

Summary: 2007 Barren-ground Caribou Calving Distribution Surveys, Northwest Territories & Nunavut

Environment & Natural Resources, Government of the Northwest Territories

Overview: The 2006-2010 Caribou Management Strategy of the Northwest Territories (NT) called for increased monitoring of the status and distribution of territorial barren-ground caribou herds. Barren-ground caribou herds across their North American range have been named and managed based on their calving grounds, and the importance of these habitats to herd productivity and calf survival has been widely recognized. In June 2007, for the first time, the calving ground distribution of the large mainland migratory barren-ground herds across the NT were surveyed near the peak of calving. Most NT herds range over large areas that include portions of Nunavut, the prairie provinces, and Yukon, thus monitoring of these herds requires inter-jurisdictional cooperation.

This summary briefly describes the results of the calving ground distribution surveys carried out in June 2007 by NT government staff, in cooperation with Nunavut government staff and community observers. The following herds were surveyed (from west to east): Tuktoyaktuk Peninsula¹, Cape Bathurst, Bluenose-West, Bluenose-East, Bathurst, Beverly, Ahlak, and Qamanirjuaq. More complete survey reports will be needed for co-management boards, partners and stake-holders; this summary describes the main findings, with maps showing calving grounds, including areas of higher and lower concentration.

Surveys were carried out with small fixed-wing aircraft in June 2007. A systematic approach was used, with parallel flight lines 5 or 10 km apart. The extent of area flown was guided by locations of radio-collared caribou and previous survey information, and flight lines continued until no more groups of calving caribou were seen. Groups of caribou seen on transect were recorded and their location was recorded using Global Positioning Systems (GPS). Approximate numbers of caribou in each group were recorded, although these surveys were not intended to estimate population size. The observations of caribou were mapped using a computer program that translates locations and numbers of caribou seen on transects into areas of higher and lower caribou density.

Overall, the calving grounds for 6 of the 7 herds surveyed in June 2007 were consistent with previous calving ground survey and radio-collar information for these herds from recent years. There had not been a previous calving distribution survey on the caribou/reindeer herd on the Tuktoyaktuk Peninsula. The calving grounds of the Beverly herd had not been surveyed since 2002 and the Qamanirjuaq calving grounds had not been surveyed since 1994. The peak of calving in the surveyed herds was estimated at June 11-14, based on seeing about 50% of the cows with newborn calves.

There were very few caribou on the calving ground of the Beverly herd, although all of the traditional calving ground of this herd was flown, along with substantial adjacent areas, to make sure that no significant groups of caribou had been missed. The limited calving concentrations that were found were near the north end of the traditional calving grounds. Possible reasons for this survey outcome include a major decline in numbers of the Beverly herd, and a possible shift of lower numbers of Beverly caribou to the range of the Ahlak herd or elsewhere. There was little survey and radio-collar monitoring of the Beverly herd between 1995 and 2006, thus it is difficult to definitively explain the low numbers of Beverly caribou. NT staff will be working with colleagues in Nunavut and other jurisdictions to increase monitoring and management of trans-border populations like the Beverly and Ahlak herds.

¹ The status of the caribou/reindeer on the Tuktoyaktuk Peninsula is uncertain, but the Inuvialuit have requested that they be managed separately from the nearby Cape Bathurst herd until their status is clarified.

Introduction:

Barren ground caribou herds across their North American range from Alaska to Labrador return annually to calving grounds in May and June and herds have been named and managed based on the location of these calving grounds. Although caribou cows show strong fidelity to calving grounds, the exact location and size of area used each year varies and can shift over time, depending on weather, snow-melt, spring traveling conditions, and the flush of green vegetation in early spring (Russell et al. 1993, 2002). Calving grounds have been recognized by aboriginal people, co-management boards and biologists as having special importance and requiring careful management (Russell et al. 2002, BQCMB 2005, NTBCMS 2006). The 2007 NT Caribou Summit (NBGCS 2007) listed protection of calving grounds as a high priority.

Because northern Canadian barren ground caribou herds have been declining in the 2000's across their range, management agencies and co-management boards have called for increased monitoring of caribou herd numbers and well-being (e.g. BCHMP 2004, BQCMB 2005, NTBCMS 2006). Among the recommendations from these boards is annual monitoring of calf survival and herd composition (proportions of cows, calves and bulls). In keeping with these recommendations, calving grounds of the following mainland herds were surveyed in June 2007 (from west to east): Tuktoyaktuk Peninsula, Cape Bathurst, Bluenose-West, Bluenose-East, Bathurst, Beverly, Ahlak and Qamanirjuaq. The main objective of the surveys was to identify the distribution of calving caribou in each herd, including areas of concentrated calving. A photographic (census) survey of the Beverly herd was also planned to follow the calving distribution survey of this herd, but it was not carried out due to poor weather and low numbers of caribou on the calving ground.

This summary was prepared to provide an overview of the main results for management and planning of further caribou surveys and studies. More complete descriptions of the results will be prepared as manuscript or file reports by the staff who carried out and organized the surveys. Maps were prepared by D. Johnson, A. D'Hont and D. Dewar following a process described by Nagy and Johnson (2007) and Johnson et al. (2007), with data from D. Johnson, B. Croft, B. Tracz and T. Davison. Text was contributed by D. Johnson, B. Croft, B. Tracz, M. Branigan and T. Davison, and collated by J. Adamczewski.

Methods:*Survey flying and caribou observations:*

All surveys were carried out in June 2007, with timing and the aircraft used depending on weather, field conditions and the aircraft available. Each survey began with reconnaissance flights to the expected calving grounds, guided by locations of radio-collared caribou and previous information on the location of calving grounds. These initial flights helped define the area to be flown and assessed how far calving had progressed. The actual calving ground surveys consisted of a series of parallel straight-line transects (either north-south or east-west) spaced 5 or 10 km apart (see Map 1). Individual flight lines were ended when no more calving caribou groups had been seen for several km. Markers on the wings were used to limit the observations of caribou to an 800-m strip transect (400 m on either side of the aircraft). Within this transect, all caribou groups were recorded with a location (using Global Positioning Systems or GPS), and the number of caribou in each group was estimated.

Mapping density and distribution of calving grounds:

The locations and numbers of calving caribou groups were entered into computer programs. These data were then translated into maps showing the extent and relative density of calving caribou, with density grouped in the following classes (all in number per km²): low (< 1/km², medium (1.0 – 9.9/km²) and high (> 10.0/km²). The method, called ordinary kriging prediction mapping, is described in reports by Nagy and Johnson (2007 a, b) and Johnson et al. (2007). The number of caribou in 5 or 10 km segments were converted into a density estimate for each transect segment. This approach can be used with results from flight lines spaced at higher or lower density.

Individual field operations:

There were 4 field operations occurring more or less simultaneously in June: (1) Cape Bathurst, Tuktoyaktuk Peninsula and Bluenose-West herds, (2) Bluenose-East herd, (3) Bathurst herd, and (4) Beverly, Ahiak and Qamanirjuaq herds. Field conditions and methods varied somewhat among the 4 operations, thus a brief summary of each is provided below.

