Formatted: Centered

Style Definition: Heading 1

Formatted: Different first page header

SATELLITE COLLARING AND CALF SURVIVAL IN THE BATHURST HERD OF BARREN-GROUND CARIBOU 2003 - 2005

Anne Gunn[1]

[1]Department of Environment and Natural Resources
Government of the Northwest Territories

Yellowknife, NT X1A 2L9
Canada

2008

Manuscript Report No.

The contents of this paper are the sole responsibility of the author i

Formatted: Bottom: 1.38", Not Different first page header

ABSTRACT

The co-management plan for the Bathurst herd of barren-ground caribou (*Rangifer tarandus groenlandicus*) requires monitoring calf survival, movements and seasonal distribution. To monitor movements and seasonal distribution, we try to maintain between 10 and 20 satellite collars on cows. In March 2003, we fitted 10 cows with satellite collars that were programmed to automatically drop off on 15 September 2004. In October 2004, we flew reconnaissance surveys before capturing and fitting 10 barren-ground caribou with satellite collars. In March 2005, we caught and aimed to add a further 10 satellite collars to Bathurst cows and 10 collars to cows in the Ahiak herd. After fixed-wing reconnaissance flights to cover the possible winter ranges of the Bathurst and neighbouring herds (Bluenose East, Bluenose West, Cape Bathurst and Ahiak herds), we spread the capture of 10 cows across that caribou distribution from the Lac Grandin area southeast to Gordon Lake. We also found concentrations of caribou south of Great Slave Lake (Nonacho Lake) extending northeast to Artillery Lake. We caught and collared five cows at Nonacho Lake and five east of Artillery Lake. Based on the distribution of the collared cows in June 2005, we assigned the satellite-collared cows to the different herds on the premise that herds are identified by the return of cows to traditional calving grounds. From the June 2005 distribution of the collared cows, we surmise that, during winter 2004/05, the distribution of the Bathurst and Bluenose East herds overlapped in the area

Formatted: Justified, Indent: First line: 0.5", Line spacing: Double

of Lac Grandin north to Great Bear Lake. The Ahiak herd and Bathurst herd overlapped their winter ranges at Nonacho Lake. In this report, we include data from a late June 2004 measure of calf-cow ratios. In April 2005, we monitored calf survival from classifying caribou into sex and age classes. The calf-cow ratios were low (mean calf-cow ratio was 14 calves to 100 cows), which is consistent with the poor calf survival during summer 2004. We also report on environmental conditions on the summer range, which may contribute to explaining the low calf survival over the summer. We extrapolated summer temperatures and wind speed to develop an index to the severity of insect harassment. Information from a hunter revealed that pregnancy rates were low to moderate across the winter range in March 2005. If the lower than average pregnancy rate and low calf survival persist, the Bathurst herd is unlikely to reverse its current decline in abundance.

Formatted: Line spacing: Double

TABLE OF CONTENTS

LIST OF FIGURES

Formatted: Justified, Tab stops: 0.88", Left + 5.25", Left

Formatted: Font: Italic

x

LIST OF TABLES

Formatted: Justified, Tab stops: 0.75", Left + 5.25", Left

Formatted: Font: Italic

Formatted: Centered

Formatted: Bottom: 1.38"

INTRODUCTION

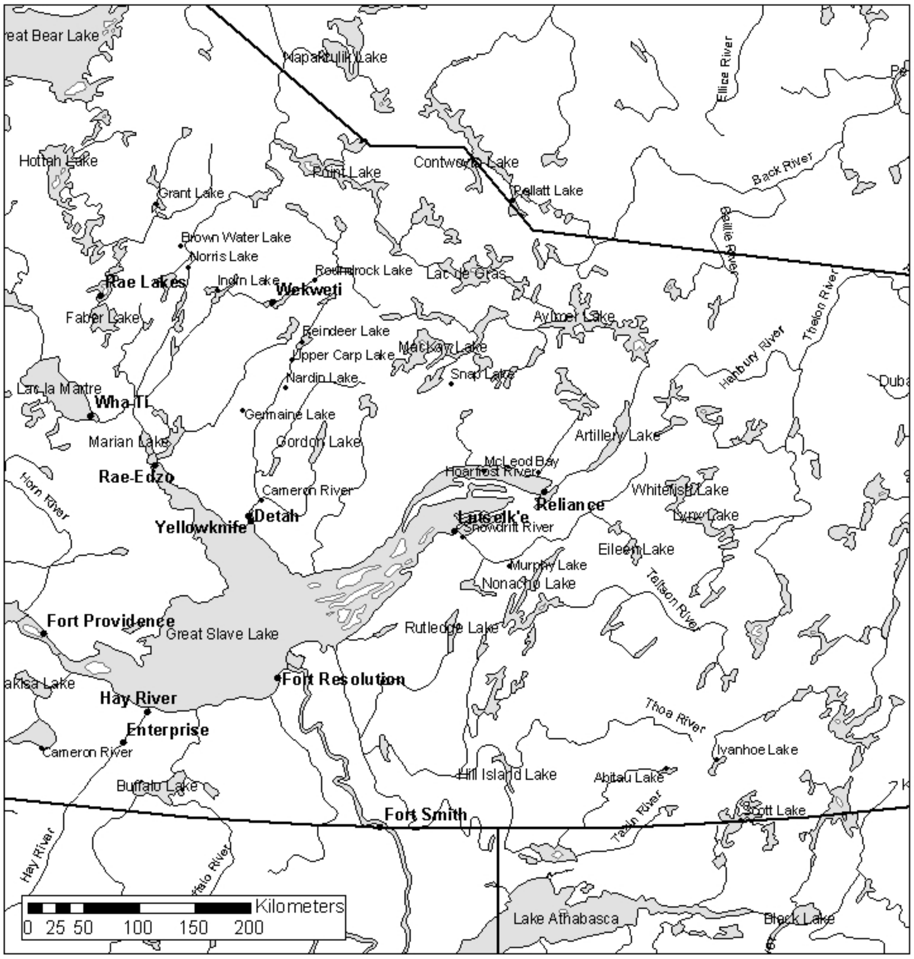
Monitoring the distribution and health of the Bathurst herd of barren-ground caribou, *Rangifer tarandus groenlandicus,* in the Northwest Territories includes monitoring distribution using satellite collars (Bathurst Caribou Management Planning Committee 2004). The objective for the collaring is to annually maintain between 10 and 20 cows fitted with satellite-collars. We have previously reported on collaring in the Bathurst herd between 1996 and 2002 (Gunn *et al*. 2001, Gunn and D'Hont 2002, Boulanger *et al*. 2004). In this report, we describe caribou collaring between 2003 and 2005.

In March 2005 and October 2004, we mapped caribou distribution during fixed-wing aircraft reconnaissance surveys before capturing and fitting cows with satellite collars. In October 2004, we flew reconnaissance surveys to locate caribou, as we were unable to rely on current locations from the 2002-2004 satellite collars to find animals, as those collars had been fitted with drop-off mechanisms that released as scheduled in mid September 2004. In March 2005, we flew surveys to cover the Bathurst herd's winter range and the western winter range of the Ahiak herd as we also had 10 satellite collars destined for that herd. During the March 2005 survey, we coordinated with biologists in the Sahtu and Inuvik regions, who were also mapping caribou distribution in preparation for collaring caribou. Those surveys covered the areas west of Lac La Martre and the Great Bear Lake area. The intent was to fit 10 satellite and 50

Formatted: Centered

Formatted: Justified

VHF collars to caribou cows in each of the Bluenose East, Bluenose West and Cape Bathurst herds (J. Nagy pers. comm.).


Great Bear Lake
Napaktulik Lake
Ellice River
Hottah Lake
Point Lake
Contwoyto Lake
Pellatt Lake
Back River
Grant Lake
Brown Water Lake
Norris Lake
Rae Lakes
Indin Lake
Wekweti
Roundrock Lake
Lac de Gras
Faber Lake
Reindeer Lake
Aylmer Lake
Thelon River
Upper Carp Lake
MacKay Lake
Hanbury River
Nardin Lake
Snap Lake
Lac la Martre
Wha Ti
Germaine Lake
Artillery Lake
Marian Lake
Gordon Lake
McLeod Bay
Hoarfrost River
Rae-Edzo
Cameron River
Whitefish Lake
Horn River
Reliance
Detah
Lutselk'e
Lynx Lake
Yellowknife
Snowdrift River
Eileen Lake
Murphy Lake
Nonacho Lake
Taltson River
Fort Providence
Great Slave Lake
Rutledge Lake
Kakisa Lake
Fort Resolution
Hay River
Enterprise
Thoa River
Cameron River
Ivanhoe Lake
Hill Island Lake
Abitau Lake
Buffalo Lake
Fort Smith
Scott Lake
Hay River
Lake Athabasca
Black Lake
Kilometers
0 25 50 100 150 200

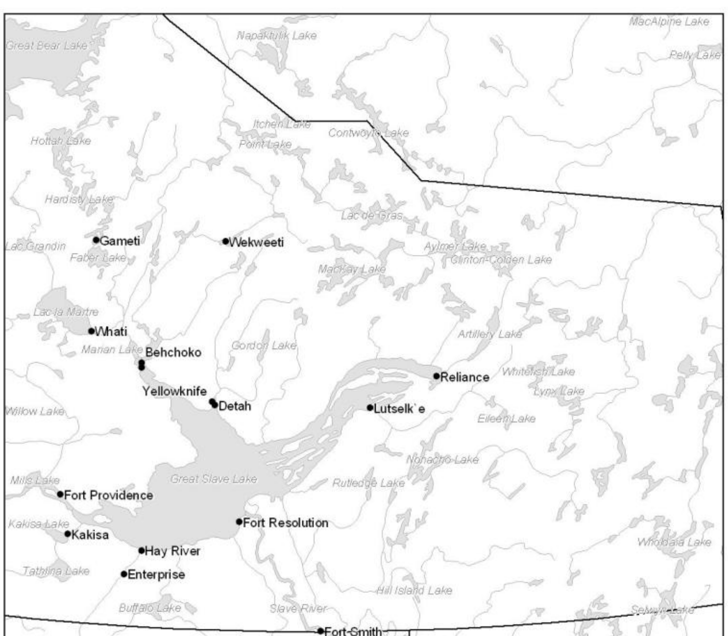

MacAlpine Lake
Great Bear Lake
Napaktulik Lake
Pelly Lake
Itchen Lake
Contwoyto Lake
Point Lake
Hottah Lake
Hardisty Lake
Lac de Gras
Lac Grandin
Gameti
Wekweeti
Aylmer Lake
Faber Lake
Clinton-Colden Lake
MacKay Lake
Lac la Martre
Whati
Artillery Lake
Marian Lake
Behchoko
Gordon Lake
Reliance
Whitefish Lake
Lynx Lake
Yellowknife
Detah
Lutselk`e
Willow Lake
Eileen Lake
Nonacho Lake
Mills Lake
Great Slave Lake
Rutledge Lake
Fort Providence
Kakisa Lake
Fort Resolution
Kakisa
Hay River
Whitefish Lake
Tathlina Lake
Enterprise
Hill Island Lake
Buffalo Lake
Slave River
Selwyn Lake
Fort Smith

Figure 1. Study area for spring and fall collaring and sex-age composition surveys conducted on the Bathurst caribou range, Northwest Territories, 2003-2005.

Comment [MS1]: This figure is not very easy to read – labelling of lakes is not always very clear; some text is cut of at figure edge; some of the water features are shown as points (misleading because points usually represent towns); probably should have NT and Nunavut labels on either side of border; some locations discussed in text are not shown on any map (I've tried to note them in text) – Fig.2 Colomac mine would be useful; Fig.3. Wopmay L. and Snake L.; Fig.4. Lac Grandin, Duncan Lakes, Fluzial Island, Gordon Lake, Upper Carp Lake (the last 2 are shown on Fig.1, but I found it hard to compare the 2 in order to find the lakes on Fig.4.

Typically, neighbouring barren-ground caribou herds in some winters overlap their ranges (Heard 1984, Gunn and ~~D'Hont 2002~~D'Hont 2002). The March 2005 reconnaissance surveys and collaring also provided an opportunity to describe, if any, winter range overlap. Barren-ground caribou occur as geographic populations (herds) that are defined from the fidelity of cows to specific calving grounds (Thomas 1969), therefore, we used the June (calving) distribution of the cows as the criterion to identify which herds were using which winter ranges.

The management plan for the Bathurst herd also refers to monitoring the trend in calf survival (Bathurst Caribou Co-management Planning Committee 2004). We previously reported a decline in calf-cow ratios and calf survival calculated from the calf-cow ratios determined in late winter and fall 2000-2004 (Gunn *et al*. 2005a) compared to 1985-1995 (Williams and Fournier 1996). Monitoring calf survival gives us a basis for interpreting changes in herd size and, when combined with monitoring the survival of cows (through the use of satellite collars), it does ~~substantiate trend~~substantiate trend in herd size. Trend in herd size is currently estimated by measuring the numbers of breeding females (Gunn *et al.* 2005b).

The decline in calf-cow ratios can be caused by an increase in calf deaths, a reduction in pregnancy rates, or both. Distinguishing between the two effects will contribute toward diagnosing causes of the decline. Pregnancy rates can be

Formatted: Justified

estimated visually checking radio-collared cows (by determining whether cows calved) as has been done for the Porcupine herd (This assumes that intra-uterine deaths are rare.). Pregnancy rates for adult cows averaged 81% (71-92%) and the rates were similar for the increase and decrease phases of herd size, although were more variable during the decrease phase (Griffith *et al*. 2002). In other herds, such as the Nelchina and Western Arctic herds, both pregnancy rates and summer calf survival decreased as the herd size decreased (Alaska Department of Fish and Game 2001).

Currently, we do not have enough collared cows in the Bathurst herd to provide a sufficient sample size to estimate pregnancy rates. An alternate method for measuring pregnacy rates is during community-based monitoring of harvested caribou (Lyver and Gunn 2004). Experienced hunters rate the condition of the caribou, as well as document whether the cows are pregnant.

Another approach for indexing pregnancy rates is to determine the proportion of cows during calving that have velvet antler growth. Barren cows shed their antlers in April and their new antler growth is highly visible in June. In contrast, pregnant cows retain their antlers until calving and new antler growth is not visible until later in June as antler 'buttons'. In the Western Arctic herd , the June cow-calf ratio was negatively correlated with the proportion of cows with velvet antlers (Alaska Department of Fish and Game 2001).

This report brings together data from the March 2003, October 2004 and March 2005 ~~collaring,~~collaring and the reconnaissance surveys in October 2004 and March 2005 on the seasonal ranges of the Bathurst and its neighbouring herds. We also discuss overlap in winter ranges and herd identity. The seasonal ranges of the Bluenose East herd are partly based on 1998-2001 satellite collar data from a project funded by the Sahtu Renewable Resource Board. As the details had not been previously written up, we have included them (Appendix A).

This report updates the trend in calf survival using data collected in April 2005. Calf survival has been recently low during the summer (Gunn *et al*. 2005a) and as part of the diagnosis of the reasons for the low calf survival, we have examined environmental conditions during the summer. We started by using weather data to develop an index for the severity of mosquito and warble fly harassment. In this report, we describe the trends in the annual indices for insect harassment.

We have also included data on the proportion of cows with new antler growth in late June 2004 as an index to pregnancy rates. As well, we have listed the information supplied by hunters who measured condition and pregnancy rates in March 2005.

METHODS

Collaring (March 2003, October 2004, March 2005): To map caribou distribution, we used a fixed-wing aircraft flying relatively systematically placed transects to cover as large an area as possible. We used a Husky Aviat aircraft flying at about 150 m above ground level. Once caribou distribution was mapped, we used a Hughes 500D helicopter, a hand held net-gun and a handler to capture and collar the caribou cows. For the capture and handling, we followed the Standard Operating Protocol from Environment and Natural ~~Resources's~~Resources' Animal Care Committee. We subsequently designated a herd identity for each collared cow based on her mid-June 2005 calving ground location.

Formatted: Justified

Calf survival (April 2005): We used a helicopter to search for caribou groups across the distribution mapped from reconnaissance flights in the preceding week. We classified small groups from the air or landed and walked to within 100-200 m of the caribou and viewed them through a spotting scope. We attempted to classify caribou as we encountered them and we assigned a GPS waypoint to each discrete caribou group or small lake or bay with caribou. The location (GPS waypoint) is the sample unit in the analyses.

We followed standard criteria to classify caribou as cows, calves, young or prime bulls (Williams and Fournier 1996). We recorded wolves and wolf kills.

Following Williams and Fournier (1996), we express the wolf sightings as a rate of wolves/1000 hours flown.

Pregnancy rates (June 2004): In June 2004, as cows were leaving the calving grounds, we sampled as many groups as possible to determine the proportion of cows with various stages of antler growth. By waiting until the cows were leaving the calving ground, we expected the barren cows to have reached the calving ground and be mixed into the large groups.

We used a helicopter to search for caribou groups across the distribution mapped from the satellite-collared cows. We landed and walked to within 100-300 m of the caribou and viewed them through a spotting scope. We attempted to classify caribou as we encountered them and we assigned a GPS waypoint to each discrete caribou group. The location (GPS waypoint) is the sample unit in the analyses.

We classified cows as having hard antlers, no visible antlers, velvet antler 'buttons', and conspicuous velvet growth (visually categorized as less than the length of the ear, or greater than the length of the ear)cows with new antler growth less or greater than half the length of their ears. We also noted the presence of calves, yearlings, young bulls and prime bulls.

Pregnancy rates (winter 2004/05): Hunters recorded whether caribou cows were pregnant and, based on their experience, rated caribou condition as excellent, good, poor, or very poor. Warble burden was rated as low (0-30), medium (30-60), or high (60^{+}). Hunters measured the depth of back fat and reported the presence of hydatid cysts, Besnoitia and other health conditions.

Insect harassment index: We worked with John Lee (Yellowknife, NT) to use Environment Canada's weather data to apply Russell *et al.*'s (1993) index for insect harassment to the Bathurst herd's summer range. Russell *et al*. (1993) developed an index of insect abundance based on wind speed (metres per second) and temperature (degrees Celsius). The model was derived by sampling mosquitoes (Culicidae), but was also applied to oestrid flies (nasal bot flies, *Cephenemyia trompe,* and warble flies, *Hypoderma tarandi)* at different wind speeds and temperatures. The index ranged from 0 to 1, with 1 being the highest.

