



THE DISTRIBUTION AND ABUNDANCE OF PEARY CARIBOU AND
MUSKOXEN ACROSS THE NORTH WESTERN HIGH ARCTIC ISLANDS,
NUNAVUT

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Summary:

As part of a multi-year research program, 7 high arctic islands, Lougheed, Ellef Ringnes, Amund Ringnes, King Christian, Cornwall, Meighen, and Axel Heiberg, Nunavut, were surveyed using conventional Distance Sampling line transect methods. This document reports on interim progress and provides maps of Peary caribou and muskox distribution. Data analysis, using program Distance 5.0, will provide density and abundance estimates for Peary caribou and muskoxen. Results are being finalized and will be detailed in a comprehensive Government of Nunavut Report.

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Introduction:

Peary caribou (*Rangifer tarandus pearyi*) and muskoxen (*Ovobos moschatus*) are the only ungulates which inhabit the High Arctic Islands of Nunavut, Canada. There is limited knowledge regarding their distribution and abundance, particularly, across the 7 most northwesterly islands of the Queen Elizabeth Islands, Nunavut. In this area, tracking populations is difficult due to the remote location and low population densities. Indeed, only irregular surveys have been carried out and to our knowledge, there have been no aerial surveys of caribou or muskoxen on Axel Heiberg, Ellef Ringnes, Amund Ringnes, King Christian and Cornwall islands since 1961 (Tener 1963, Miller et al. 2005). Loughheed Island was surveyed in 1961, 1973, 1974, and most recently in 1985 (Miller 1987, Miller 1990). Meighen has never been surveyed. Notably, Taylor (2005) documented Inuit Qaujimajatuqngit on Peary caribou and muskoxen in the High Arctic but observations and information provided by the 16 interviewees (from Grise Fiord and Resolute Bay) did not extend to this area. The spatial extent of observations likely reflects the general inaccessibility of this area and the preference for hunting elsewhere (Taylor 2005).

The first High Arctic aerial survey specifically designed to estimate the abundance of caribou and muskoxen occurred June-August 1961 (Tener 1963). The Peary caribou were estimated to be 114 on Ellef Ringnes Island, 452 on Amund Ringnes, 1325 on Loughheed, and 266 on Cornwall Island (Tener 1963). Having surveyed less than 3% of the ice free area on Axel Heiberg Island, Tener (1963) predicted ca. 300 caribou on the island. No estimate was provided for King Chistian where only 3 caribou were observed. Muskoxen were not observed on Ellef Ringnes Island, Loughheed Island, King Christian, or Cornwall Island. Tener (1963) provided preliminary estimates of 1000 muskoxen for Axel Heiberg Island and 10 for Amund Ringnes.

In April 1973, the number of Peary caribou on Loughheed Island was estimated at 56 (Miller et al. 1977). Only one caribou was seen in April 1974 (Miller et al. 1977). Constant with the 1961 survey, no muskoxen were observed on either of these surveys. During an aerial survey in July 1985, no Peary caribou or muskoxen were observed (Miller 1987). The decline of Peary caribou on Loughheed Island was not unique. During the same period (1961-1987) significant declines were measured on a number of high arctic islands due mainly to unfavorable ice conditions and snow cover that increase energetic expenditure and limit access to winter forage (Miller et al. 1977, Gunn et al. 1981, Miller 1990). The deleterious effect of hunting has also been noted (Riewes 1973) although hunting has not been implicated as the major causative factor for Peary caribou decline. Nonetheless, excessive hunting could dampen recovery and exacerbate declines, particularly when populations are low and vulnerable to local extinction.

Peary caribou and what is now known as the Dolphin and Union population of the barren-ground caribou were assigned the status of Threatened by COSEWIC in 1979. In 1991, 2 groups of Peary caribou, Banks Island and High Arctic, were designated as

Endangered by COSEWIC. In 2004, COSEWIC assessed the entire pearyi subspecies as Endangered (COSEWIC 2004).

