RECOMMENDATIONS ON TOTAL ALLOWABLE HARVEST (TAH) RATES FOR THE TERRESTRIAL WILDLIFE POPULATIONS IN NUNAVUT

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1.0 Introduction

1.1 Terms of Reference

The Wildlife Research Section (Wildlife Management Division) of the Department of Environment (DoE) was asked to provide recommendations on appropriate Total Allowable Harvest (TAH) levels for the various terrestrial wildlife species in Nunavut (Schedules 5-1 and 5-2 of the Nunavut Land Claims Agreement or NLCA, including resident non-migratory birds and birds of prey), and the TAH associated with all identified populations. Providing this information to the DoE is the mandate of this report.

The *Wildlife Act* (Nunavut) was developed to implement the NLCA with respect to terrestrial wildlife within the mandate of the Minister of DOE. The Wildlife Regulations required to implement the *Wildlife Act* require identification of the TAH for each population of each species within the Minister's mandate.

Requested information included:

- A summary of the relevant terrestrial game species present in Nunavut;
- An outline of the various stocks or populations that occur for those species;
- An outline of the population boundaries of each stock or population;
- A TAH for each stock or population;
- A management prescription on the mechanism of the sex-selective harvest that should be in place for each stock or population, if required;
- The harvesting seasons that should be in place for each stock or population;
- The harvesting zones for each stock or population (if they are different from the population boundaries); and,
- The rationale for specific recommendations.

1.2 Guiding Principles

The terms of reference presented in Section 1.1 and the NLCA were used to develop ten guiding principles to steer development of recommended levels of TAH for terrestrial wildlife species in Nunavut. These guiding principles are as follows:

P1 Each TAH identified must be within conservation limits and be consistent with conservation principles;

P2 No restrictions on harvesting activities for a species will be recommended if not required for a valid conservation purpose, including identifying a TAH for a population or restricting harvest by sex, season, or through zone restrictions;

P3 TAH recommendations must be practical with respect to monitoring, enforcement, and administrative capacity within Nunavut;

P4 TAH recommendations must be consistent with the NLCA, Wildlife Act, and all other applicable legislation;

P5 TAH recommendations must include all sex restrictions, seasons, zone designations, and other provisions required to achieve conservation goals;

P6 TAH recommendations should consider population numbers, population dynamics, and the ecology of the species in question. Recommendations for TAH should specify how the TAH varies with population status, population number, and other ecological considerations;

P7 The decision not to consider an appropriate TAH is fundamentally different from deciding there is no conservation purpose served by setting a TAH. We considered that the conservation mandate in the Nunavut Act and the NLCA required us to consider TAH levels for all populations of all species within our jurisdiction;

P8 The rationale for TAH recommendations must be internally consistent for all populations both within species and taxa, and between species and taxa;

P9 Harvest reporting is mandatory when a TAH is identified;

P10 The DoE's TAH Working Group developed these recommendations independently. An appropriate co-management consultation process is required, and impacts on other jurisdictions should be considered.

1.3 Process

Recommendations on TAH presented in this document were developed at the first TAH Workshop (Iqaluit, October 02–10, 2004) and revised after consultations through 2005, most recently from information presented during the DoE's Wildlife Research Group meeting of November 4, 2005 (Iqaluit). Consultations are not complete, however, and should be considered an ongoing initiative of the TAH Working Group.

1.4 Working Definitions, Acronyms, and Special Notes

Total Allowable Harvest for a stock or population is defined as the number of individuals from a population of wildlife that may be lawfully harvested as established by the NWMB pursuant to Sections 5.6.16 to 5.6.18 of the NLCA. Recommended levels of TAH, summarized in Appendix I, are defined for populations specific to species, whereby a population is defined as a demographic unit for which birth and death rates are believed to contribute more to population trajectory than rates of immigration and emigration. In most cases, demographic units are defined based on the female component of the population: for polygynous species, as long as there are enough males to mate available females, it is the growth rate of females that will determine population growth rate.

For each species, recommended levels of TAH include population-specific levels of TAH or, for a specific population at the present time, no identified need for a TAH ('No TAH'). In developing TAH levels for populations, we considered the maximum Basic Needs Level (BNL) applicable to a population (e.g., Appendix II), as calculated using formulae presented in Sections 5.6.19 to 5.6.24 of the NLCA and data presented in the Nunavut Wildlife Harvest Study (NWHS). These calculations were for our own purposes and do not constitute official or accepted BNLs.

Note that we recommend that the harvest of all species by all people be prohibited in the Thelon Wildlife Sanctuary, subject to consultation.

Harvest seasons are identified for each target population from the date of opening to the date of closing. An identification of 'Open Season' indicates that no season appears necessary for an indicated level of TAH, or No TAH, for conservation purposes.

Sex-selectivity of the harvest was identified in ratios of males:females (e.g., 2:1), or, if no sex-selectivity appeared necessary for conservation reasons, sex-selectivity in the harvest was designated 'Unselective.'

Acronyms presented in this report are identified here as:

BNL = Basic Needs Level

COSEWIC = Committee on the Status of Endangered Wildlife in Canada

DoE = Department of Environment

HTOs = Hunters and Trappers Organizations

IQ = Inuit Qaujimajatuqangit

NWHS = Nunavut Wildlife Harvest Study

NWMB = Nunavut Wildlife Management Board

RWO = Regional Wildlife Organization

TAH = Total Allowable Harvest

NLCA = Nunavut Land Claims Agreement

Additional definitions are used in this report as described under Section 5.1.1 of the NLCA.

1.5 Acknowledgements

This document was developed by the numerous managers, biologists, technicians, and observers present during the initial TAH Workshop of October 02–10, 2004, and at the latest meeting of the DoE's Wildlife Research Section on November 4, 2005. We anticipate that individuals will be continuously contributing towards development of this document at the annual meetings of the DoE's Wildlife Research Section.

2.0 TAH of Big Game Carnivores

2.1 Polar Bears (*Ursus maritimus*)

2.1.1 Populations

We currently recognize 12 populations of polar bears that reside wholly or partially in Nunavut (Figure 2.1, Table 2.1). Geographic boundaries of Nunavut polar bear populations (Figure 2.1) have been previously evaluated using movements of marked and recaptured (or harvested) individuals (Taylor and Lee 1995), DNA analysis (Paetkau et al. 1999), and movements of radio-collared adult females (Taylor et al. 2001).

2.1.2 Total Allowable Harvest

In collaboration and consultation with Hunters and Trappers Organizations and local Wildlife Boards, the DoE has developed management plans which identify TAH levels consistent with conservation principles for each polar bear population in Nunavut. These management plans were considered by the NWMB and a decision to accept them was conveyed to the Minister of Environment in December 2004. A summary of the recommended levels of TAH outlined in the management plans of each polar bear population is presented in Table 2.1. We refer the reader to population management plans for more detailed explanation of the development of TAH levels for polar bears; however, we include an example management plan in Appendix III (Memorandum of Understanding for harvesting the Lancaster Sound polar bear population).

2.1.3 Sex-Selectivity of Harvest

In accordance with the *Guiding Principles* presented in Section 1.2, we recommend that female polar bears be conserved in order to mitigate the impact of harvesting on populations, and encourage the number of polar bears in each population to attain and retain target population numbers presented in each management plan. This requires harvesting the TAH at two or more males per female taken (2:1 harvest sex ratio; Taylor et al. 2005). It is recognized that it would be to the benefit of each population to keep the proportion of males harvested as high as possible as long as the TAH (estimated at 2M:1F) is not exceeded (Taylor et al. 2005). It is also recognized that females with accompanying offspring should be protected from harvest, since it is unlikely offspring under two years of age will survive in the absence of their mother (although opportunities to harvest cubs accompanying females can be made available as described in each management plan; offspring not accompanied by a female are available for harvest). Implementation of sex-selectivity of the harvest is detailed in the flexible-quota system presented in each polar bear management plan (e.g., Appendix III). To be clear, we recommend the harvest of a female polar bear that is accompanied by a bear that is or appears to be under three years of age not be allowed. Further, we recommend that no person shall harvest a polar bear that is in a den or is constructing a den, since it may be

difficult to sex bears that are in or are constructing dens. Bears of either sex under three years of age and accompanying a female may be harvested only under special circumstances.

2.1.4 Seasons of Harvest

We do not feel it necessary, for conservation purposes, to regulate harvesting of polar bear populations through a restriction on season of harvest, as all causes of human-caused mortality are captured in the TAH.

2.1.5 Additional Concerns or Recommendations

Mandatory reporting of harvest to the Wildlife Research Section of the DoE is recommended to ensure proper implementation of the quota system. Reporting of harvest should include tissue samples sufficient for extraction of genetic material, which may be used to develop a better understanding of genetic relatedness and diversity of polar bear populations in Nunavut. We recommend that it be mandatory for hunters to provide proof-of-sex samples from harvested animals to confirm the reported sex to ensure conservation of females. To be clear, specific samples we recommend mandatory for collection upon the harvest of a polar bear are: the lower jaw of the bear, with the teeth, any lip tattoos and ear tags and evidence of the bear's sex (e.g., baculum). Harvesters should return any found radio telemetry transmitter or satellite collar to a conservation officer.

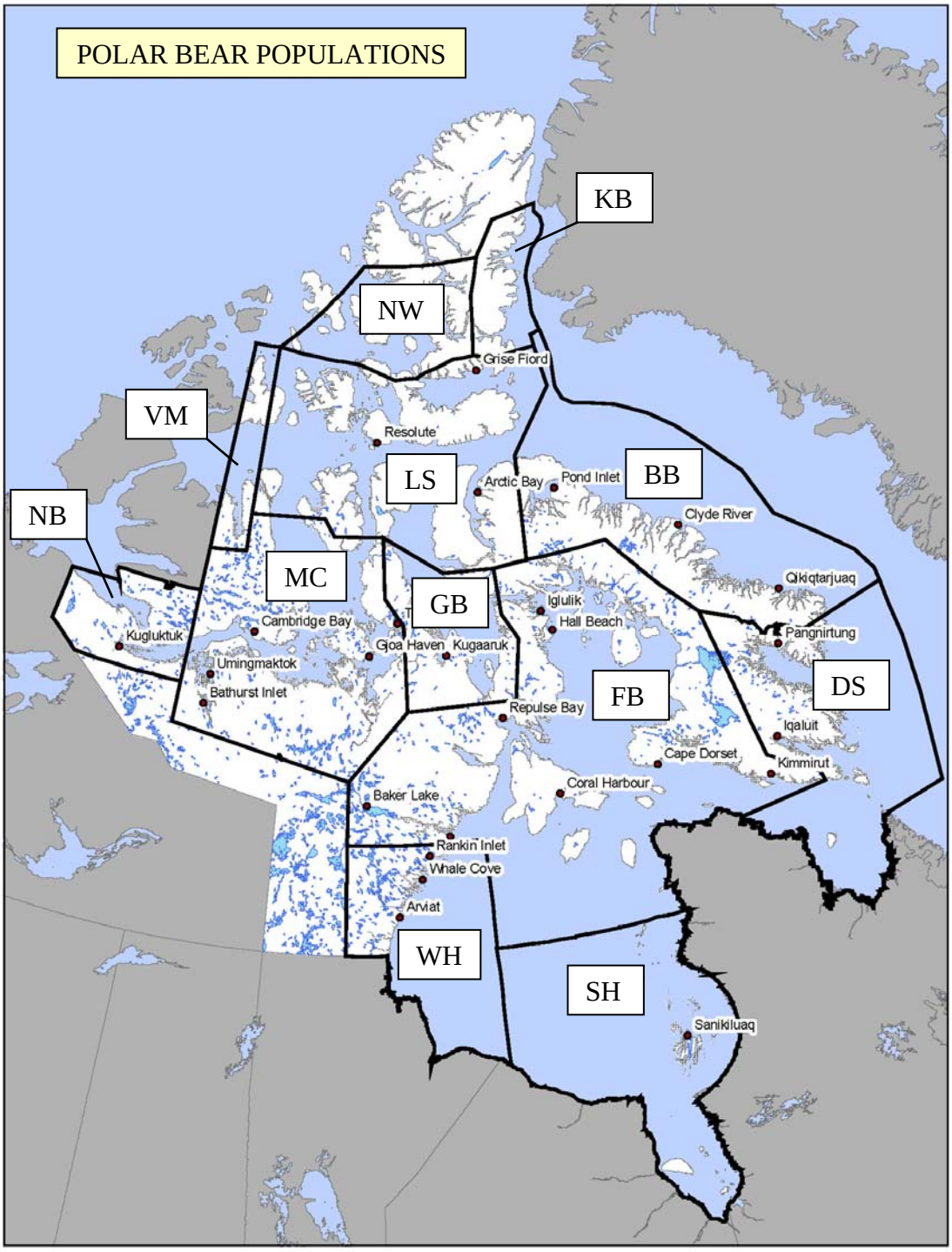

Figure 2.1. Geographic distribution of polar bear populations in Nunavut. Abbreviations of population names are described in Table 2.1.

