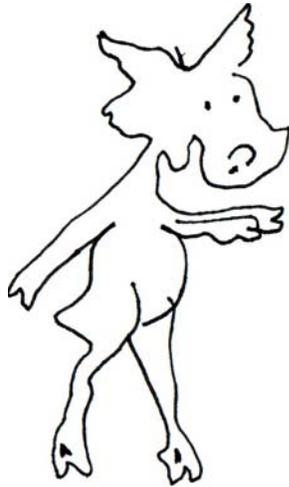

PORCUPINE CARIBOU MANAGEMENT BOARD

**VIDEO SERIES
TEACHERS' MANUALS**

UNIT THREE

MORTALITY AND ENVIRONMENTAL HAZARDS OF CARIBOU





CHIKKYI

Chikkyi is the Gwich'in name for baby caribou. Chikkyi will be used to mark student activity and information sheets.

Chikkyi was created by D. Urquhart

MORTALITY AND ENVIRONMENTAL HAZARDS OF CARIBOU

CONCEPTS

- Mortality or the causes of death of caribou can be classified as either natural or human-related. Natural mortality factors include predation by wolves, grizzly bears, golden eagles and wolverines, as well as sickness, disease, parasitism and factors related to calf mortality. Human-related mortality is primarily caused by harvest. Non-hunting factors include road kills and aerial and snow-machine harassment.
- The harvest of the Porcupine Caribou herd is international in scope, involving hunters from Alaska, Yukon, the Northwest Territories and elsewhere. There are many types of hunters including subsistence hunters who depend on the caribou for meat and resident and non-resident sport hunters who hunt recreationally for the meat and trophy.
- Industrial developments can have long term negative impacts on caribou. Caribou are most vulnerable during calving. The concern is that development of part of the core calving ground of the Porcupine Caribou herd in the Alaska National Wildlife Refuge could result in reduced survival of the calves and ultimately cause reduced productivity of the herd. Disturbance to caribou by industrial developments continues to be a topic of active scientific and political debate. The Porcupine Caribou herd is also the slowest growing herd of caribou and the reasons for this are not fully understood.

OBJECTIVES

- To help students gain a knowledge of the natural predators of the Porcupine Caribou Herd: golden eagles, grizzly bears, wolves and wolverines.
- To help students develop an appreciation of the predators and to impress upon them that the Porcupine Caribou herd is an important food source for some animals.
- To help students gain a knowledge of the natural and human-related mortality of caribou and to understand the differences between the two.
- To show students that man as a hunter is a very effective predator and can have a big effect on caribou numbers.
- To show that the human harvest of the Porcupine Caribou herd is international in scope, involving hunters from Alaska, Yukon, the Northwest Territories and elsewhere. There are many types of hunters: subsistence hunters, resident sport hunters and non-resident sport hunters.
- To start students thinking about human activities and the way in which they might

adversely affect caribou. To discuss some of the recently proposed developments on the Porcupine Caribou Herd range.

- To inform students of the lichen-caribou-human food chain and the level of contaminants in the herd.



River boats typically used to hunt along rivers.

BACKGROUND INFORMATION

NATURAL MORTALITY

Mortality or the causes of death of caribou can be classified as either natural or human-related. The natural mortality factors include predation as well as sickness, disease, parasitism and other factors related to calf mortality.

1. PREDATION

Animals that kill and feed on other animals are **predators**. The **prey** are animals eaten by predators. Predators on the range of the Porcupine Caribou herd are wolves, golden eagles, grizzly bears, wolverines and other scavengers.

a. Golden Eagles

Golden eagles, primarily the non-nesting sub-adult birds, are the most important predator of the calves on the calving grounds of the Porcupine Caribou herd. These sub-adult birds are not confined to nesting territories and are not involved in the breeding period that occurs further inland. It has been suggested that these yearling birds avoid the conflict and competition associated with the breeding adult golden eagles and move out onto the coastal plain. The sub-adult golden eagles are very mobile and are on the coastal plain during the calving and post-calving of the Porcupine Caribou herd. This is an advantage to the eagles as the calves are a readily available source of prey. The eagles are efficient avian predators that kill using their talons. The calves are eaten on site.

b. Wolf

Wolves can be an important predator of adult caribou in winter. A caribou-hunting wolf can kill the equivalent of 15 to 20 adult-sized caribou in a year. However, since the local wolf population within the winter range of the herd is relatively low, it is estimated that, on an annual basis, wolves harvest between 3% - 5% of the herd. This does not greatly affect the herd. On the Yukon's north slope, the Porcupine Caribou herd is the main prey of wolves in the area.

During the winter, wolves work together and hunt in groups called **packs**. Each wolf pack is a family unit made up of one pair of breeding adults and other subordinate wolves such as pups and young wolves. The average pack size in the Yukon is 7 to 9 wolves. An average wolf pack will kill a caribou every three days during the winter, spending one day or less feeding on the carcass. The subspecies of wolf found in the Yukon is the largest race of wolf in North America with males averaging 43 kilograms

and females 37 kilograms.

Wolves use a variety of hunting strategies. Packs may “test” a group by chasing a band and watching for animals that fall behind or veer aside. Those individuals are then pursued. The wolves exploit their advantage by cutting corners on fleeing caribou as they turn, or by positioning themselves between a caribou and the group it attempts to rejoin. Wolves also ambush animals on trails between lakes, drive them toward a hidden pack member, or chase them into deep, soft snow where they will flounder and the pack can close in.

The wolves usually attack caribou at the head and neck or shoulders. They may try to knock the animal off its feet or hang from the muzzle or throat. Skulls of calves are usually crushed. Once cornered, a caribou has no effective means of defence against wolves and is usually killed. Caribou respond to attacks by wolves by trying to outrun them. Male caribou during the rut are especially vulnerable to predation as they are distracted and do not pay attention to predators.

c. Grizzly Bear

Grizzly bears are found on both the summer and winter ranges of the Porcupine Caribou herd. It has been suggested that although individual bears may prey or scavenge on caribou that migrate through the bear's home range, they do not actually migrate with the herd. The bears whose home ranges overlap with the calving area or the migratory corridor of the caribou concentrate their feeding in these areas during the calving and post-calving period. They are major predators of newborn calves on some calving grounds. At times they appear to gather where the calving activity is most concentrated. Many observations have been made of grizzlies eating calves. Grizzlies may also prey on weaker caribou that migrate through their territories.

Grizzly bears are **omnivores** (they eat both meat, plants, berries and insects). Grizzly bears in the north Yukon primarily feed on crowberries, roots of the Eskimo potato, grasses, sedges, horsetails, blueberries, alpine bearberry, soapberries, ground squirrels, and caribou.

The grizzly bear found in the northern Yukon is generally a smaller bodied animal than a grizzly bear in Alberta. These bears have a lower maximum growth rate and also a smaller home-range size. Estimates of densities of bears on the coastal plains and foothills in Alaska ranged from 1.3 to 11.1 bears per 1000 km². Densities of bears in the Barn Mountains area of the northern Yukon averaged 26 bears per 1,000 km² in the 1970s.

d. Wolverine

Wolverine are capable of killing a newborn calf, a cow giving birth and sick or dying

caribou. Because of their relatively small size, slow speed and solitary habits, they would not be capable of bringing down a healthy adult caribou. Generally they mainly scavenge on kills made by other animals.

Wolverine are found in all habitats of the Yukon from forested valleys to alpine and arctic tundra. Wolverine are common to the home range of the Porcupine Caribou herd.

The wolverine have strong teeth and jaws and neck muscles which make it easy for them to crush bones and tear at frozen flesh. The adult male wolverine weighs 11 to 16 kilograms where the females average 8 to 11 kilograms.

e. Mosquito and Blackfly

Blood sucking insects are often called “**micro-predators**”. Both mosquitoes and blackflies bite to get a blood meal to hatch their eggs and can attack persistently. This prevents caribou from feeding, calves from nursing, and even causes injuries due to the caribou rushing wildly about. A Russian study indicates that a mosquito could suck as much as 125 cc of blood daily from an adult animal.

The calmer and hotter the weather, the more caribou are tortured by the flies and the larger are the caribou groupings. Caribou mass on breezy hills and mountain tops, the coastal shoreline and on snow banks and move restlessly to avoid the pests. They may cause the caribou to become malnourished and become generally weaker.

f. Other Scavengers

Foxes, ravens, owls, jaegers and hawks are other carrion eaters or scavengers that feed on caribou kills. These scavengers take advantage of carcasses left by other predators.

2. ACCIDENTS

Porcupine Caribou can have accidents throughout the year and are especially prone to injury during migrations and post-calving movements. Animals can be drowned or injured from having to cross treacherous and icy cold rivers. During spring migration, river crossings can be especially dangerous during ice breakup and flooding conditions. Caribou are constantly on the move and have to cross many swift flowing northern rivers even when the calves are very young. The calves swim on the downstream side or behind the cow, partially sheltered by her body from the current. Small caribou can nevertheless be swept downstream, hit by floating ice, or unable to clamber out on ice shelves along the shore and so are lost and drowned.

During the post-calving aggregation in July when the animals form large groups, they

are susceptible to panic stampeding from insect harassment or running from predators. Injuries can occur that could eventually result in mortality by predation. Calves can be trampled during these panic stampedes. The aggregations move extensively and rapidly, crossing many rivers in a relatively short period of time. Calves can lose their mothers in these large moving herds and the desertion results in death as another cow will not accept the calf.

Another cause of death for adults occurs during social interactions during breeding. Most fights between bulls are brief but fights occasionally become violent and injuries are not uncommon. Caribou are also subject to less dramatic individual accidents such as foot and leg sprains in rocky terrain.

3. NEONATAL MORTALITY

Caribou calves die from a multitude of factors, including birth defects, accidents, social interactions such as trampling, wind chill or exposure, desertion resulting in starvation, and predation. As an age class, calves have the highest mortality rate.

Poor weather on the calving grounds can affect the newborn calves, which may die directly from exposure to the cold, wet conditions. In strong winds, a newborn calf may be unable to stand up to feed and may die from weakness.

Adult cows can develop problems while giving birth resulting in death of the calf and perhaps the cow also.

In the first month of life, an average of 25% of the newborn calves will die. A calf mortality study on the Porcupine Caribou herd was conducted by Alaska Department of Fish and Game and the United States Fish and Wildlife from 1983-1985. The results showed that at birth, some calves were stillborn, and within the first 48 hours after birth, calves died from starvation due to emaciation, malnutrition and disease. Following the prenatal period, studies indicate that, of the calves that die, 52% die from birth defects due to poor nutrition and 48% die from predators. Predation is by golden eagles, grizzly bears and wolves.

4. SICKNESS, DISEASE AND PARASITISM

Information concerning diseases and parasitism of adult Porcupine Caribou is very limited. However, there are documented diseases and parasites common to the caribou in North America. Diseases and parasites are not thought to be a significant factor in the general survival of caribou. Their greatest danger is that some forms can be transmitted to humans.

To understand the importance of disease in the Porcupine Caribou herd more

information is needed. Much of the scientific knowledge comes from body condition studies done by biologists with the help of local hunters who kill the caribou and are trained to take the samples. If one finds a sick caribou or comes across unusual organs or body tissues while butchering caribou, they should inform the nearest wildlife officer or biologist.

a. Parasites

An important aspect of caribou health is the extent to which they have parasites. Parasites are: a variety of worms (tapeworms, roundworms); microscopic, one-celled animals (lumped as Protozoa); and insects that spend all, or a stage of their life, inside of and dependent on host animals. Only heavy infestations inflict clinical symptoms that generally include poor condition and malnutrition.

b. Tapeworms

There are 3 tapeworms whose immature forms are often found in caribou.