In response, the Government of Nunavut initiated a multiyear research project to survey and estimate Peary caribou and muskoxen abundance and distribution across their range in Nunavut. Since 2001, the Department of Environment and HTO's from Resolute Bay and Grise Fiord have completed joint ground and aerial surveys on the Bathurst Island Complex, Cornwallis Island, western Devon Island, Prince of Wales Island, Somerset Island, and in 2005-06 Ellesmere and Graham islands. In 2007, we used aerial survey techniques to record wildlife numbers and their locations on 7 islands including Axel Heiberg, Ellef Ringnes, Amund Ringnes, King Christian, Cornwall, Meighen, and Loughheed Island, but also smaller satellite islands. Ground surveys could not be completed in 2007 due to the remote location of the study area and the challenging relief. The results are being documented in a Government of Nunavut file report and will lead to the refinement of IQ- and scientific-based management plans for Peary caribou and muskoxen in the High Arctic Islands of Nunavut. As well, population estimates will be used to update TAH recommendations while the spatial data on wildlife distributions will inform recommendations on habitat conservation and land use applications (i.e. exploration, mining, road development).

Project Objectives.— The principle goal of this investigation was to determine the abundance and distribution of Peary caribou and muskoxen. Research was guided by 3 objectives:

- 1) Evaluate at a regional level the spatial distribution of muskox and caribou, including the identification of calving and pre-calving areas, respectively.
- 2) Evaluate population density with a view to estimating population size.
- 3) Evaluate population size and trends to effectively update the Total Allowable Harvest (TAH) and ensure sustainability.

Materials and Methods

Study Area.— The 2007 study area included Loughheed, King Christian, Ellef Ringnes, Amund Ringnes, Cornwall, Meighen, and Axel Heiberg islands which form the north western margins of the Canadian Arctic Archipelago (82°N and 95° W). We operated from 3 different base camps as our survey progressed from west to east; Isachsen, Expedition Fiord, and Eureka (Figure 1). The closest communities were Grise Fiord (Ellesmere Island) and Resolute Bay (Cornwallis Island) which were located beyond the study area.

Field Methods.—Peary caribou and muskoxen dispersed over large geographical areas. A complete census is not possible and abundance estimates are based on sampling methods. We followed standard aerial survey techniques and distance sampling methodology (Buckland et al. 2001). We used a systematic line transect design with a random starting point. Lines were positioned 5 km apart and ran east-west across the study area (Figure 1). Transects covered the entire land base with the

exception of extensive ice fields and glaciers. Transects were flown using a Bell 206L turbo-helicopter. To maximize the detection of target wildlife aircraft flew approximately 120 m above ground level at 90-130 km/hr depending on patchiness of snow cover, topography, and weather. The observation team consisted of 3 primary observers; one observer in the co-pilot seat, and a port and starboard observer in the rear of the helicopter. The pilot also assisted with spotting wildlife on the transect.

Upon detection, target animals (individuals or social groups) were approached to record location, species, group size and the sex and age of individuals. Hereafter we refer to each wildlife observation as a cluster, where a cluster refers to an individual animal or a group of animals of the same species that occur within ca.100 m of each other. Animal care and safety was priority and observation time was kept to a minimum to reduce disturbance. In particular, for muskox clusters where newborns were present, a first count and location were recorded and a picture taken to confirm information. All data were recorded in field books. As well, a GPS collected positional information every 30 seconds to produce track logs. Clusters observed while off-transect (i.e. while ferrying) were also recorded and identified as off-transect observations.

When animal care and environmental conditions permitted, scat samples of Peary caribou and muskoxen were collected for genetic investigation.



Figure 1: Study area including base camps, proposed fuel caches, and transects.

Mapping Distribution and Estimating Population Density:

Survey data were integrated in a Geographical Information System and we used ArcMap 9.1 to map the distribution of caribou and muskox clusters. We also measured the perpendicular distance of wildlife clusters from the transect, and the actual transect lengths flown.

To estimate population density we followed Buckland et al. 2001, and used Program Distance, Version 5.0, Beta 5 (Thomas et al. 2005), to model the line transect data and estimate density and abundance for each species by island. A density estimate was derived using Convention Distance Sampling and detection function models (key function/series expansion) recommended by Buckland et al. (2001). The most parsimonious model will be selected using Akaike's information criterion (AIC).