Table 2.1. Levels of TAH proposed in each management plan for management of polar bear populations in Nunavut, distributed among communities as per the flexible-quota system presented in each management plan.

POPULATION Community	**PROPOSED TAH in management plan**
NORTHERN BEAUFORT POPULATION (NB)	
Kugluktuk	6
TOTAL	**6**
VISCOUNT MELVILLE POPULATION (VM)	
Cambridge Bay	3
TOTAL	**3**
M'CLINTOCK CHANNEL POPULATION (MC)	
Kitikmeot Hunters and Trappers Assn.	3
Cambridge Bay	?
Gjoa Haven	?
Taloyoak	?
TOTAL	**3**
GULF OF BOOTHIA POPULATION (GB)	
Gjoa Haven	5
Hall Beach	4
Igloolik	11
Kugaaruk	24
Repulse Bay	5
Taloyoak	25
TOTAL	**74**
LANCASTER SOUND POPULATION (LS)	
Arctic Bay	25
Grise Fiord	25
Resolute Bay	35
TOTAL	**85**
NORWEGIAN BAY POPULATION (NW)	
Grise Fiord	4
TOTAL	**4**
KANE BASIN POPULATION (KB)	
Grise Fiord	5
TOTAL	**5**

Continued next page…

POPULATION Community	PROPOSED TAH in management plan
BAFFIN BAY POPULATION (BB)	
Qikiqtarjuak	30
Clyde River	45
Pond Inlet	30
TOTAL	**105**
DAVIS STRAIT POPULATION (DS)	
Iqaluit	23
Kimmirut	4
Pangnirtung	19
TOTAL	**46**
WESTERN HUDSON BAY POPULATION (WH)	
Arviat	22
Baker Lake	3
Chesterfield Inlet	3
Rankin Inlet	14
Whale Cove	14
TOTAL	**56**
SOUTHERN HUDSON BAY POPULATION (SH)	
Sanikiluaq	25
TOTAL	**25**
FOXE BASIN POPULATION (FB)	
Baker Lake	0
Cape Dorset	10
Chesterfield Inlet	8
Coral Harbour	40
Hall Beach	8
Igloolik	10
Kimmirut	10
Rankin Inlet	0
Repulse Bay	12
QWB TAGS	4
KWF TAGS	4
TOTAL	**106**
NUNAVUT TOTAL	**518**

2.2 Grizzly Bears (*Ursus arctos*)

2.2.1 Populations

We currently recognize four populations of grizzly bears that reside wholly or partially in Nunavut (Figure 2.2, Table 2.2). Geographic boundaries of Nunavut grizzly bear populations (Figure 2.2) were evaluated primarily from known movements of adult female grizzly bears in the Kitikmeot (McLoughlin et al. 2002) and local Inuit Qaujimajatuqangit (IQ) of the use by grizzly bears of river drainages in east-mainland Kitikmeot. Both local IQ (e.g., information presented in meeting minutes of HTOs) and scientific studies of demography (e.g., McLoughlin et al. 2003*a*,*b*) suggest growing populations of grizzly bears in Nunavut.

Grizzly bear (GB) management zones (Figure 2.2) were designed to respect known grizzly bear population structure of females (McLoughlin et al. 2002) and topographic features that can be recognized by harvesters. The decision to divide the grizzly bear population for TAH purposes between GB/01 (Kugluktuk) and GB/02 (Bathurst Inlet) was based largely on data presented in McLoughlin et al. (2002), in consideration that what is important for grizzly bear population dynamics and what constitutes a 'discrete demographic unit' are largely the birth and death rates of females. McLoughlin et al. (2002) demonstrated a clear distinction between Kugluktuk and Bathurst Inlet clusters of female grizzly bears (Figure 4 of McLoughlin et al. 2002). Between these two clusters McLoughlin et al. observed zero immigration or emigration of females (Figure 7 of McLoughlin et al. 2002). Further, there was no immigration or emigration of females from the Bathurst Inlet cluster of bears to or from the 'Lac de Gras' cluster of bears located in the Northwest Territories. The Kugluktuk cluster of female bears showed immigration and emigration to and from the Lac de Gras cluster, and the Sahtu region of the Northwest Territories (Figure 7 of McLoughlin et al. 2002). It is valid to consider demographic units based on dynamics of females (which is consistent of our treatment of polar bears), and hence it is legitimate to maintain a division between Kugluktuk bears and Bathurst Inlet bears for management purposes (P.D. McLoughlin, University of Saskatchewan, in personal communication to DoE, March 16, 2005).

GB/01 follows the Nunavut-Northwest Territories border from 65.509° -112.522° to 69.606° -118.366°, and then to 69.086° -115.924°. From this point the boundary follows the coast to 68.506° -113.962°, and then to points 68.101° -113.420°, 68.078° -111.202°, and to the shore at 67.750° -111.438°. The unit boundary then follows a line approximating the division between the Tree River watershed and that of the James and Hood River systems, to the northeast shore of Napaktulik Lake, back to the unit boundary starting point at 65.509° -112.522°.

GB/02 is adjacent to GB/01. The unit's boundary shares the boundary of GB/01 from 68.078° -111.202° to 65.509° -112.522°, from where it follows the Nunavut border to 64.594° -105.793° at the boundary of the Thelon Game Sanctuary. The boundary then follows the border of the Thelon Game Sanctuary to 64.728° -105.972°, then to point 66.003° -105.395°, and then follows the Ellice River to its mouth at 68.052° -104.001°.

From there the unit boundary follows points 68.627° -103.700°, 69.031° -106.174°, 68.786° -108.272°, and 68.452° -109.721°, before returning to 68.078° -111.202°.

Eastern boundaries of the range of grizzly bears in Nunavut (GB/03) were determined from past sightings of bears in the region (McLoughlin 2001, Ross 2002) and areas thought to have potential for colonization in the near future. GB/03 was designated as an unique unit because the region (Figure 2.2) is thought to be an area of lower productivity compared to GB/02, and largely populated with migrant bears, as indicated by the highly male-biased harvesting that takes place in the area (approximately 90% male). Dispersing grizzly bears are usually male; on the barrens male bears are known to traverse great distances that are often an order of magnitude greater than that of females (Gau et al. 2003). GB/03 encompasses all mainland areas east of GB/02 and GB/04, Southampton Island, and Coats Island.

Unit GB/04 was designated based on local observations of grizzly bears on Victoria Island. However, we do not know from where these bears come from and to which population they could be assigned, or whether they constitute a separate population. It is likely, however, that grizzly bears on Victoria Island constitute a population of grizzly bears separate from mainland Kitikmeot due to the geographic barrier presented by the Coronation Gulf.

Baffin Island and the Arctic Islands (other than Victoria Island) do not presently support grizzly bears.

2.2.2 Total Allowable Harvest

Levels of TAH for grizzly bear populations in Nunavut were developed in consideration of IQ and scientific evidence of recent population growth, but also known vulnerabilities of grizzly bear populations to be affected by over-harvesting (Ross 2002), results of population viability models specific to grizzly bear populations inhabiting mainland Kitikmeot (McLoughlin et al. 2003*b*), and increasing levels of human development in western Kitikmeot.

We recommend that the TAH for GB/01 = 8 and TAH for GB/02 = 6 (Table 2.2). Our rationale for these harvest rates is based on: 1) McLoughlin et al. (2003*b*) considering 14 bears/year but less than 20 bears/year as likely sustainable for the Slave Geological Province (and in consideration of local traditional knowledge that the population appears to be increasing); 2) the fact that there is no current sport hunt in the Northwest Territories for bears in the area; 3) the fact that problem kills in Nunavut, under TAH management, will now come off the quota, as opposed to the previous shared quota of 10 between Kugluktuk and Bathurst Inlet with no quota reductions from problem kills. Our recommendations are supported by results of McLoughlin (2003*c*), whom ran harvest simulations for barren-ground grizzly bears with a population size of 100: if we considered larger population sizes of barren-ground bears (i.e., 800 bears in the Slave Geological Province [McLoughlin et al. 2003*b*]), 2.0-2.5% annual kill would be sustainable (compared to the 1.0-2.0% for a population size of 100 bears, as modelled in

McLoughlin et al. [2003*c*]). If we assume 800 bears in the Slave Geological Province (McLoughlin et al. 2003*b*), then a total combined harvest from the Northwest Territories and Nunavut (including total problem kills) of 18 bears is <2.5% of the total population. Further, in McLoughlin et al. (2003*b*), much uncertainty in population viability would have been reduced if the standard error (SE) of the population size estimate was lower than SE = 200, which was used to base most results. If we modelled 800 bears and no SE, clearly 14-20 bears would be sustainable (P.D. McLoughlin, personal communication to DoE, March 31, 2005).

We recommend a TAH in GB/03 of 6 bears (Table 2.2). We recognize GB/03 as an area of lower productivity compared to GB/01 and GB/02. A TAH of 6 bears would only be sustainable if we assume that the harvest remains male-biased, as observed from past harvest records, and there are at least 300 bears in the entire region (i.e., 2.0% annual kill; see McLoughlin 2003*c*). For a TAH in GB/03 of 10 to be sustainable, we would need to assume that there are 500 bears in GB/03 (i.e., 2% annual kill; see McLoughlin et al. 2003*c*), which we feel to be an unlikely population size. Management goals for grizzly bears inhabiting GB/03 require further clarification; however, we believe a conservative TAH is appropriate at this time considering the COSEWIC designation of grizzly bears as a species of special concern (Ross 2002).

A TAH of zero was recommended for GB/04, the population inhabiting Victoria Island, (Table 2.2). Recent observations of grizzly bears on Victoria Island suggest a colonizing population, for which there is not enough data to recommend a harvest. To be consistent, a TAH of zero was recommended for all areas (GB/05) not identified in the units above.

2.2.3 Sex-Selectivity of Harvest

In accordance with the *Guiding Principles* presented in Section 1.2, we recommend that female grizzly bears be conserved in order to mitigate the impact of harvesting on populations, and encourage the number of bears in each population to attain and retain target population numbers. Our best research suggests this would entail harvesting the TAH at two males per female taken (McLoughlin et al. 2005; Taylor et al. 2005). We recognize that females with accompanying offspring should be protected from harvest, since it is unlikely offspring <2 years of age will survive in the absence of their mother.

To be clear, we recommend that: 1) no person shall harvest a female grizzly bear that is accompanied by a bear that is or appears to be under two years of age, and 2) no person shall harvest a grizzly bear that is in a den or is constructing a den, since it may be difficult to sex bears that are in or are constructing dens. We also recommend that harvesting a grizzly bear under two years of age be allowed only if it is not accompanying a female.

2.2.4 Seasons of Harvest

We do not feel it necessary, for conservation purposes, to regulate harvesting of grizzly bear populations through a restriction on season of harvest. However, as noted above,

we recommend that bears constructing dens or observed at den sites should not be disturbed, as the family status of such bears may not be obvious.

