



THE SEASONAL DISTRIBUTION AND HERD DELIMITATION OF
NORTHEASTERN MAINLAND CARIBOU (*Rangifer tarandus groenlandicus*)

Mitch Campbell¹

¹Regional Wildlife Biologist, Department of Environment, Government of Nunavut,
P.O. Box 120, Arviat, NU X0C 0E0

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FINAL REPORT TO NUNAVUT WILDLIFE CO-MANAGERS

Prepared by: Mitch W Campbell
Department of Environment
Kivalliq Region
P.O. Box 120
Arviat, NU. X0C 0E0

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Title: The seasonal distribution and herd delimitation of Northeastern Mainland caribou (*Rangifer tarandus groenlandicus*).

Project Leader: Mitch Campbell
Regional Wildlife Biologist
Department of Environment
Box 120
Arviat, NU.
X0C 0E0
Ph: (867)857-2828
Fax: (867)857-2986
E-mail: mcampbell@gov.nu.ca

Introduction:

Repulse Bay, Baker Lake, Chesterfield Inlet, Pelly Bay and Igloolik have reported general declines in Northeastern mainland caribou health and numbers. With little information available on the number and size of caribou populations within the Northeastern mainland region, their range requirements and seasonal range use, managers had been unable to address community concerns. Surveys flown between 1976 and 1987 found three distinct densities and associated calving grounds occupying the Northeast mainland of the Kivalliq Region in June; the Melville, Wager, and Lorillard Herds (Calef and Helmer, 1976; Calef and Heard, 1981; Heard *et al.*, 1981; Heard *et al.*, 1987; Donaldson, 1981). A VHF collaring program deployed within the Wager and Lorillard ranges during the 1980's found the presence of at least three additional aggregations of caribou displaying calving ground fidelity (Heard *et al.*, 1986). Further research to confirm these aggregations involved a series of aerial surveys. Of these surveys only one, flown in 1983, has examined the entire Northeastern Mainland Region producing an estimate of 119,800 +/- 13,900 caribou (Heard *et al.*, 1987). The 1983 survey also identified a fourth area with high caribou densities south of the Queen Maud Gulf. A follow up survey in this area in 1986 (Gunn and Lambert in prep.) found a discrete calving ground utilized by approximately 40,000 animals. This fourth population is now considered the Ahiak heard. The most recent population estimate of Northeastern mainland caribou was made in May 1995.

The survey results suggested that caribou numbers had dropped significantly from 119,800 +/- 13,900 animals in 1983 to 73,994 +/- 11,670 caribou in 1995. On Melville Peninsula caribou had all but disappeared and had significantly declined north of Wager Bay. Reasons for this 84 % decline in caribou are unknown, as are the populations or population involved.

A series of 15 traditional knowledge interviews, focusing on aspects of Northeast Mainland (NEM) caribou ecology, took place in Baker Lake, Chesterfield Inlet and Repulse bay in February 1999. The results of this study were integrated with ongoing research. This ongoing research is addressing critical knowledge gaps as well as increasing our knowledge of barren-ground caribou range and population ecology. Filling knowledge gaps concerning Northeastern mainland caribou range use, critical range identification, herd identification and status, and major shifts in range use, remains a regional priority.

Project Start:

The study of Northeast Mainland Caribou through the use of satellite telemetry and periodic calving ground delineation's began April 15th, 1999. From mid to late April ten ST-14 satellite collars were systematically placed on barren-ground caribou cows occupying an area outlined by Inuit hunters between the north shore of Chesterfield Inlet and the south shore of Wager Bay (Lorillard Population) and the following year between the north shore of Wager Bay, the southern tip of Committee Bay and the northern tip of Repulse Bay (Wager Population). Calving ground delineations were then flown, using satellite collar locations to guide survey effort, within each of these areas between June 8th and 15th, 1999, 2000, 2001, 2002, 2003 and 2004.

Project Finish:

The Lorillard field component of the Northeast Mainland research program was completed August 2005 with the recovery of the dropped collars deployed three years earlier. The expected completion date of the Wager field component is April 2006 when dropped collars are scheduled to be recovered. A final report is scheduled to be completed March 2007.

Objectives:

The objectives of the project are as follows: a) to utilize satellite telemetry and calving ground delineation's to determine the range and number of distinct populations occupying the Northeast mainland. Collars will be systematically deployed over the study area during early spring, a time of year, other than calving, when the expression of herd fidelity is at it's strongest. b) To utilize satellite telemetry to address the land use management issue of important winter, spring, summer and fall range. This base-line information is essential for determining where, when, and how natural resource

industries can become established without jeopardizing the conservation of northeastern mainland caribou or their range. The following is a breakdown of the objectives into specific questions and their biological rationale:

1) Are Northeastern Mainland caribou aggregated into distinct populations?

Biological rationale: Caribou herds are largely identified through their use of common calving and to a lesser extent, rutting grounds. Satellite collars will be used to track movement onto calving and rutting grounds. Calving ground delineations will be flown every second year to determine caribou densities and extents. Examining whether the same collared females are utilizing the same calving and rutting grounds will help us identify populations.

2a) What seasonal movements and large-scale geographical shifts in range do Northeastern mainland caribou populations undertake?

Biological rationale: Monitoring collared females over the long term will help us understand range size and importance. Caribou are extensive not intensive feeders and through time environmental and/or biological conditions require animals to either seek new range or expand existing range. These changes, although infrequent, will provide an indicity of that population's (Identified in objective 2) range requirements and fidelity to that range and components therein.

2b) Locate and quantify the seasonally important habitats within the Northeast Mainland 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 Northeast Mainland caribou habitat requirements assist managers in assessing the population's present and future needs. A determination of the seasonally important components of Northeast Mainland range will largely rely on the integration of the location and activity database with a vegetation database utilizing spatial analysis software. In addition to satellite telemetry data the analysis would also integrate components of traditional knowledge, classification and composition locations, aerial survey locations, sighting locations and habitat studies published in refereed journals. The classification of Northeast Mainland range today will also allow for comparative studies into the future. A satellite telemetry program offers the most cost effective and logistically simple means of identifying and monitoring caribou range use.

Methods:

The delineation of the Wager calving grounds continued June 12, 2004 on the original twenty-four 24-month rotation using the fixed line transect survey method. The calving ground surveys were flown using a Cessna 206 (1999 and 2000), Cessna grand caravan (2001 to 2003) and a turbo-beaver (2004 and 2005) high wing aircraft based out of both Chesterfield Inlet and Repulse Bay depending on the surveys scheduled rotation. Strip widths were established using streamers attached to the

wing struts (Figure 1). Strip width (w) was calculated using the formula of Norton-Griffiths (1978):

$$w = W * h/H$$

Where:

W = the required strip width;
h = the height of the observer's eye from the tarmac; and
H = the required flying height

Strip width calculations were confirmed by flying perpendicularly over runway distance markers periodically throughout the survey. The strip width area for density calculations was 1000 m out each side of the aircraft, for a total of 2000 m along each transect. To facilitate distance-sampling techniques, strips were subdivided into seven 250 m sections (0–250 m; 251–500 m...1750–2000 m). Distance sampling is not used specifically in this report, but the data will be available in that format for future applications and final reports.

