METHODS OF INVESTIGATING PREDATION OF LIVESTOCK

Alberta Government

AGDEX 684-14

Published by:

Alberta Agriculture and Rural Development
Information Management Division
7000 - 113 Street, Edmonton, Alberta
Canada T6H 5T6

Editor: Ken Blackley
Graphic Designer: John Gillmore
Page Production: J.A. Serafinchon

Copies of this publication may be purchased from:

Publications Office
Alberta Agriculture and Rural Development
7000 - 113 Street
Edmonton, Alberta T6H 5T6

or

see the website <www.agriculture.alberta.ca> for information on other publications, videos and CD-Roms

ISBN 0-7732-6137-0

Reprinted 2014

METHODS OF INVESTIGATING PREDATION OF LIVESTOCK

Robert C. Acorn and Michael J. Dorrance

Alberta Agriculture and Rural Development
7000 - 113 Street
Edmonton, Alberta
T6H 5T6

CONTENTS

FIGURES

ACKNOWLEDGEMENT

This manual was originally co-authored by Lawrence D. Roy and Michael J. Dorrance in 1976. We thank the following individuals for information, photographs and assistance provided in the revision of this booklet:
J.E. Allen, B.E. Beck, L.D. Bekkerus,
J.B. Bourne, D.A. Brennan, G.A. Chalmers, C.M. Cross, R.O. Flath, J.R. Gunson,
R.G. Hanson, D.B. Hogart, E.F. Hutchings, P.N. Merrill, A.W. Perry, D.C. Rodtka,
B.C. Schram, R.A. Sears and D.K. Weisser. We thank Johnson Books for permission to use illustrations of tracks from *A Field Guide to Mammal Tracking in North America* by J. Halfpenny and E. Biesiot (1986). We also thank Houghton Mifflin Company for permission to use material from *A Field Guide to Animal Tracks* by O.J. Murie (1954).

R.C.A., M.J.D.

INTRODUCTION

Alberta has a wealth of wild predatory mammals and birds including coyotes, wolves, bears, cougars, lynx, skunks, weasels, magpies, ravens, eagles and many species of hawks and owls. These animals prey on wildlife most of the time, but occasionally they attack domestic animals. Predation of livestock can cause significant losses to individual farmers.

Wildlife is under the stewardship of the people of Canada, and consequently the Alberta government has assumed certain responsibilities when wildlife conflict with human interests. The Alberta government assists farmers in the prevention and control of predation on domestic animals and under certain conditions provides compensation for livestock losses.

Judicious application of control techniques and the equitable administration of compensation require an accurate determination of the cause of death where predation is suspected.

While predation of healthy domestic animals is common, livestock can also be predisposed to predation from a variety of causes including sickness, malnourishment, inclement weather and poor management. Livestock also die from causes other than predation. Many dead animals are scavenged and sometimes completely consumed by predators. The presence of predators and predator sign, hair and feathers in droppings, and the disappearance of livestock does not necessarily mean that predation occurred. True predation should be separated from carrion feeding and the killing of animals predisposed to predation.

Predatory species exhibit a characteristic behaviour in the way that they chase, kill and feed on prey. Coyotes most frequently kill sheep with bites to the throat whereas black bears commonly kill calves with a bite on top of the neck, shoulders or back. Selection of appropriate control and preventive techniques or recommendations for changes in management depend upon accurate identification of the predator responsible for livestock losses.

The ease of investigating a complaint of predation will vary with the evidence available. You may find a live wounded animal, a fresh carcass, a few bones and clumps of wool or hair, or a report of a missing animal. Documentation of animals injured by predators may simply require an examination of the wounds, and possibly, the location of the attack site. A carcass in an advanced state of decay presents a more difficult problem and points up the importance of a prompt investigation. Evidence of predation disappears rapidly. Carcasses deteriorate rapidly in warm weather and are quickly consumed by insects, scavengers and predators. Other predation evidence can be trampled by livestock or obliterated during inclement weather.

An effective investigator knows:

- how to differentiate predation losses from other causes of death.
- which predators are in an area and how to identify their signs.
- the history of predator problems and livestock diseases in the area of the complaint.
- signs of common livestock diseases.
- how to identify common poisonous plants.

This manual provides information that will help you separate predation from carrion feeding and the killing of animals predisposed to predation. It will also help you identify the predatory species involved.

DETERMINE THE CAUSE OF DEATH

Cause of death can be classified as predation, pseudo-predation or death from other causes. Predation causes direct and indirect losses of healthy animals. Direct losses result from a physical attack by predators. Indirect losses include fatalities from predator harassment; animals may be chased onto thin ice and drown, or they may be fatally injured on broken boards or barbed wire during a predator attack. Pseudo-predation results from a predator attack on an animal in a weakened or vulnerable state, or of questionable viability. Losses from other causes include death from disease, bloat, starvation, poisonous plants and other poisonous substances, suffocation, pregnancy problems, ingestion of metal objects, self-impalement on metal or wooden "spears", theft, gunshot wounds, lightning and inclement weather.

The true cause of death is frequently obliterated when predators feed on a carcass. Thus, if you cannot respond to a complaint immediately, the producer should cover the carcass with a blanket or tarp to prevent scavenging by predators. Alternatively, the producer can remove small carcasses from kill sites and place them in buildings to keep them from being eaten or carried away.

The first priority for investigating an alleged attack is to determine whether predators were responsible or if only carrion feeding was involved. If a predator killed the animal, the next priority is to determine the predatory species involved and the state of health of the domestic animal at the time of attack.

Locate the carcass and kill site

The producer should maintain head counts and search for missing animals, because livestock disappear for many reasons. Locate and examine the attack and kill site if the carcass was moved by the producer or was dragged or carried away by predators. It may be necessary to examine a large area to find predator sign and the attack site if animals were wounded but not killed.

Look for signs of a struggle

Signs of a struggle are good evidence of predation. Broken foliage, trampled vegetation, tufts of wool or hair and a drag trail of blood show an encounter between predator and prey (Figures 1 and 2). However, the absence of these signs at a carcass or kill site does not always rule out predation.

Figure 1. *Signs of attack and struggle include trampled and broken vegetation, clumps of wool and patches blood.*

Figure 2. *A drag trail of blood suggests predation.*

Predators may kill small or newborn animals without evidence of a struggle. Furthermore, predators may carry prey from the kill site.

Note the position of the carcass

Animals dead from sickness are often found lying upright or on their side with their legs tucked under the body. Animals killed by predators are usually found on their side with legs extended, in thick cover, near cover or in rough terrain.

Look for predator sign around the carcass

Predators or predator signs near a carcass do not in themselves constitute evidence of predation because carrion feeding may have occurred. However, they do indicate that a particular predatory species is in the area. This will help substantiate a predation claim when direct evidence of predation exists. If predator tracks, scat and hair are not found in the immediate vicinity of a suspected predator kill, search for predator sign along nearby fence rows, trails and water-holes.

Examine the carcass for hemorrhage and general damage

The presence of hemorrhage (bleeding) and bruising are the most important factors in determining if an animal was killed by a predator (Figures 3 and 4). Bleeding can occur before death and for only a brief time afterwards. Examine the head and neck of smaller prey such as sheep and goats for hemorrhage; this area is most frequently attacked and is often the last part of the carcass consumed. Inspect the hindquarters and tail of calf and cattle carcasses for hemorrhage associated with tooth punctures. Look for signs of a broken neck, back or skull if a bear or cougar attack is suspected.

Figure 3. *Bleeding, bruises and tissue damage indicate a predator attack. A coyote killed this lamb with a throat attack.*

Figure 4. *Massive subcutaneous bleeding and tissue damage are revealed when the neck is skinned.*

Inspect for claw marks on the neck, back, sides and face of the carcass. Skin the areas where damage is evident or suspected, since blood may not permeate the hair or wool around a wound. Blood on the ground and vegetation at the site of the carcass suggests predation (Figures 1 to 3). Inspect remnants of hide for tooth punctures and hemorrhaging (Figure 4). Record the extent and description of body parts fed on by predators. Good clear photographs will help document predator investigations.

Caution: There are stages of decomposition in which the flesh appears to have been

bruised. Predator attacks often cause extensive damage to tissue beneath the skin. A bruise results from the rupture of tiny blood vessels and subsequent seepage of blood into surrounding tissue. A similar process occurs during decomposition; red blood cells break down and hemoglobin seeps from blood vessels into surrounding tissue. This process changes the appearance of fat, bone marrow and subcutaneous tissue (tissue beneath the skin); these areas may turn red, brown or reddish-brown in colour.

Decomposition does not occur at the same rate in all parts of the body. Normally, the side of a carcass exposed to the sun will decompose faster than the side nearest the ground. Thus, the flesh beneath the skin on the bottom side of a carcass may appear relatively normal, whereas the flesh beneath the skin on the top side of a carcass may appear reddened (Figure 5). These decomposed areas can be mistaken for bruises caused by a predator. Avoid this pitfall by skinning large areas of the carcass. Areas affected by decomposition will be similar in parts of the carcass exposed to the sun. Thin, watery blood may seep from the nose, mouth and anus of a decomposing animal. However, blood from the nose and mouth of an injured animal will be thick and clotted.

Figure 5. *Parts of a carcass exposed to the sun will decompose faster than the shaded parts. This lamb died from causes other than predation. The reddened flesh is a result of decomposition.*

There is another stage of carcass decomposition in which blood collects on the side of the carcass closest to the ground due to gravity. All flesh beneath the skin on the bottom side of the carcass will appear darker when the blood flows to lower areas. Skin large areas of the carcass to identify this condition. The areas discoloured by decomposition will be much more extensive than the localized bruises and damage caused by a predator attack.

If the abdomen and digestive tract are not punctured, the carcass will distend (grow larger) from gases formed during decomposition. Do not confuse this with bloat, which is caused by eating excessive amounts of grain or fresh legumes. Distension of a carcass from internal gas will cause slashes, cuts and puncture wounds in the hide to change shape. As the carcass becomes larger, the skin stretches and tightens and tends to even out the slight irregularities in a rip or tear. In general, an opening in the hide will become larger and more round and even in shape as the carcass distends.

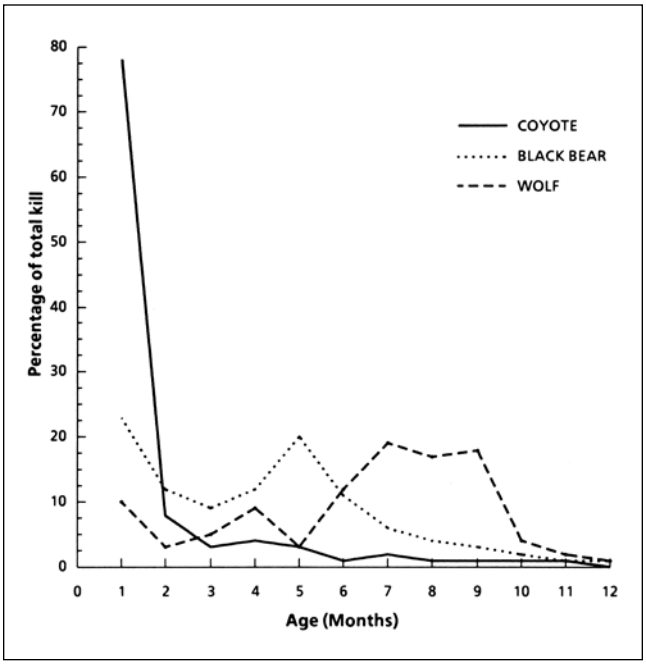

Figure 6. *Age distrubution of calves killed by predators in Alberta.*

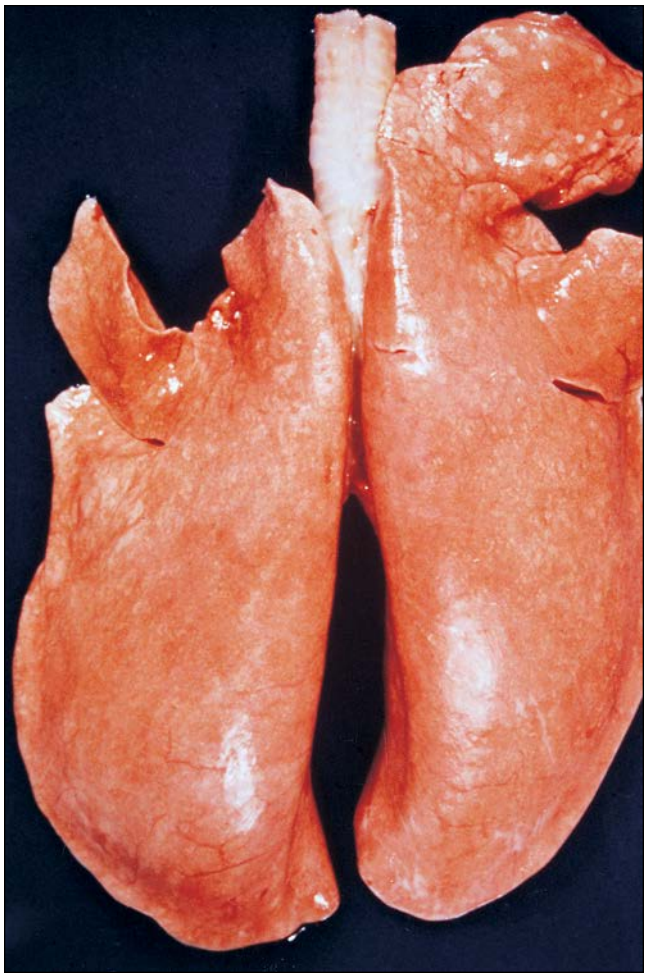

Figure 7. *A new-born calf that has breathed will have spongy, light-pink to orange coloured lungs.*

Examine the carcass for general signs of health

Generally, a dead "healthy" animal suggests predation, and a dead "unhealthy" animal suggests pseudo-predation or death from other causes. "Unhealthy" may be any deviation from normal such as starvation, poisoning by plants, bloat and disease.