Mosquito index:
If temperature>=18 then tim=1
If temperature<=6 then tim=0
If 18>temperature>6 then tim=(1-(18-temperature)/18)
If wind speed >6 then twin=0;
If wind speed <6 then twin=(6-minwind)/6;
Index =tim*twin;

Oestrid fly index:

If temperature>=18 then tio=1;

If temperature<=13 then tio=0;

If 18>temperature>13 then tio=(1-(18-temperature)/10);

If meanwind>9 then owin=0;

If meanwind<9 then owin=(9-minwind)/9;

ostindex=tio*owin;

Gunn *et al*. (2001) investigated whether a daily representation of weather would provide a reasonable index to peak conditions of insect abundance as determined with Russell's technique. They concluded that the daily minimum wind speed and the mean daily air temperature were highly correlated to the insect index. These weather measurements were used here to create a daily insect index for mosquitoes and oestrids.

Formatted: Justified

We only had weather data for the southern part of the caribou range from 1996. Hourly weather records for Yellowknife in 2004 and 2005, and from Ekati, Daring Lake, and Lupin for the years 1996 to 2005 were obtained through Environment Canada and Aurora Wildlife Research (2305 Annable Rd., Nelson, BC, V1L 6K4). The files were reformatted and daily mean temperature and minimum wind speeds were determined for each site for the period of June 1 to September 15.

A separate mosquito and oestrid index for each tundra site (Ekati: Lat 64° 42'N, Long 110° 36'W; Lupin: Lat 65° 45'N Long 111° 15'W, and Daring Lake: Lat

64^{o} 52'N Long 111^{o} 35'W) was calculated annually for every day from 1 June through to 15 September inclusive. The daily indices for the three sites were then averaged to yield a single daily mosquito and oestrid index for that day. The first and last day of each year that the index was above zero determined the length of the season.

Weather records for years prior to 1996 were consistently available only for the northern part of the summer range. Hourly weather records for Contwoyto Lake, NT (Lupin: 65^{o} 45'N, 111^{o} 15'W) from the period 1957 to 2005 were obtained from The Meteorological Service of Canada (Environment Canada). The files were reformatted and the daily mean temperature and minimum daily wind speed were determined. Using those data, a mosquito and oestrid index for Lupin was calculated for each day between June 1 and September 15 (107 days) inclusive, for each of the 49 years from 1957 to 2005. The first and last day of each year that the index was above zero defined the length of the insect season.

Using the index, we evaluated the eight indicators of insect intensity listed below to estimate the annual severity of insect harassment over the June to September sampling period:

1. Mean index for days that the index was > 0.
2. Number of days that the index was > 0.
3. Number of days that the index was > 0.75.

4. Number of days that the index was > 0 and those days were consecutive.
5. Number of days that the index was > 0.75 and those days were consecutive.
6. Frequency of groups of consecutive days that the index was > 0.
7. Number of days in the two longest groups of consecutive days that the index was > 0.
8. Length of insect season.

Because the sample period of 107 days was constant over years and weather data were available for each day, the actual number of days was used for indicators 2 to 5 rather than a percentage. A season with numerous consecutive days of high insect activity may create more harassment for caribou, as there would seldom be any respite. Similarly, the more periods of consecutive days and the longer those periods were, the more likely the harassment would be an important factor. Indicators 4 to 7 attempted to capture that effect.

Formatted: Justified

Mosquitoes and oestrids were considered separately as caribou react differently to them. The mean and 75% confidence intervals for each indicator were calculated for mosquitoes and oestrids. Values above the upper limit were given an indicator score of 3, those below the lower limit were scored as 1, and those within the limits were scored as 2. The indicator scores within each year were summed to create an annual score. This score could range from a maximum of 24 to a minimum of 8. The mean of the annual scores was determined and the 75% confidence interval calculated. Years with a score above the upper limit were rated as HIGH, those below the lower limit were LOW and the remaining years were rated as MEDIUM.

Statistical analyses:

We used the same approaches as in previous years (Gunn *et al.* 2005a). We estimated calf-cow ratios as the total number of calves divided by the total number of cows and yearling females, and we used bootstrap analysis to estimate variances. To detect trends in calf-cow ratios, we used weighted least squares regression (Kleinbaum and Kupper 1978).

Formatted: Heading 2, Indent: First line: 0"

Formatted: Font: Not Bold

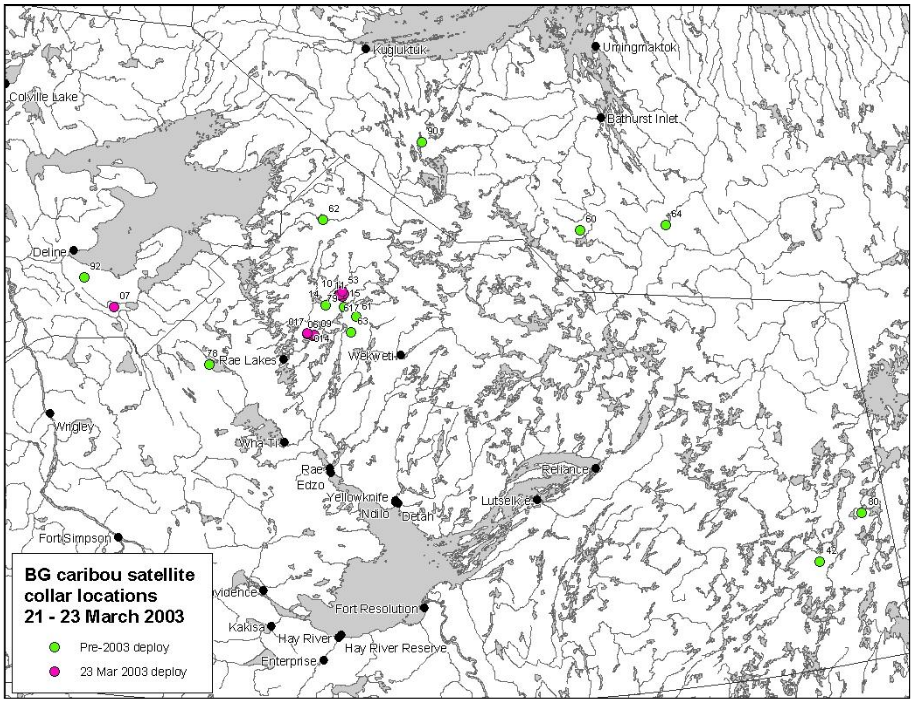
Formatted: Justified

RESULTS

Collaring (March 2003): The collaring of 10 cows in March 2003 was not preceded by fixed-wing reconnaissance flights. Instead, the capture crew flew to the vicinity of five of the eight existing satellite collars northwest of Wekweeti and deployed nine collars between 21 and 22 March 2003 (Figure 2,). There were two other 2001 and 2002 collared cows (62, and 90) that were beyond the range of the capture crew's helicopter. Also, those three Bathurst collared cows were wintering on ranges overlapping the known winter ranges of the Bluenose East herd (Nagy *et al*. in prep.).

In March 2003, we deployed a tenth collar (07) near cow 92 (collared in October 1998) south of Deline, although the area is usually considered Bluenose East winter range (R. Popko pers. comm.). The subsequent movement of collar 07 to the East Bluenose calving grounds in June 2003 and 2004 was not, then, unexpected. She migrated with the Bathurst cow wearing collar 92 until 17 May 2004; collared cow 92 continued northeast while 07 changed direction to the northwest. Unfortunately, collared cow 92 died (or the collar failed) before we could see if she returned (for the fifth year to the Bathurst calving ground).

Based on the subsequent locations in June 2003 of nine of the cows collared in March (one died in April 2003), three were identified as belonging to the Bluenose East herd (07, 53 and 14) and six were Bathurst cows. The following June 2004, cows 07, 53 and 14 again returned to the Bluenose East calving ground and the surviving five of the six Bathurst cows returned to the Bathurst herd's calving ground.



~~Figure 2~~

Figure 2 ~~. Locations for the pre-2003 collars and the 2003 collar deployments, 21-23 March 2003, NT and Nunavut.~~

Locations for the pre-2003 collars and the 2003 collar deployments, 21-23 March 2003, NT and Nunavut

Comment [MS2]: All your map figures should probably have scale bars and technically, should also have some kind of North arrow.

Formatted: Keep with next

Formatted: Caption

Formatted: Caption, Line spacing: single

Formatted: Justified

Collaring (October 2004): We flew a reconnaissance survey (7546 km) with a Husky aircraft between 6 and 17 October 2004 (Figure 3). The first flight on 6 October found the tail end of a large caribou movement southwest of Snap Lake and moving southwest. On 10 October, we found a large migration of caribou that approached the north end of Gordon Lake from the east. Most caribou passed north of Gordon Lake (14 October) to Reindeer Lake area (16 October). In the area of Reindeer Lake, we collared seven caribou (Figure 3, Appendix B). Subsequently, we saw the lead edge of the movement and thousands of caribou filing across Roundrock Lake (20 October). We previously reported on the caribou movements in a report on calf survival in October 2004 (Gunn *et al.* 2005a).

A smaller movement of caribou (low thousands) had turned south at the north end of Gordon Lake and followed the east shore south feeding heavily in the sedge areas along the shoreline and Cameron River. We collared two cows southeast of Gordon Lake from this movement.

Between 16 and ~~18 October~~18 October 2004, the caribou were collared either in grassy areas along rivers and lake edges or small muskegs. The larger lakes were mostly not frozen and, although smaller lakes were ice-covered, the snow cover on the ice was incomplete and only a few centimetres deep. The capture crew only pursued and caught caribou on the grassy areas. Air temperatures were -10 to –16°~~c~~C. The crew caught 12 caribou cows (1 yearling female captured and released). The chase times ~~averaged 1.3~~averaged 1.3 minutes (SD 0.5 range 1-2 min) and to minimise handling time, no samples were taken. Handling time averaged 13.0 min (SD 4.3 range 7-21 min) and the cows were fitted with Telonics ST20 model (3310) 850 grams. The collars download at 5 day intervals and all cows were alive 3 months post-capture.

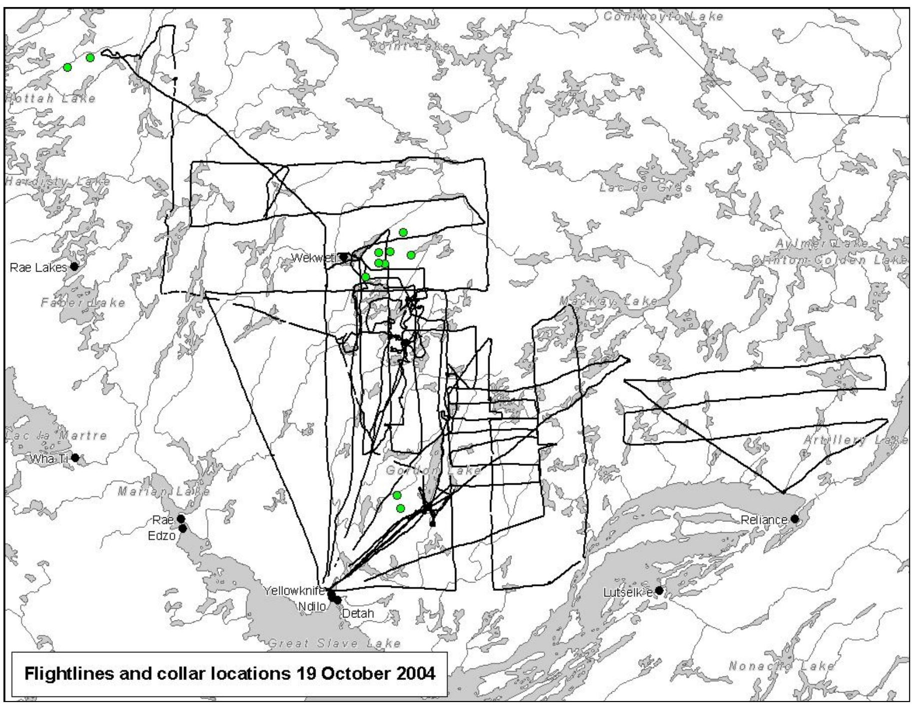


Figure ~~2~~3. ~~Flightlines~~Flight lines for aerial reconnaissance, 6-17 October 2004 and collaring locations, 19 October 2004, NT.

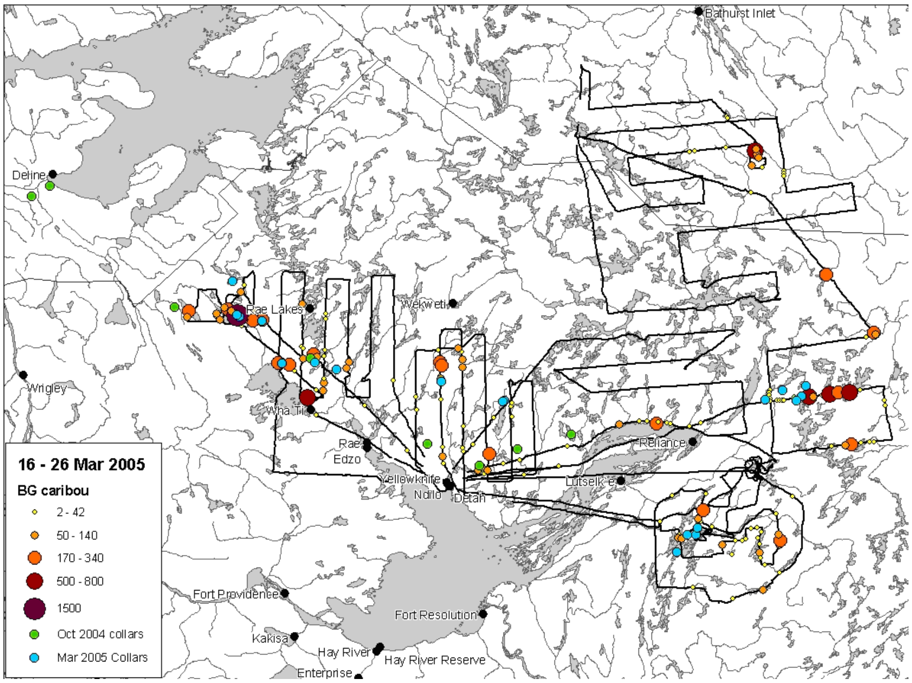
Formatted: Justified

We flew north of ~~Wekweti~~WekweetiWekweeti in the Husky fixed wing aircraft on 17 October 2004. We did not find tracks or caribou north of ~~Wekweti~~WekweetiWekweeti until we reached close to Hottah Lake. We extended the flight because, in October 2002, most collared caribou had moved west in early October along the north shore of Great Slave Lake, swung northwest passing north of Gordon Lake, and then crossed Roundrock Lake., which was almost identical to what we were seeing in 2004. Also in October 2002, two collared cows (92 and 78), that had calved on the Bathurst herd's calving grounds in 2001 and 2002, were north of ~~Wekweti~~WekweetiWekweeti and were separate from the other collared Bathurst caribou, giving us more reason to expect to find Bathurst herd caribou north of ~~Wekweti~~WekweetiWekweeti.

When we flew north of ~~Wekweti~~WekweetiWekweeti on 17 October 2004, we found a relatively narrow (<10 km) band of heavy caribou tracks and trails aligned east from Wopmay Lake and saw caribou migrating west in lines of 10s to 50s. We returned to the area on 18 October 2004 and collared two cows (05 and 99). The two collared cows continued to migrate west and by early November 2004 were south of Deline. Subsequently, those cows collared north of ~~Wekweti~~WekweetiWekweeti (05 and 99) migrated north to the Bluenose East herd's calving grounds in June 2005.

By June 2005, of the nine cows collared south of ~~Wekweti~~WekweetiWekweeti in October 2004, three died during the winter and six migrated to the Bathurst herd's calving grounds.

Collaring (March 2005): We flew relatively regular transects (10 878 km) spaced at approximately 25-km intervals during a reconnaissance survey 16-26 March 2005 in a Helio-Courier aircraft (Figure 4, Appendix B). The Sahtu Regional staff (Northwest Territories Department of Environment and Natural Resources) covered the area west of Lac La Martre (R. Popko pers. comm.). They reported large numbers of caribou near Lac Grandin, which was also the location of a collared Bathurst herd cow 06 (collared October 2004). We extended the reconnaissance flight (Figure 4) to Lac Grandin to gauge the relative caribou densities.



~~Figure~~ Figure 34. ~~Flightlines~~Flight lines and caribou observations, 16-26 March 2005, 2004 satellite collar locations on 15 March 2005, and collaring locations during March 2005, NT.

Formatted: Justified

The caribou were distributed from Lac Grandin (the heaviest concentrations of caribou, trails and feeding craters) southeast to south of Rae Lakes, and then relatively low densities until east of Yellowknife. East of Yellowknife, we saw on and off-transect caribou numbering in the low thousands extending north and south of Gordon Lake. There were smaller concentrations of caribou at the north end of Gordon Lake and toward Upper Carp Lake. Along the north shore of McLeod Bay, groups of caribou were filing west and trails indicated that they had moved from at least Kluzial Island. The island was heavily tracked and cratered.

Comment [MS3]: not identified on figure

We found caribou in association with all the October 2004 collars (Figure 4). We also found a smaller concentration caribou between the north end of Gordon Lake and Upper Carp Lake that did not have a satellite-collared cow in the area.

We did not find caribou east of Contwoyto Lake, near Pellat Lake or Alymer Lake, which were areas where collared caribou from the Ahiak herd had previously wintered. However, we found a few 100 caribou on the Back River and then thousands of caribou east of Artillery Lake. We found a second concentration of caribou in the Nonacho Lake area and caribou trails and small groups of caribou moving northeast from Nonacho Lake connected the two areas.

The fixed-wing aircraft was also used as a spotter plane and carried extra fuel to support the capture and collaring (22-26 March). The snow was deep and caribou were restricted to trails or breaking through the snow. On the barrens, caribou were not breaking through the snow. Air temperatures were -1 to –27°Ce. The crew caught 20 caribou cows. The chase times ~~averaged 1.5~~averaged 1.5 minutes (SD 0.6 range 1-3 min) and to minimise handling time, no samples were taken. Handling time averaged 6.0 min (SD 2.1 range 3-10 min) and the cows were fitted with Telonics ST20 model (3310) 850 grams. The collars download at 5 day intervals and all cows were alive ~~14 days~~14 days post-capture.

We added four satellite collars to the concentration of caribou in the Lac Grandin area and three collars to south of Rae Lakes. Three cows were collared between north Gordon and Upper Carp lakes. Of those 10 collared cows, three died (191 by 30 April; 198 by 20 May and 95 by 4 June). The remaining seven migrated to the Bathurst calving ground. Cow 198 was migrating northeast from the Lac Grandin area where she had been collared and we suspect that she was migrating with cows from the Bluenose East herd when she died.

