



THE MONITORING OF QAMANIRJUAQ CARIBOU (*Rangifer tarandus groenlandicus*) USING SATELLITE TELEMETRY

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**STATUS REPORT TO THE NUNAVUT WILDLIFE MANAGEMENT BOARD**  
**(NWMB Project #110-99-4)**

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January 15<sup>th</sup>, 2005

**Title:** The monitoring of Qamanirjuaq caribou (*Rangifer tarandus groenlandicus*) using satellite telemetry.

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**Project Summary:**

In November 1997 the GNWT's Department of Environment deployed 5 satellite collars on female Qamanirjuaq caribou, 3 in the southwestern Kivalliq and the remaining 2 just west of Rankin Inlet. An additional 5 collars were deployed in April 1998 of which 2 were placed on Qamanirjuaq cows west of Arviat and the remaining 3 west of Rankin Inlet. Following a collar recovery program in November 2000 an additional 10 satellite collars were deployed on Qamanirjuaq caribou cows in April 2001. Plans to put an additional 5 GPS/Satellite collars on Qamanirjuaq cows in March/April 2003 were thwarted by the animal's distance from fuel caches. Another attempt was made in November 2003 when the lakes were safely frozen but by this time the herd had moved out of helicopter range. Success was achieved in the spring of 2004 and 9 GPS 3 collars and one ST-14 satellite collar were deployed on Qamanirjuaq cows. Since the deployment the collared cows have moved further west south west then than has been recorded for previously collared Qamanirjuaq caribou cows. Animals moved as far south and west as Lac Brochet Manitoba and Black Lake Saskatchewan and as far west as Whitefish and Rennie Lake. Reasons for these extensive movements could be related to an icing event recorded in mid-November along the Hudson Bay Coast Line. According to hunters this event deposited ice as thick as 2 inches up to 100 Km inland. In addition a shorter than normal growing season (2004/05) last summer may have reduced plant biomass enough to cause caribou to seek higher quality and quantities of early winter forage further inland.

Since the initiation of this project interests in mining on the Qamanirjuaq Range have continued to increase. Satellite/GPS telemetry offers a useful tool to monitor caribou and identify potential conflicts with resource development, as well as improving our understanding of caribou range use. The collars (or PTTs) transmit GPS location data to orbiting satellites every 10 days, providing daily locations accurate to within 10 meters. Collar location data is used by local hunters, regional wildlife organizations and used biologically to prevent conflicts with resource development, locate concentrations of caribou for survey work, identify winter and summer ranges, locate calving grounds, determine rut and fall migration patterns and to monitor post-calving aggregations and movements.

In June 1994, the Qamanirjuaq herd size was estimated at 496,000. As development and mineral exploration activity picks up in the Kivalliq, there will be increasing pressure on calving and post-calving caribou. Proper implementation of I.N.A.C.'s Caribou Protection Measures should provide caribou with some protection during this sensitive period. In order to be effective however, these measures must be complemented with a monitoring program which: 1) determines the geographically significant components of Qamanirjuaq caribou range and how these components relate to the herd's seasonal use of its range, 2) defines calving grounds annually, 3) monitors post-calving movements, and 4) ensures that conflicts between caribou and exploration/human activity can be acknowledged and dealt with.

### **2001 Movements**

Since the 1960s Qamanirjuaq caribou have been moving out of their winter range in north-western Manitoba, north-eastern Saskatchewan, south-eastern NWT, and south-western Nunavut into staging areas in the vicinity of Cullaton Lake, Seal Hole Lake & Ennadai Lake in late March/early April. Past hunter reports and satellite collar location data suggest that tens of thousands of caribou occupy these areas through the month of April prior to their spring migration east as far as the Hudson Bay coast then north to their calving grounds in the vicinity of Qamanirjuaq Lake. However, for the first time in approximately 30 years Arviat hunters have reported few to no caribou in these areas during March and April 2001 and 2002. During this same period hunters from Tadoule Lake and Lac Brochet Manitoba reported groups of thousands of caribou moving east past their communities in northern Manitoba. This change in spring movement's concerned Arviat hunters and in response to these concerns the Department of Sustainable Development (DSD) initiated a reconnaissance flight east of Tadoule Lake and along the Hudson Bay coast where Arviat hunters were just starting to see what appeared to be large groups of caribou. The results of the reconnaissance survey clearly showed large groups of caribou staging (gathering in large numbers) in the vicinity of Seal River out onto the Hudson Bay coast. The collaring of 10 of these animals later revealed a migration north along the Hudson Bay coast past Nunella and Maguse Lake to the Banks Lake/Qamanirjuaq Lake area in mid-May. Hunters reported that the animals they harvested during this period had lots of fat and appeared to be in excellent condition.

### **2002 Movements**

Following a typical winter where Qamanirjuaq caribou spent much of their time in northern Manitoba, northeastern Saskatchewan and southeastern NWT, collared

Qamanirjuaq caribou cows began aggregating in the vicinity of Neultin Lake in late March and early April. It wasn't until late May however that collared cows began their Northward migration towards their traditional calving grounds and it wasn't until early June 2002 that it became apparent that none of the collars would make it beyond the southern edge of the calving grounds by peak calving. The reasons for this may be related to a later than average thaw. Snow covers within the calving ground, during June 2002, varied from 40% to 50% along the southern latitudes, 60% to 80% within the middle latitudes and over 90% along the northern edge of the calving ground.