Consider the age and condition of the dead animal

Determine the general age category of dead livestock from tooth wear. Older animals in poor condition have reduced vigor and viability. They are predisposed to sickness and death from many causes, including predation.

Young animals are also very susceptible to predation. For example, about one-third of the calves killed by coyotes in Alberta are one day old and about 80 per cent are less than one month of age (Figure 6). Very young animals present a special problem because they can quickly be consumed or carried away by predators. Frequently there is little or no evidence to determine whether a newborn animal was stillborn, of low viability, or normal and healthy.

A viable new-born animal should have breathed, walked, fed and been healthy. Use the following methods to determine if these activities have occurred.

- Animals born alive have spongy, light-pink to orange coloured lungs (Figure 7); stillborn animals have hard, purplish-red coloured lungs (Figure 8). Determine whether or not an animal breathed by placing a piece of lung in water. Lung tissue from an animal that has breathed will float. Lungs from stillborn animals will not float. **Caution:** If the carcass has decomposed the lungs may fill with post-mortem gas and may float.

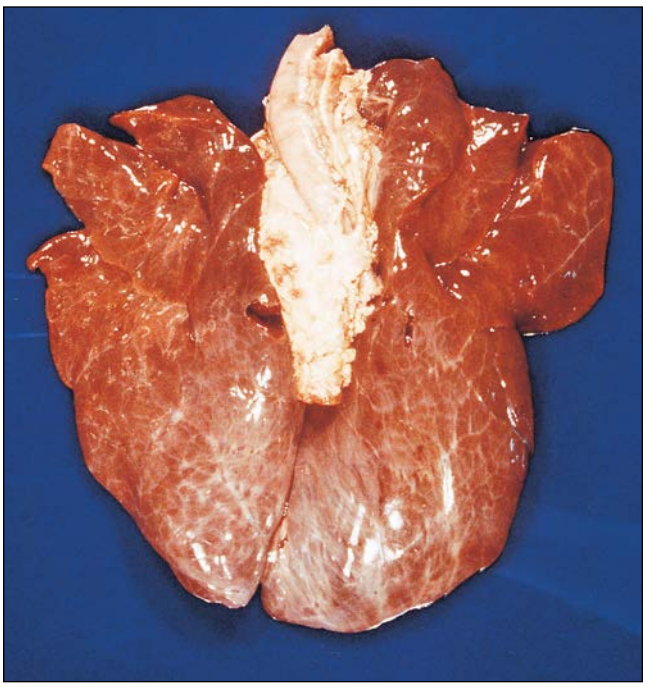

Figure 8. *Stillborn animals have hard, purplish-red lungs.*

- The soft membrane on the hooves wears away soon after a newborn starts to walk (Figures 9 and 10); under special conditions (for example wet, soft grass or straw) the membrane may resist abrasion. **Caution:** Magpies and crows may pick off the soft membrane of the hoof. This may create a false impression that the animal actually walked. If the membrane is eaten by birds, there will be a stippled appearance to the remaining tissue on the hoof.
- Milk in the stomach and gut indicates feeding (Figures 11 and 12).
- Firm, white fat on the heart and kidneys denotes health; gelatinous, red, or completely metabolized fat indicates poor nutrition or starvation (Figures 13 and 14).
- Mothers usually lick live newborn animals to remove birth secretions and tissue. A dead newborn animal that was not licked was likely dead at birth.

Figure 9. *The soft membrane remains on the hoof of a new-born calf that has not walked.*

Figure 10. *The soft membrane is worn off the hoof when an animal walks.*

- The size of a newborn affects viability; newborn animals that are small are less likely to survive than larger ones.

Newborn animals may be killed before the events described take place. Predators, particularly coyotes, may attack cows in the process of calving and the cow and calf may be lost. Expectant mothers and newborn young less than one week old should be closely guarded to prevent predation. Failure to do so may reflect poor management if predation occurs.

Consider possible pregnancy problems

Pregnancy can predispose livestock to reduced viability and possible death from complications. Abnormally large fetuses and fetuses in abnormal positions may cause birth difficulties and internal injuries.

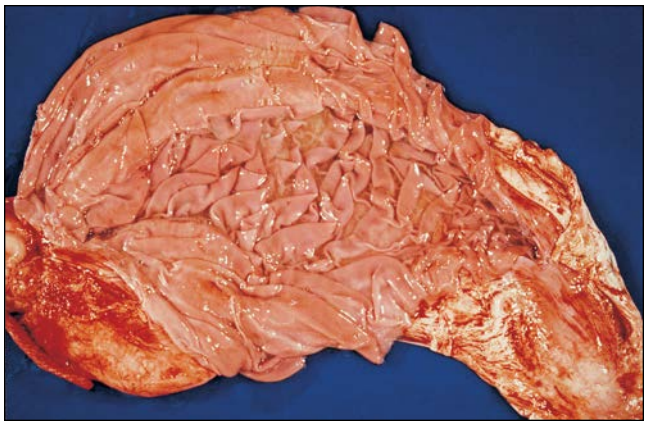

Figure 11. *There is no milk in the stomach of a calf that has not nursed.*

Figure 12. *Milk is present in this calf's stomach.*

Observe the general health and behaviour of the herd or flock

Livestock in poor condition or health are more predisposed to disease and other complications that increase mortality. Poor nutrition during pregnancy can cause abortion, fetal death, stillbirth or a weak newborn.

Herds and flocks become alert, nervous and flighty when they are repeatedly harassed or preyed upon. Unusual livestock behaviour, including mothers that urgently call and search for their young, is strong indirect evidence of predation.

Look for injured animals, old wounds and missing tails on calves. These suggest predation.

Consider weather conditions at the time of the animal's death

New-born and young animals are very susceptible to exposure and hypothermia, a cooling of the body core below normal body temperature. Calves or lambs that are born outside in cold weather and without adequate protection can quickly be injured by the cold.

If a calf or lamb is born and dies quickly from exposure (that is, within 1 to 1 1/2 hours), there may be no obvious signs of cold injury. However, if a calf or lamb gets cold and lives for several hours, lesions characteristic of cold injury will develop at the base of the ears, tail or limbs below the knees and hocks. A watery fluid, clear to yellow in colour (edema), will accumulate in these areas. If the animal survives, the frozen parts of the body will exhibit a mixture of edema and hemorrhage that should be evident after the ears, tail or legs are skinned. These injuries can predispose calves and lambs to predation.

Livestock losses from lightning do occur in Alberta. Scorch marks and bulging eyes are indications of death by electrocution. Normally hair lies flat against the body, but hair or wool on the underside of the body will point directly into the ground if the animal was lying down at the time of a lightning strike; knee joints (under the skin) may be darkened in colour if the animal was standing. These signs are not always evident. A recent thunderstorm and the location of the carcass are most important in identifying deaths from lightning. Deaths from lightning commonly occur on hill tops, along fences and near lone trees in the middle of fields.

Look for poisonous plants in the pasture

Poisonous plants can cause livestock losses. With few exceptions however, livestock will not be poisoned by plants unless unusual conditions force them to eat toxic quantities. Thus, losses from poisonous plants are often associated with poor management including: a) failure to provide salt and minerals that

results in depraved appetites, b) overgrazing and grazing too early in the spring when there is a scarcity of palatable forage, and c) an inadequate water supply which can cause livestock to graze plants that would otherwise be rejected.

Young animals are more likely to be poisoned than adults. Animals recently imported into an area are also more susceptible to poisoning. Cattle and sheep that are being driven tend to grab and swallow any green plants along the trail and may be poisoned.

The poisonous plants that cause the most problems in Alberta include:

- Water-hemlock (*Cicuta* spp.) commonly grows in moist areas, meadows, marshes and stream banks. Roots, rootstocks and early leaves are the most poisonous; small amounts kill livestock.
- Tall larkspur (*Delphinium glaucum*), common in the foothills and northern bush pastures, is frequently fatal to cattle but seldom affects sheep. Larkspur starts to grow earlier in the spring than associated plants and is palatable except in mature stages. Consequently, larkspur is most dangerous in May and June. Toxicity normally declines later in the season and is usually negligible by mid-August.
- Death camas (*Zygadenus gramineus*) starts to grow early in the spring in moist depressions. It is palatable and causes losses in sheep but rarely in cattle. All parts are poisonous, particularly the bulb. Animals may remain in a coma for some time before death. Consequently, they could be attacked and appear as a "normal" predator kill.
- Arrow-grass (*Triglochin* spp.) grows in salt marshes and alkaline sloughs. It starts to grow earlier than associated species and may be attractive to livestock in early spring. In addition, arrow-grass has a salty taste and may be eaten when salt is absent or craved.
- Narrow-leaved milk-vetch (*Astragalus pectinatus*) starts to grow early on the dry prairies of southern Alberta and affects all livestock, particularly lactating females. It is unpalatable and normally eaten only when forage is extremely short.

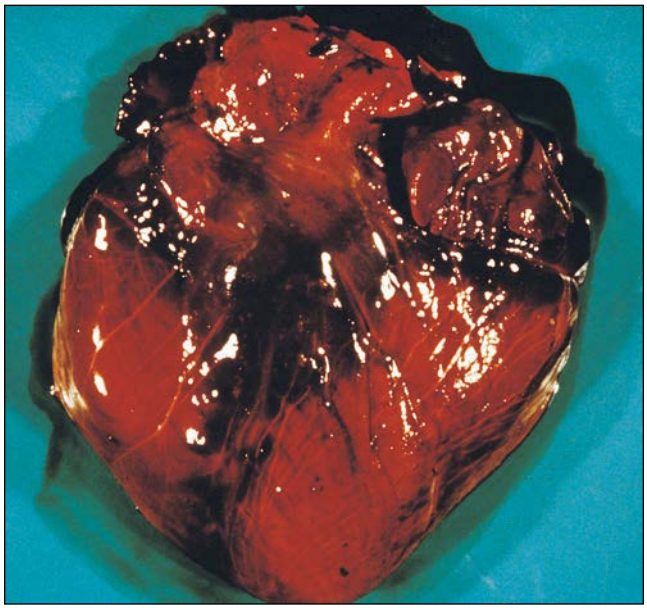

Figure 13. *The heart is devoid of fat in an animal that has died of starvation.*

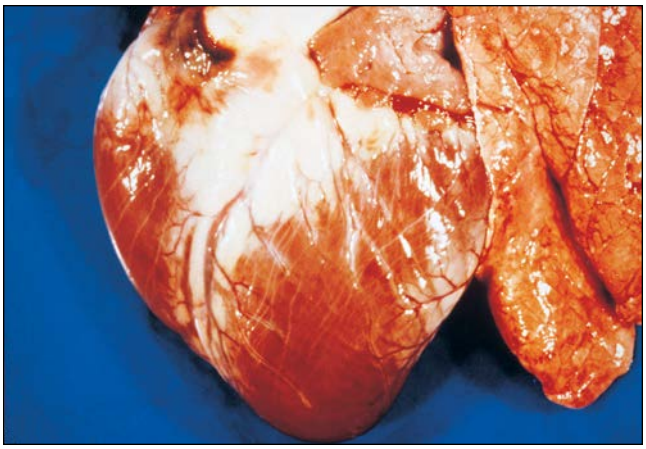

Figure 14. *The heart from a healthy animal shows normal amounts of fat.*

Descriptions and photographs of these plants are in *Weeds of the Prairies*, Agdex 640-4. If you suspect death from poisonous plants, submit a rumen sample to a regional veterinary laboratory. Take the rumen sample from the area where the esophagus (the passage for food into the stomach) enters the rumen, because the effects of the poison can be extremely rapid.

Examine the area near the carcass for other poison sources

Used crank case oil, antifreeze, fertilizer bags, storage batteries, paint cans and small metal parts are potential sources of poison. Danger also exists from pesticides such as carbofuran, warfarin and strychnine. Lush legume pastures can cause bloat and high-concentrate feed can cause grain overload. Moldy sweet clover can affect the blood clotting mechanism and cause hemorrhage that is most evident over boney prominences.

Consider other possibilities for dead, damaged or missing livestoch

Severe and fatal injuries can be inflicted in ways which appear to be predator caused but are not. Horses and cattle spooked by noise or predators can run into and be cut on barbed wire fences. Wire cuts may be confused with claw marks (Figure 15). Barbed wire causes lateral cuts on the chest and sides of animal. In comparison, claw marks of predators usually occur on the upper parts of the neck, shoulders or back. Livestock can also impale themselves on broken boards and posts.

Figure 15. *This horse was injured on a barbed wire fence.*

Young animals may be stepped on, causing internal damage and hemorrhage. Boar pigs can slash other pigs and livestock with their tusks. This damage may be confused with the claw marks of bear.

Theft may have occurred when large animals are missing without a trace. Theft is most likely to occur when human and vehicular access to livestock is easy. Cattle can be butchered in a pasture and the remains can be scavenged by predators, confounding the evidence. A knife cut will show a clean, smooth separation of the hide, and cut hairs and root hairs (Figure 16). In contrast, a tear made by a predator will have an uneven separation of the hide and no cut or shaved root hairs (Figure 17). A magnifying glass will aid any examination of suspected cuts.

Non-predator related deaths of livestock have occasionally been altered to feign predation in attempts to collect compensation. Wounds not conforming to typical bite or claw marks and without associated hemorrhage should be suspected.

