



## AVAILABILITY OF CARIBOU AND MUSKOXEN FOR LOCAL HUMAN CONSUMPTION ACROSS NUNAVUT

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## Summary

This report was prepared at the request of the Nunavut Anti-Poverty Secretariat (hereafter NAPS) to provide scientific advice related to the feasibility concerning the inclusion of caribou, reindeer, and muskoxen populations in its community-based harvesting program. The Wildlife Research Section, Nunavut Department of Environment, cannot provide a broad recommendation that the Nunavut Anti-Poverty Secretariat assist communities in purchasing barrenground caribou meat, reindeer meat or Peary caribou meat from harvesters due primarily to data gaps that currently exist in our understanding of the demographic status of many of these populations. For muskoxen, a few management units may be good candidates for implementation of a community-based harvesting program, yet resources to update and monitor these populations, in terms of status and harvest activities, would be necessary to ensure their sustainability. The details behind our recommendations are summarized below:

### **BARRENGROUND CARIBOU (*Rangifer tarandus groenlandicus*)**

1. Caribou is a highly valued food source for which harvest by Nunavut Land Claim Agreement (NLCA) beneficiaries is not restricted through legislation, unless a conservation issue requiring a Total Allowable Harvest (TAH) arises
2. Reporting of caribou harvest is not mandatory in Nunavut outside of the application of a TAH
3. Unsustainable harvesting is one of the potential causes of current or historical declines of some barrenground caribou herds in Nunavut
4. An update of the status of most caribou herds across Nunavut would be required for the purpose of effectively managing caribou harvest

### **REINDEER (*Rangifer tarandus tarandus*)**

1. There is a paucity of recent information on the single population of introduced reindeer found in Nunavut (Belcher Islands).
2. Some residents of Sanikiluaq have raised serious concerns about management of harvesting activities.
3. A ground survey was conducted in winter 2012 in order to update the status of this population.

**PEARY CARIBOU (*Rangifer tarandus pearyi*)**

1. Caribou is a highly valued food source for which harvest by NLCA beneficiaries is not restricted through legislation, unless a conservation issue requiring TAH arises
2. Reporting of caribou harvest is not mandatory in Nunavut outside of the application of a TAH
3. Peary caribou was listed as endangered under the federal Species At Risk Act (SARA) in February 2011
4. Harvesting of Peary caribou should be conducted according to recommendations that will be included in the federal recovery strategy and the territorial management plan, which are currently being developed.
5. Peary caribou are susceptible to abrupt changes in population size due to unpredictable severe weather events across their range. The frequency of these weather events is expected to increase with climate change.

**MUSKOX (*Ovibos moschatus*)**

1. Muskox harvesting is restricted through legislation and TAHs have been established for management units across Nunavut
2. Reporting of the harvest is mandatory through the use of tags
3. An update of the status of most muskoxen populations or management units across Nunavut would be required for the purpose of effectively managing muskox harvest
4. A few management units (MX07, MX10, MX11, MX15, and MX16) may be good candidates for a community-based harvesting program pending human and financial resources to update population's status and implement adequate monitoring linked to an eventual increase in harvest pressure.
5. Muskoxen in the high arctic are susceptible to abrupt changes in population size due to unpredictable severe weather events across their high arctic range. The frequency of these weather events is expected to increase with climate change.

In conclusion, this report highlights the general lack of knowledge and/or up-to-date information about harvest levels and population status available to the Wildlife Research Section for the purposes of effectively managing the harvest of caribou and reindeer. In some areas, this limitation could be overcome if reporting caribou harvest becomes mandatory, and if long-term monitoring programs of population demographic parameters are established.