Very few Qamanirjuaq caribou cows made it to their traditional calving grounds this spring. A short reconnaissance survey used to check on the status of collared Qamanirjuaq cows was flown through the area while on route to survey Northeast Mainland caribou calving grounds. There were low densities of Qamanirjuaq cows along the southern edge of the Qamanirjuaq herd's traditional calving ground. No caribou were observed within the central or northern portions of the traditional calving ground. Despite these findings, there were still many reports of healthy cows and calves. Local hunters reported observations of many calves in the Maguse Lake area and an over flight on the 18th of June reported large aggregations of cows and calves between Quarzite and Maguse Lakes.

### **2003 Movements**

Winter 2003 saw all Qamanirjuaq collars aggregated in the vicinity of Firedrake Lake Northwest Territories through December and January 2003 spreading east along the treeline as the winter progressed. Spring staging took place in the vicinity of Ennadai Lake with the spring migration moving through its more northerly route in the vicinity of Sealhole Lake though many animals migrated towards the coast south of Neultin Lake as has been observed in 2001 and 2002. Sightings in Lac Brochet suggested a contingent of animals not represented by the collars occupied the taiga of North Western Manitoba throughout early spring. Calving and post-calving proceeded normally and stayed within normal distributions. Late summer and fall movements were considerably further north and west than satellite collared Qamanirjuaq cows have previously shown. Though large groups of caribou did move closer to the coast before heading south and West into Manitoba and the NWT for the rut, they were considerably further inland (Camp Lake area) than seen in previous years (Magouse Lake area).

#### **Project Start:**

In November 1997 the GNWT's Department of Sustainable Development deployed 5 satellite collars on female Qamanirjuaq caribou, 3 in the southwestern Kivalliq and the remaining 2 just west of Rankin Inlet. An additional 5 collars were deployed in April 1998 of which 2 were placed on Qamanirjuaq cows west of Arviat and the remaining 3 west of Rankin Inlet. Following a collar recovery program in November 2000 an additional 10 satellite collars were deployed on Qamanirjuaq caribou cows in April 2001. Since the initiation of this project interests in mining on the Qamanirjuaq Range have continued to increase.

#### **Project Finish:**

The estimated completion date of the present phase of the Qamanirjuaq monitoring program is Jan 2007. An interim report is presently being generated with an expected completion date of March 15<sup>th</sup>, 2004.

### **Background:**

The Qamanirjuaq Caribou Herd is the largest herd in Nunavut occupying a massive (300,000km<sup>2</sup>) yet poorly understood range. Kivalliq Inuit utilize over 9,000 Qamanirjuaq caribou per year with an estimated value of over \$7.2 million (\$800/caribou). The logistics involved in determining how these caribou use their range are for the most part labor intensive and cost restrictive. A continuation of a satellite telemetry program launched in 1993 will aid in the building of a comprehensive location and activity database. Alone this database has been providing biologists, Hunter Trapper Organizations, Regional Wildlife Organization and inter-jurisdictional and jurisdictional management boards with the only source of information connecting the Qamanirjuaq caribou to their range. This kind of information is crucial to the development of management plans and the steering of land use activities in an informed, conservation minded direction. As land use activities heighten to meet the needs of a rapidly growing natural resource based economy, the maintenance of viable wildlife populations with high sustainable yields will require an escalation in our attempts to quantify wildlife habitat (Gray and Donihee, 1983; Scotter, 1980; Thompson et al, 1980). Knowing where the caribou are is the key to avoiding conflicts between natural resource industries and caribou (Tennenhouse, 1986).

Population surveys conducted on the Qamanirjuaq population of barren-ground caribou have shown an increase from 44,000 animals in 1977 to 260,000 +/- 60,000 animals in 1987 to 496,000 +/- 105,400 animals in 1994 (Heard, 1981; Gates, 1983; Russell, 1990). Cow/calf ratios have shown a decline from 60:100 in 1992 to 47:100 in 1996 to 30:100 in 1999 to 26:100 in 2003. Currently annual spring classifications are scheduled for March/April.

The dramatic decline in Qamanirjuaq numbers, identified in the early 1950's, sparked a flood of scientific studies all attempting to understand the underlying mechanisms responsible for the decline (Heard, 1985; Parker, 1972). Research efforts were at their peak between the late 1970's and early 1980's. A population survey in 1982 showed that the trend was dramatically, and despite research efforts, mysteriously, reversed (Gates, 1989). This mysterious increase was not surprising to local hunters as the local knowledge of the time disagreed strongly with scientific findings.

Migratory patterns exhibited by Qamanirjuaq caribou include spring, late summer/early fall and late fall/early winter are currently poorly understood by all managers on the range (Banfield, 1954; Heard and Calef, 1986; Thompson and Fisher, 1979).

### **Objectives:**

The objectives of the current project are to maintain 10 satellite collars on Qamanirjuaq caribou cows to: 1) establish an important habitats information base for the

Qamanirjuaq caribou herd by integrating the location and activity database, using spatial analysis software, with vegetation, hydrological, topographical, exploration and land use databases, 2) provide resource users, regional Wildlife Organizations, Jurisdictional and inter-jurisdictional Management Boards access to an information base with which to make management decisions and steer land use activities, in an informed and conservation minded direction, 3) locate caribou concentrations for annual spring classifications, future population surveys and calving ground delineation's. Following is a breakdown of the main objective:

1) Locate and quantify the seasonally important components of the Qaminirjuaq caribou range using satellite telemetry.

**Biological rationale:** Habitat quality, quantity and availability largely define the biological limitations of wild populations (Gray and Donihee, 1983; Scotter, 1980; Thompson et al, 1980; Dasmann, 1981). An understanding of the locations and size of distinct vegetation classes and how these classes relate to Qamanirjuaq caribou habitat requirements will assist managers in assessing the herd's present and future needs. A satellite telemetry program offers the most cost effective and logistically simple means of identifying and monitoring Qamanirjuaq caribou range use.