1. The immature form (or larvae) of a kind of tapeworm (scientific name: *Echinococcus granulosus*) lives in the lungs of the caribou in a fibrous cyst (pronounced sist), which is small, round and full of fluid from the size of a pinhead to about 10 cm long. When a wolf or dog eats the infected lungs containing the cysts with larvae, the larvae grow to adult tapeworms, which have a distinct head and segmented body, and live in the animal's gut.

The tapeworm lays eggs that are passed in the wolf or dog feces. The eggs can survive for months sticking to vegetation. If eaten by a caribou, they hatch and burrow into the lungs where they form a fibrous cyst. A cyst takes 1 to 2 years to develop in a caribou.

These tapeworms can be a serious risk to human health. People can become infected from tapeworm eggs accidentally taken in with food or water contaminated by wolf or dog feces. The eggs hatch and the larvae form a cyst in the humans that then have to be surgically removed.

Prevention

There are a number of things you can do to avoid coming into contact with these tapeworms. Never feed caribou lungs to your dogs. If infected lungs are found in caribou, they should be burned rather than left or buried to avoid infecting dogs and wolves.

2. Another type of flatworm larvae found in caribou is *Taenia hydatigena*, which

produces cysts in the livers of caribou. These cysts probably have no effect on the health of the caribou. *Taenia* cysts are small, white, egg-shaped and filled with fluid. They look like grains of rice. There are usually 1 to 5 of them in the liver although they may be found in other places in the caribou gut cavity as well. The life cycle of this type of tapeworm is similar to the lung tapeworm. When a wolf, coyote or dog eats on meat with cysts from an infected caribou, the adult tapeworm develops in its guts. This kind of tapeworm is a giant; it may be from .8 to 4.9 meters in length. Eggs of the tapeworm are passed in the feces, and the caribou eats them along with their plant food or drinks them in the water. When the eggs hatch in the caribou, the larvae travel in the caribou's blood to its liver and then grow into cysts.

There is no known danger to people from this species of tapeworm. The cysts do not develop in humans even if people eat raw caribou liver.

3. Another type of flatworm larvae, *Taenia krabbei*, migrates to the heart and muscles to form yellowish-white cysts 0.5 to 1 cm long in the caribou.

c. Roundworms

Thread lungworm (*Dictyocaulus*) are roundworms found in the lungs where their eggs are laid and hatch. The tiny immature worms (0.3 mm long) migrate up the windpipe and are eventually swallowed and deposited on the vegetation in the feces. They grow and, if eaten by a caribou, travel through the bloodstream to reach the lungs where the cycle starts again. The impact of thread lungworms can be serious as they may be a factor in causing pneumonia. The parasite has been recorded in both reindeer and caribou.

d. Protozoa

Protozoa are primitive, single-celled animals visible only under a microscope. A protozoa called *Besnoitia* is known to cause a disease called "cornmeal disease" because the pitted and roughened bones and tendons feel as though they are covered with grains of sand or cornmeal. Samples of 13 caribou legs from the Porcupine Caribou herd were examined in 1988. *Besnoitia* cysts from light to heavy infestations were observed in all the samples. The majority of the infestations were light, well-tolerated and of no consequence to the animal.

e. Disease

Disease is not just caused by a specific virus or bacteria but can include any condition that impairs the caribou's health.

- **Brucellosis**

Brucellosis is a bacterial disease that is transmissible to humans by caribou. In humans the disease is known as undulant fever. Humans can be infected by milk, aborted fetuses or the body organs and marrow from infected caribou. Thorough cooking will kill the *Brucella* bacteria, but freezing will not. The disease in humans may produce symptoms such as fever, weakness, aches, sweats, and stomach problems that can be serious enough to cause hospitalization. Brucellosis can only be detected with specialized tests of blood or tissue to determine if the bacteria is present.

In the female caribou, brucellosis causes abortion, retained afterbirth (which may cause infection) and giving birth to weak calves that might die within a few days, and generally impaired health. In the male caribou it infects the seminal vesicles and can cause enlargement of the testicles and epididymis. The major impact of herd health occurs because of abortion and sterility that reduces the productivity of the herd.

Grizzly bears, wolves, foxes and wolverines that prey or scavenge on these caribou also become infected, but the significance of the disease to predators it is not known.

- **Stress Syndrome**

Chasing caribou by snowmobile or aircraft can result in problems usually lumped under the heading of stress syndrome. Sudden and violent exertion causes changes in the muscle as chemicals from the functioning of the muscles build up faster than the blood can remove them. Such changes in the muscle can cause death to the caribou hours, days or even weeks after the chase. Hunters should be aware that chasing caribou over a long distance can be harmful. A panicked caribou can injure itself, become exhausted and suffer stress syndrome or under conditions of extreme cold, frostbite its lungs by panting. The survivors in a hunted group also suffer as much as the hunted animal.

f. Insect Parasites

- **Warble Flies**

The warble flies, which are called *Oedemagena tarandi* by scientists, look like small bumblebees. The flies cause the caribou to run about wildly so that they lose the amount of fat they would otherwise gain during the warm months. The flies chase the caribou in July and August and lay their eggs in the animal's hair on areas of the legs, flanks and lower hips. The larvae (grubs) that hatch from these eggs burrow through the caribou's skin and move under it to the area of the animal's back. There the larvae stop moving and become encysted. The encysted larvae pierce through the caribou skin to form small breathing holes. In June and July of the next year, the

grubs pop through the hole in the skin and fall to the ground to form pupae, which are a dark brown to black colour. The pupa stage lasts from 3 to 8 weeks before it changes to an adult fly. In turn, the adult fly only lives 6 to 8 days before dying. During that period, the female deposits her eggs and the cycle starts over again.

The warble fly larvae can easily be seen under the hides of caribou skinned in the winter and spring. The skin on a heavily infested caribou may have hundreds of holes through the skin. In August the caribou's skin heals and from then until October is the best time for hunting caribou to get hides for clothing.

Warble fly grubs are no danger to human health and were eaten by the Inuit. Warbles do impair the caribou's health by affecting their nutritional balance, can cause allergic responses, can cause secondary infections because of extensive tissue damage and may also suppress immune responses. Animals weakened by warble infection are more susceptible to other diseases, predation or environmental stress.

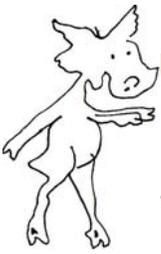
- **Nosebot Flies**

Adult nasal bots closely resemble mature warble flies in appearance. Female bot flies deposit larvae, not eggs, near the openings of the nostril of the caribou. The hovering and darting flies terrify the caribou, which stand rigidly or dash wildly about to avoid the flies. These tiny larvae move up the nose into the area at the back of the throat, called pharyngeal pouches, where they remain through the winter. In the late spring and early summer, these yellow coloured, elongated larvae (10-25 mm long), are sneezed out of the nasal area onto the ground and form pupae. The pupae in turn form adults and the life cycle begins.

Usually less than 50 grubs are found in a caribou and the effects are probably not too serious. Higher numbers of grubs block breathing to some extent but whether this is deleterious is not known. Coughing and nasal discharge can occur.

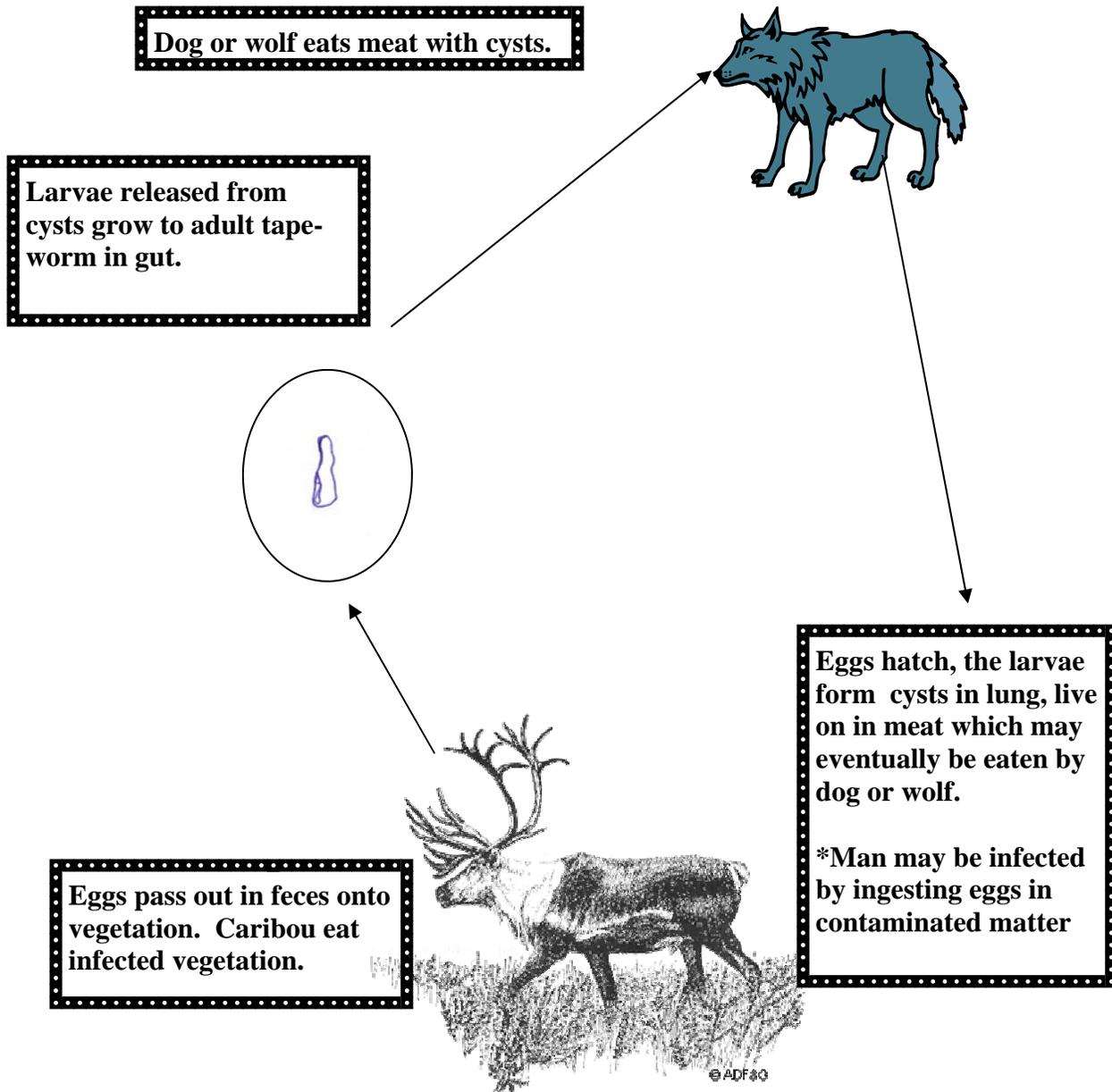
A Master's Degree student is undertaking a study of the relationship between warble flies and nasal bots and their effect on body condition. The results of this work will be available from the Porcupine Caribou Management Board in 2004.

