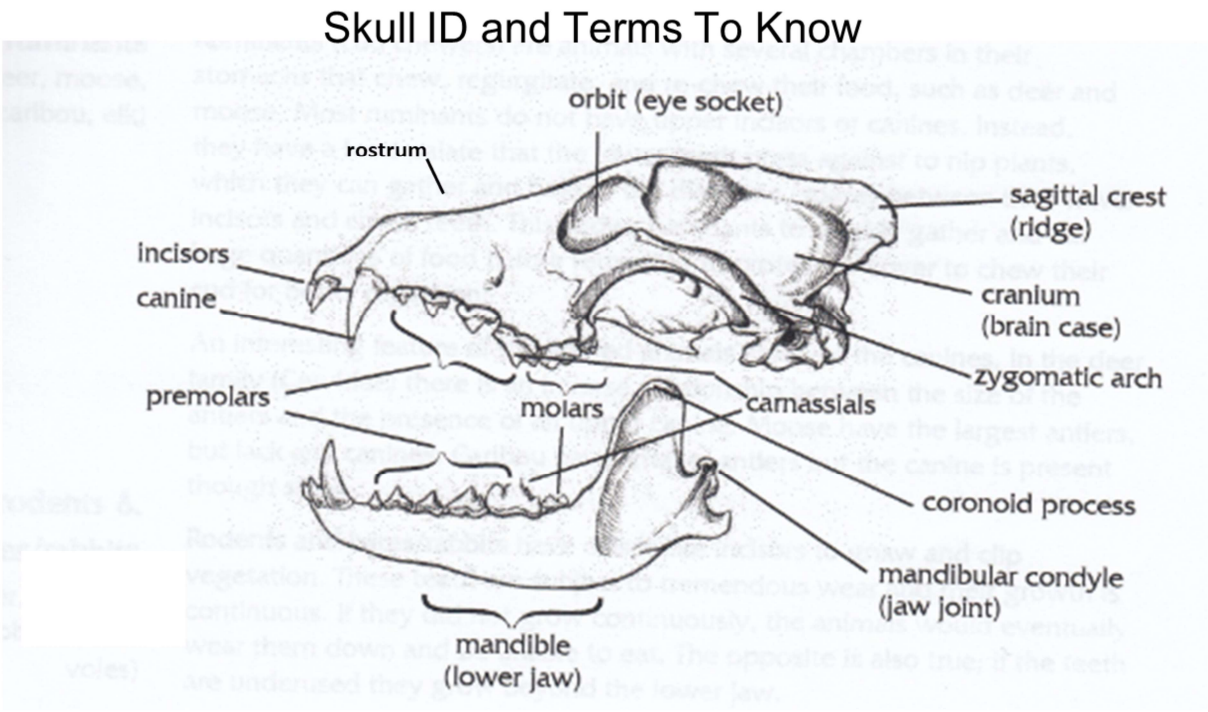
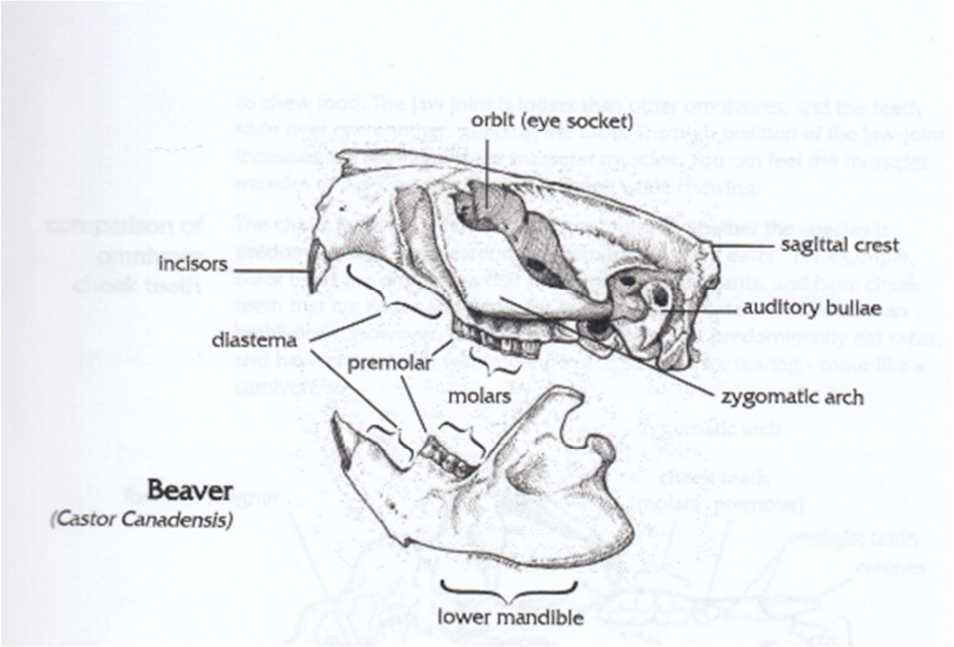
Skulls can tell us many things about an animal, including the species, its approximate age, size, health, what it ate, whether the animal was male or female, how many legs it had and even how it died. Sheep skull.

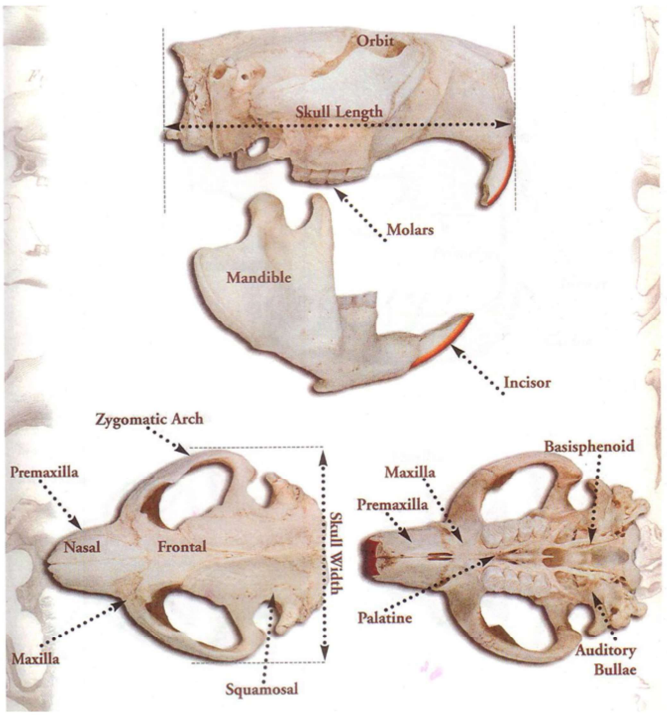
Spring is a good time to look for mammal skulls. The end of winter is a peak period of mortality for many species.
Check ditches !



