The Beaver's Needs

In Forillon National Park, slope is the main factor determining whether a beaver settles on a particular waterway. Sixty-two (80%) of the colonies identified in 1991 were located on waterways with a gradient of less than 3%. Streams with high gradients (i.e. greater than 6%) were for all intents and purposes avoided by the beavers. This is primarily because these swift-flowing waterways impair dam construction and maintenance. Topography is thus an important consideration for beavers when setting up a colony.

The surface area drained by a river, an indicator of its magnitude, is also a determining factor. Beavers are less likely to settle on a river with a drainage area greater than 15 km2, as these tend to be swift flowing. Vegetation, another key component of the beaver's habitat, does not seem to be a limiting factor in Forillon. In fact, changes brought about to the forest cover have probably contributed to the increase in the beaver population.

A Landscape Transformed

Beaver activities have a significant effect on the park's aquatic and forest ecosystems. The building of dams and subsequent increases in water levels affect a site's hydrology, soil and waterside plant life as well as the abundance and diversity of terrestrial and aquatic species that are found there.

Beaver's lodge

Once it is built, sediments and organic materials accumulate upstream from a dam. This accumulation leads to an increase in bottom-dwelling invertebrate populations, which feed on this debris. By felling trees at the edge of a river, beavers increase the amount of sunshine reaching it, thus increasing the water temperature. This phenomenon increases plankton density in the water column, and consequently the number of aquatic invertebrates that feed on them.

The first species to benefit from this increase in productivity is the brook trout. As well as increasing the amount of food available, beaver ponds serve as rest areas and overwintering sites for this species. But the beaver's activities are not always helpful for fish. In the long run, the accumulating sediments on the pond bottom and the increased water temperatures decrease the amount of dissolved oxygen available for the brook trout. Most researchers, however, agree that the beaver's activities are generally beneficial to freshwater fish.

The river otter, the American mink and the belted kingfisher are among the predatory species found in this environment. They all feed, to varying degrees, on brook trout.

Beaver ponds also attract several species of aquatic birds, such as the wood duck and the black duck, as well as some migratory birds that depend on these newly created habitats to feed, breed and rest.

The changes brought about to the pond's and the adjacent bank's plant communities also benefit some large mammals. Moose and white-tailed deer feed on the aquatic plants and the abundance of young shoots that appear after a beaver colony has settled. As for black bears, they are more interested in the abundance of wild berries that can be found in these new forest clearings.

Living in Harmony with the Beaver

However admirable the beaver's work, it is not always compatible with human activities. Dams can cause serious damage if they are built near trails and roads. The park's Natural Resource Conservation Service uses a number of techniques to resolve these conflicts while at the same time making sure it accommodates the beaver's needs.

One technique involves placing drainage pipes through a dam to maintain the water at an acceptable level. Erecting an artificial dam for beavers to build on is another technique used to keep them from constructing their dams against a trail or road. As a last resort, if none of these methods prove effective, the Natural Resource Conservation Service can consider relocating the beaver colony.

An Increasingly Important Species in the Ecosystem

Apart from man, the beaver is probably the species that modifies its environment the most. In Forillon National Park, the expansion of beaver colonies contributes to the creation of transitional forest communities and wetlands.

Considering the forest surface that a colony may affect and the number of active and inactive colonies counted in the park, it was estimated that close to 14.6 km2 of forest have been affected by the beaver (6% of the park's total area). This demonstrates just how important this species is as a component of forest renewal in the park's ecosystem.

In 1991, the ponds created by active beaver colonies represented almost 18 ha of lentic habitats (still waters). This is approximately equivalent to the total surface area of all the lakes in the park.

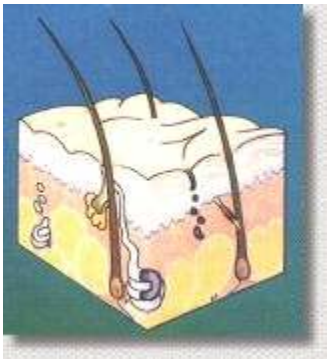
A Conservation Challenge

Preserving the beaver population and that of all species in the park, as well as controlling and regulating conflicts between humans and nature, are part of the mandate that Parks Canada implements to manage wildlife. By protecting beavers in Forillon National Park, they also give the park's many visitors the opportunity to observe this species in its natural habitat.

The Natural Resource Conservation Service regularly follows up on colonies which are found to be in conflict with the park's installations. An update of the status of Forillon's beaver population is undertaken every five years. This information serves to monitor population fluctuations and evaluate the need for further research on this species. Such studies are essential to increasing our understanding and improving the management of our ecosystems and their components.

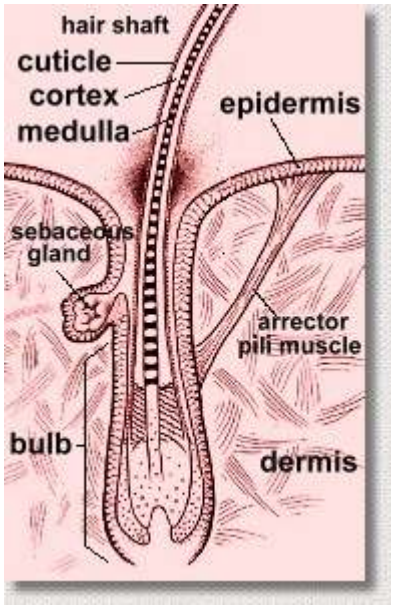
Hair!

Hair and fur can be found only on mammals, and all mammals have at least some hair or fur on their bodies at some time in their lives. On this page we're going to look closely at human and mammal hair.



The outer layer of your skin is called the **epidermis**, and it's full of holes. There are pores, sweat glands, and **hair follicles**, which are the pits from which hairs grow. Follicles extend well down into the **dermis**, or 'underneath skin', and grow from a **bulb**, or root.

Hair follicles are often next to a **sebaceous gland**, which releases oil to lubricate and protect the hair **shaft**. The follicle holding the hair shaft is also connected to a small muscle, called an **arrector pili muscle**, which can cause the hair to stand erect, and which also pulls down the skin into a little pocket. This is what happens when you get 'goosebumps'. Animals can control this muscle ... a dog can make its hairs bristle out, and a porcupine can raise its quills ... but humans can't. It's an **involuntary** muscle.



A hair shaft is made from a protein called **keratin** (the same one your fingernails are made from), and has three layers. The outer skin of a hair, called the **cuticle**, is made from dead cells that form scales, and give the shaft strength. Inside the hair is a layer called the **cortex**, which provides the colour, and inside that is the the **medulla**.

At the bottom, under the skin inside the follicle, the hair root produces the **cells** that form the living part of the hair. This all happens inside the bulb. This new growth pushes the

cells that already exist up and out from the follicle. As the hair is pushed upwards through the skin, the hair loses its DNA and becomes just a strand of proteins. This protein strand (the hair you comb or brush) is **not living tissue**. The only *living* parts of hair are the cells within the hair follicle, under the skin.

The **colour** of hair is determined, just like your skin, by how much **melanin** is in the cortex of the hair. Melanin is a protein, and there are several kinds; one of them is a pigment (it has a dark colour). Black hair has lots of this pigment; white hair has none.

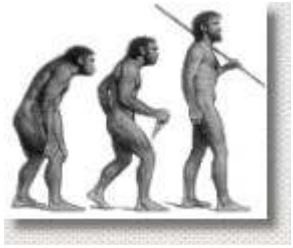
Animals actually have several kinds of hair, or fur. Guard hairs lay over the inner fur to protect it. Sometimes these guard hairs can be very unusual. For example, the guard hairs on a porcupine are its spines. On a lion, some of the guard hairs are long and thick, on its mane. The guard hairs of a polar bear are translucent, allowing light to penetrate to the skin.

Underneath the guard hairs is the fur, which can be three kinds ... underfur (which is always growing), regular fur that is short, and velli (down, or fuzz).
Animals also have hairs called *vibrissae*, or whiskers. These are straight and stiff, and are connected to nerves below the skin which are very sensitive. They provide the animal with information about its immediate surroundings.

Most hair, on humans and animals, is continually being shed, or lost, as it falls out. This is called **molting**, and humans do it too! An animal may shed all its hair in just a few weeks, which will be replaced by hair of a different colour or texture, perhaps because it is becoming an adult, or perhaps in preparation for a change in the weather. They do this only in certain seasons.
In humans, however, hairs fall out only a few at a time, and all year long. Hairs are constantly molting and being replaced.

What is hair for? Here are some reasons why animals have thick, coloured hair:

- insulation to keep heat in during cold weather
- camouflage, helping the animal hide from predators
- signals to other animals (eg: the deer's white tail)
- protection from injury
- warnings to other animals that it is dangerous (eg: the skunk's colours)



Human hair no longer serves these purposes, of course, since we've been using technology (even if just a club

and fire) for a few million years, and our survival has become less dependent on body hair; we've evolved into people who are much less hairy than we used to be.
The hair we *do* have comes in many different forms: scalp hair, facial hair, body hair, armpit hair, and pubic hair. But mostly human skin is now relatively hair-free, compared to animals. Various types of body hair are different in structure and chemical make-up. Hair also varies in shape, length, and rate of growth. For example, scalp hair or male facial hair is not at all like the fine, downy hair found on the face of infants or females. Sunlight, hormones, temperature, and nutrition all affect the rate of hair growth and its strength, as does body location ... for example, head hair grows fastest, averaging about a third of a millimetre per day, or a centimetre per month.

Species at Risk - Piping Plover

Piping Plover, Prince Edward Island National Park of Canada .

How do species become "at risk"?

All plant and animal species have their own particular role to play as parts of global ecology. However, sometimes situations or conditions arise which have an impact on the ability of a species to survive and prosper. The piping plover (*Charadrius melodus melodus*) is a small migratory shorebird that returns each spring to nest on the shores of Prince Edward Island, as well as in other parts of the Atlantic Provinces and in the Magdalen Islands of Quebec. The piping plover has been listed as ***endangered*** by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) since 1985.

Endangered species: one which faces imminent extinction or extirpation (Canadian Wildlife Service).

The plover faces challenges common to many species in nature. For example, seasonal storms or spring tides, natural predators and the possible future effects of global warming (rising sea levels) are all limiting factors on the success of the species. However, the greatest challenge for the recovery of the species is loss of habitat, which is most often an effect of human use of beaches, including disturbance by people and their pets of nesting sites and the surrounding areas.

What are we doing to help?

2002 marked the 25th year that Parks Canada has been monitoring the plover population in this national park. This means that the information collected to date represents an impressive study on a particular species at risk. In Prince Edward Island, Parks Canada staff work closely with the Canadian Wildlife Service (see " ***Banding*** ") and the Island Nature Trust. In recent years, more of the plovers on the Island have begun to nest on beaches located outside the national park. The Island Nature Trust is responsible for monitoring and protection for plovers nesting in these areas. They achieve this through an ambitious program of piping plover guardians.

Parks Canada staff work closely with the Canadian Wildlife Service .