Livestock near the Athabasca River, downstream of the town of Athabasca, and near the Peace River, in the area of Fort Vermilion, can be severely attacked by black flies, *Simulium arcticum*, leading to death. Livestock near the river are most susceptible; however, winds can move large numbers of black flies to livestock a considerable distance away. Attacks can occur from late spring through to fall. New-born calves, milk cows and stock previously unexposed to black fly bites are most susceptible. Black flies generally attack the lower parts of animals where the hair coat is thin, such as the belly, inner legs, udder, scrotum, lower neck and nose. External evidence of black fly attack shows as pinhead sized marks and dried blood droplets on exposed skin areas. Death results from toxins injected by flies during blood feeding. Subcutaneous edema (swelling and

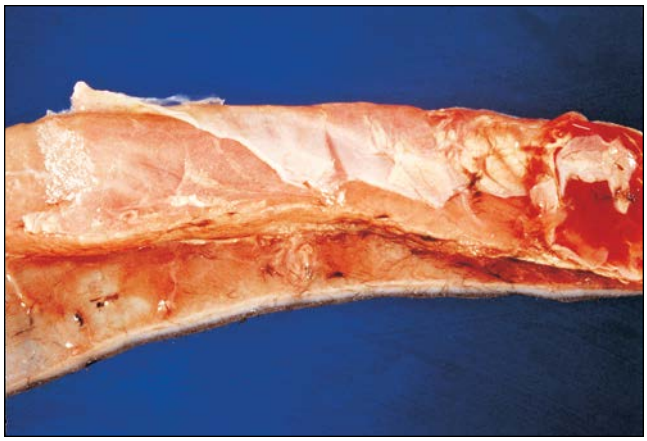

Figure 16. *A knife cut shows a clean even separation of the hide, cut hairs and cut root hairs.*

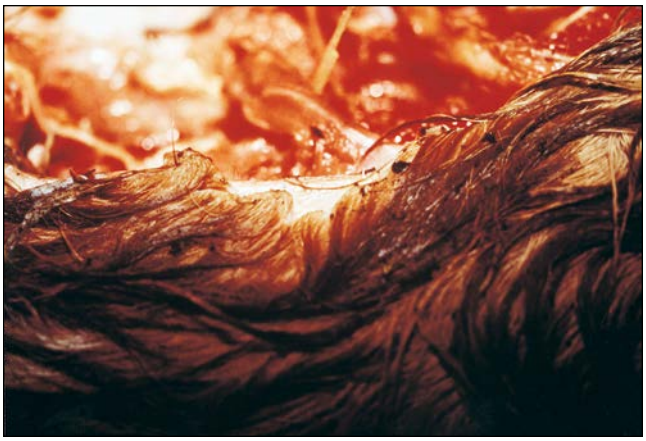

Figure 17. *A rip in a hide made by a predator is unevenly spearated in an irregular pattern.*

fluid beneath the skin) along the underline of affected cattle is a common sign. Fluid also collects in the lungs and body cavity. Death can occur quickly once signs develop. If black flies are suspected of causing death, have a necropsy performed by a veterinarian.

Confirm your suspicions on the cause of death

Cattle, sheep and hogs rarely die of fright (shock). Thus, predation losses of large animals must result from major physical injury such as a fractured skull, a broken or crushed neck or spine, or massive tissue damage and bleeding. Tooth punctures or claw marks are usually associated with subcutaneous bruising and tissue damage.

Conduct the following:

- Carefully inspect the carcass for external signs of attack (i.e., bites, claw marks) and skin back these sites. Subcutaneous bruising and tissue damage should be apparent at injury sites if an attack occurred while the animal was alive.
- Inspect the head for a fractured skull.
- Skin back the hide along the top of the neck and backbone and examine for severe hemorrhage and broken vertebrae.

If you suspect shock, disease or other non-predator related loss, the carcass can be submitted to a regional veterinary laboratory or to a local veterinary practitioner to determine the cause of death.

INDICATORS OF HEALTH

Coat Condition

A healthy animal has a thick, shiny coat of hair. The coat of an unhealthy animal is usually thin with dry, dull hair.

Hydration

The eye of a normal animal completely fills the socket, whereas the eye of a dehydrated animal will be sunken (Figure 18). However, the eye is a reliable indicator of health only in a fresh carcass. The carcass dehydrates as it deteriorates. Dehydration is often associated with scours in young animals (Figure 19). Examine the rear end of calves for physical evidence of diarrhea.

Figure 18. *The eye of a dehydreated animal is sunken.*

Figure 19. *This calf has scours as shown by yellow watery excreta.*

Body Fat

Large deposits of firm, yellow or white fat indicate good health. If an animal is ill and not feeding well, or if food is simply not available, the fat will soon be metabolized and a semi-transparent, reddish, gelatinous substance will remain. Fat deposits are metabolized first around the heart and then around the kidneys. Fat deposits in the bone marrow are metabolized before death from starvation. Break the large leg bones and examine the bone marrow. Again, firm white deposits denote health, while gelatinous, semi-transparent, reddish deposits denote starvation (Figure 20).

Digestive Abnormalities

The amount of food in the stomach and the condition of the feces are health indicators. A normal, healthy ruminant will always

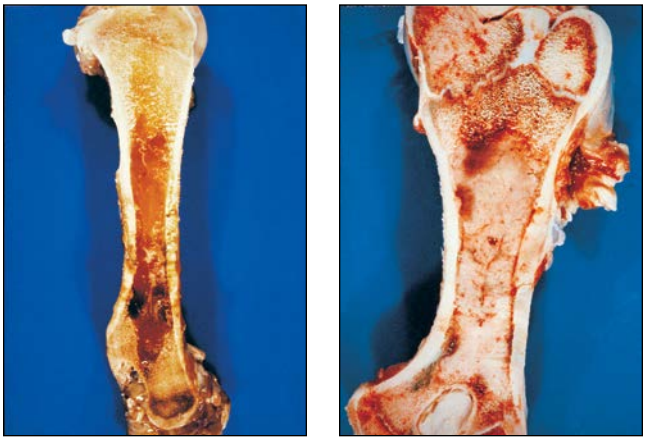

Figure 20. *Fat deposits have metabolized in the leg bone from a calf that died of starvation (left). The leg bone from a normal, healthy calf contains fat (right).*

have food in the stomach (at least one-half full). However, calves and lambs under three months of age do not have a fully-developed rumen. Thus, a small, empty rumen may be quite normal in suckling animals. The feces will be firm, although exceptions do occur, for example cows on grass. Little or no food in the stomach and diarrhea denote ill health. Signs of vomiting also suggest unhealthy animals. If grain overload, poisoning or hardware disease is suspected, take careful note of stomach contents and the condition of the animal. The rumen wall may be injured by these abnormalities. Submit a sample of stomach contents and rumen wall to a regional veterinary lab.

Respiratory Abnormalities

Pneumonia is a major cause of livestock mortality in Alberta. Normal lung tissue is soft or spongy, pinkish in colour and light in weight. The lobes of normal lungs have rather sharp edges (Figure 7).

In pneumonia caused by bacterial infections, infected tissue is firmer and denser, much like the liver. The lung tissue lacks sponginess. Affected areas are usually dark red, but may be covered with a white or pale-yellow coating of fibrin (exudate or inflammatory product) (Figure 21). Fibrin has a "cheesy" appearance and usually can be peeled off, leaving the darker coloured lung exposed. An infected lung will be dark red or "marbled" when cut open, and often pus can be squeezed from the bronchi (tubes in the lungs). Areas of lung affected by pneumonia usually sink in water.

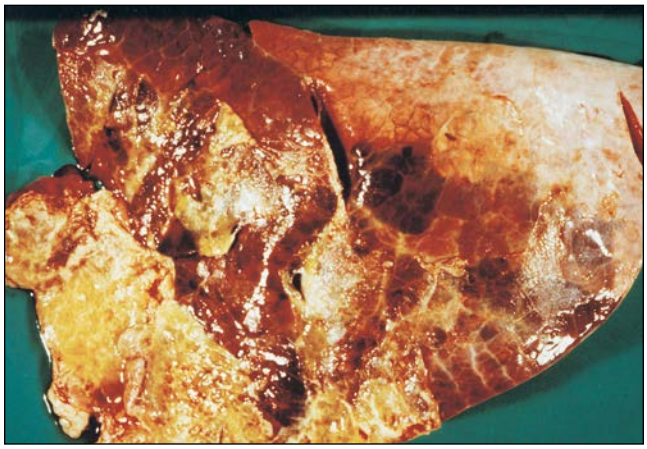

Figure 21. *Areas of lung affected by pneumonia are hard, with dark red tissue. A pale yellow fibrin coating may also be present if pneumonia is severe (lower left). Tissue in the upper right portion of this lung appears more normal.*

The trachea (windpipe) should be opened to examine for dead tissue, blood clots and fibrinous material, which can be signs of disease.

Circulatory Abnormalities

Paleness is an indicator of poor blood circulation, hemorrhage or anemia. Bloated animals commonly die from circulatory problems and asphyxia (suffocation). Cattle and sheep may bloat if they feed on highly nutritious second-growth alfalfa and clover or if they eat excessive amounts of grain. Excessive gas is produced in the rumen and the rumen distends. Thereafter, the blood supply is restricted to the posterior end of the animal, including the liver and kidneys and the flesh of the hindquarters becomes pale. Examine the rumen contents and record the amount of grain in the stomach if you suspect bloat or grain overload. Alternatively, you may submit the carcass to a regional veterinary laboratory if you are uncertain as to the cause of death.

Bloat should not be confused with the normal carcass distention that occurs when the digestive tract fills with gases as the carcass deteriorates.

General Irregularities

Any abnormalities in the carcass or secretions such as pus or blood from the eyes, nose, mouth, or anal region should be noted. Other animals in the herd should be examined for abnormalities if death is suspected from causes other than predation. Submit the carcass to a regional veterinary laboratory if an abnormality exists and you do not know whether the abnormality could cause death.

Some diseases and poisonous plants act quickly and affected animals will die suddenly with few obvious signs. In these situations, you must rely on a lack of evidence of predation, and possibly the presence of other dead or disabled livestock.

Summary

Death can be classified as predation on healthy animals, predation on animals unlikely to survive anyway (pseudo-predation) and other causes. Reconstruction of the events leading to the death of the animal is necessary because predation is seldom witnessed. Signs of a struggle and bleeding from wounds on the carcass of a healthy animal suggest predation. However, you should confirm the cause of death. Predation losses of large animals must result from a major injury. Examine the carcass for a fractured skull, a broken neck or back, or massive tissue damage and bleeding. The absence of signs of a struggle at a kill site of an animal in poor condition suggest pseudo-predation. Pseudo-predation is often difficult to distinguish from predation. A familiarity with livestock diseases can simplify the assessment. Obtain advice from a veterinarian if you are unfamiliar with livestock diseases. In the final assessment, the producer should probably be given the benefit of the doubt. Death from pseudo-predation should be assigned only to those animals that were obviously ill, seriously injured or debilitated at the time they were attacked by a predator.

IDENTIFYING THE PREDATOR

A variety of methods of attacking and killing prey have evolved among the different species of predators. Each species has a characteristic feeding behaviour and shows a preference in its choice of domestic prey. There are certain times of the year when predation by a particular species is most prevalent. Furthermore, each species has a preferred habitat type; there are certain areas where conflicts between livestock and predators are most common. These differences, although most obvious in family groups, are distinctive even among different species of the same family. Individual animals sometimes diverge from the characteristic pattern of their species, but the identity of the predator involved can usually be determined by a combination of signs (tracks, scats, killing and feeding behaviour) left at a kill site. The following sections describe predator signs and the feeding and killing behaviour of predatory species that commonly or occasionally prey on livestock. Tracks and scats are not discussed in detail. This information is covered comprehensively in *A Field Guide to Mammal Tracking in North America* by James Halfpenny and Elizabeth Biesiot (1986) and *A Field Guide to Animal Tracks* by Olaus Murie (1954).

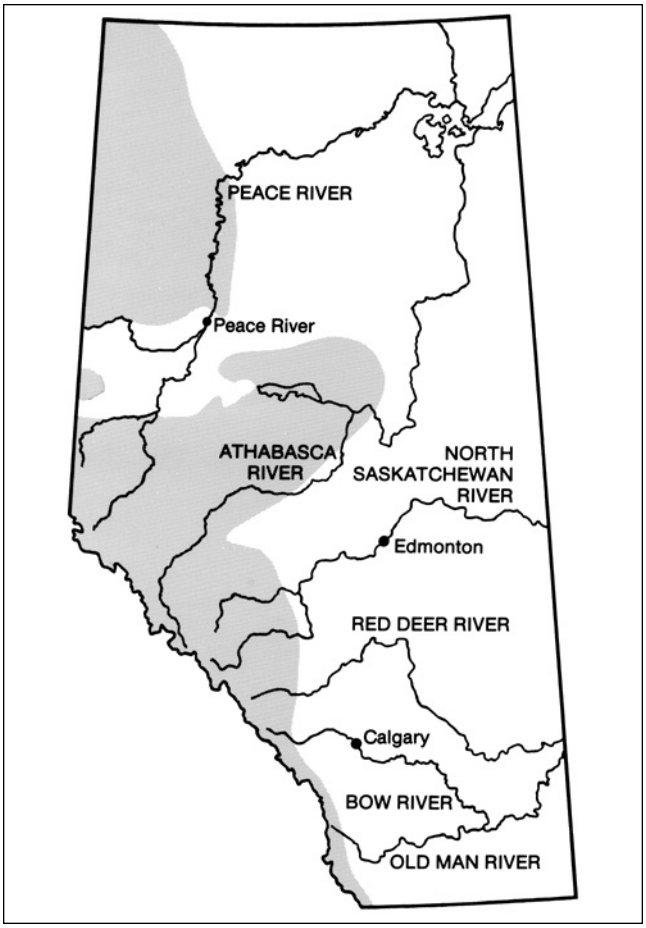

Figure 22. *Grizzly bear distribution in Alberta.*

Family Ursidae – Bears

Grizzly Bear

Grizzly bears (*Ursus arctos*) inhabit western and north-central Alberta (Figure 22). Conflicts with livestock occasionally happen. Problems normally occur in fringe areas where human settlement borders on wilderness. Grizzly bear-livestock problems are most common in June and July in Alberta. Predation may increase during food shortages.

Cattle are the most common domestic prey, likely because cattle are more common on grizzly bear range than other livestock. Grizzlies seem to prefer younger animals but do kill adult cattle. Of 17 recorded cattle kills in Wyoming, four were yearlings and 13 were calves. Similarly, 15 calves, 10 yearlings and one cow were reported killed by grizzlies in southern Alberta during 1986-87. Sheep, goats, swine and poultry are taken occasionally. Grizzly bears do not select for any age or size of sheep, probably because even the largest sheep are easy prey for bears.

