Norman Wells
N.W.T.
X0E 0V0

30th April 1979

Ron Hawkins
Regional Superintendent
Department of Natural
and Cultural Affairs
Government of the N.W.T.
Inuvik
N.W.T.

I humbly submit this, the end result of the study I undertook in Sachs Harbour May 1978. I profusely apologize for its lateness.

I have had trouble finding the time to work on it in the amount of detail it should receive. I have also had problems attempting to write it in a scientifically approved form. Since I had little literature to review, I have simply written it as if I was informally reviewing it with you.

To be honest, I felt I was not receiving the help of the nature I thought I would receive when I did not obtain the manual on comparative aging until late September 1978, four months after the collection had been finished. This factor tended to place me in a position which is not the ideal one. This did not increase the enthusiasm I had for the project or in its completion.

However I apologize for its tardiness. After the manual had been received, it should have allowed me to finish the report in much less time than it took. This was, however, compounded by my other job which does receive top priority.

I feel I have researched the problem more than adequately when one considers the conditions I have operated under i.e. isolation.

I hope the report is satisfactory and that the documentation meets your approval.

.../2

You have mentioned remuneration for my work. However when one considers how late this report is, I do not feel I should be getting remuneration. Both N.W.T. Wildlife Service and myself thought initially it would have been completed much earlier than this.

I would also like to thank the Wildlife Service for the opportunity to engage in this study. Thank you.

original signed by

Bruce Morrison

P.S. I am also returning all the jaw bones. These are numbered so that you can refer to information on the animal. I do hope these can be used in a "jaw-board" to supplement your officers resource bank.

At the end of the information on the study, there is a list of birds and when I saw the first member of each species on its northward migration. The usefulness of this information, I leave to your discretion.

I also apologize for not having all the information and the report typed. However under the time constaints, I was unable to do this. I hope you can understand this position because while I was in Sachs Harbour I worked a 70 hour workweek. At Norman Wells, we work a 54 hour workweek. This leaves little time for outside activities and interests.

I am leaving on holdiays shortly (again) but would provide you with any additional information on my return.

Thanks once again.

Bruce Morrison

PEARY CARIBOU
A STUDY OF NATURAL MORALITY

South Banks Island
May 1978

by

Bruce Morrison, B.Sc. (Zoology)

Environment Canada

Sachs Harbour, N.W.T.

INTRODUCTION

During the winter 1977-78, reports reached N.W.T. Wildlife Service that the caribou population *(Rangifer tarandus pearyie)* of Banks Island was experiencing mortality generally assumed to be greater than normal. The fear had been expressed by some individuals that the cause of induced mortality could be directly attributable to competition from the muskox population *(Ovibos moschatus)* of the island.

Although efforts to accurately estimate the caribou and muskox populations in recent years have been unsuccessful, it was felt by residents of Sachs Harbour, who directly utilize both species, that the muskox population had increased greatly in recent years. This increase supposedly was large enough that it had in fact exceeded the "carrying capacity" of the food resource. The argument followed that there was now competition between the muskox and caribou populations for the same food resource.

Most literature indicated that this is highly unlikely. The food resource of the two species is unique and it had been expressed that the success of one species totally relying on the food resource of the other would be of a dubious nature.

The status of the caribou population was also in doubt. Prior to the fall of 1977, the local Wildlife Officer, Don Vincent, felt that the caribou population was generally healthy. This was also the general belief of the people utilizing the population. However with the advent of the 1977 fox trapping season, reports reached the Wildlife Service that

large numbers of carcasses were being found throughout the interior of the island.

Normally the southward migration of caribou on Banks Island starts in early December. By late December, it is common to find numerous bands of 5-12 caribou in the Fish Lakes area (S.E. of Sachs Harbour, 70°50'N 124°33'W). In 1977, this migration was much smaller than would be normally anticipated. The residents, having to travel much farther than normal from Sachs Harbour brought back increasing reports on the mortality of the caribou population. These reports, after being passed to Wildlife personnel, are the basis of this study.

Reports from fox trappers indicated that caribou mortality was widespread, and did not seem to be more serious in any one area. They also stated that herds of muskox, up to 140 in number, were foraging not in the ravines and valleys as would be anticipated but on the hillsides and windblown plateaus.

This matter was further confused by statements from residents that certain caribou were exhibiting behavior generally associated with rabies infections. This fact would seem to be substantiated by reports that the rabies infection level within the arctic fox *(alopex lagspus)* population was at least 30%.

METHODS

Initially the study was to be divided into two investigations. The first stage, which I undertook, was to be a local collection of carcasses. The carcasses were to be studied to determine sex and age of the specimen and a subjective overview on the cause of death. This will be further explained shortly. The second phase was to be an aircraft survey to determine the size and relative health of the two populations.

By determining the age and sex of the carcasses, it was felt that one could establish if one component of the population was more or less adversely affected. It was felt by the local Wildlife Officer that a sample size of 36 would be large enough to extrapolate if these tendencies did occur. Aging was determined through comparative techniques of the teeth and jaw as described in a paper by

To determine condition of the animal prior to its death, a hind femur was collected from each animal. This allowed a superficial study of the bone marrow for quality. Necropsies of four carcasses was also done to determine the amount of fat banding on the heart, around the kidneys and within the mesenteries.

The survey was conducted by power toboggan during the time interval from May 15 - May 27. The geographical area that the survey was completed in is within the boundaries from the Decca site (eight miles west from Sachs Harbour), eastward along Thesiger Bay to the village of Sachs Harbour,

north to the first range of the Kellet Hills, westward to the Beaufort Sea, and from this point southward to the Decca site. This area is approximately 64 square miles.

Within the aforementioned area, thirty six carcasses were found. This number should be viewed with some caution since undoubtedly other carcasses existed which were not found. The lower mandible and a hind femur were collected from each carcass. Notes were taken subjectively on the animal's condition, its position, possible cause of death, and animal size. The sex of the specimen was determined and the location documented.

It must be stated, at the outset, that since the researcher was employed in another profession which was much more demanding, at least in the amount of time necessary to complete prior commitments, this study did not receive the amount of attention that would normally have been given to it. The amount of detail which the study received was adequate but the time allotted for the writing was less than adequate. I apologize for this.