One of the reasons domestic animals are prohibited from beaches in Prince Edward Island National Park from April 1 - October 15 each year is to help ensure a more secure habitat for piping plovers (and other shore birds). Other national parks such as Kouchibouguac in New Brunswick have similar protection policies. Plover nests are so well camouflaged that people or their pets can trample them without knowing it. The perception of predators or other threats can cause plovers to expend their energy, sometimes unnecessarily, in defending their territory.

A team of “Plover Monitors” has been at work in Prince Edward Island National Park since 1982. Plover monitors in the national park begin their observations when the birds arrive around mid-April. They spend the next several months monitoring nesting sites, collecting information which becomes part of the ongoing recovery effort for plovers and their habitat.

Plover nest or "scrape" with eggs .

A day in the life of a Plover Monitor

While in the field, plover monitors watch for the presence of predators or tracks, evidence of human use, other shorebirds and recording weather and tide conditions. Jennifer's typical day begins at 8:00AM. She stops at the office to collect the gear she'll need; field notes, binoculars, scope, food, water, sun screen and maybe a jacket, since the coastal weather can be unpredictable. After a thirty minute walk from the closest access point, she arrives at the first nesting site. This particular morning, she is able to observe one of the plovers foraging at the edge of the water. Its mate is sitting on the nest. This nest has four eggs and has been recently covered by an exclosure. While observing, Jennifer remains still and low to the ground at a distance, enabling her to observe the nest but not cause disturbance to the birds. All appears well at this site.

The situation is not as good at the next site, located about twenty minutes walk away. The plovers are calling and running frantically on the beach. A couple have gone in the closed area to sun bathe. Jennifer approaches them and explains why they will have to leave the area. Just as they are leaving, another couple comes along in the direction of the closed area, so Jennifer waits to answer any questions they might have. These people are more aware about the plovers and had hoped to catch a glimpse of one. The birds have calmed down slightly and are feeding at the water's edge. Jennifer explains that they should not approach the birds too closely to avoid further disturbance.

Jennifer needs to count the eggs in this nest, or at least see if the nest is still there; but she doesn't want to pinpoint the exact location of the nest so that people may discover it. When no one is around, she is able to find the nest and verify that there are three eggs, although there are fox tracks within 3 metres of the nest. Jennifer will recommend the use of an exclosure at this site and will make arrangements with her coworkers to return soon to install one.

Setting up a plover exclosure. An exclosure is designed to allow plovers to come and go easily, and to keep out predators, allowing the birds an added degree of protection while nesting .

Banding

One of the most useful tools in the monitoring of recovery efforts for the piping plover is ***banding*** . The Canadian Wildlife Service initiated a banding program in 1998, and Prince Edward Island National Park has participated ever since. Before the band is applied, its number is recorded with the date and location. This has made it possible to gain some interesting insights into the behaviour of the plover. For example, in 2002, a female plover banded in May in Prince Edward Island was found roosting in Little Talbot Island in Florida in October!

Banding a plover .

Doing the math

In 2002, there were fewer piping plovers on beaches across Prince Edward Island (101 compared to 112 in 2001). There was an increase in the number of nesting pairs (45 compared to 41 in 2001), which means more birds found mates and built nests. Things are improving at a very slow rate. It will take time, patience and the cooperation of many individuals and groups to continue the progress of recent years.

What you can do to help:

It's easy for you to participate in the piping plover recovery effort. Ensuring an undisturbed nesting area goes a long way to fostering a successful recovery for this species at risk. If you find

yourself on a beach where piping plovers are nesting you can help by respecting closed areas and by informing others about the plover and its plight.

In Prince Edward Island National Park, a sign program is used to inform and educate park users and visitors, in particular for closed areas on beaches when plovers are nesting. When visiting beaches in the park, watch for the following signs:

Watch for these types of signs when visiting beaches in the park.

On beaches outside the park, this is the sign to look for:

On beaches outside the park, this is the sign to watch for .

Pileated Woodpecker

Dryocopus pileatus ORDER: PICIFORMES FAMILY: PICIDAE

IUCN Conservation Status: Least Concern

© Warren Greene/CLO

Nearly as large as a crow, the Pileated Woodpecker is the largest woodpecker in most of North America. Its loud ringing calls and huge, rectangular excavations in dead trees announce its presence in forests across the continent.

At a Glance

Measurements

Both Sexes
Length

15.7–19.3 in
40–49 cm

Wingspan

26–29.5 in
66–75 cm

Weight

8.8–12.3 oz
250–350 g

Cool Facts

- The Pileated Woodpecker digs characteristically rectangular holes in trees to find ants. These excavations can be so broad and deep that they can cause small trees to break in half.
- A Pileated Woodpecker pair stays together on its territory all year round. It will defend the territory in all seasons, but will tolerate floaters during the winter.
- The feeding excavations of a Pileated Woodpecker are so extensive that they often attract other birds. Other woodpeckers, as well as House Wrens, may come and feed there.
- The Pileated Woodpecker prefers large trees for nesting. In young forests, it will use any large trees remaining from before the forest was cut. Because these trees are larger than the rest of the forest, they present a lightning hazard to the nesting birds.

Habitat

Forest

Found in deciduous or coniferous forests with large trees.

Food

Insects

Insects, primarily carpenter ants and wood-boring beetle larvae, fruits, and nuts.

Nesting

Nesting Facts

Clutch Size

1–6 eggs

Egg Description

White.

Condition at Hatching

Naked and helpless.

Nest Description

Cavity in tree, usually dead tree. Cavity unlined except for wood chips.

Nest Placement
Cavity

Behavior

Bark Forager

Gleans from branches, trunks, and logs. Makes deep rectangular excavations in trees and logs. Pries off long slivers of wood to expose ants.

Conservation

status via IUCN

Least Concern

Pileated Woodpecker populations declined greatly with the clearing of the eastern forests. The species rebounded in the middle 20th century, and has been increasing slowly but steadily in most of its range. Only in Arkansas do numbers seem to be going down.

Vernal pools

Photo courtesy of Woodlot Alternatives, Inc.

Vernal pools or "spring pools" are shallow depressions that usually contain water for only part of the year. In the Northeast, vernal pools may fill during the fall and winter as the water table rises. Rain and melting snow also contribute water during the spring. Vernal pools typically dry out by mid to late summer. Although vernal pools may only contain water for a relatively short period of time, they serve as essential breeding habitat for certain species of wildlife, including salamanders and frogs. Since vernal pools dry out on a regular basis, they cannot support permanent populations of fish. The absence of fish provides an important ecological advantage for species that have adapted to vernal pools, because their eggs and young are safe from predation.

Species that must have access to vernal pools in order to survive and reproduce are known as "obligate" vernal pool species. In Maine, obligate vernal pool species include wood frogs, spotted and blue-spotted salamanders (two types of mole salamanders) and fairy shrimp. While wood frogs and mole salamanders live most of their lives in uplands, they must return to vernal pools to mate and lay their eggs. The eggs and young of these amphibians develop in the pools until they are mature enough to migrate to adjacent uplands. Fairy shrimp are small crustaceans which spend their entire life cycle in vernal pools, and have adapted to constantly changing environmental conditions. Fairy shrimp egg cases remain on the pool bottom even after all water has disappeared. The eggs can survive long periods of drying and freezing, but will hatch in late winter or early spring when water returns to the pool.

Ruffed Grouse

This bird

- can hover and make complete turns in the air when flying through thick bush
- attracts females and warns off other males by making a drumming sound with his wings
- does not migrate, living all its life within a few hectares
- can spread its toes to help it travel over deep, soft snow

Back to top

Description

The scientific name for the Ruffed Grouse is *Bonasa umbellus*. Both terms are from the Latin: *Bonasa* means good when roasted and *umbellus*, a sunshade. This refers to the ruff or dark-coloured neck feathers that are particularly large in the male. When he is in display before the female, these are erected and surround his head almost like an umbrella. By nodding his head and ruffs, and spreading his tail and strutting, the male identifies himself to the female and encourages her advances.

The male Ruffed Grouse is about the size of a bantam chicken and weighs about 500 g. The females are smaller. Unlike the chicken, the grouse has a broad flat tail that is usually held down but that may be erected and spread into a half circle.

The dappled and barred plumage ranges in colour from pale grey through sombre red to rich mahogany. In the east, most grouse are predominantly grey, although some are red. Greys are in the majority in the central parts of the continent, and on the west coast most grouse are reddish brown.

The colours worn by the grouse are related to their habitat: the dark-coloured grouse inhabit dark forest, as on the coast; grey grouse live in lighter bush. This camouflage helps protect the grouse from their predators.

Males are hard to tell from females at a distance, but they are larger with larger ruffs and a longer tail. In the male the broad band of dark colour in the tail is usually unbroken.

The Ruffed Grouse is frequently called the "partridge." This leads to confusion with the Gray, or Hungarian, Partridge, which was introduced to Canada from Europe. The Ruffed Grouse is only distantly related to the Gray Partridge, which is a bird of open areas, not woodlands.

Signs and sounds

In the spring, the male Ruffed Grouse makes a throbbing *put put put put purrrrr* sound that resembles a far-off motor boat—hence, his nickname of "drummer." Native people called the Ruffed Grouse "the carpenter bird" because they thought it drummed by beating its wings against a log. The sound is actually made by the male bird cupping his wings and rapidly beating them against the air. It is generally believed that the drumming warns other male grouse to keep away and attracts hens when they are ready for mating. Beating a fist on the ground may stimulate the bird to drum.

Grouse droppings are long, curved cylinders, about the thickness of pencils. Drum logs are easily identified by the piles of droppings on them. Droppings and feathers show where grouse have been, roosted, or paused in hiding. Where there is sand and rotting wood, grouse will make depressions and tracks, which show their dust bathing and passage. In winter, tracks and roosts in the snow and bits knocked from trees are additional clues that show the presence and activity of grouse.

Habitat and habits

The Ruffed Grouse is common throughout most of Canada. It does not migrate and, once established, lives all its life within a few hectares. Its large size, rich colours, and the explosive burst with which it takes flight are distinctive.

It is found wherever there are even small amounts of broad-leaved trees, especially poplars, birch, hop-hornbeam, and alders, which provide the catkins and buds that are its staple winter food. The deciduous trees, important as food and shelter to the Ruffed Grouse, frequently occur in the early stages as forests grow back after logging or forest fires. It is likely that there are more Ruffed Grouse now than before European settlement, because much coniferous forest has been cut or burned and succeeded by aspen and other trees favoured by grouse. In many areas the increase in Ruffed Grouse has been at the expense of Spruce Grouse, a conifer-loving relative.

The Ruffed Grouse is adapted to a life in hardwood bush and forest. Its well-adapted beak, legs, wings, and gut permit it to feed by browsing on buds, leaves, and twigs. The bird is an excellent climber among slender branches and on thin, yielding stems. Essentially a ground dwelling bird, the Ruffed Grouse is also expert at short, rapid, twisting flights and can actually hover and make complete turns in the air—all useful traits for flying through thick bush.