## Introduction

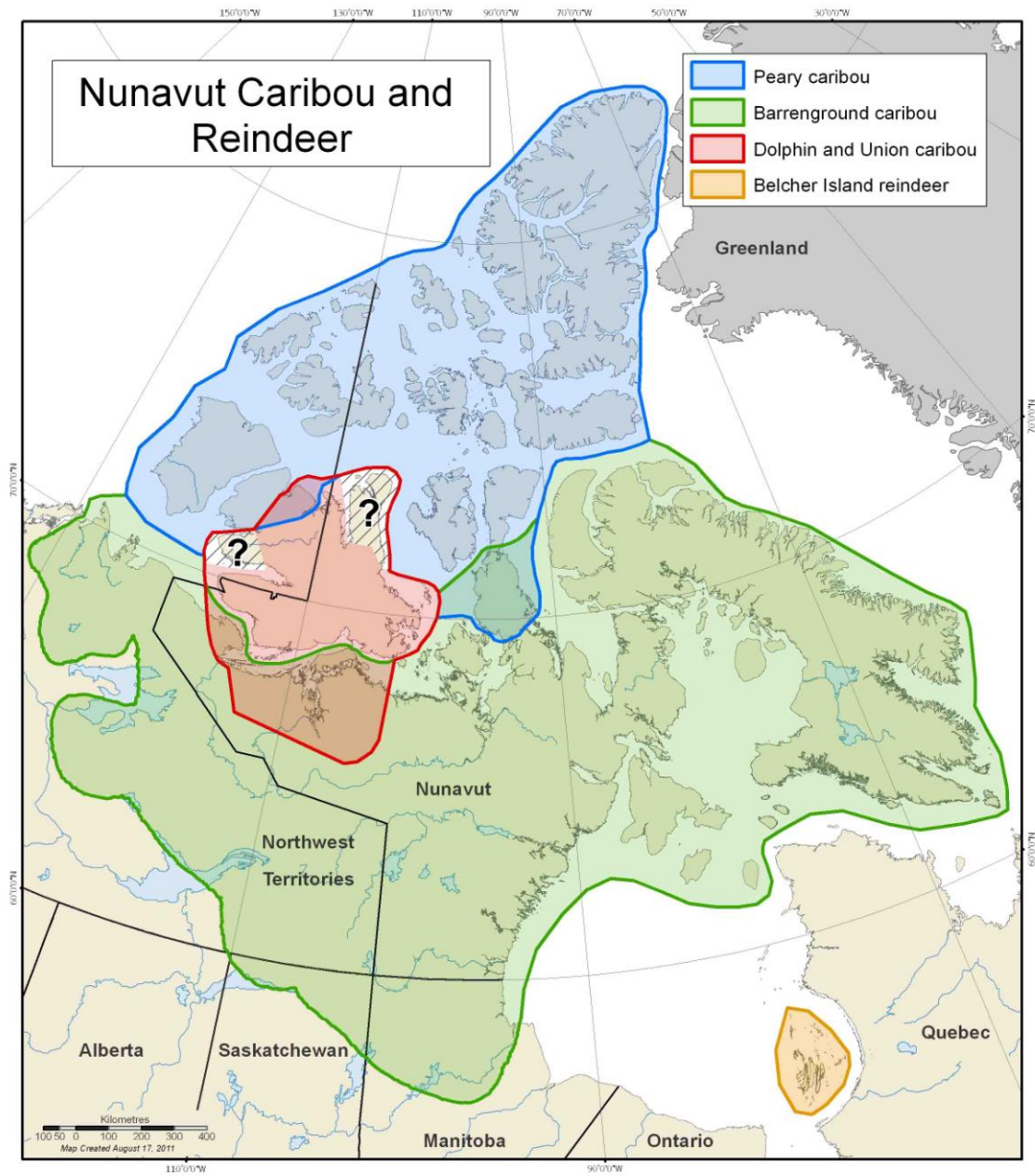
Harvesting of caribou (*Rangifer tarandus*) and muskoxen (*Ovibos moschatus*) by Inuit is a traditional activity of both cultural and economic importance. These ungulate species are an important food source for Inuit and other Nunavummiut, and as such, their populations must be managed in a sustainable way to ensure food security over the long term. Reindeer meat can also be a source of country food at a local scale, i.e. for the community of Sanikiluaq on the Belcher Islands.

This report aims to inform the NAPS on caribou, reindeer, and muskoxen populations that could be included in their program schedule entitled “Assistance for purchasing country food from harvesters for free distribution to the public with the most need”. To reach this objective, this report aims to determine which specific caribou, reindeer, and muskox populations could sustain a higher harvesting pressure by providing available information about population status and harvest levels. This information is first summarized for the three *Rangifer* sub-species found in Nunavut, i.e. barrenground caribou (*Rangifer tarandus groenlandicus*), reindeer (*Rangifer tarandus tarandus*), and Peary caribou (*Rangifer tarandus pearyi*) for all Regions combined, and then summarized by Nunavut Region for muskoxen. This report draws on available scientific information and expertise of biologists within the Wildlife Research Section. No new information was collected for this report.