(1) Cape Bathurst, Tuktoyaktuk Peninsula and Bluenose-West herds

These surveys were flown by Inuvik and Sahtu regional staff Tracy Davison and Richard Popko, with Wendy Wright providing GIS support. A brief field summary was completed (Davison et al. 2007), used in preparing this summary. Community observers were Jonah Nakimayak from Paulatuk and Robin Felix from Tuktoyaktuk, and a Cessna 206 was used for all flying. Flights were carried out between June 13 and 25. A 5 km spacing was used to be consistent with previous surveys on these herds, although a 10 km spacing was used in peripheral areas with few caribou. A total of 57.6 hours were flown, 24.7 of these in pre-survey reconnaissance, ferry flights to and from communities, and flights between fuel caches and transects. Poor weather and aircraft maintenance created several delays and changes in field plans. Flights for the Bluenose-West and Cape Bathurst ranges were flown out of Paulatuk and flights for the Tuktoyaktuk Peninsula were based in Inuvik. For the Cape Bathurst herd, a reconnaissance flight on June 13 indicated that the peak of calving was near, as about 50% of the cows had newborn calves. The survey of this calving ground was flown on June 14 and 15. The Bluenose-West calving ground was surveyed on June 17th, 21st, and 22nd, after some weather delays. The Tuktoyaktuk Peninsula was flown on June 25.

(2) Bluenose-East herd:

This survey was flown between June 10 and June 20 using a Cessna 185 based in Kugluktuk. The survey was flown by NT biologist Boyan Tracz (Sahtu region) and Nunavut staff from Kugluktuk Mathieu Dumond (biologist) and Luigi Torretti (technician), along with summer intern Andrea Niptanatiuk. Wildlife officer Allen Niptanatiak (Kugluktuk) advised on survey planning. A reconnaissance survey was flown over the potential calving area, with special note taken of locations of current satellite and GPS radio-collars, on June 12 and 13, at a 20 km spacing. The calving delineation survey was flown on June 14, 15, 16 and 19, using a 10 km spacing and flight lines running north-south. A total of 54.8 hours were flown on this survey. Weather was variable but mostly cloudy early in the day and clearing in the afternoon. There were some days with a low ceiling and danger of icing, when there were no flights.

(3) Bathurst herd:

The calving distribution survey was flown between June 10 and 12 with a Cessna 337, based at the Jericho Diamond Mine. Staff flying on the survey were Bruno Croft & Dean Cluff (North Slave ENR regional staff), and Dave Dewar (Yellowknife ENR staff). A total of 31.2 hours were flown; a 10 km spacing was used on the calving ground and a 20 km spacing on peripheral areas where there were few caribou. There were no community observers on these flights but a separate aerial tour for several elders and aboriginal leaders was carried out a few days later (June 15-18), when composition of calving groups was estimated using helicopters and ground-based observations.

(4) Beverly, Ahiak and Qamanirjuaq herds:

The Beverly and Qamanirjuaq surveys were carried out by Deborah Johnson, John Nagy, Judy Williams, Karin Clark, Robert Mulders and Nahum Lee (GNWT – ENR staff); John Nukik (Baker Lake community observer) and Pierre Robillard (Black Lake community observer). The Ahiak survey was conducted by Deborah Johnson and John Nagy (GNWT – ENR staff). Results of the Beverly survey are summarized by Johnson et al. (2007), with reports on the other two surveys to follow. The aircraft used were a Heliocourier and an Islander.

A total of 95.4 hours were flown on the Beverly herd survey. An initial reconnaissance of the main traditional Beverly calving ground was flown on June 4, and just 217 caribou were found. Additional flights on June 5, 7, 8 and 10 covered further areas of the traditional Beverly calving ground and the herd's pre-calving migration route; these flights showed some groups of calving caribou north of Gary Lake moving north and northeast (possibly to the Ahiak range). A second systematic survey was carried out on the traditional Beverly range on June 12, in the area where limited numbers of calving caribou had been seen. This region is relatively remote and offers few communities or sites from which to base aerial surveys.

The Qamanirjuaq survey was flown on 11 and 14 June 2007 and weather conditions were favourable on both days. A total of 26.1 hours were flown.

The survey of the Ahiak herd was flown between 14 and 18 June 2007, based out of Miramar Mining Corporation's Boston Camp and Gjoa Haven, both in Nunavut. Weather conditions were marginal throughout the survey and consisted of low overcast conditions with periodic snow flurries. A total of 42.9 hours were flown on this survey.

Results and Discussion:

Results and their significance are described below in individual herd summaries. Regional overviews of the western and eastern calving ranges are shown in Maps 1 & 2. Individual maps showing the calving ground distribution of each herd are included (Maps 3-9). Costs associated with each survey are summarized in Appendix 1. Overall, calving grounds of 6 of the 7 barren ground herds where calving had been mapped previously were consistent with calving grounds surveyed or known for recent years for those herds². The exceptional finding was the Beverly herd's calving ground, where only a small number of calving caribou was found despite extensive flying to verify that no significant groups had been missed. The Qamanirjuaq calving ground appears to have shifted somewhat to the south of its traditional location.

(1) Cape Bathurst & Tuktoyaktuk Peninsula

A total of 594 caribou were seen on transect in the Cape Bathurst area, and the survey on June 14 and 15 was near or just after the peak of calving estimated for the Bluenose-West herd (see below; Map 3). Locations of calving caribou in June 2007 were consistent with previous observations of this herd from 2002 to 2004 (see Nagy et al. 2005, Nagy and Johnson 2007b) and with satellite collar data from 1996 to 2004 (Nagy et al. 2005), showing the herd's calving range on Cape Bathurst, north of the mouth of the Anderson River. The Cape Bathurst herd was first recognized as a distinct herd in the late 1990's (Nagy et al. 2005), after satellite collar location data and genetic studies showed that the former Bluenose herd had 3 distinct calving areas, now recognized as 3 separate herds.

A total of 874 caribou were seen on the Tuktoyaktuk Peninsula. A survey of this type had not been carried out previously for this area. ENR first documented animals calving on the peninsula in 2005 after census survey results were presented and reports from local hunters indicated that there were animals residing on the peninsula year round. Collars were deployed on these animals in 2006 in preparation for a post calving census in 2006. A portion of this herd is considered to be feral reindeer escaped from a semi-domestic reindeer herd and, at the request of the Inuvialuit Game Council it is managed separate from the Cape Bathurst herd. The flight over this peninsula (June 25) was carried out past the peak of calving.

(2) Bluenose-West

A total of 4,365 caribou were seen on transect during the Bluenose-West survey. The peak of calving was estimated near June 13, as about 50% of the cows seen that day had newborn calves. The main concentration of cows with calves was mostly within the northern portion of Tuktut Nogait

² A survey of this type had not been flown previously for the Tuktoyaktuk Peninsula.

National Park, east of Paulatuk and west of Bluenose Lake (Map 4). This distribution was consistent with recent surveys of Bluenose-West caribou (see Nagy and Johnson 2007a). Like the Cape Bathurst herd, the Bluenose-West herd was first recognized as a distinct herd in the late 1990's (Nagy et al. 2005).

(3) Bluenose-East

Calving ground distribution surveys of the type done in June 2007 have not been carried out previously for this herd. The Bluenose-East herd was only recognized by biologists as a distinct herd in the late 1990's (Nagy et al. 2005) from analyses of satellite radio-collar locations. However, the June 2007 calving ground of the Bluenose-East herd is consistent with mapped information (Nagy et al. 2005) showing calving caribou in this herd, west of Kugluktuk and east of Bluenose Lake, in the Rae and Richardson River drainages (Map 5). A total of 4,381 caribou were seen on transect, and the peak of calving was estimated at June 11-14, similar to the other herds.