A good winter for the Ruffed Grouse is one with soft, deep snow that lasts. If the snow cover is inadequate or has a hard crust, or if there are long periods of cold and wind, grouse cannot find enough suitable protection. They are forced to seek shelter in clumps of thick conifer. Under these conditions grouse lose weight and many fall prey to hawks and other predators. Some grouse may starve; others freeze to death.

Male and female Ruffed Grouse live separately. The male establishes himself among other male grouse by drumming and fighting. He stays on his territory throughout his life, chasing other males away and courting females on the areas occupied by established males. The male's display—or drumming—post, on which he drums to warn other grouse away and to attract female grouse, is often atop a large moss-covered log at the edge of a forest opening. Near these display posts, males find all the necessities for life, such as roosts, shelter from weather and predators, food, and places to dust bathe.

The hens live alone throughout the forest, but they do not display themselves, and they move over a larger area than the males. Wildlife biologists who have attached small radio transmitters to the backs of hens have found that the hens cross trails with each other and may travel through the territories of several males.

Unique characteristics

The Ruffed Grouse is specially adapted to handle winter weather. Where the snow is deep, soft, and persistent, grouse travel over it with the help of their "snowshoes"—lateral extensions of the scales of the toes. They also burrow into the snow, which keeps them warm and protects them from predators.

Range

The deciduous forest habitat of the Ruffed Grouse occurs right across Canada from east to west, and from Alaska in the north to northern Georgia in the south.

Feeding

The Ruffed Grouse feeds on buds, leaves, and twigs. Catkins and the buds of such broad-leaved trees as poplars, birch, hop-hornbeam, and alders are its staple winter food. The chicks feed heavily on insects at first but will always take succulent vegetation. By August, they are eating a variety of flowers, soft leaves, berries, and seeds. Clover is particularly attractive to young grouse.

Breeding

Spring is mating time. The hens must find the food they need to produce good eggs that will result in healthy young. When they are ready to mate, hens are attracted by a drummer and will mate with him. Both males and females mate with any grouse that presents itself at this time.

After mating, the hen selects a nest site, which may be some distance from her mate and even on the territory of another male. Her nest is always on the ground and usually at the base of a tree, stump, or rock, close to an opening and in forest that provides shelter.

Great Blue Heron

This bird

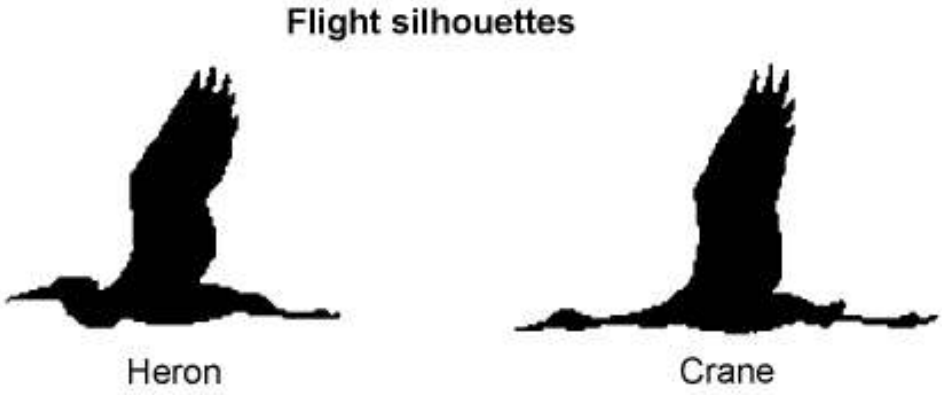
- has elaborate courtship and other displays
- often nests in colonies
- shares nurturing duties: both the male and the female incubate the eggs and feed the young
- is a patient hunter, often waiting motionless for several minutes before catching its prey

Photo: G. Beyersbergen

Description

The Great Blue Heron *Ardea herodias* is the largest heron in Canada. Adults stand over 1 m high with their necks outstretched, and they weigh around 2.5 kg.

This bird gives the general impression of being tall and thin: its wings, neck, bill, and legs are long. The long limbs dictate the heron's movements: it flies with deep, slow wing beats, and on land, or in the water, it walks erect with long strides. In flight, the neck is doubled back, the head resting against the shoulders, and the long legs held straight behind (see sketch).



The top of the adult's head is white with a black stripe on each side extending from the yellow eyes to slender black plumes at the back of the head. Its back is greyish blue, and its breast is white streaked with black. Breeding herons have long plumes on their breasts, flanks, and backs. The sexes look much alike, but the males are usually bigger than the females.

From birth to two years, Great Blue Herons moult, or replace old feathers with new, four times. During the first year, juveniles have grey crowns and grey wings flecked with brown, and they lack plumes. Adult Great Blue Herons show brighter colours during the breeding season, moult some plumes in summer, and change to duller colours in winter.

Great Blue Herons live long lives, some as long as 17 years.

Signs and sounds

The Great Blue Heron is generally silent, but it does have a repertoire of noises. It gives a *frawnk* sound at breeding colonies when alarmed, a *gooo* call at the end of one of its courtship displays, an occasional *ee* call when flying, and sometimes a series of clucks when foraging. The heron also utters a *roh-roh-roh* sound when it approaches the nest, perhaps to alert its mate to its arrival.

Part of the males' courtship displays are loud bill snaps. Females snap bills when they are approaching unmated males and after they have formed a breeding pair. It is also common for paired birds to engage in a rapid side-to-side tapping of each other's bill tips.

Habitat and habits

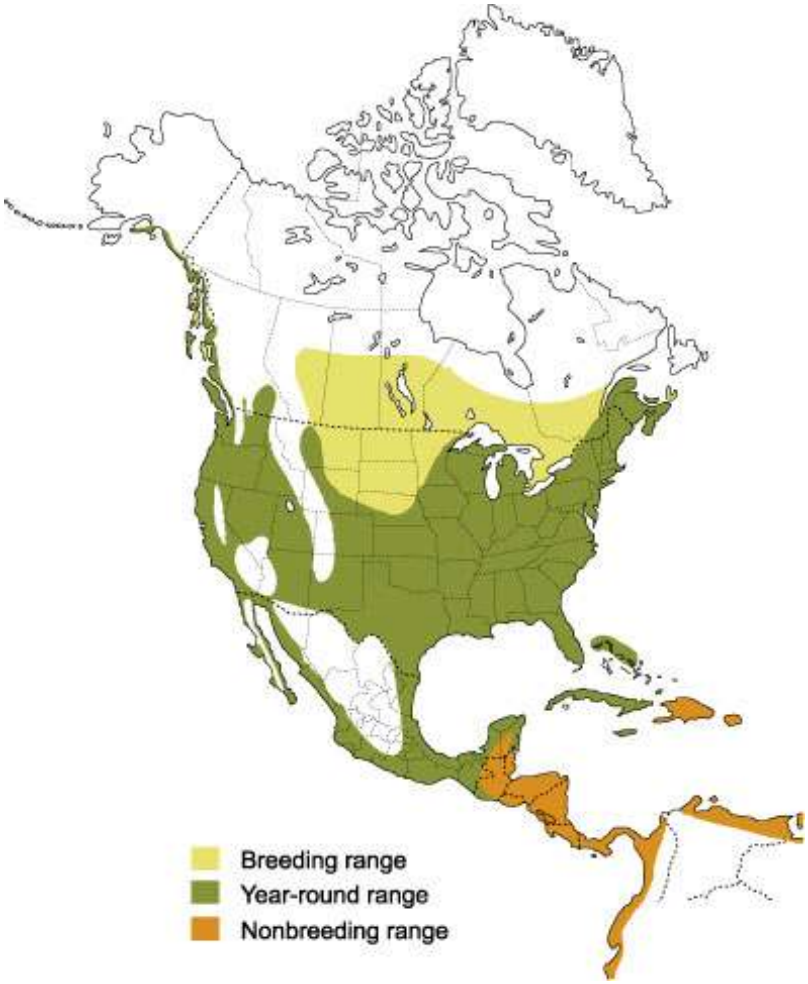
Great Blue Herons forage in marine coastal environments and in freshwater habitats, but nest on islands or in wooded swamps, where few mammals or snakes can prey on them. The birds sometimes nest alone, but often do so in colonies consisting of a dozen to several hundred pairs. Scientists do not know precisely how herons choose whether to be sociable. It seems that advantages to colonial behaviour include better defense of nests and greater chance of discovering mobile schools of fish: once one heron finds a good foraging spot, others may follow it to the same location.

Unique characteristics

The Great Blue Heron has an array of displays. Some of them are seen on the foraging grounds, as, for example, when two herons approach each other, each extending its neck fully and tilting its head over its back, with the wings partly opened and the body plumes erect. In others, the herons sleek their plumage, extend their necks forward, and tilt their heads from side to side so that they may look upwards, a posture they often use when predators and herons fly over the foraging grounds. Sometimes, a heron will thrust its beak at an opponent, and during some displays, "bill duels" erupt when opponents try to grab each other's head.

Another set of displays occurs when a mate returns to the nest. The arriving bird often greets the mate using a particular call, and the bird on the nest responds with one of a number of displays. Sometimes, the male brings sticks to the female on the nest. The female performs a display and takes the sticks, and the male then taps the female's bill from side to side while she places the sticks in the nest.

Range



Distribution of the Great Blue Heron

The Great Blue Heron has the widest distribution in Canada of all herons: it ranges from the Maritime provinces in the east across southern Canada to the Pacific Ocean, and north along the entire length of the British Columbia Pacific coast to Alaska's Prince William Sound in the west (see map). While it breeds in all provinces except Newfoundland and Labrador, this bird spends the winter in Canada only on the British Columbia coast and in parts of the Maritime provinces. Most birds move south for the winter, and banded birds from Canada have been found in Mexico, Honduras, and Cuba. Colonies of Great Blue Herons are also found in Colombia, Venezuela, and Ecuador's Galapagos Islands.

Great Blue Herons migrate alone or in groups of three to 12 and sometimes up to 100. They travel day and night. Spring migrants return to most Canadian locations in April. Some fly north in summer to arctic Alaska, southern Yukon, and northern Manitoba, Ontario, and Quebec. They migrate south from mid-September to late October.

Primary cavity nesting birds dig out (excavate) its nest site every year. Some examples of primary cavity nesters are chickadees, nuthatches, but the main one is the woodpecker.

By Myrna Pearman

By Myrna Pearman

Since woodpeckers like to use new cavities each year, other birds called secondary cavity nesters take over the abandoned site. Some of the more common secondary cavity nesters are mountain bluebird, tree swallows, and house wrens.

Nest boxes don't always protect bluebirds. Here is a picture of a bluebird killed in its nesting box. This bluebird was killed by a sparrow. The sparrow will then build its nest on top of the bluebird.

By Myrna Pearman

Photo by Devan

Here is a picture of a cavity excavated in a tree. A second cavity nester may discover it for its home!

This picture was taken along the South Saskatchewan River by a student, April 2002.