Preliminary Results:

Our Peary caribou and muskoxen survey was successfully completed between April 6th and May 3rd, 2007. During this 28-day period, we were able to fly on 21 days; poor weather limited flights, particularly from Isachsen. About 192 hours were flown by the rotary-wing crew covering both predetermined transect lines and ferries between transects and base camp (Figure 2).

The study area covered ca. 64 994 km² of land and we observed Peary caribou and muskoxen (Figure 3), but also arctic fox, ptarmigan, arctic wolf, lemming, arctic hare, and polar bear. On average, the size of muskox clusters was larger than Peary caribou groups (Figure 4 and 5). For each species, the number of clusters and the total number of individuals (both on- and off-transect) is presented by island in Table 1. These observations represent an incomplete count; the survey design providing approximately 20 – 40 percent coverage of the study area (conservatively assuming a strip width of between 500 – 1000 meters).

Although we had hoped to finish the survey before the muskoxen began calving, we encountered our first newborns on 22 April, 2007. We immediately altered our approach to reduce disturbance. Specifically, we did not approach clusters to sex and age individuals. Muskox numbers in Table 1 include newborns.

Newborns were not used to estimate density. Our analytical results are in the process of being finalized and peer reviewed.

Table 1: Observations of Peary caribou and muskoxen by island, April-May, 2007.

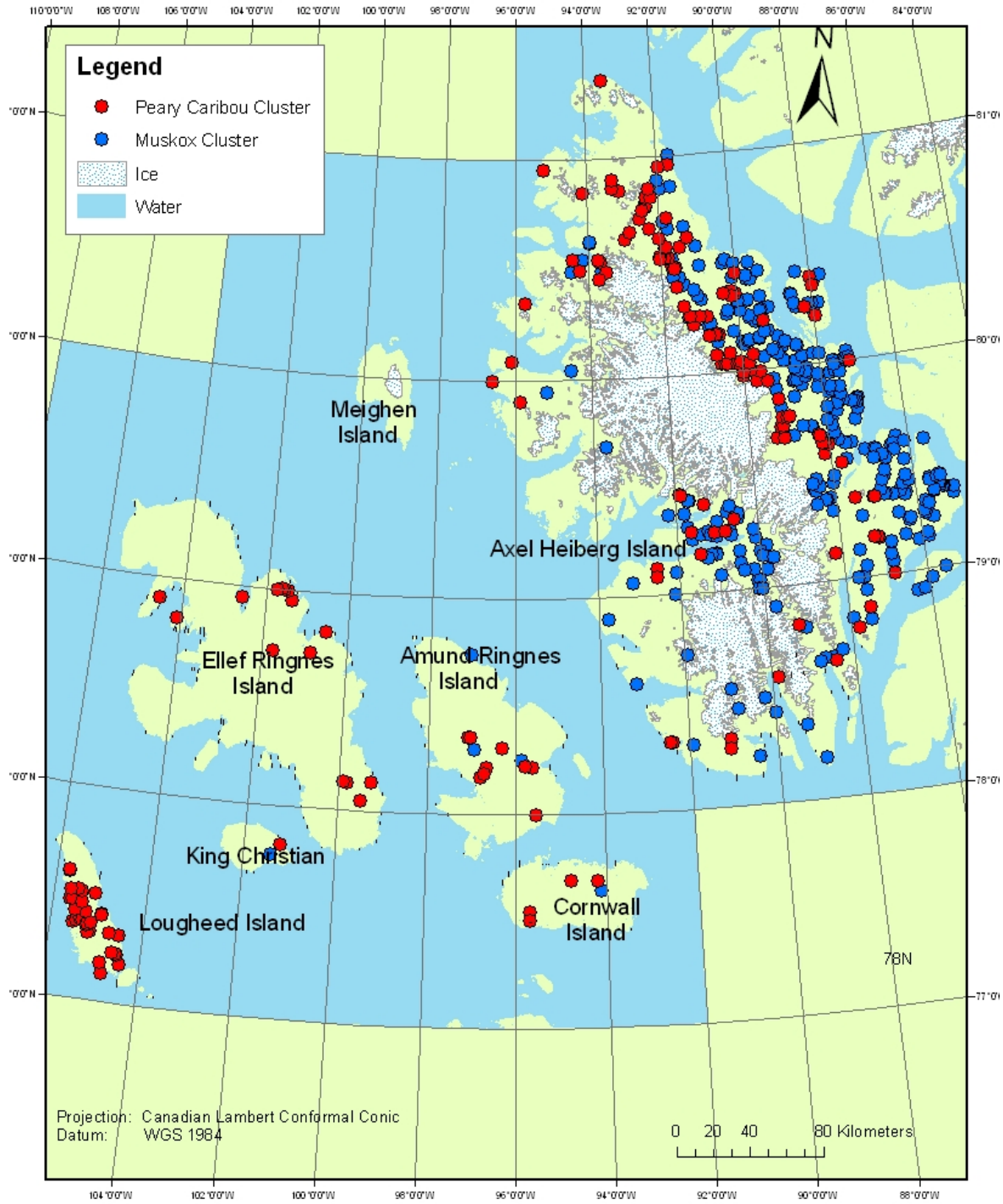
Island	Approx. Area (km²)	Caribou Clusters	Caribou Numbers	Muskox Clusters	Muskox Numbers
Ellef Ringnes	11 295	17	29	0	0
Lougheed	1 308	32	131	0	0
King Christian	645	1	6	1	2
Amund	5 255	9	26	3	13
Cornwall	2 358	4	16	1	6
Axel Heiberg	43 178	122	640	309	3097
Meighen	955	0	0	0	0
TOTAL	64 994	185*	848*	314*	3118*