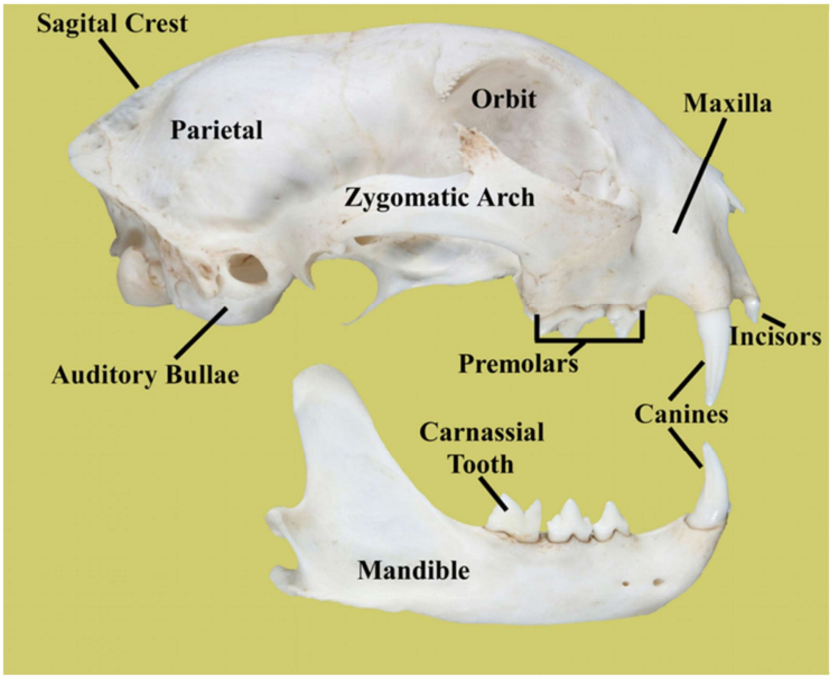
Skulls identification is best done by breaking down the skull into its parts. For the sake of simplicity, we will stick to mammal skulls here in this presentation. There are four general regions to a mammal skull: the **rostrum, zygomatic arches, braincase and mandibles.**
The rostrum is the portion of the skull that contains the upper teeth, nose and palate. The **zygomatic arches** are the bones arching outward from the braincase and rostrum to form the cavities known as the "**orbits."** These cavities contain a space for the jaw muscles and for the eyes. **The braincase** is the part of the skull behind the rostrum, that includes the cavity where the brain is contained. **The mandibles** are the lower jaws, which contain all of the lower teeth. **Mandibular condoyle** – jaw joint. Some animals have tight joints with little side to side jaw movement (carnivores such as lynx, weasles. Others animals (herbivores)such as moose and deer have loose condoyles that allows grinding by their back molars. Omnivores have less movement than herbivores as they sometimes are shearing and crushing both meat and plant material.



Distema- space btwn incisors and cheek teeth that allows food items to be easily carried. In some rodents (beaver and hare), the lips close across the gap, allowing the animals to gnaw with their incisors while keeping dirt, wood chips or water out of their mouth.



Beaver Skull (herbivore) NOTE: Shrews are the only NB land mammal that DO NOT have zygomatic arches.



Bobcat. Jugal and zygomatic arch are the same bone (the cheekbone). **Define each of the parts in this skull.**

Key for Medium to Large New Brunswick Land Mammals

1. Wide diastema (gap) between incisors and cheek teeth ..... go to 2
   No obvious diastema between incisors and cheek teeth..... go to 6
2. Incisors 2/1 ; rostrum (nose/snout) extensively perforated ..... .**snowshoe hare**
   Skull 90-100cm, zygomatic arch width 12-15mm ....**porcupine**
   Incisors 1/1 or 0/3 ; rostrum not extensively perforated..... go to 3
3. Incisors 1/1, may be orange; skull small, length 150 mm or less .....Rodentia, go to 4
   Incisors 0/3, not orange; skull length 250mm or greater .....Artiodactyl, go to 5
4. Skull small, 70mm or less .....**muskrat**
   Skull 85-95cm, zygomatic arch width 10mm or less.....**ground hog**
   Skull 120-150mm. Ear canals long, pointed up , deeply grooved on side of rostrum..... **beaver**
5. Canines 0/1; skull length 250-300mm; antlers seasonally in male only.....**white-tail deer**
   Canines 0/1; skull length 500+mm; antlers seasonally in male only, palmate .....**moose**
6. Rostrum short and blunt; orbit large; cheek teeth shearing,
   Without grinding surfaces, molars1/1, total teeth= 28, one foramen behind bulla .....**bobcat**
   Without grinding surfaces, molars1/1, total teeth= 28; two foramen behind bulla.....**lynx**
   Rostrum more or less short and blunt; total # teeth 34 or 38 .....Mustelidae, go to 7
   Rostrum more or less short and blunt; total # teeth 40.....**raccoon**
   Rostrum long; total # teeth 42.....go to 8
7. Total # of teeth 34; length of skull approx. 57mm .....**mink**
   Total # of teeth 38; length of skull approx. 80mm ..... **marten**
8. Rostrum long and narrow; cheek teeth w/ shearing & grinding surfaces.....Canidae, go to 9
   Rostrum broad; premolars rudimentary or lost, molars broad & flat .....**black bear**
9. Length of skull 105-122mm ..... **red fox**
   Length of skull 180-220mm .....**coyote**

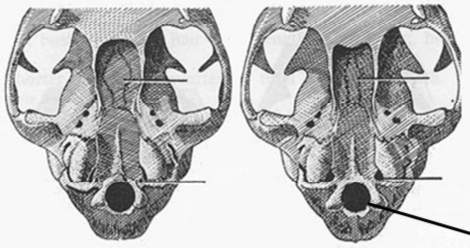
Pictoral Key (for Ontario)

https://assets.ctfassets.net/e09p19lzfrfe/3fuBzBNBTZojiSraSPJ315/403c2150fc8712103a3e069e10f9763e/Appendix-C-Mammal-Skull-ID-Key-and-Activity.pdf

I made up a skull key for NB that's fairly comprehensive (med-lg mammals) but then found a more image based key from Onatario Envirothon. Each has its positives

Bobcat vs Lynx Skull

26. Skull, without lower jaw, and with upper canines in place, usually rests on canines and auditory bullæ; one foramen behind bulla (Fig. 25 (*a*)); tail-tip black above, light below; usually one or more dark bands above black tip. Hind foot less than 7⅞ inches. Bobcat. *Lynx rufus.*

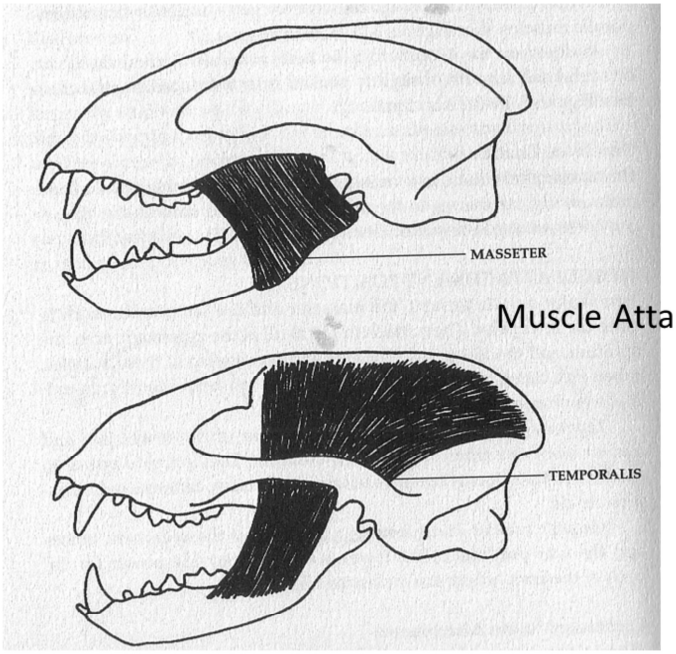


(*a*) (*b*)

Fig. 25. Ventral views of back part of skulls of (*a*) bobcat and (*b*) Canada lynx to show differences in foramina behind bulla and usual differences between shapes of presphenoid bone.