Marks left by Chewing, Biting, Rubbing, or Walking

Most plants have signs of animals if you know what to look for and look closely. Many plants will have bite or chew marks. Others show rub marks. Another way to recognize that an animal has passed by is to look for trails.

Bite and Chew Marks

Sticks and tree branches can be covered with animal markings at times. Many different animals might peel the bark off of a dead log to get out the bugs that live inside it. During winter, bark itself can provide animals with a much needed food source. It is common to find chew marks on twigs and branches throughout the winter and in spring.

Branch chewed on by rabbits

The chew marks that are most identifiable are those of rabbits and rodents. Those animals have enlarged front teeth, so their chew marks often show parallel grooves.

Rabbits and deer sometimes feed on the same plants. Twigs eaten by rabbits are usually cut sharply, at a 45 degree angle. Often the marks of individual teeth can be seen. (You might have to use a magnifying glass.)

Twigs eaten by deer are usually ripped off the bush or tree, and the torn edges are rough and irregular. The plants in the picture to the left have been gnawed on by deer.

It is also common to find the remains of nuts that have been chewed open by squirrels or other rodents.

Many leaves have bite marks from insects on them. Sometimes this makes the leaves look rough around the edges. Sometimes the leaves will be riddled with holes.

Many insects chew trails in wood beneath the bark. To find these kinds of tracks you can pull up the bark on a dead branch and see the maze of tunnels that have been made there.

Rubbings

Male deer rub their antlers on trees in late summer when they are shedding their antler velvet. This rubs the bark off the tree. If you see these rubbings, you know deer have been in the area.

Trails

Another way to recognize that an animal has passed by is to look for trails. Animals will wear down the paths that they choose, just like we do, so it is often easy to tell where they have been walking. Often you can find broken twigs that they passed by or walked on, or trees and rocks that they rubbed up against. Sometimes you can even find bits of hair that got caught on a twig as they passed.

A trail made by white-tailed deer. (trail in center of photo)

Trail left by deer, rabbit, or woodchuck. (trail in center of photo)

OTHER RAPTORS

Bald Eagle

Haliaeetus leucocephalus

The bald eagle is classified by COSSARO as endangered in Ontario. Its large size and huge nest are unmistakable.

Field Marks of Adults
□ eagle size! (2.1-2.5 m wingspan) □ bright white head and tail contrasts with the dark brown body on mature birds □ the long, wide wings are held straight out in flight □ the call is a high-pitched, descending bip-bip-bip-bip-bip-bip-bip

Immatures: Fledglings are dark brown. Until 3+ years of age, the plumage may include irregular splotches of beige or white on a mainly dark body.

Habitat: Eagle nests are found adjacent to large, productive lakes and rivers in mature forest with scattered supercanopy trees. The best lakes have a high ratio of shoreline to surface area of water. Spawning runs of fish attract eagles in spring.

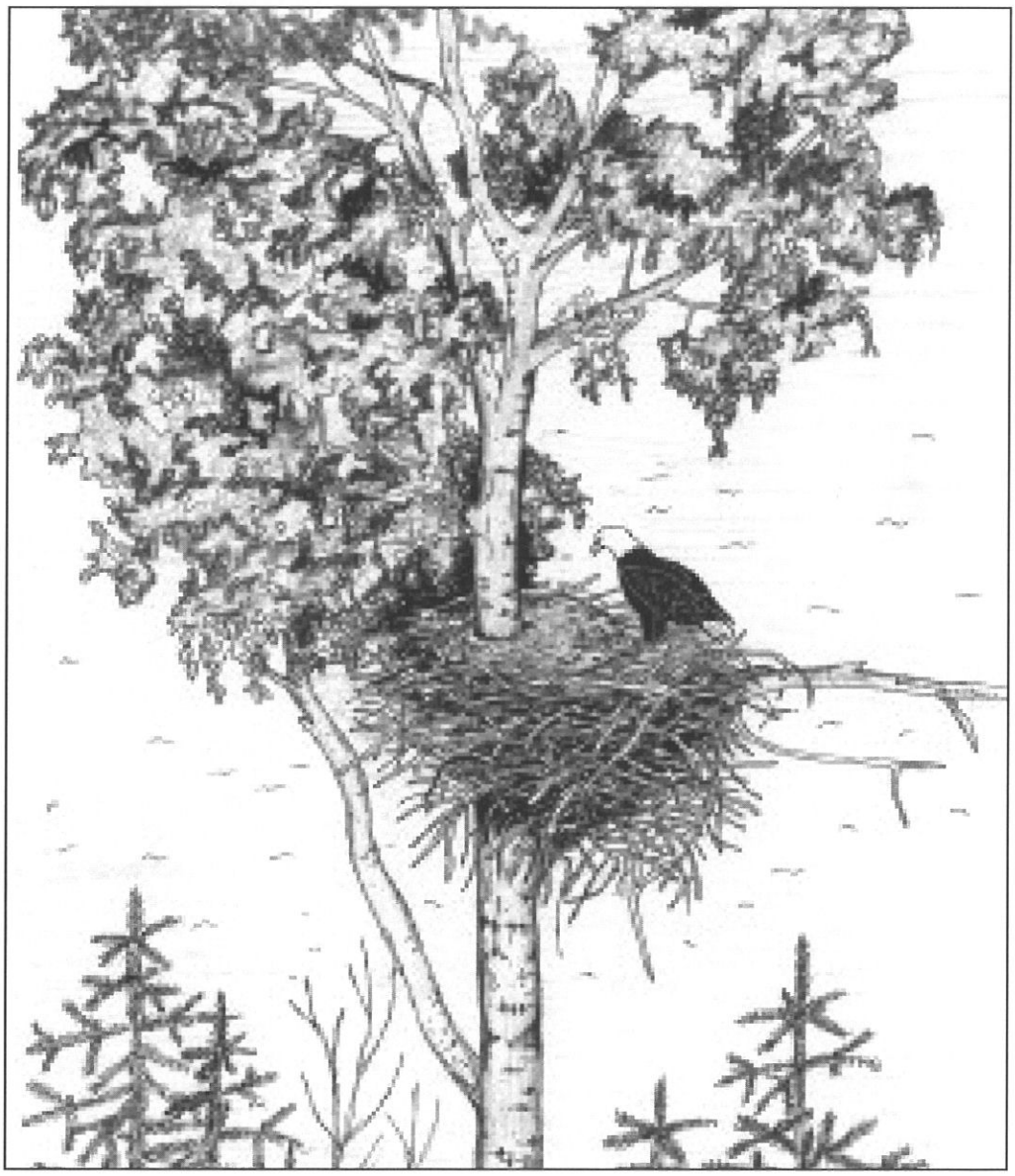
Silhouette

Nests: A stick nest well over a meter deep and one to three metres in diameter in the lowest, stoutest main fork of a live poplar just below the canopy, or high in a sturdy, living white pine near a lake shore is sure to be that of a bald eagle. Look for fresh green decoration. Pure white eggs. The nesting area may have one or more alternate nests and can be used for decades. Since new nesting material is added each year, an old nest can reach stupendous proportions. Gerrard and Bortolotti (1988) noted that the "Great Nest" in Ohio, used for 35 years, was about 3.5 m deep and 2.5 m across at the top, and

Overhead
Long, wide wings are held straight out in flight.

that the biggest nest in the world was made by a bald eagle in Florida — 3 m across at the top and 6 m deep!

Natural History: In 1900, there were one or more eagle nests for every 8 km of shoreline on Lake Erie, and eagles were common in most of Ontario. The eagle suffered from habitat loss through shoreline development, pesticide contamination of its food, lead poisoning, and accidental trapping. Northwestern Ontario is still a stronghold. Recovery programs have bolstered the Great Lakes population. The bald eagle catches fish by flying low and "casting its talons in a sweeping arc," and will also eat carrion and waterfowl. Courtship or territorial interactions sometimes result in a pair swirling downward with their talons locked. Newly fledged eaglets have a much larger wing area than their parents for additional lift. Mortality of eagles is especially high in the first year.



Osprey *Pandion haliaetus*

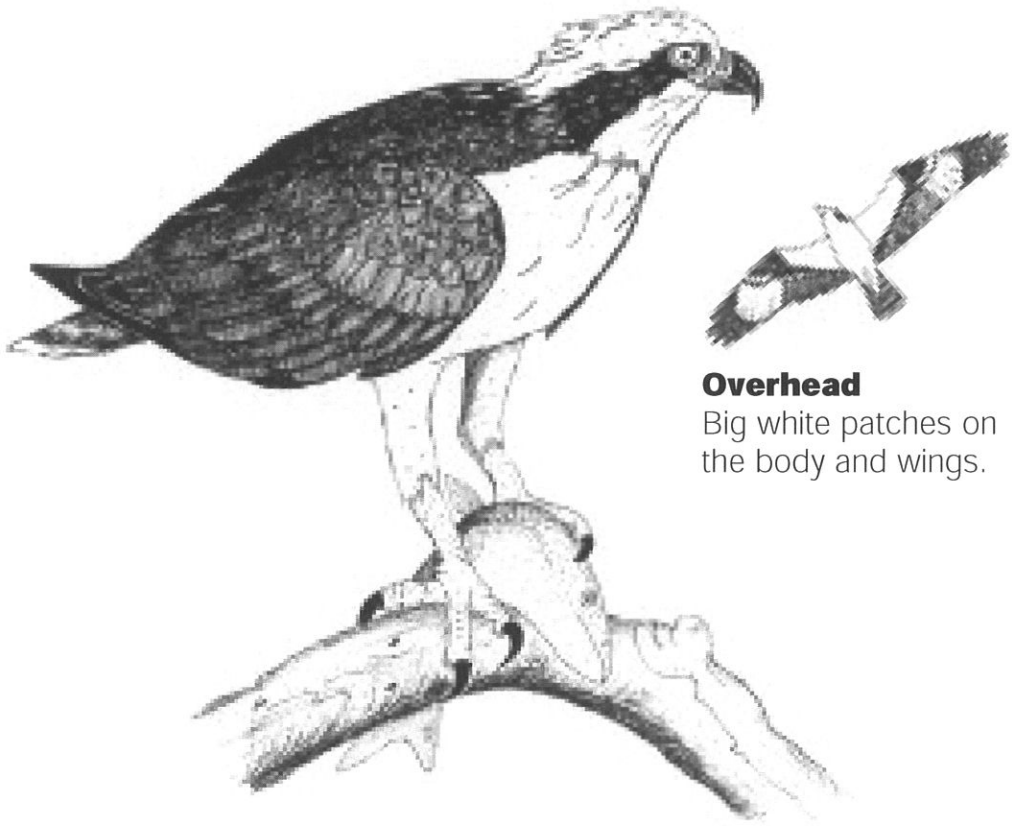
This species is found throughout the world and is the only bird in its taxonomic family.

Field Marks of Adults
□smaller than an eagle □long, narrow wings look crooked in flight □relatively short tail □white cap and black eye line □black back □white chest which has a light brown necklace on the female □powerful legs and feet □when viewed from below, see big white patches on the body and wings and big dark splotches at the wrists □the call is a series of high, short whistles that humans can imitate

Immature: Very similar to the adult but with pale feather edges which stand out against the dark back.