2) To provide an accessible information base to wildlife managers, RWOs and HTOs to assess and steer land use in a sustainable manner.

**Biological rationale:** Conflicts can and will arise during the allocation of a wildlife resource as a result of inadequate Knowledge, temporary and/or permanent alterations of wildlife populations and habitat resulting from exploration and development, hunting and trapping, and natural change, separately or combined (Donihee and Grey, 1982). Successful planning for wildlife and habitat management is contingent upon an adequate database, and a process to utilize that database. This database is lacking in the Kivalliq Region, as are our abilities as wildlife managers to make informed responses concerning the conservation of wildlife and their habitat.

3) To cost effectively locate Qamanirjuaq caribou for population studies.

**Biological rationale:** The most time consuming and costly component in the study of Qamanirjuaq caribou is finding them. Because of their massive range and often-unpredictable patterns of movement, expensive surveys have in the past been required prior to any data collection. Using collar locations as the focal points for more intensive studies would save considerable time and money relative to the cost of satellite collar deployment and maintenance. The locations of collared caribou will be used to initiate future population surveys, classification and composition work and calving ground delineation's.

## **Results:**

### **Movements Overview (1994 to 2002)**

A preliminary analysis of cumulative movements (1994 to 2002) for the Qamanirjuaq Herd revealed distributions generally within the Known Qamanirjuaq range. Exceptions to this included Qamanirjuaq caribou cows #'s QM0200398, QM0210398 and QM0250498. All three of the caribou mentioned above moved outside of the known Qamanirjuaq range (Figure 1). Caribou # QM0200398 remained within known range

extents until the winter of 2000 when it occupied the Garry Lakes area through winter 2000 and 2001. This area is also known to be winter range for the Ahiak, Lorillard and Wager populations. Caribou # QM0200398 did however return, each spring (1998- appears to be wintering in more traditional Qamanirjuaq wintering areas south of the tree line. Caribou cows # QM0210398 and QM0250498 were originally captured in the northeastern portion of the known Qamanirjuaq range. Following their capture both animals moved north across Chesterfield Inlet into the Lorillard range without returning to the Qamanirjuaq range. It is a possibility that the animals collared were in fact



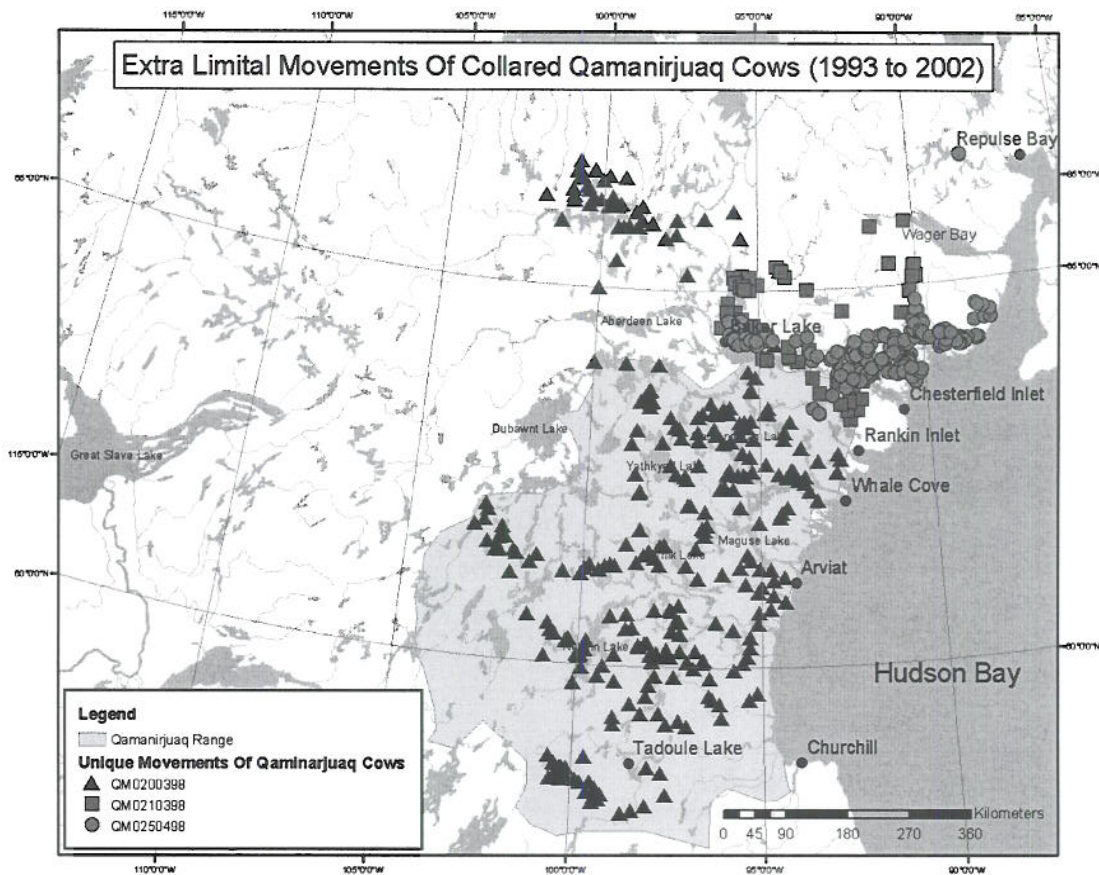


Figure 1 Movements of Qamanirjuaq cows # QM0200398, QM0210398 & QM0250498 outside of the known Qamanirjuaq range extents. All animals were collared on the Qamanirjuaq range. (ID# : QM = Qamanirjuaq population; 020 = the 20<sup>th</sup> Qamanirjuaq caribou collared since the start of the program; 03 = the month of capture; 98 = the capture year).

members of the Lorillard population. Since this time no other observations of Lorillard caribou moving south across Chesterfield inlet have been documented.