List of Animals with Age Class they fall within

Specimen	1	-	first age class	Specimen	19	-	fist age class
Specimen	2	-	fist age class	Specimen	20	-	third age class
Specimen	3	-	third age class	Specimen	21	-	second age class
Specimen	4	-	fourth age class	Specimen	22	-	third age class
Specimen	5	-	fourth age class	Specimen	23	-	second age class
Specimen	6	-	fourth age class	Specimen	24	-	first age class
Specimen	7	-	fourth age class	Specimen	25	-	first age class
Specimen	8	-	first age class	Specimen	26	-	first age class
Specimen	9	-	third age class	Specimen	27	-	fifth age class
Specimen	10	-	first age class	Specimen	28	-	third age class
Specimen	11	-	first age class	Specimen	29	-	fourth age class
Specimen	12	-	fifth age class	Specimen	30	-	first age class
Specimen	13	-	third age class	Specimen	31	-	first age class
Specimen	14	-	third age class	Specimen	32	-	fifth age class
Specimen	15	-	first age class	Specimen	33	-	first age class
Specimen	16	-	first age class	Specimen	34	-	third age class
Specimen	17	-	first age class	Specimen	35	-	fourth age class
Specimen	18	-	first age class	Specimen	36	-	first age class

Definition of Age Classes

1. First age class - composed of animals 10 - 12 months old
2. Second age class - composed of animals 22 - 24 months old
3. Third age class - composed of animals 3 - 6 years old
4. Fourth age class - composed of animals 7 - 9 years old
5. Fifth age class - composed of animals 10 years and older

Sea of animals surveyed

- of the 36 specimens collected,

  17 were males
  15 were females
  4 unknown as genitalia was to decomposed

- within the sample size of 36 specimens, the first age class (10 - 12 months) was formed by 17 animals

  - of these specimens, 8 were males
    7 were females
    2 unknown

- there were two specimens which fell within the second age class (22 - 24 months)

  - 1 was male
    the other was unknown

- The third age class was composed of 8 animals within the years 3 - 6 inclusive

  within this age class, 4 were males
  3 were females
  1 unknown

- the fourth age class was composed of animals within the years 7 - 9 inclusive

  there were 6 specimens that fell in this age class

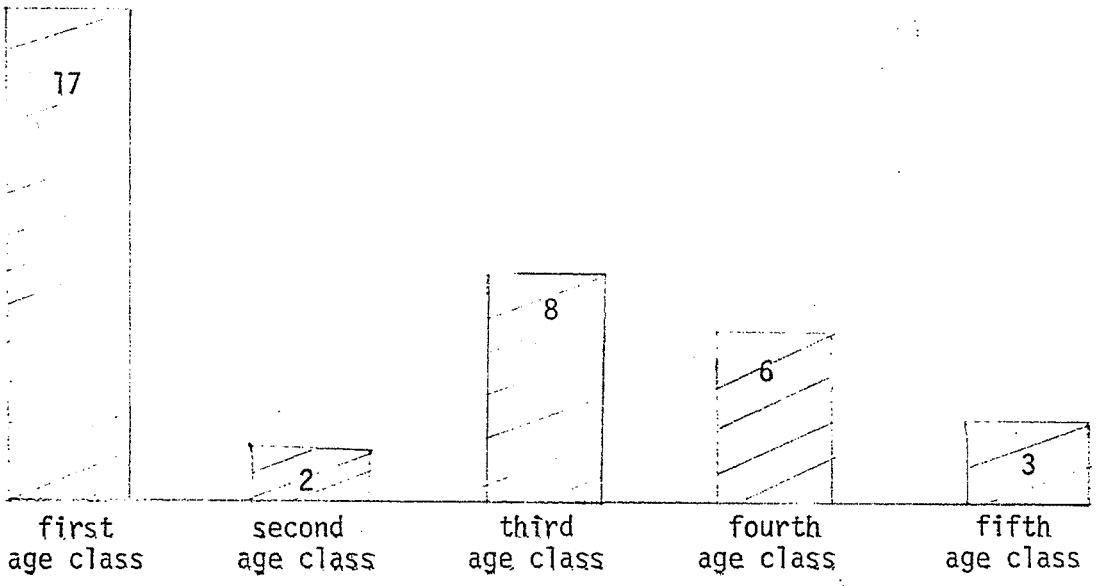
  - 3 were males
  - 3 were females

- the fifth age class was composed of animals 10 years or older

  there were 3 animals in this age class

  - 1 was a male
  - 2 were females

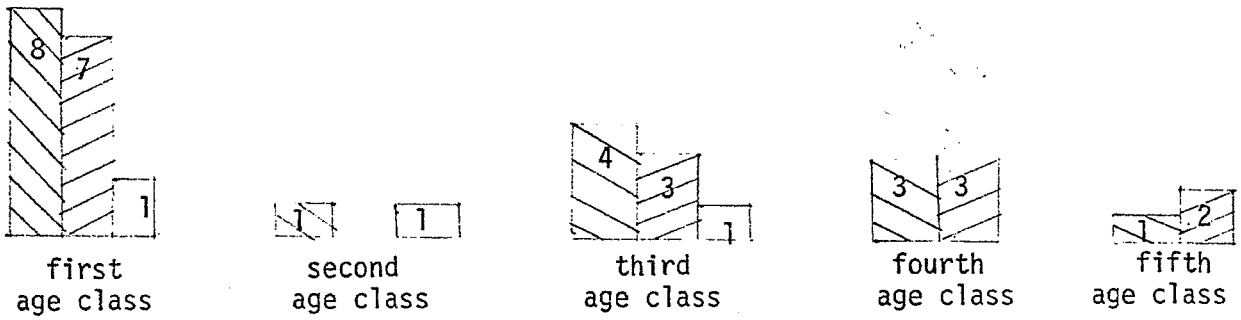
Relative numbers of the age class within the survey



Relative abundance of each sea within the survey. According to age class

TOTAL SURVEY - 36

males within survey - 17
females within survey - 15
unknown within survey - 4



- number of males in age class

- number of females in age class

- number of animals, sex unknown, in age class

RESULTS

The first topic I would like to consider is the aging of the specimens. The specimens were divided into five age classes on the basis of tooth eruption and wear. The first age class was made up of animals from 10-12 months. This age class is diagnostic because: (1) all teeth are deciduous, and (2) the jaw length is very short. Seventeen carcasses fell into the age class. This is approximately 47% of the sample size. High mortality of animals less than one year old is not uncommon within the ungulates. One should therefore be cautious about obtaining conclusions strictly from this number.