# Availability of Caribou and Reindeer

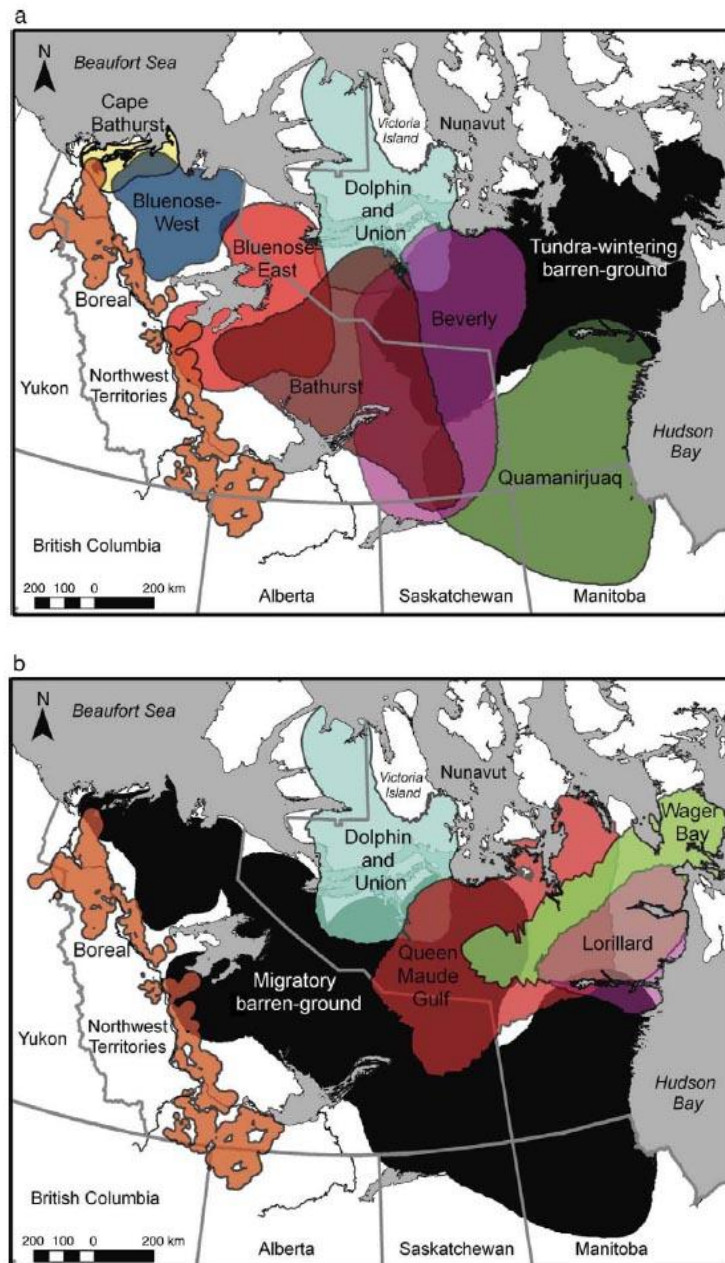
## A. Barrenground caribou

Barrenground caribou herds are found throughout the Kivalliq, Kitikmeot and Qikiqtaaluk Regions of Nunavut (Figure 1 and 2a-b).



**Figure 1.** Caribou range across Nunavut.





**Figure 2 (reproduced from Nagy et al. 2011).** Core ranges (mean 90% utilization distribution) used by (a) migratory Cape Bathurst, Bluenose-West, Bluenose-East, Bathurst, Beverly, Qamanirjuaq, and tundra-wintering barren-ground and boreal and Dolphin and Union Island caribou, and by (b) tundra-wintering Queen Maude Gulf, Wager Bay, and Lorillard and migratory barren-ground and boreal and Dolphin and Union Island caribou subpopulations in the Northwest Territories and Nunavut, Canada (1993–2009). Portions of ranges extending into Yukon Territory, Alberta, Saskatchewan, and Manitoba, Canada are shown.

The status assessment of the different herds depends on available information that varies across Nunavut. Six categories of status have been identified from the information contained in Table 1:

- 1- Declining or potentially declining herds (North Baffin, South Baffin, North Central Baffin, Qamanirjuaq, Southampton Island, and Beverly),
- 2- Herds that have stabilized following declines (Bluenose West and Bathurst),

- 3- Herd recovering from low numbers (Bluenose East),
- 4- Herd that may have plateaued following recovery from low numbers (Dolphin and Union),
- 5- Stable herds (Lorillard and Wager),
- 6- Herds of unknown status (Coats Island and Boothia).

**Table 1.** Status and causes of decline or recovery (if applicable) of the various barrenground caribou herds found in each Nunavut Region.

REGION	CARIBOU HERD	STATUS	CAUSES OF DECLINE OR RECOVERY (IF APPLICABLE)
Qikiqtaaluk	Baffin herds (South, Northeast and North)	A comprehensive population survey has never been conducted. Observations suggest that these herds have declined significantly. A major survey will be undertaken in 2012 and 2013	Current harvest levels may be unsustainable.
Kivalliq	Qamanirjuaq	Data suggest that the herd could be at the beginning of a decline (Campbell 2007)	--
	Southampton Island	Data shows that the herd is declining at a fast rate (Campbell pers. comm.).	Decline is attributed to unsustainable harvesting and the prevalence of Brucellosis (Campbell pers. comm.).
	Coats Island	The size of this population was estimated at 5000 caribou in fall 2010, but local hunters reported die-off during the winter 2010. Thus, the actual status of the population is unknown (Campbell, pers. comm.)	--
Kivalliq and Kitikmeot	Beverly	Little information is available on its current status. More information on herd status will be made available following the analysis of 2011 calving ground survey data (B. Croft pers. comm.)	Location of the calving ground has changed in the last decades (Nagy <i>et al.</i> 2011).
	Lorillard	Stable (Campbell 2007)	--
	Wager	Stable (Campbell 2007)	--

**Table 1.** Continued.

REGION	CARIBOU HERD	STATUS	CAUSES OF DECLINE OR RECOVERY (IF APPLICABLE)
Kitikmeot	Bluenose West	This herd seems to have stabilized at low numbers after a decline (B. Croft pers. comm.).	The potential decline could be attributed to naturally cycling decline, exacerbated by icing events, high predator densities, and high female harvest. Harvest pressure has been reduced in the recent years (CARMA).
	Bluenose East	This herd is recovering from low numbers and is considered stable at the moment. A survey is scheduled in 2012 (B. Croft pers. comm.).	Recovery may be due to lower harvest pressure (CARMA).
	Bathurst	This herd appears to have stabilized at low numbers after a drastic decline (Boulanger <i>et al.</i> 2011). A survey will be conducted in 2012 in order to update population status (B. Croft pers. comm.).	Human pressure on the herd and its range (harvest and land use) are believed to have accelerated the decline (M. Dumond pers. comm.). The Government of the Northwest Territories has implemented harvest restrictions to help with the recovery of the herd (B. Croft pers. comm.).
	Dolphin and Union	This herd was recovering from low numbers and seems to have plateaued.	Sustainability of harvest is questioned in the context of cumulative effects of natural and anthropogenic environmental changes.
	Boothia	Unknown	--

An array of causes listed in Table 1 may be involved in the actual or past decline of some herds. Unsustainable harvesting is one of the potential causes of decline of some barrenground caribou herds in Nunavut, and given the objective of this report, it is essential to discuss this issue further. Sustainability of harvesting is indeed important to consider given that caribou is a highly valued food source for which harvest by NLCA beneficiaries is not restricted or monitored through legislation.