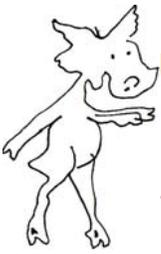




STUDENT INFORMATION SHEET

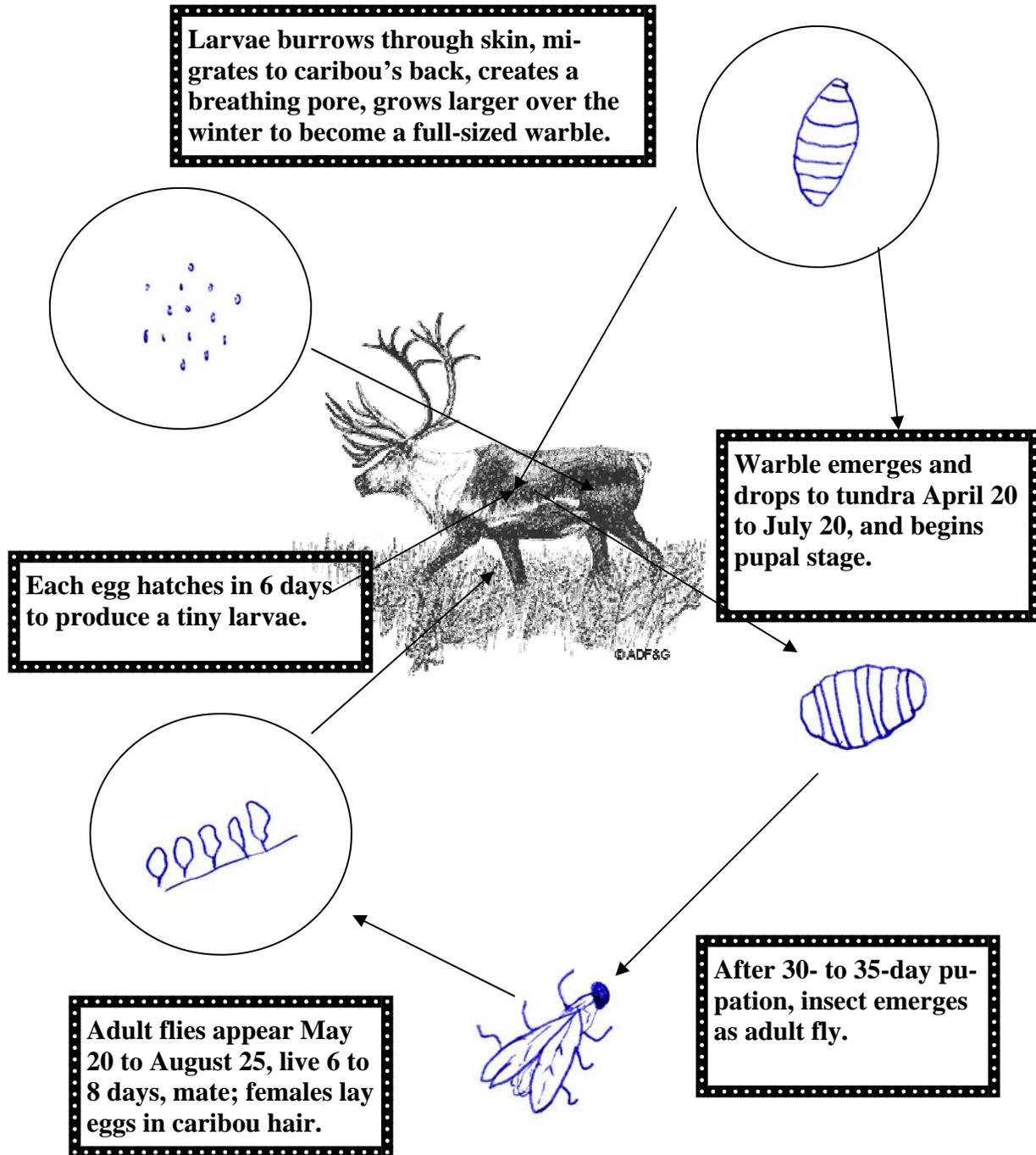
LIFE CYCLE OF TAPEWORM

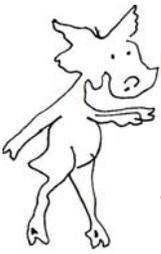




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LIFE CYCLE OF WARBLE FLIES

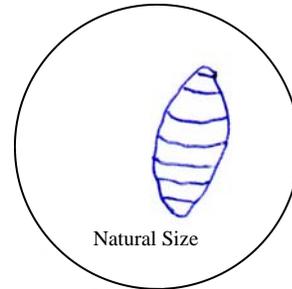




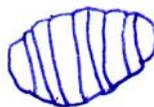
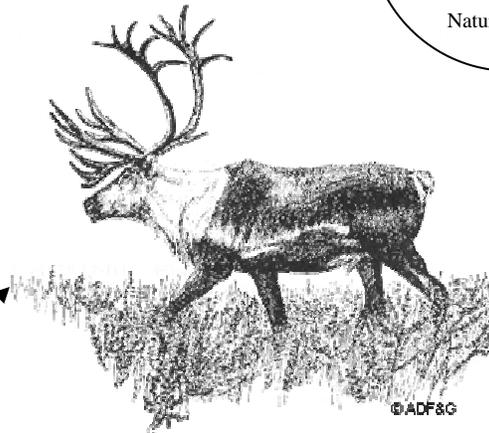
STUDENT INFORMATION SHEET

LIFE CYCLE OF NASAL BOTS

First stage larvae in nasal cavities beginning in July; not much growth until February. Third stage larvae in naso-pharyngeal pouches in April, May and June.

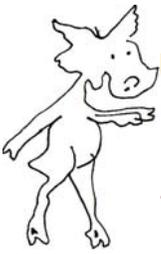


Female fly deposits larvae in nostrils in summer.



Larvae become pupae in soil, which become adults.

Mature larvae leave nostrils.



STUDENT INFORMATION SHEET

Early Calf Mortality

In the first month of life, an average of 25% of the newborn calves will die. A study in 1983 determined that of the calves that die, 52% will die from birth defects or poor nutrition and 48% die from predators. For the Porcupine Caribou Herd, the primary predator on

the calving ground is the golden eagle, followed by grizzly bears and wolves. These predators have higher concentrations in the foothills and mountains just south of the coastal plain where most calving occurs (Figure 8).

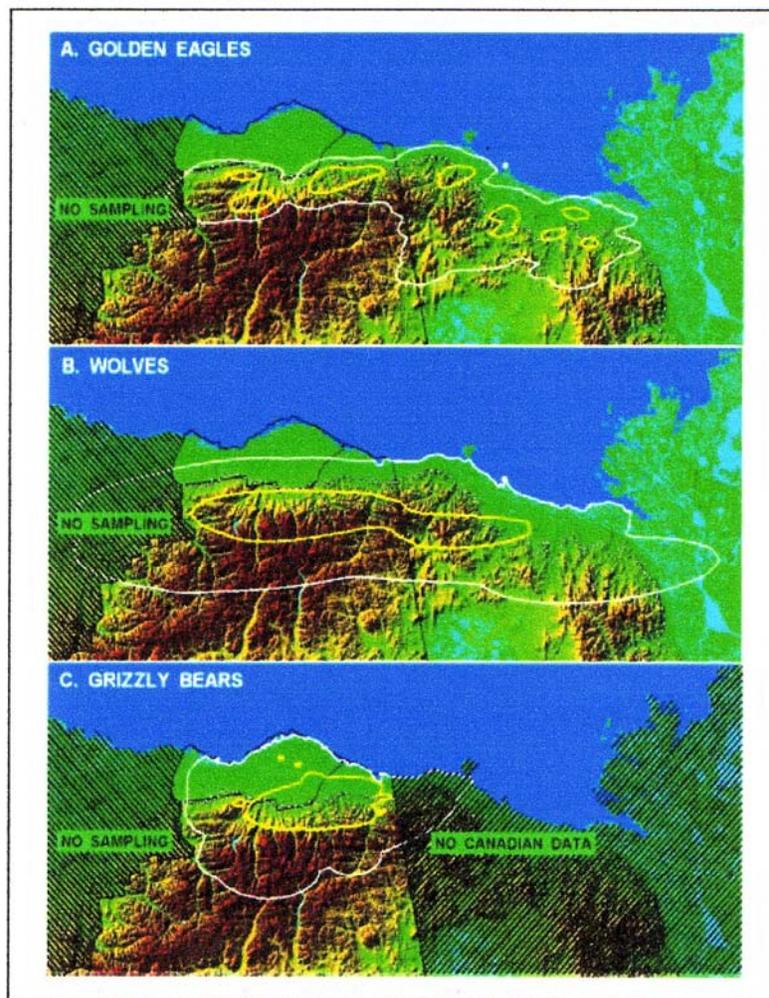
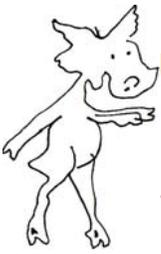


Figure 8: Distribution of predators of the Porcupine Caribou Herd: A) Golden Eagle nests; B) Wolf dens; C) Grizzly Bear radio locations. The yellow contours indicate higher than average densities of predators. The white line contains 99% of all the observations.

Taken from "Summer Ecology of the Porcupine Caribou Herd"



STUDENT INFORMATION SHEET

Even though the survival rate of calves for the first month of life is 75%, survival can vary from a low of 57% to a high of 94% (Figure 9). In the recent years (2000 and 2001) of very late spring snowmelt, calves were born during migration and only about 60% survived (Figure 9). From survey data, biologists have shown that survival of calves was

8 to 11% greater if born in the "1002" area or on the coastal plain than if they are born elsewhere. A general rule is that the earlier the snowmelt on the Alaskan coastal plain the greater of proportion of calves born in "1002". In years with particularly late snowmelt (1986-88, 2000-01, Figure 10) few calves were born in the "1002" area.

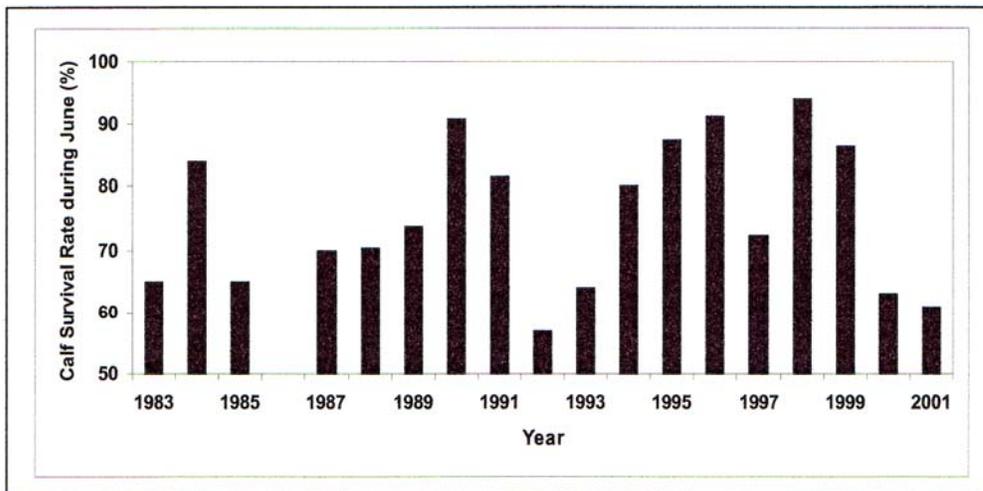


Figure 9: Calf survival rate during June (up to 1 month after birth) for the Porcupine Caribou Herd

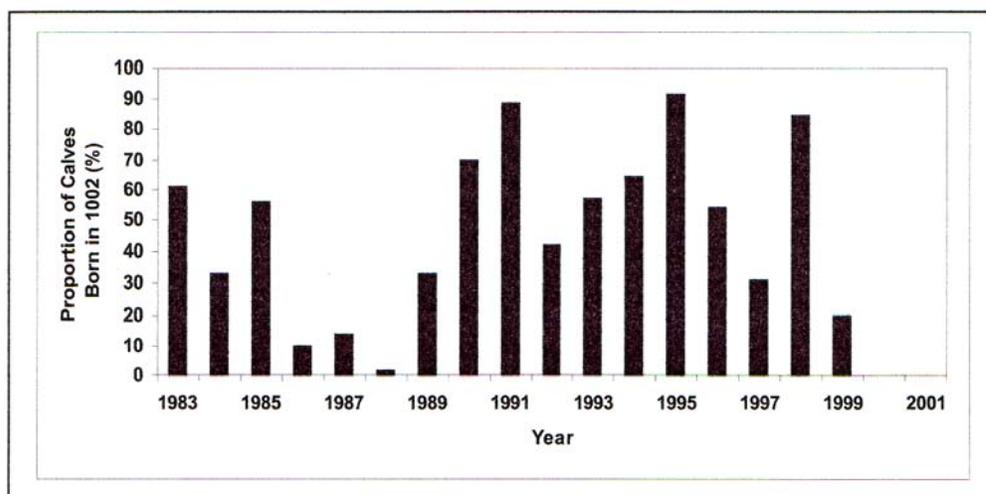


Figure 10: Proportion of calves from the Porcupine Caribou Herd born in the "1002" area of the Arctic National Wildlife Refuge. No calves were born in the "1002" area in 2000-2001.