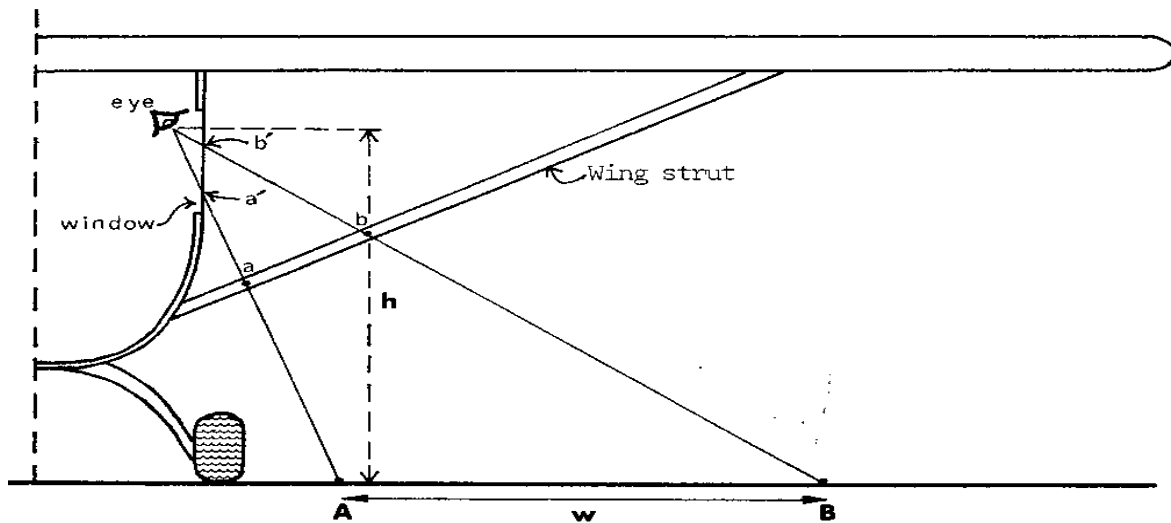


Figure 1. Schematic diagram of aircraft configuration for strip width sampling (Norton-Griffiths, 1978). W is marked out on the tarmac, and the two lines of sight $a' - a - A$ and $b' - b - B$ established. Streamers are attached to the struts at a and b . a' and b' are the window marks.

All northeast mainland surveys followed transects set out during the 1999 and 2000 reconnaissance and calving ground surveys for the Lorillard and Wager study areas respectively. The replication of past survey methodologies will allow for the determination of population and/or distribution changes between surveys for both groups of caribou and other wildlife observed along identical transects.

Results:

Lorillard Calving

On the Lorillard Range two regions, one in the northern and one in the southeastern corner of the study area, have shown relatively high densities of calves in each of June 1999, 2001 & 2003 (Figure 2). An additional calving area was apparent north of Wager Bay in 1999. Although Lorillard satellite collared cows were not in this area June 2000, 2001, 2002 or 2003, Wager satellite collared cows with calves were. In June 2001 the calving area at the headwaters of the Lorillard River just south of Wager Bay shifted approximately 20 Kilometers to the west compared to the 1999 calving ground survey. In 2003 the calving grounds were again in the same general area but slightly south of 1999 and 2001 survey findings. In addition the 2001 survey showed an increase in the number of breeding animals on the calving grounds (Figure 3) (Table 1 & 2) when compared to the 1999 and 2003 results. A population estimate using the June 1999 survey data found 13,918 +/- 5,377 adult caribou (95% confidence limits) on the calving ground. Identical surveys (using the same transects flown in 1999) flown in June 2001 and 2003 found 34,520 +/- 17,977 (95% confidence limits) and 12,156 +/- 3,697 (95% confidence limits) adult caribou respectively. Though the coefficient of variations for the 1999 and 2001 surveys were very high (1999 = .39, 2001 = .52) the data was tested to determine the significance of the change using equation 5.3 of Thompson et al. (1998):

$$z = \frac{Y_{1999} - Y_{2001}}{\sqrt{\text{Var}(Y_{1999}) + \text{Var}(Y_{2001})}}$$

where:

$z = z$ statistic;

$Y_x =$ population estimate for year x

$\text{Var}(Y_x) =$ variance of the population estimate.

There was a significant increase in the number of adult caribou on the calving grounds between June 1999 ($Y = 13918$) and June 2001 ($Y = 34520$) ($z = 2.34$, $P = 0.02$). The underlying reasons for this increase over such a short period of time may be related, in part, to the movement of Lorillard animals out of the June 1999 calving ground survey area prior to the survey and/or the movement of Wager caribou south of Wager Bay and into the Lorillard River area in 2000. This movement was documented using the location data of ST-14 satellite collars, which indicated seven of the ten satellite collared Wager cows made this journey of which only 6 returned north of Wager Bay by June 2001. The 2003 survey results in comparison to the 1999 and 2001 surveys were relatively precise with a coefficient of variation of 0.15. There was no significant difference between the 1999 and 2003 results and a significant difference between the 2001 and 2003 results. These findings are consistent with the initial hypothesis that Wager animals moved into the Lorillard study area over the 2001 survey period and moved back to the Wager study area prior to the 2003 survey. Following the 2001 survey Wager collars once again moved out of the Lorillard study area and the

