litters contain anywhere from one to 13 young. The first litter in each summer is usually the smallest, with three to four young. The second litter is often the largest, with an average size of four to seven young.

Snowshoe hares are born fully furred with their eyes open, and they are capable of hopping about almost immediately. Such precociousness is characteristic of hares in general, and is in marked contrast to young rabbits, which are born naked and blind. Young snowshoe hares nurse only once a day, usually in the evening, and are self-supporting at three to four weeks of age. They weigh between 45 and 75 g at birth, gain 450 g within a month, and reach the average adult weight of 1.4 kg by five months.

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Conservation

The snowshoe hare suffers from many diseases—viral, bacterial, and parasitic. It is also the victim of many predators: among the most common are the Canada lynx, red fox, coyote, mink, Great Horned Owl, and Northern Goshawk. Snowshoe hares younger than two weeks of age are killed primarily by red squirrels and ground squirrels. Between 1 percent and 40 percent of snowshoe hares survive each year; the rate varies with the 10-year population cycle. Although snowshoe hares can live to six years old, very few survive that long; they are extremely lucky if they make it to their second summer of breeding.

The snowshoe hare is the most important small game animal in Canada. It is a mainstay in larders of Aboriginal peoples, and on the island of Newfoundland, where it was introduced in the 1870s, thousands of snowshoe hares are snared each year for meat, and they are sold in markets. In the Prairie provinces, on the other hand, non-Aboriginals are reluctant to eat hares. This prejudice apparently stems from the widespread belief that the animals harbour a mysterious disease which causes their cyclic decline.

As one of the dominant herbivores and key prey species within the boreal forest, the snowshoe hare contributes to this ecosystem's diversity. Because they are a frequent prey item, snowshoe hares are critical to maintaining the food web in our forests; indeed, research in Yukon has demonstrated that the snowshoe hare may be a keystone, or central, species. Logging, fire, habitat conversion, and global warming are changing the distribution and quality of forested habitats. The 10-year cycle in snowshoe hares and their predators is a unique, dominant, and large-scale pattern in Canadian forests, and we do not know how habitat alteration will affect it.

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Striped Skunk

This animal

- produces an odour that is strong enough to be carried almost 1 km on the wind
- is one of the most useful small mammals that inhabit Canada's mixed farmlands, grasslands, and forests
- gathers leaves for its den by placing them under its body and then shuffling along with the leaves held between its legs
- annoys farmers by raiding beehives and henhouses, but in fact almost 70 percent of a skunk's diet is estimated to benefit people

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Description

The striped skunk *Mephitis mephitis* is about the size of a cat, but has a stout body, a rather small head, short legs, and a bushy tail. Its small head fits conveniently, but sometimes too snugly, into enticing open jars.

The thick, glossy fur is black, with a thin white stripe down the centre of the face and a broad white stripe beginning on the back of the head, forking at the shoulders and continuing as a white stripe along each side of the back to the base of the tail. The tail is mostly black, but the stripes may extend down it, usually to a tuft of white at the tip.

The skunk has long, straight claws for digging out the burrows of mice, ripping apart old logs for grubs and larvae, and digging in the sand for turtle eggs. It moves slowly and deliberately and depends for safety not on running away or on remaining inconspicuous, but on its scent glands.

Skunks belong to the weasel family Mustelidae, all of whose members have well-developed scent glands and a musky odour. The skunk is outstanding for this characteristic, however, and can discharge a bad smelling fluid to defend itself. Indeed its scientific name, mephitis, is a Latin word meaning bad odour.

Signs and sounds

An angry skunk will growl or hiss, and stamp its front feet rapidly.

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Habitat and habits

The striped skunk is one of the most useful small mammals that inhabit the mixed farmlands, grasslands, and forests of Canada. Unlike many other animals it has adapted well to the presence of humans, and its present range is much expanded since primeval times.

The skunk prefers open areas of mixed forests and grasslands and has very little fear of humans, so it has benefited from the new habitats created by the opening of the forests that accompanied settlement and agriculture.

Skunks generally live in the abandoned dens of woodchucks, foxes, or other mammals of similar or larger size and only occasionally excavate their own dens. They will also use stumps, rock piles, or refuse heaps, or will even set up housekeeping under a house or porch or in a cellar. The latter practice is especially common in farming areas.

Skunks that den under buildings should be trapped outside. Never shoot them under the building. To dispose of unwanted or locally harmful skunks without harming them, box traps may be used. Such traps permit easy handling of the skunks and transportation to more suitable localities for release. Once the skunk is captured the trap may be covered with several burlap bags until it is transported some kilometres away and the skunk released. For information on obtaining such a trap, contact the local humane society.

If a skunk digs its own den it is usually simple, but one taken over from another animal may be quite elaborate. There may be from one to five well-hidden openings that lead to a system of tunnels and chambers. One of the chambers is lined with leaves and used for a nest. The leaves may also be used to plug the openings to the den in cold weather. A skunk gathers leaves by placing them under its body and then shuffling along to the den with the leaves held between its legs as it moves.

Skunks may leave their den to forage, or search for food, at any hour of the day, but are usually abroad from late afternoon or evening through the night. They forage within about 800 m of the den, but may venture as far away as 2 km in a night. Males become more active during the breeding season, when they may travel 8 km in a night.

By autumn skunks have acquired a heavy layer of fat, and in November or December they select a deep den in which to spend the winter. As many as 20 skunks have been found in one den, but the number is typically much fewer. Usually the mother and young den together, entering the den when the temperature reaches about 0° C.

Males are active until the temperature reaches about -10° C and may join their own family, other males, or may den alone. They may emerge briefly from their den at any time during winter. Any grouping of sex and age may be found together in a den.

By late February, in some parts of Canada, skunks begin to awaken from their winter state of torpor, or inactivity, and are fully active by the end of March. On the prairies and in the most northern parts of the range, spring emergence is somewhat later.

Unique characteristics

The scent of the skunk is produced by a thick, yellow, oily fluid, or musk, secreted by two glands located on either side of the anus at the base of the tail. The glands are about the size of a grape and contain about a tablespoon of musk, enough for five or six discharges. The glands are connected by ducts to two small nipples that are hidden when the tail is down and exposed when the tail is raised. The musk is produced rather slowly, at a rate of about one-third of an ounce a week, and is discharged only as a last desperate measure after repeated warning signals.

A skunk is not an aggressive animal and will always try to retreat from a human or other large enemy. An angry skunk will growl or hiss, stamp its front feet rapidly, or even walk a short distance on its front feet with its tail high in the air. The striped skunk cannot spray from this position. To perform that defence it usually humps its back and turns in a U-shaped position so that both the head and tail face the enemy. Many people used to the antics of the striped skunk have been deceived on their first encounter with a spotted skunk, which faces an attacker standing on its front feet with its back and tail arched forward.

The skunk directs the fluid from the glands in a stream that disperses into a fine spray. The spray can reach as far as 6 m and can be aimed with considerable accuracy for up to 3 m. The odour is strong enough to be carried almost 1 km on the wind. At close range the spray of a skunk causes severe smarting of the eyes and even nausea, but these symptoms soon disappear as the nasal passages quickly become desensitized to the odour.