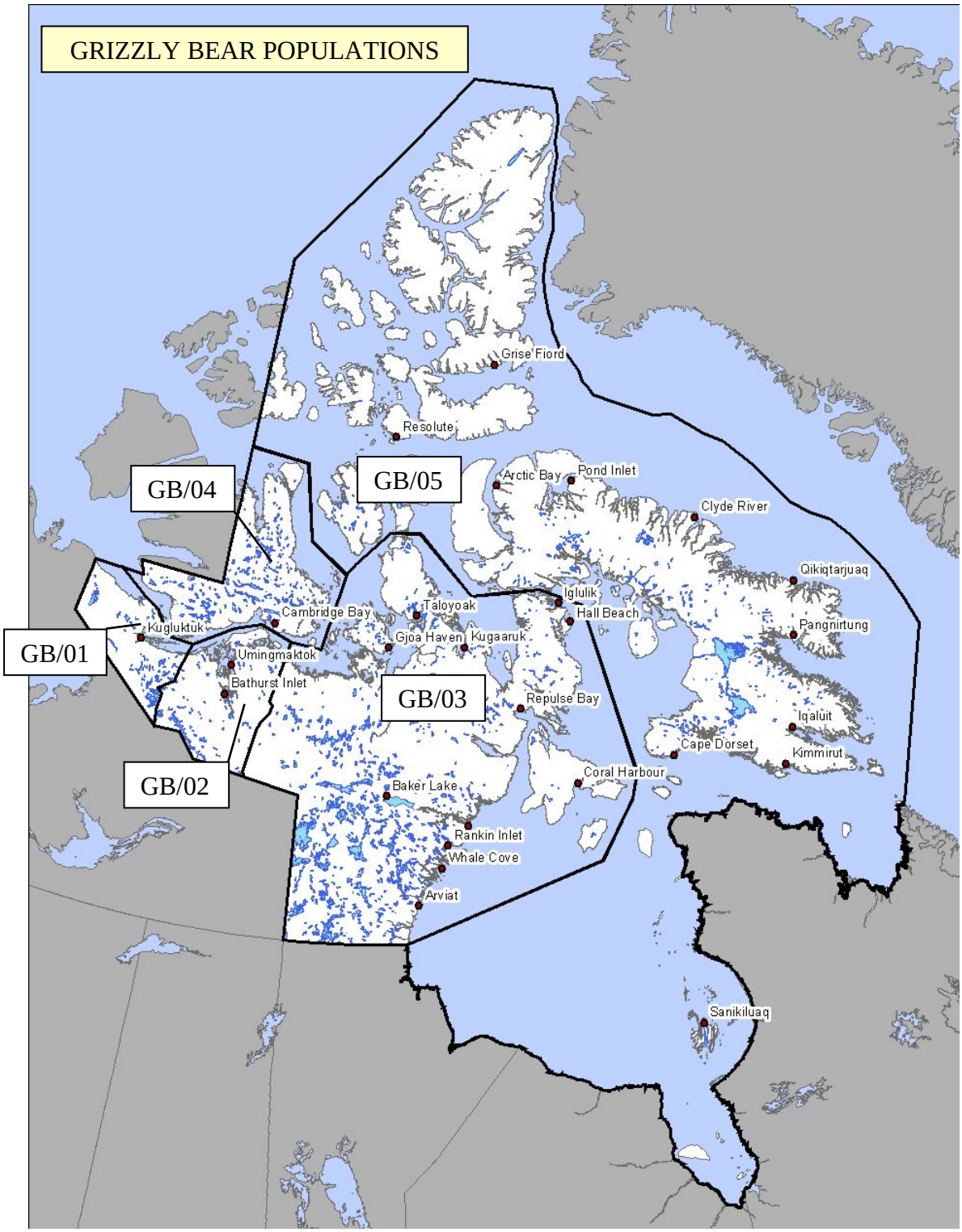

Figure 2.2. Proposed grizzly bear population units in Nunavut.

Table 2.2. Recommended levels of TAH for grizzly bear populations in Nunavut.

POPULATION	PROPOSED TAH
GRIZZLY BEAR GB/01	
TOTAL	**8**
GRIZZLY BEAR GB/02	
TOTAL	**6**
GRIZZLY BEAR GB/03	
TOTAL	**6**
GRIZZLY BEAR GB/04	
TOTAL	**0**
GRIZZLY BEAR GB/05	
TOTAL	**0**
NUNAVUT TOTAL	**20**

2.2.5 Additional Concerns or Recommendations

We recommend mandatory reporting of harvested bears to the Wildlife Research Section of the DoE to ensure proper implementation of the quota system. Reporting of harvest should include hair and tissue samples sufficient for extraction of genetic material, which may be used to develop a better understanding of genetic relatedness and diversity of grizzly bear populations in Nunavut. Samples to identify sex, in addition to genetic material, should be required to ensure sex-selectivity of harvest is maintained. To be clear, specific samples we recommend mandatory for collection upon the harvest of a grizzly bear are: the bear's skull or lower jaw, with teeth, evidence of the bear's sex (e.g., baculum), and a sample of the bear's hair and tissue. Harvesters should return any found radio telemetry transmitter or satellite collar to a conservation officer.

2.3 Black Bears (*Ursus americanus*)

2.3.1 Populations

We currently recognize that the population of black bears in Nunavut occurs only near tree line in Kitikmeot and Kivalliq, at the periphery of the species' normal range.

2.3.2 Total Allowable Harvest

We recommend that No TAH be implemented for the management of black bears in Nunavut. Black bears are not in any danger of local extirpation due to the large source populations present in the Northwest Territories, Saskatchewan, and Manitoba. In addition, Inuit have expressed only minor interest in harvesting black bears, as indicated by results presented in the NWHS.

2.3.3 Sex-Selectivity of Harvest

Given the low priority for harvesting black bears by Inuit expressed in the NWHS, and that the black bear population is not in need of management for conservation purposes, we recommend that no restrictions on age, sex, or family status be implemented for the harvest of black bears.

2.3.4 Seasons of Harvest

We do not feel it necessary, for conservation purposes, to regulate harvesting of black bear populations through a restriction on season of harvest.

2.4 Wolves (*Canis lupus*)

2.4.1 Populations

We currently recognize that two groups of wolves should be distinguished for harvesting reasons: the tundra/timber wolf (*Canis lupus occidentalis*) and the high arctic wolf (*Canis lupus arctos*).

2.4.2 Total Allowable Harvest

We recommend that No TAH be implemented for the management of tundra/timber wolves in Nunavut. Our best evidence suggests tundra/timber wolves are not in danger of local extirpation due to relatively large populations, high intrinsic (natural) rates of population growth, complete lack of barriers to movements, and large source populations present in the Northwest Territories, Saskatchewan, and Manitoba. Wolf control measures in other jurisdictions in northern Canada have not been successful at reducing wolf numbers over the long term. Anecdotal information suggests high arctic wolves may require some degree of protection, although COSEWIC currently classifies the high arctic wolf as 'data insufficient.' At this time we also cannot suggest a specific TAH level for high arctic wolves, other than No TAH.

2.4.3 Sex-Selectivity of Harvest

No sex-selectivity of harvest is recommended for the management of wolf populations in Nunavut for the same reasons as listed above.

2.4.4 Seasons of Harvest

We recommend an open season for harvesting all populations of wolves, with the caveat that no one shall harvest, harass, or otherwise disturb wolves and their pups if denning and/or building a den.

2.4.5 Additional Concerns or Recommendations

Given the current potential for a conservation issue regarding the high arctic wolf population, the Working Group recommends mandatory reporting of harvest of all high arctic wolves to the Wildlife Research Section of the DoE.

For tundra/timber wolves, we recommend a program of hunter conservation education to encourage the voluntary reporting of the harvest of tundra/timber wolves in response to concerns over relatively large harvests observed recently in Kivalliq. Reporting of harvest should include tissue samples sufficient for extraction of genetic material, which may be used to develop a better understanding of genetic relatedness and diversity of wolf populations in Nunavut.

2.5 Coyotes (*Canis latrans*)

2.5.1 Populations

We currently recognize that the population of coyotes in Nunavut occurs only near tree line in Kitikmeot and Kivalliq, at the periphery of the species' normal range.

2.5.2 Total Allowable Harvest

We recommend that No TAH be implemented for the management of coyotes in Nunavut. Coyotes are believed to be a colonizing species exotic to Nunavut, and not currently of conservation concern. In addition, Inuit have expressed only minor interest in harvesting coyotes, as indicated by results presented in the NWHS.

2.5.3 Sex-Selectivity of Harvest

Given the low priority for harvesting coyotes by Inuit expressed in the NWHS, and that the coyote population is not in need of management for conservation purposes, we do not feel it necessary to regulate coyote harvest through sex-selectivity of the harvest.

2.5.4 Seasons of Harvest

We do not feel it necessary, for conservation purposes, to regulate harvesting of coyotes through a restriction on season of harvest.

2.6 Wolverine (*Gulo gulo*)

2.6.1 Populations

We have little information on the wolverine population structure in Nunavut. From the information available we recommend dividing the territory into three areas (Figure 2.6.1) representative of the relative densities of wolverine populations as described by both IQ and scientific knowledge (COSEWIC 2003; Cardinal 2004). From the information available we recommend dividing the territory into three areas that include:

- A core area (W/01) where wolverines are abundant and constitute one or several breeding population(s).

- A colonization area (W/02) where wolverines are regularly present although it is unknown whether wolverines in the area constitute an actual breeding population or are only dispersing animals (with occasional breeding).

- A marginal area (W/03) where wolverines may be encountered occasionally but are not present in densities sufficient to sustain a viable population. This unit includes all remaining areas not included in the boundaries of W/01 and W/02.

Owing to difficulties managing species between regions, we recommend the regional boundary of the Kitikmeot and Kivalliq be used to divide the core (W/01-KT and W/01-KV) and colonization areas (W/02-KT and W/02-KT) into management zones (Figure 2.6). The boundaries separating the core, colonization, and marginal areas are approximate and uncertain as we lack data to establish these precisely. Consultation with communities and increased participation of eastern Kitikmeot and Kivalliq communities in the current wolverine carcass collection program, as well as recommended mandatory reporting of future harvesting, would help refine these boundaries. Analysis of the genetic structure of the wolverine population in the West Kitikmeot is in progress, with plans to extend this work to other areas of Nunavut and NWT.

2.6.2 Total Allowable Harvest

We recommend setting a TAH of 200 wolverines for the population inhabiting W/01, with 160 allocated to W/01-KT and 40 allocated to W/01-KV. Establishing the TAH at 200 wolverine for W/01 reflects the Working Group's observation of apparent shifts in the sex distribution of harvests (toward females) in years where the total number of animals taken in western Kitikmeot is high (Elliott and Dumond, file report in prep), and the known potential for over-harvesting to reduce wolverine populations as experienced by other jurisdictions in Canada, such as northern British Columbia (COSEWIC 2003). For example, from data on the harvest of wolverines near Kugluktuk (1986–2005), the DoE's Wildlife Research Section analyzed variations in female sex ratio as a function of the total number of animals harvested in each hunting season (Figure 2.6.2). The observed positive relationship between the proportion of females included in the harvest

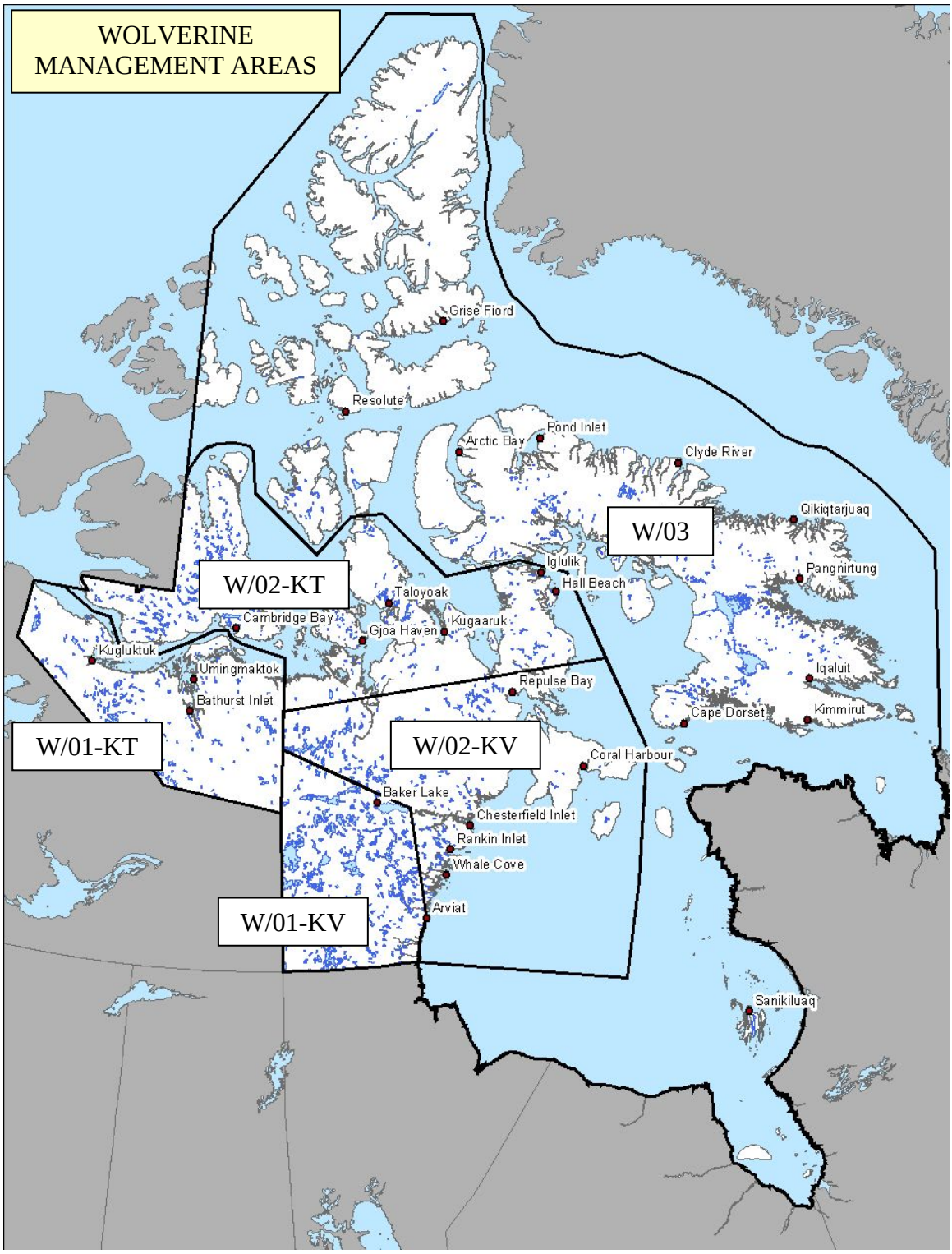

Figure 2.6.1. Wolverine management areas in Nunavut.

when the total harvest increases suggests that higher total harvests may be detrimental to the resident female population in W01/KT and W01/KV.