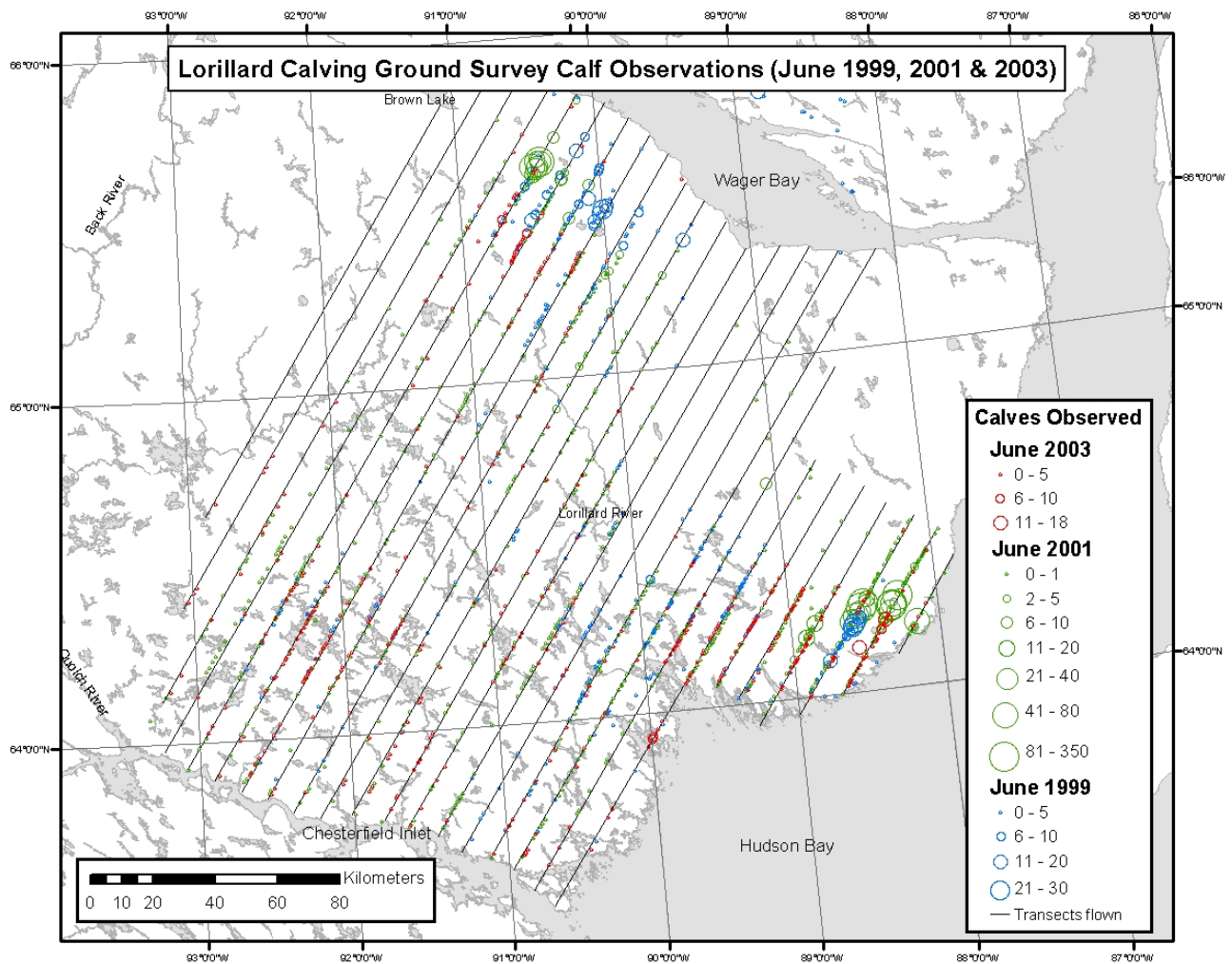


Figure 2 The distribution of calves on the Lorillard range as recorded from aerial surveys flown over the area in June 1999, 2001 & 2003.

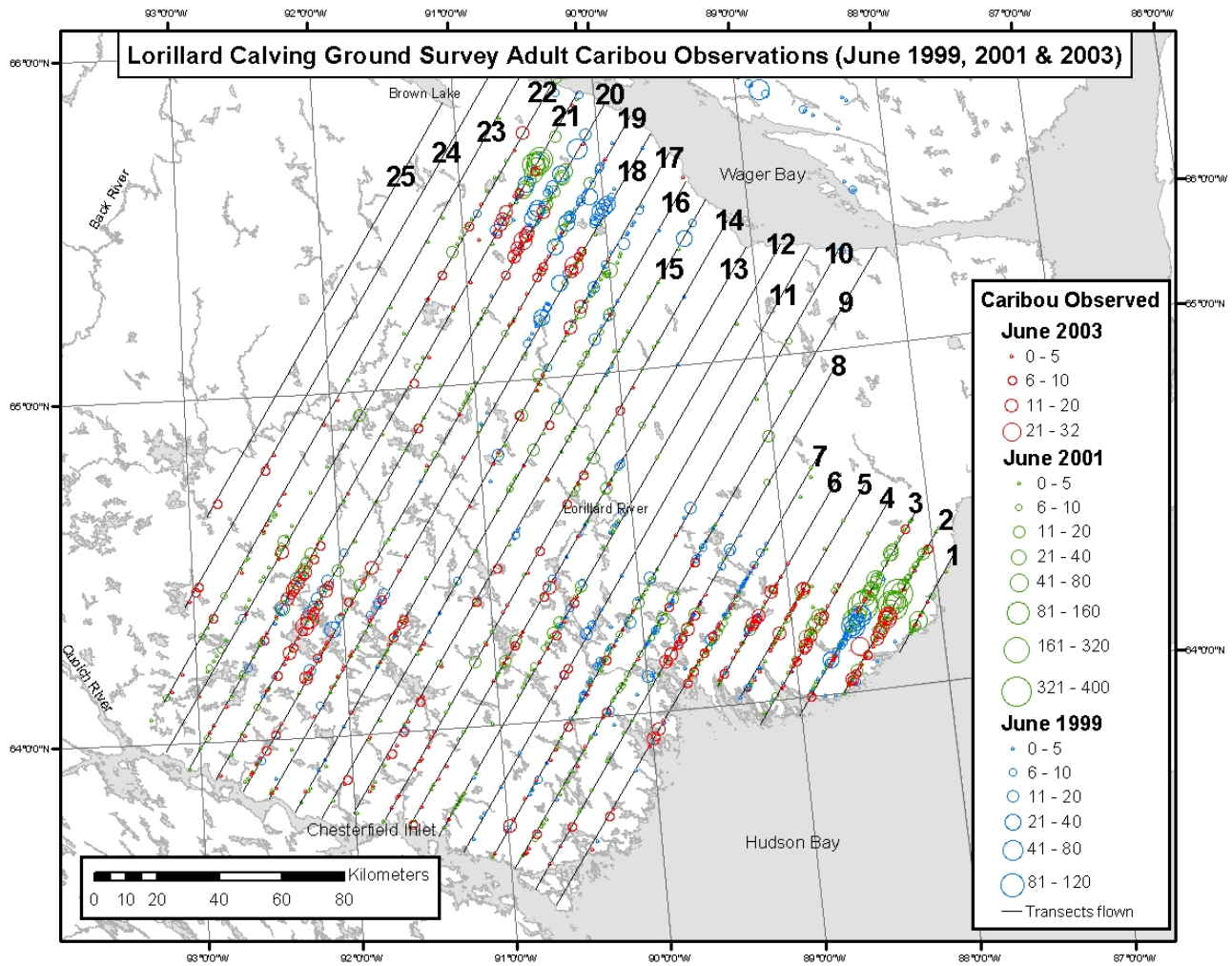


Figure 3 The distribution of adults on the Lorillard range as recorded from aerial surveys flown over the area in June 1999, 2001 & 2003.

Table 1 A population estimate of the Lorillard calving ground study area comparing June 1999, 2001 and 2003 results. All transects flown in all years were identical to those flown in June 1999.

HERD	Lorillard	Lorillard	Lorillard
YEAR	1999	2001	2003
Y = R x Z	13917.77554	34520.27285	12155.71985
Var(Y)	6367549.315	71166719.52	3367045.575
SE(Y)	2523.400348	8436.036956	1834.95111
95% Confidence Limits of Y (+/-)	5377.366141	17977.19475	3697.426486
95% Confidence Limits of Y (%)	38.63667814	52.07720933	30.41717422
Coefficient of Variation	0.386366781	0.520772093	0.150953718

Table 2 Transect observations from the Lorillard June 1999, 2001 and 2003 calving ground surveys. All surveys flew identical transects to the June 1999 survey.

Transect #	LENGTH (km)	WIDTH (km)	AREA (km ²) = (z)	Adults (1999)	Adults (2001)	Adults (2003)
1	36.477	2	72.954	15	109	7
2	60.743	2	121.486	10	1042	171
3	74.088	2	148.176	396	1194	38
4	78.783	2	157.566	16	193	110
5	79.18	2	158.36	21	76	72
6	79.839	2	159.678	39	49	106
7	134.361	2	268.722	84	119	98
8	189.469	2	378.938	72	65	90
9	235.408	2	470.816	77	150	42
10	230.976	2	461.952	132	122	53
11	225.931	2	451.862	57	0	15
12	223.01	2	446.02	38	143	21
13	218.696	2	437.392	41	89	56
14	225.99	2	451.98	3	91	57
15	231.362	2	462.724	80	86	50
16	240.674	2	481.348	46	133	28
17	246.617	2	493.234	104	192	80
18	248.934	2	497.868	335	56	107
19	252.184	2	504.368	221	155	137
20	254.968	2	509.936	319	244	305
21	253.85	2	507.7	125	1076	211
22	251.519	2	503.038	28	152	54
23	234.814	2	469.628	0	67	32
24	199.598	2	399.196	0	0	27
25	156.032	2	312.064	0	0	6

correlated drop in caribou numbers seemed to be the result. Movements of Lorillard cows into the Wager study area are unclear at present. The analysis will continue until the project's expected completion in January 2008.