26′. Skull, without lower jaw, and with upper canines in place, usually rests on canines and condyles with bullæ elevated; two obvious foramina behind bulla (Fig. 25 (*b*)); tail-tip wholly black; no dark bars on tail above tip; hind foot more than 7⅞ inches. Lynx. *Lynx canadensis.*

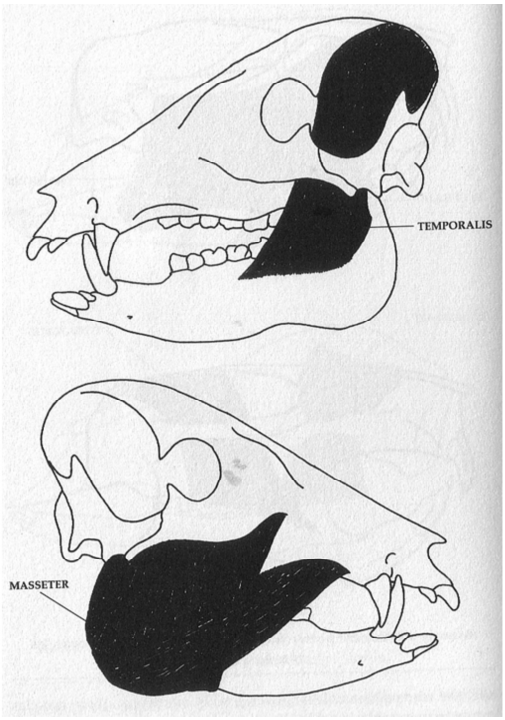
Foramen – opening in the skull that allows nerves or blood vessels to move through the skeleton. Foramen magnum is the large opening at the back of the skull which allows the spinal cord entry. Placement and orientation of the formen magnus tells you if the animal was largely horizontal or vertical in posture (bi-pedal or quadrupedal)



Muscle Attachment

Badger (carnivore) temporalis and masseter attachment . Note beefy temporalis connected to sagital crest. Zygomatic arch on this would be very large.

Muscle Attachment



Black bear (omnivore) with mid sized temporalis muscle and sagital crest and proportionally large masseter muscle for grinding forbes, etc.

Horns

A horn is a slow growing, permanent bone. Horns are seen in the **cattle family** (Bovidae), which in Alaska includes **bison, Dall sheep, mountain goats and muskoxen.** Both males and females of these species have horns, although the males' are generally larger.

The center of the horn is a spike of bone that is fused with the skull. A hollow outer cone of true horn substance sheaths this bony core. Neither the bone core nor the outer sheath is ever shed.

Horns are not shed annually but are permanent throughout the life of the animal. Horns grow from the base, and an annual ring will show on the outer sheath for each year of growth. Annual rings can be counted and used for determining age.

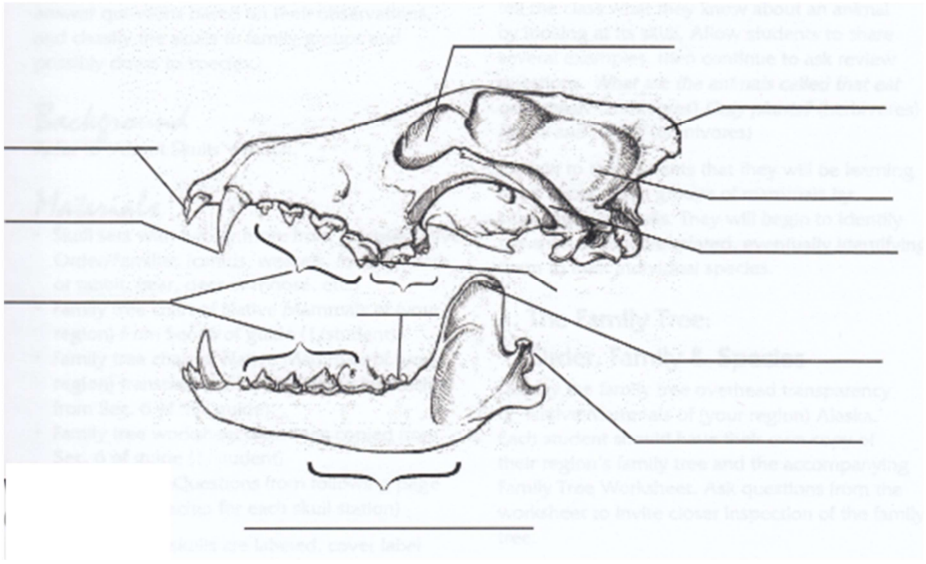
Antlers

Antlers are also made of bone growing out of the skull, but are faster growing and temporary. Antlers are found in the **deer family** (Cervidae), which in Alaska includes **moose, Sitka black-tailed deer, caribou, reindeer and elk.** Generally only males have antlers, except for caribou, where females also carry antlers, although smaller than the males'.

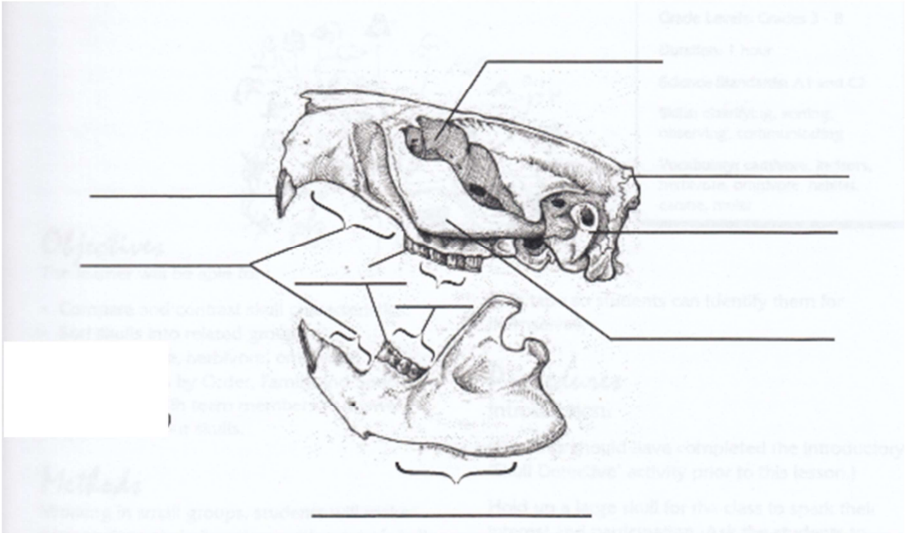
Antlers are shed annually (deciduous), usually in late winter, and begin growing again shortly thereafter. During growth, antlers are covered by furry 'velvet,' which is a layer of skin and soft, short hair. During the rutting season, the velvet dries up, and the animal scrapes or rubs it off. Later a ring of cells breaks down the bone at the base of the antlers, and the antlers fall away from the skull.

Antler growth depends a great deal upon the animal's health. The number of antler points does not indicate a deer's age.