To determine if specific barrenground caribou herds could sustain a higher harvesting pressure, and therefore be the target of the NAPS's food security program, the Wildlife Research Section requires more information on the following four critical variables: 1) abundance, 2) harvest levels, 3) productivity, and 4) natural mortality. Indeed, herds' status (i.e. abundance, productivity and natural mortality) is not being monitored frequently enough to detect herd trends in a timely manner. In addition, the

Wildlife Research Section has little information on annual harvest levels because reporting of barrenground caribou harvest is not mandatory in Nunavut. Based on the available information, the Wildlife Research Section cannot determine if the implementation of a community-based harvesting program could represent an unreasonable risk to the long-term caribou harvest of those communities situated within the ranges of the various populations across Nunavut.

**At present, in order to respect the conservation and sustainability principles underlying Article 5 of the NLCA, the Wildlife Research Section does not recommend that NAPS assists communities in purchasing barrenground caribou meat from harvesters.**

The Wildlife Research Section could review this recommendation if data about harvest levels and population status are updated.

## **B. Reindeer**

A single reindeer population is found in Nunavut and is located on the Belcher Islands in Qikiqtaaluk Region (Figure 1). Native barrenground caribou is thought to have disappeared from the Belcher Islands in the late 1800's (Ferguson 1985). In 1978, 60 semi-domesticated reindeer from the Tuktoyaktuk herd were introduced on the largest island in the archipelago, namely Flaherty I. The population initially increased at a fast rate and was estimated at 287 individuals in 1982. Harvesting of reindeer by residents of Sanikiluaq, which actually own the reindeer, started in 1983 (Ferguson 1985). Recently, some residents of Sanikiluaq have raised serious concerns about management of harvesting activities. To update the status of this reindeer population, a ground survey was conducted last winter and the release of the report is planned for August 2012.

**In order to respect the conservation and sustainability principles underlying Article 5 of the NLCA, the Wildlife Research Section does not recommend that NAPS assists communities in purchasing reindeer meat from harvesters before updated information about population status is made available and interpreted in the light of the sustainability principle.**

### **C. Peary caribou**

Peary caribou are found mainly throughout the Qikiqtaaluk Region and marginally on the Boothia Peninsula in the Kitikmeot Region (Figure 1). The entire sub-species of Peary caribou was listed as Endangered under the federal Species At Risk Act (SARA) in February 2011 (Canada Gazette Part II, Vol 145, No4, 2011-02-16), due to decline in numbers and to expected change in long-term weather patterns (COSEWIC 2004). In Nunavut, Peary caribou is a highly valued food source for which harvest by NLCA beneficiaries is not currently restricted through legislation and harvest reporting is not mandatory. However, the addition of Peary caribou to Schedule 1 of SARA implies that Peary caribou benefits from federal legal protection, and that a recovery strategy will be developed. Meanwhile, the Wildlife Research Section is working on management plans that will include recommendations about Peary caribou harvest levels across its Nunavut range.

**At present, to respect the conservation and sustainability principles underlying Article 5 of the NLCA, we cannot recommend that NAPS assists communities in purchasing Peary caribou meat from harvesters.**

### **Availability of Muskoxen**

Muskoxen are found throughout the Kivalliq, Kitikmeot and Qikiqtaaluk Regions. At the end of the 19<sup>th</sup> century and up to early 1900s, muskox populations were heavily harvested for their fur. This unsustainable harvesting pressure contributed to a major decline across Nunavut mainland, decline which is also attributed to climatic variations and natural fluctuations in numbers (Gunn 1990). Following this decline, the Canadian Government imposed a moratorium on muskoxen harvest in 1917. Muskoxen populations have recovered in most of their historical range (Barr 1991), and in 1969, the moratorium was lifted and hunting has been regulated under a quota system ever since.

To determine which specific muskoxen populations could sustain a higher harvesting pressure, the Wildlife Research Section estimated the balance between sustainable harvesting capacity and annual demand for each muskoxen population or management unit in each Nunavut Region. The boundaries of the actual muskox management units are currently being revised in order to implement more meaningful

management units based on population delineation. The Policy Planning and Legislation Section of the Department of Environment are currently including recommended management units' boundaries in the legislation. For the Qikiqtaaluk Region, this issue is also addressed in the Nunavut muskox management plan for the high Arctic that is currently being developed in consultation with communities and HTOs. While determining which specific muskoxen populations could sustain a higher harvesting pressure, we used the actual management units' boundaries for Kitikmeot and Qikiqtaaluk Regions. For Kivalliq however, the Wildlife Research Section used the recommended boundaries of the management units, because the last survey was conducted using these boundaries. While looking at Region-specific information compiled below, one should keep in mind that updating the status of most muskoxen populations or management units across Nunavut would be required for the purpose of effectively managing muskox harvest.