We collared five cows in the area of Nonacho Lake and five cows immediately east of Artillery Lake. Based on the June 2005 distribution of the collared cows, we conclude that we collared eight cows from the Ahiak herd. Two of the five cows (86 and 88) collared at Nonacho Lake migrated to the Bathurst herd's calving grounds west of Bathurst Inlet. One cow (88) crossed the East Arm of Great Slave Lake and, by 1 June 2005, she was the first collared cow to reach the Hood River (calving ground). The nine other cows collared at Nonacho Lake and Artillery Lake migrated northeast and were all east of Bathurst Inlet by 6 June 2005 and were scattered between Bathurst Inlet and east to the Back River. However, one cow (86) abruptly turned west and crossed Bathurst Inlet to the Hood River by 11 June.

Calf survival (April 2005): We recorded the sex-age classes at 175 locations between 31 March and 6 April 2005 (Figure 5, Table 1, Appendix C). The mean calf-cow ratio was 14 calves/100 cows (± 0.01 standard error (SE)). We saw 25 wolves and 47 wolf kills (Appendix C). The sighting rate of wolves was 1 wolf/1 hour flying time (Williams and Fournier 1996).

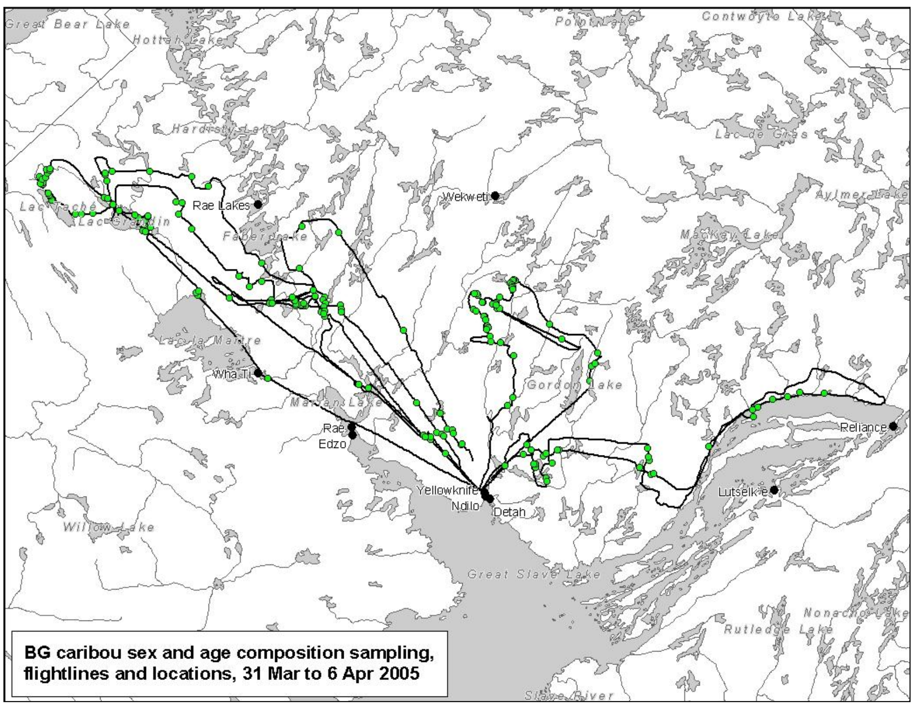


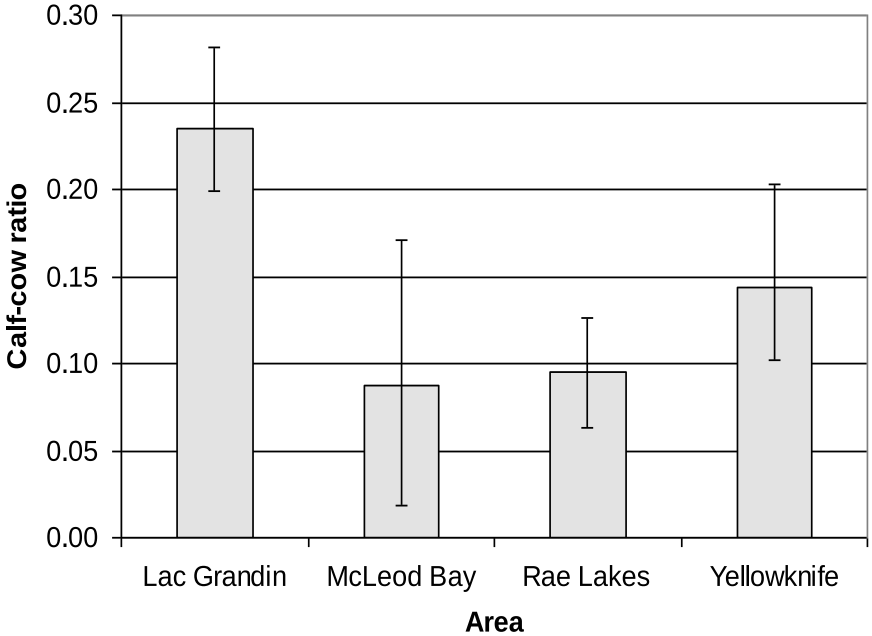
Figure Figure 45. FlightlinesFlight lines and locations for sex and age composition counts in the Bathurst caribou herd, March/April 2005, NT.

Tabl

~~e–~~Table 1. Dates, sampling effort and wolf sightings for monitoring calf survival in the caribou Bathurst herd, NT, 2000-2004 (from Gunn et al. 2005a) and 2005.

Year	Date	Search km	Hours flown	Sampling locations	Number caribou	Wolf kills	Wolves
2001	6–10 April	3831	24	240	11351	17	1, 4
2002	22–26 March	2690	17	115	7512	1	4
2003	8–14 April	3623	23	123	9571	15	6,7,1,2,7
2004	25–30 March	3862	24	247	8488	22	1,1,1,1,2,3,3, 5
2005	31 March – 6 April	3759	24	175	9660	47	2, 2, 1, 5, 3, 3, 2, 7

Based on the reconnaissance survey, we spread our sampling locations across the distribution of caribou from Lac Grandin to the north shore of Great Slave Lake. We did not include the caribou east of Artillery Lake or southeast at Nonacho Lake as we expected those caribou to be from the Ahiak herd. We found four areas of concentration separated by relatively few caribou or only scattered tracks. The calf-cow ratios differed between those four areas (Figure 6). Comparison of the calf-cow ratio estimates (with percentile-based bootstrapped confidence intervals) suggests the calf-cow ratio in the Lac Grandin area is higher than other areas.



~~Figure~~ Figure 56. Estimated calf-cow ratios in four areas sampled across the winter range of the Bathurst herd, March/April 2005, NT. Bars represent percentile-based bootstrapped confidence intervals.

Pregnancy rates June 2004:

Formatted: Font: Not Bold

Formatted: Heading 2, Indent: First line: 0"

We classified the antler status and sex-age class of 7281 caribou in 139 sampling sites between 23 and 26 June 2004 (Appendix D). The overall ratio of calves to total cows was 0.54 and we counted a total of 4444 cows. The ratio of calves to breeding cows was 0.57.

Formatted: Justified

Most cows (90%) did not have either hard antlers or much new growth. Cows with velvet buds (197) were 4% of total cows seen and, together with cows with hard antlers (205), cows with no antlers (3729), and cows with no antlers and no distended udder (60), breeding cows totalled 4191 cows. This suggests that the percentage of breeding cows was notably high or we were missing non-breeding cows. We recorded 6% young and prime bulls. Cows with hard antlers were 5% of all cows, suggesting that some calves had only been born a few days before (which is considered 1-2 weeks later than normal) and we noticed some conspicuously smaller than average calves.

Caribou Condition:

Formatted: Font: Not Bold

Formatted: Heading 2

Between 29 January 2005 and 6 April 2005, Earl and Trevor Evans harvested 179 barren ground caribou, 160 females and 19 males (Appendix E). The harvest included 16 caribou possibly from the Beverly herd at Abitall Lake, approximately 240 kilometres northeast of Fort Smith, NT. The other 163 caribou harvested were from the Bathurst herd northeast of Yellowknife in the vicinity of Gordon Lake (Table 2).

~~Table~~ Table 2. Age and sex of caribou collected on range of Beverly and Bathurst herds, March 2005.

	Beverly herd range	Bathurst herd range			
		West	Central		
	Abitall Lake	Sarah Lake	Hidden Lake	Sparrow Lake	Gordon Lake
Male	6	6	5	0	2
Female	10	87	36	18	9
Adult	15	46	40	15	11
Yearling	0	0	1	0	0
Calf	1	0	0	0	0
Unknown	0	47	0	3	0

Formatted: Justified

Formatted: Justified

Formatted: Justified

Formatted: Justified

Formatted: Justified

Formatted: Justified

Formatted: Justified

Formatted: Justified

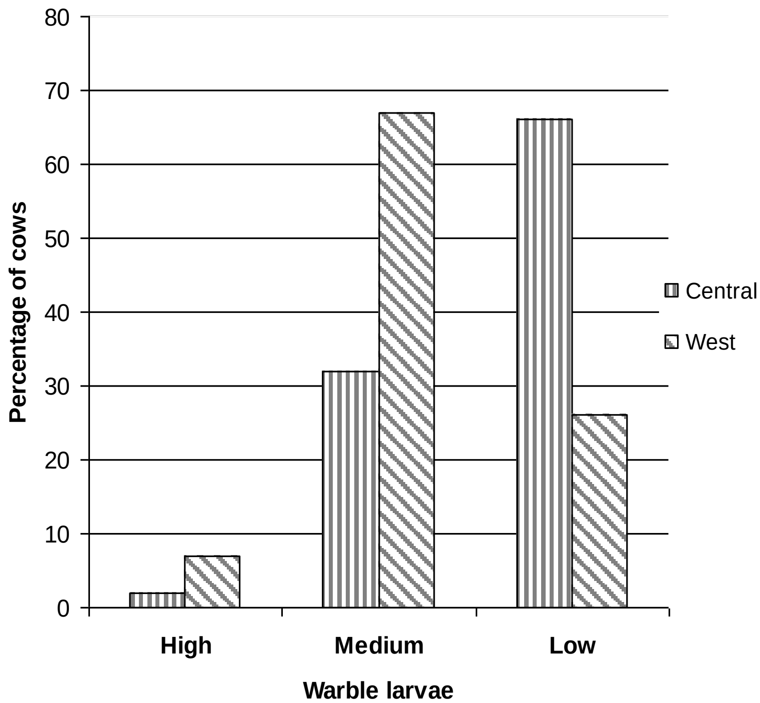
The hunters rated the overall condition of the caribou and measured back fat depth (Appendix E). For the caribou cows from the Bathurst herd, we grouped the hunter ratings into two classes: high (excellent to good) and low (fair to very poor). Mean back fat in the caribou whose condition was rated as high was 11.0 ± 0.66 mm compared to 1.9 ± 0.18 mm in the caribou whose condition was rated as Low.

On the Bathurst range, the overall pregnancy rate was 63% for 150 cows harvested. Within the overall Bathurst sample, the pregnancy rate was 52% (87 cows) on the western part of the Bathurst range (Sarah Lake near Rae Lakes), compared to 79% (63 cows) on the central winter range (Gordon, Sparrow, and Hidden Lakes).

The percentage of cows rated as being in good to excellent condition was similar between the western and central areas (40-43%) and mean back fat was similar between the west (6.4 ± 0.86 mm (SE)) and central (5.3 ± 0.53 mm) parts of the winter range for cows harvested in late March and April. The 13 males were in fair to very poor condition from both sampling areas.

The comparisons of back fat and condition had to be for the same sampling period, as the thickness of back fat did change during mid and late winter. Back fat was less for cows harvested on the central ranges in January (2.7 ± 1.24 mm, n=29 compared to late March-early April (8.0 ± 1.19 mm). Within the central range, caribou cows harvested at Hidden Lake in late January had significantly less back fat (2.9 ± 1.27 mm, n=18) than in early April (10.3 ± 1.76, n=23). However, cows harvested on Gordon Lake in January were not significantly thinner based on their back fat (2.3 ± 0.92 mm, n=11) than cows harvested in early April on Sparrow Lake (5.0 ± 1.27 mm, n=18; Mann-Whitney rank sum test T=141, P=0.281).

All the caribou were recorded as having warbles. The hunters had rated the degree of warble infestation as high (>60 warbles), medium (30-60) or low (<30). Of the relatively few males harvested, 46% were classified as having high infestations of warbles and 46% as having medium infestations. The female caribou had 5% individuals in the high category of warbles, 52% in the medium and 43% in the low category. Females from the central area tended to have fewer warbles (Figure 7).



~~Figure~~ Figure 6~~7~~. Categories of warble larvae (high, medium, low) found on caribou cows harvested on the central and western parts of the Bathurst herd's winter range January-April 2005.

Formatted: Justified

Body weight and kidney fat were measured only for the caribou from the Beverly herd. There was no difference between sexes (t=4.3, p>0.97) and the mean kidney fat weight was 71.1 g ± 13.6 (SE). From that same small sample of animals, the mean body weight was 82.7 kg ± 3.9 (SE); there was no difference between the sexes (t=-0.487, p>0.5). Of the 10 females, eight were pregnant.

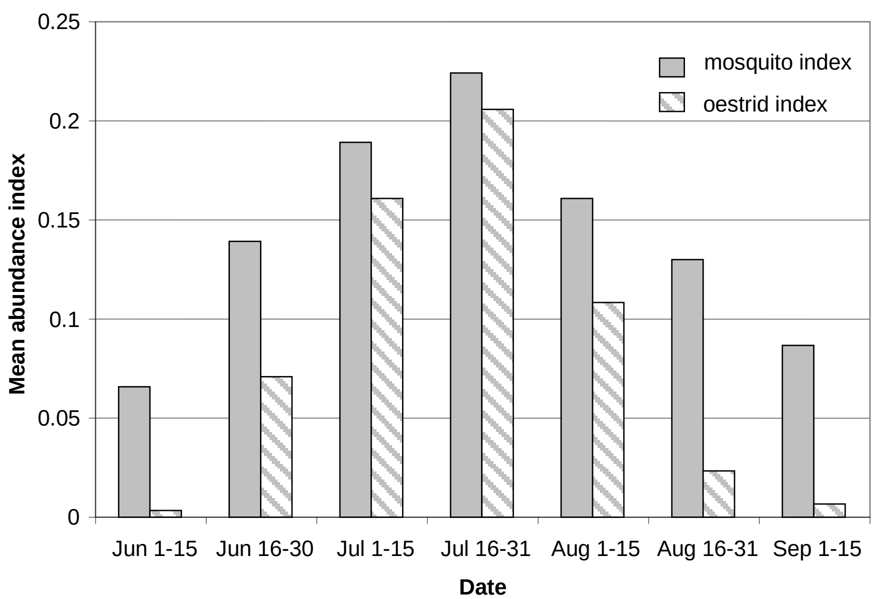
Insect harassment:

Formatted: Font: Not Bold

The annual mosquito season (99.7 days ± 4.2 (SE), n=10) was significantly longer (t=-8.46, p< 0.001) than the oestrid season (66.8 days ± 3.6 (SE), n=10). Within the June to September sample period 1996-2005, 6 June 1998 was the earliest day that the oestrid index was greater than zero and 15 Sept 1996 was the latest. The earliest mosquito index over zero occurred on 1 June 1999 and the latest on 15 Sept 2001. It is probable that a mosquito index over zero occurred before 1 June or after 15 September, however, those indices tended to be comparatively infrequent and low (Figure 8).

Formatted: Heading 2, Indent: First line: 0"

Formatted: Justified



~~Figure~~ Figure 78. Seasonal distribution of mosquito and oestrid abundance index for the years 1996 to 2005.

Longer-term weather data (1957-2005) were only available for Contwoyto Lake, which is more typically early post-calving range. However, assuming that, overall, the weather is relatively representative of the annual conditions over the region, the annual trend for oestrids and mosquitoes has been toward an increase in the number of years with a high index (Figures 9 and 10).

Formatted: Justified

The late 1970s and early 1980s marked the beginning of the global temperature increase (Jones and Moberg 2003). Based on this, the period of 1957 to 2005 was divided into two groups: 1957-1981 and 1982-2005 (Tables 3 and 4). The number of "High" oestrid ratings was significantly greater in the 1982-2005 grouping than during the earlier time period (chi^2 =18.679, df=1, p<0.01). Although the number of "High" mosquito ratings was greater in the 1982-2005 period, the difference was not significant (chi^2 =3.57, df=1, p=0.059). However, the means of the mosquito intensity scores for the two groups (1957-1981: mean=13.9, n=25; 1982-2005: mean=17.8, n=24) were different (t=2.953, df=47, p=0.005).

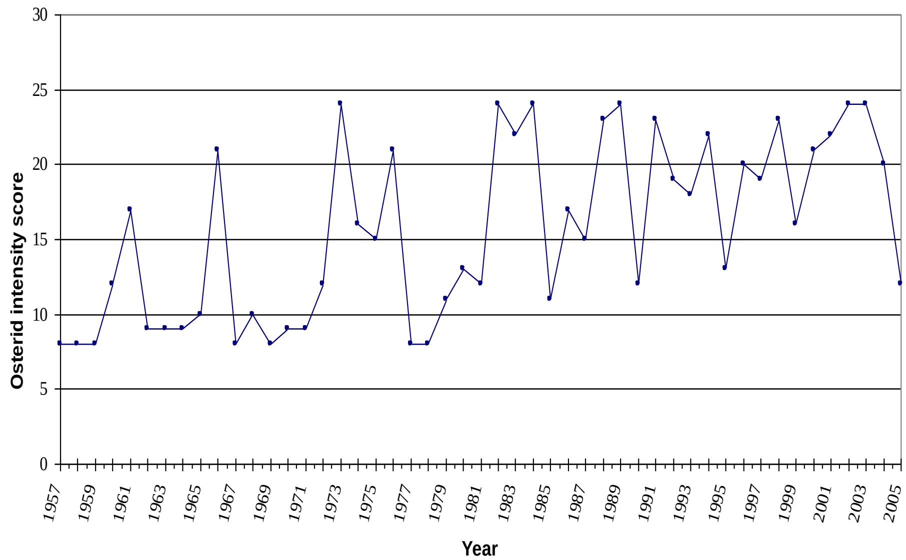


Figure- 89. Annual oestrid intensity scores for the area around Lupin, NT based on an index derived from temperature and wind speed records from 1957 to 2005.