Fill in the blanks:



Fill in the blanks:



Dental Formulas

The dental formula is the standard form for recording the number and type of different teeth a species has. The number and type of teeth are often major clues when identifying the skulls of similar species.

The dental formula of the marten is:

$$I\frac{3}{3}, C\frac{1}{1}, P\frac{4}{4}, M\frac{2}{3} = 42$$

I = incisor	3 on upper left side 3 on lower left side	**P = premolar**	4 on upper left side 4 on lower left side
C = canine	1 on upper left side 1 on lower left side	**M = molar**	2 on upper left side 3 on lower left side

The **left side** of the formula represents the number of teeth, upper and lower, **on one side of the jaw.** The **right side** of the formula is the **total number of teeth** in the skull. This is double the total of teeth on the left side of the formula since it includes **both sides** of the upper and lower jaw.

Dental Formula
I 0/3 , C 0/1, P 3/3, M 3/3

What can you tell me about this common NB mammal? I=0/3 , C=0/1, P=3/3, M=3/3 BTW: What does the body structure suggest for approx age? What does the antler structure suggest for approx age? Belly not sagging and antlers are fairly narrow, suggesting a young deer.

Scat

Herbivores

Hares produce similar round, pea-sized droppings.

Round **deer and moose droppings** are alike in composition and tend to be deposited in quantity. Piles of cherry-sized pellets are easy to identify in moose country. Both animals feed on tree bark and buds in winter, which makes for firm, woody scat. Leafier summer food produces looser droppings.

Beavers, too, are strict vegetarians and their scat reflects their bark-heavy diet. But it can be hard to find—the fibrous clumps are deposited in water and quickly break down.

Many people don't realize that **porcupines** are also tree eaters, living largely on conifer twigs and bark. Their scat is formed into elongated woody pellets, which can accumulate in deep, turpentine-scented piles outside their dens.

Carnivores

You may notice small squiggles of dark scat on rocks in the trail—a sign that a **weasel or marten** has left its mark. These stealthy predators are rarely seen, but their feather or fur-flecked droppings attest to their carnivorous lifestyle.

Omnivores

An omnivorous diet results in variable scat. **Coyotes and red foxes** exercise perhaps the widest menu options—their tubular, segmented scat may contain bones, feathers, and fur in winter, with seeds, nuts, berries, grass, leaves, insects, fruit, and eggs appearing in summer deposits. The coyote's droppings are generally larger.

Bears are also expansive in their tastes. They gorge on seasonal foods, like fruits and nuts, and leave large piles of uniform scat du jour. Near human habitation, birdseed and bits of trash will be found in their droppings.

We often will see a squirrel or perhaps a wood frog while out on a hike but most of the time we're too noisy to more cautious animals. Often, the presence of wild creatures is revealed to us only in the signs they leave behind. Tracks, nests, food scraps, and shed feathers or antlers are all clues to the ways and means of forest animals. And so is their scat.

Poop, feces, droppings, dung—scat by any other name will smell as sweet. OK, not quite sweet, but you may be surprised that scat of the non-domesticated kind does not often present olfactory offense. If you can get past a basic level of squeamishness, a study of these animal signs will reveal much about life in the woods.

We can analyze animal diets and habits by examining their scat. Wild woodland creatures eat local and eat (mostly) fresh, although some may try to mix human food into their menu.
What if the test mentions **"insectivores"** or "**piscivores**". What are they? Insect eaters and fish eaters

General Descriptions of Northeastern Wildlife Scat

Beaver scat is made up entirely of wood chips. The oval pellets are 1 to 1 1/4 inches in length and 3/4 of an inch in diameter. They would most likely be found in route to or near Beaver chews if found at all since Beavers spend the majority of their time in water.

Black Bears are omnivorous, their diet consists of animals, nuts, berries, grasses, insects and aquatic life. Evidence of these will show in their scat. Often times bear scat may contain partially undigested parts of only one food source. Their droppings are one of the largest being 1 to 2 inches in diameter. Scat may also appear as a loose pile with no particular shape when they are feeding heavily on berry crops in late summer to early fall.

Bobcat/Lynx scat are very similar and hard to distinguish between the two. Scat is up to 4 inches long and 3/4 of an inch in diameter, segmented with Blunt ends. Evidence of scratched leaf litter and soil with scat in the scratched out area will indicate cat droppings. Scat may or may not be covered over with leaves or soil.

Snowshoe Hare scat is vary similar in color shape and size, being about 1/4 to 3/8 of an inch in diameter. The scat is somewhat rough textured dark to light brown in color. It may be found in a scattered pattern rather than in piles as they defecate one pellet at a time while they continue to move. Scat found in piles would point to a feeding spot where the animal remained stationary.

Coyote scat may be up to 4 inches long & 3/4 of an inch in diameter. Their scat may contain evidence of hair, bones, fruits & berries. Colors vary from their diet.

Red Fox scat is approximately 2 inches long & 1/2 inch in diameter with pointy ends. It may contain hair, bones, insects, berry seeds & undigested fruits. Fox will usually deposit their scat on a prominent object such as a rock, stump or log to mark their territory.

Fisher scat resembles that of a Mink but has a larger diameter. Scat is brown to black in color & are twisted with tapered ends 3/8 to 5/8 of an inch in diameter & folding over. Fishers are the main predators of Porcupines so evidence of quills in their scat will help in identification.

Pine Marten scat is brown to black in color 1 1/2 to 2 inches long & up to 3/8 of an inch in diameter. Scat is twisted & tapered resembling that of a mink. Evidence of hair & bone may be present. Martens also feed on berry crops unlike Minks and Weasels and seeds may be present in their scat.

Gray / Red Squirrel scat is very similar in size, shape and color. Small smooth oval shaped to odd shaped pellets, brown to black in color and 1/8 to 1/4 of an inch in size.

Ruffed Grouse scat is brown in color with a whitish end 1 inch in length to 1/4 inch in diameter. Droppings may also be found in the form of a small pile when feeding on succulent plants. Their diet consists of nuts, berries, green leaves and fruit. to 3 inches and will have somewhat of a curved appearance. Brown in color with a lighter whitish/green color at the end of the dropping. Food consists of insects, nuts, berries and grain crops.

Mink scat is long and twisted resembling a braided rope, black to light in color with tapered ends and may fold over itself. Evidence of small bones, fur, feathers and fish may be present. Mink leave droppings as signposts on or near rocks, logs and stumps.

Muskrats are omnivores eating plant matter, fish and crustaceans. Scat can be found on prominent outcroppings in or near the water, on logs, rocks and beaver structures. Their droppings are elongated 3/8 to 5/8 inches long and 1/4 inch in diameter, clustered together in a pile.

Otter scat will at most times be found near waterways. Look near outcroppings of rocks in or near the water & partially submerged logs where they consume their prey. Their scat may have no significant shape but is easily identified by the presence of fish bones, scales and pieces of aquatic shellfish. The color varies greatly from the color of fish and crustaceans they consume.

Porcupines consume bark, twigs and buds of trees. Wood fibers are evident in their scat. Scat may be piles of pellets varying in length from 1/2 to 1 inch long or it may be present in a chainlike pattern connected by wood fibers. Color varies from season to season depending on diet but is usually brown to black.