**Prior to supporting community-based harvesting programs, we recommend an updated assessment of abundance and recruitment in muskoxen sub-populations and management units. In addition, we also recommend ensuring that these variables are monitored regularly following program implementation.**

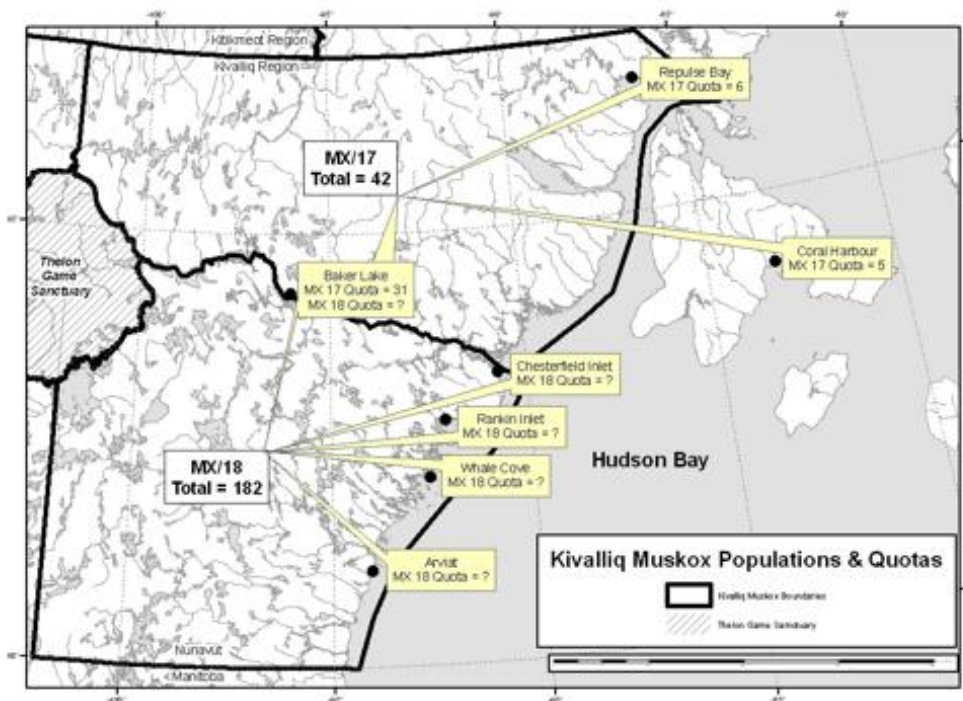
### **A. Kivalliq Region**

Two sub-populations of muskoxen are found throughout the Kivalliq Region, namely the Central and the Northern Kivalliq sub-populations (Figure 3). For both sub-populations, we compared the estimated sustainable harvesting capacity (i.e. TAHs) with the estimated annual demand (M. Campbell pers. comm.) to obtain the balance between the capacity and the demand (Table 2).

An assessment of the status of the Central Kivalliq sub-population is currently underway. Preliminary results from IQ and aerial surveys were used in 2011 to issue an exemption permit allowing an increase in TAH for the 2011-2012 hunting season for this sub-population. This permit aimed to reflect the expansion of the sub-population suggested in a draft file report prepared by the Kivalliq office of the Nunavut Department of Environment and Nunavut Tunngavik Inc. in Rankin Inlet. Harvesting of a high proportion of this temporary increased TAH is expected (Table 2), but data from the ongoing hunting season is required to confirm this prediction.

The Northern Kivalliq sub-population was last surveyed in 2000 (Campbell 2007) and the actual TAH of 42 was set according to population status at that time. The estimated annual demand, i.e. an assessment of the Basic Needs Level (BNL) as assessed by wildlife officials, suggests that a small proportion of the TAH is harvested. Therefore, the balance between the capacity and the demand is positive. However, given the fact that the population was last surveyed in 2000, we considered that the estimated sustainable harvesting capacity is out-dated.

**We do not recommend using the information about the Northern Kivalliq sub-population found in Table 2 without proper reassessment of the status of this sub-population.**



**Figure 3 (reproduced from Campbell, M., & Lee, D. in preparation).** Recommended population boundaries and TAH increases to the Central Kivalliq Muskox (MX/18) subpopulation based on the July 2010 preliminary survey results.

**Table 2.** Estimated sustainable harvesting capacity compared to estimated annual demand for muskoxen sub-populations listed. Estimated sustainable harvesting capacity corresponds to the TAH per sub-population. Estimated annual demand represents an assessment of the Basic Needs Level (BNL), as assessed by wildlife officials. The balance between the capacity and the demand was classified as followed: + (sub-populations that are likely to produce more than the demand for communities in their range), 0 (capacity is adequate to meet the demand, but no surplus anticipated), and – (capacity is insufficient to meet the demand). We caution managers using this table to support community-based harvesting programs to insure 1- that the status of muskoxen sub-populations is updated prior to program implementation, and 2- that a comprehensive monitoring of population status and harvest levels is implemented with the program to insure that it remains sustainable through time.

MUSKOXEN SUB-POPULATION	COMMUNITIES	LAST SURVEY	ESTIMATE OF CAPACITY (TAHs)	ESTIMATE OF DEMAND (EXPERT OPINION)	BALANCE
Central Kivalliq	Arviat Baker Lake Chesterfield Inlet Rankin Inlet Whale Cove	2010	182	High proportion of the TAH is <u>expected</u> to be harvested <sup>1</sup>	0 (expected)
Northern Kivalliq	Baker Lake Chesterfield Inlet Repulse Bay	2000	42	Small proportion of the TAH is harvested	+ <sup>2</sup>