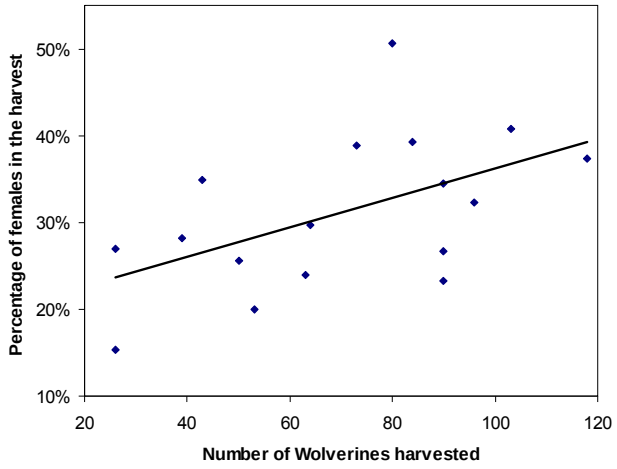

Figure 2.6.2. Observed increases in the proportion of females in the yearly harvest when the total number of wolverines harvested increases. This positive trend was significant ($F = 5.048$, $df = 1$, $P = 0.038$) when data on percentage of females in the harvest was transformed using arcsin (to obtain a normal distribution).

From the wolverine harvest monitoring near Kugluktuk (1994–2003), we also analyzed variations in female average age (at harvest) as a function of the total number of animals harvested in each hunting season (Figure 2.6.3). Older females usually have established territories and when the harvest increases, our results suggest that more resident females are taken. This is of conservation concern as the removal of resident females in W01/KT and W01/KV could affect the sustainability of the harvest.

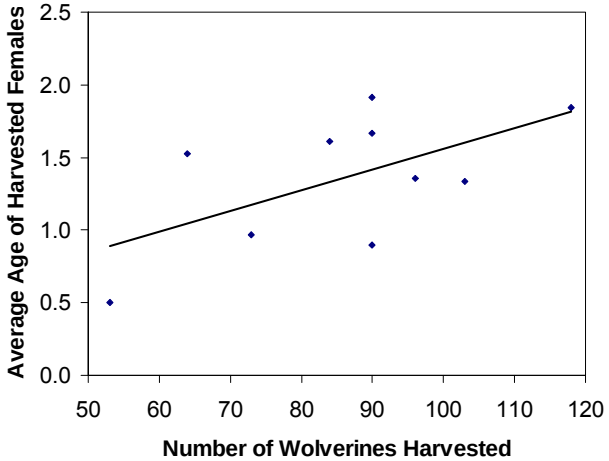

Figure 2.6.3. Observed increases in the mean age of female wolverines in the annual harvest when the total number of animals harvested increases. This trend was significant ($F = 4.437$, $df = 1$, $P = 0.068$).

For W/02 we recommend that the annual quota not exceed 65 wolverine: for management zone W/02-KT the recommended annual quota is 50 wolverine, with 15 allocated to W/02-KV. We believe No TAH is required for W/03 (marginal area) until such time communities in the area express an interest to manage wolverines for establishment in the area. The TAH for eastern Kitikmeot (W/02-KT) is based on the estimated current harvest level and the fact that local knowledge indicates a possible increase in wolverine abundance. The TAH for the Kivalliq is based on the maximum harvest level as described in the NWMB harvest study. If new information on actual harvest levels is available, the TAH recommendation should be reviewed to incorporate this new information.

2.6.3 Sex-Selectivity of Harvest

We recommend no sex-selectivity of harvest for the management of wolverine populations in Nunavut, although we also recognize that population impacts increase dramatically when the fraction of mature females in the harvest increases.

2.6.4 Seasons of Harvest

In Nunavut, wolverine are believed to give birth in natal dens in March and April. Young are weaned at about seven to eight weeks, and begin to accompany the mother on foraging trips by 10 to 12 weeks. Young do not reach adult size until 6 to 7 months of age (i.e., late fall to early winter), at which time young disperse from females. We recognize the need to protect females with litters from harvest after family groups emerge. Protection of family groups at this time is likely to increase survival of young during their first year, which may be important for maintaining wolverine harvest opportunities: our records indicate the majority of harvest is for juveniles (0.5 to 1 year old) and yearlings (1 to 2 years old). Increasing the length of the harvest season from past practices may reduce juvenile survival in an unknown manner, which might affect the current sustainability of the harvest. Current and past harvests in W/01 and W/02 appear to have been sustainable in connection with restrictions on harvest season, and we continue to recommend closing wolverine harvest season after family groups emerge to protect females and young from being harvested. Specifically, we recommend that the harvest of wolverine by trapping be restricted to the period 01 November–15 April, and the shooting of wolverine be restricted to the period 01 November–30 April.

Our recommended dates of harvest take into consideration, in part, non-quota limitations to promote the best-practice of harvesting wolverine. Harvesting of wolverine in W/03 is rare, and not likely viable for sustainable harvesting; we do not recommend seasons for harvesting wolverines in W/03. We recognize that it may be necessary to adjust the harvest season in units W/01 and W/02 if, through community consultation, more appropriate season dates for conservation purposes are identified.

2.6.5 Additional Concerns or Recommendations

Mandatory reporting of harvest to the Wildlife Research Section of the DoE is recommended to ensure proper implementation of the quota system and to monitor the sex-ratio of the harvest. Reporting of harvest should include hair and tissue samples sufficient for extraction of genetic material, which may be used to develop a better understanding of genetic relatedness and diversity of wolverine populations in Nunavut. We recommend that it be mandatory for hunters to provide samples from harvested animals that identify sex to assist in the monitoring of sex-bias in the harvest by the Wildlife Research Section. To be clear, specific samples we recommend mandatory for collection upon the harvest of a wolverine are: the skull or lower jaw, with teeth, evidence of the bear's sex (e.g., baculum), and a sample of the animal's hair and tissue. Harvesters should return any found radio telemetry transmitter or satellite collar to a conservation officer.

3.0 TAH of Big Game Ungulates

3.1 Musk ox (*Ovibos moschatus*)

3.1.1 Populations

The recommended TAH for Nunavut's 19 musk ox populations (Fig 3.1, Table 3.1), are based on a demographic definition of "population". We define musk ox populations as spatial units within which birth and death rates are believed to contribute more to population dynamics than rates of immigration and emigration. In most cases, these demographic units are defined based on the female component of the population because musk oxen are a polygynous species. For a polygynous species as long as there are enough males to mate available females, the growth rate of females will determine the population growth rate.

Geographic boundaries of Nunavut musk ox populations (Figure 3.1) have been previously identified from assessment of IQ, survey results, movements of radio-collared animals, and known physiographic barriers to movements (e.g., glaciers, sea, river and lake ice conditions, topography and forage availability).

All mainland population boundaries are based on survey results and/or hunter reports and observations showing discontinuities in musk ox distribution (e.g., low to nil densities, and/or geographic barriers). Also considered in population boundary designations are mean home range values measured in straight line distances for mainland musk ox populations (Gunn and Fournier, 2000).

For Island populations of musk ox, range disjunction at the scale of all except the largest islands reflects what we know about musk ox movements and probability of dispersal. Limited information from marked musk oxen does not reveal inter-island movements except during environmentally forced dispersal (i.e. severe winters). In addition there are few observations of musk oxen crossing sea ice (Taylor 2005) which suggests musk ox ranges are disjunct between islands.

In cases where one or more musk ox populations are adjacent to each other (i.e. MX/05, MX/06, MX/07), there is typically some cross boundary movements by individuals with home ranges near the boundaries. However, in the High Arctic, the norm is range disjunction imposed by terrain, glaciers and mountains. It is unusual for musk oxen to cross these features. Indeed, there are only rare observations of bull musk oxen crossing glaciers (Taylor 2005). Instead, musk oxen demonstrate fidelity to relatively small discrete patches of suitable habitat; lowlands and slopes with sedges, grasses and willows typically characterize their range on arctic islands (Gunn and Adamczewski 2003).

A dominating influence on biogeography is climate and arctic climate is strongly regionalized (Maxwell 1981). Western Devon (MX/07) is in a separate region (I, Northwestern Region) from north and south Devon (MX/05 and MX/06). As well,

the two management areas on Ellesmere (MX/04 and MX/03) largely correspond to the two climate regions IV and V. In the absence of information to the contrary, it is prudent and reasonable to accept the range disjunction and biogeographic areas as affecting musk ox population structuring. Additional support for the use of climate regions comes from Inuit hunters. Their knowledge indicates that musk ox numbers fluctuate less on Ellesmere and Devon islands than on Prince of Wales, Somerset and Bathurst Islands (Taylor 2005). Ellesmere and Devon Islands are largely in climate regions that are colder and drier and less subject to incursions of maritime air masses (Maxwell 1981) which can be associated with rain in winter and heavier snowfall. Climate seems likely to affect demographic productivity, which is another strong reason to identify TAH by climatic region.

3.1.2 Musk oxen seasonal movements

There is little scientific information on musk oxen seasonal movements. The main studies that followed musk oxen movements over several years are Tener (1965), Reynolds (1998), and Gunn and Fournier (2000). These movements seem quite variable from one year to the other, though a pattern of non-migratory behavior is apparent due to the relatively small home ranges exhibited (Gunn and Fournier, 2000). The main movements are between the early spring (calving) range from late April to the end of May (rarely the first week of June) and their late summer early fall range a time that includes the rut. This movement is believed to be directly related to forage accessibility through snow in early spring and forage quality and quantity later in the summer and early fall. Complicating these findings are density dependant factors likely responsible for the greater movements less commonly observed. Seasonal movements are believed to be influenced by animal density, forage availability/accessibility, and predation. Therefore, these movement patterns can vary substantially from one area to another if snow conditions, vegetation, musk ox densities, and predator species and densities differ.

The maximum straight distance observed for musk ox cows was 114 km in Alaska and 140 km in the West Kitikmeot. Mean straight line values however suggest much smaller home ranges. In Alaska (*In* Gunn and Fournier 2000), seasonal ranges were on average 20-30km apart. In the West Kitikmeot, Gunn and Fournier (2000) reported mean straight line values of 75 to 85 km between winter and summer collar locations. In almost all cases seasonal ranges overlapped.