In general, and without in depth analysis, satellite collar location data from 1995, 2000 and 2002 indicate delayed spring migration and resultant arrivals on the calving grounds (Figures 2, 3, 4 & 5). Notably the 2000 and 2002 data suggests calving outside of the traditional calving grounds. Winter range extents also seem to have steadily increased from 1993 to 2002.

Currently 7 of the original 10 satellite collars deployed in April 2001 are transmitting location and activity data. Of the original 10 one collar has malfunctioned, a second accidentally harvested by a Rankin Inlet hunter, and a third killed by wolves. A proposal to collar 10 additional Qamanirjuaq caribou in April 2003 is being drafted. Collars deployed in April 2001 are scheduled to drop automatically April 2003.

### **Movements 2000**

The spring 2000 migration to the calving grounds was delayed 3-4 weeks depending on the winter range caribou were moving out of. Animals occupying the western extents of their winter range started their spring migration in late April/early-May approximately one week behind expected dates for the onset of the migration (Figures 2, 3, 4 & 5). Animals wintering in Northern Manitoba began their spring movements on or about the last week of May approximately 4 weeks behind expected. Many of the animals overwintering in Northern Manitoba never made it to the 2000 calving grounds. Hunters and pilots observed numerous calves south of the known calving grounds in June 2000. Reasons for these changes in migratory patterns are thought to be due to the higher than normal accumulations of snow during spring. Frequent icing events on the Qamanirjuaq winter range (Cam Elliot pers. Comm., 2000) may also have played a role in the delays.

### **Movements 2001**

Qamanirjuaq spring movements for 2001 have noticeably changed when compared to satellite location data collected since 1994 (Figures 2, 3, 4 & 5). In spring 2001, collared Qamanirjuaq cows began their spring migration in mid-May, a pattern similar to caribou movements observed since 1994. However, the spring staging area, and as a result the onset of the spring migration began in the Seal River watershed to its confluence with the Hudson Bay some 300 km south east of their historic spring staging area. An April Reconnaissance survey documented this change when over 100,000 animals (Tadoule Lake hunter observations & recon. Survey density estimates) were observed moving along the Seal River watershed and staging at its confluence with the Hudson Bay (Figure 6). The reasons for this shift in spring range use are currently under investigation.

The fall migration also seems to have diverged from the norm as satellite collared animals moved onto their early winter range in mid-October, approximately three weeks ahead of expected. A component of the Qamanirjuaq Caribou Herd has historically moved into Northern Manitoba during the first or second week of November. As hunters did not start reporting “stinky” bulls until mid-October it appears the Rut was also delayed approximately 2 weeks beyond when local hunters had normally expected the its onset. The short 2000 growing season may have played a role in drawing animals further south to take advantage of an expected increase in plant biomass typical of the more southern reaches of the Qamanirjuaq Range. This hypothesis is only speculative.

### **Movements 2002**

Following a typical winter where Qamanirjuaq caribou spent much of their time in northern Manitoba, northeastern Saskatchewan and southeastern NWT, collared Qamanirjuaq caribou cows began aggregating in the vicinity of Neultin Lake in late March and early April. It wasn't until late May however that collared cows began their Northward migration towards their traditional calving grounds and it wasn't until early June 2002 that it became apparent that none of the collars would make it beyond the southern edge of the calving grounds by peak calving. The reasons for this may be related to a later than average thaw. Snow covers within the calving ground, during June 2002, varied from 40% to 50% along the southern latitudes, 60% to 80% within the middle latitudes and over 90% along the northern edge of the calving ground.

To verify the degree to which the collars represented calving ground distributions a short reconnaissance survey was flown through the area while on route to survey Northeast Mainland caribou calving grounds. Survey observations indicated low densities of Qamanirjuaq cows along the southern edge of the Qamanirjuaq herd's traditional calving ground. No caribou were observed within the central or northern portions of the traditional calving ground. Despite these findings, there were still many reports of healthy cows and calves south of the calving grounds. Local hunters reported observations of many calves in the Maguse Lake area and an over flight on the 18th of June reported large aggregations of cows and calves between Quarzite and Maguse Lakes.