Wager Calving

On the Wager range the June 2000 survey identified 5 calving aggregations. The first and largest of these aggregations was located along the eastern coast of Melville Peninsula from Cape Penrhyn south to the mouth of Lyon Inlet. The second aggregation was on a 10-15 Km stretch of beach adjacent to Wales Island along the Western coast of Melville Peninsula while a third grouping was observed along the North shore of Lyon Inlet. Two smaller calving aggregations were located south of Repulse Bay, one along the Snowbank River and the other along the Piksimanik River in the vicinity of the North shore of Wager Bay (Figure 4,5).

The June 2002 survey once again found adults and calves spread fairly evenly throughout the survey area. There were concentrations of calves found in sites common to both the 2000 and 2002 calving surveys. These common sites include the north shore of Wager Bay in the vicinity of the Piksimanik River, the south shore of Repulse Bay in the vicinity of Panalik and Beach points, and the north and south shores of Lyon Inlet west to Norman Inlet. Calving areas observed in June 2000 but not in 2002 include the west shore of Melville Peninsula adjacent to Whales Island, an area south of Whales Island extending east along the Matheson River, and an area along the east coast of Melville Peninsula in the vicinity of the Barrow River. The late arrival of spring across the Kivalliq may explain the low number of calves observed within the northern reaches of the survey area though the number of adult caribou seemed to have increased since the 2000 survey. In fact snow cover values recorded in June 2002 were higher than those recorded within the same areas in 2000 particularly in the north, from Whales Island across to the mouth of the Barrow River.

A population estimate using the June 2000 survey data found 13095 +/- 3532 adult caribou (95% confidence limits) on the calving ground (Table 3,4). An identical survey (using the same transects flown in 2000) flown in June 2002 found 20931 +/- 5296 adult caribou within the same study area. Though the coefficient of variation for both surveys was high (2000 = .27, 2002 = .25) the data was tested to determine the significance of the change using equation 5.3 of Thompson et al. (1998):

$$z = \frac{Y_{1999} - Y_{2001}}{\sqrt{\text{Var}(Y_{1999}) + \text{Var}(Y_{2001})}}$$

where:

z = z statistic;

Y_x = population estimate for year x

Var(Y_x) = variance of the population estimate.

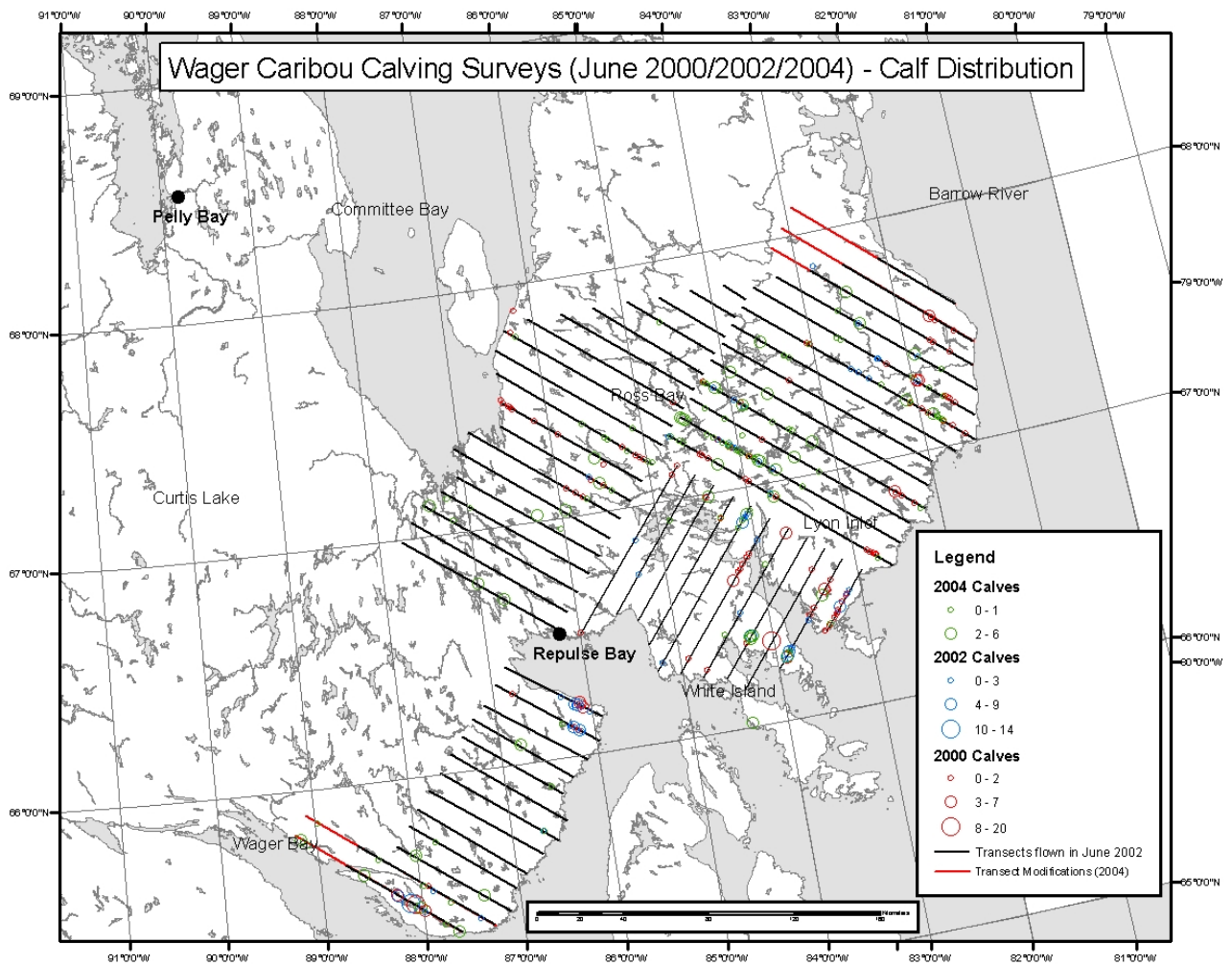


Figure 4 The distribution of calves on the Wager range as recorded from aerial surveys flown over the area in June 2000, 2002 and 2004.