Taken from "Summer Ecology of the Porcupine Caribou Herd"

5. FIRE

Generally, fires in the northern boreal forest are considered beneficial to caribou. They tend to perpetuate diversity and productivity and influence the successional sequence. All the vegetation, birds and mammals, including caribou, have evolved in and depend on this fire-dominated system. Summer and fall caribou forages, vascular plants, such as sedges and deciduous shrubs in particular, benefit from fires. These plants recover quickly and show vigorous growth after fire disturbance. Desirable species such as willows often become more abundant and more digestible after fires. Reindeer lichens also benefit from fire. Reindeer lichens in the first growing stage are most productive and most palatable to caribou. Fires tend to rejuvenate climax reindeer lichens, which are avoided by caribou, to the early preferred growing stage. Fires also create openings in the trees and openings are generally preferred by caribou, possibly due to predator avoidance characteristics. It has been suggested that burned sites were used by caribou in response to wolf harassment. Caribou are thought to select open sites, often brought about by burning, during late winter migration.

On the downside, vast, hot burns on caribou winter ranges may negatively impact on the herd. The widespread destruction of lichen stands may eliminate forage opportunities and the micro-climatic changes associated with the snow accumulations. These relationships between vast, severe wildfires and caribou distribution and forage availability have not been well studied but theoretically could impact on caribou. Computer simulation modeling on data provided from the caribou winter ranges of the taiga in north-central Canada revealed that the occurrence of wildfires would need to increase ten-fold over normal wildfire rates to reduce winter lichen supplies sufficiently to impact on caribou. This has not occurred in the northern Yukon; wildfire rates have changed little in the last 20 years.

More specifically, the early 1990s wildfires in the Old Crow area did not occur on winter range but occurred along a traditional migration corridor, used irregularly by caribou en route to winter range. This seasonal range would be expected to improve with fires through facilitating the growth of willows and sedges, and creating openings. In the short term, before regeneration can occur, there are numerous alternate routes that have been delineated. The impact of the 1990 fires near Old Crow on the caribou was minimal in 1990 and beneficial in years to come. There are plans to further investigate the effect of fire on the caribou.

Most fires are caused by the lightning of summer thunderstorms. However, human-caused forest fires, whether by accident or on purpose, add to the natural causes.

HUMAN-RELATED MORTALITY

1. HARVEST

For thousands of years native and Inuvialuit people have hunted the Porcupine Caribou herd. Early people had only primitive weapons, such as the bow and arrow and the spear. Hunting strategies included spearing at water crossings, chasing animals on foot, ambush, and using fences and corrals with snares to capture and kill many caribou at one time. People were subject to periods of starvation when caribou were not available or when hunts were unsuccessful.

The arrival of Europeans and their tools brought changes that improved the way of life of native people but also changed their relationship with caribou. The introduction of the rifle made a marked difference to hunting. While people successfully used techniques similar to those previously used, the amount of skill required in their execution was reduced. For example, they could shoot caribou from extremely long distances compared to the closer range required for the bow and spear. Purchased ammunition replaced spearheads and arrows laboriously fashioned from bone.

The nature of the caribou harvest began to change significantly with the advent of the whalers in the 1800s when caribou were needed for provisions. It has been suggested that there was a peak in harvest at the height of the arctic whaling industry in the 1890s, when up to 5,000 caribou may have been taken. Later, fur trading, prospectors, trappers and miners all added to the caribou harvest. In the period of 1891-1910, professional meat hunting was a common occupation in order to feed all the people on the land. In the 1930s, many people used dogs and sleds for transportation and these animals were also fed caribou meat.

In less than a generation, mechanized transportation and high-powered rifles have revolutionized hunting. Northern hunters now have the technology to pursue the caribou. In the past, the numbers and movements of the caribou determined the survival of human hunters. Now human hunters have a significant impact on caribou populations.

Porcupine Caribou are hunted every month of the year and consumed everyday by the Gwich'in, Inuvialuit and Inuit people of Alaska, Yukon and Northwest Territories. Seventeen communities with a total population of 10,600 (over 7,000 of native descent) rely on the caribou for subsistence to a greater or lesser degree, depending on location. In addition, sport hunters from the urban centers of Whitehorse, Inuvik and Fairbanks also harvest the Porcupine herd for both meat and trophies.

Generally, a subsistence hunter is of native descent who depends on the caribou for nutritional, cultural and other essential needs. In Alaska, non-natives are included in this category when they live on the land, have low incomes and also hunt caribou for customary and traditional uses. In the Yukon, a resident hunter (non-native) is generally classified as a

sport hunter as the hunt has a large recreational (sport) value as well as a meat and trophy value. A non-resident hunter is also a sport hunter because the hunt is a holiday where the person has a chance to experience the wilderness as well as bring home the trophy and/or meat.

The harvest ranges from 2,000 to 7,000 animals per year. Most of the harvest is for subsistence. The harvest by hunters for other than subsistence is estimated at 200-400 caribou per year.

The total kill by all hunters should allow for the animals that die later from gunshot wounds. This “crippling loss” has been estimated at an average of 25%, which is added to the total kill.

Annual harvests vary considerably not only in total but also for particular communities depending on the specific migration routes and winter ranges chosen by the majority of the herd. In particular, the communities in the Northwest Territories on the eastern periphery of the range exhibit the highest variability among annual harvests. In most years, more caribou are harvested annually in Canada than in the United States.

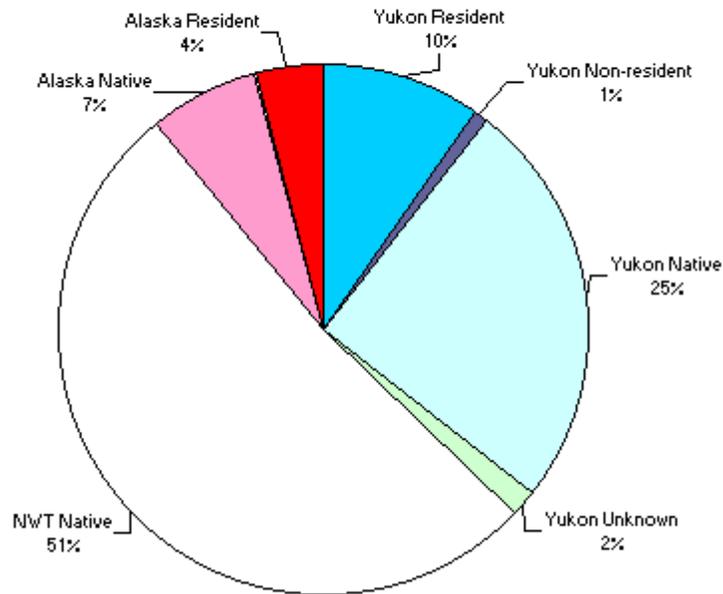
Other human activities associated with hunting are harassment by snow machines, aircraft, etc. If caribou are chased for long periods of time, it causes stress syndrome (see Diseases) that can contribute to mortality anytime after the harassment occurs. Human-caused forest fires (e.g. from campfires) can destroy the lichens, which are the main component of the caribou's winter diet.



STUDENT INFORMATION SHEET

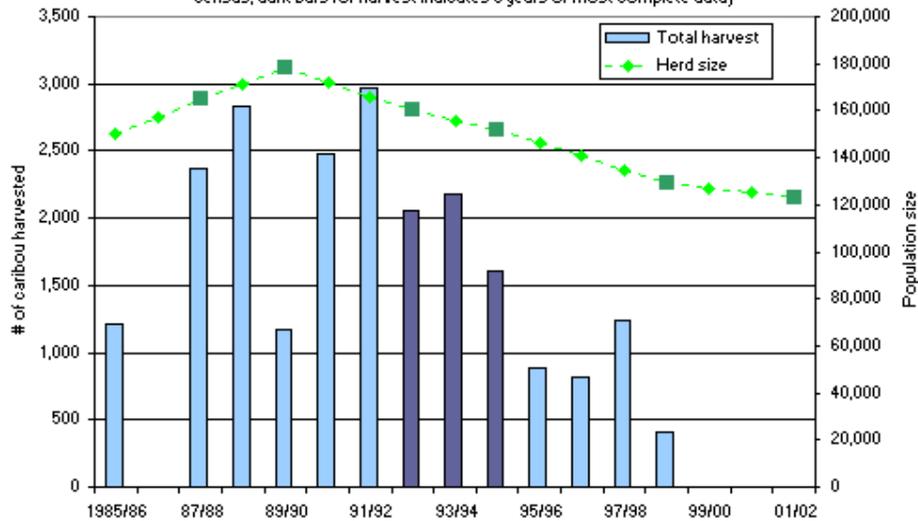
Average reported harvest by user group

For the 3 years with the most complete information (1992, 93, 94 combined)



Total reported harvest and herd size

(harvest for 1986, 1999 to present not yet available. Dark points on herd size line indicates census, dark bars for harvest indicates 3 years of most complete data)



2. DISTURBANCE

Throughout North America much concern has been expressed about the potential impacts of development on large herds of migratory caribou.

Spot developments that occur on a few acres have a different impact from **linear** developments. If a development is serviced by lakes or rivers and is designed to minimize effects on caribou through mitigative measures, then the impact can be relatively small. However, the probable impact of even a small development on a caribou range increases if it must be serviced by large aircraft or linked to other centers by permanent transmission lines, pipelines or roads.

Concerns about caribou and industrial developments (except for roads) revolve primarily around the construction phase. Once linear developments such as pipelines or power lines are in place, the animals may be disturbed by occasional inspection or repairs. Roads are a different story. The caribou in the area can be continually disturbed by traffic and the activities of the people who travel the roads.

a. Roads

Where roads traverse winter ranges, a number of factors are thought to influence whether or not the animals will cross. Those factors include availability of cover near the road, the road profile (if the caribou can see across it or not), the direction of the road in relation to the direction of movement of the caribou, and the amount and duration of harassment of the animals by traffic and hunters.

The major problem with roads is hunting and the provision of increased access to a caribou herd. The second most important factor is whether or not the road itself, or the road and people on it, will be a barrier to caribou movements. If for any reason the caribou refuse to cross a road, that portion of the herd's range on the other side is lost to them.

Caribou can also be killed in collisions with vehicles, especially at night when the headlights appear to distract the animals. The caribou use the plowed surface for walking and might hesitate to move off it into deeper snow when a vehicle comes along. Even just the passage of vehicles can temporarily disturb the caribou trying to cross.

Hunting along roads is a dual problem. In theory, one would think that if you depend on caribou from a given herd and travel by pickup truck instead of a snowmobile to get them, the result would be the same to the herd. But in practice, that is not what seems to happen. As hunting becomes easier, more hunters go out and the success rate increases. More caribou are killed, and many more may be disturbed or prevented from crossing the road. The road can also provide a hunting corridor for wolves that can easily travel the plowed road surface and effectively locate caribou and hunt them from the road.

Roads also cause problems for caribou herds by allowing access to the herd by people who would not normally hunt it. For example, people from the southern Yukon drive to the northern Yukon to hunt on the Dempster Highway and harvest caribou.

Permanent roads bring with them even more problems than winter roads. All-weather surfaces are often a physical barrier, as they are raised above the surrounding terrain. The high berms, snow plowed off the road and piled along side it, and lateral ditches filled with snow can provide a barrier effect for caribou.