The second age class was composed of animals 22-24 months old. In this age class, the incisiform teeth are permanent, the second molar has erupted while the third molar has migrated to the alveolar bone but is only starting to erupt. The deciduous premolars are starting to be replaced by their permanent counterpart. Only 2 specimens fell within this age class. The observer felt that this may cause serious conjectures to arise as to the health of the population. It would seem to indicate that recruitment of first year animals during 1976 was low. If this is in fact true, the overall population may suffer in a time period 5-10 years hence if recruitment is low now.

The third age class is composed of animals 3-6 years old inclusive. In this age group all permanent teeth have erupted and are stained. We now must use tooth wear and the aging technique. To briefly describe the

molariform teeth during this time period, the first premolar, p2, may be worn on the posterior surface but not to the extent that dentine width exceeds enamel width. The second premolar, p3, will be worn to a point where dentine exceeds enamel. However, the cusps are still present and the infindibula are open. The third premolar will show much as p3 does, i.e. dentine exceeding enamel, evidence of cusps, the antierior infindibula usually open. The posterior surface of p4, will show the greatest amount of wear of the premolars. The infindibula may be closed and dentine will occupy the whole tooth surface posteriorily. M1 will show some buccal-lingual flattening, possibly to the point that cusps are absent. Dentine will occupy the entire anterise tooth surface. M2 and m3 will show little wear. Cusps will be present so that the teeth maintain their selenodont nature. Eight carcasses were determined to fall within this age class. This number would suggest little to warrant further enquiries on the basis of age-specific mortality.

Animals in the fourth age class are from age 7-9 inclusive. At the outset, one must be warned that errors in aging between age class three and four may exist. The comparative nature of the aging leaves something to be desired when comparing animals that may be 6 or 7 years old. No diagnostic criteria were evident. Specimens within this age class show wear on both the anterior and posterior portions of p2, although this will be concentrated on the posterior position where dentine may now exceed enamel. P3 shows greater attrition. The tooth has lost the labial cutting surfaces and is buccal-lingually flattened. Posteriorly it is worn to an

extent that a p3 - p4 depression has formed. P4 is depressed anteriorily and posteriorly. These arise directly from attrition. Dentine occupies the entire tooth surface. Cusps are absent and the tooth is buccal-lingually flattened. Infindibula have disappeared or are tending to disappear. M1 is usually very flattened, has dentine over the entire tooth surface, and shows the greatest amount of attrition of all the teeth. M2 and m3 are tending to be much more flattened than in the third age class. Dentine now occupies as much or more of the tooth surface as the enamel. There were 6 specimens which fell within this age class. In light of the first year mortality and the number of specimens in the third age class, I do not feel that this is significant.

The fifth age class is typified by all teeth showing a high degree of attrition. P2 has been worn on both anterior and posterior edges. P3 is flattened, the infindibula and cusps have been lost and the posterior margin of the tooth may be worn to the gum line. P4 is often peg-like because of attrition. Little evidence of cusps or infindibula is present. Anteriorily a space may be present between p3-p4. Usually m1, if present at all, is isolated by spaces from adjecent molarform teeth. It is usually worn adjacent to the gum line. M2 and m3 are worn so the infindibula have disappeared, as have the cusps. They are buccal-lingually flattened and dentine covers most, if not all of the tooth surface. Three specimens were found to belong to this age class. This number, I do not believe, is very significant to the ratio that would be anticipated in a healthy situation (i.e. I would expect this to be rather normal).

I would like to mention two points that may affect the aging of these

animals. The first has to deal with the descriptions found in the paper which was used as a basis for my work. It dealt with animals of the Kaminuriak herd of the southern N.W.T. In their environment, these animals would not have the amount of tooth wear each year that the animals on Banks Island would. The first reason for this is that the lichens *(Cladonia spp.)* that they feed on, grow much higher in the southern N.W.T. than on the arctic islands. This would suggest that they ingest reduced quantities of sand or other gritty substances that enhance tooth wear, than those on Banks Island. The second reason for my postulation is that the tree growth in the south would tend to reduce the effect of the wind in depositing the gritty substances directly upon the vegetation. I feel one can not overlook this occurrence. If this in fact did occur, one would age animals of the third, fourth and fifth age classes to be older than they actually are.

The observation of malocculsion would also cause tooth wear to be proceed at abnormal rates. This would greatly confuse the aging technique.

When one examines the sex ratios of the carcasses and the age classes of the animals, the effect of mortality would neither favour or neglect any given sex. The sex ratio was approximately 50/59 through the entire sample. One would expect to find more males than females in the third, fourth and fifth age classes since it has been found that the energy expenditure by males during the rut often put them at a disadvantage during the winter. Thiswould not however seem to be significatn within this sample.

When looking at the position of the carcasses geographically, one would expect to find them randomly throughout the areas where the caribou frequent. This was not the case however. Fifteen of the carcasses were found on south-facing hillsides where the animal obviously was in the lee of the prevalent north winds. To be anthropomorphic, one would postulate that an animal which has little fat reserves or is having such difficulty obtaining food that starvation may be a problem, may attempt to stay out of the wind to conserve energy. This would seem to be corroborated by the fact that the south-facing hillsides would allow the animal to obtain its maximum warmth from the sun. South-facing hillsides would also be the first to melt off and allow the animal access to the food resource. This may have implications when one is doing aerial surveys to determine population mortality. All of the fifteen carcasses had the animal in the sleeping posture. The remaining 21 specimens were distributed randomly throughout the survey area.

The cause of death is a very confusing one. Of the 36 carcasses, four animals were shot and left, two animals died as a result of wolf predation and the remainder were by natural causes. Two of the four animals that were shot were shot as "mercy killings". The animals were not healthy enough to cope and certain residents of Sachs Harbour acted to put them "out of their misery". One of the wolf kills had been observed in early December by the researcher.

Of the animals which died as a result of natural causes, starvation plays an important role. Whether it is the cause of death or an effect of another phenomenon is very important. All the carcasses had a femur (hind)

removed. Of the thirty specimens, the bone marrow within the femur was almost totally absent. All that was left was a transparent gel-like substance flecked with red. This abnormal situation shows the very poor condition of the animals. In the description of the contents of the femur of each animal, I have termed reddish jelly if the gelatenous material was more or less evenly mixed with the reddish material. Reddish-tinged on the other hand indicated the majority of the gel was transparent.

Four of the animals were necropsied to determine the amount of fat on the visceral organs. Each of the four specimens had extremely little or no fat within the mesenteries. The heart also had extremely little fat adhering to it. Although there was very little fat present, if it was present, it was around the kidneys. Even then the quantities of fat suggested the animals condition to be very poor.