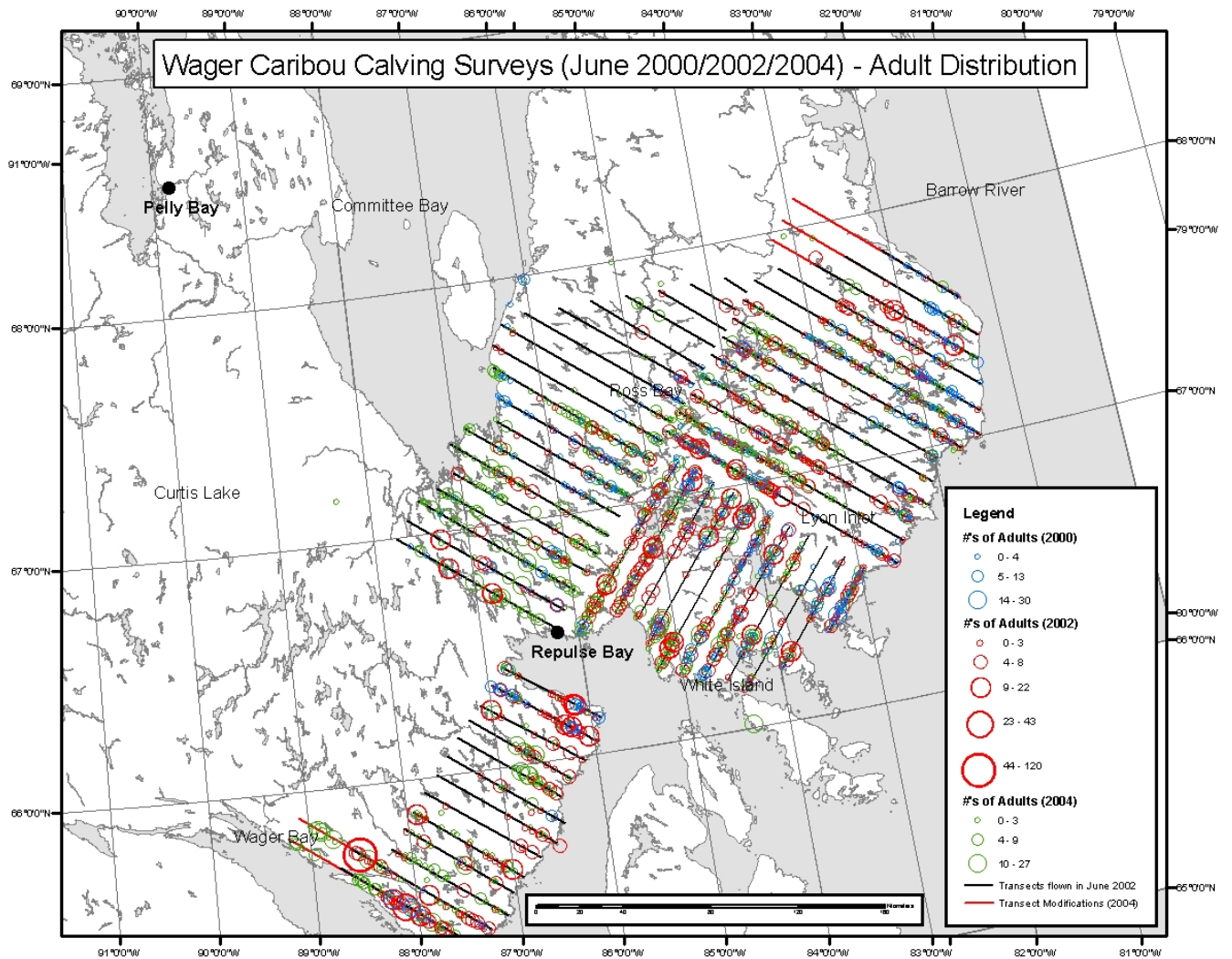


Figure 5. The distribution of adults on the Wager range as recorded from aerial surveys flown over the area in June 2000, 2002 and 2004.

There was a significant increase in the number of adult caribou on the calving grounds between June 2000 ($Y = 13095$) and June 2002 ($Y = 20931$) ($z = 2.62$, $P = 0.01$) and no significant difference detected between the 2002 and 2004 estimates (Table 3 and 4). There was a significant increase in the number of adult caribou on the Lorillard calving grounds between June 1999 ($Y = 13918$) and June 2001 ($Y = 34520$) ($z = 2.34$, $P = 0.02$). The underlying reasons for this increase over such a short period of time may be related, in part, to the movement of Lorillard animals out of the June 1999 calving ground survey area prior to the survey and/or the movement of Wager caribou south of Wager Bay and into the Lorillard River area in 2000. This movement was documented using the location data of ST-14 satellite collars, which indicated seven of the ten satellite collared Wager cows made this journey of which only six returned north of Wager Bay by June 2001. The 2003 survey results in comparison to the 1999 and 2001 surveys were more reliable with a coefficient of variation of 0.15. There was no significant difference between the 1999 and 2003 results and a significant difference between the 2001 and 2003 results. These findings are consistent with the initial hypothesis that Wager animals moved into the Lorillard study area over the 2001 survey period and moved back to the Wager study area prior to the 2003 survey. The underlying reasons for this increase may be related, in part, to the movement of Lorillard animals into the Wager Bay area which may account for the lower numbers observed on the Lorillard range in April 2002 (Figure 6). Such a movement was not apparent when examining locations of collared animals.

Table 3 Population estimates of the Wager and Lorillard calving grounds. Surveys were flown between June 12th and 20th 1999 through 2004. Transects flown in each of the Lorillard and Wager study areas were identical between years.

HERD	Lorillard	Wager	Lorillard	Wager	Lorillard	Wager
YEAR	1999.00	2000.00	2001.00	2002.00	2003.00	2004.00
Y = R x Z	13917.78	13095.94	34520.27	20931.87	12155.72	28128.73
Var(Y)	6367549.31	2747421.65	71166719.52	6177744.81	3367045.57	7827422.41
SE(Y)	2523.40	1657.53	8436.04	2485.51	1834.95	2797.75
95% Con. Limits of Y (+/-)	5377.37	3532.21	17977.19	5296.62	3697.43	5962.01
95% Con. Limits of Y (%)	38.64	26.97	52.08	25.30	30.42	21.20
Coefficient of Variation	0.39	0.27	0.52	0.25	0.15	0.21

Table 4 Transect observations from the Wager June 2000, 2002 and 2004 calving ground surveys. The June 2002 and 2004 surveys flew identical transects to the June 2000 survey.

Transect #	LENGTH (km)	WIDTH (km)	AREA(km ²) = (z)	ADULTS (2000)	ADULTS (2002)	ADULTS (2004)
1	84.389	2	168.778	7	32	100
2	84.389	2	168.778	13	33	22
3	84.389	2	168.778	11	1	98
4	78.760	2	157.520	14	16	125
5	75.927	2	151.854	2	10	51
6	84.561	2	169.122	1	24	69
7	81.527	2	163.054	14	8	32
8	70.333	2	140.666	24	18	36
9	74.667	2	149.334	47	18	28
10	82.661	2	165.322	17	30	132
11	89.787	2	179.574	7	6	21
12	91.546	2	183.092	4	3	15
13	92.851	2	185.702	23	5	6
14	94.651	2	189.302	4	12	5
15	61.220	2	122.440	2	4	0
16	48.585	2	97.170	0	0	11
17	36.051	2	72.102	0	3	0
18	24.796	2	49.592	0	5	0
19	13.199	2	26.398	0	0	0
20	41.706	2	83.412	16	10	7
21	69.894	2	139.788	46	7	17
22	87.348	2	174.696	18	54	18
23	107.367	2	214.734	20	43	21
24	118.918	2	237.836	72	47	45
25	125.984	2	251.968	86	44	92
26	120.990	2	241.980	35	38	72
27	113.677	2	227.354	31	27	41
28	118.147	2	236.294	9	19	27
29	122.169	2	244.338	27	50	96
30	119.080	2	238.160	25	102	66
31	119.906	2	239.812	26	51	152
32	122.028	2	244.056	75	153	88
33	34.166	2	68.332	85	41	56
34	58.620	2	117.240	41	44	40
35	74.919	2	149.838	39	14	34
36	74.748	2	149.496	27	33	61
37	79.626	2	159.252	64	83	69
38	83.850	2	167.700	69	59	84
39	88.053	2	176.106	17	77	82
40	79.813	2	159.626	38	60	83
41	72.707	2	145.414	11	51	37
42	74.838	2	149.676	42	129	96
43	90.689	2	181.378	30	111	162
44	52.259	2	104.518	42	77	26
45	55.848	2	111.696	71	117	20
46	56.241	2	112.482	0	35	11
47	54.936	2	109.872	3	22	56
48	55.404	2	110.808	0	29	95
49	62.662	2	125.324	5	8	8
50	63.942	2	127.884	0	19	5
51	61.956	2	123.912	0	12	0
52	59.406	2	118.812	0	31	29
53	59.270	2	118.540	2	16	29
54	62.007	2	124.014	0	7	42
55	59.003	2	118.006	10	57	109
56	47.678	2	95.356	60	124	134