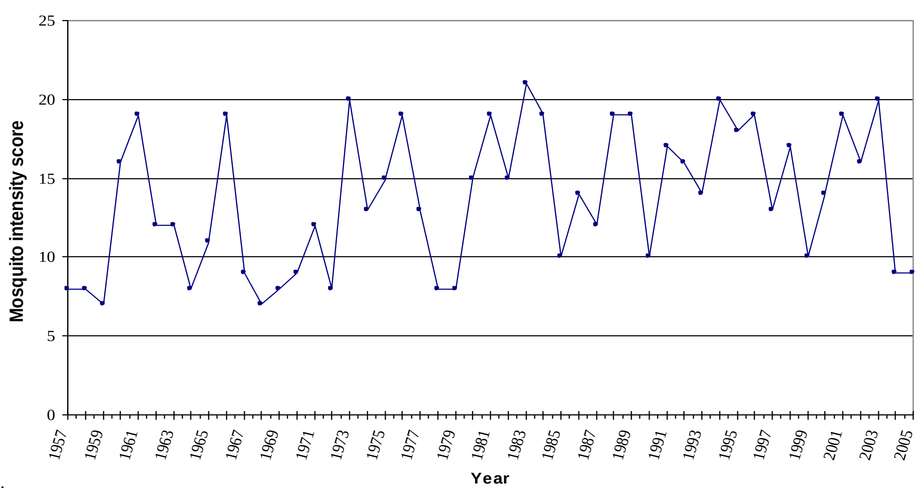


Figure_ -910. Annual mosquito intensity scores for the area around Lupin, NT based on an index derived from temperature and wind speed records from 1957 to 2005.

~~Table~~ Table 3. Distribution of oestrid intensity ratings before and after 1982.

Time period	High	Medium	Low	Total
1957 to 1981	4	2	19	25
1982 to 2005	18	2	4	24
Total	22	4	23	49

~~Table~~ Table 4. Distribution of mosquito intensity ratings before and after 1982.

Time period	High	Medium	Low	Total
1957 to 1981	8	1	16	25
1982 to 2005	14	1	9	24
Total	22	2	25	49

Formatted: Justified

Formatted: Justified

Formatted: Justified

Formatted: Justified

Formatted: Justified

Formatted: Justified

Formatted: Justified

Formatted: Justified

Formatted: Justified

DISCUSSION

Formatted: Justified

We replaced the satellite collars on caribou in late winter when conditions were best for capture and handling (cool temperatures and snow-covered lakes). However, overlap in the winter ranges of neighbouring herds meant that we inadvertently collared cows from neighbouring herds when the caribou from one herd used the same area as another herd in any one year. Overlap in the winter ranges of neighbouring herds has been known previously at the regional scale based on hunters returning ear-tags for the Beverly and Qamanirjuaq herds (Heard 1984). Comparisons of the locations of satellite-collared cows revealed that, on their winter ranges, caribou in the same area (within kilometres of each other) could be from different herds.

Overlapping winter ranges has meant that, since 2001 during late winter, we have collared 40 cows on the winter ranges of the Bathurst herd and 12 have migrated to and shown fidelity to calving grounds other than the Bathurst herd's calving ground (nine to the Ahiak Herd, one to the Beverly Herd and two to the Bluenose East Herd). And of the collars intended for other herds in March 2005, five cows migrated to the Bathurst herd's calving grounds in 2005.

Using satellite collars on cows has added to our understanding of the extent and annual variability in overlapping winter ranges. The advantage of having individually marked cows is that we also know where they calved and rutted. Despite overlap on the winter range, we have found that collared cows annually return to their same calving grounds and also have fidelity to post-calving and summer ranges. Between 1996 and 2005, we have not found collared cows during calving to be on one traditional calving ground in any one year and then a different calving ground in other years (this report, Gunn and D'Hont 2002, Nagy *et al*. in prep. for the Bluenose West, Bluenose East and Cape Bathurst herds).

Understanding the basis for how caribou are assigned to a particular herd is key to monitoring the changes in caribou numbers and the effects of harvesting. Satellite telemetry has reinforced the earlier definition of caribou herds based on the return of the cows to their traditional calving grounds (Thomas 1969, Bergerud 1974). Satellite telemetry has also justified the use of either calving ground or post-calving aggregation photography to census herd size based on fidelity to calving and post-calving areas. However, satellite telemetry is revealing more overlap in winter distribution, which affects how harvests are allocated to individual herds.

In March 2003, based on the movements of the satellite-collared cows, we found that the winter range of the East Bluenose caribou extended further east and south to north of ~~Wekweti~~WekweetiWekweeti, overlapping with Bathurst caribou winter range. Our original supposition that the area north of ~~Wekweti~~WekweetiWekweeti was most likely the Bathurst herd's winter range and not an overlap area was based on winter 1996/97, 1998/99 and 2001/02 satellite telemetry when collared caribou wintered west and north of ~~Wekweti~~WekweetiWekweeti and then subsequently migrated to the Bathurst calving grounds. The overlap raised the possibility that hunters from ~~Wekweti~~WekweetiWekweeti could be harvesting East Bluenose caribou in some years. The overlap between the winter ranges of the East Bluenose and Bathurst caribou also extended west to Deline in winter 2002/03 based on the movements of collared cow 92.

Although overlap in winter ranges is a characteristic of the winter distribution of neighbouring herds, the extent of the overlap varies annually as does the annual use of the winter ranges. Analyses using telemetry and weather data reveal how the annual variation in the winter range partly reflects snowfall early in winter (McNeil *et al.* 2005). Unusual weather also can influence caribou distribution. For example, freezing rains and unusually heavy snowfall resulting in deeper snow along the western Arctic coast during fall 2003 may have caused caribou of the Bluenose West and Cape Bathurst herds to winter south of their normal wintering ranges (D'Hont *et al.* in prep.).

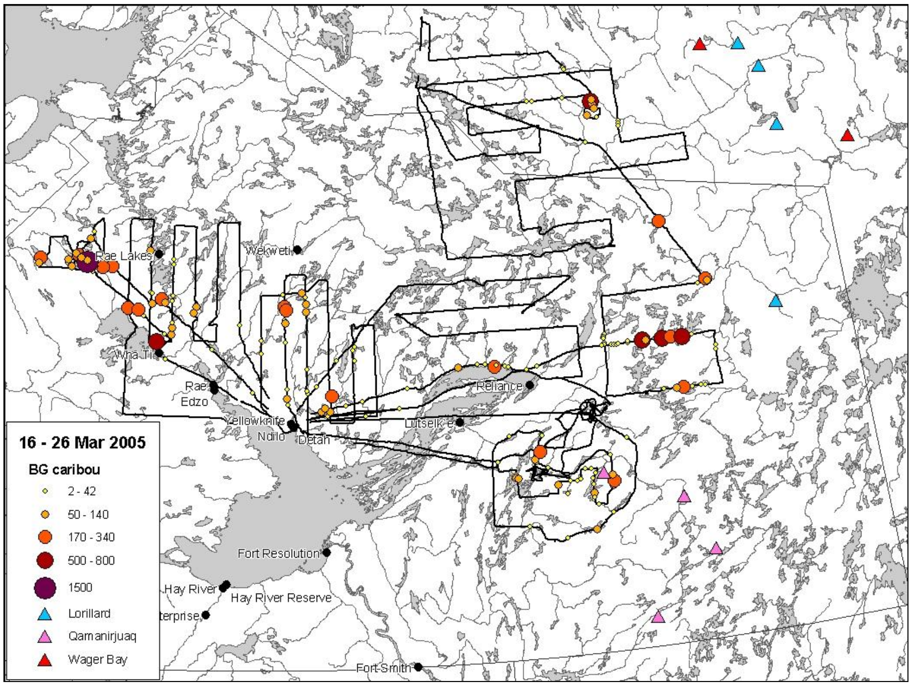


Figure 1011. Locations of collared caribou from the Qamanirjuaq, Wager Bay and Lorillard River herds and caribou sightings during reconnaissance flights March 2005 (data from Mitch Campbell, Government of Nunavut).

Formatted: Justified

Along the coast of Hudson Bay in November 2004, there was freezing rain and heavy snowfall (M. Campbell pers. comm.) and satellite-collared caribou from the Qamanirjuaq, Wager Bay and Lorillard River herds extended their distribution west and overlapped the known winter ranges of the Bathurst, Ahiak and Beverly herds (Figure 11). This extension of winter range for cows from the Qamanirjuaq, Wager Bay and Lorillard River herds (based on satellite collars) was a concern to us in deciding where to collar caribou for the Ahiak herd. We had decided to collar the caribou in the area of Nonacho Lake and Artillery Lake as caribou collared from the Ahiak and Bathurst herds had previously used both areas.

The use of the locations from the satellite-collared caribou cows of the Bathurst herd for monitoring at the diamond mines is increasing. We are also

~~Figure 12. Locations of collared caribou from the Qamanirjuaq, Wager Bay and Lorillard River herds and caribou sightings during reconnaissance flights March 2005 (data from Mitch Campbell, Government of Nunavut).~~

Formatted: Justified, Indent: First line: 0.5"

realizing that the ability to measure caribou responses to the diamond mines is limited by the numbered of collared caribou (Boulanger *et al.* 2004). The objective of collaring cows in March 2003, October 2004 and March 2005 was to maintain a sample size of 10-20 satellite-collared cows in the Bathurst herd. An additional objective in 2005 was to have 10 satellite-collared cows in the Ahiak herd (also 10 cows in each of the Bluenose East, Bluenose West and Cape Bathurst herds, which are reported separately; J. Nagy pers. comm.). By June 2005, we had 15 satellite-collared cows in the Bathurst herd, eight in the Ahiak and nine in the Bluenose East herd.

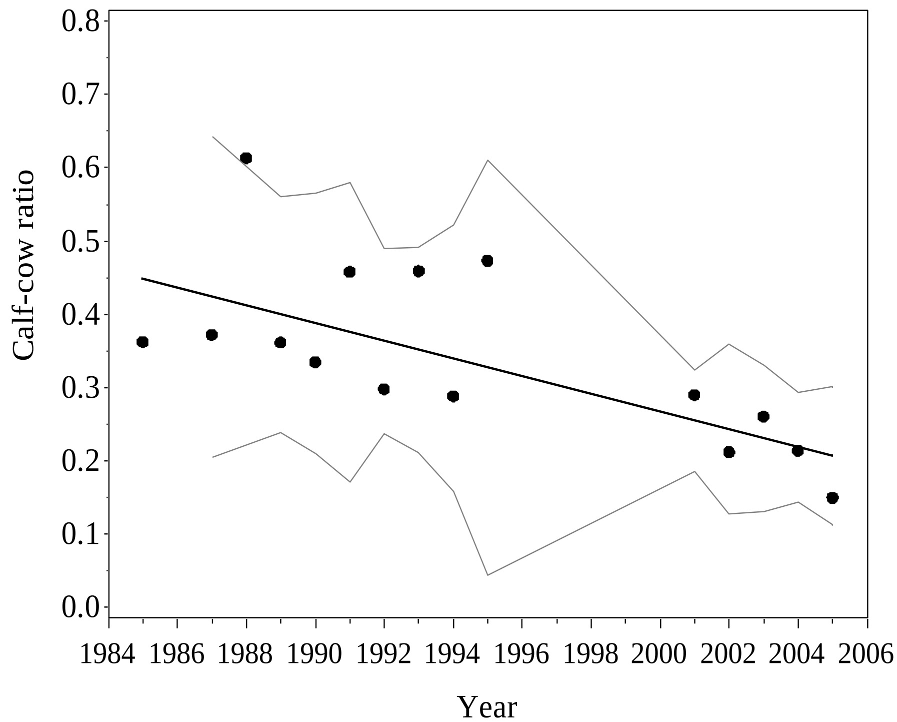
Formatted: Justified

The sample size of collared caribou for each herd is reduced by the death of the cow, failure of the collar, or the collared cow belonging to another herd.

Between October 2004 and June 2005, none of the 30 collars deployed had prematurely failed. Between October 2004 and March 2005, one cow was shot and two other collared caribou died. Of 20 collars deployed on Bathurst and Ahiak cows in March 2005, three collared cows had died by June 2005 (30 April, 20 May and 4 June). The average annual survival rate of satellite-collared cows between 1996 and 2003 was 0.82 (CI= 0.74 to 0.878) for the Bathurst herd (Boulanger and Gunn unpubl. data).

The calf-cow ratio in March 2005 was low (14 calves:100: 100 cows) which is consistent with the 18 calves:100: 100 cows recorded in October 2004. The trend in mean late winter calf survival is a significant decline (p=0.0003) since 1985 (Figure 12) and the calf-cow ratios have declined by almost half in 2001-2004 compared with 1985-1996.

On the 2004/05 winter range, pregnancy rates were relatively low (63%; 150 cows sampled) and were 52% and 79% on the western (Lac Grandin) and central (Gordon Lake) area of the winter range, respectively. The caribou cows in the Lac Grandin area, with the lower pregnancy rate, had relatively more calves (higher calf-cow ratio), and although in similar condition (based on fat reserves) to the cows in the central area, the intensity of warble infections was higher.



~~Figure 13.~~

Figure 11 Calf-cow ratios and their confidence intervals regressed against year for the Bathurst herd 1985-2005.

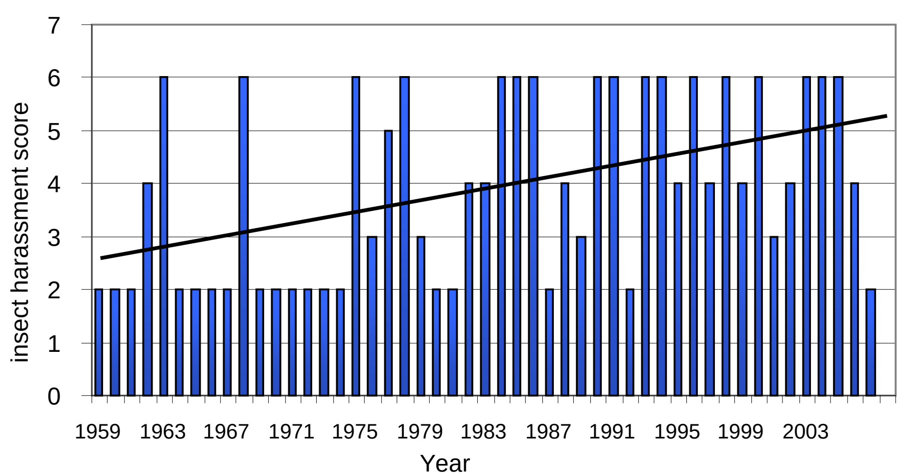
Formatted: Keep with next

Formatted: Caption, Justified

These differences between the two areas of the winter range indicate the need to consider regional differences in designing caribou health and condition monitoring studies.

The relatively low pregnancy rate is consistent with the low calf survival seen in October 2004 and April 2005. One interpretation is that cows were in poor shape during 2004 post calving and summer, therefore, calves were prematurely weaned (and so did not survive) and cows may not have made up sufficient condition in late summer to conceive during the rut. Summer 2004 was the fifth consecutive summer with a high index for warble and nosebot fly harassment and three years of high mosquito harassment.

Brotton and Wall (1997) had previously detected an increase in summer temperatures on the ranges of the Bathurst herd using monthly temperature data 1951-1980. They suggested that insect harassment would increase. We used more recent annual temperatures from the central barrens and our analysis suggested that the potential increase intensified after the early 1980s as the trend for the index of severity of warble fly and mosquito abundance (Figure 13 and Appendix E) was toward greater number of years with greater severity.



~~Figure 14~~Figure 12 ~~.~~Trend line and annual scores for mosquito and oestrid fly harassment based on 1957-2005 weather records for Contwoyto Lake, NU.

Formatted: Justified

Formatted: Caption, Space Before: 0 pt, After: 0 pt

Formatted: Justified

The trend in the western and central Canadian Arctic is toward warmer summers (Jones and Moberg 2003, Arctic Climate Impact Assessment 2005). It is possible that the trend to warmer temperatures may increase the effects of insect harassment. During other periods of warming such as followed the retreat of glaciers, caribou shifted their distribution north following the cooler temperatures. Or in some cases, when re-distribution was not possible such as in ~~southwestern~~south western France, reindeer disappeared as the Pleistocene ended and summer temperatures increased (Grayson and Delpech 2005).

We used Russell *et al.*'s (1993) index using temperature and wind speed which are strong predictors for oestrid flies. The index ~~does~~does not include cloud cover, although cloud reduces the flying ~~of warbles~~of warbles Mörschel, and Klein (1997). Weladji *et al.* (2003) did include cloud cover in their indices and they recorded that reindeer calf weight declined as the index to insect harassment increased. Hagemoen and Reimers (2002) also included cloud cover in their index to insect harassment. They concluded that reindeer responded strongly to warble fly harassment by reducing foraging and lying. They also concluded that mosquitoes had relatively little effect on reindeer behaviour. We suggest that a new index incorporating cloud cover should be applied for the Bathurst herd's summer ranges and correlated with observations of caribou foraging and lying behaviour.

Although measurements and field data exist for reindeer condition related to insect harassment, empirical data are need for the Bathurst herd. For example, Toupin *et al*. (1996) did not find that insect harassment was an explanation for poor summer condition of caribou from the George River herd although their study was during an unusually cool summer (Bergerud et al. 2008). Instead ~~the post~~the post-calving and summer ranges were considered to have been affected by the foraging behaviour of the caribou and it was reduced forage that resulted in the poor condition of the caribou. Although amounts of grasses, sedges, forbs and most shrubs were similar between grazed and non-grazed sites, caribou grazing had reduced lichens and dwarf birch (Manseau *et al*. 1996). However, reduced amounts of some forage species especially on the summer ranges are not clear-cut direct evidence for reduced condition, hence the need for empirical data on foraging behaviour and environmental conditions. Additionally, Bergerud et al. (2008) noted that although warble fly infection reduce caribou's physical condition, it cannot be determined whether the warble infection caused the poor condition or caribou in poor condition especially reduced protein reserves are more likely vulnerable to warble fly infection.