Because I was the meteorological observer at Sachs Harbour for approximately a year before the study took place, I feel I can sufficiently postulate that starvation was the effect of another phenomenon. In late November 1977, Sachs Harbour and the adjacent area experienced a widespread, fairly intense freezing rain storm. Up to 5 m.m. of ice was deposited over the area. I feel that this type of weather would place the caribou population at a serious enough disadvantage, that starvation would and did result. The freezing rain makes it virtually impossible for the caribou to forage on the windswept hills and plateaus since the lichens would be crusted in ice. It would further limit their access to lichens moderately covered by snow, since it would deposit a firm crust which would hamper attempts to obtain the food.

Because I did observe the freezing rain and its consequences, I feel it was the single most important factor in inducing mortality through starvation. This phenomenon had been observed approximately five years earlier on Melvill Island. In that instance, approximately 70% of the caribou population and 90% of the muskox population was lost due to mortality.

This would also be a factor in why the residents of Sachs Harbour were seeing muskox on the windswept slopes. They were also having difficulty obtaining food. However one would tend to think that since the mortality in the muskox population was not as great as in the caribou population, that they were not as adversely affected.

Although rabies may be the cause of certain animals' death, I feel its importance is dwarfed by the importance of the freezing rain. Undoubtedly instances of caribou dying from rabies infections do occur; I do not feel it is as widespread or common as was orginally believed.

One last point I would like to mention is the scavenging of the caribou carcasses by sandhill cranes *(Grus Canadensis)*. This occurrence was so widespread that I feel this scavenging was an important food resource for the cranes until the snow and ice melted so they could utilize their normal food sources.

May 14	-	first sandhill crane - much scavenging on dead caribou (important).
May 14	-	first snow bunting
May 16	-	first herring gull
May 16	-	first rough-legged hawk
May 18	-	raven
May 19	-	snow geese
May 28	-	lapland longspur
May 29	-	semipalmated plover
May 30	-	long billed dowitcher
July 11	-	bain swallow
July 12	-	found 2 rough legged hawks nests one with 3 eggs other with 1 newly hatched chick plus 3 eggs
July 21	-	pod of 6 beluga whales reported by C-GAMY app. 40 m.m. south of Sachs.

- date of earliest arrival of birds on Banks Island as observed by

Bruce Morrison

SPECIMEN #1

FEMALE
Collected May 17 on a south facing slope of Kellet hills (in lee of the wind) directly north of Met station
Posture sleeping position
weight 33 kg
Horns 4 inch nubs still firmly attached
Femur content transparent reddish-coloured gelatin
stomach contents-full-some grasses while majority is brownish coloured semi-decomposed lichen
intestines also full-nutritional content unknown
no fat on heart or mesentary-some fat banding around kidneys

incisors not available
all premolar teeth deciduous
one cusp of m1 protruding and faintly stained
m2-has migrated to alveolar bone but no evidence of eruption
dentine on p2 not as wide as enamel
on p3 and p4, dentine wider than enamel
little wear or staining on any teeth
dentine just starting to be exposed on m1

specimen aged as in 10-12 month class (very little doubt exists aboutthe age of this animal)

SPECIMEN #2

MALE
Collected May 17 on south facing slope of Kellet hills
north of upper air station
Weight 31.5 kg
Femur content-very viscous jelly-reddish tinged-much thinner
in consistency than specimen #1
Stomach contents full brownish coloured lichen and some grass
intestines empty
nil fat around heart or mesentary-some small amounts around
kidneys

Molariform teeth present
all premolars are deciduous while first molar is permanent
p3 on right dentary bone has been damaged through abrasive
components of food stuff
for incisiform teeth, I1 and I2 appear as they were permanent
while other incisiform teeth are deciduous
in reality all incisiform teeth are deciduous-first mistake
of person doing analysis
on all premolars and m1, dentine only a fine line in comparison
with enamel width-very little tooth staining

positively placed in first age category 10-12 months

SPECIMEN #3

MALE
cause of death-had been shot-possible mercy killing as specimen found within 3/4 mile of Sachs Harbour
collected May 17
Femur content-reddish coloured transparent jelly

All molariform teeth present-incisiform are not
all teeth present are permanent-very deeply stained
all teeth have dentine covering over 3/4 of surface
infindibula from p2 have disappeared
wear on p2 is only on posterior portion not on anterior surface
molars starting to be flattened buccal-labially
m3 is highly worn

Initially aged as 6-7 year old will be verified
- animal placed in third age class - (i.e. animals from age 3 - 6 inclusive)

SPECIMEN #4

LARGE MALE
collected May 19th 3 miles east of Easter Creek
had died in early fall - as reported by R.C.M.P.
content of femur - red jelly - much more gelatinized than many other animals collected

complete mandible present
all teeth permanent
- all incisiform teeth worn to gum line (or very close to it) -
  dentine approx. 4 times the width of enamel.
  p2 - dentine width far exceeds enamel width
  p3 - infindibula worn enough to be closing - lophodont like
  p4 - also lophodont like- infindibula are closed
  M1 - worn to gum line
  M2 -
    - infindibula are very small
    - lophodont - like
    - animal placed in 4th age class - (from 7-9 years inclusive)
  M3 -
    - posterior cusp the only one still in evidence
    - lophodont like

SPECIMEN #5

LARGE FEMALE
taken on south-facing slopes of hills near Easter Creek (in lee of wind) thought to have died in early fall - moderate sized antlers still firmly attached
content of femur - a reddish coloured jelly

mandible complete - all teeth permanent

p2 - shows some attrition as dentine width is greater than enamel width however anterior portion is still raised - posterior margin highly worn
p3 - dentine width is much greater than enamel (over whole tooth surface) infindibula have almost disappeared
cusps not present as such - have been worn
much buccal lingual flattening
p4 - very flat - no cusps present
occlusal surface entirely made up of dentine
infindibula have either disappeared or are about to
M1 - anterior portion shows extensive attrition
all infindibula have disappeared
no cusps present - buccal-lingual flattened
M2 - dentine width still far in excess of enamel
very flat - no cusps
infindibula present but in reduced form
M2 broken on one side
M3 - buccal-lingually flattened - only cusp showing some evidence of its former animal in 4th age class - from 7-9 years inclusive
size is the posterior one
- anterior portion has dentine for in excess of enamel with infindibulum closed - in posterior section, dentine also exceeds enamel but infindibula has remained open

animal is in 7-9 year class (initially) = it would appear the animal is an 8 year old (some age as #29 & #4).