(4) Bathurst

The main concentration of calving caribou from the Bathurst herd was consistent with the calving grounds documented from 1996 to 2006 (Map 6). Calving ground information for the Bathurst herd from biologists' surveys and studies begins in 1965, when the herd calved to the east of Bathurst Inlet, as far east as the Perry River and MacAlpine Lake (Sutherland and Gunn 1996, Gunn et al. 2005), but oral history of Inuit people indicates that in the 1950's caribou calved on the western side of Bathurst Inlet. From the 1990's to the 2007, the herd has calved west of Bathurst Inlet (Gunn et al. 2005). The estimated peak of calving was around June 11-12, based on about half the cows having newborn calves. A total of 2,370 caribou were seen on transect during the survey.

(5) Ahiak

On the Ahiak survey, a total of 5,971 caribou were observed on transect. The cow:calf ratio for caribou observed was 57:100, which indicates that the June 14-18 survey was conducted close to or just after the peak of calving. The distribution of breeding cows was mostly in an east-west direction; it extended eastward from the Ellice River to Chantrey Inlet and southward from the Queen Maud Gulf coast to approximately 67° N (Map 7). The Ahiak calving distribution was similar to the calving grounds delineated in 1986 and 1996 (Gunn et al. 2000, Gunn and D'Hont 2003); in addition, satellite telemetry data from cows in this herd has shown fidelity to a coastal calving range. The number of caribou observed and the calving distribution in June 2007 were very similar to the June 2006 survey results (D. Johnson, unpublished data).

(5) Beverly

The numbers of calving caribou on the traditional Beverly calving range herd were much lower than had been found in the past, although survey methods were kept consistent with the earlier calving ground surveys. Systematic strip transect surveys in 1994, 2002, and 2007, all carried out using the same methods, resulted in total numbers of caribou on transect of 5737, 2629 and 189, respectively (Gunn and Sutherland 1997, D. Johnson unpublished data, Johnson et al. 2007). A much higher number of hours was flown on this survey than on any other, to be certain that no significant numbers of Beverly caribou had been missed. Calving likely peaked around June 12 in this herd, based on observations of cows with newborn calves. The limited calving ground in 2007 occupied only a small portion of the traditional calving range of this herd, near its north end (Map 8). The eastern boundary of breeding cows was approximately 15 km west of Sand Lake and was bounded to the west by the Upper Gary River, to the south by the southern latitude of Sand Lake, and to the north by Gary Lakes.

Because survey work and radio-collar information for Beverly caribou was very limited between 1995 and the present, it is difficult to identify a clear cause for the large decline in numbers of calving Beverly caribou. It is unlikely that any significant groups of caribou were missed, given the number of hours flown and the size of the area covered. Other possible reasons for the low numbers of calving Beverly caribou are (1) a major decline in the herd's numbers and (2) a possible shift of lower

numbers of Beverly caribou to the calving grounds of the Ahiak herd to the north. Barren-ground caribou herds are declining all across the Northwest Territories and Nunavut, thus a decline in the Beverly herd's numbers would be consistent with territory-wide trends. Limited evidence suggests a heavy harvest of Beverly caribou on their winter range in recent years. Spring migration northward of radio-collared Ahiak caribou would have taken some of them through the Beverly calving ground from 2003 on, which could have provided an opportunity for relatively low numbers of Beverly caribou to join larger numbers of Ahiak caribou migrating north. Four radio-collared caribou cows that were on the Beverly calving ground in June 2006 were on the Ahiak calving grounds in June 2007. The information available does not allow for a definitive explanation of the very low numbers of Beverly caribou in June 2007. The NT Wildlife Division will work with partners (Nunavut government, Beverly and Qamanirjuaq Caribou Management Board, government of Saskatchewan) to improve monitoring, understanding and management of this herd's status and ecology.

(7) Qamanirjuaq

A total of 6,082 caribou were observed on transect during the Qamanirjuaq survey. The cow:calf ratio for caribou observed was 48:100, which indicates that the survey (June 11 & 14) was conducted just prior or near the peak of calving. The main distribution of breeding cows extended northward from Arviat to Kaminuriak Lake and was bounded to the east by the Wilson River and to the west by the Ferguson River and Harling at the north and south portions of the calving distribution (Map 9). A small pocket of breeding cows was also observed around South Henik Lake. The northern portion of the 2007 calving distribution fell within the traditional Qamanirjuaq calving ground defined from 1957-1994 survey data; however, almost half of the 2007 calving distribution was south of the traditional calving ground. However, the Qamanirjuaq calving ground has not been delineated by aerial systematic reconnaissance surveys since 1994. Information from radio-collared cows indicates that from 2000 to 2007 there has been a southward trend in calving distribution. A southward shift in calving distribution may be related to early river break-up, which could have impeded the northward movement of cows during pre-calving migration (M. Campbell, pers. comm. to D. Johnson).