Raccoon scat can be found in prominent areas such as the crotch of a tree, on or under rock outcroppings and fallen trees and stumps. Several raccoons may make use of the same site to deposit their droppings. Raccoons are omnivorous eating both plant and animal matter their scat may contain evidence of berries, insects, fruits, fish and shellfish. Their droppings are blunt ended and up to 3/4 of an inch in diameter.

Skunks are omnivores eating plants, animals and insects. Insects make up the majority of their diet and their presence will be found in their droppings, often times their scat will contain only insect parts. Small bones, hair and plant matter may also be evident at times. Their scat is blunt ended 3/4 to 1 inch in diameter.

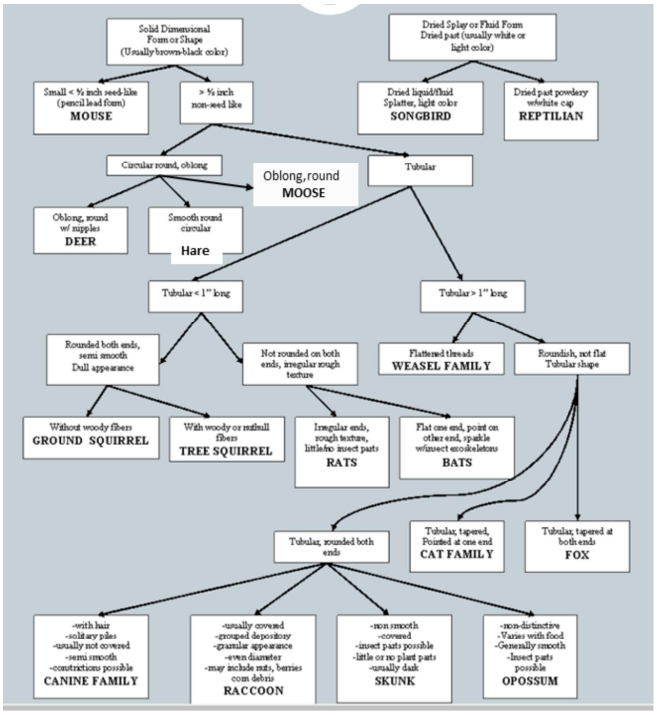
Weasel scat is brown to black in color and will show evidence of bones & hair. Small rodents are the majority of their diet. Scat is twisted, thin and tapered at the ends, 1/8 inch in diameter and 1 to 1 1/2 inches long.

Whitetail Deer scat is oval in shape, pellet like 1/2 to 5/8 inches in diameter, black in color scattered piles. It may also be found clumped together when their summer & fall diet consists of high moisture foods such as berries, apples & other succulent plants. Their winter scat is lighter in color, consist of mainly woody fibers & is quite hard.

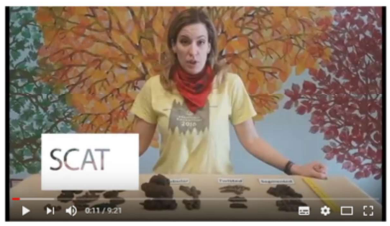
Moose scat may resemble that of a domestic cow in the months that they feed on succulent plants. They resemble the pellets of the Whitetail but larger, being 1 to 1 1/2 inches long.

https://www.northwoodsguides.com/animal_scat_notes.php

IMPORTANT: you must remember that scat consistency and shape change with seasonal changes in diet. Moose scat from winter to early spring is a woodly marble while lates spring to late fall scat can be like a thick greenish/black pudding or greenish black pellets mashed together in one clump.



Scat ID

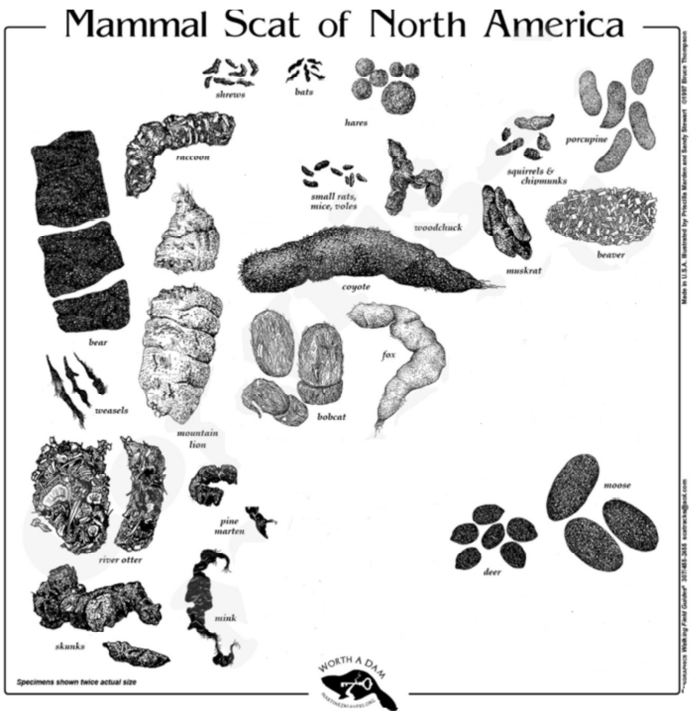


Manitoba Envirothon - Training Series - Scat Video

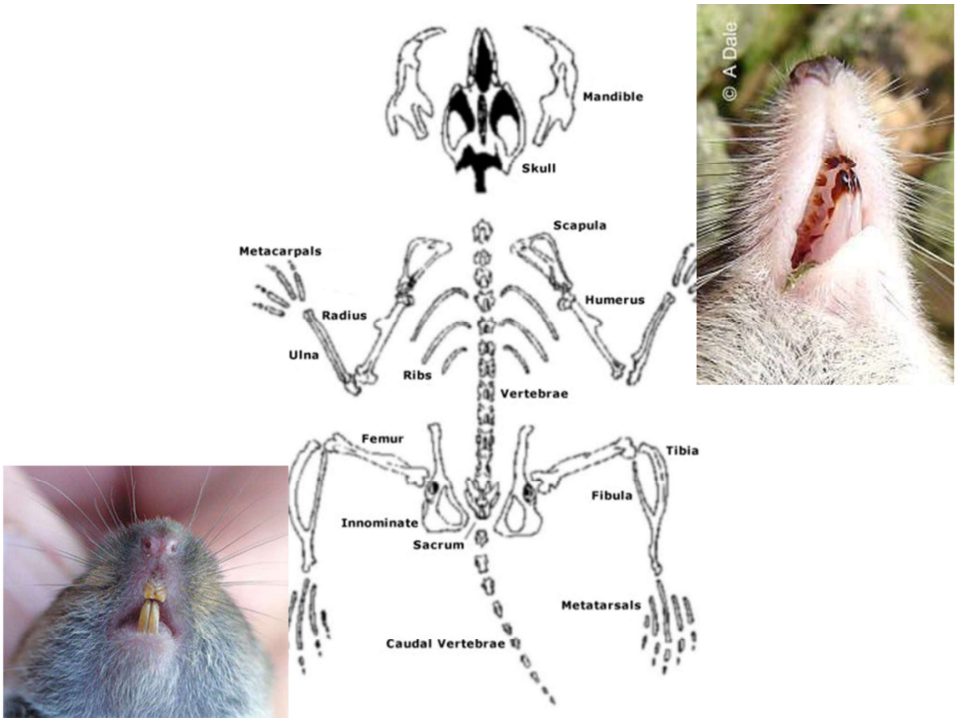
56 views

https://www.youtube.com/watch?v=dUurGnK7oM4

Note: This **chart contains some non-NB species** (ie. Opossum, Ground Squirrel)