Figure 23a. *This cow was wounded by a grizzly bear. Grizzly bears typically bite cattle on the top of the back or neck and often on the withers.*

Figure 23b. *Skin removed from area of back reveals damage from Grizzly bear bites. Also damage on face.*

Grizzlies are larger and stronger than black bears and have less trouble killing prey. Thus, grizzly bears normally make cleaner kills than black bears. Grizzlies usually capture prey with a bite to the back near the withers or to the top of the neck (Figure 23). This causes extensive damage to the spine and surrounding tissues. Tooth wounds on the head or lumbar region of the back are less common. Cattle may have claw marks on the face, neck, shoulders, and other body parts.

Characteristically, grizzlies seize cattle with their forelegs and bite them on top of the neck or back. Bears are reluctant to pursue prey, so signs of a long chase are seldom evident. A grizzly bear kill often occurs in cover or close to cover. Bears usually drag their kill into cover before feeding. Grizzly bears cover their prey with leaves, grass and other debris (Figure 24). Sometimes, however, the carcass is not covered (Figure 31). Grizzly bears

Figure 24. *Grizzly bears usually cover the remains of a carcass with debris. This cow was almost completely covered, except for the hind feet (on the left) and head (on the right).*

generally leave many signs around a carcass (tracks, scats, etc).

Grizzly bear feeding behaviour has not been well documented in Alberta. However, they appear to prefer meat over viscera. Removal of the stomach and intestines from a kill is normal for grizzlies. In Wyoming, grizzlies will often first consume flesh on the brisket and ribs of cattle. Bears do not chew and scatter bones as do members of the dog family. The skeleton including the ribs will frequently be left intact. Grizzlies readily feed on carrion.

Tracks of grizzly bears are generally larger than black bears (Figure 25). Tracks wider than 13 cm (5 in.) are most likely from a grizzly bear. However, bears of similar size display tracks of similar size. Claw marks are usually more prominent on grizzly tracks than on black bear tracks.

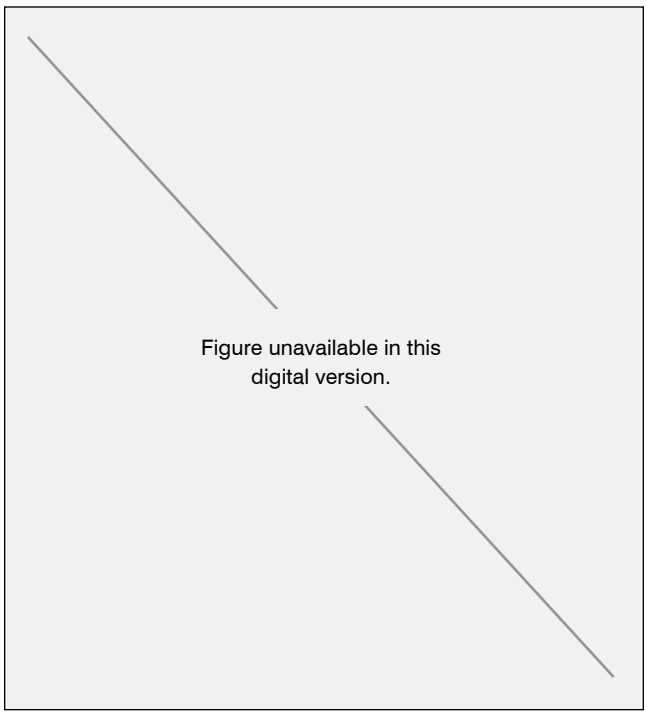

Figure 25. *Bear tracks.*

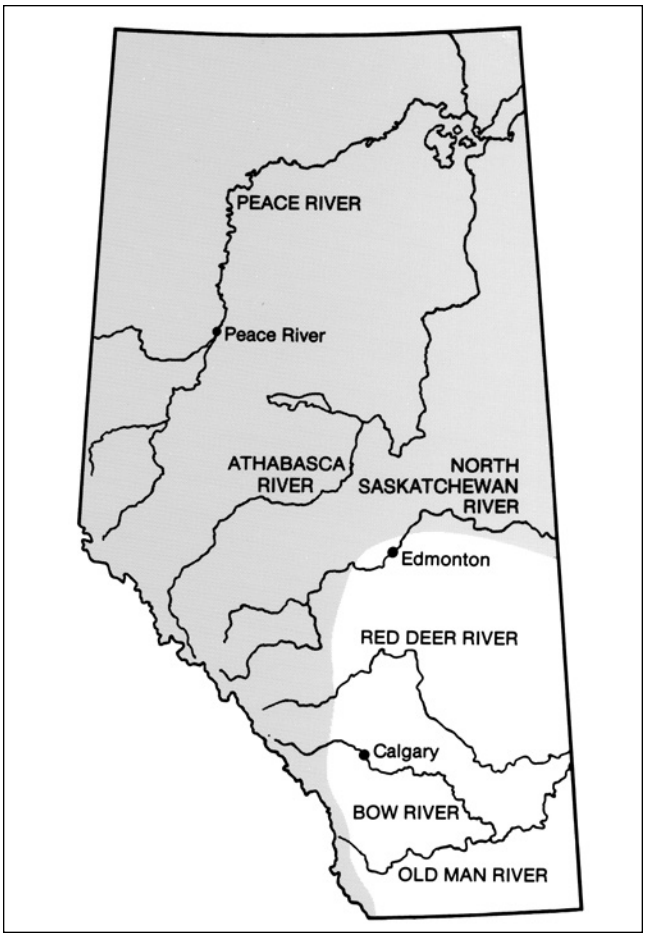

Figure 26. *Black bear distribution in Alberta.*

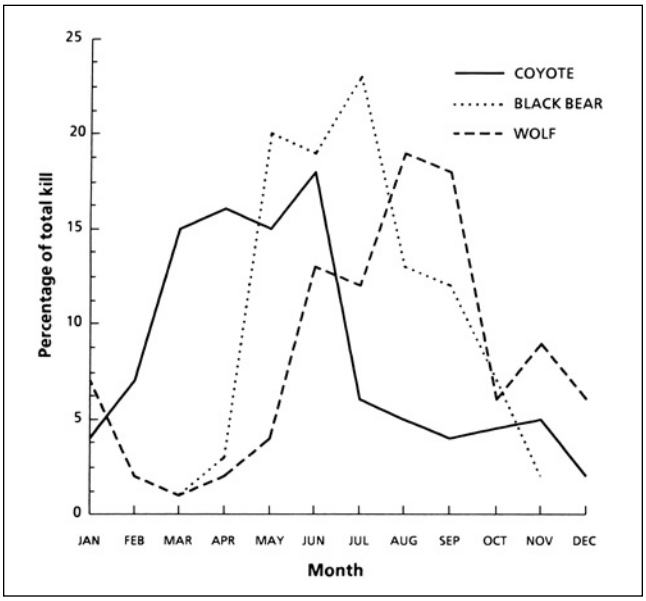

Figure 27. *Monthly chronology of cattle predation in Alberta.*

Black Bear

Black bears (*Ursus americanus*) inhabit the western and northern forest areas of Alberta (Figure 26). They are better adapted to living near people than grizzly bears. Predation on livestock commonly occurs on farms that are close to forests. Black bears prey on cattle, swine, sheep and poultry. Cattle are taken more often than other livestock. Black bears tend to prey on calves less than 6 months of age (Figure 6). Calves, yearlings and adults comprised 71, 11 and 18 per cent, respectively, of the 466 cattle killed by black bears in Alberta from 1974 to 1978. Multiple kills are common when sheep, swine or poultry are attacked in a pen or other confined area. Black bear/cattle problems peak during May-July in Alberta (Figure 27). Predation in late summer may be dependent on the berry crop. Fewer livestock problems develop if berries are readily available.

Black bears bite and claw the top of the neck and back of cattle, pigs and sheep (Figures 28 and 29). Smaller prey are usually bitten or sometimes killed by a blow to the head or neck. Inexperienced bears may rip open the underparts of prey and expose the viscera. Black bear kills usually have more claw marks on them than on grizzly bear kills. Black bears are generally not as large as grizzly bears, and probably have more difficulty killing larger animals. Black bears do not pursue prey to any great length; consequently, larger stock are often severely wounded with claw marks along the shoulders and back and tooth marks on the back and neck. The dulled, unretractable claws of a bear do not pierce and cleanly cut the hide of prey like the sharp, retractable claws of cougar, lynx and bobcat.

Black bears and grizzly bears have a similar feeding behaviour. Generally, meat is consumed before viscera and the bones are not broken and scattered (Figures 30 and 31). Bears readily feed on carrion. Black bears kill most prey near cover, then drag the carcass to cover before feeding. Unlike grizzly bears,

Figure 28a. *This calf was bitten on the back by a black bear*

Figure 28b. *Hide stripped away to show black bear injuries to calf.*

Figure 29. *This pig was bitten on the top of the neck and back and had flesh eaten from its back by a black bear.*

Figure 30. *This calf was killed and fed upon by a black bear.*

Figure 31. *This cow was killed by a grizzly bear. This bear made no attempt to bury the carcass as most grizzly bears do.*

black bears rarely attempt to cover prey. Many signs are left around a black bear kill; that is, tracks, scat, trampled grass and trails.

Black bear tracks are similar to those of grizzly bears (Figure 25). However, black bear tracks are generally smaller than those of a grizzly bear. As a rule, tracks less than 13 cm (5 in.) in width will be from black bear. Claw marks are usually more evident with grizzly bear tracks than black bear tracks.

Family Canidae – Dogs

Wolf

Wolves (*Canis lupus*) range throughout northern and western Alberta (Figure 32). Wolf predation of livestock is common and normally occurs on forested grazing leases and farmland at the forest fringe.

Wolves prey on a variety of domestic animals including cattle, sheep, swine, horses, poultry and dogs. Cattle and other livestock in grazing leases and private pastures are readily available to wolves and other predators. Cattle, primarily calves, are the most common livestock prey. Alberta data suggest that wolves select young, inexperienced or disabled cattle as prey much more often than healthy

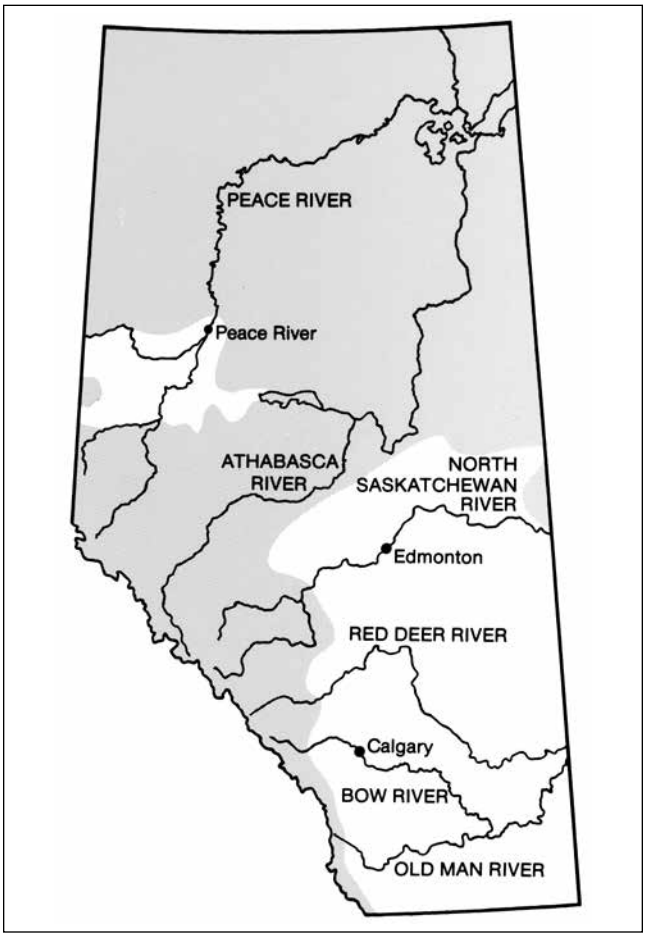

Figure 32. *Wolf distribution in Alberta*

adult cattle. Calves comprised about 70 per cent of 1581 cattle killed by wolves in Alberta from 1980 to 1987.

Unlike coyotes, wolf predation on livestock is less common in spring and early summer. This is probably due to reduced movement of wolves during the May to June denning period. The bond and protective instinct of cattle herds to young calves may also make predation on calves more difficult at this time. Most calves of domestic cattle killed by wolves are from 6 to 9 months old (Figure 6) because wolf predation on cattle is greatest from July to September (Figure 27). Wolves apparently prefer the young of cervids but will prey on domestic cattle in late summer when family packs become mobile and more closely associated with the cattle that are in their territory.

In Minnesota, wolf predation of livestock tends to decrease following severe winters. Presumably, this is related to the availability of young moose and deer. Following a severe winter, fawns are weaker and easier for wolves to catch. Consequently, wolves prey less frequently on livestock.

After a long chase, packs of wolves usually attack moose by lunging and biting at the flanks and hindquarters. A trail of blood and patches of hair are often evident. A few wolves distract the moose by biting at the nose and throat; the rest of the pack attacks the hindquarters and flanks. Wolves attack their prey on the flank, high on the shoulder and high on the hind leg.

Individual wolves and small packs concentrate on the flank and hind legs of ungulates. The prey is often left to become weak and stiff before the kill is made. Wolves begin to feed when the prey is knocked over, lies down or falls from weakness.