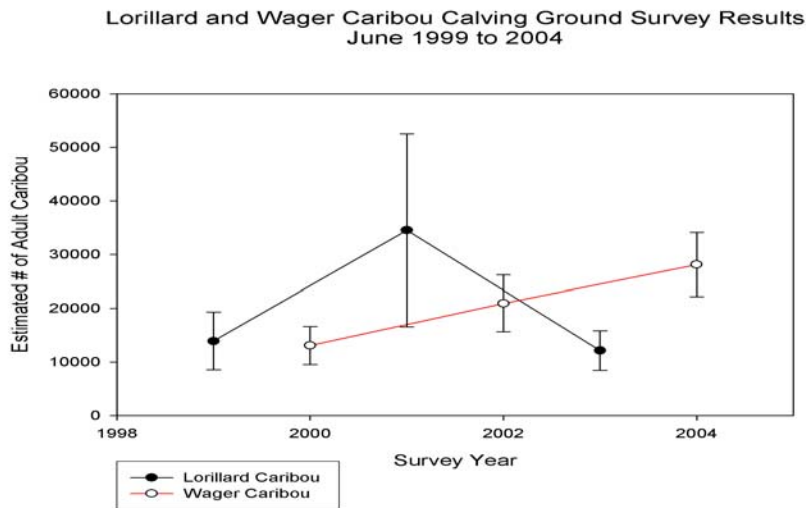


Figure 6 Tracking the Lorillard and Wager populations during the calving season.

Distribution and Movements:

With the completion of the Northeast Mainland population delimitation study comes the final analysis of the data collected since the study inception in April 1999. Components of the analysis have been completed and are presented within this interim report with additional information presented in a compact disk titled “Journey of the Caribou”. In the CD are the detailed results of preliminary home range analysis as well as animations of Kivalliq caribou population movements.

The analysis of distribution and movements is nearing completion. To date nested plot home range analysis examining the probabilities of geo-referenced telemetry data up to the 95th percentile are presented for both the Lorillard and Wager herds (Figure 7 & 8). The analysis of both herds was conducted using spatial analyst, an extension of the ESRI suite of Geographic Information System software. Results clearly show range overlap specifically of the Wager herd into Lorillard range a finding consistent with calving survey results (Figure 6). In addition to the analysis of home range across all years an analysis of calving areas using the same methods was conducted. Over lap between Wager and Lorillard calving areas was minimal though the Wager herd displayed little fidelity to any specific geographic area with the exception of all areas indicated as high density ((Figure 9). Lorillard caribou displayed tight fidelity to their calving areas along the Lorillard River basin (Figure 10). Though calving surveys indicated some between year variation in the distribution of calving Wager and

Lorillard cows, this shift was consistently from one high density area to another. Home range analysis examining spring and fall migration, post-calving, Rutting and Winter range extents is ongoing.

The study analysis is nearing completion and a file report presenting all Kivalliq caribou research results is being prepared. The Department of Environment estimates file report completion by April 2007.

Management Implications:

To date the Northeast Mainland study has provided information on the numbers of caribou occupying the Northeast Mainland. This preliminary information can be used to make recommendations concerning commercial allocations within the Lorillard and Wager populations as well as for estimating TAH (Total Allowable Harvest). In addition, the movement and survey data have provided valuable information concerning seasonal movements and range use. This preliminary information has identified frequently used annual calving grounds, spring and fall migration corridors and wintering grounds as well as areas shared by both the Lorillard and Wager populations of caribou primarily during the winter season. Though continued monitoring is necessary to fill in the information gaps that still exist concerning these populations, the information collected thus far can and is being used to assess land use issues and mitigate potential impacts.

Schedule:

The collar recovery programs have been completed as have all phases of the field program. The analysis is nearing completion and a file report is being prepared. The Department of Environment expects completion of all phases of this project by April 2007.

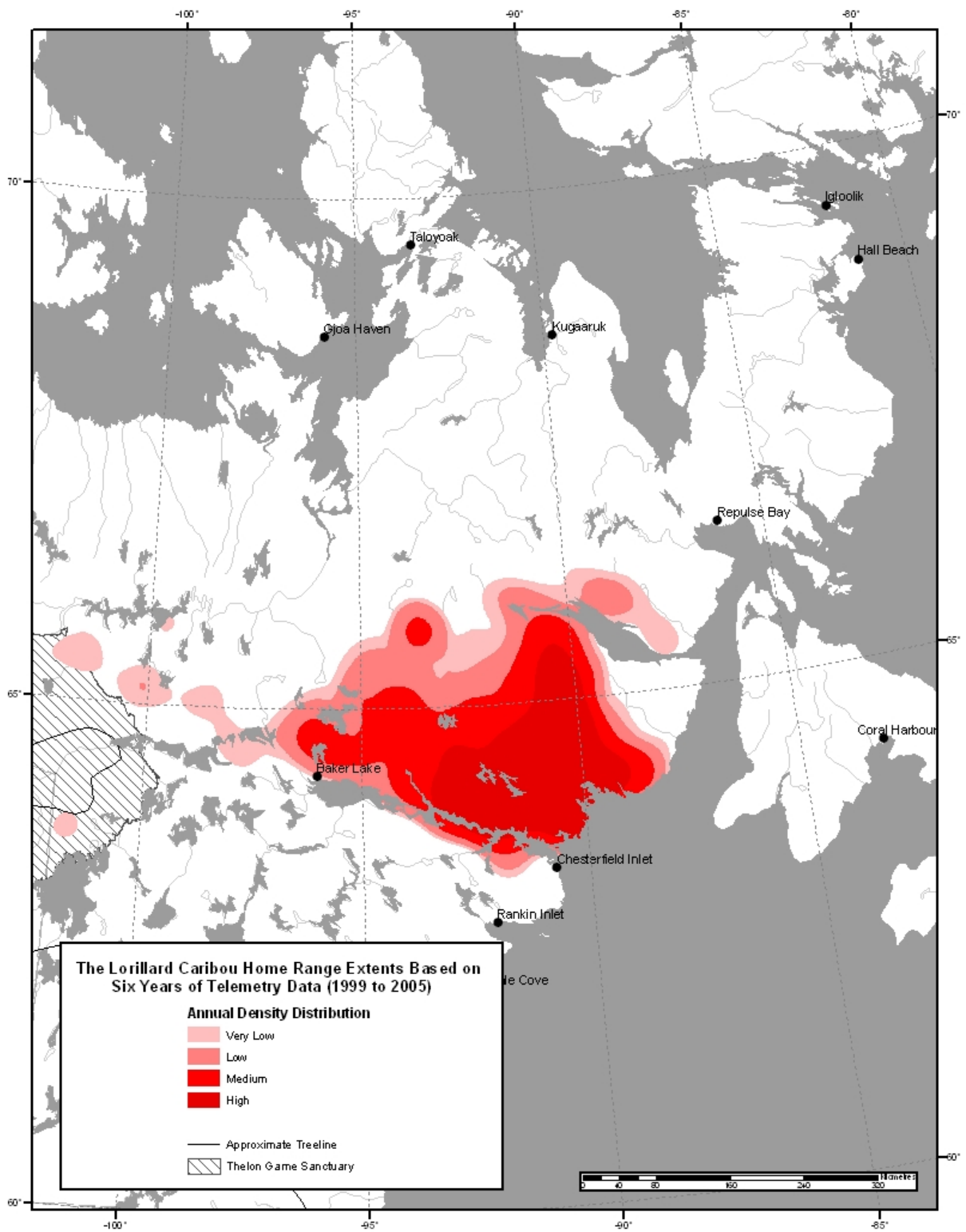


Figure 7 The home range of the Lorillard Caribou Herd based on telemetry data collected between 1999 and 2005 from 25 adult cows.