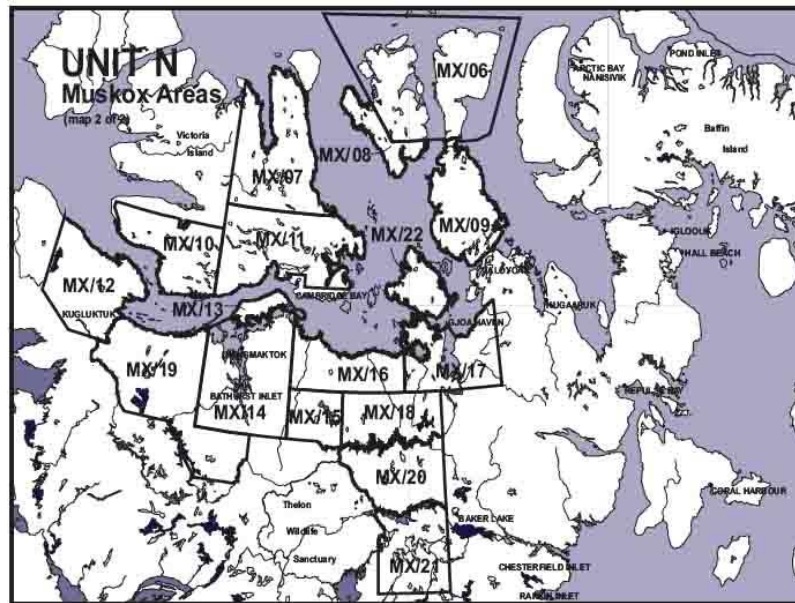
<sup>1</sup>An exemption permit was issued in 2011 to increase the TAH of this population to 182 muskoxen for the 2011-2012 season. Information about the proportion of the TAH that will be harvested is not yet available.

<sup>2</sup>Since this result is based on an out-dated estimate of capacity (based on the 2000 survey), we do not recommend the use of this information without proper reassessment of the population status.



## B. Kitikmeot Region

The Kitikmeot Region is divided in 13 muskoxen management units (Figure 4). For each management unit, we compared the estimated sustainable harvesting capacity (i.e. TAHs) with the estimated annual demand (expert opinion of a professional biologist) to obtain the balance between the capacity and the demand (Table 3).



**Figure 4 (reproduced from the Summary of Nunavut Hunting Regulations 2010-2011).** Muskox Management Units in the Kitikmeot Region as of February 2012.

A thorough review of muskox status across Kitikmeot is available in Dumond 2006, 2007a, 2007b, and 2007c. Therefore, we will only discuss muskox status in management units where the balance between the estimated sustainable harvesting capacity and annual demand is classified as positive in Table 3 (i.e. MX07, MX10, MX11, MX06-08, MX15, and MX16).

MX07, MX10, and MX11 are located on Victoria Island. Those management units were surveyed in 1992, 1994, and 1999, respectively, and actual TAHs are based on population estimates obtained during those surveys. We therefore considered that estimates of sustainable harvesting capacity for MX07, MX10, and MX11 are out-dated. However, while there could be early signs of decline, the muskox population on Victoria island remains abundant at this time and harvest is well below the TAH and very localized around a few locations.

**There is currently an opportunity to increase the harvest in MX07, MX10, and MX11 pending human and financial resources to update population's status and implement adequate monitoring linked to an eventual increase in harvest pressure.**

While updating population status and planning an eventual community-based harvesting program, the question of the spatial distribution of harvest should be addressed in order to manage spatial variations in muskox numbers adequately.

Management unit MX16 has been last surveyed in 1996, and there is no population estimate available in MX15.

**Because MX16 and MX15 are seldom accessed for harvest, they could be good areas to implement a community-based harvesting program pending resources to update population's status and implement adequate monitoring linked to an eventual increase in harvest pressure.**

Management units MX06-08 overlap Kitikmeot and Qikiqtaaluk Regions. We will therefore discuss those management units below (see Qikiqtaaluk Region section).

## Kitikmeot

**Table 3.** Estimated sustainable harvesting capacity compared to estimated annual demand for muskoxen management units listed. Estimated sustainable harvesting capacity corresponds to the TAH per management unit. Estimated annual demand represents expert opinion of professional biologists. The balance between the capacity and the demand was classified as followed: + (populations that are likely to produce more than the demand for communities in their range), 0 (capacity is adequate to meet the demand, but no surplus anticipated), and – (capacity is insufficient to meet the demand). We indicated in bold the management units in which there is currently an opportunity to increase the harvest pending human and financial resources to update population’s status and implement adequate monitoring linked to an eventual increase in harvest pressure.

MUSKOXEN MANAGEMENT UNIT	COMMUNITIES	LAST SURVEY	ESTIMATE OF CAPACITY (TAHs)	ESTIMATE OF DEMAND (EXPERT OPINION)	BALANCE
<b>MX07</b>	<b>Cambridge Bay</b>	<b>1992</b>	<b>100</b>	<b>Small proportion of the TAH is harvested</b>	<b>+<sup>1</sup></b>
<b>MX10</b>	<b>Kugluktuk</b>	<b>1994</b>	<b>100</b>	<b>50-75</b>	<b>+<sup>1</sup></b>
<b>MX11</b>	<b>Cambridge Bay</b>	<b>1999</b>	<b>1300</b>	<b>450</b>	<b>+<sup>1</sup></b>
MX06-08	Taloyoak	2004	12	Harvest pressure varies from year to year	Variable
MX09	Taloyoak	2006	63	High proportion of the TAH is <u>expected</u> to be harvested <sup>2</sup>	0 (expected)
MX12	Kugluktuk	2007	20	20	0
MX19	Bathurst Inlet	2005	75	High proportion of the TAH is <u>expected</u> to be harvested <sup>2</sup>	0 (expected)
	Kugluktuk				
MX13	Umingmaktok	Unknown	20	Unknown	Unknown
MX14	Bathurst Inlet	2005	20	Unknown	Unknown
	Umingmaktok		20		
<b>MX15</b>	<b>Umingmaktok</b>	<b>Unknown</b>	<b>10</b>	<b>10-20 at the most</b>	<b>+<sup>1</sup></b>
	<b>Bathurst Inlet</b>		<b>10</b>		
	<b>Cambridge Bay</b>		<b>70</b>		