Wolves attack and kill large domestic animals in a manner similar to predation on moose. The focal point of attack on cattle is the hindquarters, including the tail, thighs and rectal area (Figure 33). The face, front legs,

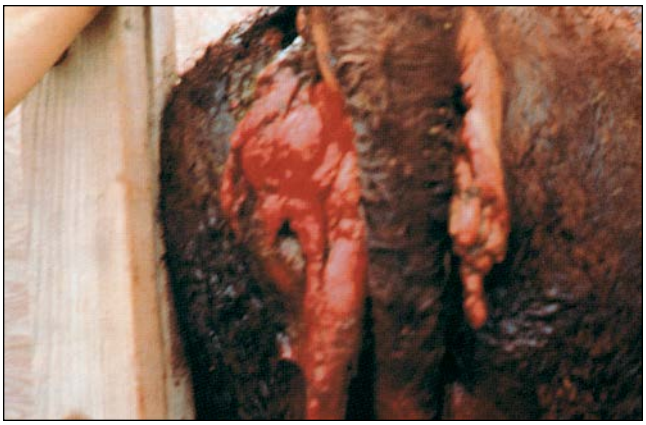

Figure 33. *The hindquarters of cattle are the focus of attack by wolves.*

flanks and upper shoulders may also be attacked. The powerful bite of a wolf usually causes damage deep in the underlying tissues. Cattle will often exhibit severe pain and trauma when wounded by wolves (Figures 34).

Wolves usually do not select for age, size, or a particular attack area on smaller livestock prey such as sheep (Figure 35). Multiple kills often occur. Bites to the head, neck, back, flanks and hindquarters are common. Injuries may include a crushed skull, severed spine, disembowelment and massive tissue damage. Wolves often attack the throat and neck of sheep in a manner similar to coyotes, but wolves damage the underlying tissue much more extensively. Wolves may carry or drag small prey away to be eaten, or they may totally consume their prey at the kill site. Wolves feed on large prey at the kill site. Parts of prey are sometimes carried off and buried. Bones are often chewed and broken.

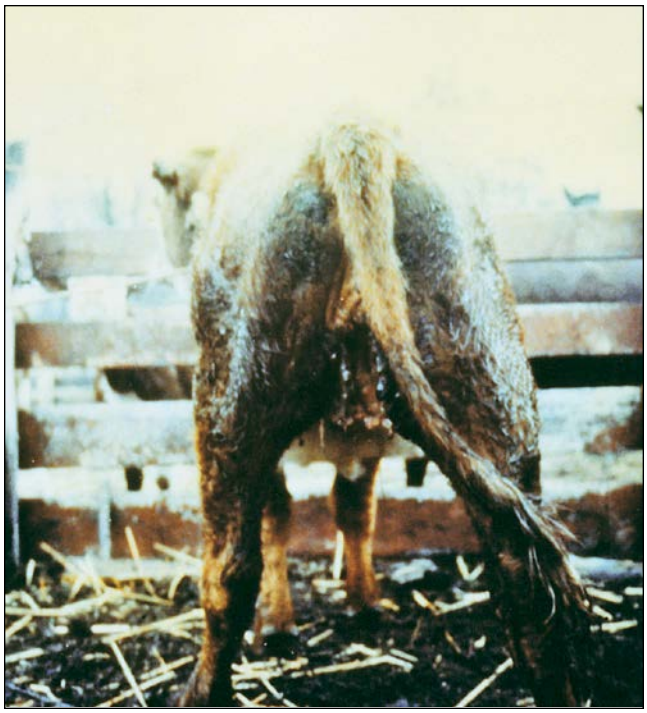

Figure 34. *Animals severely injured by wolves appear dazed and exhibit a characteristic stance. They are reluctant to move because it is painful.*

Figure 35. *This ewe was killed by wolves with bites to the base of the skull and back. Flesh from the neck and the udder were eaten.*

Wolves easily break and consume bones of young or small livestock and eat the hide along with other tissues (Figure 36).

Wolves prefer to feed on the viscera and hind legs of large domestic prey in Alberta (Figure 37). Similarly, wolves feed on the neck, throat, tongue, intestines and hind legs of caribou. In Minnesota, wolves seem to prefer the pelvic and abdominal regions and

Figure 36. *Sheep leftovers after a wolf attack.*

nose of moose; wolves feed first on the rump area, then the intestinal fat, heart, lungs, liver and other viscera except for the stomach contents.

Wolves in Alaska eat the viscera, except for the stomach contents, before other parts of moose calves and caribou. The soft parts of the neck and ribs are preferred over the fore and hind limbs. However, preferential feeding patterns are not obvious on prey killed by packs; the prey is most often completely consumed. Wolves readily feed on carrion, especially during the winter months when food is scarce or harder to secure.

Tracks of wild and domestic canids are similar (Figure 38). Track sizes of domestic dogs vary widely. Therefore, you may not be able to identify a wolf from a large dog at a kill site by considering only tracks. Use all available evidence to identify the predator at the kill site. Wolf tracks are larger than coyote tracks and the pace (the distance between hind and front foot prints) is longer. The stride (distance between imprints of the same foot, normally every other imprint) on level ground is approximately 100 cm (40 in.). Foot prints measure about 12 cm (4 3/4 in.) long and 10 cm (4 in.) wide, although the front-foot prints are sometimes longer and wider than the back-foot prints. In deep snow, members of a pack will commonly follow in the exact footprints of the pack leader.

Wolf scats are usually larger than those of a coyote. Scats 2.5 cm (l in.) or larger in

Figure 37. *Wolves consumed all viscera except the rumen on this cow. They also fed on the hind legs and neck.*

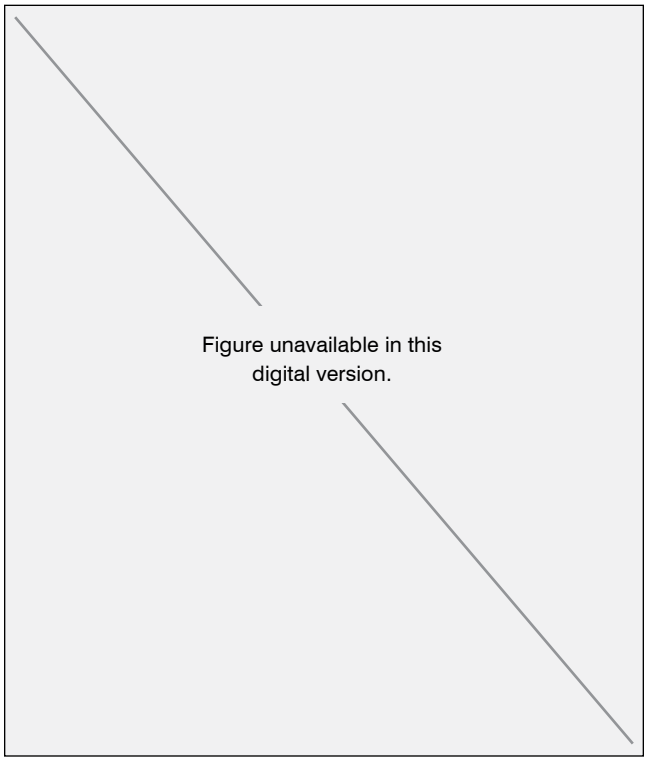

Figure 38. *Canid tracks – front foot.*

diameter are probably from wolves; smaller scats may be from either wolves or coyotes because overlap in size does occur. The size of dog scats overlaps that of wolves and coyotes. Wild canid scat usually contains hair and is blackish from digested meat.

Wolves and other dog family members use scat and urine to mark territories. They also leave scratch marks with their hind feet near scent posts.

Coyote

Coyotes (*Canis latrans*) are found throughout Alberta and are highly adapted to human presence. Consequently, coyote predation on domestic animals may occur in a backyard or miles from human habitation. Coyotes prey on sheep, goats, cattle, pigs, poultry, dogs and cats.

The coyote is the major predator of sheep in Alberta. Coyotes kill lambs in preference to ewes or rams. Lambs comprise about 70 per cent of the sheep killed by coyotes in Alberta. Bottle-fed or disabled lambs, lambs from old or crippled ewes and the smallest lambs in the flock are the most susceptible to coyote predation. Single lambs, which are more active, may be preyed on more often than twin or triplet lambs.

Young calves are also vulnerable to coyote predation (Figure 6). About 80 per cent of calves killed by coyotes are one month old or less and one-third are killed at one day of age. Calves less than a week old should be carefully guarded. Coyotes rarely attack adult cattle unless they are predisposed to attack due to birthing problems, illness or injury.

Most coyote predation of cattle happens during the spring through fall pasture season (Figure 27). Few losses occur in winter when livestock are generally kept and fed at close quarters. Sheep losses due to predation varied as follows in Alberta:

Winter 1%	Summer 40%
Spring 26%	Fall 33%

Coyote predation usually occurs in the early morning, although sheep may be attacked by coyotes at any time of day. Sheep kills may occur at any location, however, coyotes seem to prefer to kill in the open near bush or under cover of a hollow, ravine or other rough terrain. Once predation begins, coyotes generally approach and attack sheep at will. Sheep on range or large pastures are often attacked near bedgrounds. In Montana, many coyote kills occur in ditches, stream bottoms and ravines around the higher bedgrounds of sheep flocks on range.

Over 70 per cent of the sheep are killed by a throat attack (Figures 3, 4 and 39). During a throat attack, the coyote's grip is usually readjusted several times, which causes many tooth punctures and much tissue damage and hemorrhage. Coyotes attack and wound white-tailed deer, mule deer and elk calves in a similar manner.

In penned studies, a coyote would consistently run alongside fleeing sheep and bite the sheep laterally or dorsally just behind the ear. The coyote then braced its feet to stop the sheep. The coyote's grip would then shift to the throat. The grip was maintained for as long as 20 minutes until the sheep died, usually from suffocation. In tests with two coyotes, one coyote held a sheep by the throat while the other attacked the rear of the sheep. Occasionally both coyotes would grip the neck from opposite sides. A similar pattern of throat attack on sheep occurs in Alberta. However, inexperienced or pup coyotes may on occasion chase prey and bite at the sides and rear of the animal.

Very young lambs are often bitten on top of the head, fracturing the skull (Figure 40). Coyotes immediately consume young lambs or carry them away without a trace. Without careful supervision and head counts, several small lambs can disappear before a predator problem is recognized.

The helpless nature of new-born calves makes them easy prey for coyotes. It is often difficult to determine if young calves were killed by coyotes or died from other causes and were eaten by coyotes. There is usually little evidence of a struggle. New-born calves are generally attacked in the flank. The abdomen is ripped open and the internal organs are eaten. Calves killed by coyotes may also have bites on top of the back (Figure 41). The hindquarters and flanks are the focal point of attacks on older calves, however the neck, nose, shoulders and tail may also be damaged. Cows unable to stand while birthing can have their unborn calf and rectal area eaten by coyotes. Expectant mothers, especially first-term heifers, should be closely watched when delivery is due. Attacks on larger cattle by packs of coyotes are rare but are similar to wolf attacks on moose (distraction from the front and attack from the rear). Coyotes attack elk calves in a similar manner.

Figure 39. *This lamb was killed with a throat attack by coyotes. Coyotes fed on the viscera and hind leg.*

Figure 40. *This small lamb was bitten on the top of the skull by a coyote.*

Figure 41a. *This calf was killed by coyotes by an attack to the flank.*

Figure 41b. *Skinned back area of calf showing attack on area of back (on withers).*

Multiple kills of poultry are common, especially when attacks occur in confinement. Coyotes usually kill birds by a bite on the back or neck. Unconfined poultry are killed individually, carried off and consumed elsewhere.

The killing and feeding behaviour of coyotes varies among individuals. For example, some coyotes kill one or more sheep and do not feed or feed very little on a carcass, returning later to repeat the process. Other coyotes may kill one sheep and repeatedly feed on the carcass until it is consumed. A coyote feeding on sheep or calves typically begins with entry into the abdomen (Figures 39 and 41). Most of the viscera is eaten with the exception of the stomach contents of older animals. Occasionally, feeding begins on the front leg or rib cage. Coyotes usually eat flesh on the hindquarters first and continue forward on the carcass until only the skeleton, head and hide remain (Figure 42). Adult coyotes regurgitate

Figure 42. *Only the skeleton, head and hide remain of this lamb killed and eaten by coyotes.*

consumed prey items as food for their young pups. Carcass parts and unconsumed flesh may be taken and hoarded especially when food is scarce. The hides of sheep and calves are often left more or less intact during the initial stage of feeding (Figure 42). Unlike wolves, coyotes cannot break and consume the larger, harder bones of older prey, such as the skull, spine, pelvis and leg bones. Scattered bones, stomach contents and wool or hair are often all that remains at a coyote kill site.

Coyotes may clean themselves after feeding by rubbing their muzzle, chin and throat on ground near a kill site. They may also leave scat, tracks and scratch marks.

Coyote tracks are smaller than wolf tracks (Figure 38) and are similar to those of domestic dogs of the same size. A coyote has a walking stride of about 75 cm (30 in.). The front foot measures approximately 6 cm (2 1/2 in.) long and 6 cm (2 1/2 in.) wide.

Domestic Dog

Domestic dog (*Canis familiaris*) attacks on livestock occur throughout Alberta's farming community. Cattle, sheep, goats, swine, horses and poultry may be attacked. Several stray or neighborhood dogs, occasionally accompanied by the livestock owner's dog, are usually involved. Livestock attacks by feral dogs or coy-dogs (coyote crossed with domestic dog) are less common. Of the sheep killed by dogs in Alberta, only 25 per cent are killed by dogs whose owner is unknown. Livestock near

urban centres or residential sub-divisions are generally more vulnerable to dog attacks than in less populated rural areas. In Alberta, most dog attacks on livestock occur during late fall and winter. Dogs most frequently attack adult sheep and poultry. During one year in Alberta, dogs were responsible for 15 per cent of the ewe and three per cent of lamb deaths attributed to predators.

Dog attacks on livestock are typified by many dead and wounded animals. Attacks are usually prolonged and most often occur near building sites. Dogs are usually motivated by the enjoyment of the chase rather than the need for food. Dogs normally chase and bite any part of their prey. Sheep, goats and pigs attacked by dogs are usually mutilated. Prey may have torn ears and hide, protruding organs and bite marks on the neck, head, hindlegs and flank (Figure 43). Dogs seldom feed on kills. Dogs often chase horses and cattle through fences. Harassment of livestock may cause indirect losses from self-inflicted injury, exhaustion, smothering, abortion or drowning. Multiple kills are typical of poultry attacks.