Various remedies are recommended to get rid of the odour on clothing or dogs that have been sprayed by a skunk, but some of the remedies are almost as bad as the musk. Vinegar or a mixture of vinegar and detergent is a simple and quite effective treatment. The Ontario Ministry of Natural Resources suggests the following recipe:
1 l hydrogen peroxide
50 ml baking soda
5 ml dishwashing liquid

Skunks seem to be aware of the repulsiveness of their own odour and refrain from scenting on themselves. They therefore avoid musking in confined spaces, and their dens have little of the skunk odour about them.

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Range

There are three groups of skunks represented by eight species in North America, but only two species occur in Canada. The striped skunk is the one familiar to most Canadians. Its range extends from central Mexico to Nunavut and the Northwest Territories and from the Maritimes to west-central British Columbia.

The hog-nosed skunks Conepatus are confined to the southwestern United States, Mexico, and South America; and the hooded skunk Mephitis macroura occurs in the southwestern United States and Mexico. Of the four species of spotted skunk Spilogale, the eastern spotted skunk Spilogale putorius almost reaches the Canadian border between Minnesota and Manitoba, but only the western spotted skunk Spilogale gracilis actually occurs in Canada. There are a few records of this skunk in southern British Columbia, but only as far as 120 km north of Vancouver.

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Feeding

Skunks are truly omnivorous, eating a wide variety of foods. They eat insects, mice, shrews, ground squirrels, young rabbits, birds' eggs, and various plants. During the autumn and winter they eat about equal amounts of plant and animal foods, but eat mainly insects in the summer. Skunks are especially fond of grasshoppers, crickets, and insect larvae such as white grubs, army worms, and cutworms. They will even eat wasps and bees, which they kill with their front feet. Although they annoy farmers by raids on beehives and henhouses, it has been estimated that almost 70 percent of a skunk's diet is beneficial to people and only five percent is harmful to human property.

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Breeding

Skunks begin to breed in late February or March, when they emerge from their dens, and the young are usually born in early May. There are typically four to six young in a litter, although the number may vary from two to 16.

Newborn skunks weigh about 15 g and, although almost naked at birth, show the characteristic black and white colour pattern of the adult. They are fully haired in about 13 days, and their eyes open after 17 to 21 days.

When the young skunks are approximately seven weeks old the female takes them out to search for food, and at about two months they are weaned, or have made the transition from the mother's milk to other foods. They remain with their mother until autumn and may join her in the winter den.

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Conservation

The scent of the skunk is an effective defence against most natural enemies. Nevertheless, it is preyed upon by bobcats and birds of prey. Most birds, especially hawks and owls, have developed the sense of sight at the expense of their sense of smell; the Great Horned Owl in particular seems relatively unaffected by the scent and has made the skunk its principal prey.

Trappers take 6 000 to 7 000 skunks a year in Canada, but this represents only a small fraction of the total skunk population and has no appreciable effect on numbers.

Motorists are a much greater hazard. Skunks, like porcupines, are overly confident of their defence mechanisms and often pay heavily for the air of unconcern with which they cross highways.

Although skunks may become a nuisance to poultry and bee keepers, the damage they inflict is not economically important and they are beneficial to agriculture. In fact, skunks proved such an efficient enemy of the hop grub in New York State that legislation was passed to protect the skunk. In many parts of their range they are the most important predator on insect pests.

The skunk is a furbearer of minor importance. Its fur, which is thick and lustrous, can be made into coats and jackets, but is used mainly for trimming. Most of the pelts marketed in Canada come from eastern Canada.

In the period following the First World War, when fur prices were high and unstriped black skunks were in great demand, various attempts were made to raise skunks on fur farms. If fur prices had remained at the level they reached during the boom, these ventures might have succeeded, but today the cost of raising a skunk is far more than the pelt is worth. The value of the skunk lies elsewhere. It is an interesting and attractive animal that plays a significant part in nature, especially as a predator of mice and insects.

Skunks are major carriers of the rabies virus, to which all warm-blooded animals, including humans, are susceptible. The occurrence of rabies is a continuing problem in many parts of Canada. Skunks may transmit the disease to other wildlife, livestock, and humans and propagate it among their own kind. Although skunks will normally retreat from a person, the rabid animal will often show no fear. Children in particular should be warned against handling over-friendly skunks.

Medical authorities recommend that a person who comes into contact with a potentially rabid animal immediately wash the wound or exposed surfaces with soap and water. Any clothing that may have been contaminated should be removed, and the person who may have been exposed should speak to a family doctor or go to the nearest hospital emergency department. The doctor who treats the person will notify the local medical officer of health. The disease can be prevented if the person who has come into contact with a rabid animal seeks treatment promptly.

Rabies is a reportable disease under the Health of Animals Regulations. This means that anyone who suspects that a skunk has rabies is required by law to report the animal. If the skunk is available for testing, the nearest office of the Canadian Food Inspection Agency, which is listed in the blue pages of the telephone book, should be notified. An inspector from the agency will investigate all calls.

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White-tailed Deer

This animal

- is the most widely distributed and the most numerous of all North America's large animals
- leaves its fawn unattended for hours at a time
- may have difficulty surviving the winter, particularly if there are too many deer competing for food or if snow is deep
- occasionally gets its antlers hopelessly entangled with those of another male during a mating season battle, resulting in the slow death of both animals

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Description

The graceful white-tailed deer *Odocoileus virginianus* is well known to most North Americans. Hunters and nonhunters alike recognize the animal by its habit of flourishing its tail over its back, revealing a stark white underside and white buttocks. This "flag" of the white-tailed deer is often glimpsed as the high spirited animal dashes away from people. The tail has a broad base and is almost a foot long. When lowered, it is brown with a white fringe.

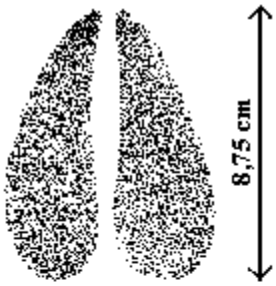
In summer, the white-tailed deer has a reddish pelage, or fur, on its back and sides and is whitish beneath. In winter the upper parts turn greyish. Full grown male deer frequently exceed 1 m at shoulder height and 110 kg in weight, with exceptional individuals weighing up to 200 kg in the northern part of their range.

The antlers of the mature male white-tail consist of a forward curving main beam from which single points project upward and often slightly inward. Perhaps one of every 1 000 females also bears small, simple antlers.

The white-tailed deer is hard to distinguish from the black-tailed deer. The black-tail has similar antlers and will sometimes show the characteristic "flag" of the white-tail but usually with less flare. Fortunately, for identification purposes, the black-tailed deer occurs only west of the Great Divide (its Canadian range is coastal B.C. and Vancouver Island), where the white-tailed deer is uncommon.

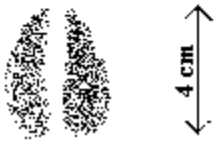
Confusion is less likely between the white-tailed deer and the darker stockier mule deer. The mule deer can be distinguished by a small white tail with a black tip and antlers that divide and redivide into paired beams and points. It also has large ears that are more like those of a mule than those of its more delicate cousin. Unfortunately people in different parts of Canada have given these two types of deer the same nickname, "jumper." In the Prairies the mule deer is dubbed "jumper," in recognition of its stiff-legged bouncing gait. Elsewhere people may mean the white-tail when they use the term, referring to that animal's irregular jumping gallop when alarmed.