SPECIMEN #6

LARGE FEMALE
from appearance belived to have died in early winter
specimen collected from west of Berger Creek in Kellet hills on May 19
Antlers rather large and still firmly attached

Mandible present (in two parts)
p2 - wear only on posterior half of tooth-tooth height high-dentine only as wide as enamel
p3 - both infindibula present-dentine wider than enamel-very little grinding surface left-buccal-lingually flattened-tooth height still high
p4 - anterior infindibula present-dentine only present in anterior tooth-posterior infindibula missing-still some evidence of cusps-posteriorly, tooth being reduced to form characteristic p4-M1 depression-tooth height about 3/4 normal
M1 - shows moderate attrition-highly flattened- on one dentary, space occurs between p4-M1-on other dentary, the M1 has been split into two portions-no dentine present-no evidence of cusps or remnants
M2 - anterior infindibulum tending to disappear-buccal-lingually side-tooth height at least 3/4 normal
M3 - all infindibula present-dentine only as wide as enamel-posterior cusp still very high-tooth height 2/3 normal

animal initially aged as 5-6 year old. must be verified

- after comparison with other specimens, animal placed in 4th age class (from age 7-9 inclusive)

SPECIMEN #7

FEMALE
Approximate size of yearling but jaw dentition indicates it is older
collected May 19 in Berger Creek area of Kellet hills
much depredation by cranes on body
Femur contains reddish tinted jelly - very little colour and almost transparent

only one half of mandible present (one ramus)
all teeth permanent
little wear on incisiform teeth
p2 - only wear on posterior half of tooth -posterior half of tooth about 1/2 of anterior portions-dentine in centre of tooth is wider than enamel but in all other areas of the tooth, dentine is less than enamel-tooth is incompletely stained
p3 - dentine much wider than enamel-cusps still present - all infindibula present-tooth height 1/2 - 3/4 normal-tooth not completely stained
p4 - characteristic p4-M1 depression posteriorly - cusps still present anteriorly - tooth height anteriorly 1/2 while posterior is 1/5-posterior infindibula missing-anterior infindibula present-dentine only on anterior surface
M1 - tooth shows strong attrition-buccal-lingually flattened-tooth separated into two peg-like vestiges-no dentine-no infindibula
M2 - tooth height 1/2 normal-dentine far exceeds enamel-still evidence of cusps but anterior infindibula have disappeared-buccal-lingually flattened
M3 - very flat-all infindibula present-dentine as wide as enamel - tooth height 2/3 normal

initially aged as 5-6 year old. Will verify

animal placed in 4th age class (from age 7-9 inclusive)

SPECIMEN #8

YOUNGER FEMALE
- collected along west edge of Burger Creek on May 19 in badly decomposed state
- femur contains only reddish coloured gelatin

- complete mandible present
- all incisiform teeth and premolars are deciduous
- I1 starting to be displaced by its permanent counterpart
- p2 - dentine in excess of enamel
- p3 - dentine in excess of enamel - high degree of cusp attrition
  - cusp height lower than animals in same age class
- p4 - dentine greater than enamel - cusp attrition has lowered cusp height
- m1 - present but only stained half the way down the tooth
  - still very selenodont
- m2 - permanent tooth just starting to emerge with no staining evident

animal in latter portions of 10 - 12 month class

SPECIMEN #9

OLDER FEMALE
collected on south facing hillside by Easter Creek on May 19th (in lee of the wind).
Femur content - reddish tinged jelly

complete mandible present - all teeth permanent
incisiform teeth show high attrition - many worn to gum line
p2 - shows large amount of attrition - even on anterior portions
- dentine much wider than enamel - left side shows much more attrition than right side - possible malocclusion
infindibula tending to close
left side appears broken off
p3 - characteristic p3 wear and form of p3 - ml depression

- all molariform teeth characteristic of animal in 3rd age class (from age 3-6 inclusive) (looks like 6 year old)

SPECIMEN # 10

Immature male
collected May 17th - near Easter Creek
- fat accumulation - no fat around heart - some banding around kidneys - very little fat in intestinal mesentaries
- contents of femur - reddish jelly - consistency is much more that of marrow than of jelly - consistency is better than that found in most of the other animals

- some evidence of malorclusion on left side of incisors
- all incisors and premolars are deciduous
- premolars all show dentine lines wider than adjacent enamel
- posterior surfaces of p2 and p3 and anterior surfaces of p3 and p4 show cusp attrition
- m1 present and selenodont - cusps fullypresent
- m1 stained to the bottom of the tooth
- animal in 10-12 month age class

SPECIMEN #11

YOUNGER FEMALE
collected May 19 near Byrum Creek
in semi-decomposed condition-scavenged badly by sandhill cranes
content of femur-very "runny" reddish coloured jelly

Mandibular tooth rows show much greater attrition than in specimen of 10-12 month age class
deciduous I2, I3, C1, p2, p3 and p4 present-decidous I1 is missing but permanent I1 has migrated so that it would have replaced it in a short time
all other incisiform teeth show great deal of wear
in all premolar teeth dentine exceeds enamel in deciduous state
dentine also exceeds enamel in permanent m1
premolar tooth row is not as long as the tooth row for permanent premolars

age of animal is for the latter part of 10-12 month age class
(very substantive evidence to support this)

SPECIMEN # 12

OLDER FEMALE
Collected May 17
cause of death-hunting-had been shot and left
tongue very swollen-blood filling oral cavity
contents of femur-deep red colour-good consistency-very granular

complete mandible
All teeth permanent
Incisiform teeth show moderate wear-especially true of I1

- p2 - wear only on posterior half-on posterior half, dentine fare exceeds enamel-anterior cusp still present
- p3 - both infindibula present although posterior one is disappearing-tooth buccal-lingually flattened but cutting edges of cusps still present-tooth height 1/2 normal-dentine far exceeds enamel-space present between p2 and p3
- p4 - posterior infindibula missing-depression on posterior half forming characteristic p4-m1 depression-still evidence of cusps on anterior edges for cutting and grinding-dentine far exceeds enamel-tooth height 1/3 of normal height
- m1 - shows high degree of attrition-both m1 are separated into two separate sections-no evidence of cusps-very little dentine present-tooth height 1/3 normal
- m2 - also split into two sections due to attrition-height is greater than that of m1 through-little dentine showing-no cusps-tooth is peg-like-tooth height 1/4 normal
- m3 - anterior infindibula lost but posterior ones present in reduced form-posterior cusp reduced-tooth very flattened-some dentine still present-tooth 1/3 normal height

Initially, aged as 7-8 year old. Evidence of cusps on p3 and p4 suggest it is younger while attrition on m1, m2 and m3 suggest it is older. After comparison with other specimens, animal placed in 5th age class (age 10 years +).