You will generally find dead animals and attack sites in various locations. You will also find many dog tracks and blood, wool or hair scattered throughout the site of dog predation.

The size of dog tracks varies widely (Figure 38). Different sizes of canid tracks made by several dogs of different size at a predation site help substantiate domestic dog involvement.

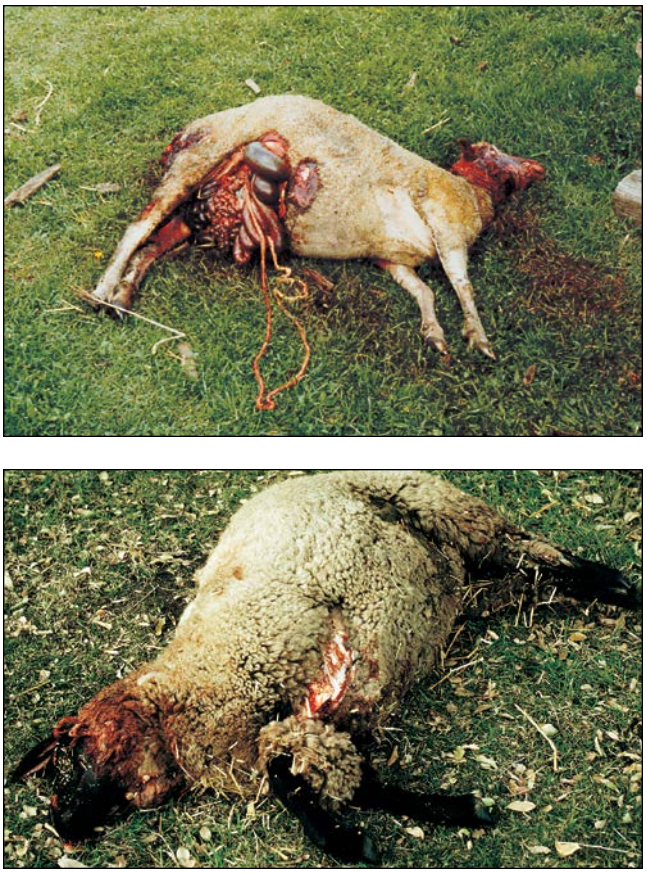

Figure 43. *Dog attacks show excessive multilation. These ewes were disembowelled and bitten on the head, nose, ears, legs, shoulders and hindquarters.*

Red Fox

Red foxes (*Vulpes fulva*) are distributed throughout Alberta. Fox predation of poultry, especially chickens, is common in the southern half of Alberta. Newborn lambs, cats and other small domestic animals are occasionally killed. Most poultry predation occurs in early summer when adults secure food for pups in their den and in late summer by family groups and young foxes. Foxes generally carry prey away from the kill site to their den or another secluded spot to feed. There is often no evidence of predation at the kill site. Consequently, many small animals may be killed and carried away before predation is noticed by the farmer. Remains of prey are often found around fox dens.

Foxes kill poultry by bites on the back or neck. Multiple kills may occur among confined poultry. Unconfined poultry are usually taken individually and carried away.

Foxes normally kill small lambs by multiple bites to the head, neck or throat. Small lambs may be injured. Foxes will carry or drag dead lambs to a secluded spot or take them to their dens to feed pups. Foxes usually feed on lambs by entry into the abdominal cavity behind the ribs. Viscera is eaten in preference to meat.

The spacing between canine tooth punctures on the hide of prey will help determine if a fox or coyote was responsible. Canine teeth of fox are 1.9 to 2.5 cm (3/4 - 1 in.) apart, while coyote canine teeth are 2.9 to 3.5 cm (1 1/8 - 1 3/8 in.) apart.

Tracks of red fox are generally smaller than those of coyotes (Figure 38). The stride distance is also shorter. The stride of a walking fox is about 64 cm (25 in.).

Family Felidae – Cats

Cougar

Cougars (*Felis concolor*) live in the mountains and foothills of western Alberta (Figure 44). They are elusive and solitary except when mating or when a female is accompanied by kittens. Cougars primarily prey on deer; however, they will occasionally kill cattle, colts, sheep, goats, swine, dogs and cats. In Arizona, 80 per cent of the cattle killed by cougars were under six months of age. Cougar predation of livestock usually occurs along the agricultural-forest fringe in Alberta.

While primarily nocturnal, cougars may attack prey during the day. Cougars hunt by stalking like a domestic cat. Attacks generally occur in or near cover, allowing the cougar to approach within striking distance. Little evidence of a chase is apparent at a cougar predation site. Confined livestock are often attacked. Corrals and fences offer little resistance or discouragement to cougars, which easily jump or climb. Multiple kills may occur, with feeding on only one or two animals. There may be drag marks at a kill site. Cougars usually drag or carry smaller prey to cover before feeding.

Cougars typically kill small prey such as sheep, goats or calves with a bite to the top of the neck or head, usually severing the spinal column. Cougars leap on the back or shoulders of larger animals such as cattle, horses, elk and deer and kill with a bite to the neck. Claw marks are usually on the shoulders, neck and back of larger prey (Figure 45). Occasionally, bite marks may also be on the throat area. The massive canines and powerful jaw structure of cougars cause severe damage during a bite, often breaking the neck.

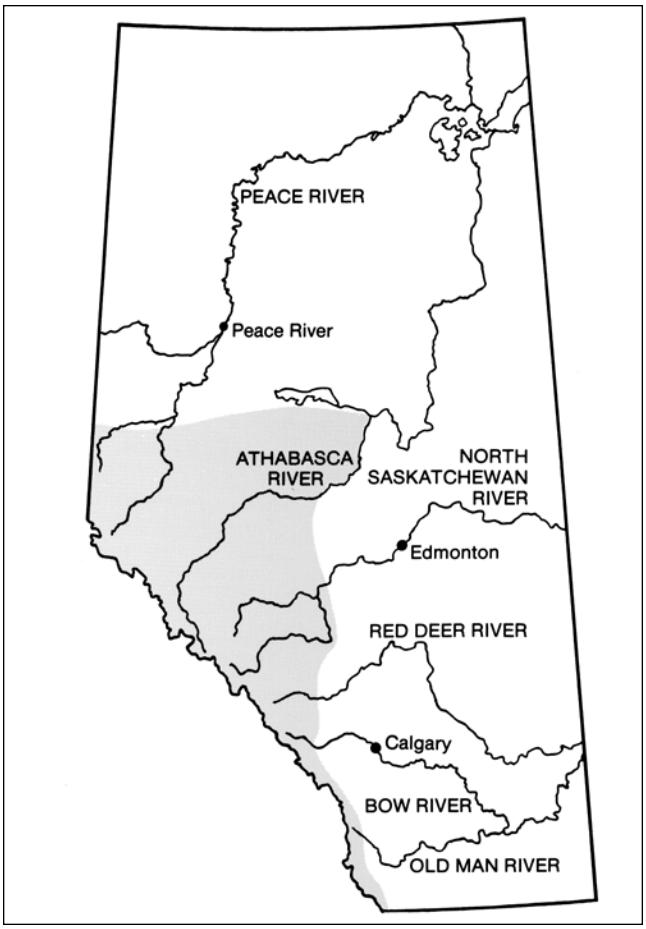

Figure 44. *Cougar distribution in Alberta.*

Figure 45. *This calf was attacked and bitten on the neck by a cougar.*

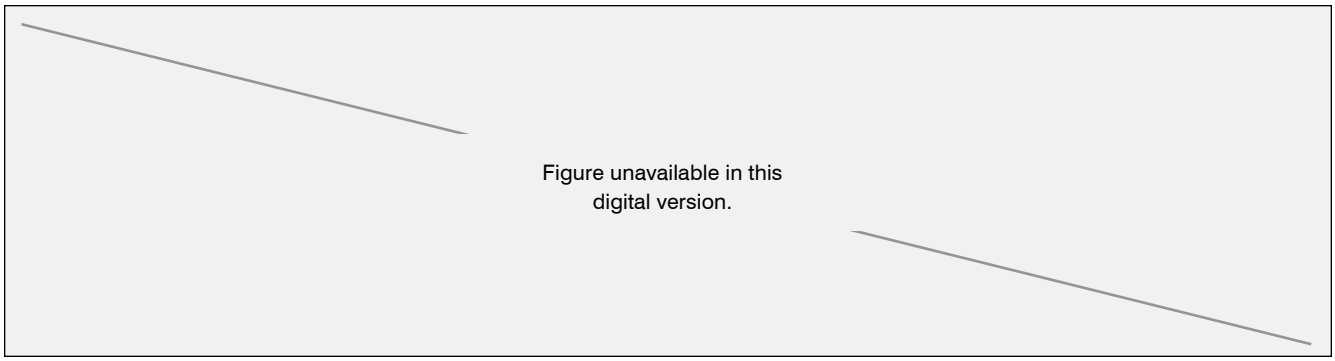

Figure 46. *Cat tracks.*

Feeding is characterized by heavy gorging with two or three days between feeds or kills. Smaller or young prey may be completely consumed during the first feeding. Cougars generally begin to feed on internal organs through an opening behind the ribs. Blood, heart, lungs, liver and kidneys are usually eaten first. The stomach and intestines are often removed from a kill but are not eaten.

Cougars readily feed on meat. As with all cats, cougars will chew off pieces of meat and leave clean-cut edges where they feed. These clean-cut edges are in contrast to the ragged edges left by the pull-and-tear feeding of other carnivores. Cougars will not eat carrion except when live prey is scarce.

Attempts are usually made to cover remains of a kill with vegetation, soil or snow. Cougars do not have as great a reach as bears when scratching debris over a kill; cougars reach out about 1 m (3 ft).

Cougar paw prints show no claw marks unless the animal runs or slips. The front foot print of adults average 9 cm (3 1/2 in.) in length and 9 cm (3 1/2 in.) in width (Figure 46). The hind and front foot prints are similar, but the hind print is slightly narrower, with the heel imprint not as pronounced. The hind foot is placed in the imprint made from the forepaw when cats are walking. Cats walk around puddles rather than through them. Cougars generally travel on paths unless food is scarce. Scratchhills made by cougars to cover their urine or dung are often found along travelways or near kill sites. Scrapes of debris, sometimes including scat and urine, are also used by males as territorial markers.

Lynx and Bobcat

The ranges of lynx (*Lynx canadenis*) and bobcat (*Lynx rufus*) in Alberta are shown in Figures 47 and 48. The predatory and feeding behaviour of these animals are similar. Poultry is their most common prey. Lynx predation on sheep, goats, calves, colts and pigs has been reported on rare occasions in Alberta.

Lynx and bobcats stalk and attack prey from cover in a manner similar to cougars. They normally leap on the back and bite at the neck and throat of larger prey. Claw marks are often found on the neck and shoulders. Deer, caribou calves and lambs have been attacked in this manner.

Predation of large prey by lynx or bobcat is poorly documented in Alberta. However, the neck of large prey seems to be the focal point of a lynx attack. Lynx or bobcat will commonly be seen around a farmstead before poultry predation occurs. Lynx and bobcat carry poultry away and return night after night, and they will frequently kill more animals than they can eat or carry away.

Feeding patterns of lynx and bobcat are similar to those of the cougar. Generally, the abdomen of prey is entered behind the ribs and the internal organs are eaten first. Meat from the thighs and shoulders is usually consumed last. Bobcat and lynx leave

clean-cut edges where they feed. Bobcat and lynx do not normally feed on carrion except when prey is scarce. Kills are often covered with debris or snow. You can distinguish bobcat and lynx kills from cougar kills by the way in which they are covered. Bobcat and lynx reach out to scratch for debris a little over 0.3 m (1 ft), while cougars reach out about 1 m (3 ft).

Bobcat tracks are much smaller than those of lynx or cougar (Figure 46). Lynx and cougar tracks tend to be greater than 9 cm (3 1/2 in.) long, while bobcat tracks are usually less than 6 cm (2 1/2 in.) long. Bobcat and cougar tracks are more distinct than the imprint of a furred lynx paw. The paw size of lynx and cougar are similar, but the heavier cougar makes deeper track impressions in snow or soft ground and the stride length is much greater than that of the smaller lynx.