Signs and sounds



Buck

Doe



Fawn

White-tailed Deer Droppings

Moose Droppings

Rabbit Droppings

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Habitat and habits

Abundant food makes almost any forested or bushy area suitable for white-tailed deer during the summer, but as snow deepens the deer concentrate in "deer yards," or areas that provide food and shelter from storms and deep snow. Sometimes the move from summer to winter range requires travelling many kilometres.

Unique characteristics

The doe leaves her fawn unattended for hours at a time. When the fawn remains bedded, the natural camouflage of its spotted coat and its almost scentless condition effectively conceal it from predators. The doe returns at intervals to suckle the fawn.

People sometimes chance to find fawns in their secluded hiding places and mistakenly believe they have been deserted by their mothers. In fact, a doe will rarely desert her fawn, and the little animals should not be touched. Human scent on the fawn may cause the doe to desert it.

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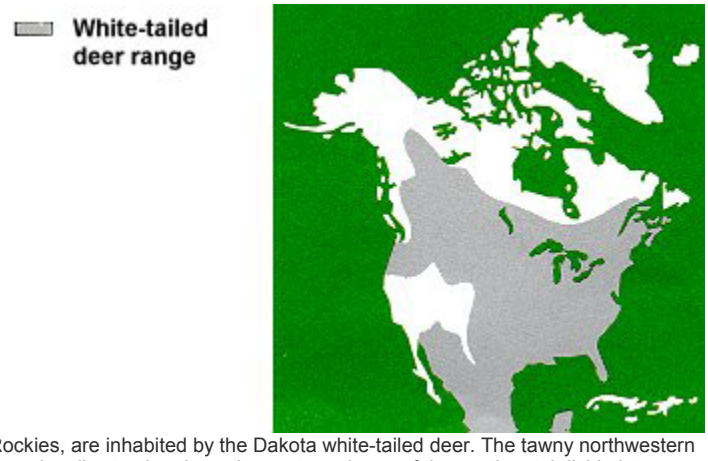
Range



Of all North America's large animals, the white-tailed deer is the most widely distributed and the most numerous. Its range extends from the southern tip of the continent northward well into the boreal, or northern coniferous, forest. Scattered individuals occur as far north as Great Slave Lake. In southern Canada, the white-tailed deer can be found from Cape Breton Island westward to south-central British Columbia. There were at least 15 million white-tails in Canada and the United States in 1982. Average densities throughout its range exceeded three deer per square kilometre.

There are 16 recognized subspecies of white-tailed deer in North America. Only three of these are found in Canada. The northern white-tailed deer is found throughout eastern Canada, from about the Ontario-Manitoba border eastward to Cape Breton. The brushy draws (valleys), parklands, and forest fringes of the prairies, westward to the foothills of the Rockies, are inhabited by the Dakota white-tailed deer. The tawny northwestern white-tailed deer is found in southeastern British Columbia, occasionally straying down the eastern slopes of the continental divide into Alberta.

White-tailed deer are relative newcomers to much of the range they now occupy in Canada. When Europeans first explored the northern half of the continent they found deer in only the most southerly parts of Canada and this situation had not changed much at Confederation. At that time there were no deer in Nova Scotia and they were not numerous in New Brunswick. Deer were in southern Quebec and their range extended some distance down the St. Lawrence River and up the Ottawa River. Although deer were numerous in southern Ontario, none had penetrated northward beyond Lake Nipissing. There were a few white-tailed deer in south-central Manitoba, but most of the remainder of the Prairie Provinces was populated by only the mule deer.

Since then human activities, including the cutting and burning of blocks of forests, the seeding of agricultural crops, the winter feeding of cattle, the reduction of competitors such as mule deer, elk, moose, and bison, and the restriction on hunting of white-tails have helped this deer to extend its range northward and westward. Long-term easing of the severity of winters may have been an important factor. Whatever the exact combination of causes, the range of the white-tailed deer extended considerably during the late 19th and the first half of the 20th centuries. Extension of range and development of substantial populations have been somewhat more recent in Saskatchewan, Alberta, and British Columbia than elsewhere in Canada. Thus, the current range of most white-tailed deer in Canada represents a marked recent extension of northern limits. It is not surprising, therefore, that severe winters and changes in habitats cause marked sporadic declines in population levels through much of the currently occupied Canadian range.

The white-tailed deer shares some parts of its western range with its relations the black-tailed deer and the mule deer.

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Feeding

During the spring and summer the white-tailed deer's diet consists of leafy material from a variety of woody plants, grasses, herbs, and forbs. It also includes such delicacies as fiddleheads, mushrooms, and blueberries. When summer's lush vegetation turns brown and dry in autumn, the deer must depend largely on the twigs and buds that are within their reach. Acorns are a favourite autumn food for white-tailed deer living in eastern Canada, and in Western Canada grain piles left in fields attract white-tailed deer throughout the autumn and winter. Even in winter white-tailed deer consume green forage, such as winter-green forbs, grasses, and sedges.

Even the most favourable winter concentration areas have a limited food supply. If there are too many deer using the area, the most nutritious fodder disappears rapidly, leaving foods of only marginal value for the remainder of the winter. Deep snow worsens the problem. When snow is deeper than 40 cm, deer find it increasingly difficult to move about freely and tend to follow previously broken trails. The quantity and quality of food that can be reached from these trails further limit nutritional intake at the very time that intense cold and difficult travel tend to increase the deer's energy requirements.

Converting surplus fat stored during the late summer and early autumn meets some of this energy requirement, but once this remaining source of energy has been depleted, there is less likelihood of the deer surviving until spring. If food remains scarce and the deer begin to break down muscle tissue for energy, then the chances of survival become extremely poor. It is not surprising that those that do survive a severe winter return to their summer ranges as little more than gaunt shadows of their sleek autumn form. The green growth of spring brings welcome relief.

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Breeding

Deer reproduce quickly. A healthy herd is capable of almost doubling its numbers during one favourable year. Under favourable conditions, female fawns tend to breed at six to seven months and at 12 months of age produce singletons, or one baby. Male fawns and male yearlings are sexually mature but are seldom given a chance to breed.

The white-tailed deer's spotted, wobbly legged fawns, weighing 2 to 4 kg at birth, are born in late spring. Although birth may take place from late March to early August, most fawns are born during the last week of May or the first week of June. On high quality range twin fawns are the rule, although single births are quite common among younger females, especially those giving birth for the first time. Triplets are relatively uncommon and quadruplets occur only rarely. On poorer ranges or after a severe winter single births usually outnumber double births and multiple births do not occur.

The newborn fawn can get to its feet within minutes, and very soon takes its first nourishment from the doe's rich milk; however, it remains relatively feeble during the first week or so of its life.

As the fawn grows stronger it begins to follow the mother about during her feeding and soon learns to supplement its milk diet by nibbling on succulent vegetation. The doe, meantime, like other adult members of the deer herd, has been feeding steadily on new spring vegetation. She has entered the spring period in lean condition and with a shabby, tattered winter coat. Gradually the coarse grey winter coat is replaced by the fine reddish summer coat. Improved food supply results in both doe and fawn becoming sleek and sturdy by midsummer.