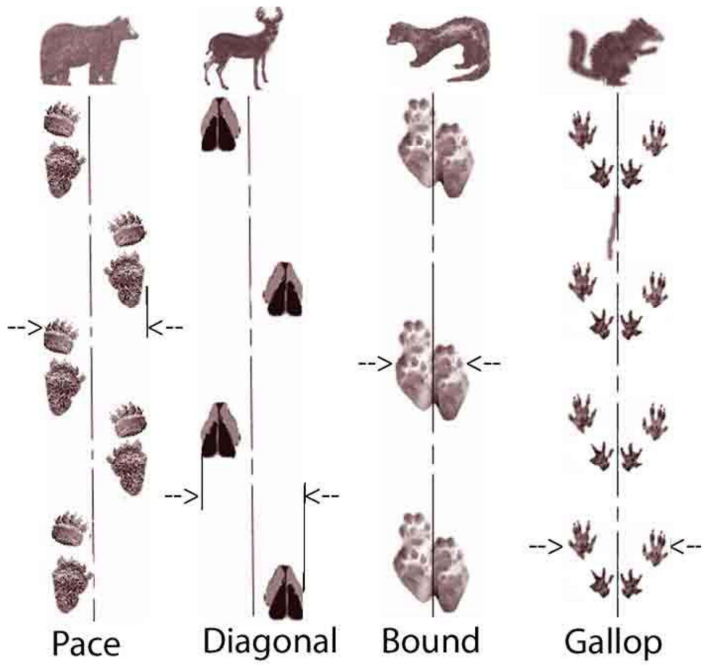


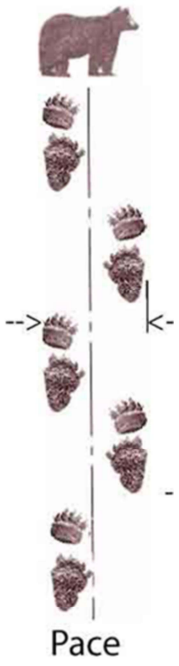
Diet: Hair and bones – scat will be twisty with tapered end
Meat and organs only – little to no twist, smooth casing and tapered or blunt end.
Fruit – shapeless blobs or loose tubes of crumbly material (pits/seeds) , blunt ends



Left is Vole, Right is Shrew (note iron oxidizing in teeth making then rusty red) Shrew teeth do not grow continuously, like those of voles, hare or porcupines. They're like humans with a set of deciduous (milk or baby) teeth and set of permanent adult teeth that have to "do them out" therefore they have adapted by hardening their enamel with iron.

The Four Basic Track Patterns

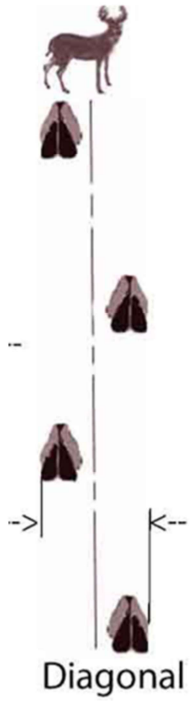




Pace

-Typically wide-bodied, slow moving types: **Beaver**, **muskrat**, **porcupine**, **bear** and **raccoon**.

-Animals waddle alongshifting from side to side. Legs on one side of body move together, followed by the two legs on the other side.



Diagonal

-Includes **deer**, **moose**, **fox**, **coyote**, **bobcat**, **lynx**, **dog** and **cat**.

-Animals rear right foot lands on top of, but slightly behind where the front right foot was a moment ago.

-With cats and foxes, the rear foot lands directly on top of the front track (called direct register)

-Front feet have a wider stance for a male, than for a female although doesn't hold true for immature.

Bounder

-Includes the **short-tail weasel**, **fisher**, **mink**, **otter** and **marten**.

-Look for 5 toes.

-As they move, the front two feet land first, then the rear, just behind the front. There can be some overlapping of prints, with the rear slightly wider stance.

-Fishers can switch between walking patterns so you'll need to measure the trail width to be sure.

ST weasel - pound for pound these are the most ferocious and hard working carnivores you'll ever track in NB. A ST weasel with a normal bound distance of only a few cm can increase to over a meter when on the chase.
Fishers are the only regular and successful consumers of porcupine in the province.

Galloper

-Includes **mice**, **voles**, **shrews**, **chipmunks**, **squirrels** and **snowshore hare**.

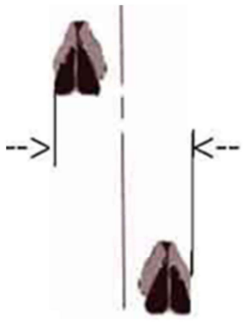
-As they move, the front two feet land closely tighter, with the rear feet coming around the outside and past the front feet.

-Rear feet are larger than the front.

-If front feet are exactly side by side with a tail drag. Voles front feet are slightly offset.

-Larger front feet side by side with no trail drag is a squirrel, unless the rear feet are huge. Then it's a hare.

Trail Widths



Pacers: Beaver 15-28cm, muskrat 7-13cm, porcupine 15-23cm, bear 25-28cm, raccoon 12-15cm

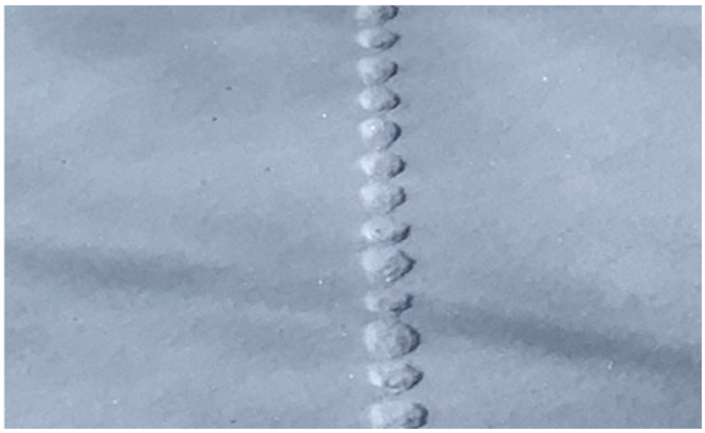
Diagonal Walkers: Bobcat 10-18cm, red fox 10cm, coyote 10-18cm, deer 16-20cm, moose 22-50cm

Bounders: Short-tailed weasel 2.5-6cm, mink 7.5cm, marten 10cm, fisher 7.5-18cm, skunk 7-10cm