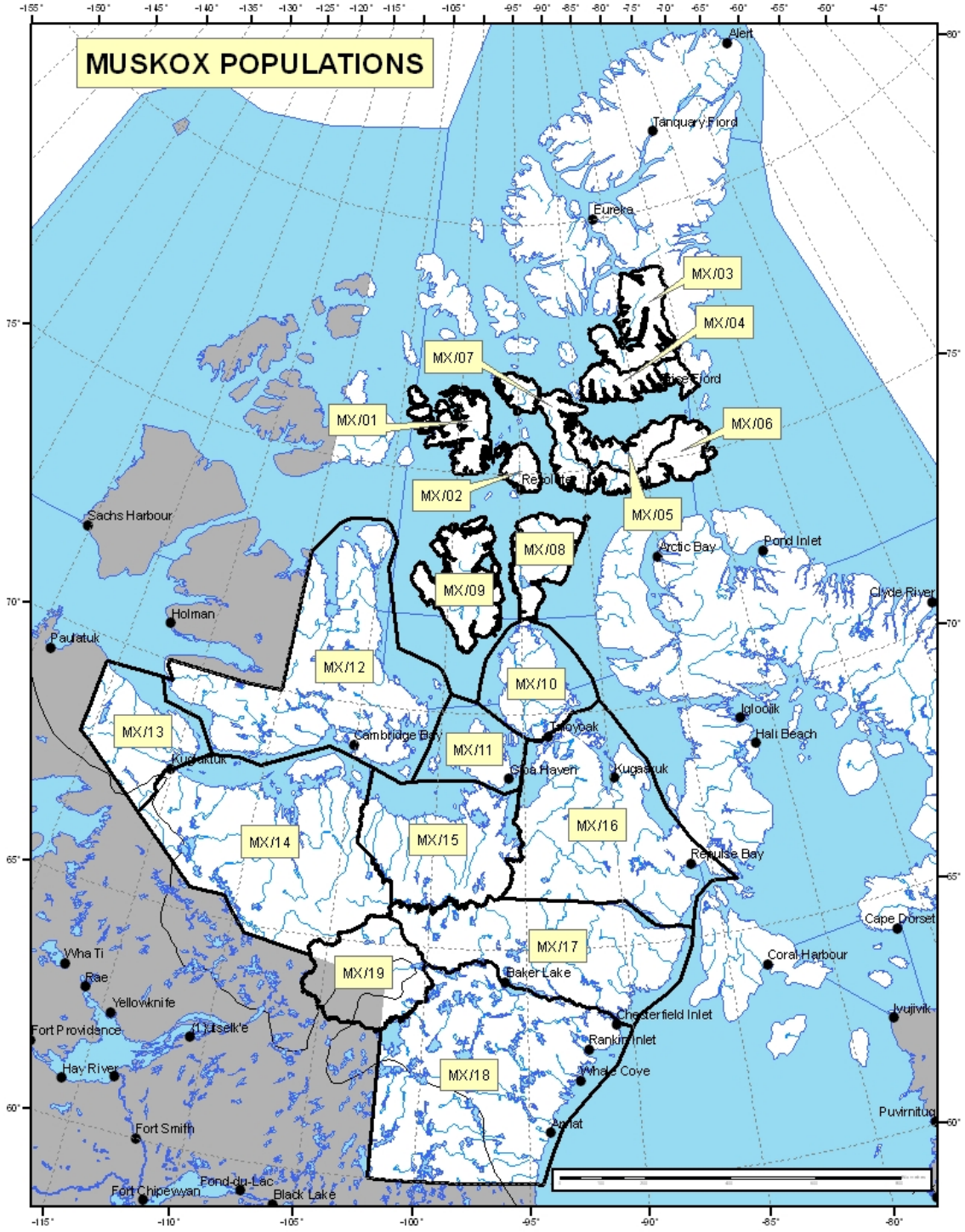

Figure 3.1. Musk ox populations in Nunavut.

Nevertheless, current studies suggest that seasonal movements are generally limited to less than 80 km on average and summer is usually the season with the longest movements and the most dispersion of musk ox breeding groups (Gunn and Fournier 2000). Moreover, seasonal ranges generally overlap. Therefore, the distribution of musk oxen, observed during surveys conducted during summer, is likely to represent the major part of the annual reproductive range with, on average, a 30 to 75 km buffer defining these areas. This means that musk ox clusters separated with a low (or nil) musk ox density area of a width ≥150km are unlikely to have regular demographic exchange, and thus can be considered as discrete populations in the current management context.

Some reports are contradictory regarding geographic barriers to musk ox populations but it seems that although they can, in general, musk oxen rarely swim (Tener 1965, Gunn and Adamczewski, 2003). Musk ox herds were found stranded on lake islands during the summer and did not swim to reach the mainland despite the lack of forage (*in* Gunn and Adamczewski 2003). Although, musk oxen have been observed crossing rivers on occasion (Mallory 1995), it is likely rare enough to suggest that large rivers could be considered a demographic barrier at the time scale we are managing musk oxen. During the winter when frozen rivers would allow movements across, musk oxen movements are limited to a relatively small area (Tener 1965, Gunn and Adamczewski, 2003). During breakup (Calving) and into the summer months (rut), when musk oxen movements are more extensive, large rivers and lakes/open ocean limit movements across these water bodies effectively reducing any demographic exchange .

3.1.3 Boundary Justifications

MX/01

The designation of Bathurst and its satellite islands is based on IQ (Taylor 2005), survey results and movements of radio-collared musk oxen. Musk ox seasonal movements remain within Bathurst Island (for example; preliminary location data for 4 musk oxen fitted with satellite-collars in 2003 indicates that movements are limited to Bathurst Island). Only during severe winters have Inuit hunters and biologists reported occasional desperation movements on to the sea ice (Taylor 2005, Gray 1987, Miller 1998).

MX/02

The designation of Cornwallis as a musk ox population is new and is based on IQ (Taylor 2005), survey results, and movements of radio-collared animals. The unit is an island large enough to encompass seasonal home ranges although the amount of suitable habitat is low (Tener 1965). The 2 musk oxen radio-collared on Cornwallis Island demonstrate no inter-island migration during their yearly cycle. Some movements from Bathurst Island have occurred during exceptionally

severe winters (1973 and 1994) when Inuit hunters reported more musk oxen on Cornwallis (Taylor 2005).

MX/03 and MX/04

Ellesmere is one of the largest High Arctic Islands with high mountains, glaciers and fiords creating likely barriers to movements. The original populations are being recommended for change at the request of the Grise Fiord HTO.

The climate is strongly regionalized (Maxwell 1981) and the two musk ox areas on Ellesmere (MX/03 and MX/04) largely correspond to the two climate regions IV and V. The regional climate is considered to influence biogeographic zoning which likely affects musk ox demography through local climate and its effects on vegetation. The regular hunting area is south Ellesmere although hunters occasionally charter planes for hunting beyond this area (Taylor 2005). There is no information that suggests that musk oxen migrate from north to south.

MX/05, MX/06 and MX/07

North Devon (MX/05) is within a separate climate region from the rest of the island (Maxwell 1981) and is also separated by rugged terrain from the other two musk ox populations on the Island. The other two populations occupy a string of small lowlands along the north and south coast, respectively. The two areas are also separated by rugged terrain and glaciers. These three areas are a rationalization of the previous two populations which owed more to historical patterns. The previous population MX/05 included the central and eastern portion of Devon Island and is now divided into MX/05 (north Devon) and MX/06 (south Devon). MX/07 is a newly identified population for western Devon. Six musk oxen were radio-collared in 2003 and preliminary analysis of location data indicates fidelity to the island and no movement from western Devon island to the east.

MX/08

The Somerset Island Population of Musk ox, MX/08 is considered a separate population based on the sea and ice conditions during spring, summer and fall and sea ice during winter and their effects as a barrier to adjacent Island and mainland populations. The available literature supports the ability of these barriers to effectively restricting reproductive exchange with adjacent populations.

MX/09

The Prince of Whales Island Population of Musk ox, MX/09, is considered a separate population based on the sea and ice conditions during spring, summer and fall and sea ice during winter and their effects as a barrier to adjacent Island and mainland populations. The available literature supports the ability of these barriers to effectively restricting reproductive exchange with adjacent populations.

MX/10

Although musk oxen have likely re-colonized the Boothia Peninsula from Somerset Island, the Boothia Peninsula Population of Musk ox, MX/10, should be considered as a separate population considering the changing ice conditions and human activities on the Northwest Passage that is likely increasing the geographic barrier between Somerset and Boothia.

MX/11

The King William Island population, MX 11, is considered a separate population based on the sea and sea ice barrier to the mainland effectively restricting reproductive exchange. The Gjoa Haven HTO is also in agreement with the separation of the islands musk ox from mainland animals.

MX/12

Arctic Island musk oxen differ genetically from mainland musk oxen (De Groot 2001) therefore we recommend to separate Victoria Island musk oxen from mainland musk oxen. We do not know if the musk oxen on Victoria Island constitute one or several populations. However, considering the high musk oxen densities on the island, there is at this point no conservation issue and therefore we recommend treating the whole island as one population.

MX/13

The Western Kitikmeot Population of Musk ox, MX/13, population dynamic is considerably different then that of MX14 which justifies the treatment of these two populations as separate populations. The stagnating low densities of musk oxen in MX/13 compared to the high densities on the east side of the Coppermine (MX/14) seem to indicate that there is little movement from MX14 to MX13. Moreover, a reason for the decline of the musk ox population in MX12 is likely the presence of a parasite (*Umingmakstrongylus pallikuukensis*). The absence of reports of this parasite by local hunters on the east side of the Coppermine (MX14) further indicates that movements from MX13 to MX14 are extremely limited or nil.

MX/14

The Central Mainland Population, MX/14, has its western boundary following the Coppermine River that according to IQ represents a strong geographic barrier year round due to the Rivers uncertain ice conditions and cliff like banks along is length. The MX/14 population is separated from the MX/15 population along the Perry River connecting through to McAlpine Lake through to its confluence with the Thelon Sanctuary. According to Dumond (in prep) in addition to the geographic barrier poised by this watershed, densities along the north and northwestern portions of this boundary are extremely low to nil suggesting a break in reproductive exchange thus justifying a separate population.

MX/15

The Queen Maud Gulf Population of musk ox, MX/15 is separated from the MX/14 population along the Perry River connecting through to McAlpine Lake through to its confluence with the Thelon Sanctuary. According to Dumond (in prep) in addition to the geographic barrier poised by this watershed densities along the north and northwestern portions of this boundary are extremely low to nil suggesting a break in reproductive exchange thus justifying a separate population. The MX/15 western boundary with the MX/16 population is drawn based on moderate densities to the west of the boundary and very low to nil densities to the east suggesting restricted movements of animals between these populations.

MX/16

The Eastern Mainland Population, MX/16, shares its southern boundary with MX/17 running west through Wager where survey observations recorded extremely low to nil densities of musk ox along its length up to its confluence with the Back River (Campbell and Setterington, 2003). MX/16s northern boundary is drawn just north of Taloyoak separating zero densities to the south from low to moderate densities north of the boundary (Campbell and Setterington 2003, Dumond in prep). The MX/16 population has not re-colonized historic range last occupied in the early 1920's. It is currently considered an extirpated population with a management goal for the re-establishment of the population to restore the integrity of the ecosystem in the eastern mainland. Within this population extremely low densities of musk oxen exist mainly along its south western and northern most boundaries (Campbell and Setterington, 2003, Dumond 2006).

MX/17

The Eastern Mainland Population of musk ox, MX/17, is thought to have been largely from the west and North West. Some movement out of the Thelon Game Sanctuary was also indicated in historic reports though the extent of this movement is unclear and occurred over a long period of time (Barr, 1991). The north eastern boundary of MX/17 running west through Wager Bay was drawn based on extremely low to nil densities of musk ox recorded along its length up to its confluence with the Back River (Campbell and Setterington, 2003). This boundary separates it from the MX/16 population. Directly north of the MX/17 boundary and its confluence with the Back River, musk ox densities increase in a northward progression as you proceed closer to Committee Bay. Northeast of this confluence musk ox densities drop off entirely (Campbell and Setterington, 2003). To the northwest of MX/17 a boundary is drawn along the course of the Back River to its confluence with the boundary of the Thelon Sanctuary separating it from the MX/15 geographically given the musk oxen's reluctance to cross major river systems during the reproductive seasons. Research findings and the available literature support the identification of this population as being reproductively isolated from adjacent populations. These findings support the suggestion that this population is reproductively isolated.

MX/18

The Southern Kivalliq Population of Musk ox, MX/18 is bounded in the south and west by the Nunavut border with Manitoba and the Nunavut/NWT border up until it contacts the Dubawnt River/Thelon Game Sanctuary boundary. The northern boundary separating MX/18 from MX/17 separates two distinct populations based on a zone of no to extremely low densities of musk ox present along this entire boundary effectively restricting reproductive exchange (Campbell and Setterington, 2003).

MX/19

Musk ox management zone 15 encompasses the Thelon Game Sanctuary. The population is bordered to the southeast and east by the Dubawnt River forming a geographic barrier to musk ox movements during the calving and rutting periods on most years. The northern boundary of this population showed zero densities between it and the MX/14 population. The available information suggests that reproductive flow outside of the sanctuary boundary is extremely low thus supporting its designation as a population.