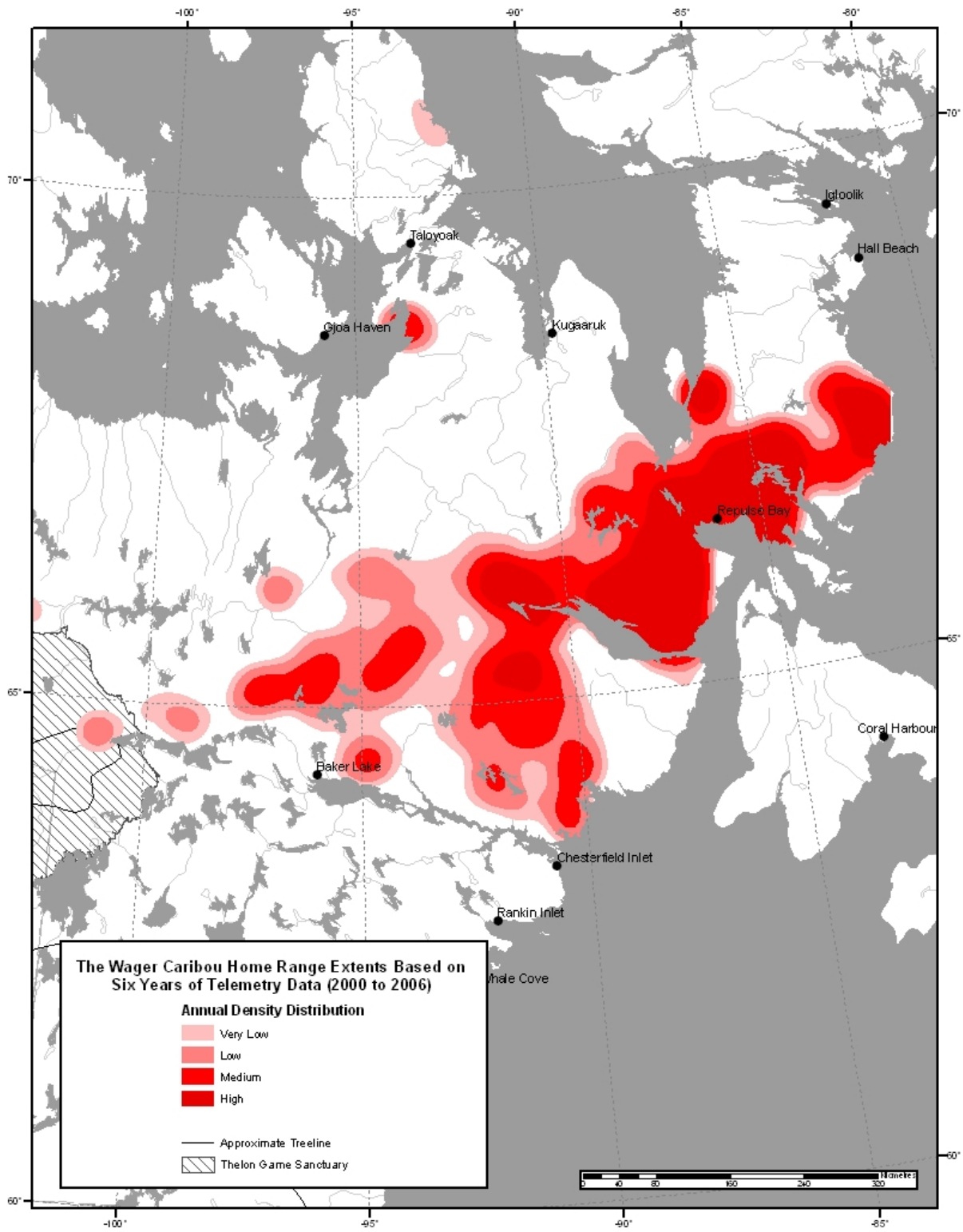


Figure 8 The home range of the Wager Caribou Herd based on telemetry data collected between 2000 and 2006 from 20 adult cows.

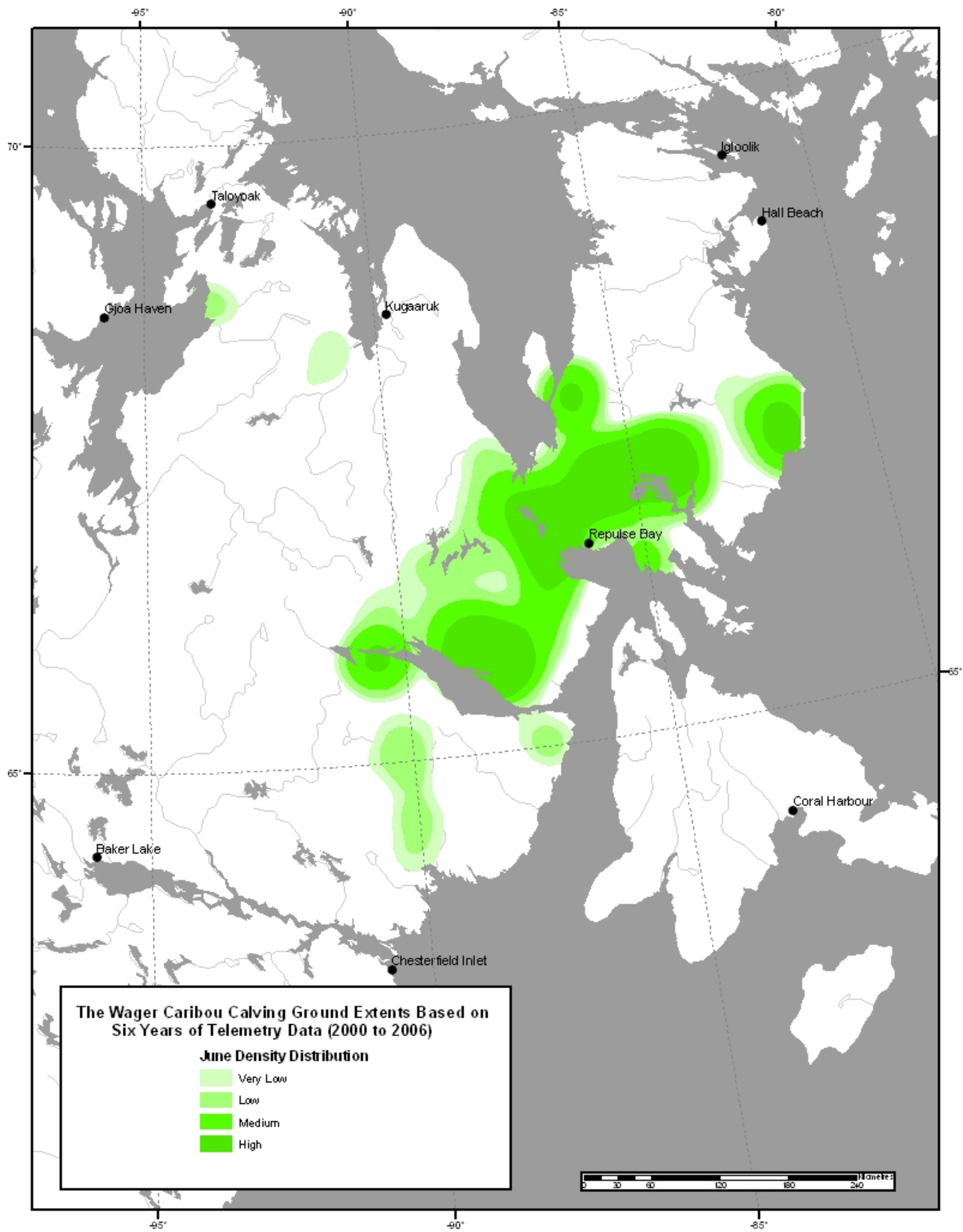


Figure 9 Areas of calving of the Wager Caribou Herd based on telemetry data collected between 1999 and 2005 from 25 adult cows.