Permanent roads invariably attract tourist traffic, increasing the risk of forest fires. Tourists and larger populations of people come to formerly remote villages. The end of the road has become a jumping-off site for industrial exploration.

b. Dempster Highway

Presently the only major industrial development on the Porcupine Caribou herd's range is the Dempster Highway. This road crosses the herd's winter range in the Yukon.

The most important disturbance factor of the highway is that it has provided all hunters with increased hunting access to the herd and has resulted in increased hunting success. The current restrictions for no-hunting apply to the highway corridor (500 meters on either side of the center line), and there is a one-week closure to caribou hunting to "let the leaders pass".

As with any highway, further development is possible. Increased interest in oil and gas leases along the Dempster Highway, particularly in the Eagle Plains area, is of concern.

c. Calving Grounds Development

Caribou appear to be most vulnerable during calving and these calving grounds are essential for the survival of the herd.

The calving ground is the area where the caribou give birth to their young every year. The calving grounds of the Porcupine Caribou herd are international in scope extending from the Babbage River in the Yukon to the Canning River in Alaska. The area includes the arctic foothills up to 100 m elevation and the arctic coastal plain to the Beaufort Sea. Within this general area certain "core" areas have been documented where high density concentrations occur every year.

Some of the theories explaining why caribou are loyal to a calving ground are:

1. Avoidance of insects at that time period on the winter range.
2. Avoidance of high density predator populations that occur at treeline in the winter range.

3. The ability of the cows (at a time when their energy demands for producing milk are high) to locate the newly flushing, nitrogen-rich vegetation that occurs on the calving grounds.

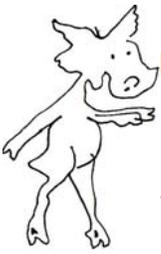
For whatever reason or reasons, the caribou consistently use this traditional area and it should be recognized as critical habitat.

Oil development proposals for the “1002” Section of the Alaska National Wildlife Refuge in Alaska pose a serious threat to the Porcupine Caribou herd. Development of the “1002” area may displace parturient cows from traditional calving areas, thereby increasing predations on calves, or reducing the foraging opportunities for cows and calves. According to a study updated by the United States Geological Survey in 2000, there is a 95% chance of finding only 1.9 billion barrels of economically recoverable oil and a 50% chance of finding 5.3 billion barrels of oil. This may sound like a lot, but Americans use 19 million barrels of oil each day, or 7 billion barrels per year. The survey concluded that at the present rate of consumption, there would be about a 180-day supply of oil lying beneath the refuge’s coastal plain. A previous environmental assessment done by the US Department of the Interior found that oil and gas development would likely reduce the size of the herd. The report admits that if full leasing were permitted in the core calving area, “it could result in a major population decline of 20% to 40 % of the Porcupine Caribou herd.”

Other human activities that could disturb caribou include dams, logging and increased air travel.

Forestry operations may remove caribou wintering habitat in much the same way fire does. Clear-cut logging removes the trees that form the microhabitat allowing lichens to thrive. The primary effects of timber harvest on caribou are loss of the habitat and possible disturbance during the cutting. Secondary effects of logging also have a high potential for affecting caribou. Haul roads, spur roads and winter roads provide additional human access to the winter range and bring with them the full complement of problems associated with roads.

Hydro dams require major construction phases that bring in many people, facilities and equipment, which can initially disturb the caribou. The dams change the river water quantity and can control the flow during the seasons. A major disaster occurred in 1984 when 10,000 caribou from the George River herd were drowned during the fall migration to their winter range. Abnormally high flood waters swept these animals over Limestone Falls as they attempted to ford the Caniapiscaw River in northern Quebec. Dams can also produce large bodies of water that can flood critical winter habitat.



STUDENT INFORMATION SHEET

Possible Impacts of “1002” Development

As researchers and managers, we can only use the best information available to predict the impacts of oil and gas development within the “1002” area on the Porcupine Caribou Herd. We have the luxury however of a tremendous amount of information on this herd, probably more than for any other wild caribou or reindeer herd in the world. We therefore use the following five research-based observations to argue that this herd would be particularly sensitive to development within the “1002” portion of the calving ground.

Low productivity of the Porcupine Caribou Herd - The Porcupine Caribou Herd has the lowest population growth among Alaskan arctic calving herds and is the only Alaskan arctic herd known to be in decline in the 1990’s. This suggests that the Porcupine Caribou Herd is less able to withstand natural or man-made stresses to its ecosystem. For example, even a 5% reduction in calf survival would be enough to halt growth in the Porcupine Caribou Herd but would not be enough to halt growth in the other Alaskan arctic calving herds.

Demonstrated shift of the Central Arctic Herd concentrated calving away from development - Avoidance of disturbance by female caribou during the first few weeks of the life of calves is the most consistent behavioral response of caribou to development that has been observed. It is assumed that the Porcupine Caribou Herd calving will shift away from development in a similar manner as observed for the Central Arctic Herd if development of the “1002” area occurs.

Lack of high-quality alternate calving habitat - Calving areas in Canada and off the Alaskan coastal plain were used only when the Alaskan coastal plain and “1002” areas were unavailable due to late snow melt. Diet quality on Canadian portions of the calving ground was substantially lower than on the Alaskan coastal plain and “1002” portions of the calving ground. When cows were not able to access the Alaskan coastal plain and “1002” area for calving, calf mortality was up to 19% higher than when they calved on the Alaskan coastal plain and/or “1002” area.

Strong linkage between calf survival and free movement of cows - The location of the annual calving grounds and concentrated calving areas was variable among years in response to variable habitat conditions and was often coincident with the “1002” area. The relationships between calf survival, food available to nursing cows, and predation risk predict that June calf survival for the Porcupine Caribou Herd will decline if the calving grounds are displaced, and that the effect will increase with displacement distance. Higher calf mortality will occur because of poorer feeding and higher predation.

No evidence that Porcupine Caribou calves or cows can compensate, later in the summer, for poor late June physical condition - The condition of the cows and their calves in the Porcupine Caribou Herd at the end of June predicts their condition during the autumn breeding season. If animals are in poor condition in fall, then pregnancy rate is reduced, age of first reproduction may be delayed, and winter mortality will increase.

Taken from “Summer Ecology of the Porcupine Caribou Herd”

3. CONTAMINANTS

Lichens absorb nutrients from air and water that might also contain radioactive material. Radioactive fallout accumulates at a higher concentration in lichens than many other plants because they grow slowly, live a long time and change very little. As well, there is not enough rain to wash the radioactive material into the rivers or soil in the arctic.

Lichens are the base of the lichen-caribou-human food chain. Caribou subsist primarily on lichens during winter months and therefore can absorb unusually high amounts of radioactivity. This would be passed on to humans who eat a lot of caribou meat.

Between 1985 and 1995, there were several concerns about the level of Cesium in the herd, especially following the explosion of the Chernobyl nuclear reactor in 1986. However, results of studies of contaminant levels released in 1998 show that the level of Cesium is negligible.

In the fall of 1993, the Canadian Wildlife Service released a report that stated that there could be a health risk from cadmium contamination for people eating Porcupine Caribou under certain conditions. After a thorough examination of the data and a public education program, the Porcupine Caribou Management Board concluded that there was no realistic health risk to anyone eating caribou kidneys or livers. At that time some Old Crow residents were tested for evidence of cadmium toxicity and were found to have none. Tests from caribou samples from 1990-1994 showed that cadmium levels had not increased in the herd.

The only other contaminant in Porcupine Caribou that is being investigated is mercury. In 1995 it was reported that mercury levels in caribou were slightly higher but the mercury was not the toxic methyl mercury and so is not considered a health hazard. Mercury levels have continued to be low and unchanged.

Samples obtained from body condition studies are being archived and will be used to continue monitoring contaminant levels in the herd.

SUGGESTED LEVEL 1 ACTIVITIES

1. Brainstorm all the possible causes of death of caribou before watching the video. List them on the board under headings of natural and human-caused. Complete the chart after watching the video.
2. Cut out pictures of predators and scavengers of caribou. Use the internet and old Alaska magazines or other wildlife magazines. Write a few sentences to go with each picture. Or draw some of the animals you might not be able to get pictures of.
3. Learn the native names of the predators of the caribou. Are there local legends associated with these animals?
4. Obtain a tape of wolf howlings. Have students try to imitate it. The howls are ways in which wolves communicate - find out where they are in order to regroup, mark their territory to warn other packs away, etc. Draw pictures of wolves howling.
5. Set up a display area using materials and pictures of the predators. Perhaps locate skulls and hides, track castings, etc. Write a caption with each article displayed.
6. Research the tracks of predators and draw them to scale. Draw you own track in comparison.
7. Have the students tell their favourite bear story.
8. Invite a biologist in to talk about predators in your area. Help the students prepare for the visit by preparing questions they would like answered.
9. Make cut potato ink prints of caribou and their predators. Design notepaper or wrapping paper.

SUGGESTED LEVEL 2 ACTIVITIES

1. Ask students to find out from elders and current hunters of caribou any examples of deaths, injuries, disease and parasites they have seen in the past and present.
2. Invite a biologist to give a talk about predators in your area. Prepare questions before the biologist arrives. Follow up by having a group discussion on some of the aspects covered.
3. Have the students provide their body weights. Calculate the average body weight of male and female students. Chart this on a graph. Then plot the average weight of male and female wolves, grizzly bears and wolverines.
4. Go out on a winter walk and try to identify tracks in the snow. Perhaps even dog tracks in town will provide an idea of sinking depth, direction of travel, etc.
5. Select a pamphlet from the Yukon Mammal Series on one of the predators of caribou. Have students group-read some of the paragraphs. Write the difficult words on the board. Have the students look up the meanings and discuss the paragraph.
6. Draw a pictorial diagram of a wolf's territory including rivers, lakes, mountains, and forested areas and valleys. Cut out silhouettes of caribou, moose, beaver and rabbits and put them on the landscape. Then draw a wolf and make a dotted line over the territory showing the wolf's travel over its home range. Include a good place for a den close to water.
7. Discuss the calving ground of the Porcupine Caribou herd as being a place where cows have their calves. When the cows give birth and start producing milk, they need good, nutritious food. The vegetation right at that time is just greening up and is high in nitrogen. This place has fewer predators than farther south into the mountains. Introduce the topic of proposed oil developments in the 1002 section of the Arctic National Wildlife Refuge in Alaska. Research the lobbying effort conducted by the Porcupine Caribou Management Board. (See PCMB Annual Reports and "Community Caribou Updates".) Have students discuss their concerns. Perhaps they can debate the issue of developing the calving grounds. Have students write their concerns to appropriate government sources. Or have the students develop a film script to show their point of view on preserving this area.
8. As a class project, list all potential hazards within 5 km of your community. Divide into human-made (roads, airports, etc.) and natural (water crossings, wolf occurrences, etc.). Chart history of hazards, predation, accidents, hunts, etc. in the same area over a couple of years.