Another possible, but less likely, contribution to low calf survival, besides insect harassment and early weaning due to poor condition of cows, could have been that cows were calving late. The sex ratio in the Bathurst herd is skewed toward females (Gunn *et al*. 2005a) but not at an extreme level. If, as well as there being fewer males, the male age structure were skewed toward younger males, then we could expect that the younger males would breed cows on their second oestrus. This would cause calving to be delayed, which could reduce calf survival (Mysterud *et al*. 2002). In other deer, the harassment of females by young males is not trivial and influences female strategies and mate choice (Clutton-Brock *et al*. 1992). However, in caribou much remains to be determined about their breeding strategies and caution is needed about interpreting the effects of sex ratios. Mysterud *et al*. (2002) concluded, "We argue that the effects of males on population dynamics of ungulates are likely to be non-trivial, and that their potential effects should not be ignored. The mechanisms we discuss may be important – though much more research is required before we can demonstrate they are."

In conclusion, the collaring of caribou cows on the late winter ranges has added further support to the identification of caribou herds based on fidelity of cows to a particular calving ground. At the same time, the collaring is revealing the extent of overlapping winter distributions. Calf recruitment in 2005 was low mostly because calf survival had been poor during summer 2004, which was the fifth consecutive year with a severe rating for warble fly harassment. Also during summer and/or fall 2004, cow condition was likely relatively poor as late winter 2005 pregnancy rates were lower than average. Pregnancy rates are likely to rebound in 2006 as those cows which were not pregnant in 2005 will be in improved physical condition. If the lower than average pregnancy rate and low calf survival persist, the Bathurst herd is unlikely to reverse its current decline in abundance.

ACKNOWLEDGEMENTS

David Abernethy and Morris Martin helped during the classification surveys. We also thank Dave Olsen (Air Tindi) and Perry Linton (Northwright Air Services) who were both especially helpful while flying the fixed-wing reconnaissance. Great Slave Helicopters Ltd provided the safe flying for the net-gunning and we thank pilots Guy Henry and Rob Carroll. We appreciate the care and professionalism of the capture crews: Bernie Goski; Glen Keddie; Gord Carl; Hugo Knametofolow. We enjoyed Dave and Christin Olsen's hospitality at the Hoarfrost River. John Lee undertook the application of the insect harassment index and compiled the observation collected by Earl and Trevor Evans. Earl and ~~Trevor had~~Trevor had shared their observations and information on the caribou that they harvested for the community of Fort Smith. Mika Sutherland patiently and helpfully edited the report.

Formatted: Justified

PERSONAL COMMUNICATIONS

Campbell, Mitch, Wildlife Biologist, Wildlife Management, Nunavut Department of Environment, Arviat, NU.

Popko, Richard, Wildlife Technician, Northwest Territories Department of Environment and Natural Resources, Norman Wells, NT.

Nagy, John, Senior Research Biologist, Northwest Territories Department of Environment and Natural Resources, Inuvik, NT.

Formatted: Justified

Formatted: Justified, Indent: Left: 0.5"

Formatted: Justified

LITERATURE CITED

Alaska Department of Fish and Game. 2001. Caribou management report of survey-inventory activities 1July 1998-30 June 2000. C. Healy, editor. Project 3.0. Juneau, Alaska.

Arctic Climate Impact Assessment. 2005. Arctic Climate Impact Assessment. Cambridge University Press. 1042 pp.

Bathurst Caribou Management Planning Committee. 2004. A management plan for the Bathurst caribou herd. Yellowknife, NT. 51 pp. Copies available from Bathurst Caribou Management Planning Committee Secretariat, Box 1320, Yellowknife, NT, X1A 3S8.

Bergerud, A.T. 1974. The role of the environment in the aggregation, movement and disturbance behaviour of caribou. Pages 552-584 in Geist, V. and F. Walther (eds). The behaviour of ungulates and its relation to management. IUCN Publ. New series 24(2).

Bergerud, A. T., S. N. Luttich and L. Camps. 2008. The return of the caribou to Ungava.McGill-Queen's University Press, Montreal, Quebec. 586pp.

Brotton, J. and G. Wall. 1997. Climate change and the Bathurst caribou herd in the Northwest Territories, Canada. Climate Change 35:35-52.

Boulanger, J., K. Poole, B. Fournier, J. Wierzchowski, T. Gaines and A. Gunn. 2004. Assessment of Bathurst caribou movements and distribution in the Slave Geological Province. Northwest Territories Department of Resources, Wildlife and Economic Development Manuscript Report No. 158. 113 pp.

Clutton-Brock, T.H., O.F. Price and A.D.C MacColl. 1992. Mate retention, harassment, and the evolution of ungulate leks. Behavioral Ecology 3: 234-242.

D'Hont, A., A. Gunn, J. Nagy, R. Popko and A. Veitch. In prep. Barren-ground caribou distribution in late winter 2004, western NWT. Northwest Territories Department of Environment and Natural Resources Manuscript Report.

Grayson, D.K. and F. Delpech. 2005. Pleistocene reindeer and global warming. Conservation Biology 19:557.

Formatted: Justified

Griffith, B., D.C. Douglas, N.E. Walsh, D.D. Young, T.R. McCabe, D.E. Russell, R.G. White, R.D. Cameron and K.R. Whitten. 2002. The Porcupine caribou herd. Pages 8-37 in Douglas, D.C., P.E. Reynolds and E.B. Rhode (eds). Arctic Refuge coastal plain terrestrial wildlife research summaries, USGS Biological Science Report, USGS/BRD/BSR-2002-0001.

Gunn, A., J. Boulanger and J. Williams. 2005a. Calf survival and fall sex ratios in the Bathurst herd of barren-ground caribou 2000-2004. Northwest Territories Department of Resources, Wildlife and Economic Development Manuscript Report No. 163. 89pp.

Gunn, A, and A. D'Hont. 2002. Extent of calving for the Bathurst and Ahiak caribou herds, June 2002. Northwest Territories Department of Resources, Wildlife and Economic Development Manuscript Report No. 149. 35pp.

Gunn, A., J. Dragon and J. Boulanger. 2001. Seasonal movements of satellite-collared caribou from the Bathurst herd. Final report to the West Kitikmeot Slave Study Society, Yellowknife, NT. 80pp.

Gunn, A., J. Nishi , J. Boulanger and J. Williams. 2005b. Numbers of breeding cows in the Bathurst herd of barren-ground caribou, June 2003. Northwest Territories Department of Resources, Wildlife and Economic Development Manuscript Report No. 164. 75pp.

Hagemoen, R.I.M. and E. Reimers. 2002. Reindeer summer activity pattern in relation to weather insect harassment. Journal of Animal Ecology 71:883-892.

Heard, D.C. 1984. Hunting patterns and the distribution of the Beverly, Bathurst and Kaminuriak caribou herds based on the returns of tags by hunters. Northwest Territories Department of Renewable Resources File Report No. 37. 49 pp.

Jones, P.D. and A. Moberg. 2003. Hemispheric and large scale surface air temperature variations: an extensive revision and update to 2001. Journal of Climate 16:206-223.

Kleinbaum, D.G. and L.L. Kupper. 1978. Applied regression analysis and other multivariable methods. Belmont, California: Wadsworth Inc.

Formatted: Justified

Lyver, P.O'B. and A. Gunn. 2004. Calibration of hunters' impressions with female caribou body condition indices to predict probability of pregnancy. Arctic 57:233-241.

Manseau, M., J. Huot and M. Crête. 1996. Effects of summer grazing by caribou on composition and productivity of vegetation: community and landscape level. Journal of Ecology 84:503-513.

McNeil, P., D.E. Russell, B. Griffith, A. Gunn and G.P. Kofinas. 2005. Where the wild things are: seasonal variation in caribou movements in relation to climate change. Rangifer Special Issue 16: 51–63.

Mörschel, F.M. and D.R. Klein. 1997. Effects of weather and parasitic insects on behaviour and group dynamics of caribou of the Delta Herd, Alaska. Canadian Journal of Zoology 75:1659-1670.

Mysterud, A., T. Coulson and N.C. Stenseth. 2002. The role of males in the dynamics of ungulate populations. Journal of Animal Ecology 71: 907-915.

Nagy, J.A., W.H. Wright, T.M. Slack and A.M. Veitch. In prep. Seasonal ranges of the Cape Bathurst, Bluenose-west, and Bluenose-east barren-ground caribou herds. Northwest Territories Department of Environment and Natural Resources Manuscript Report.

Russell, D.E., A.M. Martell and W.A.C. Nixon. 1993. Range ecology of the Porcupine caribou herd in Canada. Rangifer Special Issue 8. 168 pp.

Thomas, D.C. 1969. Population estimates and distribution of barren-ground caribou in Mackenzie District, N.W.T., Saskatchewan, and Alberta-March to May, 1967. Canadian Wildlife Service Report Series No 9, Ottawa, ON. 44 p.

Toupin, B., J. Huot and M. Manseau. 1996. Effect of insect harassment on the behaviour of the Rivière George Caribou. Arctic 49:375-382.

Weladji, R.B., O. Holand and T. Almoy. 2003. Use of climatic data to assess the effect of insect harassment on the autumn weight of reindeer (*Rangifer tarandus*) calves. Journal of Zoology 260:79-85.

Williams, T.M. and B. Fournier. 1996. Summary of spring classification surveys of the Bathurst caribou herd 1985-1995. Northwest Territories Department of Resources, Wildlife and Economic Development Manuscript Report No. 92. 50 pp.

APPENDIX A
Summary of 1998-2000 satellite collars on Bluenose East caribou herd

Formatted: Justified

Introduction: In 1998, a small-scale co-operative study between the Sahtu Renewable Resource Board and the Department of Resources, Wildlife and Economic Development (RWED) was started to map the seasonal movements of caribou wintering in the vicinity of Great Bear Lake. The area south of Great Bear Lake is within the known winter distribution for both the Bathurst and the East Bluenose herds of barren-ground caribou and hunters from Tulita and Deline have traditionally hunted caribou south of Great Bear Lake. Distinguishing which herds are being hunted is necessary to determine the sustainable harvest levels for the herds. The number of caribou harvested varies among years depending on caribou distribution as caribou rotate their use of winter range over the years.

Maps showing the movements of the satellite-collared caribou were sent weekly to the communities on the ranges of the Bathurst and East Bluenose herds. The database was provided to the Sahtu Renewable Resource Board but, with changes in staff, a report was not completed. Consequently, the project is summarised here and the database was provided to the Inuvik Region for John Nagy's (2005) summary maps of cumulative winter ranges for the three Bluenose herds.

On 26 April 1998, Joe Blondin (Deline Renewable Resource Council) and Richard Popko (RWED) flew south along McVicar Arm (Great Bear Lake) where they observed mostly bulls. Their reconnaissance flight continued southeast to Hottah and Rae Lakes before turning east to Snare Lake, but they did not see caribou east of Hottah Lake. Hunters returning by snowmachine from Kugluktuk reported seeing many cows at Dismal Lakes and Hornby Bay west of Port Radium.

The caribou distribution was discussed with Robert Nowasad (Sahtu Renewable Resources Board) and RWED staff and the consensus was to go ahead with the collaring of the caribou that had wintered south of Great Bear Lake. On 6 May 1998, the contracted helicopter capture crew collared five cows in the vicinity of Dismal Lakes. Pursuit times were less than one minute and no cows were injured. The cows were fitted with satellite collars programmed to transmit every five days for two years.

The five cows that were collared in 6 May 1998 moved northeast to presumably calve in the vicinity of Rae River (east of Bluenose Lake). Calving was not verified through observations on the calving ground. By October, four of the cows were on the northeast shore of Great Bear Lake (McTavish Arm) and the fifth cow was further west on the north shore of Smith Arm and she remained in that area until December when she died. The other four cows travelled south and west crossing McVicar Arm in early December 1998.

The four cows migrated northeast, crossing McTavish Arm, during March and April 1999. In June, the four cows were east of Bluenose Lake returning to the Caribou Point area in August. By mid-October 1999, the four cows were between the east coast of Great Bear Lake and the Coppermine River and they migrated through the Hottah Lake area south of the Bear River and Deline.

By June 2000, there were only two cows alive (or functional collars) and they were east of Bluenose Lake in a similar area to June 1999. In mid-October 2000, the two collared caribou migrated through the north end of Hottah Lake and wintered south of the Bear River. By May 2001, one collared cow had migrated across Great Bear Lake to Caribou Point where she died. The remaining cow migrated across Great Bear Lake in April and in June ~~2001,~~2001; she was north of the Richardson River.

APPENDIX B.
Caribou collaring capture details for March 2005 and October 2004.

March 2005

ID #	**55190**	**55191**	**55192**	**55193**	**55194**	**55195**	**55196**	**55197**	**55198**	**55199**
DATE	23/03/05	24/03/05	24/03/05	24/03/05	22/03/05	24/03/05	24/03/05	23/03/05	23/03/05	23/03/05
LATITUDE (N)	63º 58.940′	63º 11.058′	63º 11.058′	64º 01.573′	63º 26.22′	64º 01.573′	63º 39′	63º 51.87′	64º 14.406′	63º 574′
LONGITUDE (W)	118º 23.656′	113º 03.538′	113º 03.538′	118º 58.661′	114º 26.15′	118º 58.661′	117º 14′	116º 66.113′	118º 55.101′	118º 01′
SYSTEM	551601A	551602A	551603A	45902A	551608A	551610A	551611A	551612A	551615A	551616A
FREQUENCY	152.150	152.170	152.190	150.530	152.220	152.230	152.240	152.250	152.270	152.290
CHASE TIME	17h27	15h28	15h51	12h19	16h59	11h49	10h57	12h59	16h58	15h51
CAPTURE TIME	17h29	15h30	15h54	12h21	17h01	11h50	10h58	13h00	17h00	14h52
RELEASE TIME	17h32	15h37	16h01	12h26	17h07	11h56	11h07	13h09	17h06	15h00
HANDLING TIME	3 min	7 min	7 min	5 min	5 min	6 min	9 min	9 min	6 min	8 min
TEMPERATURE	-8ºC	-1ºC	-1ºC	-9ºC	-20ºC	-10ºC	-11ºC	-10ºC	-8ºC	-10ºC
AGE	4	5	3	5	3	6	5	4	6+	4
age A Gunn	**4**	**4**	**3-4**	**4**	**2**	**old**	**4+**	**4+**	**4+**	**4**
AGE (1st database)	5	6+	4	6+	5	6+	5+	4+	6+	6+
HERD SIZE	200	50	50	500	20/20	500	50	150	90	40
CALF	without	without	without	without	without	without	without	without	without	without
BODY SIZE	medium	medium	medium	medium	small	medium	medium	medium	medium	medium
BODY CONDITION	good	good+	good++	good++	good	good+	good+	good	good++	good
ANTLERS	2 medium	2 medium	0*	2 medium	2 small	2 medium	2 medium	2 medium	2 medium	2 medium
RUMP FAT (1-10)	7	7	8	8	6	7	7	6+	8	7
INCISOR WEAR	light	light	light	light	light	moderate	light	light	moderate	light
EXTERNAL INJURIES	none	none	none	none	none	none	none	none	none	none
NOTES	---	---	* broke 1	---	---	---	---	---	---	---

Formatted: Justified

March 2005 continued)

ID #	**55180**	**55181**	**55182**	**55183**	**55184**	**55185**	**55186**	**55187**	**55188**
DATE	25/03/05	25/03/05	26/03/05	26/03/05	25/03/05	26/03/05	26/03/05	25/03/05	26/03/05
LATITUDE (N)	63° 01′	63° 08′	61° 51′	61.82782°	63.00°	62° 27.3′	61° 50.820′	62.59697°	62° 37.794′
LONGITUDE (W)	106.43°	107.18°	109.15°	109.47275°	106.56°	107° 54.02′	109° 36.390′	107.3512°	111° 59.211′
SYSTEM	545030A	545038A	545059A	545116A	545116A	545125A	545136A	545137A	545138A
FREQUENCY	150.090	150.210	150.250	150.260	150.270	150.280	150.290	150.320	150.330
CHASE TIME	13h10	15h28	13h14	11h39	12h45	15h19	12h31	12h01	15h45
CAPTURE TIME	13h11	15h30	13h15	11h40	12h46	15h20	12h32	12h02	15h46
RELEASE TIME	13h17	15h34	13h25	11h44	12h54	15h24	12h36	12h08	15h49
HANDLING TIME	6 min	4 min	10 min	4 min	8 min	4 min	4 min	6 min	3 min
TEMPERATURE	-21'C	-21'C	-24'C	-21'C	-21'C	-27'C	-21'C	-21'C	-23'C
AGE	5+	6+	3+	-3	5+	6	4	4	5
HERD SIZE	50	120	60	30	150	12	50	15	30
CALF	without	without	without	without	without	without	without	without	without
BODY SIZE	medium	medium	medium	small	medium	medium	medium	medium	medium
BODY CONDITION	good+	good	excellent	good++	excellent-	good-	good+	good+	light+
ANTLERS	1 medium	1 medium	1*	1 small	2 medium	2 medium	2 medium	2 medium	2 medium
RUMP FAT (1-10)	6	7	6	6	6	7	7	7	5
INCISOR WEAR	moderate-	moderate-	light	light	moderate+	light	light	light	light
EXTERNAL INJURIES	none	none	none	none	none	none	none	none	none
NOTES	---	---	* broke 1	---	---	---	---	---	---

October 2004

ID #	45896	45897	45898	45899	45900	45901	45902	45903	45904	45905	45906
DATE	16-Oct-04	17-Oct-04	16-Oct-04	16-Oct-04	16-Oct-04	17-Oct-04	17-Oct-04	18-Oct-04	16-Oct-04	16-Oct-04	17-Oct-04
LATITUDE (N)	63º 45.70′	63º 57.67′	63º 55.88′	63º 45.67′	63º 47.13′	62º 49.95′	63º 55.69′	65º 14.60′	65º 12.85′	63º 55.98′	62º 48.02′
LONGITUDE (W)	113º 33.68′	113º 28.36′	113º 22.76′	113º 33.57′	113º 33.62′	113º 13.31′	113º 31.06′	116º 41.05′	116º 38.56′	113º 22.78′	113º 13.26′
SYSTEM #	530525	530532	530533	530534	530537	530538	530542	530515	530545	530554	530556
FREQUENCY	150.620	150.630	150.650	150.690	150.750	150.840	150.530	150.870	150.540	150.240	150.600
CHASE TIME	< 1 min	< 1 min	< 2 min	< 2 min	< 2 min	< 1 min	< 1 min	< 1 min	< 1 min	< 1 min	< 1 min
CAPTURE TIME	10:50	13:11	14:47	11:34	12:40	10:35	12:28	11:52	11:30	13:55	10:05
RELEASE TIME	11:04	13:19	15:00	11:47	12:50	10:52	12:49	12:01	11:37	14:12	10:19
HANDLING TIME	0:14	0:08	0:13	0:13	0:10	0:17	0:21	0:09	0:07	0:17	0:14
TEMPERATURE	-10'C	-10'C	-10'C	-10'C	-10'C	-11'C	-8'C	-16'C	-16'C	-10'C	-11'C
SEX	female	female	female	female	female	female	female	female	female	female	female
AGE CLASS	adult	adult	adult	adult	adult	adult	adult	adult	adult	adult	adult
STATUS	Lrg grp / w. calf	w. calf	w. bull	Lrg grp / w. calf	Lrg grp / w. calf	Lrg grp / w. calf	w. calf	10-15 cb w. calf	15-20 cb w. calf	Lrg grp / w. calf	Lrg grp / w. calf
BODY SIZE	medium	medium	large	medium	medium	medium	medium	medium	medium	medium	medium
BODY CONDITION	good	good	excellent	good	good	good	good	good	good	good	good
ANTLERS	medium	large	large	medium	medium	medium	medium	medium	medium	small	medium
RUMP FAT	palpable	palpable	palpable	palpable	palpable	palpable	palpable	palpable	palpable	palpable	palpable
INCISOR WEAR	light	moderate	light	moderate	moderate	moderate	heavy	light	moderate	moderate	moderate

Formatted: Centered
Formatted: Justified
Formatted: Justified
Formatted: Justified
Formatted: Justified
Formatted: Justified
Formatted: Justified
Formatted: Justified
Formatted: Justified
Formatted: Justified
Formatted: Justified
Formatted: Justified
Formatted: Justified
Formatted: Justified
Formatted: Justified
Formatted: Justified
Formatted: Justified
Formatted: Justified
Formatted: Justified
Formatted: Justified
Formatted: Justified

APPENDIX C.