In the early spring the antlers of the male begin to show as twin dark protrusions from the frontal bones of the head. Growth of the antlers and regaining of body weight continue rapidly through the late spring and early summer. Antlers are true bones and during growth have both an internal supply of blood through the pedicels, or branches, and an external supply in the hairy skin covering of the velvet. In late summer during advanced growth the antlers appear bulbous and distended under the velvet. The shortening days of late summer terminate growth of the antlers.

The velvet dries and begins to peel off, revealing the hard bony tissue beneath. Bucks rub their antlers against brush and small trees to speed this process. The antlers are usually shed in January although shedding may occur from December through March.

White-tailed deer are truly magnificent specimens in the early autumn. Their bodies are rounded out by reserves of fat stored for the lean months ahead. The new thick winter coat exaggerates the thickness and sturdiness of the body. Fawns have lost their spots and are now short-faced, smaller replicas of their parents. Most of the breeding occurs during the last three weeks of November although some fawns and yearlings breed in December and, rarely, into January. The peak of the rut, or period of male sexual activity, occurs during the last two weeks in November in Canada but is more variable in the southern U.S. Bucks with swollen necks, caused by hormones associated with the rut, travel almost incessantly, searching out the does and engaging in mock battles with their rivals. Sometimes a real battle develops, and occasionally the antlers of the combatants become hopelessly entangled, leaving both to die slowly.

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Conservation

Deer in Canada are relatively free of serious diseases or parasites. In much of their range their natural predators, such as the timber wolf, coyote, bobcat, and mountain lion, have been greatly reduced in number and infrequently exert substantial pressure on the deer. Most of the predation on fawns occurs during the first few weeks of life. Free-roaming dogs do sometimes take a heavy toll on deer of all ages, particularly in late winter when crusted snow aids the dogs but hinders the weakened deer.

Although a series of severe winters may tend to shrink the range of the white-tailed deer in Canada, a few favourable years permit it to rebuild substantial populations, and even extend its range farther northward.

Maintaining healthy stocks of white-tailed deer is primarily a matter of keeping numbers of deer in balance with their supply of winter food. People engaged in activities that alter the landscape can improve the availability of food and shelter for deer, particularly during harsh winters. For example, logging in the forest, which normally favours deer by opening the high canopy so that new growth will start on the forest floor, can be made even more beneficial to the deer if cover is left in place to shelter them from the deep snow. In eastern Canada, hemlock is the best cover, followed by cedar, balsam, spruce, and pine. In areas where brushy or woodland cover is scarce, such as on the prairies, suitable habitat can be saved from land clearing for agriculture.

Given adequate food and shelter, healthy deer populations grow rapidly if the annual increment of animals is not hunted. Overpopulation invariably leads to pressure on food supplies, which results in malnutrition, even in the face of heavy predation. Too many deer can do immense damage to their winter range, depleting suitable browse species and sometimes preventing regeneration of valuable forest trees. Moderately heavy hunting helps prevent these natural catastrophes by holding deer numbers in check while, at the same time, providing recreation and valuable meat.

Surveys indicate that the legal kill of white-tails in 1978 was 125 000 in Canada and 1 875 000 in the U.S. By 1982, the legal kill in the U.S. had risen to about 2.6 million.

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Wolf

The wolf

- has a highly organized social structure centring on a dominant male and a dominant female
- has been exterminated in many parts of North America
- works hard for its food—a pack kills only about one large mammal for every 10 chased
- howls as a form of communication among packs

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Description

It is virtually impossible to describe the typical appearance of the wolf *Canis lupus*. Wolves of many large arctic islands and Greenland usually appear snow-white from a distance, but closer up often reveal grey, black, or reddish shades. Wolves of northern North America and Eurasia vary in colour. A single pack may contain animals that are black, shades of grey-brown, and white. Wolves in the heavily forested areas of eastern North America are more uniform in colour. They are often a grizzled grey-brown, similar to some German shepherd dogs.

This colour variation is a good example of natural selection, a process that enables those animals best suited to a particular environment to survive. On the arctic islands, where much of the ground is snow-covered for at least nine months of the year, being white is a distinct advantage, so wolves in the Arctic may be nearly white. In the mottled grey, green, and brown world of the eastern forests the normal coat of the wolf is an effective camouflage. As a wolf moves stealthily, or rests, it blends into the background and is hardly seen.

Wolves in the Arctic have extremely dense underfur, which insulates them against rigorous winters. Another adaptation to environment is their habit of hunting in packs, or groups, which enables them to kill large animals, such as deer, elk, moose, caribou, bison, and muskox.

Signs and sounds

The howling of a wolf pack is one of the most awe-inspiring wilderness sounds. It is a form of communication among wolf packs.

Wolves often howl spontaneously at a rendezvous site, or place where the pack meets. This howling may be a form of "song-fest," for the wolves apparently enjoy it. In one instance, a pack of arctic wolves separated from some pups by a fast-flowing river howled frequently for several hours. As they did so, the pups moved anxiously along the river bank. This howling seemed to be a form of calling or coaxing. Howling by a pack may also be a way of warning other packs to keep away from occupied territory and may serve to separate packs.

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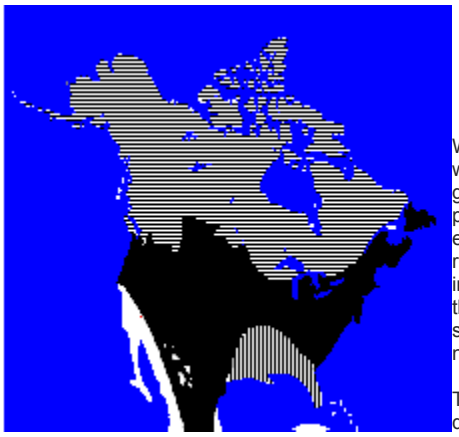
Habitat and habits

Distribution of the wolf *Canis lupus* in North America

Present range

Former range

Former range of the red wolf *C. rufus*



Wolves are territorial. Each pack occupies an area that it will defend against intruders. Sizes of territories vary greatly and are dependent on the kind and abundance of prey available. When neighbouring packs trespass into each other's territories, fights often ensue that frequently result in the death of pack members. Subordinate wolves in the hierarchy are often forced out of the packs. When this happens, the lone wolves may find mates, then search for unoccupied areas where they can establish new packs.

The wolves' habit of hunting in packs has resulted in the development of complex patterns of social behaviour. Wolves are social animals: they not only hunt in packs or groups but live most of their lives with other wolves. Studies in Alaska, Minnesota, Michigan (Isle Royale), and parts of Canada (Algonquin Provincial Park and Jasper, Banff, and Wood Buffalo national parks) show that a family made up of male, female, and pups is the basic pack unit. Other adults are pups of previous years or, more rarely, adults from other packs. Adolescent wolves have been learning to hunt for at least a year, so can probably hunt big game animals, wolves' usual prey, with the rest of the pack.

Studies of wolf packs in captivity show a highly organized social structure centring on a dominant male and a dominant female. A dominant wolf holds its tail high, stands stiff-legged, and bristles its mane. In its presence, a subservient animal cowers on the ground with its ears back or stands with its tail between its legs, maintaining a slinking posture.

The pack bond is strongest during winter, when the wolves travel and hunt together. In summer, when the pups are young, the adults seldom go on long forays. They may hunt together occasionally after meeting at the den or home site where the pups are being cared for.