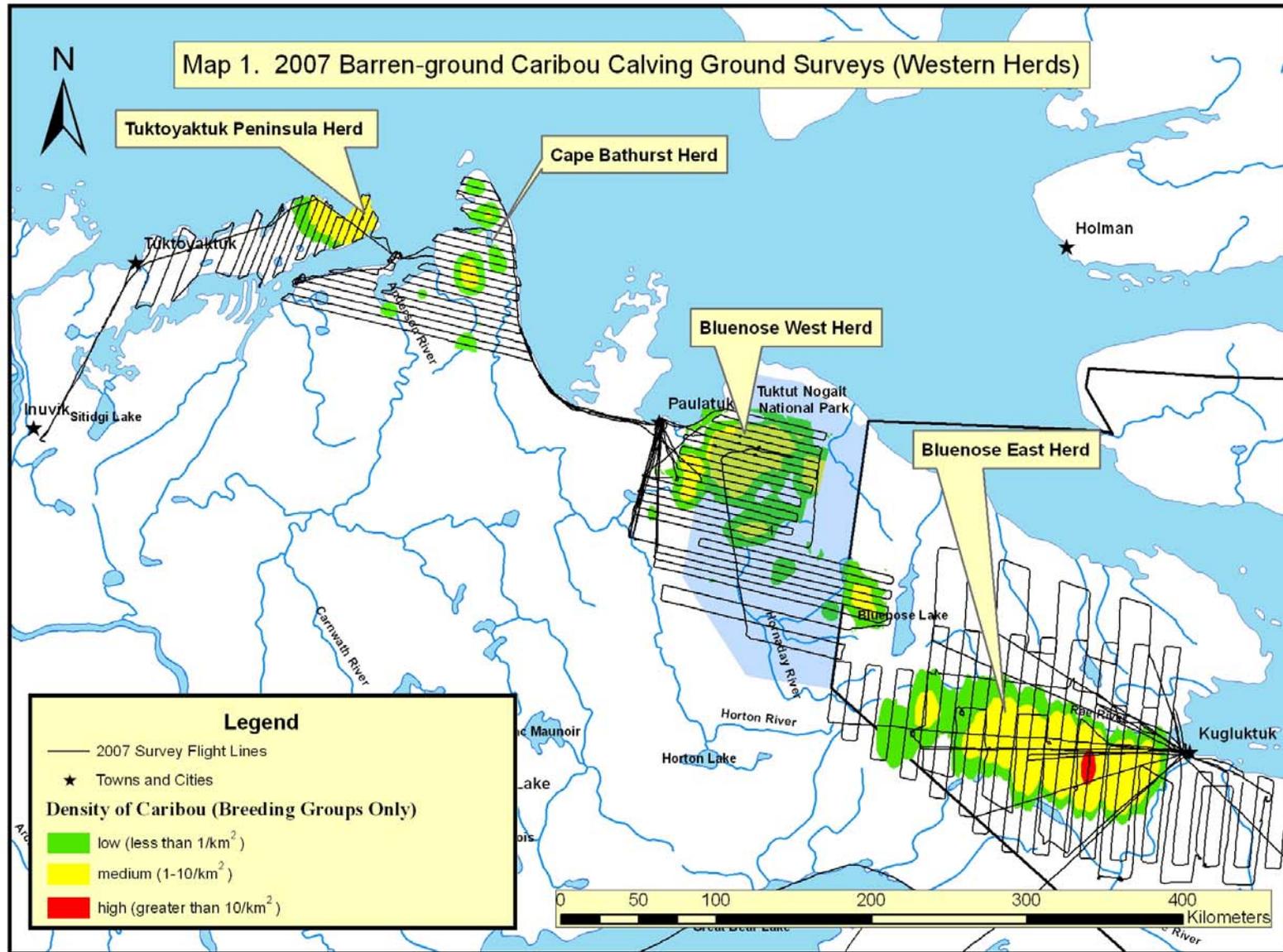
Acknowledgements

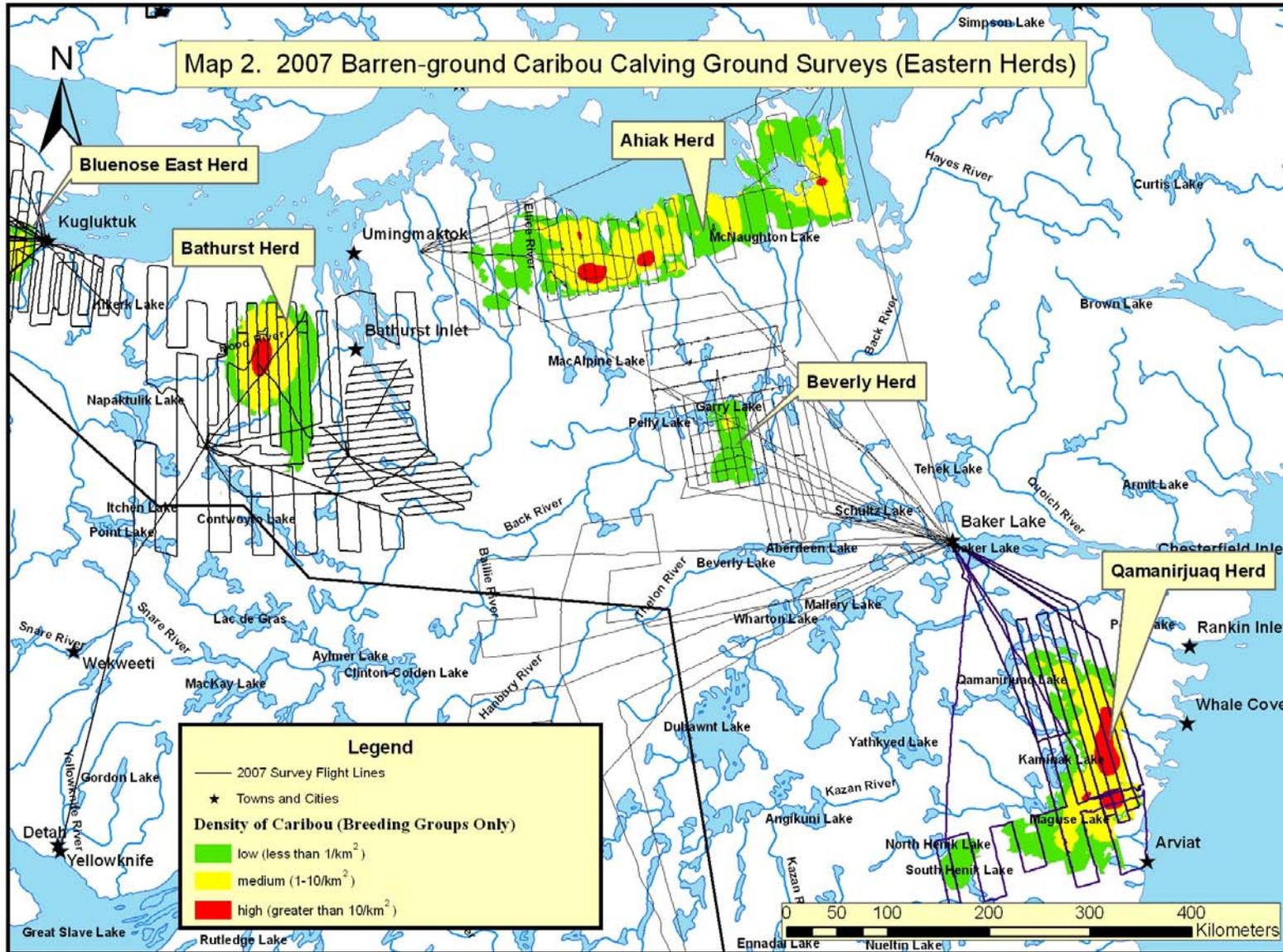
We are very grateful to the community observers, skilled pilots, and helpful colleagues in Nunavut who worked with our staff to carry out the many hours of surveys flown in June 2007. We are also very appreciative for the support extended by the Tahera Diamond Corporation's Jericho Diamond Mine and Miramar Mining Corporation's Boston Camp to our field operations. Financial support for the surveys was received from the Government of the Northwest Territories Barren-ground Caribou Management Strategy, the Government of Nunavut, the Nunavut Wildlife Management Board, Inuvialuit Implementation funding, and Circum-Arctic Rangifer Monitoring and Assessment International Polar Year funding. The Government of Saskatchewan also contributed funding to the Beverly survey and the Government of Nunavut donated fuel in Kugluktuk.