Family Mustelidae

Weasel, Mink, Skunk and Badger

Weasels and mink (*Mustela* spp.), badgers (*Taxidea taxus*) and skunks (*Mephitus mephitus*) occasionally kill poultry and domestic rabbits. Weasels, skunks and mink are distributed throughout Alberta. Badgers occur throughout the prairie and parkland areas of Alberta (Figure 49). Weasels and mink usually kill prey with bites to the skull, neck or throat. Multiple kills of confined poultry are common, with feeding only on one or two birds. Poultry chicks may be carried away or piled in a corner of the pen; larger prey are fed on at the kill site. The head is often eaten. They may also feed on the breast. Mink prefer habitat near streams, lakes or other water bodies. Mink predation usually occurs on farms close to water. Weasels

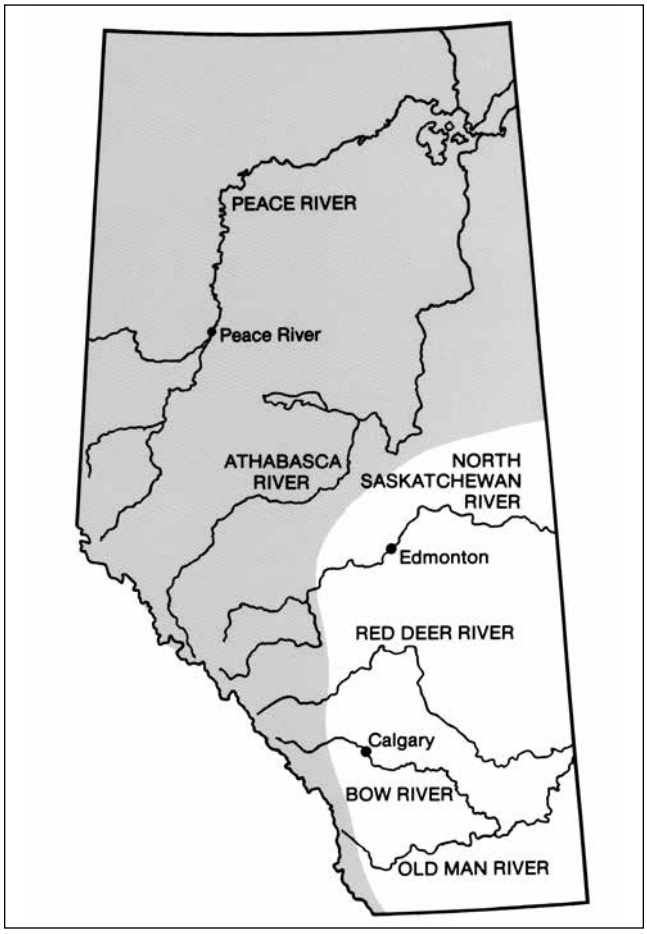

Figure 47. *Lynx distribution in Alberta.*

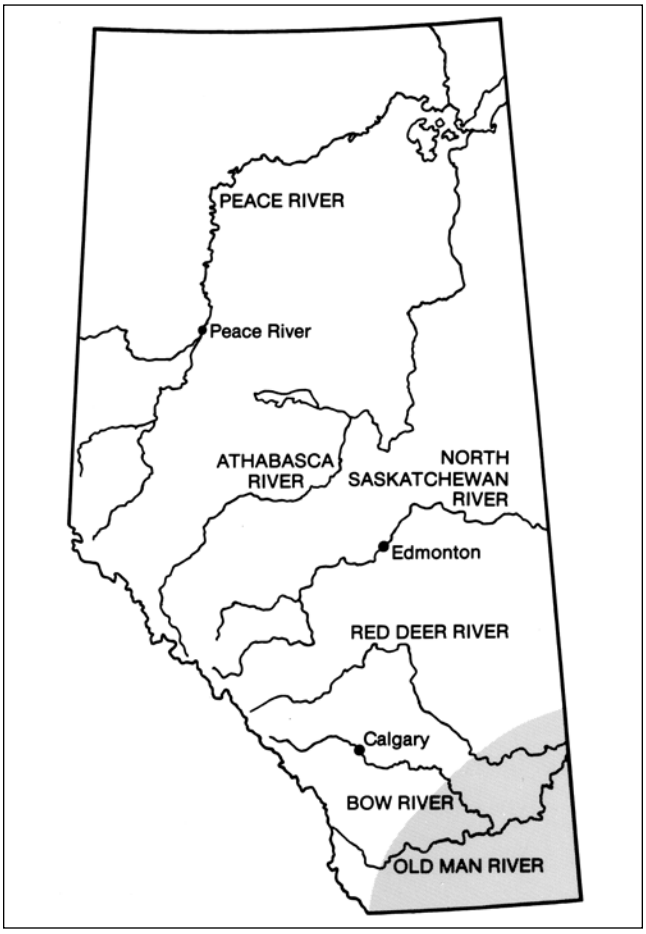

Figure 48. *Bobcat distribution in Alberta.*

occur in a variety of habitats. Consequently, weasel predation may occur anywhere. Mink and weasels climb and enter buildings or fenced areas through openings too small for most other predators. Mink are larger than weasels, so predation by these animals may be differentiated by the distance between canine tooth punctures on prey. The canines of mink are just over 1.3 cm (1/2 in.) apart while those of weasels are less than 1.3 cm (1/2 in.) apart.

Badgers commonly gain access to confined poultry, rabbits or other small farm animals by burrowing under fences or walls. Multiple kills are common. Extensive digging, large dig holes and badger tracks are usually present where badger predation occurs. Prey is often cached in holes dug at the predation site.

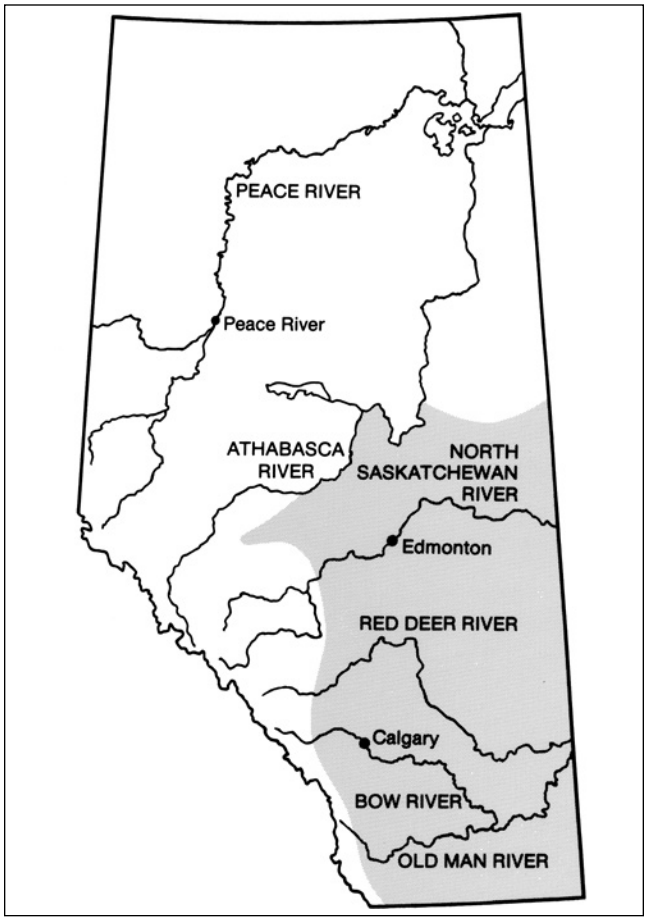

Figure 49. *Badger distribution in Alberta.*

Skunks generally kill one or two birds during each visit. Birds are typically mauled and bitten on the lower neck and breast. Confined poultry are most vulnerable, especially those that roost on the ground. Skunks normally dig or crawl into pens or buildings through holes in wire or walls. Do not confuse scavenging of poultry carcasses with actual skunk predation.

The presence of a predator can cause large numbers of poultry to be lost from suffocation as they crowd into a corner in panic. Mustelids (members of the weasel family) are often observed near predation sites and will return to feed on kills or kill additional prey.

Badgers and skunks have large claws on their front feet that usually show in paw prints (Figure 50). Badger tracks measure 5 to 6.5 cm (2 - 2 1/2 in.) long and approximately 5 cm (2 in.) wide. Skunk tracks are about 4 to 5 cm (1 1/2 - 2 in.) long and 3 cm (1 1/4 in.) wide.

Mink and weasel tracks are generally absent at predation sites unless snow is present. Mink and weasels leave a characteristic bounding track pattern with two feet together at approximate equal distances (Figure 50). Mink tracks are larger than weasel tracks. Weasel tracks average 1.5 cm (2/3 in.) in length while mink tracks average about 4.4 cm (1 3/4 in.).

Family Procyonidae

Raccoon

Raccoons (Procyon lotor) are common in southern Alberta, especially south of the Bow and South Saskatchewan rivers (Figure 51). They will occasionally prey on poultry. Raccoons prefer habitat near water. Farms near streams, lakes or other water bodies are most susceptible to raccoon problems. Raccoons are excellent climbers and can manipulate objects with their front feet. This helps them to enter uncovered or poorly constructed poultry pens easily. They can climb over fences, and pull off or open loose boards and weak wire mesh.

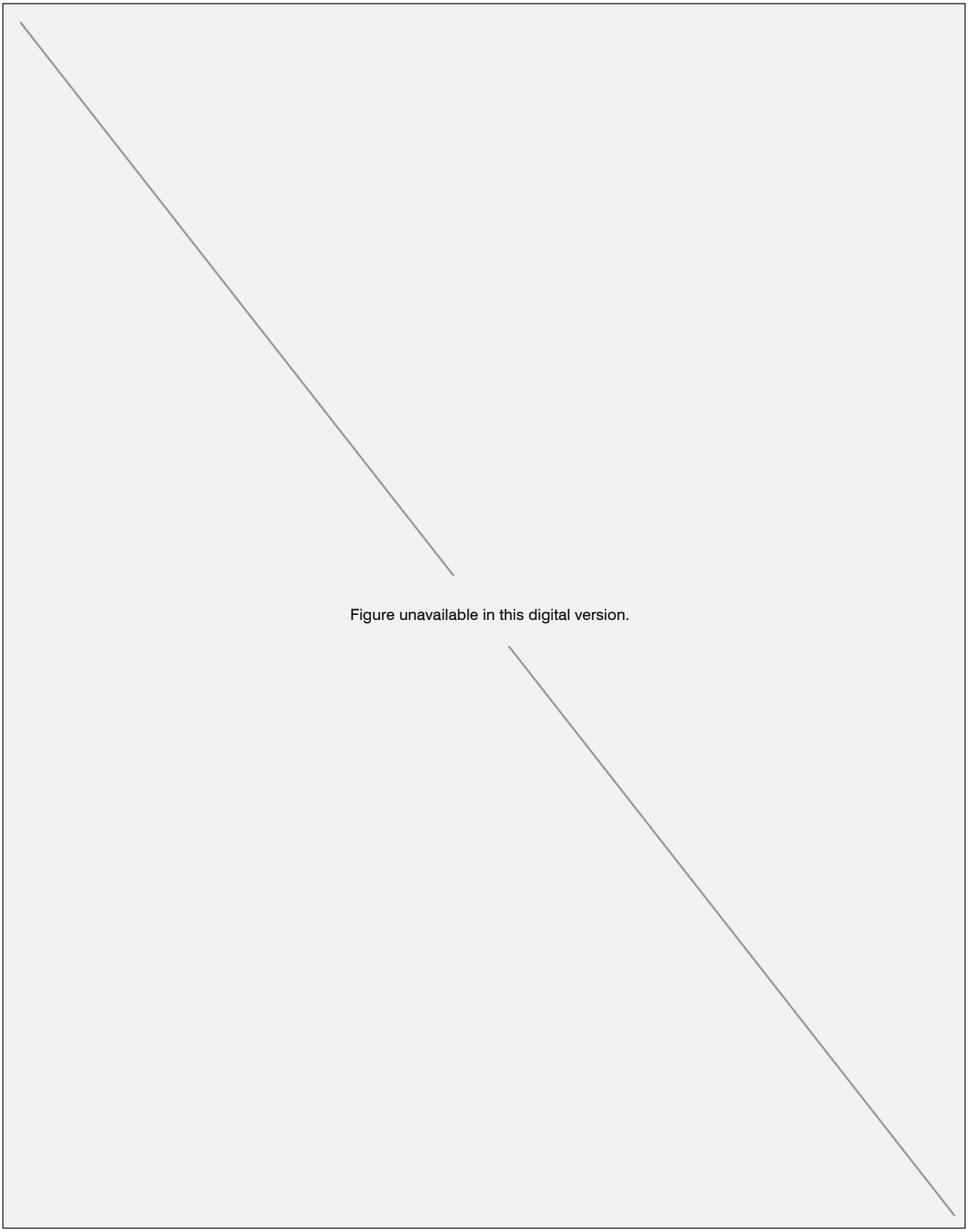

Figure 50. *Weasel, Mink, Skunk and Badger tracks.*

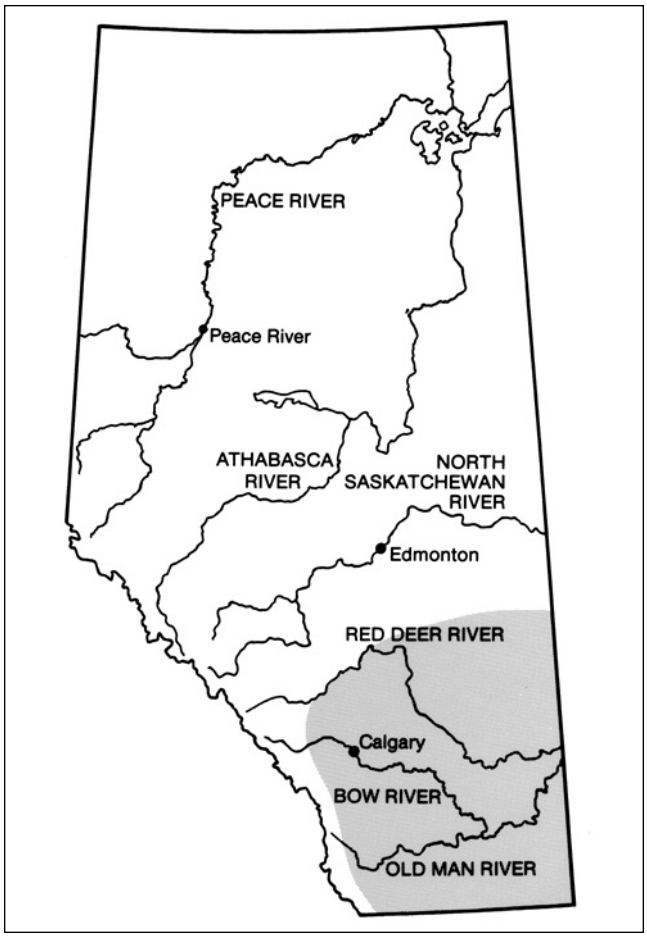

Figure 51. *Racoon distribution in Alberta.*

Signs of raccoon predation may include carcasses with missing heads, bites on the back, torn necks and breasts, and feeding on the breast or entrails (Figure 52). Raccoons usually attempt to drag or carry prey to cover before they feed. They may kill several birds in one night. Often a family group is involved in predation. Eggs are also removed from nests or eaten on the spot.