Unique characteristics

The wolf was once a much maligned animal. In the western world, people feared and hated wolves, and this legacy is reflected in stories such as *Little Red Riding Hood* and *The Boy Who Cried Wolf.* In these popular children's tales the wolf is made out to be a marauder and a killer of livestock and people.

There is some basis for *The Boy Who Cried Wolf,* for wolves have killed cattle and sheep. But what of *Little Red Riding Hood*? There are no records of wolves killing humans in Canada or the United States. Yet, when wolves were spotted near rural communities, fear used to grip the residents. Over time this has become less prevalent. Today, many people know that scientists studying wolves have lived very close to dens where there were pups without being attacked. They have even taken pups from a den without being molested. The parents have usually run away, returning later only to take their young to a more private den or to a rendezvous site.

In areas where wolves are hunted or trapped they fear people and are very wary. However, in remote places, such as in the Canadian Arctic, they show little fear and will often allow people to live near them.

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Range

Two hundred years ago wolves, also known as grey wolves, were more widely distributed than any other mammal of historic times. They lived in large areas of North America, Europe, and Asia; the only places they could not occupy were deserts, tropical rain forests, and peaks of the highest mountain ranges.

Wolves still live in large areas of the Northern Hemisphere; however, their primitive range has been greatly reduced due to changes in the landscape and people's efforts to exterminate them.

In North America, wolves have been exterminated in the Atlantic provinces, Mexico, the United States (except Minnesota, Alaska, and some of the western states), and the heavily populated areas of southern Canada. They are still common in lightly settled portions of Canada from Labrador to British Columbia and in the Yukon Territory and the Northwest Territories.

The red wolf *C. rufus* was once common in the southeastern United States. It has been eliminated in the wild. However, through a captive breeding program, the species is being reintroduced into its former range.

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Feeding

Wolves' chief prey are large mammals such as deer, moose, caribou, elk, bison, and muskox. Wolves also eat a variety of smaller mammals and birds, but these rarely make up more than a small part of their diet.

Wolves work hard for their food. They have to. Studies show that they kill only about one large mammal for every 10 chased. In winter, they usually kill old or young animals when these are available, but when prey numbers decline wolves prey on all age groups, and it may take the entire pack to bring an animal down. In summer, much of the wolves' diet consists of young animals born that year, because they are easiest

to catch.

In winter, scientists can study the hunting behaviour of wolves from aircraft, using radio transmitters, or by following their tracks in the snow. More recently, scientists have used collars that monitor movements by satellite technology.

Opportunities for watching summer hunts are rare, so much less is known about hunting habits in this season. Because wolves usually travel alone or in pairs in summer, much of the hunting may be of a different nature. Stealthy stalking may play a large part in summertime hunting, according to one scientist who has studied wolves intensively.

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Breeding

Wolves differ from domestic dogs in their reproductive cycles. Male dogs can breed at any time of year and females every six months, whereas both male and female wolves in the wild can breed only once a year. In captivity, male wolves can successfully breed with more than one female. Breeding time varies with the latitude but most commonly occurs in March and April. After a nine-week gestation, or pregnancy, period, litters of five or six pups (sometimes eight or more) are born.

Wolves usually reach sexual maturity in their second year. It is possible for younger animals to have pups, but this is not normally the case. A pack may include several mature females that can produce pups.

Wolf pups are usually born in a den. In coniferous forests and on tundra this den is commonly dug in a type of soil that lends itself to digging, such as in an esker, or gravel ridge caused by glacial meltwater, or similar area. In mixed forest areas the den may be located in an old pine stump or rock crevice. The pack usually remains at the whelping, or birthing, den for a month or more unless it is disturbed.

The pups remain inside whelping dens for approximately two weeks. When they begin to move around outside, another member of the pack may sometimes babysit while the parents go hunting. Occasionally, the pups are left alone for a day or longer at a time. By mid-autumn they are travelling with the pack and participating in hunting and other pack activities.

Frequent play helps young wolves develop hunting skills. Mature wolves can set up ambushes or drive prey toward other wolves. These learned, or non-instinctive, skills originated in their clumsy attempts as pups to hide behind obstacles and then jump out at each other. Even in winter, after they are almost fully grown, pups continue to play in a variety of ways, such as chasing around a tree in a forest opening or having a fast-moving game on a wilderness lake with a piece of wood or garbage as the prize.

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Conservation

People have long practised population control and extermination of wolves. At times, governments have paid a sum of money, called a bounty, for each animal killed. In Canada, the first bounty payment was made in Ontario (then Upper Canada) in 1792. Eventually bounties were paid in every province and territory inhabited by wolves, but by 1973 they had been discontinued at the provincial and territorial level, except in the Northwest Territories. When Ontario repealed the wolf bounty in November 1972, it was replaced by the Wolf Damage to Livestock Compensation Act, which makes cash payments to farmers whose livestock is damaged by wolves or coyotes. In Quebec, bounties are occasionally offered by certain municipalities; however, since 1984 trapping and hunting of wolves is only allowed during part of the year. British Columbia and the prairie provinces now use traps and poisons to kill wolves inhabiting areas where they may threaten livestock or game populations.

Wolves prey on big game animals and help to control their populations. Where wolves are absent (for example, Anticosti Island, Pennsylvania, and Wisconsin), white-tailed deer have overpopulated their ranges and damaged forests. Food shortages and mass starvation of deer during the winter sometimes follow. Where wolves remain, hunting by humans and easier access to big game in wilderness areas has led to increasing competition between people and wolves for game animals, as elk, moose, deer, and caribou numbers decline.

Wolves have already been exterminated in many places. However, there may be less danger of such excesses in the future, as wolf control is increasingly based on biology rather than emotion. There is now a greater awareness among hunters and others that the killing by wolves of deer and other prey species, which we may want for ourselves, is not a sufficient reason for the extermination of wolves. Sometimes populations of game animals are critically low, so on biological grounds wolf control could be justified; however, control programs are always opposed by ever-increasing urban populations. Proposed wolf culls have become major political issues in many areas in North America. When controls are carried out, they need to be done to meet certain criteria, which are based on sound scientific information and stewardship of wildlife populations.

In wilderness ecology, wolves play an important role. And from a human point of view, the great interest and value of having this intelligent animal as part of our wilderness heritage should be sufficient justification for allowing it to survive in a wide variety of wilderness and semi-wilderness areas of Canada.

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Wolverine

This animal

- generally prefers remote areas, far away from humans and development
- can travel up to 40 km during its daily hunting activities
- is known by a variety of descriptive names, including “skunk-bear,” because it marks its food and various landmarks with urine and musk
- has one of the most striking pelts of all fur-bearing animals

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Description

Although the wolverine *Gulo gulo* belongs to the weasel family, Mustelidae, it is not long and lean like a weasel, but short and thick, like a small bear. Its head is broad and round, with small eyes and short rounded ears. Its legs are short and sturdy, with five toes on each foot. Its long, curved claws are semi-retractile, which means they can be partly drawn back in, and they are used for climbing and digging. Its teeth are strong, and its head, neck, and shoulder muscles are well developed. These adaptations allow the wolverine to feed on frozen flesh and bone, and they provide a clue as to how wolverines survive.

An adult wolverine is about the size of a medium-sized dog. Adult males weigh about 12 to 18 kg, adult females about 8 to 12 kg. Wolverines that live in the north of their range are usually larger than those living farther south.