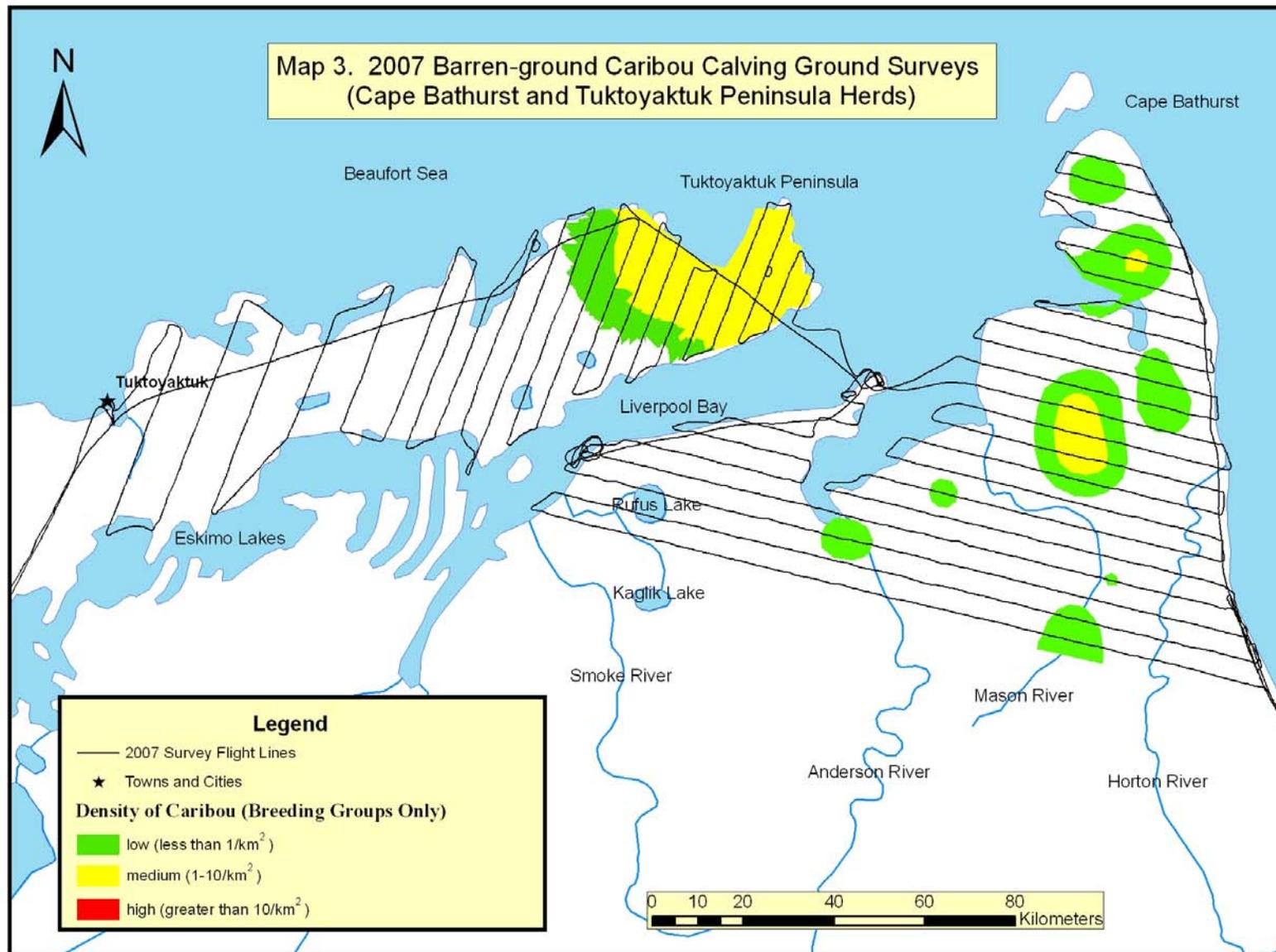
References

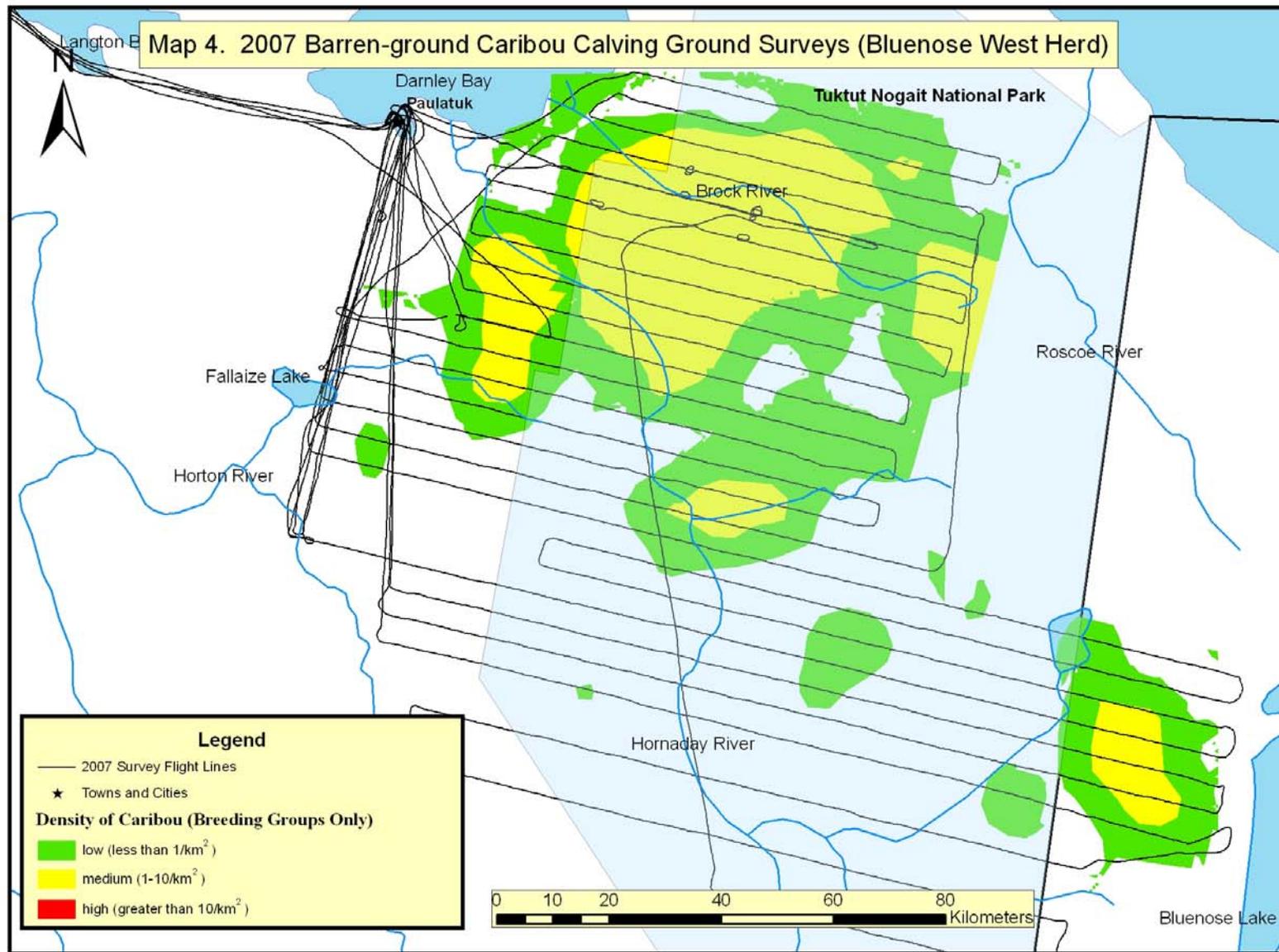
- BCMPC (Bathurst Caribou Management Planning Committee). 2004. A management plan for the Bathurst Caribou herd. Environment and Natural Resources Wildlife Division, Yellowknife. 51 pp.
- BQCMB (Beverly and Qamanirjuaq Caribou Management Board). 2005. Beverly and Qamanirjuaq Caribou management plan 2005-1012. BQCMB Secretariat, Box 629, Stonewall, Manitoba. 17 pp.
- Davison, T., R. Popko, and W. Wright. 2007. An aerial survey of barren-ground caribou calving grounds Tuktoyaktuk Peninsula, Cape Bathurst, and Bluenose-West herds, June 2007. Environment and Natural Resources, Inuvik region, Inuvik. (unpublished report). 8 pp.
- Gunn, A, and A. D'Hont. 2003. Extent of calving for the Bathurst and Ahiak caribou herds June 2002. Department of Resources, Wildlife and Economic Development. Manuscript Rep. 149. 35pp.
- Gunn, A. and M. Sutherland. 1997. Surveys of the Beverly caribou calving grounds, 1957-1994. Northwest Territories Department of Resources, Wildlife and Economic Development. File Rep. No. 120. 119 pp.
- Gunn, A., B. Fournier and J. Nishi. 2000. Abundance and distribution of the Queen Maud Gulf caribou herd, 1986-98. Northwest Territories Department of Resources, Wildlife and Economic Development. File Rep. No. 126. 76pp.
- Gunn, A., J. Nishi , J. Boulanger and J. Williams. 2005. An estimate of breeding females in the Bathurst herd of barren-ground caribou, June 2003. Northwest Territories Department of Resources, Wildlife and Economic Development. Manuscript Rep. 164. 75pp.
- Johnson, D., A. Gunn, J. Nagy, and J. Williams. 2007. Beverly herd calving ground survey, June 2007. Environment and Natural Resources Wildlife Division, Yellowknife, Manuscript Report (unpublished).
- Nagy, J., and D. Johnson. 2007a. Calf:cow ratios estimated at or near the peak of calving for the Bluenose-West Herd. Environment and Natural Resources Wildlife Division, Yellowknife, Manuscript Report (unpublished).
- Nagy, J., and D. Johnson. 2007b. Post-calving surveys of the Cape Bathurst herd, 2002 to 2005. Environment and Natural Resources Wildlife Division, Yellowknife, Manuscript Report (unpublished).
- Nagy, J. A., W. H. Wright, T. M. Slack, and A. M. Veitch. 2005. Seasonal ranges of the Cape Bathurst, Bluenose-West, and Bluenose-East barren-ground caribou herds. Environment and Natural Resources, Wildlife Division, Yellowknife. Manuscript Report No. 167. 43 pp.
- NTBCMS (Northwest Territories Barren-Ground Caribou Management Strategy). 2006. Caribou forever – our heritage, our responsibility. A barren-ground caribou management strategy 2006-2010. Environment and Natural Resources, Wildlife Division, Yellowknife. 38 pp.
- NBGCS (Northwest Territories Barren-ground Caribou Summit). 2007. Caribou forever – our heritage, our responsibility. Meeting in Inuvik, January 23-26, 2007. Environment and Natural Resources, Wildlife Division, Yellowknife. 51 pp.