Sex and age composition of caribou from the Bathurst herd, March 2005, NT.

Lac Grandin area				Cow		Calf	Young bull	Prime bull	Non-cow Total
				Antlered	None				
4-Apr-05	36	64.20348	-120.275	16		7			7
4-Apr-05	35	64.16329	-120.255	31	6	13	2		15
4-Apr-05	37	64.18714	-120.245	19	1	5			5
4-Apr-05	32	64.15738	-120.24	8		3	2		5
4-Apr-05	34	64.16939	-120.226	7		4	2		6
4-Apr-05	33	64.15553	-120.218	48	1	20	20	1	41
4-Apr-05	38	64.20006	-120.202	150	4	30	48	8	86
4-Apr-05	40	64.24343	-120.19	24	1	11	5	1	17
4-Apr-05	39	64.22508	-120.175						0
4-Apr-05	42	64.25257	-120.148	31		5	4		9
4-Apr-05	41	64.24059	-120.147	38	1	7	7	3	17
4-Apr-05	31	64.10888	-120.145	14		3	3		6
4-Apr-05	30	64.10096	-120.128	91	2	18	26	3	47
4-Apr-05	29	64.09538	-120.12	18		8	7	1	16
4-Apr-05	26	64.07658	-120.091	73	1	14	32	8	54
4-Apr-05	27	64.07134	-120.091	44	1	18	13	3	34
4-Apr-05	25	64.07815	-120.075	21		2	5	5	12
4-Apr-05	24	63.99774	-119.766	35	3	9	4	2	15
4-Apr-05	23	64.00137	-119.685				4		4
4-Apr-05	22	64.01127	-119.535						0
5-Apr-05	26	64.25168	-119.414	42	4	6	3	5	14
5-Apr-05	25	64.24177	-119.404	1				2	2
4-Apr-05	43	64.10917	-119.401	30	1	6			6
5-Apr-05	27	64.20686	-119.38	10	1	2	2	8	12
4-Apr-05	44	64.10502	-119.347	161	10	25	43	4	72
5-Apr-05	24	64.26504	-119.315						0
5-Apr-05	29	64.07031	-119.277						0
4-Apr-05	45	64.03638	-119.189	169	2	39	39	25	103
4-Apr-05	21	64.02009	-118.98						0
4-Apr-05	20	64.00395	-118.933	160	6	33	53	10	96
4-Apr-05	5	63.93118	-118.862	60	1	13	19	3	35
4-Apr-05	10	63.98027	-118.838						0
4-Apr-05	9	63.96842	-118.837	48	3	19	23	3	45
4-Apr-05	11	63.9902	-118.836	206	10	31	71	5	107
4-Apr-05	6	63.9251	-118.82	14		4	2		6
5-Apr-05	23	64.2792	-118.813						0
4-Apr-05	15	64.01483	-118.802	48	1	8	13		21
4-Apr-05	16	64.01897	-118.801	61	1	17	12	15	44
4-Apr-05	12	64.01145	-118.799	10	1	7	5	2	14
4-Apr-05	8	63.95268	-118.755	6		2	1		3
5-Apr-05	196	64.10769	-118.444	33	3	4	1		5
5-Apr-05	198	64.0386	-118.397	49	3	6	5	12	23
5-Apr-05	197	64.10273	-118.358	69	2	9	31	35	75
5-Apr-05	21	64.26184	-118.245	24	2	4	2	9	15
5-Apr-05	199	63.95499	-118.214						0
4-Apr-05	3	63.58518	-118.109	35	3	6	7		13
4-Apr-05	2	63.56827	-118.093	26		10	7	14	31
4-Apr-05	4	63.59725	-118.086	75	4	23	42	1	66
5-Apr-05	20	64.20768	-118.023	38	2	4	2		6

Rae Lakes area				Cow		Calf	Young bull	Prime bull	Total
				Antlered	None				
4-Apr-05	46	63.56365	-117.675						
5-Apr-05	200	63.69555	-117.568	79	6	13	14	18	45
5-Apr-05	201	63.63561	-117.419	189	16	27	35	7	69
5-Apr-05	202	63.63633	-117.416				1	9	10
5-Apr-05	19	63.77362	-117.273						0
5-Apr-05	203	63.66821	-117.266	73	2	11	7		18
4-Apr-05	47	63.5396	-117.149						0
4-Apr-05	1	63.10179	-117.136	15	2	6	3	31	40
1-Apr-05	7	63.56193	-117.127						0
5-Apr-05	204	63.54153	-117.119	68	4	7	21	2	30
5-Apr-05	205	63.58219	-116.86						0
1-Apr-05	8	63.56712	-116.839						0
5-Apr-05	17	63.55944	-116.818	66	4	15	26	53	94
5-Apr-05	16	63.54059	-116.807						0
4-Apr-05	48	63.53097	-116.802						0
5-Apr-05	15	63.53976	-116.782	126	3	7	25	7	39
5-Apr-05	206	63.7488	-116.772						0
5-Apr-05	207	63.99623	-116.758						0
5-Apr-05	13	63.53551	-116.741	17	1	2		12	14
5-Apr-05	12	63.53347	-116.735						0
4-Apr-05	49	63.53198	-116.729						0
5-Apr-05	11	63.53072	-116.711	15	2	1	3	3	7
5-Apr-05	14	63.54878	-116.71	19	1	1	6	5	12
5-Apr-05	10	63.53535	-116.683	97	5	4	10	26	40
1-Apr-05	9	63.62583	-116.58						0
5-Apr-05	9	63.58943	-116.564	36	2	4	1	8	13
5-Apr-05	8	63.58391	-116.555	15			5	6	11
1-Apr-05	15	63.50194	-116.474	6		1	3		4
1-Apr-05	14	63.50368	-116.464	7	3		1	7	8
1-Apr-05	11	63.56962	-116.452	3					0
5-Apr-05	6	63.49049	-116.445	54	3	6	4		10
1-Apr-05	13	63.53116	-116.443	19	3	3	6	3	12
1-Apr-05	10	63.58553	-116.429	7	1	1	5	24	30
1-Apr-05	16	63.50648	-116.428	343	30	36	75	30	141
5-Apr-05	5	63.47675	-116.425	275	13	6	67	53	126
1-Apr-05	12	63.54968	-116.418	23	1	4	6		10
5-Apr-05	208	63.96439	-116.267	3		1	1	2	4
4-Apr-05	51	63.54221	-116.228	35	2	1		2	3
4-Apr-05	52	63.51778	-116.211	8	4				0
4-Apr-05	53	63.50003	-116.207	11	1	1	2		3
1-Apr-05	17	63.0794	-115.969						0
1-Apr-05	18	63.06053	-115.848	1	1			1	1
				1610	**110**	**158**	**327**	**309**	**794**

Yellowknife east and west				Cow		Calf	Young Bull	Prime Bull	Total
				Antlered	None				
5-Apr-05	210	63.39913	-115.397					6	6
4-Apr-05	54	62.97734	-115.226	5	1				0
1-Apr-05	19	62.78736	-115.134				1	14	15
5-Apr-05	3	62.77946	-115.115				4	59	63
1-Apr-05	20	62.76524	-115.053				1	22	23
5-Apr-05	2	62.78042	-115.05				1	22	23
4-Apr-05	55	62.80671	-114.968					11	11
5-Apr-05	211	62.91436	-114.926	18		4	3	6	13
4-Apr-05	56	62.79266	-114.908	9		1	1		2
4-Apr-05	57	62.7816	-114.886					2	2
5-Apr-05	1	62.68115	-114.862					11	11
5-Apr-05	212	62.82602	-114.835	18	3	6	2		8
5-Apr-05	213	62.82179	-114.772				2	5	7
5-Apr-05	214	62.79701	-114.764	7	1		7	6	13
5-Apr-05	215	62.73429	-114.664	10		3	4	1	8
5-Apr-05	216	62.73552	-114.644	36	2	7	6	1	14
31-Mar-05	31	63.51922	-114.49	19	1	1	2		3
31-Mar-05	30	63.61316	-114.476	19	1	2	2		4
31-Mar-05	32	63.51286	-114.452	6	1				0
31-Mar-05	29	63.61316	-114.448						0
31-Mar-05	28	63.60263	-114.428	12	1	1	1		2
31-Mar-05	27	63.55952	-114.372		1	1			1
31-Mar-05	26	63.56341	-114.359	14	1	3	2		5
31-Mar-05	34	63.4809	-114.354						0
31-Mar-05	33	63.48259	-114.345	180	3	6	44	2	52
31-Mar-05	36	63.46175	-114.331	43	3	5	4		9
31-Mar-05	37	63.42561	-114.323	81	3	4	12	1	17
31-Mar-05	40	63.40282	-114.317	28	4		1		1
31-Mar-05	38	63.42417	-114.311	6	2	2			2
31-Mar-05	39	63.41205	-114.305	45		1	8		9
31-Mar-05	41	63.36393	-114.276	22	1		4		4
31-Mar-05	42	63.33094	-114.269						0
31-Mar-05	21	63.55109	-114.243						0
31-Mar-05	20	63.55625	-114.205						0
31-Mar-05	19	63.56099	-114.192	87	6	7	9		16
31-Mar-05	25	63.54577	-114.192	88	6	4	17		21
31-Mar-05	22	63.52364	-114.177						0
31-Mar-05	18	63.58937	-114.149						0
31-Mar-05	24	63.52457	-114.146	96	5	3	33	2	38
31-Mar-05	43	63.32462	-114.139	2	1		1		1
6-Apr-05	1	62.609	-114.113	8		3			3
6-Apr-05	32	62.63935	-114.104						0
31-Mar-05	46	62.95751	-114.068	13	2	2			2
31-Mar-05	13	63.67294	-114.005	2			3	2	5
31-Mar-05	45	63.00213	-113.991	14	2	2			2
31-Mar-05	16	63.64411	-113.986	115	10	7	30		37
31-Mar-05	14	63.6617	-113.984	6		1	4	2	7
31-Mar-05	44	63.25135	-113.976	18					0
31-Mar-05	12	63.68519	-113.97						0
31-Mar-05	15	63.64927	-113.969	111		14	37	5	56
31-Mar-05	17	63.6348	-113.969	77	3	4	15		19
31-Mar-05	11	63.69044	-113.962	2					0

Yellowknife east and west (continued)				Cow					
				Antlered	None	Calf	Young Bull	Prime Bull	Total
31-Mar-05	10	63.68627	-113.933						0
6-Apr-05	2	62.67245	-113.876	25	2	5	3		8
6-Apr-05	31	62.73015	-113.831	46	1	7		14	21
6-Apr-05	3	62.69487	-113.771	74	2	8	14	1	23
6-Apr-05	30	62.61655	-113.742	130	2	23	35	7	65
6-Apr-05	27	62.59311	-113.731	27	1	7	6	6	19
6-Apr-05	29	62.61653	-113.718	121	1	19	20		39
6-Apr-05	28	62.59376	-113.717	99	3	18	40	4	62
6-Apr-05	4	62.66204	-113.623	36	3	34	35		69
6-Apr-05	25	62.52993	-113.594	55	4	7	22	1	30
6-Apr-05	26	62.51249	-113.587	9		4	2		6
6-Apr-05	5	62.67322	-113.582	46	1	15	13	8	36
6-Apr-05	24	62.61852	-113.507	8	2	1	9	2	12
31-Mar-05	9	63.42687	-113.5						0
6-Apr-05	7	62.69355	-113.441	10	1	3	2		5
6-Apr-05	6	62.69552	-113.415	69	1	14	15		29
31-Mar-05	23	63.3388	-113.353						0
31-Mar-05	5	63.09282	-113.006	7	2		3		3
31-Mar-05	6	63.17672	-112.979						0
				1979	**90**	**259**	**480**	**223**	**962**

McLeod Bay area				Cow					
				Antlered	None	Calf	Young Bull	Prime Bull	Total
31-Mar-05	7	63.19207	-112.93	4			5	2	7
31-Mar-05	8	63.25319	-112.889						0
6-Apr-05	9	62.57697	-112.411	15			3	5	8
6-Apr-05	22	62.63585	-112.297	5					0
6-Apr-05	23	62.6842	-112.294				1	5	6
6-Apr-05	21	62.61294	-112.284				2	2	4
6-Apr-05	10	62.53424	-112.264	146	5	33	26	13	72
6-Apr-05	11	62.53656	-112.236	47	3	7	11		18
6-Apr-05	12	62.68023	-111.522	15					0
6-Apr-05	18	62.87676	-110.939	36	1	3	11		14
6-Apr-05	19	62.83616	-110.936	12	1	1	3		4
6-Apr-05	13	62.8903	-110.87	117	6	2	40	1	43
6-Apr-05	14	62.9293	-110.675						0
6-Apr-05	15	62.94009	-110.485	62	4	1	4		5
6-Apr-05	16	62.96229	-110.321	15			6	1	7
6-Apr-05	17	62.94343	-110.013	28	1	1	5		6
6-Apr-05	20	62 50	110 55	55	1		8		8
				557	**22**	**48**	**125**	**29**	**202**

APPENDIX D.

Sex and age classes and antler status for caribou classified 23-26 June 2005.

Way-point	Date (June)	Breeding Females				Non Breeding females				Calves	Bulls	Total
		No antler	Hard antler	No antler and udder	Antler buds	New antler classes 1	2	3	4			
2	23								1		1	2
3	23										2	2
4	23										6	6
5	23										8	8
6	23										9	9
7	23										2	2
8	23										6	6
9	23	6	3				1				3	13
10	23										3	3
11	23										2	2
12	23										5	5
13	23										0	0
14	23										0	0
15	23										0	0
16	23	1									4	5
17	23										3	3
18	23	4	1	1	1						9	16
19	23										3	3
20	23										6	6
21	23	5		1							7	13
22	23				1						5	6
23	23										0	0
24	23			1							0	1
25	23	1	1							1	1	4
26	23										3	3
27	23	6									0	6
28	23	4					1				0	5
29	23										1	1
30	23	13	1	2						3	0	19
31	23										0	0
32	23	1									3	4
33	23	10				2				1	7	20
34	23										0	0
35	23	12	1	2	3	3	2			3	2	28
36	23										2	2
37	23	8	1	1		1	1				0	12
38	23	2									0	2
39	23	3			1						0	4
40	23	8				1				1	0	10
41	23	8		1		1					7	17
42	23										2	2
43	23	21	2	1	8			1		1	5	39
44	23	12			2	1	1				0	16
45	23	8	1		3						2	14
46	23	9									5	14
47	23				1	2					2	5
48	23					1	1				2	4
49	23	1		2						1	1	5
50	23							1			2	3
51	23										4	4

Way-point	Date (June)	**Breeding Females**				**Non Breeding females**				**Calves**	**Bulls**	**Total**
		No antler	**Hard antler**	**No antler or udder**	**Antler buds**	**New antler classes 1**	**2**	**3**	**4**			
52	23	3									1	4
53	23										8	8
54	23										4	4
55	23										2	2
56	23	1	1								3	5
57	23	2			3		1				11	17
58	23										5	5
59	23										1	1
72	23	289	22		21	3	7	3	1	231	1	578
75	23	165	13	4	2					152	0	336
77	23	127	6		1	2				118	0	254
78	23	152	7			1				128	0	288
82	23	64	4							64	0	132
88	23	12				2	1	1		2	0	18
89	24	138	3			2				116	0	259
92	24	140	3		2					143	0	288
93	24	12	1	4						10	0	27
94	24	54	2	15						51	0	122
95	24	31	4	2						7	0	44
96	24	169	13					1		97	0	280
97	24	43	4							34	1	82
98	24	15								4	0	19
99	24	7								2	0	9
100	24	55	3							21	0	79
101	24	14	1								0	15
102	24	14					1			3	0	18
103	24	51	1				1			16	0	69
104	24	65	3		1	5	1	1		17	2	95
106	24	8			1	2	2				2	15
107	24	1				2		1			3	7
108	24	1	1	1		3		1			10	17
109	24	4									0	4
110	24					1	1				0	2
111	24										4	4
112	24	2									15	17
114	24					1					7	8
115	24					1					2	3
116	24					1					1	2
117	24					1					21	22
119	25	5		1						1	0	7
120	25	69	2		17	6				19	3	116
122	25	10	1	3	19	4				5	1	43
123	25	149	21	3	3					152	0	328
125	25	184	21		17	1				179	0	402
127	25	239	9	2	2	4				135	0	391
129	25	2									0	2
130	25	96	4	11	3	2				51	0	167
132	25	23								11	0	34
133	25	12		1						1	2	16
135	25	208	6		2		1			106	0	323
141	25										5	5
142	25	1				1					1	3
144	25										1	1

Way-point	Date (June)	Breeding Females: No antler	Breeding Females: Hard antler	Breeding Females: No antler or udder	Breeding Females: Antler buds	Non Breeding females, New antler classes: 1	2	3	4	Calves	Bulls	Total
145	25										8	8
146	25										16	16
147	25										5	5
148	25										6	6
149	25					2		1			0	3
151	25					1		2	1		30	34
152	25		1			2	1	1			0	5
153	25										4	4
154	25										9	9
155	25				1	1					11	13
156	25					4					5	9
157	25	57			4	13	2	4	1	27	8	116
159	25	261	5		4	6	2	1	2	157	1	439
162	25	7	4			2				9	0	22
163	25	21					1		2	15	0	39
169	26	3				3	1				3	10
170	26				1						10	11
171	26					1					8	9
172	26	1									0	1
173	26							1	1		6	8
174	26				1				1		3	5
175	26	2		1	1	1					0	5
176	26	3			2		1		1		0	7
177	26	2			1	1	1				0	5
178	26	1				2			2		0	5
179	26	32	2		5	5		5	1		1	51
180	26					1		2			0	3
181	26										0	0
182	26	2									0	2
184	26	5				1					0	6
185	26	4				2					3	9
186	26				1	2		1	1		8	13
187	26	5			2	2			1		8	18
188	26	2			1	4					2	9
190	26	541	26		59	39	5	14	6	312	23	1025
		3729	**205**	**60**	**197**	**152**	**37**	**42**	**22**	**2407**	**430**	**7281**

APPENDIX E.