Table 3. Continued

MUSKOX MANAGEMENT UNIT	COMMUNITIES	LAST SURVEY	ESTIMATE OF CAPACITY (TAHS)	ESTIMATE OF DEMAND (EXPERT OPINION)	BALANCE
MX16	Gjoa Haven	1996	80	Small proportion of the TAH is harvested	+ <sup>1</sup>
	Kugaaruk		5		
	Taloyoak		5		
MX17	Gjoa Haven	2000	100	High proportion of the TAH is <u>expected</u> to be harvested <sup>2</sup>	0 (expected)
	Kugaaruk				
	Taloyoak				
	Baffin and Kivalliq				
MX22	Gjoa Haven	2002	8	8	0

<sup>1</sup>Since these results are based on out-dated estimates of capacity, we recommend that a proper reassessment of the population be conducted prior to implement a community-based harvesting program.

<sup>2</sup>Exemption permits were issued in 2011 to increase the TAH of these populations. Information about the proportion of the TAH that will be harvested is not yet available. Note also that under the permit, the boundaries of MX16, MX17 and MX22 were changed which may increase ability for communities to utilize a larger proportion of their TAH.

### C. Qikiqtaaluk Region

There are 6 muskox management units in the Qikiqtaaluk Region, and those management units do not cover the entire muskox range in this Region (Figure 5; but see also Figure 4 for MX06 that overlaps Qikiqtaaluk and Kitikmeot Regions). This issue will be addressed in the muskox management plan for high Arctic scheduled for completion in 2012, but before its completion, this issue limits the present discussion. As highlighted in Jenkins *et al.* (2011) and in Table 4, TAHs across the Qikiqtaaluk Region may no longer be sustainable. We therefore indicated TAHs for the different management units, but we rather estimated the sustainable harvesting capacity using a harvest rate of 3% applied to the lower bound of the 95% confidence interval of the last estimate of population size per management unit. Sustainable harvesting capacity of muskox populations across the Qikiqtaaluk Region will be updated in the management plan in development.

**Our current estimates of sustainable harvesting capacity (Table 4) should therefore be considered as unofficial, because they were obtained without taking into account loss of recruitment, die-offs, and very low abundance characterizing some muskoxen populations.**

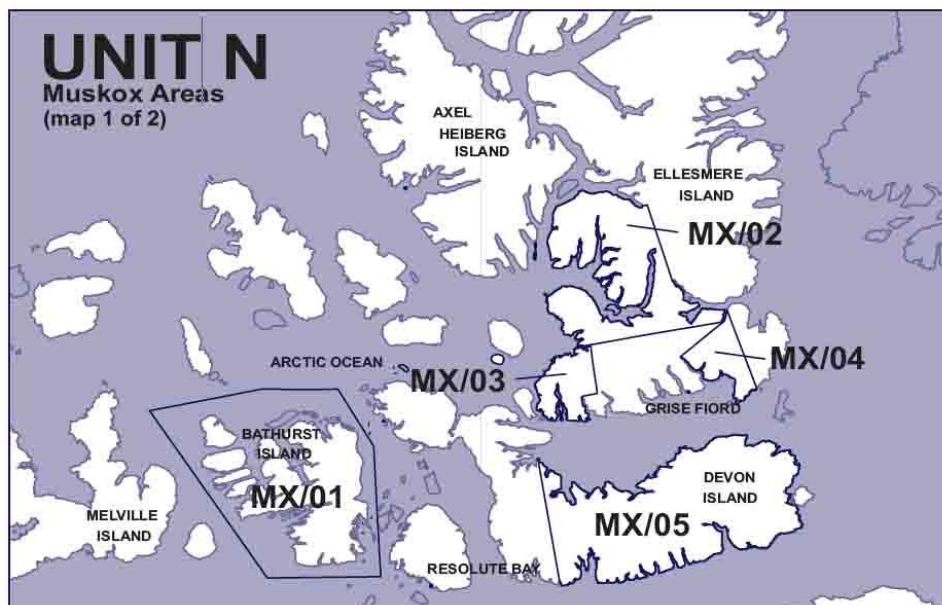
Indeed, muskoxen in the high arctic are susceptible to abrupt changes in population size due to unpredictable severe weather events across their high arctic range. The frequency of these weather events is expected to increase with climate change (Tews *et al.* 2007). In addition, losses of recruitment and die-offs have been observed in certain populations (Miller and Gunn 2003a, Miller and Gunn 2003b, Miller and Barry 2009). Some populations of Arctic Island muskoxen are at very low density and abundance levels (i.e. Bathurst Island muskoxen, South Ellesmere muskoxen; Jenkins *et al.* 2011), highlighting their current vulnerability to stochastic events (Caughley and Gunn 1996).

We compared our unofficial estimations of sustainable harvesting capacity with the estimated annual demand (harvest reports) to obtain the balance between the capacity and the demand (Table 4). For most management units, the capacity are either adequate to meet the demand, but no surplus is anticipated (MX01 and MX05), or insufficient to meet the demand (MX02, MX03, and MX04). In the case of MX02, MX03, and MX04 (Southern Ellesmere Island), Jenkins *et al.* (2011) recommended a revision of the current management units boundaries, because the majority of muskoxen observed on Ellesmere Island in 2005 were found outside the boundaries of the Ellesmere management units. Muskoxen on

southern Ellesmere were also at low numbers, and recruitment was negligible (Jenkins et al. 2011).