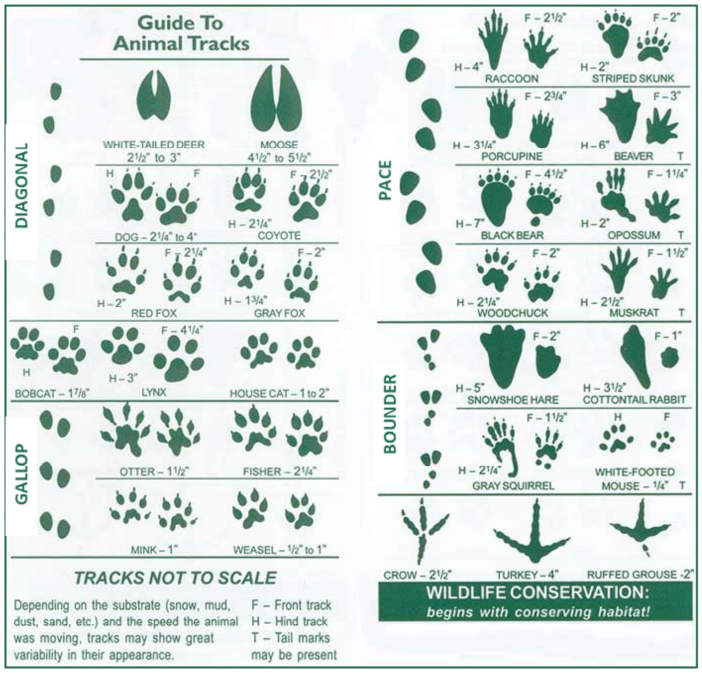
Gallopers: masked shrew 2.5cm, deer mouse 4-5cm, meadow vole, 3-5cm, chipmunk 5cm, red squirrel 10cm, grey squirrel 12.5cm, hare 15cm.

Sometimes you need additional clues to id the animal

Mystery Track



Don’t be fooled by prints made from snow falling off trees, or wind blown dog poo!



https://scoutlife.org/quizzes/6662/animal-track-identification-quiz/

Activities and References

Skulls
https://dept.dokkyomed.ac.jp/dep-m/macro/mammal/en/index_eng.html

https://assets.ctfassets.net/e09p19lzfrfe/3fuBzBNBTZojiSraSPJ315/403c2150fc8712103a3e069e10f9763e/Appendix-C-Mammal-Skull-ID-Key-and-Activity.pdf

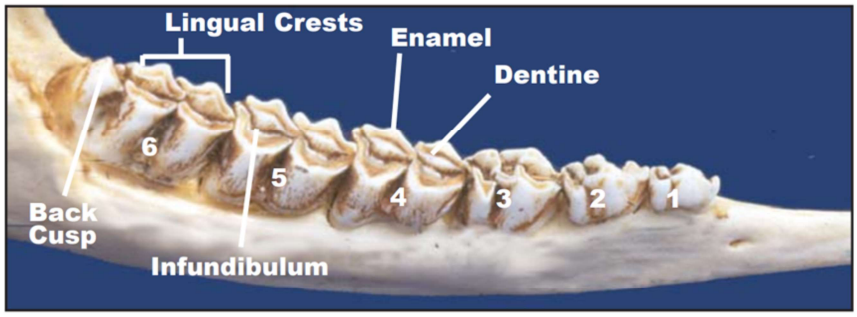
Activities:

https://scoutlife.org/quizzes/6662/animal-track-identification-quiz/

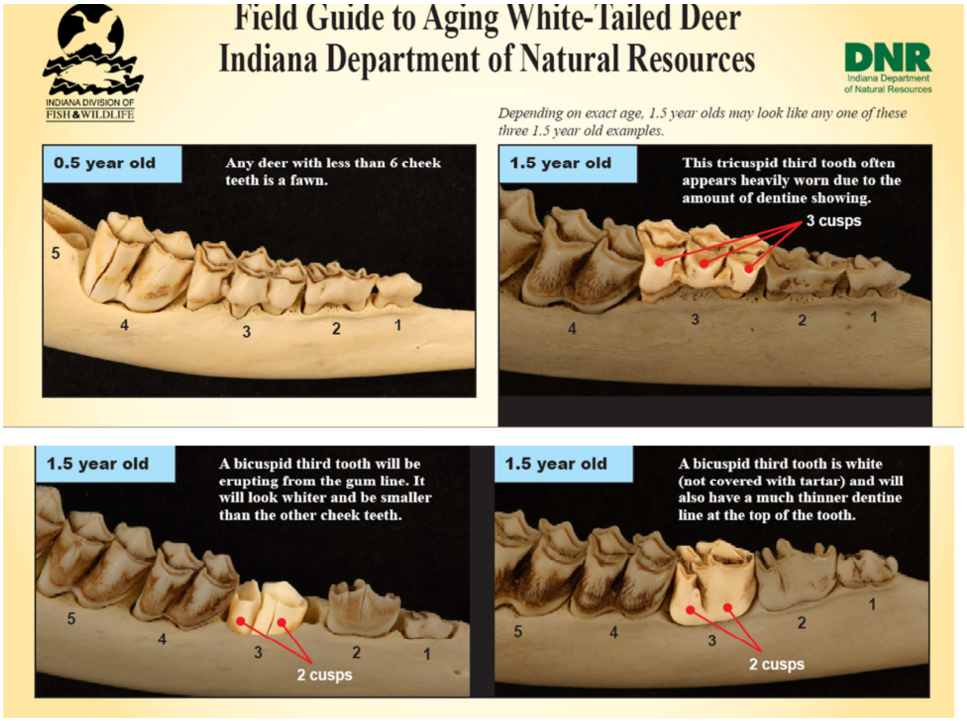
Aging Techniques

Why do we need to age deer? By determining the average herd age, (as well as antler characteristics , body weights and lactation / ovary scars in females) we can infer how productive a habitat is and look for potential issues to correst.
Rough aging techniques: RB- Rack within ears= yearling buck (1.5yr) L – Rack beyond ears =3.5yr
Also, older deer will get belly droop just like humans (note diff btwn L and R bucks).
We'll be using jaws to establish the ages of the deer here in the workshop.

Cusp: a point or projection on a tooth
Back Cusp: very last cusp on tooth 6 on cheek-side of the jaw
Lingual Crest: tooth ridge adjacent to the tongue
Enamel: hard, white, outer coating of a tooth
Dentine: soft inner core of a tooth, dark brown color
Infundibulum: crescent-shaped depression in the central crown of a tooth between the enamel ridge or crest



You will likely have to age and ungulate for the competition. This you will need to study on your own. **Tooth Wear and Replacement Method** - deer are aged by examining the wear and replacement of the premolars and molars of the lower jaw. As the deer ages its dentine becomes more exposed and noticeable distinctions in in tooth wear occur between each age class.



Why aged in year and half increments? Fawns are born late May-June but not harvested until the fall hunting season.

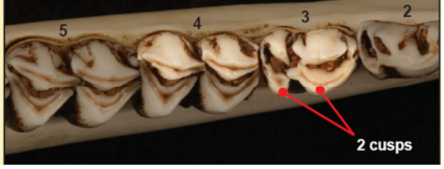
Field Guide to Aging White-Tailed Deer
Indiana Department of Natural Resources

INDIANA DIVISION OF FISH & WILDLIFE

DNR Indiana Department of Natural Resources

2.5 year old

The bicuspid third tooth is now stained, while the fourth tooth has thinner dentine than enamel, while the ridges remain sharp.

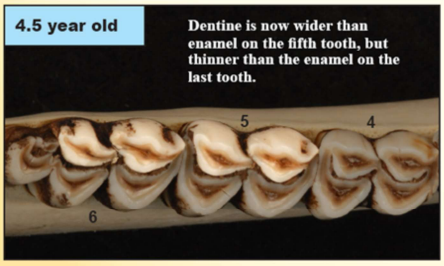


3.5 year old

Dentine is wider than enamel on the fourth tooth, but on the fifth tooth, the dentine is thinner than the enamel.