Physical condition and measurements for caribou harvested January-April 2005, Bathurst Herd winter ranges, NT (data from Earl and Trevor Evans, Fort Smith, NT)

Sample	Date	Location	Sex	Age	Condition	Back fat (mm)	Preg	Lactating	Warble	Notes
1	5-Apr-05	Hidden Lake	F	UNK	POOR	0.5	Y	UNK	LOW	besnoitia on lower legs
2	5-Apr-05	Hidden Lake	F	UNK	GOOD	6	Y	UNK	MED	*Tania krabbei* present in legs
3	5-Apr-05	Hidden Lake	F	UNK	VERY GOOD	13	Y	UNK	LOW	Warble scale: Low=0-30, medium=30-60, high=60+
4	5-Apr-05	Hidden Lake	F	UNK	VERY GOOD	12	Y	UNK	LOW	older cow, 1 tooth broken
5	5-Apr-05	Hidden Lake	F	UNK	VERY GOOD	13	Y	UNK	MED	some besnoitia in legs
6	5-Apr-05	Hidden Lake	F	UNK	EXCELLENT	16	Y	UNK	LOW	
7	5-Apr-05	Hidden Lake	F	UNK	FAIR	4	Y	UNK	LOW	#1 photo taken of hydatid lung cyst
8	5-Apr-05	Hidden Lake	F	UNK	EXCELLENT	24	Y	UNK	LOW	
9	5-Apr-05	Hidden Lake	F	UNK	EXCELLENT	29	Y	UNK	LOW	photo of backfat. This is the fattest caribou harvested this year.
10	5-Apr-05	Hidden Lake	F	UNK	GOOD	6	Y	UNK	LOW	
1	6-Apr-05	Hidden Lake	F	UNK	GOOD	9	Y	UNK	LOW	
2	6-Apr-05	Hidden Lake	F	UNK	FAIR	3	Y	UNK	MED	
3	6-Apr-05	Hidden Lake	F	UNK	GOOD	7	Y	UNK	LOW	
4	6-Apr-05	Hidden Lake	F	UNK	VERY GOOD	19	Y	UNK	LOW	
5	6-Apr-05	Hidden Lake	F	UNK	POOR	0.5	Y	UNK	LOW	1 small cyst on liver
6	6-Apr-05	Hidden Lake	F	UNK	FAIR	3	N	UNK	MED	
7	6-Apr-05	Hidden Lake	F	UNK	VERY POOR	0	Y	UNK	LOW	pic 2, very poor but pregnant. Photo of hydatid
8	6-Apr-05	Hidden Lake	F	UNK	FAIR	3	Y	UNK	VERY LOW	only 12 warbles
9	6-Apr-05	Hidden Lake	F	UNK	EXCELLENT	24	Y	UNK	VERY LOW	
10	6-Apr-05	Hidden Lake	F	UNK	VERY GOOD	17	Y	UNK	VERY LOW	
11	6-Apr-05	Hidden Lake	F	UNK	VERY GOOD	18	Y	UNK	VERY LOW	
12	6-Apr-05	Hidden Lake	F	UNK	FAIR	7	Y	UNK	MED	besnoitia on legs
13	6-Apr-05	Hidden Lake	F	UNK	FAIR	3	Y	UNK	MED	

Sample	Date	Location	Sex	Age	Condition	Back fat (mm)	Preg	Lactating	Warble	Notes
1	7-Apr-05	Sparrow Lake	F	UNK	FAIR	4	Y	UNK	LOW	no antler on this cow
2	7-Apr-05	Sparrow Lake	F	UNK	FAIR	2	Y	UNK	LOW	older cow
3	7-Apr-05	Sparrow Lake	F	UNK	FAIR	5	Y	UNK	LOW	1 liver cyst
4	7-Apr-05	Sparrow Lake	F	UNK	POOR	0	N	UNK	HIGH	mucus on lungs, sample and photo. Very old cow, 2 middle teeth broken/worn
5	7-Apr-05	Sparrow Lake	F	UNK	FAIR	5	Y	UNK	LOW	
6	7-Apr-05	Sparrow Lake	F	UNK	FAIR	3	N	UNK	LOW	
7	7-Apr-05	Sparrow Lake	F	UNK	GOOD	7	Y	UNK	LOW	
8	7-Apr-05	Sparrow Lake	F	UNK	GOOD	12	Y	UNK	LOW	
9	7-Apr-05	Sparrow Lake	F	UNK	VERY GOOD	14	Y	UNK	LOW	
10	7-Apr-05	Sparrow Lake	F	UNK	VERY POOR	0	N	UNK	LOW	2 lung cysts, 1 liver cyst. Photo
11	7-Apr-05	Sparrow Lake	F	UNK	POOR	0	N	UNK	LOW	lung stuck to rib wall
1	6-Apr-05	Sparrow Lake	F	UNK	FAIR	6	Y	UNK	MEDIUM	
2	6-Apr-05	Sparrow Lake	F	UNK	FAIR	3	Y	UNK	MEDIUM	besnoitia on legs
3	6-Apr-05	Sparrow Lake	F	UNK	GOOD	12	Y	UNK	LOW	
4	6-Apr-05	Sparrow Lake	F	UNK	VERY GOOD	17	Y	UNK	LOW	
5	6-Apr-05	Sparrow Lake	F	UNK	POOR	0	Y	UNK	MEDIUM	
6	6-Apr-05	Sparrow Lake	F	UNK	VERY POOR	0	N	UNK	VERY HIGH	one of the highest warble counts
7	6-Apr-05	Sparrow Lake	F	UNK	POOR	0.5	N	UNK	MEDIUM	huge 35-40cm cyst in lungs, collected to A Gunn, photo. Small heart
1	19-Mar-05	Sarah Lake	F	UNK	POOR	0	N	UNK	MEDIUM	Warble scale: Low=0-30, medium=30-60, high=60+
2	19-Mar-05	Sarah Lake	F	UNK	FAIR	2	Y	UNK	MEDIUM	
3	19-Mar-05	Sarah Lake	F	UNK	POOR	0	N	UNK	HIGH	5 hydatid cysts in lungs, photos
4	19-Mar-05	Sarah Lake	F	UNK	POOR	0.5	N	UNK	MEDIUM	besnoitia in lower legs
5	19-Mar-05	Sarah Lake	F	UNK	GOOD	7	Y	UNK	LOW	
6	19-Mar-05	Sarah Lake	F	UNK	FAIR	2	Y	UNK	MEDIUM	
7	19-Mar-05	Sarah Lake	F	UNK	FAIR	0.5	N	UNK	MEDIUM	mesentery fat good. Mucus like fluid in udder
8	19-Mar-05	Sarah Lake	F	UNK	GOOD	6	Y	UNK	MEDIUM	
9	19-Mar-05	Sarah Lake	F	UNK	POOR	0	N	UNK	MEDIUM	*Taenia krabbi* present
10	19-Mar-05	Sarah Lake	M	UNK	POOR	0.5	N	UNK	HIGH	older male
11	19-Mar-05	Sarah Lake	M	UNK	POOR	0.5	N	UNK	HIGH	older male
12	19-Mar-05	Sarah Lake	F	UNK	GOOD	12	Y	UNK	LOW	besnoitia in lower legs

Sample	Date	Location	Sex	Age	Condition	Back fat (mm)	Preg	Lactating	Warble	Notes
13	20-Mar-05	Sarah Lake	F	UNK	FAIR	3	Y	UNK	MEDIUM	
14	20-Mar-05	Sarah Lake	F	UNK	FAIR	2	Y	UNK	MEDIUM	
15	20-Mar-05	Sarah Lake	F	UNK	FAIR	4	N	UNK	LOW	1 hydatid liver cyst, 1cm
16	20-Mar-05	Sarah Lake	F	UNK	POOR	0.5	N	UNK	MEDIUM	
17	20-Mar-05	Sarah Lake	F	UNK	GOOD	11	Y	UNK	MEDIUM	
18	20-Mar-05	Sarah Lake	F	UNK	GOOD	7	Y	UNK	LOW	
19	20-Mar-05	Sarah Lake	F	UNK	GOOD	5	N	UNK	MEDIUM	Thread worm in lungs
20	20-Mar-05	Sarah Lake	F	UNK	POOR	0.5	N	UNK	MEDIUM	
21	20-Mar-05	Sarah Lake	M	UNK	POOR	0.5	N	UNK	VERY HIGH	280 warbles. Highest count yet
22	20-Mar-05	Sarah Lake	F	UNK	FAIR	3	N	UNK	LOW	
23	20-Mar-05	Sarah Lake	F	UNK	POOR	0.5	N	UNK	MEDIUM	heavy bruising in front legs
24	20-Mar-05	Sarah Lake	F	UNK	GOOD	5	Y	UNK	MEDIUM	
25	20-Mar-05	Sarah Lake	F	UNK	GOOD	11	Y	UNK	LOW	
26	20-Mar-05	Sarah Lake	F	UNK	FAIR	2	Y	UNK	MEDIUM	
27	20-Mar-05	Sarah Lake	F	UNK	POOR	0.5	N	UNK	MEDIUM	
28	20-Mar-05	Sarah Lake	F	UNK	FAIR	3	N	UNK	HIGH	
29	20-Mar-05	Sarah Lake	F	UNK	GOOD	9	Y	UNK	MEDIUM	no antlers
30	20-Mar-05	Sarah Lake	M	UNK	FAIR	3	N	UNK	MEDIUM	
31	20-Mar-05	Sarah Lake	M	UNK	POOR	0	N	UNK	HIGH	*Taenia krabbi* present
32	20-Mar-05	Sarah Lake	F	UNK	GOOD	6	Y	UNK	MEDIUM	
33	20-Mar-05	Sarah Lake	F	UNK	FAIR	4	Y	UNK	MEDIUM	Left antler broken off
34	20-Mar-05	Sarah Lake	F	UNK	GOOD	8	Y	UNK	MEDIUM	
35	20-Mar-05	Sarah Lake	F	UNK	POOR	0.5	N	UNK	MEDIUM	2 large hydatid cysts in lungs, photos
36	20-Mar-05	Sarah Lake	F	UNK	FAIR	2	N	UNK	LOW	
37	20-Mar-05	Sarah Lake	F	UNK	FAIR	3	Y	UNK	MEDIUM	
38	20-Mar-05	Sarah Lake	F	UNK	GOOD	7	N	UNK	MEDIUM	*Taenia krabbi* present
39	21-Mar-05	Sarah Lake	F	UNK	GOOD	10	Y	UNK	MEDIUM	besnoitia in lower legs
40	21-Mar-05	Sarah Lake	F	UNK	EXCELLENT	17	Y	UNK	MEDIUM	Heavy mesentery fat
41	21-Mar-05	Sarah Lake	F	UNK	FAIR	3	N	UNK	LOW	only 9 warbles on entire hide
42	21-Mar-05	Sarah Lake	F	UNK	FAIR	2	Y	UNK	LOW	
43	21-Mar-05	Sarah Lake	F	UNK	FAIR	4	Y	UNK	MEDIUM	
44	21-Mar-05	Sarah Lake	F	UNK	POOR	0.5	N	UNK	MEDIUM	

Sample	Date	Location	Sex	Age	Condition	Back fat (mm)	Preg	Lactating	Warble	Notes
45	21-Mar-05	Sarah Lake	F	UNK	POOR	0	N	UNK	HIGH	older cow, teeth badly warn
46	21-Mar-05	Sarah Lake	F	UNK	FAIR	2	N	UNK	MEDIUM	
47	21-Mar-05	Sarah Lake	F	UNK	GOOD	7	Y	UNK	MEDIUM	
48	21-Mar-05	Sarah Lake	F	UNK	FAIR	3	N	UNK	LOW	besnoitia in lower legs
49	21-Mar-05	Sarah Lake	F	UNK	GOOD	12	Y	UNK	MEDIUM	
50	21-Mar-05	Sarah Lake	F	UNK	GOOD	8	Y	UNK	MEDIUM	
51	21-Mar-05	Sarah Lake	F	UNK	POOR	0	N	UNK	LOW	Lung stuck to ribs
52	21-Mar-05	Sarah Lake	F	UNK	POOR	0.5	Y	UNK	MEDIUM	
53	21-Mar-05	Sarah Lake	F	UNK	FAIR	2	N	UNK	MEDIUM	
54	21-Mar-05	Sarah Lake	F	UNK	FAIR	4	N	UNK	MEDIUM	
55	21-Mar-05	Sarah Lake	F	UNK	GOOD	9	N	UNK	MEDIUM	
56	21-Mar-05	Sarah Lake	F	UNK	GOOD	11	Y	UNK	LOW	
57	21-Mar-05	Sarah Lake	M	UNK	FAIR	3	N	UNK	MEDIUM	
58	21-Mar-05	Sarah Lake	F	UNK	POOR	2	N	UNK	LOW	
59	21-Mar-05	Sarah Lake	F	UNK	POOR	0.5	Y	UNK	LOW	
60	21-Mar-05	Sarah Lake	F	UNK	GOOD	9	Y	UNK	MEDIUM	
61	22-Mar-05	Sarah Lake	F	UNK	GOOD	11	Y	UNK	MEDIUM	besnoitia in lower legs
62	22-Mar-05	Sarah Lake	F	UNK	VERY GOOD	16	Y	UNK	MEDIUM	
63	22-Mar-05	Sarah Lake	F	UNK	GOOD	7	N	UNK	LOW	*Taenia krabbi* present
64	22-Mar-05	Sarah Lake	F	UNK	POOR	0	N	UNK	MEDIUM	
65	22-Mar-05	Sarah Lake	F	UNK	FAIR	3	N	UNK	HIGH	
66	22-Mar-05	Sarah Lake	F	UNK	FAIR	3	Y	UNK	MEDIUM	
67	22-Mar-05	Sarah Lake	F	UNK	POOR	0.5	N	UNK	MEDIUM	
68	22-Mar-05	Sarah Lake	F	UNK	EXCELLENT	20	Y	UNK	MEDIUM	Fattest caribou harvested
69	22-Mar-05	Sarah Lake	F	UNK	GOOD	9	Y	UNK	LOW	
70	22-Mar-05	Sarah Lake	F	UNK	POOR	0.5	N	UNK	MEDIUM	huge swollen lower leg, pictures
71	22-Mar-05	Sarah Lake	F	UNK	FAIR	3	N	UNK	MEDIUM	
72	22-Mar-05	Sarah Lake	F	UNK	GOOD	10	Y	UNK	LOW	Thread worm in left lung
73	22-Mar-05	Sarah Lake	F	UNK	GOOD	7	N	UNK	LOW	
74	22-Mar-05	Sarah Lake	F	UNK	GOOD	9	Y	UNK	MEDIUM	
75	22-Mar-05	Sarah Lake	F	UNK	POOR	1	N	UNK	MEDIUM	
76	22-Mar-05	Sarah Lake	F	UNK	FAIR	3	N	UNK	VERY HIGH	*Taenia krabbi* present

Sample	Date	Location	Sex	Age	Condition	Back fat (mm)	Preg	Lactating	Warble	Notes
77	22-Mar-05	Sarah Lake	F	UNK	GOOD	14	Y	UNK	MEDIUM	
78	23-Mar-05	Sarah Lake	F	UNK	GOOD	11	Y	UNK	MEDIUM	Mucus in udder
79	23-Mar-05	Sarah Lake	F	UNK	GOOD	8	Y	UNK	LOW	
80	23-Mar-05	Sarah Lake	F	UNK	GOOD	0.5	N	UNK	MEDIUM	
81	23-Mar-05	Sarah Lake	F	UNK	FAIR	4	Y	UNK	MEDIUM	1 hydatid liver cyst, 1 small hydatid cyst on lungs
82	23-Mar-05	Sarah Lake	F	UNK	VERY GOOD	16	Y	UNK	LOW	
83	23-Mar-05	Sarah Lake	F	UNK	POOR	2	N	UNK	MEDIUM	
84	23-Mar-05	Sarah Lake	F	UNK	POOR	0.5	N	UNK	HIGH	besnoitia in lower legs
85	23-Mar-05	Sarah Lake	F	UNK	FAIR	4	N	UNK	MEDIUM	liver stuck to back of stomach
86	23-Mar-05	Sarah Lake	F	UNK	GOOD	10	Y	UNK	MEDIUM	
87	23-Mar-05	Sarah Lake	F	UNK	VERY GOOD	15	Y	UNK	LOW	no antlers
88	23-Mar-05	Sarah Lake	F	UNK	FAIR	6	N	UNK	MEDIUM	
89	23-Mar-05	Sarah Lake	F	UNK	VERY GOOD	17	Y	UNK	MEDIUM	
90	23-Mar-05	Sarah Lake	F	UNK	POOR	0.5	N	UNK	LOW	
91	23-Mar-05	Sarah Lake	F	UNK	GOOD	12	Y	UNK	MEDIUM	
92	23-Mar-05	Sarah Lake	F	UNK	FAIR	3	Y	UNK	MEDIUM	
93	23-Mar-05	Sarah Lake	F	UNK	VERY POOR	0	N	UNK	LOW	cluster of white rice-like balls found on spleen, collected sample. Photos
1	26-Feb-05	Abitall Lake	F	Adult	VERY GOOD	15	Y	N	LOW	150mi NE Fort Smith
2	1-Mar-05	Abitall Lake	M	Adult	GOOD	6	N	N	LOW	
3	1-Mar-05	Abitall Lake	M	Calf	VERY LOW	0	N	N	LOW	
4	1-Mar-05	Abitall River	M	Adult	LOW	0.5	N	N	MEDIUM	*Taenia krabbi* present in hind quarters
5	1-Mar-05	Abitall Lake	M	Adult	GOOD	5	N	N	LOW	
6	1-Mar-05	Abitall Lake	M	Adult	LOW	0.5	N	N	HIGH	LF hoof has abnormal lump 1.5cm diam between hoof and 1st joint
7	1-Mar-05	Abitall Lake	F	Adult	GOOD	11	Y	N	LOW	
8	28-Feb-05	Abitall River	F	Adult	VERY GOOD	14	Y	N	LOW	besnoitia on legs, heavy bruising on forelegs
9	28-Feb-05	Abitall River	F	Adult	GOOD	5	Y	N	UNK	Rt side of lungs adhered to rib cage
10	28-Feb-05	Abitall River	F	Adult	VERY LOW	1	N	N	MEDIUM	Incisors worn, older animal, antlers well developed
11	1-Mar-05	Abitall Lake	F	Adult	EXCELLENT	17	Y	UNK	LOW	Loaded with mesentery fat
12	1-Mar-05	Abitall Lake	F	Adult	GOOD	7	Y	UNK	UNK	
13	1-Mar-05	Abitall Lake	M	Adult	LOW	0.5	N	N	MEDIUM	Old injury rear hock hair gone, 1x6 inches