3.1.4 Total Allowable Harvest

The total allowable harvest is essentially the maximum level of a particular harvest regime that can be sustained. How the harvest is taken can affect its impact on the population. For that reason, the TAH recommendations made herein depend on (assume) simultaneous acceptance of the suite of non-quota limitations (NQL's) that comprise the musk ox harvest management regulations. Any modification of the NQLs recommended herein would require a re-assessment (i.e., reduction) of the TAH levels to ensure the sustainability of the harvest for all populations.

Years of survey data and the monitoring of population trends of most musk ox populations in Nunavut has provided valuable information regarding the setting of harvesting rates now termed TAH. This long term data has shown that musk ox harvest rates of 3% fostered slow growth, 5% stability and 7% slow decline when factored over years of variable environmental conditions. These rates of harvest reflect empirical data collected by Tener (1965) over a number of years. Tener found survival rates for calves to vary between years, however, values of between 40% and 80% survival were observed suggesting that between 4% and 8% of the population in any one year was made up of yearlings. Factoring in adult survival through predation, disease and natural causes, the more common 24 month breeding cycle (36 months during times of environmental stress) of breeding cows, the values used to set TAHs above represent a medium risk to the long term sustainability of the harvest in most populations especially when applying the 5% harvesting levels to mean population estimates. Whether these values were drawn from the lower confidence interval of an estimate (generally 95% CI) or the mean estimate, has been effectively made by wildlife managers

through the assessment of range quality as well as the monitoring of localized trends and assessment of adult survival between surveys. This being said managers must also consider that the persistence of populations may depend more on their rate of change than their absolute size (Caughley and Gunn 1996) and that harvesting rates may be specifically related to the trend between the two most recent population estimates and management objectives when those data exist.

Most contemporary musk ox populations in Nunavut are considered growing and/or stable compared to pre-1920 population levels, although repatriation of their former (pre-commercial exploitation) densities and distributions have yet to be achieved for all but a very few populations. The instance of dramatically growing populations are likely the result of the calculated TAH not being fully harvested and/or too long an interval between population estimates where interim growth estimates were not available to guide the estimate of TAH. Recommended levels of TAH and justification for levels of TAH are summarized in Table 3.1.

3.1.5 Sex-Selectivity of Harvest

No sex selective harvest is currently recommended for any of Nunavut's 19 musk ox populations.

3.1.6 Seasons of Harvest

During summer, musk ox form smaller groups led, usually, by a single bull (i.e., a male and harem of females with calves.) (Banfield 1974, Tener 1965). We believe there is a risk that the loss of bull at this time may predispose females with calves to unknown, but likely higher levels of predation, given that bulls are thought to lead and coordinate harem defense against predators (Urquhart 1982). Further, bulls are believed to play an important role in leading females and calves to adequate forage during summer. Summer and early fall is critical for musk ox nutrition (Tedesco et al. 1993): There is evidence that the likelihood of pregnancy and successful parturition is related to fat reserves, and most fat reserves are accumulated during the summer and early fall (Adamczewski et al. 1997). During winter, the harem social structure dissolves and musk ox form larger, multi-male and multi-female congregations (Banfield 1974), at which time the loss of some males from the group is not thought to have an large impact on predator defense or foraging behavior.

The DoE Wildlife Research group in consultation with the available literature and other northern ungulate biologists believe implementing a harvest season to protect against the disruption of musk ox groups during summer is a valid conservation strategy that allows the maximization of harvesting opportunities

while maintaining healthy musk ox populations and, to this end, we recommend a harvest season from 01 October–15 April for all Nunavut populations with the exception of the Victoria Island Population (MX/12) due to an inability of harvesters to fulfill the TAH allowance for this population.

3.1.7 Mandatory reporting and Sampling

We recommend that it be mandatory that harvesters report the harvesting of a musk ox through the filling out of hunter kill reports and the use of tags. Information collected on the reports should include date, location (Latitude and Longitude), hunters name, tag number, sex, approximate age, size of herd harvested from, and should also include a sample of skin with hair attached (equal or equivalent to a 2 by 2 inch square) from the harvested musk ox. The harvest reporting is essential to monitor the harvest and to be able to modify populations TAH when harvest figures are compared to survey findings. A skin sample is needed to increase our understanding of musk ox populations through genetic analysis as well as to monitor the sex ratio of the harvest in the instance of a reported decline and/or increase in a population's growth rate. Harvesters should return any found radio telemetry transmitter or satellite collar to a conservation officer.

Table 3.1 Recommended delineations of Nunavut musk ox populations and associated TAH.

Region	Population	TAH	Notes
Baffin	MX/01	3	***Bathurst Island Population.*** TAH based on 3% of the current minimum count (94) determined in 2001. The objective is to encourage population growth until the population is about half the peak sizes (1961, 1994) when the TAH should be re-examined. The population is relatively small and could be vulnerable to environmental variation. The sex and age structure is unknown.
	MX/02	0	***Cornwallis Island Population***. The objective is to encourage population growth until the population is half the known peak (25 ind.) when the TAH should be re-examined. The population is extremely small (based on 2002 survey) and could be vulnerable to environmental variation.
	MX/03	20	***Central Ellesmere Island Population***. Recent aerial & ground survey of Ellesmere I found the majority of musk oxen distributed north of designated musk oxen populations (Fosheim Peninsula). The TAH represents 5% of the upper confidence interval of the population estimate (394) (Gunn and Jenkins, in prep).
	MX/04	4	***Southern Ellesmere Island Population***. A population estimate of 139 (95% CI 98 – 196) was calculated from 2005 survey results (Gunn & Jenkins, in prep). Given the poor condition of observed musk oxen in 2005, a harvest of 3% of the mean abundance estimate is recommended until new information on trends/recovery is available.
	MX/05	14	***North Devon Island Population***. IQ suggests musk oxen are increasing. Recommendation of a TAH of 14 or 5% of the 1990 estimates.
	MX/06	2	***South Devon Island Population***. Objective to maintain the population at a level to meet current Inuit needs. A TAH of 2 which is 3% of 1990 estimate is recommended as the population is small (72, 1990 survey).
	MX/07	5	***West Devon Island Population***. The population is small but appears to be increasing. . The objective is to maintain the population. A TAH of 5 or c. 5% of the 2002/03 estimate is recommended
	MX/08	117	***Somerset Island Population***. Objective is to encourage sustainable harvesting of musk oxen and foster the recovery of caribou. The average annual rate of increase (6%) is recommended as the TAH.
Kitikmeot	MX/09	20	***Prince of Whales Island Population***. Since 1995 musk ox abundance has declined. The recommended TAH is a balance between allowing musk oxen to decline further (possibly foster caribou recovery) without accelerating the decline to the point of jeopardizing sustainable harvesting.
	MX/10	20	***Boothia Peninsula Population***. Current recommendation based on the previous population estimate. The TAH will be reviewed to the light of the survey conducted in June 2006. Report should be available by March 2007.
	MX/11	12	***King William Island Population***. Population estimate (adult musk oxen): 317 (extrapolation from ground survey 2002), current population status: increasing (HTO), recommended rate of harvest of 4% (TAH of 12).
	MX/12	None	***Victoria Island Population***. The current total harvest is far less than even conservative estimates of the TAH, so no TAH is required.
	MX/13	20	***Western Coppermine Population***. The population declined by over 50% and was estimated around 650 individuals in 1994. Since then local knowledge and reconnaissance flights or ground travels are consistent that the population hasn't recovered and is still at low density. The recommended harvest rate represents approximately 3% of the population.
	MX/14	240	***Central Mainland Population***. TAH of 240 based on 4% of population estimate.
	MX/15	66	***Queen Maud Gulf Population***. Population estimate (adult musk oxen): 2200 (projection from past aerial survey 1996 and 2000), current population status: decreasing (HTO, aerial surveys), recommended rate of harvest: 3% (TAH of 66).
	MX/16	10	***Eastern Mainland Population***. Most recent estimate (adult musk oxen): 165 (aerial survey 2000), current population status: re-colonizing (HTO), recommended rate of harvest: 4% (but TAH of 10 to include un-surveyed areas until further information is gathered.
Kivalliq	MX/17	41	***Northern Kivalliq Population***. TAH based on survey results, approximately 3% of the lower confidence interval of survey means. TAH level set to promote population growth. Division between the MX/17 and MX/16 based on musk ox distribution and known movements and a geographic separation in excess of known movements between the 2 populations as identified in Campbell & Setterington, 2003.
	MX/18	60	***Southern Kivalliq Population***. TAH based on survey results, approx. 3% of the lower confidence interval of survey means. TAH level set to promote population growth. Division between the North Kivalliq and South Kivalliq (SK) based on musk ox movements (being a non-migratory species) and a geographic separation in excess of known movements identified in Campbell & Setterington, 2003.
	MX/19	0	***Thelon Game Sanctuary population*** (No harvest allowed)

We believe implementing a harvest season to protect against disruption of musk ox groups during summer is a valid conservation strategy, and, to this end, we recommend a harvest season from 01 October–15 April for southern musk ox populations inhabiting central mainland Kitikmeot (MX/11), the Boothia Peninsula (MX/12), and mainland Kivalliq (MX/13). Here, management is directed at increasing population growth rates and conserving expanding populations. An open season is recommended for Victoria Island (MX/10), where the musk ox population is large and increasing under the current harvesting regimen. An open season is also recommended for all northern musk ox populations, where harvesters do not usually have access to musk ox herds during summer.

3.1.5 Additional Concerns or Recommendations

We recommend that it be mandatory that harvesters provide a sample of hair and tissue from harvested musk ox, and evidence of sex if the total allowable harvest is sex specific. Harvesters should return any found radio telemetry transmitter or satellite collar to a conservation officer.

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3.2 Caribou and Reindeer (Genus *Rangifer*)

3.2.1 Populations

We currently recognize 23 populations of caribou and one population of reindeer (semi-domestic members of the genus *Rangifer* imported from northern Europe and Asia) that reside wholly or partially in Nunavut (Figures 3.2A, 3.2B, and 3.2C, Table 3.2), including populations of barren-ground caribou (*Rangifer tarandus groenlandicus*) and Peary caribou (*Rangifer tarandus pearyi*). Geographic boundaries of Nunavut caribou populations have been previously evaluated from assessment of IQ, survey results, movements of radio-collared animals, and known geographic barriers to caribou movements.

3.2.2 Total Allowable Harvest

The spatial overlap of caribou herds (Figures 3.2A, 3.2B, and 3.2C) presents some difficulty for management. Our approach was to treat each population, regardless of spatial overlap, separately and distinctly for TAH recommendations. Recommended levels of TAH for populations and their justification are presented in Table 3.2 and Section 8.0 of this report (Appendix II: Summary of BNL Calculations for Caribou). For the most part, No TAH is recommended as populations are either growing or relatively large under current harvest regimens. Additionally, both scientific and Inuit information suggest that the ultimate cause of fluctuations in caribou population numbers is caribou grazing effects on range condition, rather than harvest levels. TAH levels were specified for the endangered (COSEWIC 2004) Peary caribou populations in the high Arctic. Consultations toward a Peary caribou management plan are ongoing with the affected