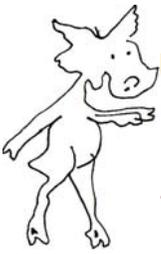
SUGGESTED LEVEL 3 ACTIVITIES

1. Invite a biologist to give a talk about predators in your area. Prepare questions before the biologist arrives. Follow up by writing a small report.
2. Have students ask people in their community about sightings of grizzly bears and wolves in their area. How many grizzly bears have been seen and/or killed, and how many wolves have been seen and/or trapped over the years? Do people think there are more or less of these predators now?
3. Discuss the vulnerability of different age classes of caribou, calves, pregnant cows, bulls in the rut, old and sick caribou, etc., to the natural hazards and predators.
4. Using the life cycle diagram of either the nose-bot or warble fly, have the students describe the cycle and how it might affect the caribou.
5. Find out what the fire protection priority areas are in the Yukon. Colour these areas on a map of the general area around your community. How much of the winter range of the Porcupine Caribou is protected? Has there been a recent fire in your area? Do caribou still use this area?
6. Research the book *Never Cry Wolf*, by Farley Mowat. Emphasize that it is a fictional book. Point out the fact that wolves eat large prey such as moose and caribou instead of mice as indicated in the book. Invite a wolf biologist in to discuss the story. Have students read out parts of the book and ask the biologist questions.
7. Have students choose a predator or scavenger. Research this animal. They can refer to the Yukon Mammal Series for pertinent Yukon information. Encourage students to use the scientific name and even the native name of the animal.
8. Obtain skulls of bears, wolves, wolverine and caribou or moose from the community hunters or from the YTG Department of Environment. Have the students examine the skulls and point out differences between the meat- and plant-eaters.
9. Discuss the calving ground of the Porcupine Caribou herd as being a place where cows have their calves. When the cows give birth and start producing milk they need good nutritious food. The vegetation right at that time is just greening up and is high in nitrogen. This place has fewer predators than further south into the mountains. Introduce the topic of proposed oil developments in the 1002 section of the Arctic National Wildlife Refuge in Alaska. Research the lobbying effort conducted by the Porcupine Caribou Management Board. (See PCMB Annual Reports and "Community Caribou Updates".) Have students discuss their concerns. Perhaps they can debate the issue of developing the calving grounds. Have students write their concerns to appropriate government sources. Or have the students develop a film

script to show their point of view on preserving this area.

10. Draw a chart of the lichen-caribou-human/wolf food chain.
11. Have students research the Exxon Valdez oil spill that occurred on March 24, 1989. There are good sources of information on the internet. Refer to websites at back of manual.





STUDENT ACTIVITY SHEET

Life has many natural dangers. Read about the caribou in these stories. Why are they in danger? Which danger will probably kill the caribou? Check off the correct answer in each box.

Accident	<input type="checkbox"/>
Predation	<input type="checkbox"/>
Disease	<input type="checkbox"/>
Bad weather	<input type="checkbox"/>

Wolves! Everyone is running. The calf is frightened. It's mother is gone. The other caribou jump into the river. The calf tries to swim too but bigger animals bump into it. It gets very tired and the current is too strong for it. It can't swim any longer. The water carries it away.

Accident	<input type="checkbox"/>
Predation	<input type="checkbox"/>
Disease	<input type="checkbox"/>
Bad weather	<input type="checkbox"/>

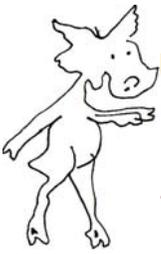
There are many, many insects. The caribou begin to stampede to the top of the ridge. There may be a breeze there to keep the insects away. As they run some fall and injure their legs or ankles. They are very tired. Suddenly a shot is fired. A caribou falls. Hunters!

Accident	<input type="checkbox"/>
Predation	<input type="checkbox"/>
Disease	<input type="checkbox"/>
Bad weather	<input type="checkbox"/>

The herd is going north again. The snow is very deep and in places it is covered with a hard crust of snow. It has been hard to find food. A caribou bull slips. His knees are swollen. He is in pain. He is weak from a lack of food. He must lie down. He cannot go on.

Accident	<input type="checkbox"/>
Predation	<input type="checkbox"/>
Disease	<input type="checkbox"/>
Bad weather	<input type="checkbox"/>

The caribou cow is very nervous. She can smell the scent of wolves. Her newborn calf is wet after being in the freezing rain. She tries to keep it warm but the cold wind is still very strong. The calf is getting too cold.



STUDENT ACTIVITY SHEET

Read the list of natural dangers. Which caribou are most vulnerable? Think about calves, yearlings, pregnant cows. Think about sick or injured animals. Draw a picture of caribou on their migration. How many natural dangers will your caribou face? Check off the dangers in your picture from the list below.

There is an ice crust on the snow.

There is fast-moving water.

Insects are harassing the caribou.

A caribou has swollen joints.

Wolves are following the herd.

A bull has broken an ankle.

Hunters with bows, arrows and spears are waiting to ambush a group of caribou.

A blizzard is blowing.

Caribou have been startled and are stampeding.

The snow is too deep for them to forage.

There are ice floes at the water crossing.

Caribou are being chased over rough ground.

A calf has lost its mother.

There is freezing rain falling.

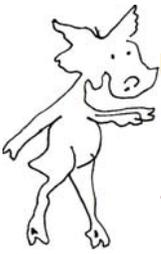
There is a burned area without food to eat.

Two bulls are fighting during the rut.

It is calving time.

The weather is very cold and it is windy and wet.

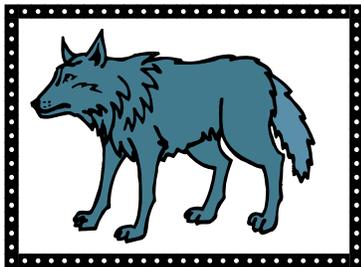
The new calves are very cold.



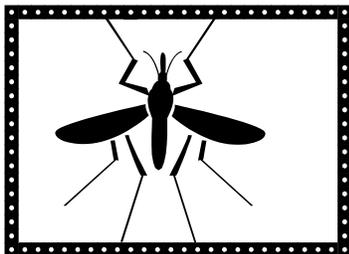
STUDENT ACTIVITY SHEET

Some predators kill caribou. Some micro-predators feed off living caribou.
Some scavengers feed on caribou they find already dead.

Look at the pictures. Read about them. Then write in the name of another predator who uses caribou in the same way.



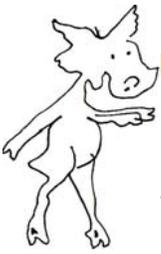
The wolf kills caribou and eats the meat.
Name another predator that does the same thing.



The mosquito is a micro-predator that
feeds off living caribou. Name another one.



Some predators scavenge by feeding on dead
caribou. The fox is one. Name another.



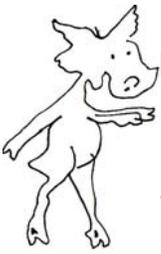
STUDENT ACTIVITY SHEET

Below is a list of some of the predators who use caribou as part of nature in their own way. Some are mammals, some are birds, some are insects.

In column 1, write down which animal group they belong to. In the boxes in column 2, write in a number to show how serious a threat to caribou you think they are. Start with the most dangerous predator as number 1. End with the one you think is least dangerous as number 12.

	<u>Column 1</u>	<u>Column 2</u>
golden eagle	_____	<input type="checkbox"/>
mosquito	_____	<input type="checkbox"/>
fox	_____	<input type="checkbox"/>
owl	_____	<input type="checkbox"/>
wolf	_____	<input type="checkbox"/>
raven	_____	<input type="checkbox"/>
humans	_____	<input type="checkbox"/>
warble fly	_____	<input type="checkbox"/>
wolverine	_____	<input type="checkbox"/>
jaeger	_____	<input type="checkbox"/>
grizzly bear	_____	<input type="checkbox"/>
hawk	_____	<input type="checkbox"/>
blackfly	_____	<input type="checkbox"/>

Why did you choose your priorities 1 and 2? Explain:



STUDENT ACTIVITY SHEET

Some predators kill caribou and eat the meat. Some micro-predators feed off living caribou. Some other predators feed off caribou that they find, already dead. Which are which in the list below?

wolf mosquito fox humans owl
blackfly wolverine warble fly hawk jaegar
raven grizzly bear golden eagle

Predators that kill	Predators that are carrion eaters	Micro-predators

Draw a picture of one of the predators that is a very serious threat to caribou.



STUDENT ACTIVITY SHEET

NATURAL MORTALITY

Find the words taken from the following paragraph.
Words can go horizontally, vertically and diagonally in all eight directions.

Golden eagles, wolves and grizzly bears are the most common predators of Porcupine Caribou calves. When caribou are abundant on the coastal plain (May and June), most wolves are probably confined to the mountains where they are denning. Wolves that were not involved with denning follow the caribou. Grizzly bears are quite common on the Porcupine calving grounds and at times appear to be gathered where calving activity is most concentrated. However studies have shown that golden eagles, particularly the non-nesting sub-adults, are the most important predator on the calving and post-calving grounds. Golden Eagles were involved in 50% of the total mortality either as the probable predator or as a predator / scavenger. While in order of importance, the major calving ground predators are eagles, grizzlies and wolves respectively, neither eagles nor grizzlies are likely to be very significant predators of adult caribou whereas wolves are.

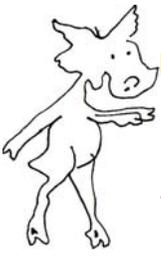
V	E	R	Y	N	D	P	T	S	E	L	G	A	E	W	R	K	R	I
N	B	D	I	B	K	N	D	N	S	N	I	A	T	N	U	O	M	M
Y	G	A	W	O	L	V	E	S	P	W	T	T	K	C	T	R	Y	P
G	L	F	M	K	W	D	R	R	R	M	N	J	N	H	L	R	K	O
P	X	E	C	J	L	M	E	G	O	S	A	W	E	X	B	L	F	R
S	H	R	V	O	J	W	H	R	B	T	D	Y	Y	X	A	Q	Y	T
C	I	R	G	I	M	V	T	J	A	U	N	C	J	T	D	G	L	A
N	R	G	E	L	T	A	A	Z	B	D	U	M	O	E	X	C	R	N
G	N	K	N	H	L	C	G	L	L	I	B	T	N	R	K	V	A	C
N	R	V	D	I	T	W	E	M	Y	E	A	N	C	G	M	W	L	E
I	T	O	T	E	F	I	G	P	F	S	I	M	O	N	K	P	U	R
T	R	Y	U	T	W	I	E	T	S	N	K	N	A	M	X	R	C	M
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N	V	L	L	X	L	S	K	L	N	R	P	J	A	Y	T	A	R	B
C	S	E	M	I	T	V	C	J	O	T	L	G	L	L	R	T	A	X
D	G	R	I	Z	Z	L	I	E	S	F	L	V	U	N	P	O	P	X
F	Y	Q	B	E	A	R	S	N	R	R	Q	D	L	L	C	R	K	M
S	C	A	V	E	N	G	E	R	G	X	A	V	G	R	Q	S	F	R

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ABUNDANT
CALVING
EAGLES
GOLDEN
IMPORTANCE
NEITHER
PLAIN
SCAVENGER
THEY
VERY

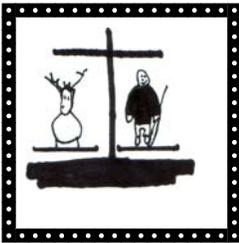
ADULT
COASTAL
FOLLOWED
GRIZZLIES
MORTALITY
NESTING
PREDATORS
SIGNIFICANT
TIMES
WOLVES

BEARS
DENNING
GATHERED
GROUNDS
MOUNTAINS
PARTICULARLY
PROBABLY RESPECTIVELY
STUDIES
TOTAL



STUDENT ACTIVITY SHEET

In the last lesson we learned about prehistoric people and their tools and equipment. They could never kill enough caribou to put the survival of the herds in danger. They did not have the technology needed to kill and transport large numbers of caribou. They had to compete with other predators, like the wolf. So we say that nature was in balance.



Early people had only primitive weapons, such as the bow and arrow, and the spear. They had to travel on foot much of the time. Dogs were used to carry loads or to pull sleds. People could not own many dogs because they could not feed more than a few.

Like all predators, people who depended on caribou sometimes went hungry. Many died if they could not get enough meat to feed their camp.

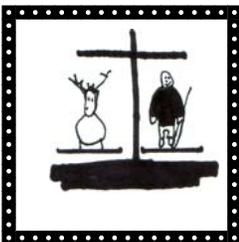


If there were lots of caribou the predators grew strong and healthy. They raised bigger families and their numbers increased. So there were more humans, more wolves, and more of other predators. When there were too many predators they killed many more caribou and the herds began to decline.