* All data are being validated.



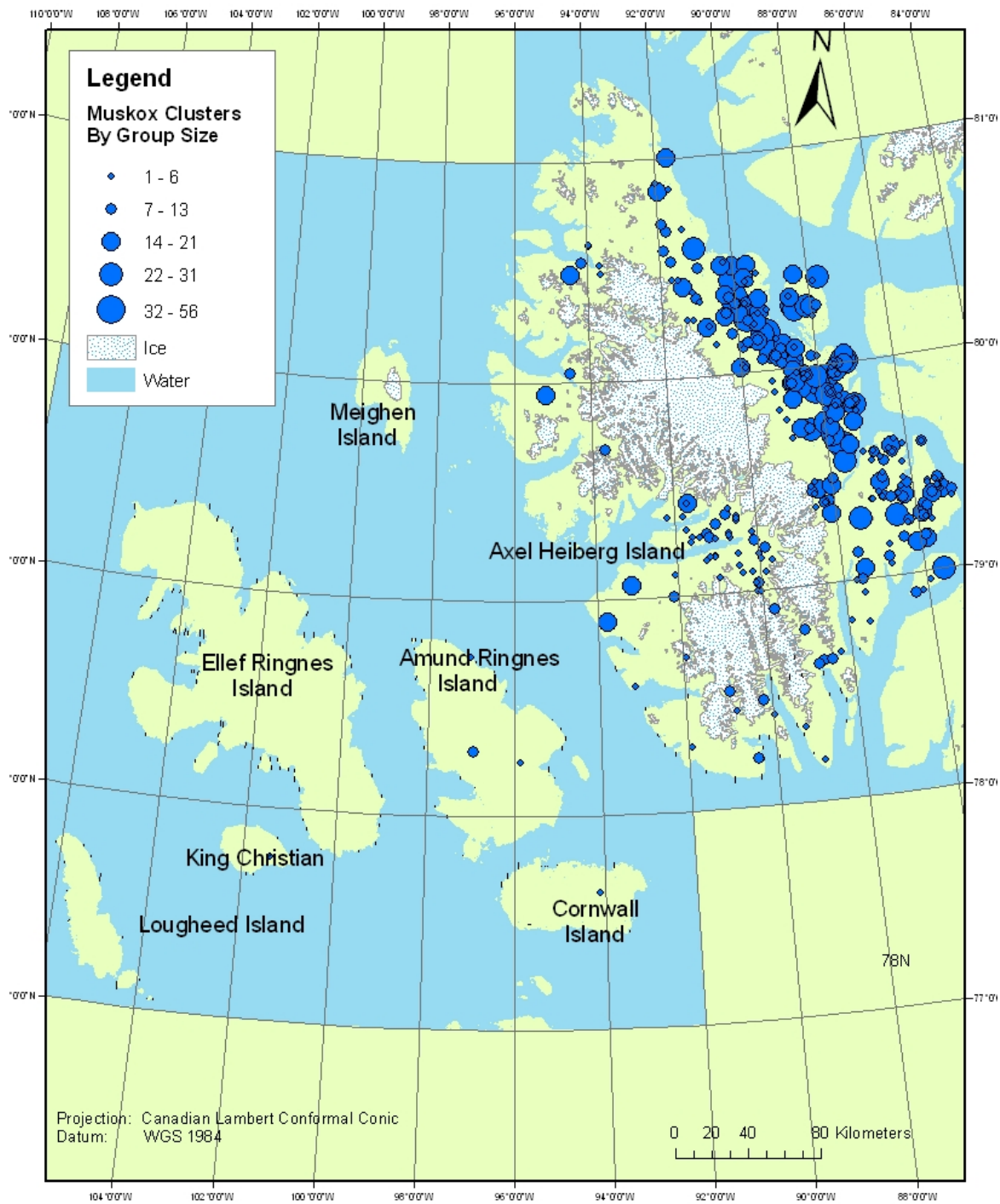
Study Area 2007

Figure 2: Flight track records for the rotary-wing aerial survey of Peary caribou and muskoxen, April-May, 2007.