The wolverine has one of the most striking pelts of all fur-bearing animals. Its fur is typically a rich, glossy, dark brown. Two pale yellow stripes originate at the nape of its neck and sweep along each flank to merge at the base of its long, bushy tail. White or orange patches are common on the chest or throat. The wolverine’s toes, forepaws, or legs may occasionally be marked with white.

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Habitat and habits

Within its range, the wolverine occupies many different kinds of habitats. Wolverines generally prefer remote areas, far away from humans and their developments. However, the specific characteristics of the wilderness that the wolverine depends upon are not yet known. Labrador and Quebec, for example, have not been recolonized by wolverines, despite the abundance of caribou and undisturbed habitat. This lack of knowledge about wolverine habitat makes it difficult for wildlife managers to manage the species and protect its habitat.

One specific type of habitat wolverines need is the den used by the female to give birth and raise her kits. Finding such a den is difficult. Most dens that have been found are in tundra regions and consist of a complex of snow tunnels associated with boulders or rocks. The configuration of the rocks results in natural cavities under the snow, which form dens for the wolverines.

Studies are expensive and difficult to conduct because of wolverines’ large home ranges and low densities. It is not surprising that we are still learning about the biology and behaviour of this species. Some of the mysteries have been dispelled with the help of studies in Alaska, Montana, British Columbia, Yukon, and Nunavut of wolverines equipped with collars that allow their movements to be monitored using satellites.

The home range of an adult wolverine extends from less than 100 km^2 for females to over 1 000 km^2 for males. These home ranges are the largest reported for a carnivore of this size, and in many areas they rival the home ranges of bears, wolves, and cougars. The size of the home range varies depending on the availability of food and how it is distributed across the landscape — the more food there is, the smaller the home range needs to be.

The density of wolverines ranges from one individual per 40 km^2 to one per 800 km^2. Those regions that have the most different kinds of habitat and prey, particularly those that include large ungulates, or animals with hooves, contain the most wolverines. The mountainous and forested areas of British Columbia and Yukon have the highest densities, although these numbers are still low compared with the densities of other carnivores. Densities of wolverines in Manitoba and Ontario are lower. The rarity of wolverines becomes readily apparent when their density is compared with the density of other solitary carnivores: one coyote per 0.5 to 10 km^2 and one grizzly bear per 1.5 to 260 km^2.

Wolverines can travel long distances during their daily hunting activities, up to 40 km, with males travelling farther than females. They have traditional routes, and they revisit the same places every year. Wolverines are constantly on the move, unless they have found a kill site. The young leave their home range, or disperse, when they become sexually mature, at about one or two years of age. These dispersal movements can be extensive, 300 km and more for young males. The young females settle within or next to the area where they were born.

The wolverine is known by a variety of descriptive names, including “skunk-bear,” because it marks its food and various landmarks with urine and musk, a fluid secreted from its anal glands, and “glutton,” because of its voracious appetite.

The wolverine has been described as the fiercest creature on earth and a fearless aggressive fighter that will drive bears away from their kills. It is, in fact, the wolverine’s reliance on scavenging in order to survive that has given rise to exaggerations about its gluttony and

ferocity.

The wolverine is also a creature important in the folklore of North American First Nations peoples and a mammal very well adapted for its way of life.

Because of its reputation and conflicts with trappers, the wolverine was considered a pest by European North Americans, an attitude that persisted into the 1960s. Today, wolverines' numbers are greatly reduced in some areas, and conservation biologists and wildlife managers consider wolverines to be animals in need of protection.

Unique characteristics

Few people, even those who spend a lot of time outdoors, have seen wolverines in the wild. This contributes to the animals' mysterious reputation and explains why they are probably the most misunderstood and one of the least known of Canada's wild animals.

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Range

The wolverine is found throughout all northern regions of the globe. Wolverines are not abundant anywhere, even where they do well. The species is known for a large home range and low density, which is a measure of its numbers. The Committee on the Status of Endangered Wildlife in Canada considers wolverines found west of Hudson Bay to be of "special concern" and the eastern population, found in Quebec and Labrador, to be "endangered."

Historically, before the appearance of Europeans in North America, wolverines occurred throughout Canada and Alaska, with some small extensions of this range into the western United States and into the Great Lakes area. They occupied a wide variety of habitat types, excepting very dry, hot areas.

A portion of the wolverine's historical range has been lost. Wolverines have also disappeared from areas with relatively intact habitats. Eastern Canada and the western United States have been particularly hard hit. Wolverines disappeared most rapidly at the edges of their distribution and in Eastern Canada. We do not know if any wolverines still occur in Eastern Canada, although Labrador and Quebec are still considered part of the current distribution. Similarly, whether wolverines still occur on Vancouver Island is unknown.

There are two main reasons why wolverine populations disappeared from parts of North America. The first is that wolverines are scavengers—which means they feed on carrion, or dead animals—and are attracted to bait. Because the wolverines damaged traplines, early trappers used any means to kill them, including poison. The extensive wolf poisoning programs that occurred throughout Canada beginning in the late 1700s also killed many wolverines.

The second, and more important, reason for the decline of wolverine populations is that wolverines have a low resiliency because of their low densities and low reproduction, or the number of young that are successfully produced and raised. This means that wolverine populations have a difficult time rebounding once their numbers have been lowered by either nature or human-influenced factors.

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Feeding

The wolverine is a carnivore, or flesh eater. It is more of a scavenger than a hunter, and is usually dependent on other carnivores, such as wolves, to kill the animals for it to eat. Leftovers from a wolf kill can be considerable. The wolverine has been known to carry away moose carcasses and caribou heads. Because of its great dependence on carrion, or dead flesh, from large mammal kills, the wolverine needs to be able to survive long periods without food. It will revisit old kills to consume frozen bones and pelts when it cannot find other food.

Some individual wolverines can become good hunters and can kill young and adult ungulates, or animals with hooves, such as caribou and even moose, if the prey is in poor physical condition or if the wolverine has manoeuvred it into a disadvantaged position, such as in heavy snow.

Since ungulates are not always available, wolverines must have a diversity of prey in their diet to survive. Female wolverines with young, or "kits," rely on small mammals, such as marmots and ground squirrels. As the movements of family groups are restricted, food must be found in a smaller area. Snowshoe hares, especially when they are particularly abundant, are an important food source for all wolverines. Wolverines hide excess food by burying it or stashing it in rock crevices or in trees.

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Breeding

Wolverines mate in the summer and reproduce by what is known as “delayed implantation.” The egg is fertilized, but its development temporarily stops. The egg floats around in the uterus and implants some time later, as early as November or as late as March. The active period of gestation, or pregnancy, lasts 30 to 40 days. Birth occurs between February and May.

The female gives birth to and raises her kits in a den. Most dens that have been found are in tundra regions and consist of a complex of snow tunnels that have formed naturally around rock configurations.

Wolverines can have as many as six kits, but they typically have three or fewer. Not all of the young survive their first year: some die of starvation, others from predation. Wolverine kits grow quickly compared to the young of other mammals. This rapid rate of growth continues after the mother stops nursing her kits, which happens at nine or 10 weeks of age. Kits reach the size of adults by seven months of age.