Management units MX06-08 overlap Kitikmeot and Qikiqtaaluk Regions (Figure 4). A TAH of 12 and 20 is allocated to Taloyoak and Resolute Bay, respectively (Table 3 and 4). These TAHs can be harvested from both Prince of Wales and Somerset islands. Abundance of muskox in those management units was estimated by aerial survey in 2004. This survey showed that the abundance of muskoxen on Prince of Wales Island declined by 60% over 9 years (Jenkins *et al.* 2011). Given this fast rate of decline, we cannot use the population size estimate obtained 8 years ago to suggest a sustainable harvesting capacity. Meanwhile, population size remained stable on Somerset Island between 1995 and 2004 (Jenkins *et al.* 2011). Based on these results, Jenkins *et al.* (2011) recommended that a separate TAH should be established for Prince of Wales Island and Somerset Island, respectively.

**As shown in Table 4, there could be a potential for harvesting more individuals from Somerset Island, but before to support any community-based harvesting program, the status of this population should be updated and a separate TAH should be established for this population.**



**Figure 5 (reproduced from the Summary of Nunavut Hunting Regulations 2010-2011). Muskox Management Units in the Qikiqtaaluk Region as of February 2012.**

## Qikiqtaaluk

Table 4. Estimated sustainable harvesting capacity compared to estimated annual demand for muskoxen management units listed. We estimated sustainable harvesting capacity using a harvest rate of 3% applied to the lower bound of the 95% confidence interval of the last estimate of population size per management unit. We estimated annual demand using harvest records, yet this source of data may underestimate the actual demand. We show the number of muskox harvested per year averaged over 20 years (1990-2010), as well as the minimum and maximum number of muskox harvested per year in parentheses. The balance between the capacity and the demand was classified as followed: + (populations that are likely to produce more than the demand for communities in their range), 0 (capacity is adequate to meet the demand, but no surplus anticipated), and – (capacity is insufficient to meet the demand). We caution managers using this table to support community-based harvesting programs to insure 1- that the status of muskoxen populations is updated prior to the implementation of the program, and 2- that a comprehensive monitoring of population status and harvest levels is implemented with the program to insure that it remains sustainable through time.

<i>Muskox management unit</i>	<i>Communities</i>	<i>Last survey</i>	<i>TAHs</i>	<i>Unofficial estimate of capacity (based on population survey)</i>	<i>Estimate of demand (Harvest records)</i>	<i>Balance</i>
MX01	Resolute Bay	2001	5	2	3 (0-28)	0
MX02	Grise Fiord	2005	60	9	13 (3-23)	-
MX03	Grise Fiord		10		2 (0-8)	
MX04	Grise Fiord		4		2 (0-7)	
MX05	Grise Fiord	2002 & 2008	4	11	3 (1-5)	0
	Resolute Bay		7		0 (0-2)	
	Arctic Bay		4		1 (0-5)	
MX06 - Prince of Wales	Resolute Bay	2004	20	Unknown	6 (0-18)	Unknown
MX06 - Somerset				57		

<sup>1</sup>Since the TAH of Somerset is currently combined with Prince of Wales, where there was a 60% decline in population abundance between 1995 and 2004, we do not recommend the use of this information without proper reassessment of population status, and before modification of management units boundaries.

## Conclusion

In conclusion, this report highlights that the Wildlife Research Section’s assessment is limited by a general lack of knowledge and/or up-to-date information about harvest levels, population status and trends. These limitations preclude identification of any caribou or reindeer populations that could be included in the community-based harvesting program of the NAPS. This situation could change if reporting caribou harvest becomes mandatory, and if long-term monitoring programs of caribou and reindeer population status are established.

For muskoxen, a few populations or management units may be good candidates for the community-based harvesting program of the NAPS (see summary in Table 5). However it would be necessary to update and monitor these populations’ status and harvest levels in order to ensure the sustainability of these populations and thus the efficiency of the NAPS program.

Table 5. Muskoxen management units that may be good candidates for the community-based harvesting program of the NAPS

MUSKOXEN MANAGEMENT UNITS	MX07	MX10	MX11	MX15	MX16
COMMUNITIES	Cambridge Bay	Kugluktuk	Cambridge Bay	Umingmaktok	Gjoa Haven
				Bathurst Inlet	Kugaaruk
				Cambridge Bay	Taloyoak

Two alternative options are proposed in order to insure long-term food security across Nunavut. First, Snow Goose populations are currently over-abundant and they have strong negative impacts on vegetation on their arctic breeding grounds (Jefferies, Rockwell & Abraham 2004, Gauthier 2005). Harvesting geese in colonies across Nunavut could be an option worth exploring in collaboration with the Canadian Wildlife Service, Environment Canada, i.e. the agency responsible for management of Snow Goose populations<sup>1</sup>. Second, Nunavut has a rich and actually quite diverse wildlife and rather than focussing on species that are already heavily used for subsistence by local hunters, a better option may be to diversify food sources for communities. In some parts of the Kitikmeot and Kivalliq Regions, although appropriate assessment and monitoring would be required, moose could provide country food at a local scale. To determine if other terrestrial species under the Nunavut Department of Environment’s mandate such as small game (ptarmigan, arctic hare, ground squirrel) could sustain a higher harvesting pressure, the implementation of a monitoring program to assess the status of these populations would first be required. There is currently a paucity of data for those species.

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