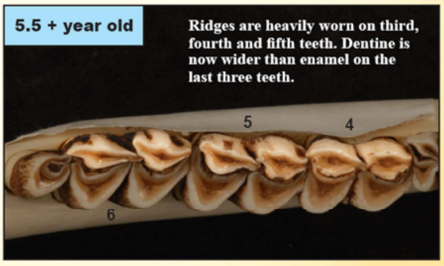
4.5 year old

Dentine is now wider than enamel on the fifth tooth, but thinner than the enamel on the last tooth.

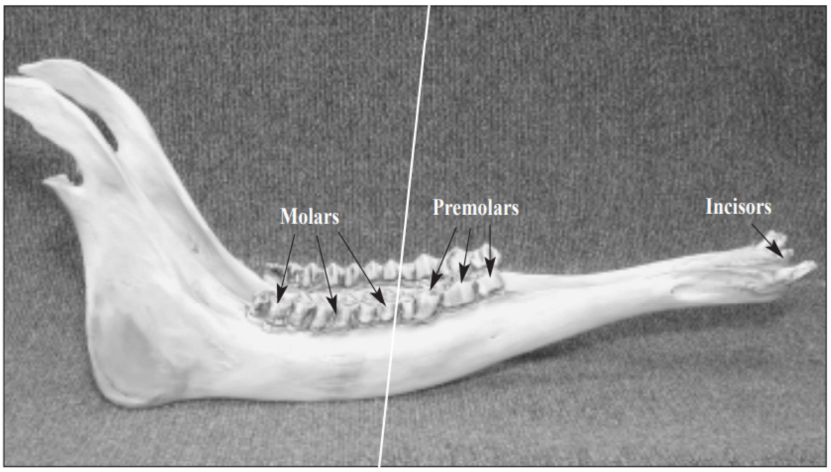


5.5 + year old

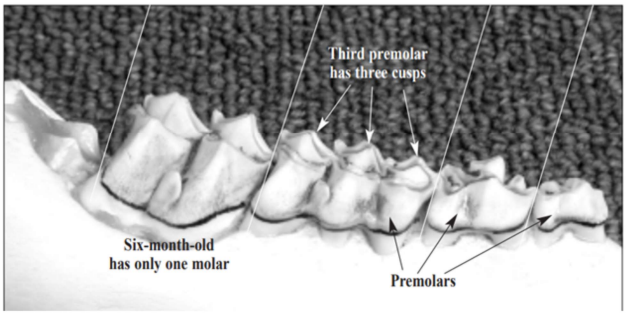
Ridges are heavily worn on third, fourth and fifth teeth. Dentine is now wider than enamel on the last three teeth.



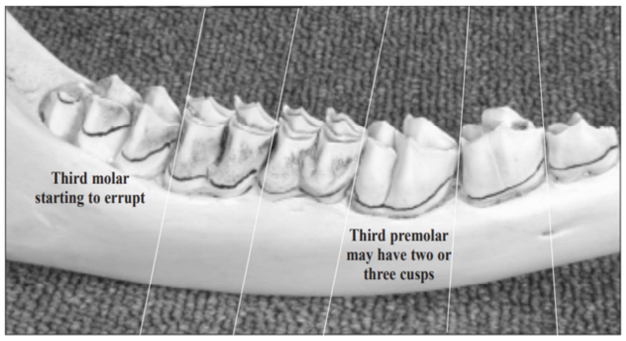
Aging Moose



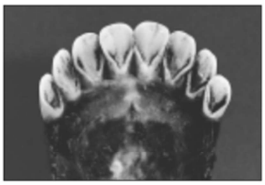
Moose in New Brunswick are generally born in late May and early June. Therefore, when most animals are harvested in September, they are considered roughly six months, 1 1/2 years, 2 1/2 years, 3 1/2 years, etc., in age. Although moose may live to 20 years or more in the wild, the overall age structure of a hunted moose population is younger than most people think. Of the moose harvested in North Dakota that biologists have examined, more than 80 percent of bulls and cows were 3 1/2 years old or younger. I don't suspect any different trend here. Antler and body size can help indicate a moose's age, but physical characteristics are often misleading. The number of antler points do not correspond to age. Even if it did, it wouldn't help in aging cows, which make up a proportion of the harvest each year.



Six Months: The nose or muzzle of the moose appears short or stubby, when compared to older moose. All the immature incisors are still present. Generally, there are only four cheek teeth showing. The third premolar has three cusps.



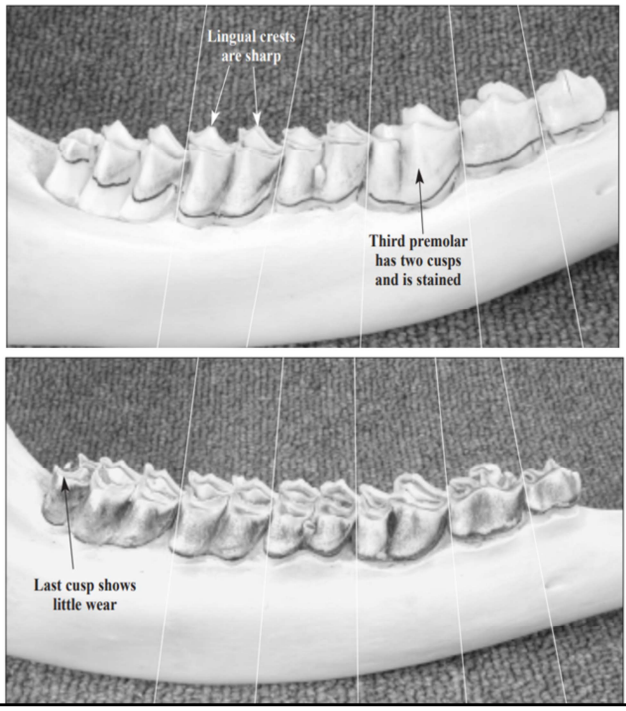
1½ Years: All permanent front teeth are in place. Moose harvested in September and early October may show the outer canine teeth still emerging and may not be fully rotated into final position (see incisor inset photo). Six cheek teeth are visible in the lower jaw. The third premolar may still have three cusps and be well worn. Third molar starting to erupt through the gum and shows no sign of wear. Lingual crest of molars have sharp points.



Incisors of a moose 2½ years old; all incisors in their final position. Little wear is visible.

2½ Years: Last cusp of third molar slightly cradled into the angle of the jaw. All the premolars and molars show slight wear and are stained.

3½ Years: Lower jaw has now elongated so that the last cusp of the third molar does not appear cradled into the back angle of the jaw. The dentine (brown portion) now wider than the enamel (white portion) of the lingual crest.



4½ Years and Older: Aging moose 4½ to 8½ years is difficult. Wear on the lingual crest and cupping of molars becomes increasing pronounced. By 8½ years the pit, or infundibula of the first molar (four cheek tooth) will usually be completely worn away. Older animals show excessive wear and cupping in all molars. By 12½ years the pit, or infundibula, of the third premolar is usually worn away completely. Periodontal diseases, impacted food, and infection of tissue around the teeth is very common among older moose.