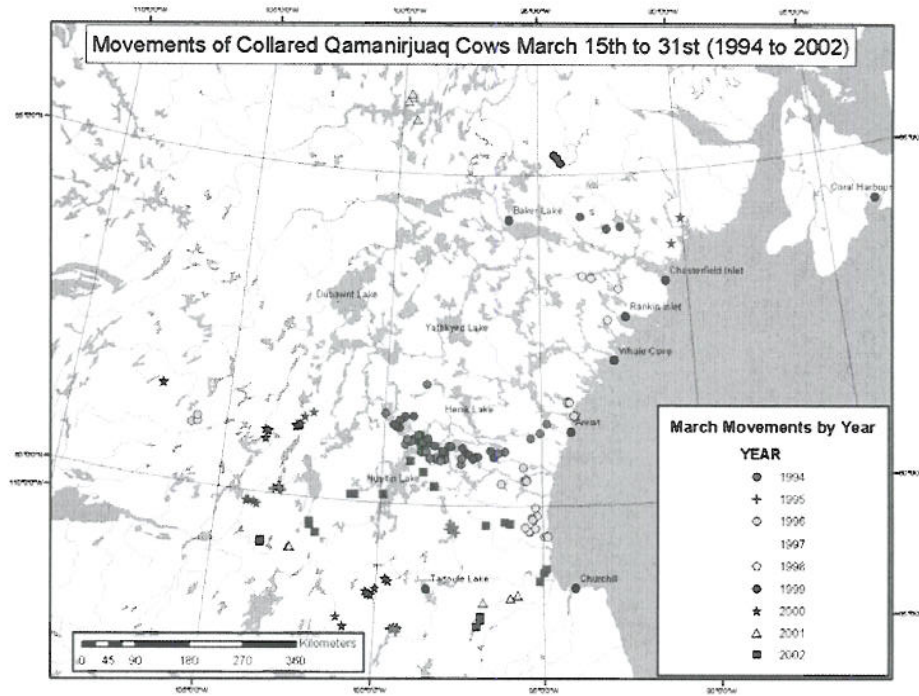


Figure 2 Yearly movements of satellite collared Qamanirjuaq caribou from March 15<sup>th</sup> to March 31<sup>st</sup> .1994 to 2002.

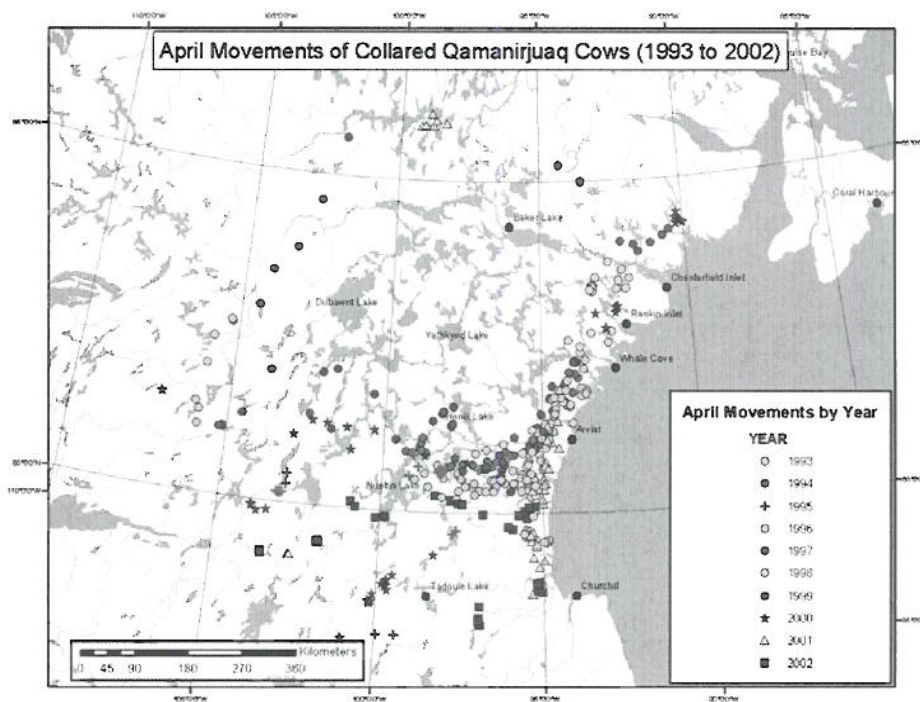


Figure 3 Yearly movements of satellite collared Qamanirjuaq caribou during the month of April 1994 to 2002.

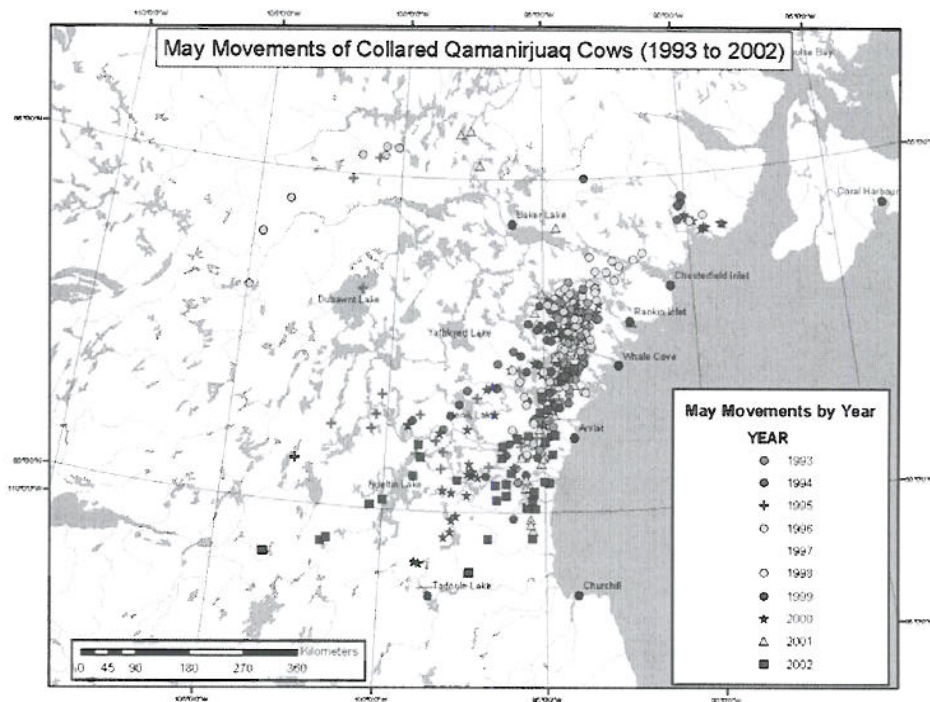


Figure 4 Yearly movements of satellite collared Qamanirjuaq caribou during the month of May 1994 to 2002.