SPECIMEN # 13

SEX UNKNOWN
Collected May 17 east of Easter Creek
Body decomposed and much evidence of scavenging by both foxes and sandhill cranes
content of femur-nil
Animal though to have died in early fall - supported by fact that 6 inch spikes (nubs) still firmly attached to head
Body found on south-facing hillside in lee of wind skeleton still firmly intact

Only molariform teeth present (on both rami) - incisiform teeth have been lost
p2 - shows wear on both anterior and posterior sections - only moderate evidence of anterior cusps-dentine much wider than enamel-tooth height 1/2 normal
p3 - both infindibula present-evidence of cusps still strong-some buccal-lingual flattening has occurred-dentine wider than enamel-tooth height still good
p4 - only anterior infindibula present-posterior infindibula have disappeared where characteristic p4-m1 depression starts to occur-on anterior portions, some enamel is present but posteriorly only dentine is present-only remnants of cusps are present-tooth slopes posteriorly so that the posterior portion is just above the gum line
m1 - on one side, attrition has separated tooth into two parts-on other side tooth very close to separating-no infindibula present-no cusps-buccal-lingually flattened-tooth height 1/2 normal
m2 - posterior infindibula on both teeth missing-only one of anterior infindibula present-dentine much wider than enamel-tooth is buccal-lingually flattened-still remnants of cusps - on right dentary, m2 about to separate into two parts
m3 - infindibula still present but on verge of disappearing-tooth is buccal-lingually flattened-some cusp evidence still present-dentine far exceeds enamel-tooth height 1/2 normal

Initially aged as approximately 7-8 year old. Will be verified

- animal placed in 4th age class from age 7-9 years inclusive

SPECIMEN #14

OLDER MALE
collected May 17 - directly east of Easter Creek in Kellet valley.
- position and condition (example presence of antlers) would indicate animal died early in fall
- contents of femur - deep reddish colour - consistency is firm but granular - animal in the "best condition" of those looked at to this point

- All incisiform teeth permanent - show fair degree of attrition (c1,I3)
- premolars permanent - posterior p2 shows fair amount of wear with dentine as wide as enamel - p3 cusp and crest heights being reduced on posterior surfaces dentine is wider than enamel
  - p4 - cusp tending to be worn down - enamel wider than dentine and characteristic p4 - m1 starting to appear (depression)
  - m1 - dentine far exceeds enamel - anterior portion grooved
    - infindibula tending to disappear
    - no cusp development due buccal-lingual flattening
  - m2 - dentine far exceeds enamel - typical horseshoe pattern around infindibula starting to close
    - flattened but not to extent of m1 - cusps on lingual side still present
  - m3 - only anterior portion is present - dentine wider than enamel
    - infindibula closing
    - cusp on anterior portion is present in reduced state
- animal placed in 3rd age class (from 3-6 years inclusive)

aging - wear progressing on p2 - starting to occur on anterior anterior 1/2 - p3 and p4 still show lingual cusps in a reduced form evidence of molar buccal lingual flattening.

- aged in 4-6 year age class - most probably a 4 or 5 year old

SPECIMEN # 15

IMMATURE MALE
collected near Easter Creek on south facing slopes of Kellet hills
- in sleeping position
- contents of femur - very fluid reddish tinged jelly
- age class 10-12 ymonths
- all incisiform teeth are deciduous - greater wear on left side than on right
- premolars are deciduous - show moderate wear
- m1 present - still highly selenodont
  - significant staining only 1/2 way down tooth as gum line has only recently receded
- m2 starting to erupt but unstained

SPECIMEN #16

IMMATURE FEMALE
collected at mouth of Easter Creek
- killed by wolves - known since investigator had found her in January within an hour of her death
- contents of femur - very liquid - reddish coloured jelly
- only half of ramus present - all teeth deciduous
- I1 deciduous in process of being replaced by permanent homologue
- premolars are deciduous with dentine as wide or wider than enamel
- posterior p2 - anterior p3 surface and anterior p4 - posterior p3 are lophodont like
- m1 present and dentine lines are present on both anterior and posterior cusps
- animal member of 10-12 month class

SPECIMEN # 17

MALE (IMMATURE)
collected May 17 west of Easter Creek
- content of femur - liquid reddish colored jelly
- animal had some malocclusion problems - p3 and p4
  deformed as a result
- all incisiform teeth are deciduous
- I1 being replaced by permanent counterpart
- premolars deciduous
  p2 - dentine lines smaller than enamel lines
  p3 and p4 - dentine much wider than enamel
m1 - staining to bottom of tooth - very selenodont
  - dentine lines present on both anterior and posterior surfaces
m2 - starting to erupt on one side - not on the other
- animal a member of 10-12 month age class

SPECIMEN #18

VERY SMALL MALE
collected on west side of Easter Creek
- jawbone very thin
- contents of femur runny reddish tinged jelly
- all incisiform teeth missing
- premolars deciduous - show moderate to extensive attrition
- m1 present - very selenodont - little wear
  - only stained 1/2 way down tooth as gum line receded recently
  - no attrition
- m2 - has not emerged yet
- animal in 10-12 month class

SPECIMEN #19

SEX UNKNOWN
- collected May 17 near Easter Creek
- badly scavenged by sandhill cranes.
- definately immature
- content of femur - reddish jelly - no consistency
- all incisiform teeth deciduous - I1 starting to be replaced
- all premolars deciduous
- dentine width on p2, p3 and p4 greatly exceeds enamel width
  - cusp height reduced - resembles lophodont dentition
- m1 present - selenodont - stained to bottom of tooth
  - dentine width - equal to enamel width
- m2 - ready to erupt from aveolar bone but as yet has not
- animal in 10-12 month class

SPECIMEN # 20

VERY LARGE MALE
- found along Kellet river flats May 23rd
- contents of femur - reddish jelly - very watery

- complete mandible present
- all teeth permanent
- incisiform teeth show little wear but some evidence of maloclusion is present
- P2 not excessive wear - dentine a fine line not as wide as enamel - tooth height strong
- P3 all cusps present - wear not excessive - infindibula are open - tooth height strong - dentine width not as wide as enamel width
- P4 shows moderate wear on cusps - dentine as wide as enamel - position of cusps still evident - strong tooth height
- M1 moderate tooth attrition - infindibula present but tending to disappear - dentine wider than enamel - some buccal-lingual flattening but cusps still present - good tooth height
- M2 still selenodont with cusps evident - dentine same width as enamel - anterior infindibula present but tending to disappear while posterior one is large - some flattening shown
- M3 still selenodont - dentine as wide as enamel - some buccal lingual flattening - infindibula still very evident