Tracks of raccoon are longer than they are wide and resemble miniature human hands or footprints (Figure 53). Five toes are evident. The toes are bulbous on the tips. Claw marks usually show in the tracks. Front paws measure approximately 6.5 cm (2 1/2 in.) long and 6.5 cm (2 1/2 in.) wide; hind feet measure about 10 cm (4 in.) long and 6 cm (2 1/4 in.) wide.

Figure 52. *These ducks were bitten on the neck and back, and the entrails were eaten by a racoon.*

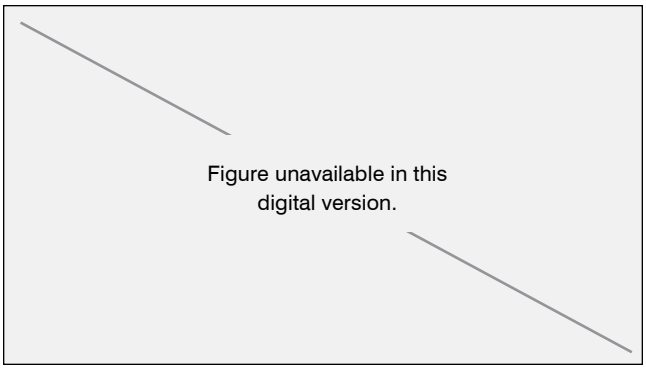

Figure 53. *Racoon tracks.*

Raptors – Birds of Prey

Eagles, Hawks and Owls

Raptors occasionally kill poultry, domestic rabbits and other small domestic animals. Hawks and eagles normally attack unconfined domestic prey during the day. Small animals are simply picked up and taken away. Occasionally owls will enter a poultry house and make multiple kills or cause severe losses when poultry pile and suffocate. The great horned owl (*Bubo virginianus*) is usually the owl species responsible for predation on poultry and other domestic animals. Prey are killed by talon punctures into vital organs. The head of dead poultry is characteristically bitten off close to the body. When multiple killing takes place, not all birds will be decapitated.

Figure 54. *The skinned shoulder of this day-old calf reveals talon puncture wounds from a golden eagle. The eagle has fed on the rear quarters of this calf.*

Figure 55. *This stillborn calf was scavenged by a bald eagle. The ealge picked flesh from between the ribs.*

Newborn lambs and calves have been attacked by eagles on rare occasions in Alberta. However, eagle predation of lambs and kid goats is common in the United States. Adults are also occasionally attacked. Golden eagles (*Aquila chrysaetos*) are usually involved. Prey is grasped with the talons anywhere on the head, neck or body. Multiple talon punctures in the skull or along the spine damage organs and tissue (Figure 54). Death usually occurs from shock and blood loss. Eagles strip all soft tissue including cartilage, tendons and soft bones from a carcass. They leave most of the skeleton intact and the hide turned inside out. Tissue and hemorrhage may be cleanly removed from the hide. The rumen of larger prey is usually not eaten. Eagles will readily feed on carrion, especially when prey is scarce (Figure 55).

Birds may defecate on or around a carcass leaving characteristic white streaks of feces.

Scavenging Birds

Magpies, Ravens and Crows

Healthy livestock are rarely preyed upon by scavenging birds. Most attacks occur on livestock that are in difficulty and unable to escape or defend themselves (Figure 56). Most situations would therefore be classified as pseudo-predation. Typically, these birds attack and feed on the eyes, nose, neck and rectal area or at wounds. Scavenging birds are often associated with remains of animals preyed upon by carnivores. Birds may defecate on or around a carcass leaving characteristic white streaks of feces.

True predation of young poultry, piglets, newborn lambs and calves by ravens (*Corvus corax*) and magpies (*Pica pica*) has occurred in Alberta and British Columbia. High densities of birds, lack of food and feeding of nestlings contribute to predation by scavenging birds. Changes in management usually alleviate this kind of predation.

Figure 56. *Magpies fed on this goat after its horns became entangled in a fence.*

CHARACTERISTICS OF MAJOR PREDATORS

	Wolf	Coyote	Dog	Bear	Cougar
Area of conflict	Fringe of settlement, grazing leases, pastures and farmland along the forest-agricultural transition fringe.	Throughout Alberta.	Throughout agricultural areas; often near urban centres or residential subdivisions.	Grazing leases, pastures and farmland along the forest – agricultural transition fringe.	Mountains and foothills near agricultural area.
Domestic prey	Cattle, sheep, horses, dogs.	Sheep, calves, goats, poultry.	Sheep, poultry, calves, goats.	Cattle, sheep, swine.	Horses, swine cattle, sheep.
Attack behaviour	Cattle, horses: long chase, trails of blood and hair, bites on hindquarters, vulva and tail. May attack shoulders, flank, nose or head. Sheep: Severe bites on neck, hindquarters, head or flank. Disembowelment common.	Sheep: usually throat, top of neck or head. Occasionally attack hindquarters or flank. Calves: Newborn – flank bites on back. Older calves – hindquarters, tail, flank and back. Poultry: multiple kills when confined. Carry off individual unconfined poultry.	Prolonged harassment and mutilation ears, nose and shoulders, flank, hindquarters and tail.	Bite on top of neck, back or head. Shallow claw marks on face and shoulders. Wounded prey common.	Bites on top of neck damaging spine, teeth marks on upper neck, deep claw marks on neck and shoulders.
Feeding behaviour	Prefer viscera and hind limbs, preferential feeding not obvious in packs.	Feed on prey through upper flank, consume viscera and upper thigh first, leave hide in more or less one piece.	Feed lightly or not at all.	Drag prey to cover; prefer flesh over viscera. Skin and bones remain more or less intact. Grizzlies generally cover prey, black bears usually do not.	Drag prey to cover. Heart, lungs, liver, and kidneys eaten first, then meat. Cover remains of prey.

SUMMARY

Locate the attack and kill site.
Record:
Vegetation – Woods, brush, open pasture
Topography – Ravine, hilltop, stream bottom
Distance from buildings

Note the position of the carcass.

Look for signs of a struggle.
Record:
Broken vegetation
Trampling
Blood trails
Tufts of hair

Note predator sign.
Record:
Tracks
Scat
Hair

Examine the carcass for wounds.
Record and photograph:
Signs of hemorrhage
Blood on ground
Stage of decomposition
Location and description of external wounds (i.e., bites, claw marks, tooth punctures)
Parts consumed

Skin normal attack sites or areas of carcass where wounds are evident (that is, throat, hind legs, neck).
Record:
Size and description of subcutaneous bruises and wounds

Open the chest and abdomen.
Record:
Damaged organs and massive blood clots

Cut along neck and back bone.
Record:
Broken vertebrae
Hemorrhage

Note and record the age of the animal.
Examine footpads of newborn.
Did the newborn breathe and nurse?
Was it cleaned by the mother?

Check the carcass for general health.
Record abnormalities of:
Coat condition
Body fat
Amount and kind of food in rumen
Lungs
Circulation
General appearance
Age

Note the condition of pasture.
Record:
Overgrazing
Poisonous plants

Note any irregularities in the rest of the herd.

Check for sources of poison.

Determine the cause of death.
Predation
Pseudo-predation
Other causes

In case of predation, determine species responsible from:
Predator ranges
Habitat preference
Domestic prey involved
Attack behaviour
Feeding behaviour
Tracks, scat, hair

REFERENCES

ALFORD, J.R., and E.G. BOLEN. 1972. A note on golden eagle talon wounds. Wilson Bull. 84:487-489.

BANFIELD, A.W.F. 1974. The mammals of Canada. Univ. of Toronto Press., Toronto, Ont. 438 pp.

BARNES, C.T. 1960. The cougar or mountain lion. Ralton Co. Salt Lake City, Utah. 176 pp.

BERGERUD, A.T. 1971. The population dynamics of Newfoundland caribou. Wildl. Monogr. 25.55 pp.

BJORGE, R.R., and J.R. GUNSON. 1983. Wolf predation of cattle on the Simonette river pastures in northwestern Alberta. In: Wolves in Canada and Alaska; the status, biology and management. (L.N. Carbyn – Ed.) Can. Wildl. Serv. Rpt. Ser. 45: 106-111.

BOWNS, J.E. 1976. Field criteria for predator damage assessment. Utah Science. 37:26-30.

BRENCHLEY, A. 1985. Ravens and their effect on sheep production on Saltspring Island, British Columbia: A preliminary study. Min. of Agri.and Fish., British Columbia, Victoria, B.C. 27 pp.

BURKHOLDER, B.L. 1959. Movements and behavior of a wolf pack in Alaska. J. Wildl. Manage. 23:1-11.

CALAHANE, V.H. 1947. A deer-coyote episode. J. Mammal. 28:36-39.

CONNOLLY, G.E., R.M. TIMM, W.E. HOWARD, and W.M. LONGHURST. 1976. Sheep killing behavior of captive coyotes. J. Wildl. Manage. 40:400-407.

COWAN, I.M. 1947. The timber wolf of the Rocky Mountain national parks of Canada. Can. J. Res. 25 Sect. D: 139-174.

DORRANCE, M.J., and L.D. ROY. 1976. Predation losses of domestic sheep in Alberta. J. Range Manage. 29:457-460.

DORRANCE, M.J. 1982. Predation losses of cattle in Alberta. J. Range Manage. 35:690-692.

GILES, R.H. 1971. Wildlife management techniques. The Wildl. Soc. Washington, D.C. 633 pp.

GLUESING, E.A. 1977. Sheep behavior and vulnerability to coyote predation. Ph.D. Thesis, Utah State Univ., Logan, Utah.121 pp.

GLUESING, E.A., D.F. BALPH, and F.F. KNOWLTON 1980. Behavioral patterns of domestic sheep and their relationship to coyote predation. Appl. Anim. Ethol. 6:315-330.

GUNSON, J.R. 1983. Wolf predation of livestock in western Canada. In: Wolves in Canada and Alaska: their status, biology and management. (L.N. Carbyn – Ed.) Can. Wildl. Serv. Rpt. Ser. 45:102-105.

HALFPENNY, J., and E. BIESIOT. 1986. A field guide to mammal tracking in North America. Johnson Pub. Co., Boulder, Colorado. 161 pp.

HALL, E.R., and K.R. Kelson. 1959. The mammals of North America. The Ronald Press Co., New York, N. Y. 1083 pp.

HENNE, D.R. 1975. Domestic sheep mortality on a western Montana ranch. M.S. Thesis. Univ. of Montana, Missoula. 53 pp.

HORNOCKER, M.G. 1970. An analysis of mountain lion predation on mule deer and elk in the Idaho Primitive Area. Wildl. Manage. 21. 39 pp.

KUYT, E. 1972. Food habits and ecology of wolves on barren-ground caribou range in the Northwest Territories. Can. Wildl. Serv. Rpt. Ser. 21. 36 pp.

MECH, L.D. 1966. The wolves of Isle Royale. U.S. Nat. Parks. Fauna Ser. 7. 210 pp.

MECH, L.D. 1966. Hunting behavior of timber wolves in Minnesota. J. Mammal. 47:347-348.

MECH, L.D. 1970. The wolf. Natural History Press, Garden City, N. Y. 384 pp.

MECH, L.D., S.H. FRITTS, and W.J. PAUL. 1988. Relationship between winter severity and wolf depredations on domestic animals in Minnesota. Wildl. Soc. Bull. 16:269-272.

MURIE, A. 1948. Cattle on grizzly bear range. J. Wildl. Manage. 12:57-72.

MURIE, O.J. 1954. A Field guide to animal tracks. The Riverside Press, Cambridge, Mass. 374 pp.

NELLIS, C.H., and L.B. KEITH. 1968. Hunting activities and success of lynxes in Alberta. J. Wildl. Manage. 32:718-722.

NELLIS, C.H., and L.B. KEITH. 1976. Population dynamics of coyotes in central Alberta, 1964-1968. J. Wild. Manage. 40:389-399.

NIELSON, D., and D. CURLE. 1970. Predator costs to Utah's range sheep industry. National Wool Grower. 60(12):14-22.

OZOGA, J., and E. HARGER. 1966. Winter activities and feeding habits of northern Michigan coyotes. J. Wildl. Manage. 30:809-818.

REYNOLDS, R.N., and O.C. GUSTAD. 1971. Analysis of statistical data on sheep losses caused by predation in four western states during 1966-1969. Div. of Wildl. Serv. Bur. of Sport Fish and Wildl., U.S. Dept. Int. Washington, D.C. 7 pp.

ROBINETTE, W.L., J.S. GASHWILER, and O.W. MORRIS. 1959. Food habits of the cougar in Utah and Nevada. J. Wildl. Manage. 23:261-273.

ROBINSON, W.B. 1952. Some observations on coyote predation in Yellowstone National Park. J. Mammal. 33:470-476.

ROWLEY, I. 1970. Lamb predation in Australia. Incidence, predisposing conditions, and the identification of wounds. CSIRO Wildl. Res. 15:79-123.

RUE, L.L., III. 1969. The world of the red fox. J.B. Lippincott Co. Philadelphia, Pa. 204 pp.

SHAW, H.G. 1981. Comparison of mountain lion predation on cattle on two study areas in Arizona. Proc. from Wildlife – Livestock Relationships Symposium. Coeur D'Alene, Idaho, pp. 307-317.

SOPER, J.D. 1964. The mammals of Alberta. Queen's Printer, Edmonton, Alberta. 402 pp.

WADE, D.A., and J.E. BOWNS. 1982. Procedures for evaluating predation of livestock and wildlife. Texas Agricultural Extension Service, San Angelo, Tex. 42 pp.

WHITE, M. 1973. Description of remains of deer fawns killed by coyotes. J. Mammal. 54:291-293.

YOUNG, S.P. 1958. The bobcat of North America. Stackpole Co., Harrisburg, Pa. and Wildl. Manage. Inst. Washington, D.C. 193 pp.

YOUNG, S.P., and E.A. GOLDMAN. 1946. The puma, mysterious American cat. Dover Publ. Inc., New York, N. Y. 358 pp.

7 78753 06137 0

Alberta Government

AGDEX 684-14
Printed in Canada