Habitat: Solitary ospreys are usually perched near the water's edge, but the nest can be several hundred metres from water. Nests may be near lakes or wetlands, or even in cutovers or burns.

Nest: The bulky nest is almost as large as an eagle's. Whereas an eagle nest would be under the shade of the nest tree's crown, an



Overhead
Big white patches on the body and wings.

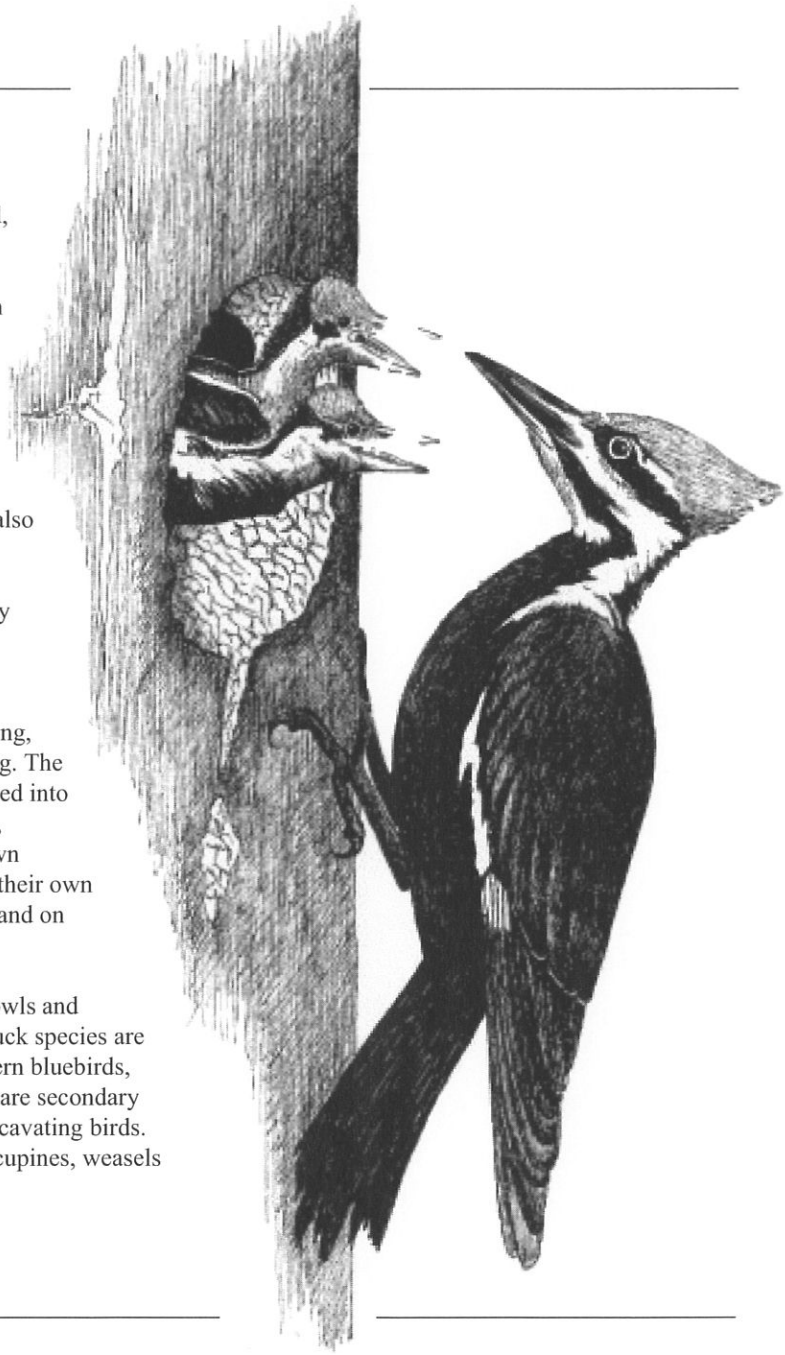
osprey nest is in the open, at or very near the top, usually in a broken tree and never low in the main fork. Most osprey nest trees (86%) are dead, but eagles rarely use dead trees. Conifers are preferred by ospreys. Nest platforms and telephone poles are also used. In other parts of the world, nesting may be almost colonial with some nests as close as 20 m apart.

Natural History: The osprey hunts for fish while it is in flight, while hovering, or from a perch. When an osprey dives feet-first into the water, spicules on the toe pads keep slippery fish from escaping its grip, and closable nostrils keep water out.

EXTENSION NOTES

Ontario

CAVITY TREES ARE REFUGES FOR WILDLIFE



To many people, a dead or dying, partly hollowed tree hardly seems worth preserving. Yet to many birds and mammals, these "cavity" trees are a vital source of food, shelter and safety.

By letting cavity trees remain on your property, you can provide important habitat for wildlife.

WHAT ARE CAVITY TREES?

Cavity trees are dead or dying trees that have one or more holes in the trunk or main branches. Cavities can also be found in some healthy trees, such as basswoods.

Cavities are excavated by birds. They are also created by decay and by broken branches.

In Ontario, more than 50 species of birds and mammals depend on cavity trees for nesting, rearing young, roosting, feeding, storing food, escaping predators and hibernating. The bird and mammal species that use tree cavities are divided into two groups. Primary cavity-users, such as woodpeckers, chickadees and the red-breasted nuthatch, make their own cavities. Secondary cavity-users are unable to excavate their own cavities. They rely on cavities excavated by other birds and on naturally occurring cavities.

Secondary cavity users include saw-whet owls, barred owls and kestrels. Common goldeneyes, wood ducks and other duck species are members of this group. Many songbirds, including eastern bluebirds, great-crested flycatchers and white-breasted nuthatches are secondary cavity users. Mammals also rely on cavities made by excavating birds. They include deer mice, martens, fishers, raccoons, porcupines, weasels and black bears.

WHAT WILDLIFE LOOK FOR IN A CAVITY TREE

Not all cavities are the same. The size, shape and location of cavities determine how wildlife species use them. Generally speaking, cavities fall into three categories:

- nest or den cavities
- escape or roost cavities
- feeding cavities

NEST OR DEN CAVITIES

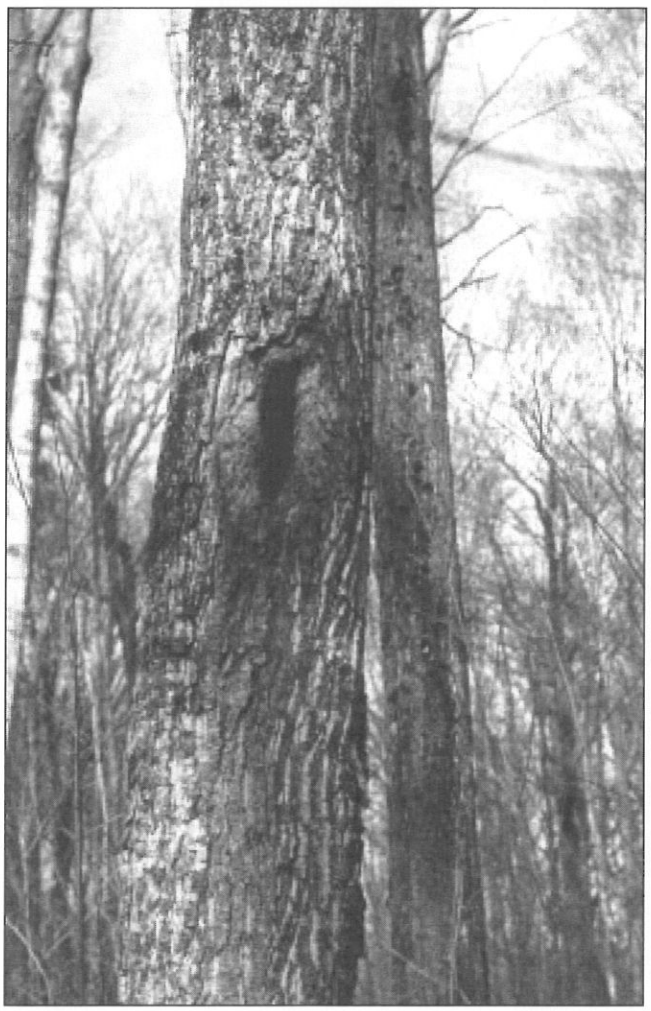
Nest or den cavities are used by birds or mammals for nesting and rearing their young. They should be left standing on your property unless they pose a safety risk.

Excavated nest holes are usually surrounded by relatively healthy wood. They are often circular, with clean edges and surfaces. They may also appear dark because they lead to a hollow chamber. Nest cavities created by decay or broken branches are often more irregular in shape.

In most cases a primary user, such as a woodpecker, will nest in a cavity only once, preferring to notch-out a new nest hole in the same or another tree the following year.

Some primary users, such as the yellow-bellied sapsucker, like to create nest holes in live trees. Others, like the downy woodpecker, prefer the dead parts of living trees or snags, which are standing dead trees.

Once a primary user has abandoned a nest hole, it becomes a valuable site for many other birds and mammals. Saw-whet owls, wood ducks, grey squirrels, martens and many other species use vacated holes for nesting and rearing their young.



Nest cavity created by a broken branch

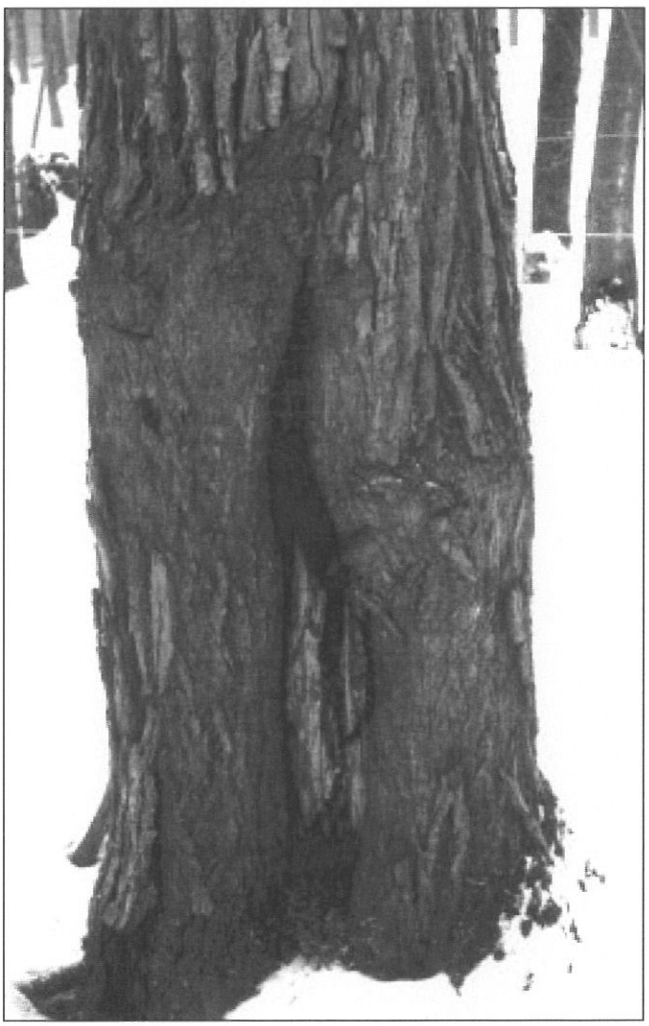
Excavated nest hole

ESCAPE OR ROOST CAVITIES

Not all holes in trees are suitable for nesting. Some provide temporary shelter from the elements or protection from predators. These are called escape or roost cavities.