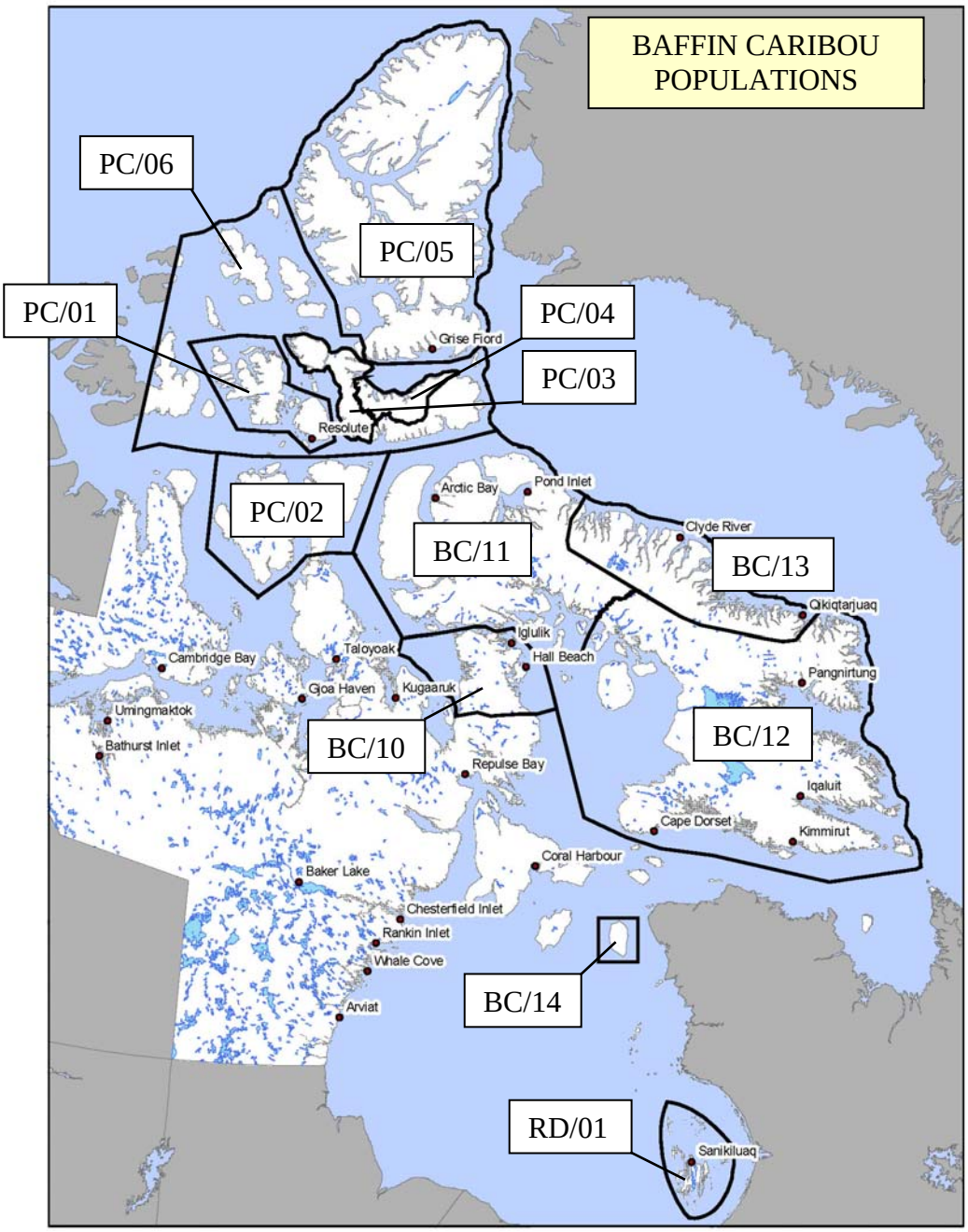

Figure 3.2A. Peary caribou (PC), barren-ground caribou (BC), and reindeer (RD) populations in the Baffin Region of Nunavut.

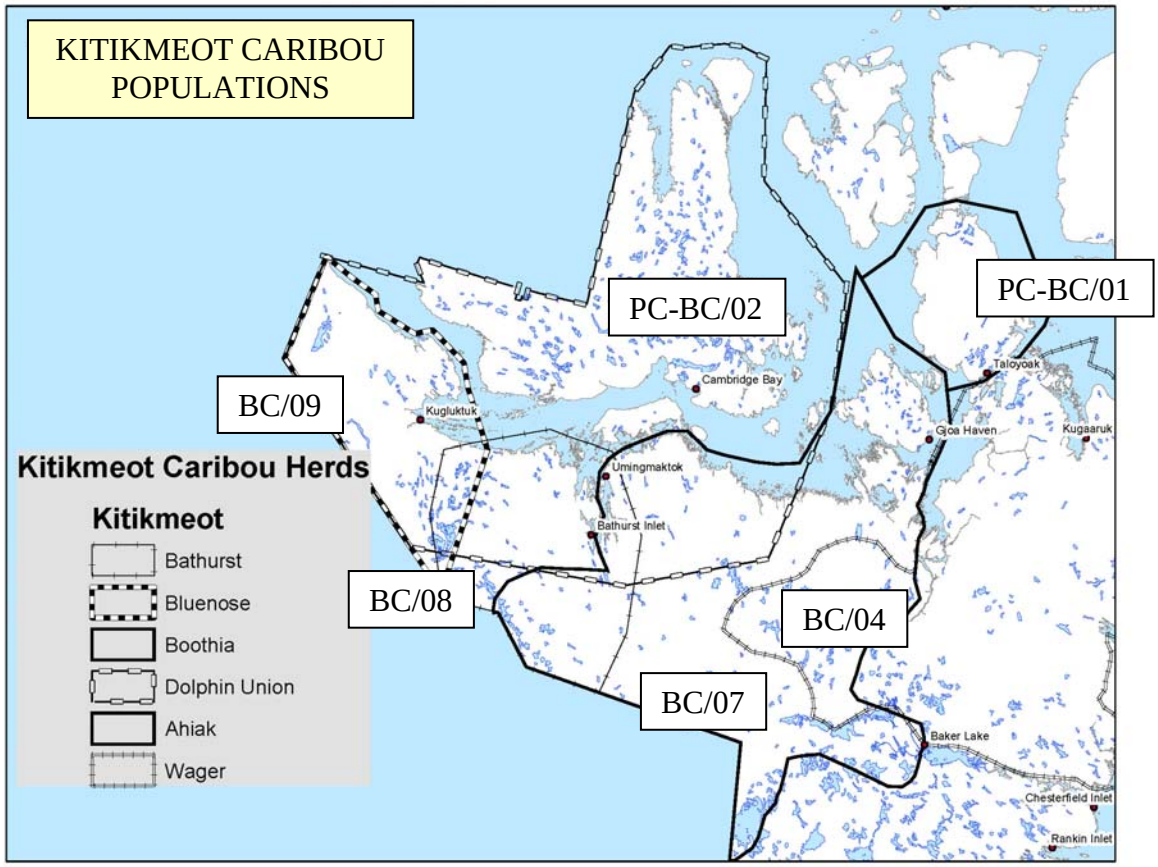

Figure 3.2B. Peary caribou (PC) and barren-ground caribou (BC) populations in the Kitikmeot Region of Nunavut.

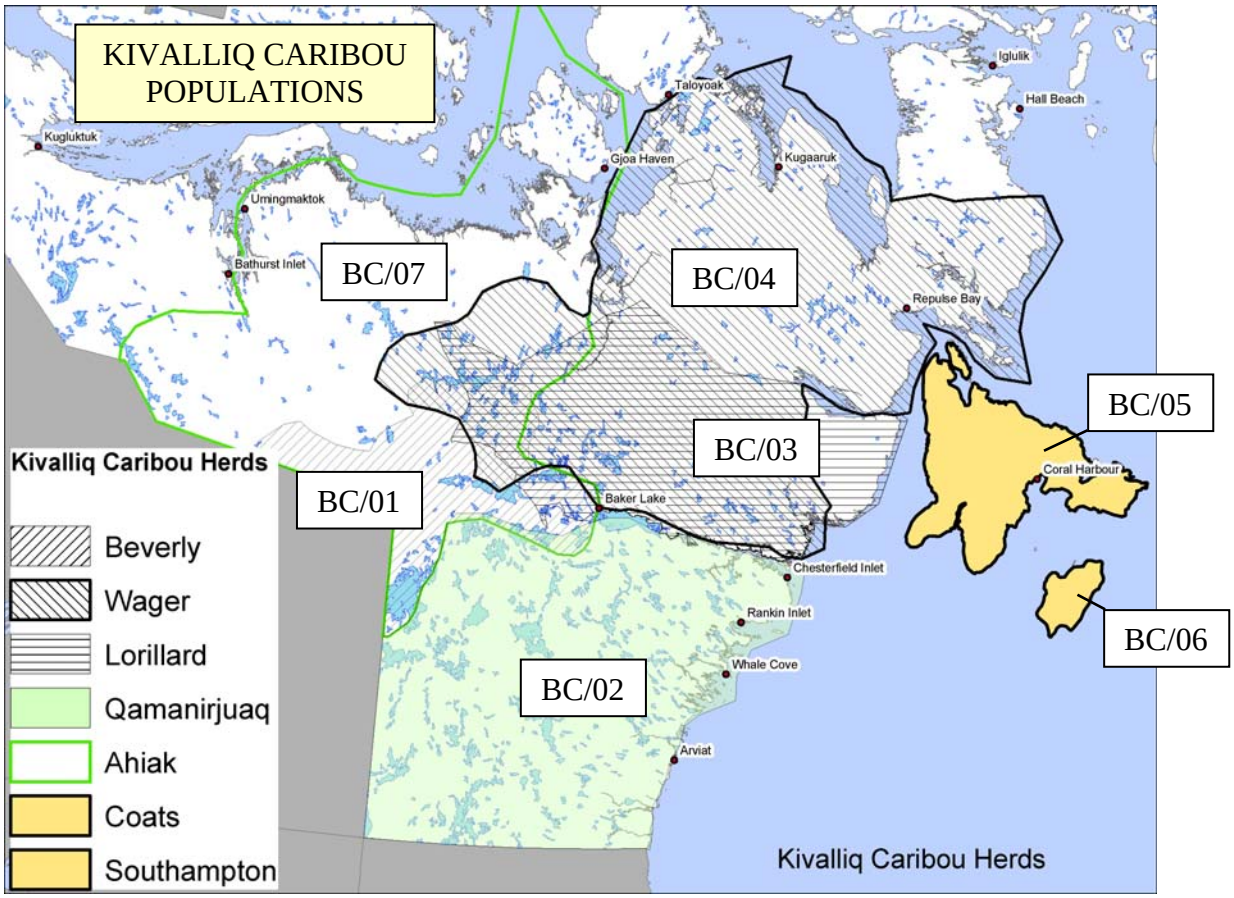

Figure 3.2C. Barren-ground caribou populations in the Kivalliq Region of Nunavut.

Table 3.2. Recommended levels of TAH and additional information on the basis of recommendations for managing Nunavut *Rangifer* populations (BC = Barren-ground caribou; PC = Peary Caribou; RD = Reindeer).

Population	TAH Code	Recommended TAH	Comments
Beverly	BC/01	No TAH	Overall need for strategic research plans. Subject to consultation.
Qamanirjuaq	BC/02	No TAH	
Lorillard	BC/03	No TAH	
Wager	BC/04	No TAH	
Southampton Island	BC/05	No TAH	Recommend considering sex-selective harvest if a large-scale commercial harvest continues. Need for strategic research. Subject to consultation.
Coats Island	BC/06	No TAH	Overall need for strategic research plans. Subject to consultation. Recognize that the Dolphin-Union caribou herd (PC-BC/02) has special status based on assessments by COSEWIC and is viewed locally as being distinct from mainland caribou. TAH recommendations could be forthcoming for PC-BC/02 from surveys scheduled for 2006.
Ahiak	BC/07	No TAH	
Bathurst	BC/08	No TAH	
Bluenose East	BC/09	No TAH	
Boothia Peninsula	PC-BC/01	No TAH	
Dolphin-Union	PC-BC/02	No TAH	
Northern Melville Peninsula	BC/10	No TAH	
North Baffin	BC/11	No TAH	
South Baffin	BC/12	No TAH	
Northeast Baffin	BC/13	No TAH	
Bathurst Island Archipelago	PC/01	14	TAH based on 5% of mean population estimate for a recovering population with growth rate of 30% annually; approved by resident HTO. Need for strategic research. Sex selective harvest subject to management plan.
Somerset/Prince of Wales	PC/02	0	Very low numbers. Overall need for strategic research plans. West Devon harvest based on 2002 survey estimate of 65 animals.
West Devon	PC/03	2	
North Devon	PC/04	0	
Ellesmere/Axel Heiberg	PC/05	50	Current harvest appears sustainable. Need for strategic research.
Other Queen Elizabeth Islands	PC/06	0	Densities are known to be very low.
Mansel Island	BC/14	No TAH	Overall need for strategic research plans. Subject to consultation.
Belcher Islands	RD/01	No TAH	

HTOs and other co-management partners. We note the Dolphin-Union herd is of special concern since much of the harvest is conducted during fall when caribou congregate along the south coast of Victoria Island (waiting for the ice to cross to mainland Nunavut). Harvest pressure may press caribou to cross on thin ice; other threats may arise for this herd as climate change affects ice conditions and shipping traffic in the Arctic increases.