- iniatially (subjectively) aged as a four year old
- animal placed in 3rd age class (from year 3-6 years inclusive)

SPECIMEN #21

YOUNGER MALE
collected near Berger Creek
- contents of femur - viscous reddish tinged liquid

- all incisiform teeth permanent
- premolars all deciduous with extensive attrition of p4
  m1 present - dentine much wider than enamel - some wear
  m2 present - highly selenodont - dentine line very thin
  m3 in erupting condition - stained only at the tip

jaw - a very good example of animal in age class of 22-24 month old class

SPECIMEN # 22

LARGE FEMALE
taken May 25 west of Decca site
contents of femur reddish tinged jelly

- due to poor collection techniques, some of teeth were not collected - increases possibilities of errors in aging
- M2 and M3 missing as per note above
- all teeth present are permanent
- incisiform teeth show moderate to excessive attrition; I1 has been worn even with gum line
- P2 wear has occurred from posterior edge to anterior line of tooth - dentine far exceeds enamel - posterior tooth height approximately 1/3 normal while anteriorly it is almost as in normal tooth
- P3 exhibits strong buccal-lingual flattening - infindibula are about to close completely - dentine far in excess of enamel - tooth height is low-posterior margin P3 is lowered to form P3 -P4 depression
- P4 only remnants of lingual cusps present - very strong buccal lingual flatening - infindibula very close to disappearing tooth height 1/3 normal - slopes posteriorly to form characteristic P4 - M1 depression
- M1 shows moderate attrition - anterior portion dips sub-stantially to form characteristic P4 - M1 depression some evidence of lingual cusps but buccal lingual flattening is considerable - both anterior and posterior infindibula are closed or about to close - posterior portion of tooth is depressed to form part of a M1 - M2 depression

- animal was initially placed as a 6-7 year old
- animal placed in 3rd age class (from year 3-6 years inclusive)

SPECIMEN #23

SEX UNKNOWN
animal collected May 25 near Decca site
- specimen had been shot in head
- scavenged by sandhill cranes
- femur filled with reddish jelly
- all incisiform teeth permanent
- all premolars are deciduous - large degree of attrition
  - p4 strongly buccal - lingually flattened
  M1 permanent - dentine lines equal to enamel width
  M2 permanent - very selenodont - incompletely stained as gum line still receding
  M3 starting to erupt

animal in 22-24 month age class

SPECIMEN #24

YEARLING FEMALE
collected May 25 along Mary Sachs River
- died in early fall
- animal very small
- content of femur - reddish tinged jelly
- all incisiform teeth are deciduous
- all premolars deciduous - very little wear - only on posterior cusps of p4 is dentine as wide as enamel
  p3 and p4 strongly selenodont
- gum line has not fully receded from M1-only partially stained
  - m1 strongly selenodont
- part of 10-12 month age class but may have died as early as 8 months

SPECIMEN #25

YEARLING FEMALE
collected along west end of town May 25
- content of femur a reddish tinged jelly
- all incisiform present - all deciduous
  I1 will be replaced shortly by permanent counterpart
- deciduous teeth - premolars present
- m1 present - staining not well developed
- m2 showing some evidence of forthcoming eruption
- animal in 10-12 month class

SPECIMEN #26

YEARLING MALE
- collected near Duck Hawk Bluff on May 25
- content of femur - reddish coloured jelly
- all incisiform teeth deciduous
- all premolars are deciduous
  dentine lines of p2 and p3 less than enamel width
  dentine lines of p4 wider than enamel
  - all premolars are selenodont
- m1 present fully stained - little wear
  - dentine lines present on anterior surfaces - lacking on posterior cusps
- little evidence of m2 future eruption
- animal in 10-12 month age class

SPECIMEN #27

OLDER MALE
collected May 25 west of Mary Sachs River
content of femur reddish jelly

mandible present
all teeth permanent
incisiform teeth show great attrition - c1, 13 and 12 missing from left dentary - all other incisiform teeth are worn almost to the gum line
- p2 shows wear on both the anterior and posterior portions of the tooth surface (although wear much greater on posterior (surface) - tooth height 1/2 of normal - dentine width far exceed enamel
- p3 great attrition - only the anterior infindibulum on the left dentary is present - all others have disappeared - tooth worn down to 1/5 of normal height - large space between p3 and p4 - only very small amount of dentine left (on anterior tooth surface) tooth very flat no evidence of cusps
- p4 anterior and posterior portions of tooth spearated into two distincts parts - no dentine visible - great attrition - no cusps present nor remnants thereof - tooth height 1/7 normal with the tooth devided into two, some malocculucion has occurred to force the remaining parts of tooth together, however this tooth surface is both small and flat so that its usefulness is questionable
- M1 tooth also separated into two distinct parts - both parts together have very little grinding surface - no cusps present - no dentine - tooth height very low - great attrition
- M2 complete tooth present - very little dentine present - posterior infindibulum present while the anterior one has disappeared due to tooth wear - no cusps - very strong buccal-lingual flattening
- M3 whole tooth present - both infindibula present but anterior one is tending to disappear - tooth height 1/2 normal - some evidence of cusps present but tooth generally very flattened -dentine far exceeds enamel

initially placed in 9 year class

-animal after comparison with other specimens was placed in 10 age class i.e. age class number 5.

SPECIMEN # 28

OLDER MALE
found in sleeping position along south - facing slopes of Sachs River on May 25
- contents of femur reddish jelly
- all teeth permanent
- incisiform teeth show fair attrition
  - p2 - on anterior surface dentine as wide as enamel - tooth height high - no excessive wear on posterior surface
  - p3 - dentine same width as enamel - lingual cusps present with moderate development - some wear on posterior surface
  - p4 - some flattening but not complete - infindibula still present posterior cusp still present - tooth height high
  - m1 -dentine as wider or wider than enamel - not excessively worn cusps identifiable as are infindibula - tooth height high
  - m2 - still selenodont - dentine wider than enamel - infindibula tending to disappear - cusp height high as little attrition
  - m3 - still selenodont - dentine equal to enamel - lingual cusps still present - some buccal-lingual flattening but not excessive

animal in 4-5 year
animal placed in 3rd age class from years 3-6 inclusive

SPECIMEN #29

OLDER MALE
- mandible broken during removal from specimen
- femur filled with reddish coloured jelly
- collected May 25 at Decca site
- all teeth permanent
- incisiform teeth show little wear
- mandible broken badly
  - p2 - worn flat on both posterior and anterior surfaces - dentine wider than enamel - infindibula closed - tooth height low
  - p3 - buccal-lingually flattened - dentine wider than enamel infindibula present but reduced - start of p3-p4 depression
  - p4 - worn flat - infindibula open - anterior sections low as are posterior sections for classic p4 - m1 depression
  - m1 - reduced in height - dentine forms complete tooth surface anterior portions even with gum line - tip of root canal on anterior portion opening - flattened buccally
  - m2 - flattened no evidence of cusps - dentine is majority of the tooth surface - infindibula either closed or tending to close
  - m3 - flattened laterally except for posterior cusp which is raised infindibula open but tending to close - dentine wider than enamel