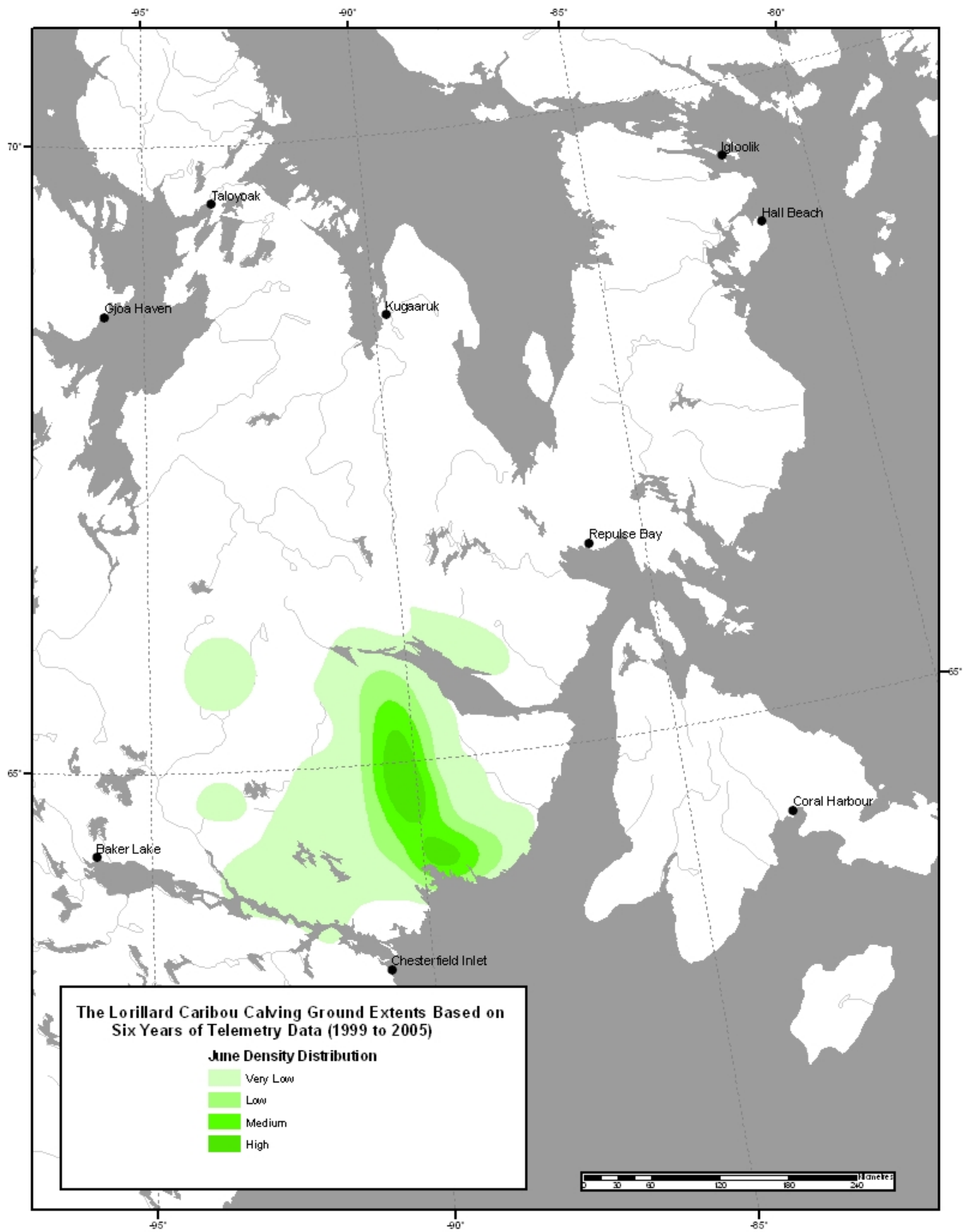


Figure 10 The calving grounds of the Lorillard Caribou Herd based on telemetry data collected between 1999 and 2005 from 25 adult cows.

Personnel:

Mitch Campbell, Regional Wildlife Biologist, DSD, Arviat, NU.

- project design and implementation

Jonathon Pameolik, Regional Wildlife Technician, DSD, Arviat, NU.

- coordinator of project logistics

Local contractors, Chesterfield Inlet, Repulse Bay.

- Fuel caching, logistic support, survey observers.

Partners:

The seasonal distribution and herd delimitation of Northeastern Mainland caribou (*Rangifer tarandus groenlandicus*) is a cooperative research effort between the Department of Sustainable Development, the Nunavut Wildlife Management Board with support from Heritage Parks Canada during phase one. The project is strongly supported by the Baker Lake, Chesterfield Inlet and Repulse Bay HTOs (Hunters and Trappers Organization) and by the KWB (Kivalliq Wildlife Board).

Reporting to Communities/Resource Users:

Initial meetings explaining the capturing and collaring process and proposed study schedule with local HTOs have been completed. More formal meetings were held in Chesterfield Inlet and Repulse Bay following the completion of the deployment and the collection of preliminary data. During this meeting, methods, schedules and current results were discussed. Updated study results were provided to all Kivalliq HTOs and the Kivalliq Wildlife Board in October, 2001, 2002, 2003, 2004 and 2005. The Department will continue to provide updates to all HTO's 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 2007 to take advantage of communities annual general meetings. Verbal information will be relayed to the public through the use of a translator.

Literature Cited:

Calef, G.W. and Helmer, A. 1981. A population estimate for the Melville Peninsula caribou herd in 1976. 16 pp.

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- Heard, D.C., Calef, C.W. and Cooper, S. 1981. Numbers, distribution and productivity of caribou in northeastern Keewatin District, N.W.T. 27 pp.
- Heard, D.C., Williams, T.M. and Jingfors, K. 1986. Precalving distribution and abundance of barren-ground caribou on the northeastern mainland of the Northwest Territories. *Arctic*. 39(1): 24-28.
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Budget 2006/07:

Northeast Mainland Caribou

ITEM	TOTAL BUDGET	VENDOR	STATUS	EXPENDED	COMMITTED	STATUS
Aircraft Charters	\$15,000.00	Northern Networks	PO	\$20,600.00		
<i>subtotal</i>				\$20,600.00	\$0.00	-\$5,600.00
Fuel Purchas/Shipping/Cacheing		Northern Networks	Awaiting Barge		\$4,774.13	
		Northern Networks	Awaiting Barge		\$4,774.13	
<i>subtotal</i>				\$0.00	\$9,548.26	-\$9,548.26
Printing/Graphics/Comm. Supplies	\$500.00					
<i>subtotal</i>				\$0.00	\$0.00	\$500.00
Scientific/Field Equip. disposable						
<i>subtotal</i>				\$0.00	\$0.00	\$0.00
Shipping						
<i>subtotal</i>				\$0.00	\$0.00	\$0.00
Travel & Accomadations	\$5,600.00					
<i>subtotal</i>				\$0.00	\$0.00	\$5,600.00
Service Contracts South	\$10,000.00					
<i>subtotal</i>				\$0.00	\$0.00	\$10,000.00
PROJECT TOTALS	\$31,100.00			\$20,600.00	\$9,548.26	\$951.74