Sample	Date	Location	Sex	Age	Condition	Back fat (mm)	Preg	Lactating	Warble	Notes
14	1-Mar-05	Abitall Lake	F	Adult	LOW	0.5	N	N	UNK	2 hydatid cysts in lungs approx 12-15cm. besnoitia present
15	1-Mar-05	Abitall Lake	F	Adult	GOOD	12	Y	UNK	LOW	Good mesentery fat
16	1-Mar-05	Abitall Lake	F	Adult	VERY GOOD	18	Y	N	LOW	Heavy inside fat
1	28-Jan-05	West Bay Gordon Lake	F	Adult	LOW	0.5	Y	N	MEDIUM	-38c Deep snow. *Taenia krabbi*. 1 hydatid, 1 thread worm
2	28-Jan-05	West Bay Gordon Lake	F	Adult	GOOD	4	Y	N	LOW	besnoitia lower legs
3	28-Jan-05	West Bay Gordon Lake	M	Adult	LOW	0	N	N	MEDIUM	Thread worm left lung, very poor condition
4	28-Jan-05	West Bay Gordon Lake	F	Adult	LOW	0.5	N	N	LOW	
5	28-Jan-05	West Bay Gordon Lake	F	Adult	LOW	0.5	N	N	MEDIUM	
6	28-Jan-05	West Bay Gordon Lake	F	Adult	GOOD	10	Y	N	LOW	
7	28-Jan-05	West Bay Gordon Lake	F	Adult	LOW	2	Y	N	MEDIUM	
8	28-Jan-05	West Bay Gordon Lake	F	Adult	LOW	0.5	N	N	LOW	*Taenia krabbi* in meat, besnoitia lower legs
9	28-Jan-05	West Bay Gordon Lake	F	Adult	GOOD	5	Y	N	LOW	
10	28-Jan-05	West Bay Gordon Lake	F	Adult	LOW	2	Y	N	MEDIUM	
11	28-Jan-05	West Bay Gordon Lake	M	Adult	LOW	0	N	N	HIGH	Big bull in poor condition. 1 hydatid cyst in lung
1	29-Jan-05	Hidden Lake	F	Adult	GOOD	4	Y	N	LOW	-38c, DEEP SNOW
2	29-Jan-05	Hidden Lake	F	Adult	LOW	0	N	N	MEDIUM	besnoitia lower legs
3	29-Jan-05	Hidden Lake	M	Yearling	LOW	0	N	N	LOW	Very poor condition
4	29-Jan-05	Hidden Lake	M	Adult	LOW	0.5	N	N	MEDIUM	Big male, poor condition. 2 *Taenia hydatigena* on liver, 10-12 cm
5	29-Jan-05	Hidden Lake	F	Adult	LOW	2	Y	N	MEDIUM	besnoitia lower legs
6	29-Jan-05	Hidden Lake	F	Adult	GOOD	7	Y	N	LOW	
7	29-Jan-05	Hidden Lake	M	Adult	LOW	0	N	N	HIGH	

Sample	Date	Location	Sex	Age	Condition	Back fat (mm)	Preg	Lactating	Warble	Notes
8	29-Jan-05	Hidden Lake	F	Adult	LOW	0.5	N	UNK	MEDIUM	besnoitia lower legs
9	29-Jan-05	Hidden Lake	F	Adult	LOW	3	Y	N	LOW	2 hydatid cysts approx 12cm in diameter
10	29-Jan-05	Hidden Lake	F	Adult	GOOD	7	Y	N	MEDIUM	Mucus like fluid in utter
11	29-Jan-05	Hidden Lake	F	Adult	LOW	3	Y	N	LOW	
12	29-Jan-05	Hidden Lake	M	Adult	LOW	0.5	N	N	MEDIUM	
13	29-Jan-05	Hidden Lake	F	Adult	LOW	0.5	N	N	LOW	
14	29-Jan-05	Hidden Lake	F	Adult	LOW	0.5	Y	N	LOW	besnoitia lower legs, 1 Cyst on liver, 1cm Long
15	29-Jan-05	Hidden Lake	M	Adult	LOW	2	N	N	MEDIUM	1 hydatid cyst on lungs, 10-14cm
16	29-Jan-05	Hidden Lake	F	Adult	GOOD	8	Y	N	LOW	*Taenia krabbi* present
17	29-Jan-05	Hidden Lake	F	Adult	LOW	2	Y	N	MEDIUM	lungs stuck to rib wall about 4 inches
18	29-Jan-05	Hidden Lake	F	Adult	VERY GOOD	12	Y	N	LOW	

Formatted: Justified
Formatted: Justified
Formatted: Justified
Formatted: Justified
Formatted: Justified
Formatted: Justified
Formatted: Justified
Formatted: Justified
Formatted: Justified
Formatted: Justified
Formatted: Justified

APPENDIX F

A weather-related index to mosquito and warble fly abundance for the post-calving and summer range of the Bathurst herd, NT, 1957-2005 (Service Contract 781079 to John Lee)

Table 1. Relative annual ratings of oestrid harassment intensity for the area centered around Lupin, Ekati, and Daring Lake based on an index derived from temperature and wind speed, 1996 to 2005. Numbers in parentheses are the annual indicator scores.

Indicators of insect harassment level	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**
Mean yearly oestrid index for days index > 0	0.692 (3)	0.593 (1)	0.607(2)	0.594 (1)	0.659 (3)	0.599 (1)	0.633 (2)	0.655 (3)	0.591 (1)	0.562 (1)
Percent days where oestrid index > 0.0	41.7 (1)	45.0 (2)	53.9 (3)	34.9 (1)	70.2 (3)	45.2 (2)	54.2 (3)	46.2 (2)	65.3 (3)	25.3 (1)
Percent days where oestrid index > 0.75	21.4 (2)	15.0 (1)	21.1 (2)	7.9 (1)	33.3 (3)	16.1 (2)	20.3 (2)	23.8 (3)	22.4 (3)	8.0 (1)
Percent days where oestrid index > 0.0 and days were consecutive	39.3 (1)	36.3 (1)	54.9 (3)	30.2 (1)	66.7 (3)	40.3 (2)	50.8 (2)	57.4 (3)	63.3 (3)	21.3(1)
Percent days where oestrid index > 0.75 and days were consecutive	16.7 (2)	12.5 (1)	19.7 (2)	7.9 (1)	31.6 (3)	16.1 (2)	18.6 (2)	27.7 (3)	14.3 (2)	6.7 (1)
Number of groups of consecutive days where oestrid index was > 0	3 (1)	6 (2)	9 (3)	6 (2)	4 (1)	5 (2)	5 (2)	6 (2)	6 (2)	6 (2)
Number of days in the highest 2 groups of consecutive days	26 (3)	19 (2)	17 (2)	11 (1)	32 (3)	19 (2)	19 (2)	16 (2)	18 (2)	8 (1)
Oestrid score	13	10	17	8	19	13	15	18	16	8
Oestrid rating	**Medium**	**Low**	**High**	**Low**	**High**	**Medium**	**Medium**	**High**	**High**	**Low**

Table 2. Relative annual ratings of mosquito harassment intensity for the area centered around Lupin, Ekati, and Daring Lake based on an index derived from temperature and wind speed, 1996 to 2005. Numbers in parenthesis are the annual indicator scores.

Indicators of potential insect level	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**
Mean yearly mosquito index for days index > 0	0.544 (3)	0.465 (2)	0.475 (2)	0.436 (1)	0.483 (3)	0.435 (1)	0.448 (2)	0.466 (2)	0.454 (2)	0.414 (1)
Percent days where mosquito index > 0.0	45.7 (1)	64.6 (3)	63.4 (3)	58.8 (3)	50.5 (2)	55.3 (2)	51.0 (2)	57.7 (3)	51.1 (2)	37.1 (1)
Percent days where mosquito index > 0.75	28.6 (3)	29.2 (3)	33.7 (3)	23.5 (2)	17.6 (1)	16.5 (1)	26.0 (2)	24.0 (2)	20.2 (1)	18.6 (1)
Percent days where mosquito index > 0.0 and days were consecutive	80.0 (1)	89.6 (3)	90.1 (3)	77.5 (1)	89.0 (3)	81.6 (2)	78.8 (1)	85.5 (3)	71.3 (1)	80.4 (2)
Percent days where mosquito index > 0.75 and days were consecutive	18.1 (3)	11.5 (2)	17.8 (3)	6.9 (1)	14.3 (3)	8.7 (1)	13.5 (3)	10.6 (2)	8.5 (1)	5.2 (1)
Number of groups of consecutive days where mosquito index was > 0	6 (2)	2 (1)	2 (1)	8 (3)	3 (1)	5 (2)	7 (3)	5 (2)	8 (3)	6 (2)
Number of days in the highest 2 groups of consecutive days	71 (3)	76 (3)	82 (3)	43 (1)	75 (3)	66(2)	48 (1)	62 (2)	42 (1)	43 (1)
Mosquito score	16	17	18	12	16	11	14	16	11	9
Mosquito rating	**High**	**High**	**High**	**Medium**	**High**	**Low**	**Medium**	**High**	**Low**	**Low**

Indicators of oestrid intensity based on an index derived from temperature and wind speed at Lupin, NT between June 1 and September 15, 1957 – 2005.

Year	Mean oestrid index for days index > 0	Days oestrid index > 0	Days oestrid index >0.75	Days oestrid index > 0 and days consecutive	Days oestrid index > 0.75 and days consecutive	Number groups consecutive days oestrid index > 0	Number days in highest 2 groups consecutive day	Season length in days	Oestrid Intensity Score	**Oestrid Intensity Rating**
1957	0.50	4	0	2	0	1	2	13	8	**L**
1958	0.52	1	0	0	0	0	0	1	8	**L**
1959	0.44	2	0	4	0	2	2	2	8	**L**
1960	0.61	12	1	10	0	4	5	50	12	**L**
1961	0.58	19	0	14	3	5	5	66	17	**H**
1962	0.58	8	0	8	0	2	8	9	9	**L**
1963	0.49	9	0	4	0	2	2	48	9	**L**
1964	0.48	14	1	8	0	4	2	42	9	**L**
1965	0.62	5	1	5	0	2	5	11	10	**L**
1966	0.58	23	5	21	5	8	8	60	21	**H**
1967	0.55	3	0	0	0	0	0	11	8	**L**
1968	0.54	5	0	4	0	2	2	63	10	**L**
1969	0.47	8	0	5	0	2	2	43	8	**L**
1970	0.51	10	1	8	0	3	6	47	9	**L**
1971	0.52	8	1	7	0	3	5	53	9	**L**
1972	0.62	4	0	0	0	0	0	62	12	**L**
1973	0.62	31	11	28	11	6	15	68	24	**H**
1974	0.60	17	4	15	2	4	9	50	16	**M**
1975	0.58	16	0	15	0	4	10	54	15	**M**
1976	0.59	23	5	19	4	4	15	49	21	**H**
1977	0.53	9	0	4	0	2	2	45	8	**L**
1978	0.00	0	0	0	0	0	0	0	8	**L**
1979	0.74	8	4	6	2	2	3	45	11	**L**
1980	0.51	16	1	15	0	3	13	48	13	**L**
1981	0.54	17	3	14	2	6	5	33	12	**L**
1982	0.60	24	6	23	6	7	12	66	24	**H**
1983	0.69	19	7	17	3	5	11	52	22	**H**
1984	0.69	28	8	26	7	6	14	69	24	**H**

Year	Mean oestrid index for days index > 0	Days oestrid index > 0	Days oestrid index >0.75	Days oestrid index > 0 and days consecutive	Days oestrid index > 0.75 and days consecutive	Number groups consecutive days oestrid index > 0	Number days in highest 2 groups consecutive day	Season length in days	Oestrid Intensity Score	**Oestrid Intensity Rating**
1985	0.62	8	2	7	2	2	6	46	11	**L**
1986	0.68	17	6	11	0	2	11	55	17	**H**
1987	0.62	16	3	15	2	5	3	49	15	**M**
1988	0.66	26	8	23	5	4	16	76	23	**H**
1989	0.68	39	14	37	11	7	19	83	24	**H**
1990	0.62	13	3	11	2	2	11	37	12	**L**
1991	0.63	33	8	29	4	4	21	56	23	**H**
1992	0.73	17	9	16	5	5	9	44	19	**H**
1993	0.57	20	0	20	0	4	14	56	18	**H**
1994	0.55	41	8	37	5	11	15	89	22	**H**
1995	0.58	12	1	11	0	2	11	70	13	**L**
1996	0.67	30	10	30	7	3	24	39	20	**H**
1997	0.57	29	3	23	0	5	16	81	19	**H**
1998	0.56	38	7	36	4	9	16	77	23	**H**
1999	0.52	19	2	15	2	5	9	64	16	**M**
2000	0.62	37	8	36	2	4	32	58	21	**H**
2001	0.64	19	7	14	5	4	11	63	22	**H**
2002	0.61	26	8	23	7	5	16	62	24	**H**
2003	0.65	25	12	20	10	5	13	64	24	**H**
2004	0.60	19	6	14	5	4	9	48	20	**H**
2005	0.59	15	3	11	2	4	7	76	12	**L**

Indicators of mosquito intensity based on an index derived from temperature and wind speed at Lupin, NT between June 1 and September 15, 1957 – 2005.

Year	Mean mosquito index for days index > 0	Days mosquito index >0	Days mosquito index>0.75	Days mosquito index > 0 and days consecutive	Days mosquito index >0.75 and days consecutive	Number groups consecutive days mosquito index >0	Number days in highest 2 groups consecutive day	Season length in days	Mosquito Intensity Score	**Mosquito Intensity Rating**
1957	0.44	58	2	57	2	8	27	76	9	**L**
1958	0.41	66	0	32	0	5	21	96	11	**L**
1959	0.34	21	0	15	0	5	9	70	8	**L**
1960	0.49	70	7	70	3	7	32	86	17	**H**
1961	0.52	67	9	67	5	6	40	80	20	**H**
1962	0.41	67	5	62	2	6	45	101	15	**L**
1963	0.41	64	3	63	0	7	42	83	13	**L**
1964	0.44	62	3	52	0	7	31	73	9	**L**
1965	0.48	62	3	61	2	7	33	76	12	**L**
1966	0.51	77	8	66	6	10	29	102	22	**H**
1967	0.39	54	2	48	0	9	16	91	11	**L**
1968	0.37	54	2	49	2	7	23	89	8	**L**
1969	0.41	54	2	53	0	6	32	67	9	**L**
1970	0.43	62	1	57	0	10	31	90	10	**L**
1971	0.45	64	1	61	0	11	24	92	14	**L**
1972	0.42	59	2	55	0	6	36	85	9	**L**
1973	0.50	82	15	80	12	11	34	105	23	**H**
1974	0.47	60	6	60	4	12	9	86	14	**L**
1975	0.45	77	10	75	4	7	13	97	18	**H**
1976	0.46	69	11	63	9	9	34	100	22	**H**
1977	0.44	69	3	65	2	11	23	101	16	**M**
1978	0.40	33	0	24	0	8	9	96	11	**L**
1979	0.44	60	5	56	3	8	31	86	9	**L**
1980	0.44	67	5	65	4	8	39	91	17	**H**
1981	0.47	68	8	67	4	7	34	101	22	**H**
1982	0.55	52	12	48	7	7	26	97	18	**H**
1983	0.51	75	12	72	6	7	44	96	24	**H**

Year	Mean mosquito index for days index > 0	Days mosquito index >0	Days mosquito index>0.75	Days mosquito index > 0 and days consecutive	Days mosquito index >0.75 and days consecutive	Number groups consecutive days mosquito index >0	Number days in highest 2 groups consecutive day	Season length in days	Mosquito Intensity Score	**Mosquito Intensity Rating**
1984	0.58	75	16	75	13	2	72	82	20	**H**
1985	0.45	56	3	49	3	9	24	105	13	**L**
1986	0.51	59	10	55	9	8	25	83	15	**L**
1987	0.45	53	8	49	4	9	25	98	15	**L**
1988	0.50	79	14	74	10	3	61	99	22	**H**
1989	0.50	85	18	80	12	4	63	102	22	**H**
1990	0.39	57	5	57	4	9	31	94	13	**L**
1991	0.49	66	9	63	4	5	38	93	19	**H**
1992	0.51	61	10	59	7	5	40	84	17	**H**
1993	0.51	56	8	54	6	6	32	82	15	**L**
1994	0.45	78	11	75	6	9	47	108	23	**H**
1995	0.47	68	6	67	6	8	38	83	19	**H**
1996	0.51	81	12	82	8	5	71	106	22	**H**
1997	0.43	79	6	79	0	4	58	91	15	**L**
1998	0.43	80	11	68	9	11	23	101	20	**H**
1999	0.39	64	3	51	2	9	30	101	13	**L**
2000	0.45	75	6	73	2	5	50	92	16	**M**
2001	0.42	72	9	66	5	9	38	103	22	**H**
2002	0.45	64	9	58	7	7	32	100	19	**H**
2003	0.47	76	10	72	7	12	34	104	23	**H**
2004	0.46	48	4	42	2	8	23	98	12	**L**
2005	0.42	59	6	55	2	10	29	90	10	**L**