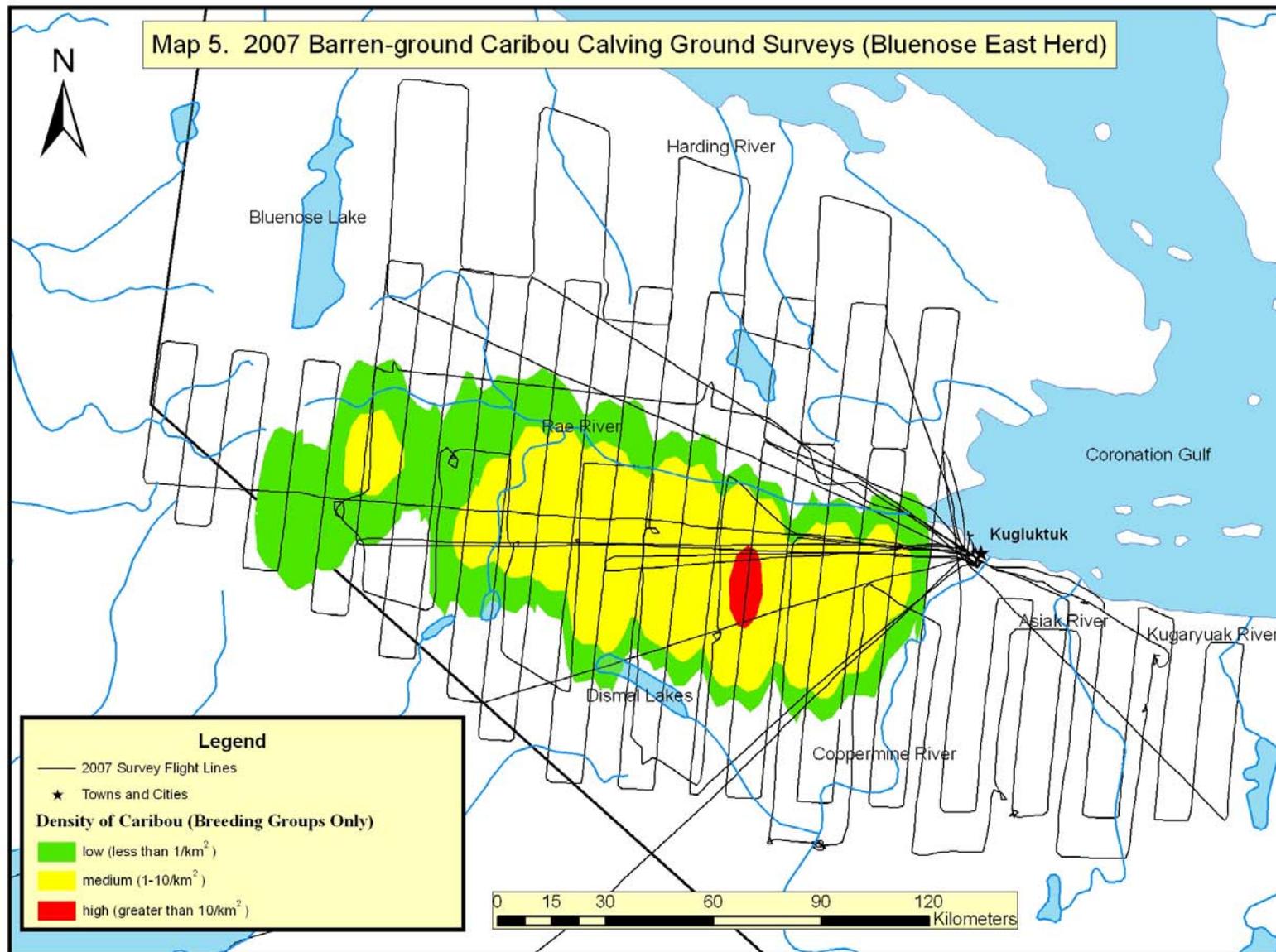
- Russell, D. E., A. M. Martell, and W.A.C. Nixon. 1993. Range ecology of the Porcupine caribou herd in Canada. *Rangifer* Special Issue no. 8. 168 pp.
- Russell, D. E., G. Kofinas, and B. Griffith. 2002. Barren-ground caribou calving ground workshop: report of proceedings. Technical Report Series No. 390. Canadian Wildlife Service, Ottawa. 40 pp.
- Sutherland, M. and A. Gunn. 1996. Bathurst calving ground surveys, 1965-1996. Northwest Territories Department of Resources, Wildlife and Economic Development File Report No. 118. 97 pp.