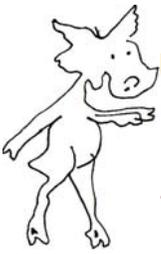


Then the predators went hungry again and sometimes died.

These cycles of good times and bad times continued for hundreds (or thousands) of years and kept nature in balance.



The caribou and their predators were able to survive these good and bad times. Things did not change until human hunters got guns.



STUDENT ACTIVITY SHEET

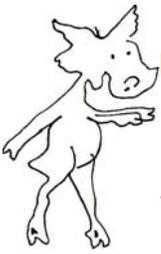
Fill in the missing words. They are all in the box. Use the Documentation Sheet if you need help.

Early man worked very h _ _ _ to feed his family. He had few _ _ _ p _ _ _ to hunt with and he traveled on _ _ o _ much of the time. If he _ _ l _ _ _ more than one or two _ _ r _ _ _ _ he had to stay in one spot or c _ _ _ _ the meat because he could not carry large _ o _ _ _ .

This meant he had few advantages over other _ r _ _ _ _ _ _ who preyed on caribou. Because no _ _ i _ _ _ could kill too many caribou people say _ _ t _ _ _ was in _ _ _ a _ _ _ .

When there were lots of caribou there were _ _ t _ of predators. When the caribou _ _ c _ _ _ _ _ the number of predators began to d _ _ _ _ _ . Then, because the caribou were not being _ _ k _ _ in great numbers, the herds started to _ n _ _ _ _ _ again. This _ y _ _ _ seems to be nature's way. Is nature in balance today, or must we all help by _ s _ _ _ caribou very _ _ r _ _ _ _ ?

caribou	nature	carefully	declined	cycle
killed	taken	balance	lots	decreased
cache	hard	using	animal	increase
weapons	loads	predators	foot	increased



STUDENT ACTIVITY SHEET

Fill in the numbers and do the sums in the story.

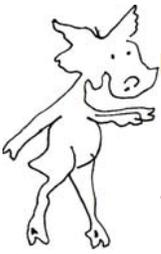
A group of 69 caribou cows reach the calving grounds. 48 of them have calves. There are now _____ + _____ = _____ animals. 3 wolves kill 15 of the calves. That leaves _____ + _____ = caribou. On their way south for the winter, 4 calves drown at water crossings. _____ - _____ = _____ caribou are left. 16 of the cows are killed by hunters.

So the group is then _____ - _____ = _____. 5 more calves and 7 more cows die of accidents and wolf attacks, leaving _____ - _____ - _____ + _____ caribou.

During a very bad winter, 14 of the cows die and 9 of the calves. So, from the 69 cows, there are now only $69 - 16 - 7 - 14 =$ _____. From the calves there are $48 - 15 - 4 - 5 - 9 =$ _____. Can the wolves and hunters live on the caribou left? Will some of them starve to death?

If some of the predators die, more cows will return to the calving grounds next year and have new calves. If there are fewer wolves and fewer hunters, more caribou will survive. Then the number of caribou may increase. Then there will be more meat to feed more wolves and hunters.

That is the way the balance of nature works. Do you think nature will always be in balance? Who and what can upset nature's balance? What will happen to caribou?



STUDENT INFORMATION SHEET

In the last lesson we learned that prehistoric people who depended on caribou were, like all predators, part of the balance of nature. The rules of nature applied to them, just as they did to the other animals.



When people got guns, the balance of nature changed, but hunters still could not kill too many caribou. Ammunition was scarce and expensive. Shells had to be refilled and used many times. Transportation was still difficult because materials were poor. A hunter could not get enough meat to feed a big dog team that could pull heavy loads.

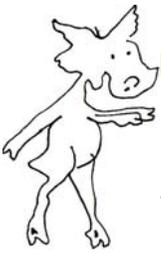


Then, about 50 years ago, hunters and trappers were able to buy the repeating rifles. This fired many shots quickly and it was easier to kill caribou.

Then the balance of nature changed, and humans were the most dangerous predator. People no longer needed to starve and perhaps die because they could not get enough meat. That only happened when the caribou did not come, or the people were too poor to buy ammunition, or too sick to hunt.

With the rifle, people could also kill wolves, which also depended on the herds. People were able to feed more dogs, and this meant that they could travel farther and carry bigger loads. People were becoming more mobile.

Nature was no longer in balance. Humans were no longer limited by all the rules of nature. Their technology was superior. The other predators still used their instinctive ways. But if a hunter wanted to, he could shoot other predators so as not to compete with them for the caribou.



STUDENT ACTIVITY SHEET

Modern hunters today have many advantages over earlier hunters. That is why they could kill many more caribou if they wanted to. They know it is important to harvest only what they need. Here are lists of things early hunters used and things modern hunters use. Can you explain what differences the new equipment made to hunting caribou?

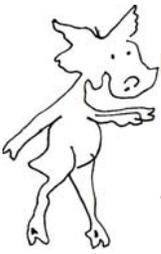
Early caribou hunters had:

Bows, arrows, spears
Kayaks, birch bark canoes
Paddles
A sled and a few dogs
Watchers to look for the coming of the caribou
Runners who warned others that the herd had arrived
Tools made mainly from bone, antler and sinew

Modern hunters have:

Rifles, telescopic sights
Freighter canoes
Outboard motors
Snowmobiles
Aircraft to search for the herds
Radios
Metal tools bought at the stores

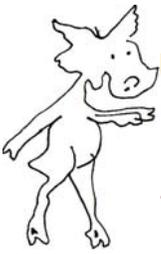
Caribou users no longer live in tents and igloos. They live in comfortable houses. What advantage is that for modern hunters?



STUDENT ACTIVITY SHEET

This sheet gives you descriptions of some of the enemies of caribou. They are clues. Can you guess what they are?

<p>I am the biggest enemy of caribou. I eat caribou. Caribou skin keeps me warm. I disturb caribou with noise, mines and roads. I cause fires. Who am I?</p> <p>_____</p>	<p>I am hot. I do not like water. I am difficult to stop. I destroy caribou feeding places. What am I?</p> <p>_____</p>
<p>We fly and we buzz. We drink blood. We breed in warm weather. We follow caribou. We do not let caribou rest. We are very small, but we are very hungry. What are we?</p> <p>_____</p>	<p>In winter I freeze. In summer I run. Caribou cross me. When I run fast, caribou get tired. Sometimes I carry away weak caribou. What am I?</p> <p>_____</p>
<p>I am so small you cannot see me. I can attack caribou and kill them. I can make caribou weak. Weak animals cannot feed. What am I?</p> <p>_____</p>	<p>I am a member of a pack. I follow caribou. I hunt with friends. I kill caribou. Sometimes I eat a lot. Sometimes I eat only the caribou tongue. What am I?</p> <p>_____</p>
<p>Trees are like matches. When I strike them they burn. I can cause many fires. My fires destroy parts of forests where caribou live and feed in winter. Who am I?</p> <p>_____</p>	<p>I am hot, warm and cool. I change every season. When I am very cold, weak caribou die. I make snow turn to ice. Then it is difficult for caribou to find food. Who am I?</p> <p>_____</p>



STUDENT ACTIVITY SHEET

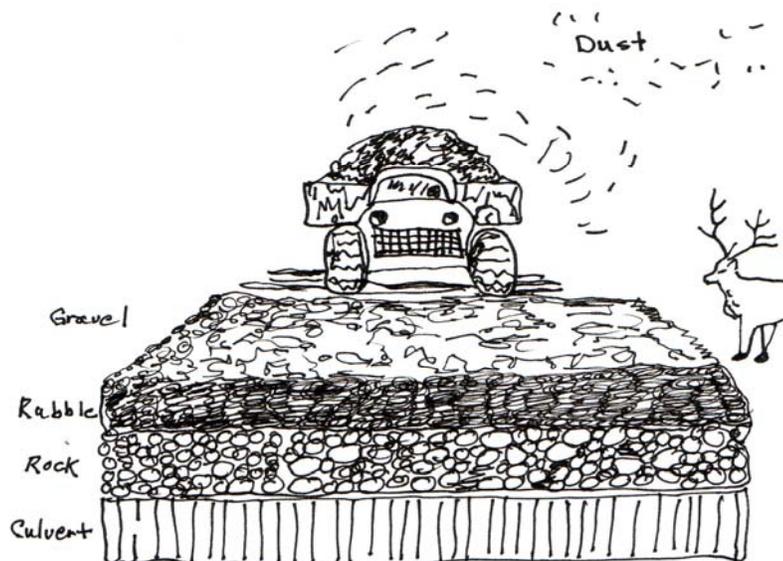
Imagine there is a mine 100 kilometers southeast of _____. A road runs from the mine to the community. It is built of rock, gravel and rubble. The road surface is built high above the terrain to stop the permafrost from thawing.

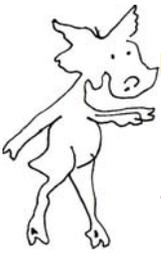
The caribou need to cross the road on their way to the calving grounds. To them the road seems like a wall. Sometimes they cannot see over it and do not know what is on the other side, so they are afraid to go on. The embankments are very steep in many places and are hard for caribou to climb. There are big culverts to let streams run under the road.

Very big trucks carry mineral ore from the mine to _____. There it is put on ships. The trucks are noisy and make lots of dust. A truck passes along the road every 15 minutes.

Ask your teacher to explain the words you do not understand.

What do you think the caribou will do? Will they cross the road? Will the noise of the big trucks scare them away? Can they find places where they can climb the embankments? Do you think they would go through the big culverts? Would they turn back and calve somewhere else?





STUDENT ACTIVITY SHEET

Here are four symbols that show developments that can affect caribou. Some are more serious threats than others. Number them from 1 to 4 to show how big a threat you think they are to caribou. Then finish and read the answers below.

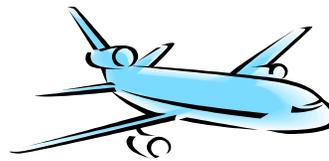
Mine



Road



Pipeline



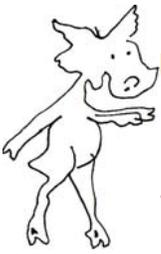
Airplane

_____ are linear developments. They bring traffic, noise and dust. They can bring more people who might want to hunt. Linear developments are the biggest threat.

_____ are linear, also. If they are buried, they are no problem for caribou. Experience in Alaska shows that if they are raised above the ground the caribou will get used to them.