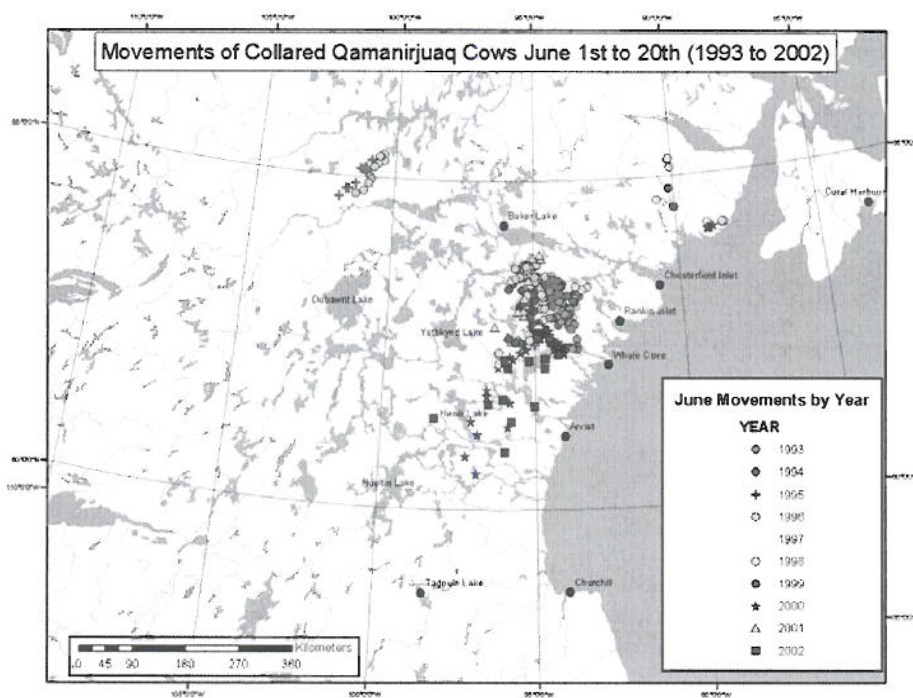


Figure 5 Yearly movements of satellite collared Qamanirjuaq caribou from June 1<sup>st</sup> to June 15<sup>th</sup>, 1994 to 2002.

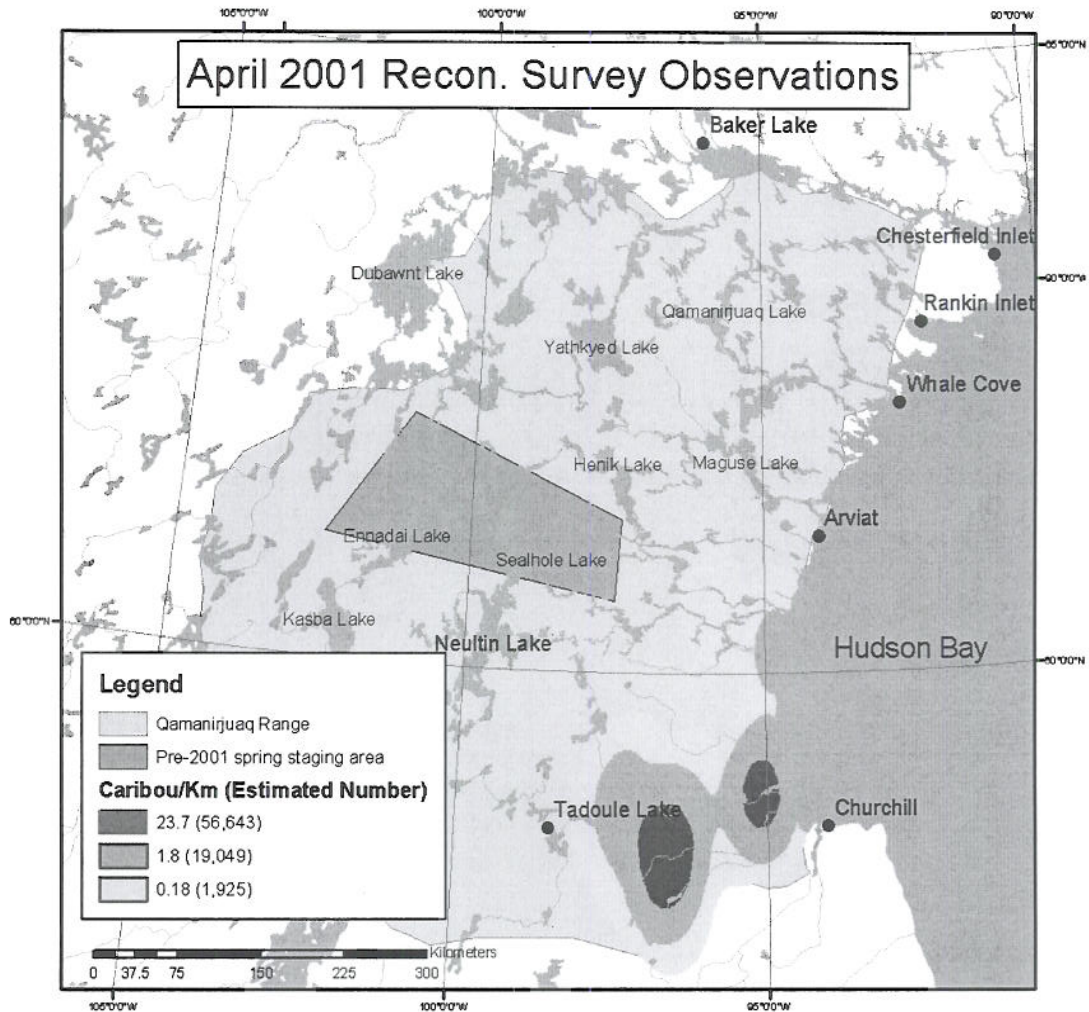


Figure 6 The 2001 Qamanirjuaq spring staging area based on observations from a reconnaissance survey flown April 8<sup>th</sup>, 2001. The pre-2001 Qamanirjuaq spring staging area (based on satellite collar location data 1994 to 2000) is included for comparative purposes.