Pileated woodpeckers, for example, create roosting trees by excavating many football-shaped holes along the trunk of a hollow tree. At night they enter the hollow by one of the holes and cling to the inside and sleep. This gives them many exits to choose from if a predator tries to trap them inside.

Trees with large escape cavities are also used by larger mammals, such as black bears, who use them for shelter and winter hibernation.



Escape hole

Feeding holes

FEEDING CAVITIES

Birds carve feeding cavities to find food, such as carpenter ants or the larvae of wood-boring beetles. Because they are rarely used for nesting or roosting, feeding cavities are not as valuable to wildlife as other kinds of cavities.

Feeding cavities can look like excavated nest holes, but most are more irregular in shape and have rough edges and surfaces. They are also lighter in color because they don't lead to hollow chambers.

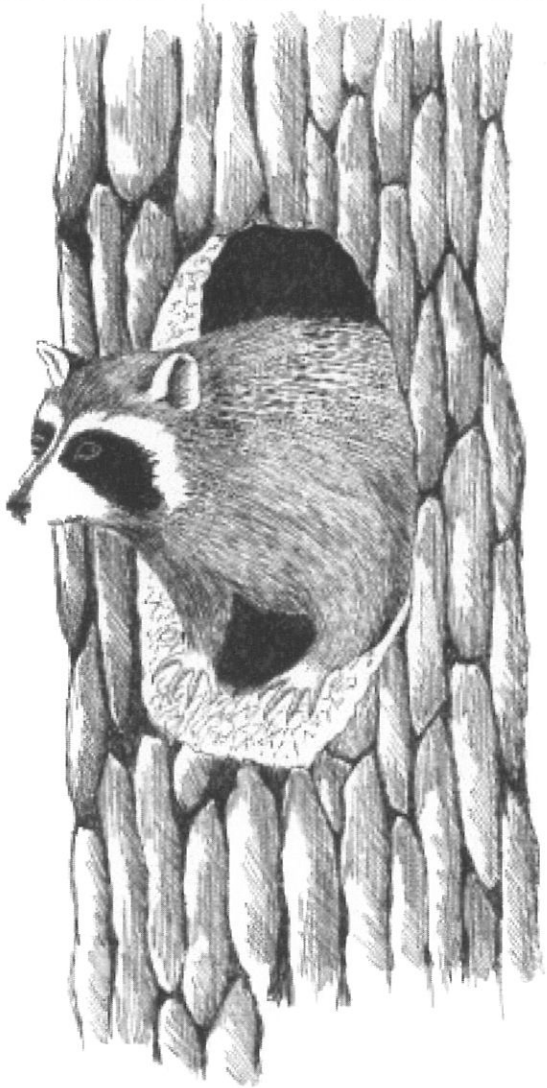
PROTECT CAVITY TREES ON YOUR PROPERTY

In southern Ontario, the early logging practices of the 1800s and 1900s removed only the healthiest of trees, leaving an abundance of cavity trees for wildlife. However, as harvesting operations became more efficient, the number of cavity trees began to decline.

Today, loggers, woodlot owners, farmers and urban dwellers are being encouraged to preserve cavity trees, when possible. The following guidelines will help you choose the cavity trees that are most valuable to wildlife.

- Leave at least six cavity trees on each hectare of land
- In order of priority, leave living trees with nest and den cavities, followed by escape and roost cavities, then feeding cavities.
- Protect potential cavity trees (trees that may appear to have rotten cores) when there is a shortage of trees with existing cavities. Basswoods are a good choice.
- Leave trees with many cavities of various sizes, which are more valuable than those with a single cavity.
- Choose trees that have cavities in the upper trunk, which are more valuable than those in the lower trunk.
- Leave cavities of all sizes, but give priority to big cavities which provide habitat for more species than small cavities.
- Give priority to hardwood cavity trees, which live longer than softwood trees.
- Leave cavity trees that have a low risk of blowing down.
- Remove trees that pose a risk to human safety or property.

For more information on preserving cavity trees contact your local conservation authority or office of the Ministry of Natural Resources.



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Deer wintering areas

As snow accumulates, deer congregate in wintering areas, commonly known as ‘deer yards’. These areas are usually located in mature softwood stands. They provide protection from the blustery winds, intercept snowfall, and minimize the animal’s heat loss.

Did you know:

New Brunswick actively manages over 800 deer wintering areas (280 000 hectares) on Crown land. This habitat has the potential to over-winter aboout 50 000 deer; though fewer than that reside on Crown land today.

Our approach

Government requires a specified area of land be maintained as deer habitat on each of its 10 Crown timber licences.

Management plans are prepared for each deer wintering area to guide forest harvesting and silviculture activities to benefit deer.

Temperature and snow conditions vary across the province. As a result, licensees must provide habitat for both moderate and severe winter weather.

New Brunswick has a rich logging heritage. Did you know that the loggers who harvested our mature forest over the past century were also helping our white-tailed deer?

Cutting opened the old forest and created better ‘browse’. With this fresh supply of food – tender shoots and twigs – the herd grew rapidly.

Late in the year, the deer feeds on raspberry, clover and other vegetation that remain green long into the fall. It also depends on apples, beech nuts and various plant by-products.

As winter starts and snow covers the ground, the deer seeks protection in mature conifer (evergreen) cover. Its winter diet will consist of hardwood twigs and cedar browse.

Because New Brunswick is at the northern tip of the white-tail's range, finding both winter cover and browse in close proximity is a challenge. It also limits the animal's survival.

Deer wintering areas are generally on south- or southeast-facing slopes. This offers protection from prevailing winds and maximizes exposure to the sun's radiant energy. Typically, they are stands of spruce and fir with some cedar. Crown closure – or density of tree cover – is usually between 50 and 70 per cent.

The white-tail develops an extensive network of trails through the wintering area. This reduces the energy required to move about and helps it evade predators.

Wintering areas are key to deer survival in New Brunswick. That is why we at Natural Resources require that forestry companies maintain a proportion of the Crown land they manage as habitat to support our white-tail population.

American Black Duck

This duck

- is very wary and among the most difficult of all ducks to deceive
- was once the most abundant dabbling duck in eastern North America, but is now only half as numerous as it was in the 1950s
- returns to the same marshes each fall, sometimes even starving rather than migrating farther south if those marshes are frozen

Description

The sooty-brown American Black Duck *Anas rubripes* is a common sight in ponds and marshes in eastern Canada. It is the only common duck in eastern North America in which the sexes are almost identical in appearance. Male and female American Black Ducks resemble the female Mallard in size and appearance. Their brown bodies are darker than the Mallard's, however, and lack the Mallard's whitish outer tail-feathers and prominent white wing bars. The American Black Duck's head and neck are a lighter brown than its torso, and there is a beautiful purplish-blue patch, or speculum, on the wing. In flight, the American Black Duck is identifiable by the flash of its white underwings.

The colours of the legs and bill may be used to determine the age and sex of American Black Ducks. These differences led to an earlier belief that there were two subspecies, a northern, red-legged race, and a southern "common" one. Data from bird banding, or tracking birds by placing numbered aluminum bands around their legs, has demonstrated conclusively that this is not the case.

About five percent of the wild ducks that look like American Black Ducks in eastern North America (in some local areas the percentage may be much higher) are actually hybrids, the result of cross-breeding between blacks and Mallards in the wild. Hybrids are difficult to detect by their plumage, but watch for American Black Ducks with traces of green on the sides of their heads and traces of white bordering their blue speculums. Conversely, if you see birds that look like Mallards with some American Black Duck features, they are also hybrid offspring of American Black Duck–Mallard pairs. The American Black Duck most likely evolved from an ancestor of the Mallard.

Signs and sounds

The call of female American Black Ducks is a loud quack or series of quacks, indistinguishable from the call of female Mallards. The males have lower, softer, and shorter calls more like a low reedy *quek*.

Habitat and habits

The American Black Duck occupies a variety of habitats across its breeding range. In Canada, the highest breeding densities of this duck occur in the Great Lakes–St. Lawrence River region of mixed forests. On the Atlantic coast and on the St. Lawrence estuary, the American Black Duck is particularly abundant in coastal marshes. In northern Ontario and Quebec, countless lakes, ponds, and streams provide an extensive but sparsely populated breeding area. Small groups also spend the nonbreeding season in southern Canada (see map), both inland, at ice-free sites where there is abundant food, and on the Atlantic coast, in bays and estuaries.

Like other dabbling ducks, the American Black Duck takes off from the surface of the water by rising straight up into the air, unlike the diving ducks, which run along the water to become airborne.

Unique characteristics

All ducks tend to return in fall and winter to the same marshes that they visited the previous year, but this trait is most pronounced in the American Black Duck. When tidal feeding areas have become frozen in New England, some American Black Ducks have starved rather than migrate farther south to unfamiliar ground.

Range

The American Black Duck is found in eastern and central North America, largely east of the Great Plains and south of the tundra.

As temperatures drop and the feeding areas freeze over one by one, the southward migration starts. The onset of migration is earliest (early September) in northern interior parts of the American Black Duck's range and follows a broad front southwards and towards the coast. North American waterfowl migrate along one or more of four major flyways: the Atlantic, the Mississippi, the Central, and the Pacific. Most American Black Ducks follow the Atlantic Flyway, but about a third of them use the Mississippi. There is no mass movement of American Black Ducks, as occurs with some prairie ducks. The American Black Ducks move in groups of 20 to 100, leapfrogging each other from one area of good food to another.

When the northern birds reach southern Canada they encounter waterfowl hunters in significant numbers for the first time. American Black Ducks are naturally alert and wary, and they are among the most difficult of all ducks to deceive. To survive, they must learn to avoid decoys, calls, and blinds. They spend the daylight hours in "rafts" (flocks on the surface of the water) far out on large bodies of water where they cannot be approached. They come in to feed in fields of grain stubble or in freshwater marshes only at dusk and leave at the first streaks of dawn.

By the first week of November, migrating American Black Ducks have reached their northernmost nonbreeding areas along Lakes Erie and Ontario, the St. Lawrence River, and the Atlantic coast from the Bay of Fundy south. A few spend the nonbreeding season in the jagged bays of Nova Scotia. Grand Manan and the surrounding islands hold some, but most continue south.