When food is scarce, a high percentage of a population will not have young. In fact, some females may not reproduce even when food is apparently abundant, because raising young results in a large loss of energy for wolverine mothers. The mechanism of delayed implantation, which allows wolverines to have young when food is most abundant and to adjust the size of the litter to the availability of food, is an effective way of reproducing without sacrificing precious energy.

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Conservation

Wolverines have few natural predators, but they are occasionally attacked and killed, although seldom eaten, by wolves and other large carnivores. Eagles have been known to take young kits. Wolverine mothers go to great lengths to find secure dens for their young, suggesting that predation may be important in some areas. During the mating season, fights between resident males and other males can occur as they compete for females. It may be this fighting that encourages the young males to disperse considerable distances.

Scavenging is a difficult way to survive. Many young, inexperienced wolverines and very old wolverines die from starvation, even if food is abundant. Transients, typically young adults passing through the territory, have a higher mortality rate than residents, because they do not benefit from hunting in a familiar home range.

The wolverine pelt remains one of the most prized furs because of its beauty and because frost brushes off easily. The Inuit and Dene of northern Canada use wolverine fur as trim and lining for their clothing, such as parkas, mitts, and moccasins. Over 80 percent of all wolverine pelts sold in Canada—about 400 to 600 each year—come from the Northwest Territories, Nunavut, Yukon, and British Columbia. Wolverine fur is consistently high in value: a well-handled and prime pelt sells for an average of $400.

Roads that permit human access to wolverine habitat can be detrimental to wolverine populations, especially if the animals are also killed by trapping or hunting. In areas where logging occurs, wolverines may use the forested corridors adjacent to roads to get to other parts of their home ranges. This makes them vulnerable to trappers who use the same roads to set their traps. Major roads, like the Trans-Canada Highway, can also keep wolverines from reaching important parts of their habitat.

Denning females are sensitive to disturbance, particularly human activity. Even the presence of careful researchers has caused wolverines to abandon their dens. The increasing use of snowmobiles and skiing in the vicinity of wolverine dens, such as in subalpine mountainous regions, can harm wolverine populations. However, in tundra areas, female wolverines have tolerated human activity without abandoning their dens.

A number of zoological organizations and individuals have been successful in raising wolverines in captivity. Researchers have learned much about wolverine behaviour from studying these captive animals. It has been suggested that wolverines raised in captivity could be used in reintroductions, where wolverines are moved to a new region in order to increase or augment existing populations or assist in the recovery of endangered populations. The success of wolverine reintroductions depends on many factors. There must be a sufficient supply of animals, and reintroduced animals must originate from the same habitat, environmental conditions, and genetic stock (to protect those characteristics that have allowed them to adapt to those environmental conditions) as the animals they are joining.

A recovery plan is being written to examine the options for the survival of the eastern Canadian wolverine population and the measures necessary to achieve its recovery. In other regions of Canada, trapping can be a concern in areas where safe places or refuges for wolverines need to be maintained, especially if an increase in population numbers is required. Trapping must be excluded over a very large area to protect a sufficient number of resident wolverines. Protection of denning habitat from human disturbance may also be critical for wolverine survival.

Wolverines are subject to the same habitat threats that affect other large carnivores in Canada, like the grizzly bear. The wolverine does not appear to thrive in habitats that have been permanently altered by land-based activities, such as agriculture, urban and industrial development, and human settlement. The problem does not appear to be the actual loss of habitat or the presence of humans. Instead, the problem seems to be the breaking up, or fragmentation, of the wolverine habitat, as well as the increased human access to the habitat. Studies of wolverine ecology do not suggest that wolverines cannot co-exist with certain land-use activities, such as forestry and mining. However, where such activities occur, especially if they are coupled with trapping, low-density wolverine populations can have a difficult time surviving or growing. Even higher-density populations, such as those in the mountainous areas of British Columbia, can be negatively affected by human access and trapping.

The future of the wolverine in Canada is of international importance. At present, Russia, Canada, and Alaska maintain the only large and relatively secure populations left in the world. Within North America, the species’ long-term survival in the western United States is

dependent upon maintaining continuity with wolverines in British Columbia and Alberta. Success at retaining wilderness in Canada may be the key to maintaining and restoring the wolverine throughout its range.

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Canadian Wildlife Service, Species at Risk

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Woodchuck

This animal

- is sometimes completely black or completely white
- is one of Canada's largest true hibernators and the subject of a great deal of medical research
- spends much of its time eating and sunning when not hibernating or caring for young
- is the major hole-digging mammal over much of eastern North America, and in some places in the west, providing all sorts of animals with shelter

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Description

The woodchuck *Marmota monax*—sometimes called groundhog—is a rodent and belongs to the large group of mammals Rodentia, which includes squirrels, prairie dogs, and chipmunks. Within this large group the woodchuck is considered one of the marmots.

Among North American rodents, only beavers and porcupines are larger than the marmots. Woodchucks are stocky little animals with a flattened head. They commonly weigh 2 to 4 kg, and large ones may be heavier in the autumn. They measure 40 to 65 cm total length, including a short bushy tail about 15 cm long. Fur colour varies from place to place and between individual animals. It ranges from yellowish to dark reddish brown, with an intermediate brown colour being the most common shade. The fur is usually grizzled in appearance because of light-coloured tips on the hairs. The belly fur is commonly straw-coloured and the feet black.

Woodchucks are occasionally found with melanistic or albino fur. The fur of melanistic specimens is completely black. Albinos, on the other hand, have no colour in their fur at all, and even their eyes lack pigmentation, merely showing a pinkish tinge from blood vessels near the surface. Being white, they are conspicuous, and usually fall easily to predators.

Because woodchucks are burrowing mammals, their feet have sturdy claws and their legs are thick and strong. Their forefeet, the principal ones used for digging, each have four well developed claws, and the hind feet have five. They escape from enemies by diving into burrows, which may account for the fact that their top running speed does not exceed 15 km per hour.

A close relative of the woodchuck's, the hoary marmot or whistler, lives in the mountains of western North America, from Washington, Idaho, and Montana northward into Yukon and Alaska. It inhabits tundra, alpine meadows, and rock slides in mountains. Two other marmots, very closely related to the hoary marmot, but differing from it in colour, live only on high portions of Vancouver Island and the Olympic Peninsula. The rockchuck, or yellow-bellied marmot, found from California, Texas, and New Mexico to British Columbia and southwestern Alberta, is another close woodchuck relative. Where the woodchuck is brownish, this somewhat smaller cousin tends to be yellowish. It favours rockier country and higher elevations (over 3 000 m) than the woodchuck, but it is also found on agricultural land in foothills and valleys.

Scientists recognize as many as nine varieties or subspecies of woodchuck, mainly based on subtle differences in colour or skull characteristics.

Signs and sounds

Woodchucks seem constantly on the alert when outside their burrows and give a shrill warning whistle when alarmed. When fighting, seriously injured, or caught by an enemy, woodchucks give a squeal. They also produce a sound by grinding their teeth. In addition, woodchucks can give a low bark, but the function of this particular sound is unknown.