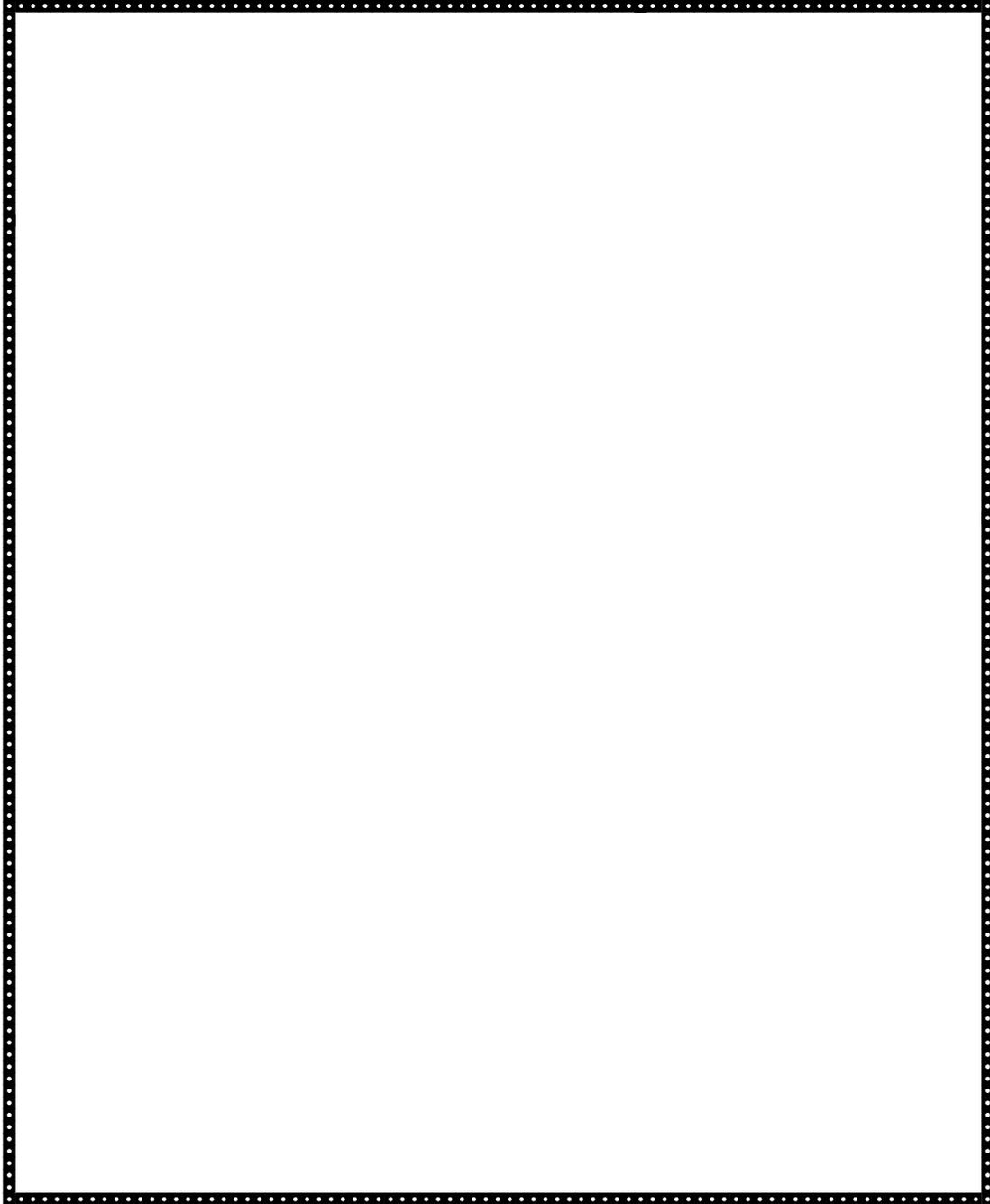
_____ are spot developments. They are noisy but caribou adapt to them. So they do not seem to be a threat if there is no road to them.

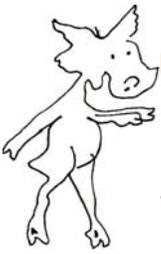
_____ flying high are ignored by caribou. They disturb the animals only if they fly too low.



STUDENT ACTIVITY SHEET

Look at the Documentation Sheet. Think about how caribou would feel about crossing a busy road. Then draw a picture to show what you think would happen.



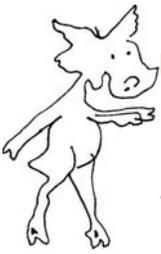


STUDENT ACTIVITY SHEET

Draw a map of the area around your community. Mark in all the developments you can think of. Remember such things as winter roads, tourist camps, fishing lodges, power lines, survey lines and fire breaks. Make a legend in the small box.

LEGEND	DRAW YOUR OWN HERE
	_____
building	_____
	_____
power line	_____
	
road	
	
fire break	

A large empty rectangular area with a dotted border is provided for drawing a map of the community.



STUDENT ACTIVITY SHEET

Look at the map of the caribou ranges. Think about some of the development projects you have heard about. Try to imagine what the map will look like if developers build roads, pipelines, new airports, hydro electric dams and power lines. Draw them in and put a legend in the small box. Will such things harm the caribou? Or do you think they will adapt to the changes?

DRAW YOUR LEGEND HERE



building

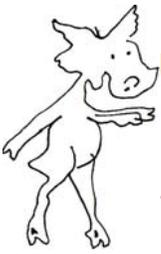


road



pipeline





STUDENT ACTIVITY SHEET

Work with your group. Plan what you would do to protect the caribou winter range from being burned over. Remember that governments are responsible for fire protection. Remember that their priorities are usually to protect:

1. People
2. Property
3. Valuable resources, such as good timber

Think about the questions below. Write at least one answer to each question. Use another sheet of paper to write your plan.

QUESTIONS TO ASK YOURSELVES

- Why should we worry about the winter range being burned?
Is there enough food for caribou in other places?
- If all the range is burned, what will happen to the caribou?
- Are traplines and hunting camps “property”?
- What areas on the map should be protected?
- Why those and not others?
- How will you know fires are burning? Who will watch for fires? How will they do it?
- How many firefighters will be needed? Where will they come from?
- What kind of equipment will they need? How much?
- How will the operation be organized?
- How much money will be needed each year?
- Where will the money come from?

REFERENCES/RESOURCES

Audio-Visual Material

Nedaa Video Unit 3 - "Hazards and Enemies of Caribou"

Books for Classroom Use

Know Your Reindeer Diseases pamphlet (prepared by the University of Alaska)

A Field Guide To Common Wildlife Diseases and Parasites in the Northwest Territories and Nunavut. NWT Department of Resources, Wildlife, and Economic Development.

The Caribou are Our Life. 1988. A.N.W.R.: A Neighbours View. Y.T.G. Executive Council. 8 pp. (Available at the Resource Centre. Contains pictures and text by local native people, biologists and the chairman of the PCMP.)

Yukon Mammal Series pamphlets. Wolf, Grizzly Bear and Wolverine, Y.T.G Renewable Resources.

Bromley, M., Fennel, C., Lloyd, D., and Savage, C. 1988 Science Alive - A Science Fair idea file for teachers in the NWT, Science Institute of the NWT.

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Dieterich, R.A. 1981. Alaskan Wildlife Diseases. University of Alaska.

Miller, Frank L. 1985 Some physical characteristics of caribou spring migration crossing

sites on the Dempster Highway, Yukon Territory. Proceeding of the 1st N.A. Caribou Workshop, Whitehorse, Yukon. 28-29 September, 1983.

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Porcupine Caribou Management Board, 1996 Porcupine Caribou Review.

Nagy, John A. 1990. Biology and Management of Grizzly Bears on the Yukon North Slope. Yukon Dep. Ren. Res. Report. 68 pp.

Aird, Paul. 1987. The Dangers of Radioactive Fallout: Lest we Forget. Caribou News, Vol. 6. No. 5. February 1987.

Alleye-Chan, A.C., White, R.G., Holleman, D.F., and Russell, D.E. 1989. Seasonal concentrations of cesium-137 in rumen content, skeletal muscles, and feces of caribou from the PCH: lichen ingestion rates and implications for human consumption. Fifth Int. Reindeer Symposium 1988.

Urquhart, D.R. 1983. The Status and Life History of the PCH.

Gwich'in Renewable Resource Board, Gwich'in Words About the Land, 1997

Vuntut Gwich'in First Nation, Sherry, Erin, The Land Still Speaks, 1999

Department of Environment, Government of Yukon, Project Caribou, An Educators' Guide to Wild Caribou in North America, 2001

Farnell, R., Zarnke, R., Kuzyk G. Serologic Survey of Yukon Caribou 1987-1997, A Look at Disease Prevalence. Yukon Department of Renewable Resources, 1999.

People:

- Native Language Teacher
- Local First Nation Office
- Elders in the community
- Porcupine Caribou Management Board
- Department of Resources, Wildlife and Economic Development, NWT
- Department of Environment, Yukon Government

VIDEO 3 QUESTIONS

1. If a calf loses its mother what happens to it?

2. What kind of eagle eats caribou?

3. What are two other animals that eat caribou?

4. Before rifles, how were lots of caribou taken at one time?

5. What is subsistence hunting?

6. What is sport hunting?

7. How does development affect caribou?

ANSWERS TO VIDEO 3 QUESTIONS

1. The calf will die by starving to death without food from its mother or could be killed by a predator. An abandoned calf will not be adopted by another cow.
2. A Golden Eagle kills and eats caribou.
3. Wolves, grizzly bears and wolverines can kill and eat caribou. Foxes, ravens, owls, jaegers and hawks are scavengers that feed on caribou kills.
4. Caribou fences and corrals were built to entrap caribou moving through the area. Snares placed in the fence and inside the corral held caribou so they could be speared or shot with a bow and arrow.
5. When native people depend on caribou as a main source of food it is called subsistence hunting. Also native people are not restricted on how many caribou they take or whether they take male or female caribou. In Alaska, both native and non-native have subsistence rights depending on if they live in a rural area and have a low income and need the caribou as a main source of food.
6. Sport hunting is recreational hunting for both the value of the meat and trophy. There is a regulation on the bag limit and also on the sex of the caribou depending on the area hunted in the Yukon.
7. Development such as a road can cause increased access for hunting. If the human activity on a road prevents caribou from using a part of their range, they will have less space to live and feed in. Development on critical ranges such as the calving and summer ranges has already been suggested to have an effect on the Porcupine Caribou herd by causing a population decline of 20%-40%. Human activity could result in loss of habitat in the core calving area and reduced use of avoidance of the insect relief areas. If the caribou calve further inland toward the mountains there will be increased mortality because of the higher numbers of predators including bears and wolves.

INTERNET SITES

Satellite collared caribou tracking site <http://www.taiga.net/satellite/update.html>
Project Caribou Educators' Guide <http://www.taiga.net>
Environment Canada, http://www.ecoinfo.org/env_ind/region/arcibou_e.cfm
Journey North, <http://www.learner.org/jnorth>
The Vuntut Gwitch'in of Old Crow, Yukon <http://www.oldcrow.yk.net>
Gwich'in Steering Committee <http://www.alaska.net/~gwichin/index.html>
Audubon Society <http://www.audubon.org>
Public Interest Research Group <http://www.pirg.org>
Alaska Wilderness League <http://www.alaskawild.org>
Sierra Club <http://www.sierraclub.org/wilderness/wildlands>
The Wilderness Society <http://www.wilderness.org>
Northern Alaska Environmental Center <http://www.northern.org>
World Wildlife Federation <http://www.panda.org>
Canadian Nature Federation <http://www.cnf.ca>
Northern Research Defence Council <http://www.nrdc.org>
Native Web <http://www.nativeweb.org>
Taiga Net <http://www.taiga.net/>
Porcupine Caribou Management Board <http://www.pcmb.yk.ca/pcmb.html>
Arctic National Wildlife Refuge - A Special Report: <http://arcticcircle.uconn.edu/ArcticCircle/ANWR/>
Canadian Parks & Wilderness Society <http://www.cpaws.org/>
Porcupine Caribou Harvest Model: <http://www.taiga.net/caribou/models/harvest/index.html>
Canadian & International Green Links <http://www.raysweb.net/greenlinks/>
Audubon Refuge Planning: <http://refuges100.fws.gov>
Alaska Coalition: <http://www.alaskacoalition.org>
National Wildlife Federation: <http://www.nwf.org>
International Agreement: <http://arcticcircle.uconn.edu/ANWR/anwrint-agreement.html>
Canadian- American Govt site: <http://can-am.gc.ca>
US Fish and Wildlife has several sites, enter key words
Alaska Fish and Game <http://www.state.ak.us/local/akpages/FISH.GAME/notebook/biggame/caribou.htm>
Northwest Territories Government <http://www.gov.nt.ca/RWED/index.html>
Department of Resources, Wildlife, Economic Development, NWT <http://www.inuvik.rwed.gov.nt.ca>
Department of Environment, Yukon <http://www.environmentyukon.gov.yk.ca/main/index.shtml>
Field Guide to Common Wild Diseases and Parasites in NWT and Nunavut:
<http://www.nwtwildlife.rwed.gov.nt.ca/Publications/diseasepamphletweb/diseasesindex.htm>