Along the Atlantic coast, migrating American Black Ducks mingle with other birds, including Black, Surf, and White-winged Scoters, as well as Oldsquaws, Harlequin Ducks, eiders, Canada Geese, and Brant. This host moves south to the great bays and sounds of the nonbreeding grounds of the mid-Atlantic coast. As the migration progresses, the American Black Ducks from farthest north drop out, travelling just far enough south to assure an unfrozen food supply. Migration tapers off in early December.

In the interior of the continent, large numbers of American Black Ducks spend the nonbreeding season in the marshes and river valleys south of the Great Lakes.

Feeding

By the time ducklings have hatched, the surfaces of streams, lakes, marshes, and ponds are nutritious "soups" of mosquito larvae and other insects and tiny water animals which collectively are called aquatic invertebrates. This is the sole food of the ducklings for their first two weeks. They go on to larger items, such as tadpoles and snails, as they grow stronger, and finally begin dabbling for the seeds and tubers, or fleshy roots, of a variety of aquatic plants, as the adults do at this time of year.

Animal foods such as periwinkles, mussels, and various snails become increasingly important to American Black Ducks during their nonbreeding period on the coast. Birds inland continue to eat the seeds and other parts of various aquatic plants. Waste corn in harvested fields is an important food in late fall and winter, whenever it occurs near water areas used by the ducks.

Breeding

Adult black ducks begin selecting a mate in the fall, and probably most are paired by mid-December. Immatures begin pairing somewhat later, but almost all American Black Ducks arrive paired at the breeding grounds in the spring.

The female selects the nest site, usually in a clump of grass, under a shrub or tree, or in a hole or fork in a tree, near the ground. She digs a scrape (nest) using both feet and her bill, then lines it with grasses, leaves, and other dry plant material. She plucks down, or fine feathers, from her body and adds it to the nest during the approximately one- to two-week period when she is laying her seven to 12 (nine on average) creamy white, or sometimes greenish-buff, eggs.

Incubation, or protection of the eggs until they hatch, takes up to 29 days from the laying of the last egg. Whenever the female leaves the nest during this time, she covers the eggs with down to keep them warm; the male remains nearby for another one to three weeks but does not sit on the eggs. As incubation progresses the males become more and more restless and leave the sitting females for increasing stretches.

Around the time that the first eggs hatch, the males fly to the nearest large body of water and congregate in the centre. Here they moult, or shed their old feathers. They remain flightless for about 10 days until their new primary feathers grow in. Their protection from enemies, such as people, hawks, and owls, at this vulnerable time depends on the fact that it is impossible to approach them unseen on their open lake. They dive to escape danger.

The chicks hatch within a few hours of one another. Shortly afterwards, the female leads them to water to feed. If the nest is far from water and the spring run-off has dried up, this journey may be long and difficult for the young ducklings.

The female guards the ducklings closely for seven to eight weeks until their first flight feathers appear. Then, leaving the young to feed and learn to fly, the female retires into a secluded area to moult. She loses her flight feathers, also remaining flightless for about 10 days until a complete set of new feathers grows in.

As soon as the young are capable of flying from the marshes to the open lakes they leave the females and join the males. Later the females arrive one by one, flying out of the marshes on their newly feathered, shining wings.

BACKGROUND

Wetland Functions

Wetlands perform many important functions, including, but not limited to, the following :

- Protect human health by storing and purifying ground and surface water;
- Maintain ecosystem health and provide habitats, food and nutrients for many species, including humans;
- Provide habitat for Endangered Species and other species of special status;
- Provide important repositories for bio-diversity;
- Provide protection from flooding and storm surges;
- Stabilize shorelines of rivers and along the coast;
- Provide areas for natural food production and commercial products; and
- Provides recreational, scientific, aesthetic, spiritual and cultural opportunities.

Economic Consequences of Wetland Loss

Many wetlands play an integral part in purifying drinking water. Some jurisdictions, such as New York State, are recognizing the savings associated with conserving wetlands in comparison with the upgrading of expensive water treatment systems.

As more and more wetlands are degraded or lost, the natural capacity to buffer floods from spring runoff and tidal forces is lessened, increasing the threat of

CONTEXTE

Fonctions des terres humides

Les terres humides remplissent d'importantes fonctions, notamment, sans toutefois s'y limiter :

- elles protègent la santé humaine en emmagasinant et en purifiant les eaux souterraines et les eaux de surface;
- elles maintiennent la santé des écosystèmes et fournissent des habitats, de la nourriture et des éléments nutritifs à de nombreuses espèces, y compris aux humains;
- elles fournissent un habitat aux espèces en danger de disparition et aux autres espèces jouissant d'un statut spécial;
- elles servent de réserves importantes pour la biodiversité;
- elles assurent une protection contre les inondations et les ondes de tempête;
- elles stabilisent les rives des rivières et le littoral;
- elles fournissent des aires de production alimentaire et de production commerciale;
- elles fournissent des possibilités récréatives, scientifiques, esthétiques, spirituelles et culturelles.

Conséquences économiques de la perte des terres humides

De nombreuses terres humides jouent un rôle capital dans la purification de l'eau potable. Certaines administrations, comme l'État de New York, reconnaissent les économies pouvant découler de la conservation des terres humides comparativement au coût élevé de la réfection des systèmes de traitement de l'eau.

Au fur et à mesure que disparaissent ou se dégradent les terres humides, la nature devient moins en mesure d'absorber les inondations causées par les eaux de

About Atlantic Salmon | Migration

Atlantic salmon are ***ANADROMOUS*** - they lay their eggs in fresh water streams, and grow for several years before moving to ocean waters.

- **Hormones** control the behaviour of the salmon.
- When certain conditions of size in the growing salmon, and light conditions are meant, hormones bring about 'downstream' behaviour.
- It is thought that the lateral line has an important sensory role in maintaining a 'downstream' direction

- Special cells in the gills allow the Atlantic salmon to modify its physiology to adapt to salt water and fresh water at various times during the fish's life

- No one is certain how Atlantic salmon navigate in the ocean. They may use polarized light, their highly developed sense of smell, and even magnetic fields of the Earth.

- Atlantic salmon sometimes travel thousands of kilometres to ocean feeding grounds. Many salmon from North American rivers travel to feeding grounds off Greenland and Labrador. Many salmon from more southerly Europe (Ireland, England, France, etc.) also travel to Greenland waters. Other European Atlantic salmon visit feeding areas near the Faroe Islands.

When ready to return to fresh water, it is likely that Atlantic salmon rely on their sense of smell, and perhaps some visual clues, to find their home river and enter it.

One Canadian researcher discovered that a salmon can detect one drop of a substance (Prostaglandin-A) in the equivalent of eight Olympic-sized swimming pools of water.

- Hormones continue to control the upstream migration of the fish, back to its native stream - and even to the same stretch of water in which it was born.

Introduced Species: The Threat to Biodiversity & What Can Be Done

Daniel Simberloff

Invasive species are a major threat to our environment because they

- can change an entire habitat, placing ecosystems at risk
- crowd out or replace native species that are beneficial to a habitat
- damage human enterprise, such as fisheries, costing the economy millions of dollars

The Cuban Tree Frog is an invasive species in southeast USA, competing with smaller native species. Photo: Oksana Hlodan

There are many ways in which the introduction of non-native or exotic species negatively affects our environment and the diversity of life on our planet. The statistics are startling and more attention must be paid to the problem and devising a solution before the cost is more than we can bear.

Invasive species cause more damage than some pollutants.

Almost half of the native species in America are endangered because of invasive species.

- Compared to other threats to biodiversity, invasive introduced species rank second only to habitat destruction, such as forest clearing.
- Of all 1,880 imperiled species in the United States, 49% are endangered because of introduced species alone or because of their impact combined with other forces.
- In fact, introduced species are a greater threat to native biodiversity than pollution, harvest, and disease combined.
- Further, through damage to agriculture, forestry, fisheries, and other human enterprises, introduced species inflict an enormous economic cost, estimated at $137 billion per year to the U.S. economy alone.
- Of course, some introduced species (such as most of our food crops and pets) are beneficial. However, others are very damaging.

Introduced species are not good guests

The greatest impact is caused by introduced species that change an entire habitat, because many native species thrive only in a particular habitat.

- When the Asian chestnut blight fungus virtually eliminated American chestnut from over 180 million acres of eastern United States forests in the first half of the 20th century, it was a disaster for many animals that were highly adapted to live in forests dominated by this tree species. For example, ten moth species that could live only on chestnut trees became extinct.

- Similarly, the Australian paperbark tree has replaced native plants, such as sawgrass, over 400,000 acres of south Florida, because it has a combination of traits (for example, spongy outer bark and flammable leaves and litter) that increase fire frequency and intensity. Many birds and mammals adapted to the native plant community declined in abundance as paperbark spread.

- In similar fashion, aquatic plants such as South American water hyacinth in Texas and Louisiana and marine algae such as Australian Caulerpa in the Mediterranean Sea change vast expanses of habitat by replacing formerly dominant native plants.

- The zebra mussel, accidentally brought to the United States from southern Russia, transforms aquatic habitats by filtering prodigious amounts of water (thereby lowering densities of planktonic organisms) and settling in dense masses over vast areas. At least thirty freshwater mussel species are threatened with extinction by the zebra mussel.

Other invaders, though they do not change a habitat, endanger single species or even entire groups of them in various ways:

- The predatory brown tree snake, introduced in cargo from the Admiralty Islands, has eliminated ten of the eleven native bird species from the forests of Guam.
- The Nile perch, a voracious predator introduced to Lake Victoria as a food fish, has already extinguished over one hundred species of native cichlid fish there.
- A parasite can be similarly devastating. The sea lamprey reached the Great Lakes through a series of canals and, in combination with overfishing, led to the extinction of three endemic fishes.
- The European parasite that causes whirling disease in fishes, introduced to rainbow trout in a hatchery in Pennsylvania, has now spread to many states and devastated the rainbow trout sport fishery in Montana and Colorado.
- Herbivores can wreak great damage. The first sailors to land on the remote Atlantic island of St. Helena in the 16th century introduced goats, which quickly extinguished over half the endemic plant species.