## Movements 2003

Winter 2003 saw all Qamanirjuaq collars aggregated in the vicinity of Firedrake Lake Northwest Territories through December and January 2003 spreading east along the treeline as the winter progressed (Figure 7). Spring staging took place in the vicinity of Ennadai Lake with the spring migration moving through its more northerly route in the vicinity of Sealhole Lake though many animals migrated towards the coast south of Neultin Lake as has been observed in 2001 and 2002. Sightings in Lac Brochet suggested a contingent of animals not represented by the collars occupied the taiga of North Western Manitoba throughout early spring. Calving and post-calving proceeded normally and stayed within normal distributions. Late summer and fall movements were considerably further north and west than satellite collared Qamanirjuaq cows have previously shown. Though large groups of caribou did move closer to the coast before heading south and West into Manitoba and the NWT for the rut, they were considerably further inland (Camp Lake area) than seen in previous years (Magouse Lake area).

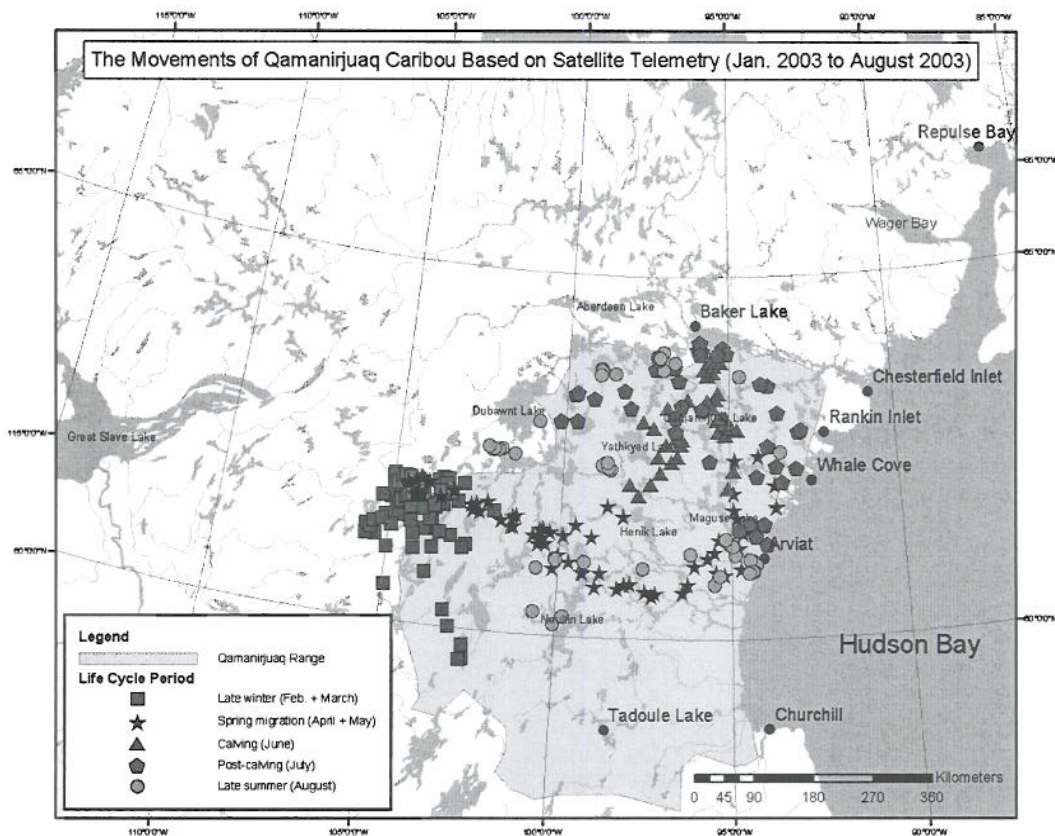


Figure 7 The movements of Satellite collared cows from the Qamanirjuaq Herd from January 2003 to August 2003.

### Demographics (1993 to 2003)

The most recent classification survey was conducted in March 2003. Attempts were made to classify Qamanirjuaq caribou in spring of 2000, 2001 and 2002, however spring staging took place below tree line and in at least three separate locations. In addition the late timing of staging and early migration conflicted with other research schedules. The results of the 2003 classification showed similar values to those collected in March 1999 (Table 1). Higher cow/calf ratios were observed between 1993 and 1996 and likely represented the tail end of a period of growth for the herd. Current figures suggest a moderation in herd growth. Although these figures alone might suggest a slowing of the growth of the Qamanirjuaq herd, new classification data is needed if we are to determine a more reliable trend. A spring classification is planned for March/April 2004.

**Table 1.** Qamanirjuaq caribou spring composition data from 1993 to 2003 (Ca:Cow = cow calf ratio; C = cow; Ca = calf; YF = yearling female; YM = yearling male; YB = young bull; MB = mature bull).