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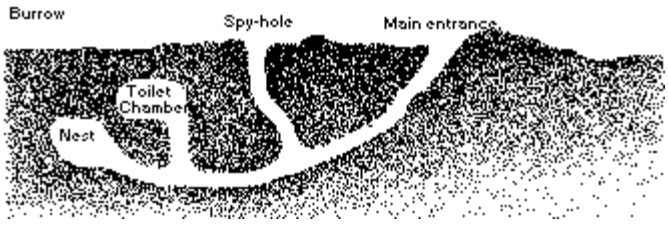
Habitat and habits

Woodchucks prefer open areas such as fields, clearings, open forests, and rocky slopes. They generally dig their burrows in areas where luxuriant grasses and other short-growing plants provide food. They tend to avoid damp or swampy areas.

Summer burrows are often in the middle of pastures and meadows, and the animals will have a denning burrow, used only in the winter, in woody or brushy areas nearby. Winter burrows, whether separate or part of a woodchuck family's main burrow system, are usually deep enough to be located below the frost level.

Burrows usually have a main entrance, one or more "spyholes" for added safety from enemies, and separate toilet and nesting chambers. The same nest is used for sleeping, hibernation, and as a nursery. It is made of dry grass in a chamber that may be 45 cm wide and over 30 cm high.



When not hibernating or caring for young, woodchucks spend much of their time eating and sunning. They love to stretch out on warm ground, a smooth rock or along a low branch of a convenient tree. Their tree climbing ability is limited, however, and infrequently used.

In preparation for their long winter sleep, or hibernation, woodchucks grow enormously fat towards the end of the summer. They begin hibernation with the onset of freezing weather, the adults before the young ones, who probably need extra time to put on sufficient fat to see them through the winter. The first adults to hibernate disappear late in September, and all woodchucks are underground in October.

Hibernation is a process of deep comatose sleep. Bodily functions are greatly retarded, allowing the accumulated body fat to nourish the animal throughout the winter. Body temperature may drop to 3°C (just above freezing), and the heartbeat will drop from its normal rate of about 80 beats per minute to only four or five. The breathing rate and consequent consumption of oxygen are also much reduced. When the animals emerge in the spring, they generally still have a good deal of body fat left. This is necessary because emerging in March, as many of them do, they find little food about them. They may even burrow up through snow to reach daylight. Several weeks may pass before the snow is all gone and there is abundant fresh green plant growth to eat.

Because they are among Canada's largest true hibernators, woodchucks are the subject of a great deal of medical research. Scientists are studying their ability to lower their body temperature, reduce their heart rate, and reduce their oxygen consumption.

Unique characteristics

Woodchucks are the major hole-digging mammals over much of eastern North America, and in some places in the west. All sorts of animals are able to thrive because of the shelter supplied by woodchuck holes. The list includes a wide variety of fur and game animals, some of which destroy huge quantities of farm pests, such as rats, mice and insects. Skunks, raccoons, foxes, rabbits, and snakes all take shelter in woodchuck holes.

On the second of February each year, much of North America observes Groundhog Day. On that day, according to folklore, the woodchuck awakes from its long winter sleep and comes out of its den. If it sees its shadow it will go back in, and we will have another six weeks of winter. If it does not see its shadow it will remain awake and active, and we will have an early spring. This popular old legend apparently came to North America with early settlers from Europe, where it is believed in some parts that bears or badgers behave in the same manner. Although most people recognize that the legend has no basis in fact, it provides a welcome mid-winter diversion, which is usually promoted by the news media. In reality, most woodchucks do not come out of hibernation until March, or even later in the north.

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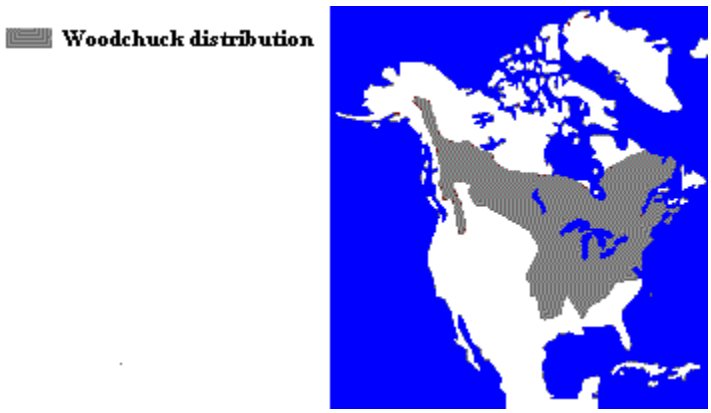
Range



Woodchucks are widely distributed in North America and are particularly common in the east where they are found from Alabama and Georgia in the United States to northern Quebec and Ontario. In the west, their range extends northward to Alaska and through southern Yukon and Northwest Territories. Woodchuck distribution is spotty everywhere on the edges of the range.

The woodchuck, like a small number of other animals (for example, the coyote), has prospered because of deforestation and agriculture. Before the felling of the forests of eastern North America, the woodchuck population was many times smaller than it is today. When large numbers of European settlers began to farm what had once been dense forest, woodchuck numbers skyrocketed among the woodlots, pastures, and cultivated fields. Although farming has been abandoned in many parts of eastern Canada, today's landscape of mixed bush and pasture still suits these familiar burrowing mammals.

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Feeding

Woodchucks prefer to eat fresh green vegetation. They eat a wide variety of wild plants, clover and alfalfa, and garden vegetables if they can get them. On rare occasions, they eat snails, insects, or young birds that they come upon by accident. Early in spring they eat bark and small branches.

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Breeding

Young woodchucks are born in April and May (in Canada, mainly in May) following a gestation, or pregnancy, period of 30 days. One litter, usually with four young, is produced per year. Woodchucks are blind and helpless at birth, about 10 cm in length and about 30 g in weight. At about 28 days old, their eyes are open, and they are covered with short hair. They are weaned, or have made the transition from mother's milk to solid foods, when they start to emerge from the burrow at five to six weeks of age. Woodchucks grow rapidly. They weigh 570 g at eight weeks of age and become very fat for hibernation. Woodchucks have been known to live for 10 years, although the average life span is probably much less.

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Conservation

Woodchucks are a natural prey for large carnivorous animals, such as bears, wolves, lynx, bobcats, and cougars; however, these major predators are scarce or absent in the predominantly agricultural landscape, where most woodchucks live. The principal woodchuck predators today are foxes, coyotes, and dogs. Woodchucks, curiously enough, can be fierce and determined fighters in defence of their lives and would probably be a match for any fox that was unable to take them wholly by surprise. There are many records of a woodchuck having held a dog the size of a collie at bay and driven it off.

Many farmers consider woodchucks to be nuisance animals, because of the vegetation that they eat, and because the piles of earth that they throw up while digging interfere with haymaking. Woodchucks do compete on a small scale with farmers' cattle for food and occasionally get into people's vegetable gardens. But the view that woodchucks are therefore pests, to be exterminated where possible, is nearly always a short-sighted one which overlooks the benefits of having the animals about.

To many hunters, particularly in eastern North America, woodchucks are valuable game animals. Some hunters simply waste the carcass of the animal they shoot, but a growing number are learning that fried, roasted, or stewed woodchuck can be tasty. Late summer and early fall are the common woodchuck hunting seasons. Sometimes woodchucks are trapped for their fur, but it is generally of low value. Many are killed on highways. Although not frequently tamed, the animals make affectionate pets.

Finally, woodchucks are a link with the wild for people who spend more and more time in artificial surroundings. Even just catching a fleeting glimpse from a car of one of these dumpy mammals standing by its roadside burrow can be a much-needed reminder of how satisfying it is to have wild animals around.

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