Appendix A

Table 1. Optimal temperatures at different life stages for various species of New Brunswick freshwater fish. d = days

Common Name	Scientific name	Optimal Temperatures				
		Spawning	Eggs	Larvae	Juvenile	Adult
Alewife	*Alosa pseudoharengus*		15.5℃ -6d [1] 22.2℃ 3 d [1]		17-19℃ [4]	11-19℃ [4]
American Eel	*Anguilla rostrata*	17℃ [1]				16.7℃ [26]
American Shad	*Alosa sapidissima*	12-18.3℃ [1]	12℃ [1]		10-31 C[7].	
Arctic Charr	*Salvelinus alpinus*	4℃ (autumn) [1]	0 - 2.2℃ (hatch April) [1]			
Atlantic Salmon	*Salmo salar* (Anadromous)	5-8 C[29]	4-7.2 C[29]		smolt 7-14.3 C[29]	14-20 C[29]
Atlantic Salmon	*Salmo salar* (Landlocked)					
Atlantic Sturgeon	*Acipenser oxyrhynchus*	13.3-17.8℃ [1]	17.8℃ (hatch 1week) [1]			5-30 C
Atlantic Tomcod	*Microgadus tomcod*	0.0-3.9℃ [1]	4.4℃ 30d [1] 6.1℃ 24d [1]			
Banded Killifish	*Fundulus diaphanus*	23℃ (end of May) [1]	22.2-26.7℃ (11-12d) [1]			19.3℃ [27]
Blacknose Dace	*Rhinichthys atratulus*	21.1℃ (spring) [1]				
Blacknose Shiner	*Notropis heterolepis*					
Blackspotted Stickleback	*Gasterosteus wheatlandi*					
Blueback Herring	*Alosa aestivalis*	20-24 ℃ [6]	22.2-23.9℃ 2-3 d[1]	16-24℃ [6]	11.5-32℃ [6]	Prefers 2-17℃ [5]

Brook Stickleback	*Culaea inconstans*	8℃ (May-June)[1]	18.3℃ (8-9 d)[1]		
Brook Trout	*Salvelinus fontinalis*		5℃ 100d[1] 6.1℃ 75 d[1] 10℃ 50 d[1]		11-16 C[7]
Brown Bullhead	*Ameiurus nebulosus*	21.1℃ (May-June)[1]	20.6-23.3℃ (6-9d)[1]		
Brown Trout	*Salmo trutta*	6.7-8.9℃[1]		12.6℃[23]	18.3-23.9℃[1]
Burbot	*Lota lota*	0.6-1.7℃[1]			15.6-18.3℃[1]
Chain Pickerel	*Esox niger*	8.3-11.1℃[1]			21.1-30.0℃ (summer)[1]
Common Shiner	*Notropis cornutus*	15.6-18.3℃[1]			
Creek Chub	*Semotilus atromaculatus*	12.8℃ and above[1]			
Fallfish	*Semotilus corporalis*	16.6℃[1]			
Fathead Minnow	*Pimephales promelas*	17.8℃[1]	25℃ (5-6d)[1]		26.6°C[16]
Finescale Dace	*Phoxinus neogaeus*				
Fourspine Stickleback	*Apeltes quadracus*				
Golden Shiner	*Notemigonus crysoleucas*	20℃[1]			
Goldfish	*Carassius auratus*	18.4-24.9℃[1]	18.5℃-25℃[1]	25℃[24]	28℃[15]
Lake Chub	*Couesius plumbeus*	14-19℃[1]			
Lake Trout	*Salvelinus namaycush*	8.9-13.9℃[1]	0.3-1.0℃ (15-21weeks(March)[1]		<16℃[8]
Lake Whitefish	*Coregonus clupeaformis*	7.8℃[1]	0.5-6.1℃[1]		12-16℃[14]
Longnose Sucker	*Catostomus catostomus*	5℃[1]	15℃ 8d[1] 10℃ 11d[1]		

Mummichog	*Fundulus heteroclitus*	16.5 -25℃ [13]	12.8-17.2℃ 24d[1]			25℃ [17]
Muskellunge	*Esox masquinongy*	9.4-15℃ [1]	11.7-17.2℃ 8-14 d[1]			25.6℃ [1]
Ninespine Stickleback	*Pungitius pungitius*		19-24℃ [28]			
Northern Redbelly Dace	*Phoxinus eos*		21.1-26.7℃ 8-10 d[1]			
Pearl Dace	*Margariscus margarita*	17.2-18.3℃ spring[1]				
Pumpkinseed	*Lepomis gibbosus*	20-27.8℃ [1]	28℃ (3d [1]			21-24 ℃ [3]
Rainbow Smelt	*Osmerus mordax* (Anadromous)_	10-15℃ [1]	6-7℃ 29d [1] 7.1-8.0℃ 25d [1] 9-10℃ 19d [1]			7.2℃ [1]
Rainbow Smelt	*Osmerus mordax* (Landlocked)					
Rainbow Smelt; Dwarf Smelt	*Osmerus mordax*					
Rainbow Trout	*Oncorhynchus mykiss*	10-15.5℃ [1]	15˚C 19d[11] 5˚C 80d[11]		10-22˚C[11]	13℃ [1] up to 24℃ [3]
Redbreast Sunfish	*Lepomis auritus*	21.1-27.2℃ [9]	21.1-27.2℃ [9]		15-35 ℃ [9]	15-35°C [9]
Round Whitefish	*Prosopium cylindraceum*	4.5℃ winter [1]	2.2℃(140d) [1]			
Sea Lamprey	*Petromyzon marinus*	11.1-15.6℃ [1] late up to 24.4℃ [1]	13.9-18.3℃ 13-14d[1]	17.8-21.8℃ [21]		14.3℃ [22]
Shortnose Sturgeon	*Acipenser brevirostrum*	9 - 12℃ [19]				11 – 22℃ [20]
Slimy Sculpin	*Cottus cognatus*	5-10℃ [1]				
Smallmouth Bass	*Micropterus dolomieu*	16.1-18.3℃ [1]	Same as spawn[12]	20-30˚C[12]		20.3-21.3℃ [1]

Striped Bass	*Morone saxatilis*		14.4-15.6℃ 70-74hrs[1] 17.8-19.4℃ 48hrs[1]	10°C - 30°C[5]	25°C[2]	6°C - 30°C[5]
Threespine Stickleback	*Gasterosteus aculeatus*	5-20℃[28]	19℃ 7d[1]			16-18 °C[18]
White Perch	*Morone americana*	11-15℃[1]	20˚ C 30 hrs[3] 18˚C 50 hrs[3] 15˚C 96hrs[3]	10°C - 30°C[5]		10°C - 30°C[5]
White Sucker	*Catostomus commersoni*	10–16℃[10]		27℃[10]		19-21℃[25]
Yellow Perch	*Perca flavescens*	8.9-12.2℃[1]	8.3℃ 27d[1]			19-21℃[1]

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Environmentalism: Freedom to Roam

Wildlife Corridors that Work

In Canada's Banff National Park, animals traverse the Trans-Canada Highway via 22 underpasses and two overpasses. These are among the oldest wildlife corridors on the North American continent. And they work. Estimates are that the overpasses and underpasses have cut roadkill on Highway 22 by as much as 96%.

The success of these bridges has led engineers to plan over- and underpasses in other states. An overpass is planned on Highway 70 near Vail in Colorado and on Interstate 90 east of Snoqualmie Pass in Washington's Cascade Mountains, as well as in Utah and Florida. Two amphibian tunnels in Massachusetts allow spotted salamanders to move from their breeding grounds to higher habitat. In Arizona, construction is underway on State Route 260 to build 11 underpasses, and six bridges over streams. Already, research shows that the underpasses and the fencing that funnel elk to the underpasses have made SR 260 much safer for both elk and people: Elk versus vehicle collisions dropped 85% in the first year fencing was erected on a section of the highway, and the reduction in accidents has saved almost $1 million per year.

Larger pieces of land that form corridors between protected areas are the focus of intense research, mapping and planning. The Pinhook Swamp, for example, connects the wetlands of the Okefenokee National Wildlife Refuge in southern Georgia with the pine flatwoods and cypress swamps of the Osceola National Forest in northern Florida.

Rarity Ranking

- The overall status of a species or ecosystem is regarded as its "global" status; this range-wide assessment of condition is referred to as its global conservation status rank **(G-rank)**. Because the G-rank refers to the species or ecosystem as a whole, each species or ecosystem can have just a single global conservation status rank. Similarly, status can vary by state or province, and thus subnational conservation status ranks **(S-rank)** document the condition of the species or ecosystem within a particular state or province. Again, there may be as many subnational conservation status ranks as the number of states or provinces in which the species or ecosystem occurs.

S1	**Extremely rare**: May be especially vulnerable to extirpation (typically 5 or fewer occurrences or very few remaining individuals).
S2	**Rare**: May be vulnerable to extirpation due to rarity or other factors (6 to 20 occurrences or few remaining individuals).
S3	**Uncommon**, or found only in a restricted range, even if abundant at some locations (21 to 100 occurrences).
S4	**Usually widespread**, **fairly common**, and apparently secure with many occurrences, but of longer-term concern (e.g., watch list) (100+ occurrences).
S5	Widespread, **abundant**, and secure, under present conditions.
S#S#	Numeric **range rank**: A range between two consecutive ranks for a species/community. Denotes uncertainty about the exact rarity (e.g., S1S2).
SH	**Historical**: Previously occurred in the province but may have been overlooked during the past 20-70 years. Presence is suspected and will likely be rediscovered; depending on species/community.
SU	**Unrankable**: Possibly in peril, but status is uncertain - need more information.
SX	**Extinct/Extirpated**: believed to be extirpated from its former range.
S?	**Unranked**: not yet ranked.
SA	**Accidental**: Accidental or casual, infrequent and far outside usual range. Includes species (usually birds or butterflies) recorded once or twice or only at very great intervals, hundreds or even thousands of miles outside their usual range.
SE	**Exotic**: An exotic established in the province (e.g., Purple Loosestrife or Coltsfoot); may be native in nearby regions.
SE#	**Exotic numeric**: An established exotic that has been assigned a rank.

GX	**Presumed Extinct** (species)— Not located despite intensive searches and virtually no likelihood of rediscovery. **Eliminated** (ecological communities)—Eliminated throughout its range, with no restoration potential due to extinction of dominant or characteristic taxa and/or elimination of the sites and disturbance factors on which the type depends.
GH	**Possibly Extinct** (species) **Eliminated** (ecological communities and systems) — Known from only historical occurrences but still some hope of rediscovery. There is evidence that the species may be extinct or the ecosystem may be eliminated throughout its range, but not enough to state this with certainty. Examples of such evidence include (1) that a species has not been documented in approximately 20-40 years despite some searching or some evidence of significant habitat loss or degradation; (2) that a species or ecosystem has been searched for unsuccessfully, but not thoroughly enough to presume that it is extinct or eliminated throughout its range.[1]
G1	**Critically Imperiled**—At very high risk of extinction due to extreme rarity (often 5 or fewer populations), very steep declines, or other factors.

G2	**Imperiled**—At high risk of extinction or elimination due to very restricted range, very few populations, steep declines, or other factors.
G3	**Vulnerable**—At moderate risk of extinction or elimination due to a restricted range, relatively few populations, recent and widespread declines, or other factors.
G4	**Apparently Secure**—Uncommon but not rare; some cause for long-term concern due to declines or other factors.
G5	**Secure**—Common; widespread and abundant.
G#G#	**Range Rank**—A numeric range rank (e.g., G2G3, G1G3) is used to indicate the range of uncertainty about the exact status of a taxon or ecosystem type. Ranges cannot skip more than two ranks (e.g., GU should be used rather than G1G4).
GU	**Unrankable**—-Currently unrankable due to lack of information or due to substantially conflicting information about status or trends. NOTE: Whenever possible (when the range of uncertainty is three consecutive ranks or less), a range rank (e.g., G2G3) should be used to delineate the limits (range) of uncertainty.
GNR	**Unranked**—Global rank not yet assessed.