- animal in 7-9 age class - corroborated by complete flattening of p2, extensive attrition of m1 and the reduction of the lingual cusps of p3 and p4 with
- after comparison, animal placed in 4th age class from year 7-9 inclusive the consequent closing of the infindibula
  - believe it to be an 8 year old animal p2 concave pioximal cusp of m3 still raised so not a 9 year old

SPECIMEN # 30

IMMATURE ANIMAL - SEX UNKNOWN
found May 25 near Mary Sachs River
- scavenged by sandhills
- contens of femur - reddish tinged jelly
- good example of an animal in 10-12 month class
- all incisiform teeth present - deciduous - permanent I1 replacing deciduous counterpart
- all premolars deciduous p2 - little wear
  p3 and p4 - dentine wider than enamel
- m1 - gum line has not regressed to show complete tooth - only stained on upper half of tooth
- m2 - some evidence to suggest forthcoming eruption of m2
- animal example of 10-12 month age class

SPECIMEN #31

IMMATURE MALE
- specimen was shot - looks like it occurred last fall
- content of femur is a red jelly - colour deeper than most specimens

- all incisiform teeth missing
- p2, p3 and p4 deciduous - dentine width much wider than enamel in all premolars
  p4 - anterior portion lophodont like - cusps show high degree of wear

m1 - selenodont and hypsodont - only stained half way down tooth as gum line has recently receded.
m2 - at alveolar bone but no hint of eruption
- example of animal in 10-12 month class

SPECIMEN #32

OLDER FEMALE
found on south facing hillside (in lee of wind) on north side of Sachs River
Femur empty - strong evidence of fox scavenging the carcass after death occurred

complete mandible present
all teeth permanent
incisiform teeth show high degree of attrition
- p2 anterior posterior flattening in evidence - wear has taken place to where dentine now starting to disappear - tooth height is very low
- p3 no cusps - no infindibula - dentine has almost disappeared - tooth as separated on one side of mandible while still intact on the other - tooth only just above gum line in height
- p4 no cusps - no infindibula - dentine disappearing - separated into anterior and posterior sections due attrition
- m1 no cusps - no infindibula - dentine disappearing - on one side of mandible it has been lost, on the other there are two stubs that are the vestiges of m1
- m2 completely flattened - no cusps - no infindibula - on one side of dentary, attrition has split m2 into two sections - tooth height on both sides is bearely above gum line
- m3 only posterior infindibula are present - very little dentine still present - tooth shows strong buccal-lingual flattening approximately 1/2 normal tooth height

animal placed in 10+ age group - initally though to possibly be as old as 12 years

- animal placed in 5th age class (year 10+)

SPECIMEN #33

IMMATURE FEMALE
found near west end of town
- collected May 24
- antlers still intact (nubs)
-content of femur - transparent jelly
- all incisiform teeth deciduous I1 starting to be replaced
  by permanent counterpart
- premolars all deciduous - dentine width greatly exceeds width
  of enamel on all premolars
M1 - stained to bottom of tooth
M2 - some evidence of forthcoming eruption of m2 but not visible yet

- animal in 10-12 month class

SPECIMEN #34

LARGE MALE
collected May 25 west of station
- femur contents - transparent jelly
- all teeth permanent
- incisiform teeth show little attrition
  p2 - wear on posterior surface results in depressed appearance
    - dentine wider than enamel but not flattened
    - posterior infindibula tending to disappear
  p3 - lingual cusps present in reduced form - some buccal lingual flattening - dentine much wider than enamel. infindibula still clearly apparent
  p4 - lingual anterior cusp still present - dentine much wider than enamel - infindibula present but reduced
  m1 - shows moderate attrition - right side greater than left side - infindibula have disappeared - dentine is majority of occlusal surface - m1 is 1/2 height of p4
  m2 - exhibts buccal-lingual flattening - infindibula present but reduced - dentine much wider than enamel - lingual cusps very reduced
  m3 - exhibits buccal-lingual flattening but posterior cusp is still present in anterior areas, dentine is wider than enamel; in posterior sections, enamel, is wider than dentine

place in 4-6 age class, looks like a 5 year old
- definately in 3rd age class (year 3-6 inclusive)

SPECIMEN #35

VARY LARGE MALE
collected May 27, east of village of Sachs approximately halfway between village and Sachs River
content of femur - jelly

mandible present
all teeth permanent
incisiform teeth show moderate attrition - I1 worn down to gum line-others not worn as much but do show attrition
p2 - posterior portion shows moderate wear - posterior portion shows greater amount of wear - posterior infindibulum present but reduced in size-dentine much wider than enamel
p3 - shows buccal-lingual flattening - cusps not present - almost lophodont - like appearance - infindibula present but reduced in size-tooth height about 1/2 normal
p4 - anterior lingual cusp present but only as a vestige of what was present - general buccal-lingual flattening - dentine much wider than enamel - tooth height 1/2 normal - posterior portion depressed to form part of p4 - m1 depression
M1 - great attrition - whole tooth bearely above gum line-all dentine and both infindibula are not present - tooth ready to separate into two portions (anterior and posterior)
M2 - very flat no trace of former cusps - infindibula present but reduced in size

Initially aged as an 8-9 year old will verify by comparison

animal placed in 4th age class (age 7-9 inclusive)

SPECIMEN #36

YOUNG MALE
taken by Esaus
- location unknown - sex unknown - only head available
- content of femur reddish tinged jelly
- animal in 10-12 month class
- all teeth deciduous except m1
-dentine some width as enamel in p2 - wider in p3 and p4
M1 - lightly stained - hypsodont and selenodont
M2 - at alveolar bone but no evidence of eruption

- animal in 10-12 month age class