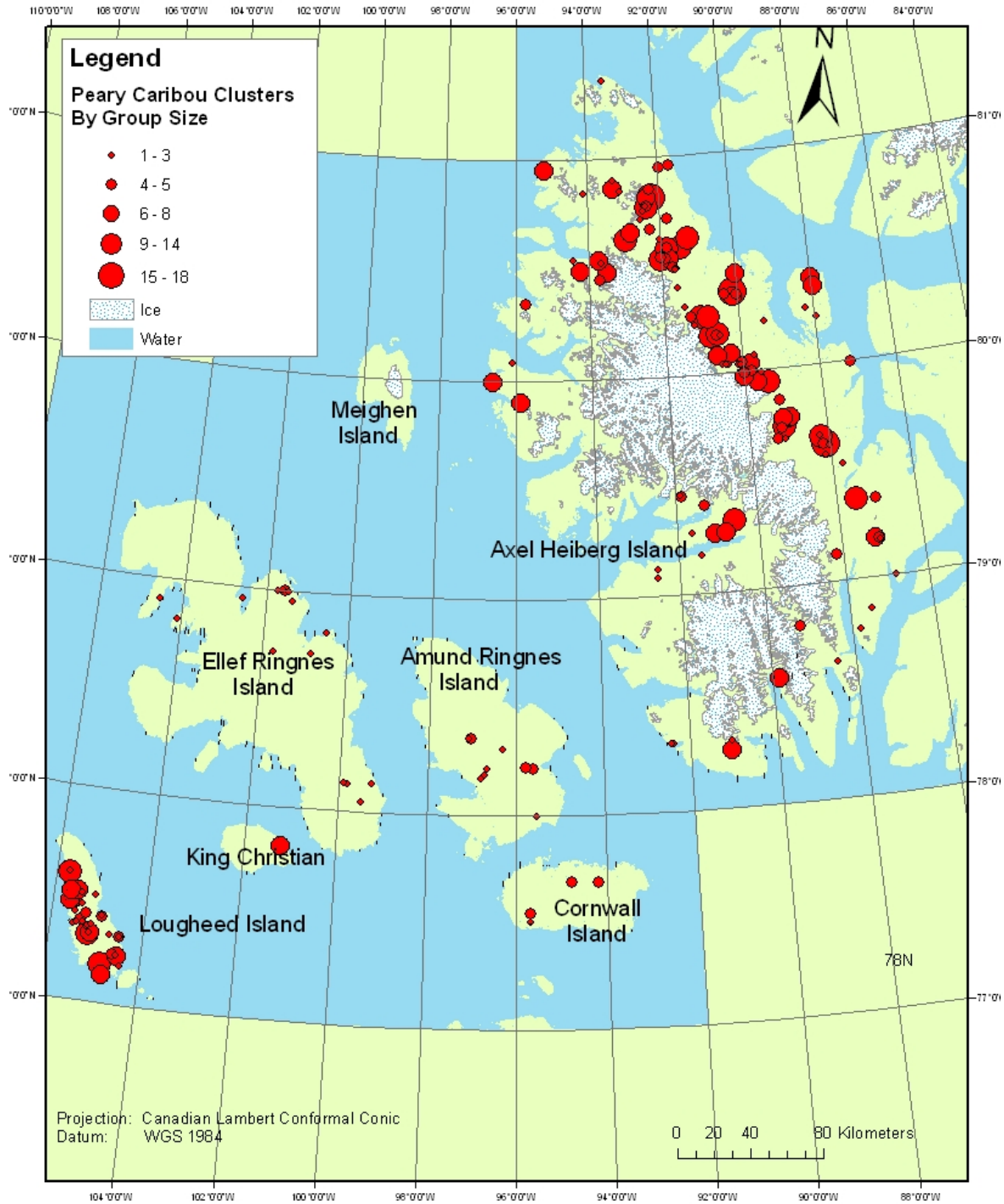
Study Area 2007

Figure 3: Observations of Peary caribou and muskoxen from April 6th-May 3rd, 2007.



Study Area 2007

Figure 4: Muskox observations by group size, April 6th - May 3rd, 2007.



Study Area 2007

Figure 5: Peary caribou observations by group size, April 6th – May 3rd, 2007.

Discussion

- Both Peary caribou and muskoxen occurred within the study area. Distribution of the two species was not uniform. In the most westerly portion of the study area, muskoxen were not observed. Instead, 99% of muskox observations occurred on Axel Heiberg Island.
- Peary caribou also occurred on Axel Heiberg Island. The relative abundance of both caribou and muskoxen was greatest east of the Princess Margaret Range and ice fields. This was an important calving area for muskoxen.
- On eastern Axel Heiberg Island, caribou were generally not observed in areas of high muskox densities nor were muskoxen located in areas of high caribou densities. Similar spatial patterns were observed on Ellesmere Island (Jenkins 2007)
- Eastern Axel Heiberg appeared to have considerably less snow than was observed elsewhere. Indeed, much of the coastal area was snow-free. In the west, movement of some muskox groups appeared to be severely limited by deep snow.
- Given its location and size, Loughheed Island had a high number and density of caribou. This has been previously observed although surveys in 1974 and 1985 found no caribou on the island.
- Along the coast (ca. 50% coverage), ferrying between transects allowed us to observe tracks and identify potential movement between islands. Only polar bear tracks were observed on the sea ice. On one occasion, ungulate tracks were observed following the coast line before moving inland.

The observations presented here are only summary and in-depth analysis and peer review is on-going. Our final results will be detailed in a Government of Nunavut File Report later this year.

Management Implications:

The distribution of Peary caribou and muskoxen during the survey period (April/May) provides fundamental information on areas critical for calving and post calving. The survey data is essential for the estimation of population parameters and this information will be used to update TAH recommendations to 1) ensure the conservation of caribou and muskoxen, and 2) the long-term sustainable use of these resources by local people. As well, these population estimates will provide benchmarks against which future estimates can be compared and the recovery of Peary caribou measured.

Reporting to Communities/Resource Users:

Reporting on the 2007 survey program was initiated immediately after the field program was completed. A field report was distributed to the Resolute Bay and Grise Fiord HTO's and Wildlife officers, NWMB, NTI, the Director of Wildlife, the Baffin Regional Manager, and the Manager of Wildlife Research in July 2007. In November 2007, the

biologist presented a research summary to the Qikiqtaaluk Wildlife Board at their annual meeting in Iqaluit, Nunavut.

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