Year	Date (Julian)	Ca:Cow	C (%)	Ca (%)	YF (%)	YM (%)	YB (%)	MB (%)	Total #'s
1993	86-89	46:100	51	24	2	6	11	7	6702
1994	82-87	48:100	47	25	4	5	16	4	10248
1995	98-104	47:100	52	25	8	5	8	3	5167
1996	93-99	42:100	54	23	8	5	10	1	13488
1999	77-83	30:100	56	17	5	5	14	3	16831
2003	126-129	26:100	69	18	6	2	4	4	17796

### Other Research

A pilot study examining the use of post calving photography to estimate the population status of Qamanirjuaq caribou was undertaken July 4<sup>th</sup> and 5<sup>th</sup> 2001 (Figure 8). Satellite collars were used to locate groups of post calving caribou, which are then photographed and counted at a later date. In order for this method to be cost effective groups of caribou found at each of the collar locations should exceed 10,000 to 20,000 animals. In July 2001 group sizes of only 500 to 3000 were found in the vicinity of each of the collars. This would suggest that the application of enough collars to adequately represent the over 400,000 animals thought to be occupying the range would be too expensive. Photos taken during the survey are presently being digitized. Completed counts are expected by early February 2003.





Figure 8 Aggregations of caribou cows, calves & yearlings on their post-calving range near Ferguson Lake, Kivalliq Region (July 5<sup>th</sup> 2001).

#### **Reporting to Communities/Resource Users:**

Since 1997 meetings explaining the capturing and collaring process and proposed study schedule with local HTOs have already been completed. More formal meetings have been held in Arviat, Baker Lake, Whale Cove, and Chesterfield Inlet following the completion of the deployment and the collection of preliminary data. During these meetings, methods, schedules and current results were discussed. Local HTOs and DSD wildlife officers also used local radio to inform the public of the project status. Preliminary study results were provided to all Kivalliq HTO's and the Kivalliq Wildlife Board in the form of a bi-annual Newsletter the Kivalliq Wildlife Research Update (KWRU) and annual status reports. The Department will continue to provide updates to all HTOs and the KWB as results become available or on request. The final results of the study will be communicated both verbally and through the use of visual displays (Posters and Slides) and handouts in both Inuktitut and English on or about November

2005 to take advantage of communities annual general meetings. Verbal information will be relayed to the public through the use of a translator.

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**Budget:**

Please note that the collaring was not completed this season due to a lack of animals in the vicinity of remote fuel caches. The rotary wing invoice was paid as DSDs purchasing department put a guarantee of payment clause on the Req. not authorized by the proponent. The rotary wing company is however holding the hours in trust for use in April 2004 to fulfill the objectives of the original proposal.

Scientific supplies non-disposable was overlooked in the 2003/04 proposal. Collar breakaway devices, and capture.

<b>Budget Item</b>	<b>Budgeted</b>	<b>Disbursed</b>	<b>Variance</b>
Community Observer	\$1,500.00	\$0.00	+\$1,500.00
Scheduled Air			
Meals and Accommodation	\$2,500.00	\$0.00	+\$2,500.00
Air Charter (Fixed Wing)			
Air Charter (Rotary Wing)	\$17,000.00	\$16,027.00	+\$973.00
Fuel Purchase			
Scientific Supplies (Disposable)	\$1,000.00	\$1,548.00	-\$548.00
Scientific Supplies (Non-disposable)		\$10,756.00	-\$10,756.00
Freight			
Telephone			
Fuel Delivery			
Community contracts	\$2,500.00	\$0.00	+\$2,500.00
Technical services (south)	\$22,500.00	\$23,000.00	-\$500.00
Printing and Graphics			
<b>Totals</b>	<b>\$47,000.00</b>	<b>\$51,331.00</b>	<b>-\$4,331.00</b>

**The monitoring of Qamanirjuaq caribou (*Rangifer tarandus groenlandicus*) using satellite telemetry**

<b>Agency</b>	<b>Proposed Contribution</b>	<b>Actual Contribution</b>	<b>Variance</b>
Department of Sustainable Development	\$27,000.00	\$31,331.00	-\$4,331.00
Nunavut Wildlife Management Board	\$20,000.00	\$20,000.00	\$0.00
<b>Totals</b>	<b>\$47,000.00</b>	<b>\$51,331.00</b>	<b>-\$4,331.00</b>

**PROPOSED BUDGET 2003-2004**

**Project Name: Qamanirjuaq**

**Caribou**

**Project Code: 1174020**

**Year: 2003-2004**

	<b>ORIGINAL TOTAL</b>	<b>Apr.-Dec.</b>	<b>Jan.-Mar.</b>	<b>Total</b>
<b>Casual Wages</b>				
Research Assistant	\$1,500.00	\$0.00		\$0.00
<b>Travel and Accommodations</b>				
Meals/accom (north)	\$2,500.00	\$0.00		\$0.00
Air charter (rotary)	\$17,000.00	\$16,027.00		\$16,027.00
<b>Materials and Supplies</b>				
Scientific supplies non-disposable		\$10,756.00		\$10,756.00
Fuel Purchase				
Field supplies dispos. (Food, fuel)	\$1,000.00	\$1,548.00		\$1,548.00
<b>Contract Services</b>				
Community contracts (fuel caching)	\$2,500.00	\$0.00		\$0.00
Technical services (consultants, south) (Argos Fees)	\$22,500.00		*\$23,000.00	\$23,000.00
<b>PROPOSED TOTAL</b>	<b>\$47,000.00</b>	<b>\$28,331.00</b>	<b>\$23,000.00</b>	<b>\$51,331.00</b>

\* Estimated expenditure to year end.

\*\* Rotary wing hours are to be carried over to 2004/2005 field season.