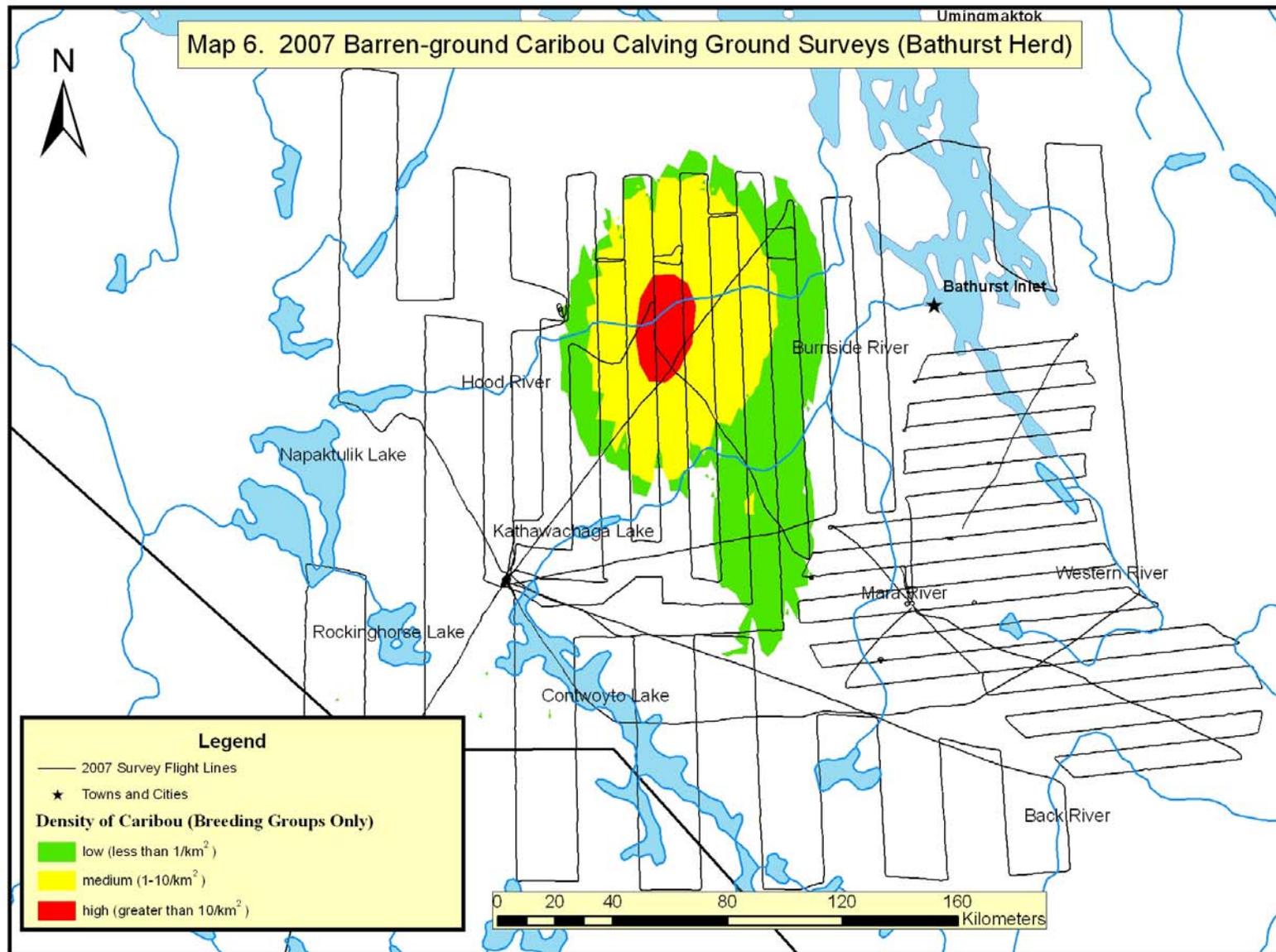


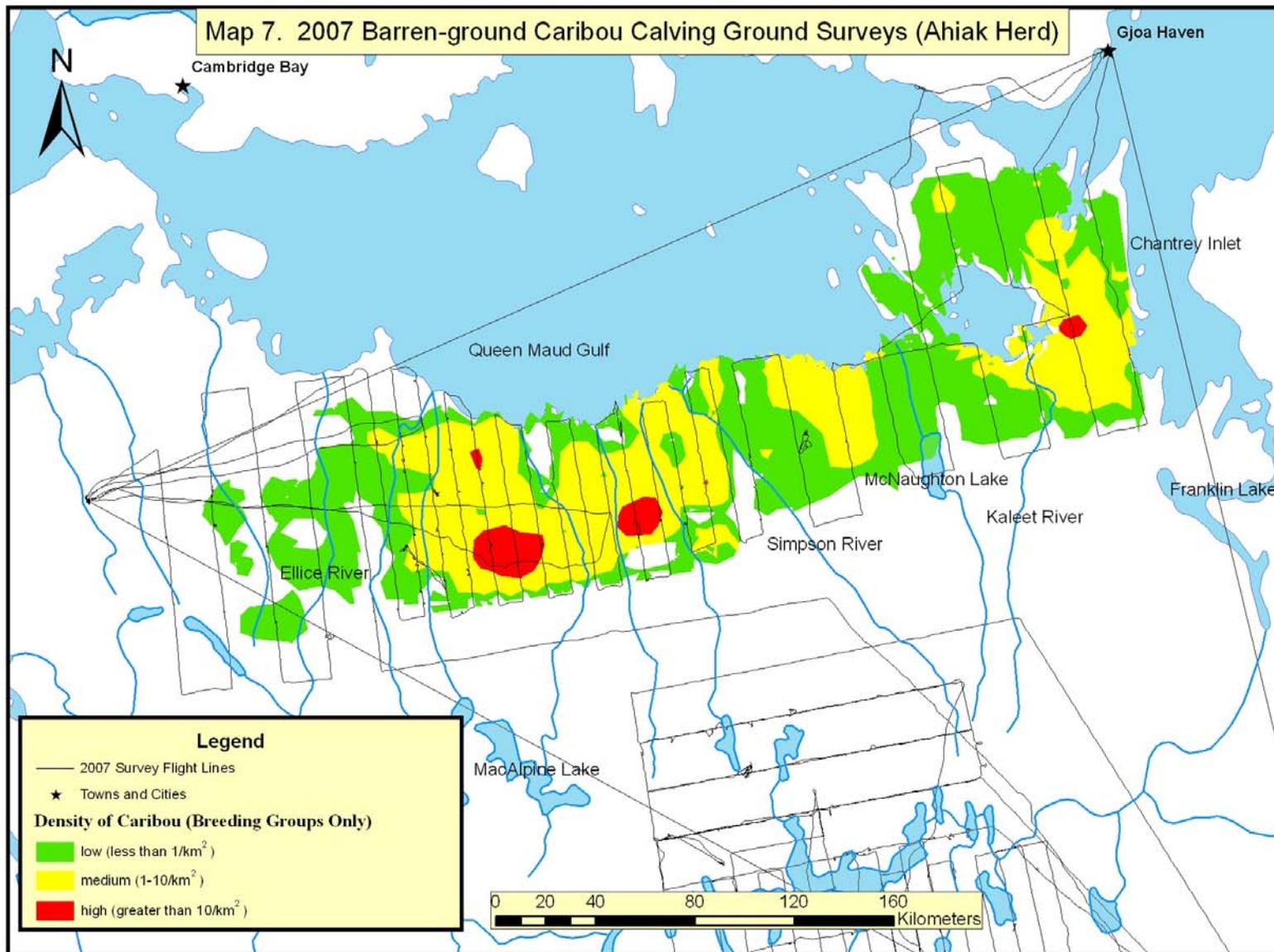


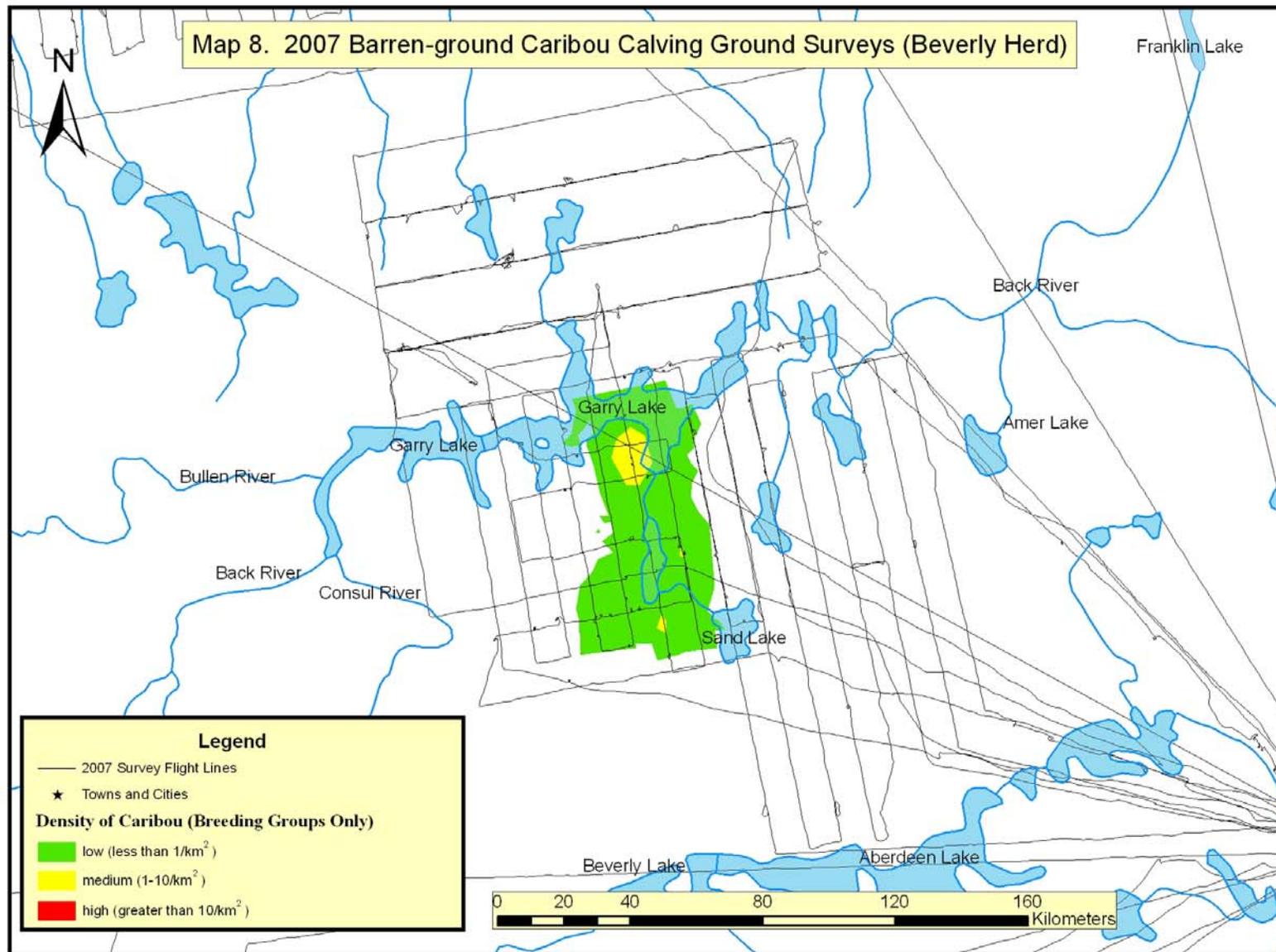


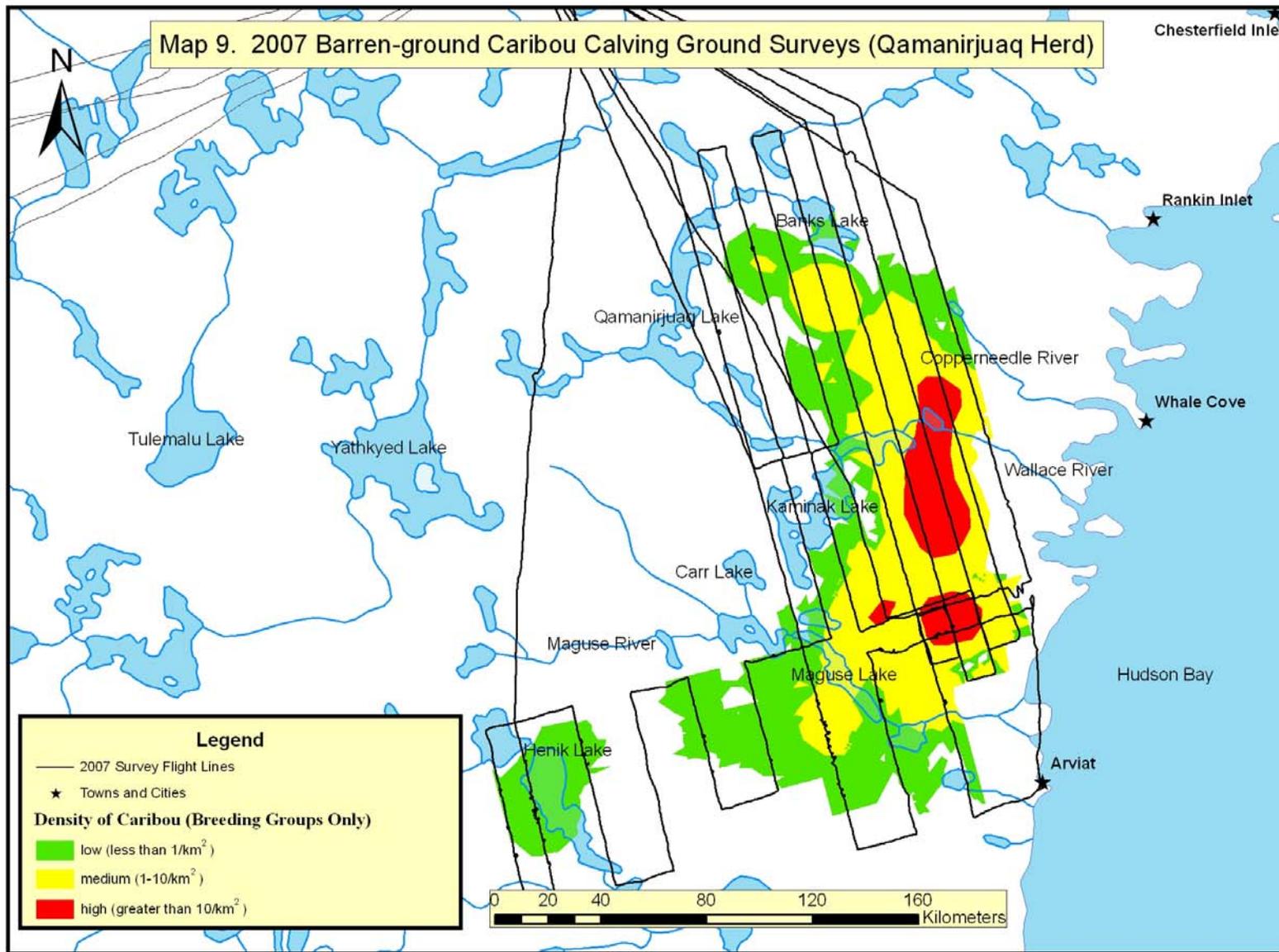












Appendix 1. Costs of NT/NU June 2007 calving ground distribution surveys

Herd Name	Fixed-wing flights	Aircraft fuel & fuel hauls	Staff Travel & Accommodation	Other costs	Totals
Tuktoyaktuk Peninsula	4,200	2,300	1,000	450D	7,950
Cape Bathurst	23,800	16,100	3,100	1,240D	44,240
Bluenose-West	26,600	16,700	4,400	1,860D	49,560
Bluenose-East	27,300	23,600	0 G	0	50,900
Bathurst	18,950	0 E	0 F	0	18,950
Beverly	85,150	30,100	37,550	25,200 C	178,000
Ahiak	29,000	15,260	2,400 B	3,000 D	49,660
Qamanirjuaq	21,450	A	A	0	21,450
Totals	236,450	104,060	48,450	31,750	420,710

A – Included with Beverly costs.

B – Miramar Mining Corporation provided free accommodation at their Boston camp.

C – Includes community observer, material and supplies, and contract costs, and \$11,060 for film for photo survey.

D – Community observer cost.

E – Government of Nunavut in Kugluktuk donated fuel.

F – Accommodation and meals donated by Tahera Diamond Corporation's Jericho Diamond Mine.

G – Accommodation and meals donated by Nunavut regional staff in Kugluktuk.