3.2.3 Sex-Selectivity of Harvest

In accordance with the *Guiding Principles* presented in Section 1.2, we recommend that for small populations of caribou, females be conserved in order to mitigate the impact of harvesting on populations and encourage populations to attain and retain increased numbers when range conditions have recovered. Nunavut's smallest caribou populations are those of Peary caribou. We recommend an annual sex-selective harvest of 5 males to every 5 individuals of either sex for the Bathurst Island archipelago (Figure 3.2A). Sex-selective harvesting is under negotiation between the DoE and Hunters and Trappers Organizations responsible for Peary caribou inhabiting North and South Devon Island (Figure 3.2A). Other northern herds are too small to support a sustainable harvest (i.e., TAH = 0) or large enough such that sex-selectivity of harvest is not of immediate concern. One exception is the population of barren-ground caribou on Southampton Island, which appears to have lower than usual numbers of mature males. If evidence suggests that low numbers of mature males are reducing female fecundity, or large-scale commercial harvest of the population continues, the present recommendation of No TAH and no restrictions on sex-selectivity of hunting on Southampton Island may change.

3.2.4 Seasons of Harvest

We do not feel it necessary, for conservation purposes, to regulate harvesting of caribou through a restriction on season of harvest.

3.2.5 Additional Concerns or Recommendations

We recognize that, for conservation monitoring purposes, mandatory reporting of harvest be required for all Peary caribou populations. For those populations subject to sex-selective harvest, evidence of sex should be presented to assist quota implementation. Harvesters should return any found radio telemetry transmitter or satellite collar to a conservation officer.

Caribou are of major economic and cultural importance to Inuit and other residents of Nunavut. The economic value of the caribou harvest to Inuit is the greatest among all hunted terrestrial wildlife species in Nunavut. As such, we suggest several additional recommendations to promote the conservation of caribou in Nunavut further to recommendations on TAH, sex-selectivity, and seasons of harvest.

Of primary importance, there is an overall need for a unified conceptual framework to guide caribou management decisions. This framework would allow strategic allocation

of our limited research capacity to ensure management decisions are appropriate and timely. Current information gaps for some or all caribou populations include:

- population monitoring using scientific air or ground surveys or telemetry devices attached to caribou;
- surveys of parasite loads and effects of parasitism and disease on caribou population dynamics;
- comprehensive mapping of habitat to monitor effects of habitat change over time on caribou population dynamics;
- improved understanding of predator-prey dynamics, and
- further documentation of Inuit knowledge.

We also recommend that involvement of the Government of Nunavut in developing commercial enterprises requiring large-scale harvesting of caribou cease. Subsidized commercial harvesting imposes an additional conservation burden on caribou without providing any actual net benefits to Nunavut. The political demand to continue subsidized commercial harvesting as caribou numbers decline and the demand in order to provide jobs and to keep meat plants operating would likely accelerate declines to the detriment of resident hunters. The true value of caribou for Nunavummiut is domestic consumption. Subsidized commercial harvesting is not an efficient way to support the traditional economy. We believe more of subsidies provided would go to Nunavut hunters if subsidies were used to provide caribou meat for domestic use rather than commercial sales: many Nunavut communities cannot get enough caribou to meet their needs.

We recognize that exotic diseases have spread from farmed cervids to wild cervids in a number of North American jurisdictions (e.g., chronic wasting disease in Saskatchewan). The establishment of transmissible diseases such chronic wasting disease in Nunavut populations of caribou would devastate country-food economies based on caribou. Hence, we recommend that the importation of any cervid (deer, caribou, moose, elk, and reindeer) into Nunavut, for any reason, be prohibited, including any further attempts to introduce reindeer into Nunavut.

3.3 Moose (*Alces alces*)

3.3.1 Populations

We recognize that the population of moose in Nunavut occurs only near tree line in Kitikmeot and Kivalliq, at the periphery of the species' normal range.

3.3.2 Total Allowable Harvest

We recommend that No TAH be implemented for the management of moose in Nunavut. Moose are not currently of conservation concern. In addition, in the NWHS Inuit expressed only minor interest in harvesting moose.

3.3.3 Sex-Selectivity of Harvest

Given the low priority for harvesting moose by Inuit expressed in the NWHS, and that the moose population is not in need of management for conservation purposes, we do not feel it necessary to regulate moose harvest through sex-selection.

3.3.4 Seasons of Harvest

We do not feel it necessary, for conservation purposes, to regulate harvesting of moose through a restriction on season of harvest.

3.4 White-tailed Deer (*Odocoileus virginianus*)

3.4.1 Populations

We recognize that the population of white-tailed deer in Nunavut occurs only near tree line in Kitikmeot and Kivalliq, at the periphery of the species' normal range.

3.4.2 Total Allowable Harvest

We recommend that No TAH be implemented for the management of deer in Nunavut. Deer are believed to be a colonizing species exotic to Nunavut, and not currently of conservation concern; however, because of the possibility of disease transmission from colonizing deer to indigenous ungulates, it would be advisable to harvest white-tailed deer as they are encountered.

3.4.3 Sex-Selectivity of Harvest

Given the low priority for harvesting white-tailed deer by Inuit expressed in the NWHS, and that the deer population is not in need of management for conservation purposes, we do not feel it necessary to regulate deer harvest through sex-selection.

3.4.4 Seasons of Harvest

We do not feel it necessary, for conservation purposes, to regulate harvesting of deer through a restriction on season of harvest.

3.4.5 Additional Concerns or Recommendations

We recognize that continued expansion of white-tailed deer into Nunavut may pose a conservation risk to caribou herds that overlap with white-tailed deer, the definitive host of meningeal worm (*Elaphostrongylus tenuis*). Risk would be present, however, only in areas where the intermediate invertebrate host of the meningeal worm parasite is also able to exist (currently restricted to northern Manitoba, although it would appear the range is expanding as climate warms). Meningeal worm has been shown to be lethal to caribou in eastern Canada where ranges of woodland caribou (*Rangifer tarandus tarandus*) and white-tailed deer overlap.

Chronic wasting disease is also prevalent in three wild populations of white-tailed deer in Saskatchewan. Although presently restricted to areas far-removed from overlap with wintering barren-ground caribou that calve in Nunavut, the disease is of concern due to its lethality to cervids. Chronic wasting disease is highly infectious and fatal to cervids: affected animals will invariably die because no known treatment or vaccine currently exists. Continued expansion of chronic wasting disease in the white-tailed deer population in Saskatchewan may become a conservation concern to Nunavut caribou in the near future. Containment of the disease is currently achieved only through large-scale culling of infected herds.

To safeguard against the spread of wildlife diseases from deer to wild stocks of caribou, we recommend the prohibition of importation of live white-tailed deer into Nunavut for any purpose.

4.0 TAH of Furbearers

4.1 Furbearers

4.1.1 Populations

We currently recognize the following furbearers as having populations within Nunavut (Schedule 5-1 of NLCA, excluding those furbearers additionally classed as Big Game in Schedule 5-2 of NLCA):

- Arctic ground squirrel (*Spermophilus*)
- Red squirrels (*Tamiascuirus*)
- Hares (*Lepus*)
- Beaver (*Castor*)
- White fox and Arctic fox (*Alopex*)
- Red, cross, black, and silver fox (*Vulpes*)
- Ermine, weasels, least weasels and mink (*Mustela*)
- Otter (*Lutra*)
- Martens and fishers (*Martes*)
- Lynx (*Lynx*)
- Muskrat (*Ondatra*)
- Striped skunk (*Mephitis*)
- Lemmings (*Lemmus*, *Dicrostony*, *Synaptomys*)
- Voles (*Penacomys*, *Clethrionomys*, *Microtus*)
- Marmot, groundhog or woodchuck (*Marmota*)

4.1.2 Total Allowable Harvest

All populations are poorly defined due to lack of research on these species; however, all species occur in relatively large adjacent populations in the Northwest Territories, Saskatchewan, or Manitoba and are not believed to be at risk of over-harvest in Nunavut given past harvest levels presented in the NWHS. We recommend that No TAH be implemented for the management of all furbearers in Nunavut.

4.1.3 Sex-Selectivity of Harvest

No sex-selectivity of harvest is recommended for the management of furbearer populations in Nunavut. Most furbearers are trapped, which makes sex-selectivity in the harvest difficult to manage; further, there appears to be no current conservation reason to regulate harvest by sex.

4.1.4 Seasons of Harvest

We do not feel it necessary, for conservation purposes, to currently regulate harvesting of furbearers through a restriction on season of harvest.

4.1.5 Additional Concerns or Recommendations

Pregnant female wolverine should be protected from by-catch harvest. Hence, it may be advisable or become necessary to restrict trapping of foxes to the wolverine harvest season (01 November–15 April) in wolverine zones W/04 and W/05 for the purpose of avoiding unintentional by-catch of female wolverine. This restriction would only become necessary if evidence suggests the by-catch to be detrimental to the wolverine population.

5.0 TAH of Birds Species

5.1 Gyrfalcons

5.1.1 Populations

Gyrfalcons are a migratory bird of prey that occur throughout Nunavut. We currently recognize three regions (Kitikmeot, Kivalliq, and Baffin) as having quotas for this species.

5.1.2 Total Allowable Harvest

All populations are poorly defined due to lack of research on these species; however, management of these species is a concern due to the large black-market that presently exists for live-captured birds, which are sold at high prices for falconry purposes.

After consultation with population biologists familiar with gyrfalcon biology in arctic Canada (R. Bromley, K. Poole), we recommend an annual quota of 5 birds in Kitikmeot, 5 birds in Kivalliq, and 10 birds in the Baffin region as a sustainable TAH.

5.1.3 Sex and Age-Selectivity of Harvest

No sex-selectivity of harvest is recommended for the management of gyrfalcon populations in Nunavut; however, we recommend harvest be restricted to fall passage birds only (<1 year of age), as removal of animals less than 1 year of age is thought to be largely compensatory for the population.

5.1.4 Seasons of Harvest

We suggest harvest of gyrfalcons be restricted to fall-passage birds only; however, the dates required for harvesting may vary across Nunavut. After consultation with recognized experts on arctic gyrfalcon ecology (B. Bromley, K. Poole), we recommend that the harvest of gyrfalcons be restricted to the months of September and October (i.e., 01 September–31 October).

5.1.5 Additional Concerns or Recommendations

The gyrfalcon is a migratory species; however, like most birds of prey it is not subject to the Migratory Birds Convention Act (Canada). Thus, it is important for Nunavut to develop a sound management plan to protect gyrfalcons. We recognize the need to curtail black-market activity surrounding the live-capture of gyrfalcons. We recommend that the transport of eggs and live birds be strictly monitored to ensure recommended levels of TAH are not exceeded. We also recommend that it be mandatory for harvesters to report the length of each bird harvested and any band number on the bird.

5.2 Other Birds of Prey

5.2.1 Populations

We currently recognize the following birds of prey, in addition to gyrfalcons, as residing within Nunavut:

- Peregrine falcons
- Snowy owls
- Short-eared owls
- Golden eagles
- Bald eagles
- Rough-legged hawk
- Harrier
- Osprey

All populations are poorly defined due to lack of research on these species.

5.2.2 Total Allowable Harvest

Given the general lack of interest in harvesting birds of prey listed in Section 5.2.1 of this document in the NWHS, and the listing of short-eared owls, golden eagles, bald eagles, and harriers under COSEWIC, we recommend that a TAH of zero (0) be implemented for the management of the majority of birds of prey listed in Section 5.2.1 of this document. Exceptions to a TAH of zero include only the snowy owl, for which a TAH of 15, allocated as 5 for each region is recommended. A TAH is recommended for snowy owls because some interest in harvesting adults for food or eggs of adults for food was demonstrated by Inuit in the NWHS. However, the lack of information on the magnitude of snowy owl harvest and the status of snowy owl populations leads us to recommend a conservative harvest.

5.2.3 Sex-Selectivity of Harvest

No sex-selectivity of harvest is recommended for the management of snowy owls. All other birds of prey presented in Section 5.2.1 of this report have a recommended TAH of zero, and thus no harvest to consider.

5.2.4 Seasons of Harvest

We do not feel it necessary, for conservation purposes, to currently regulate harvesting snowy owls through a restriction on season of harvest. All other birds of prey presented in Section 5.2.1 of this report have a recommended TAH of zero, and thus no season.

5.2.5 Additional Concerns and Recommendations

We recommend mandatory reporting of the harvest of all birds of prey for monitoring purposes. All harvested birds of prey must be brought into the local wildlife office for identification and aging before shipping.

5.3 Resident (Non-Migratory) Birds

5.3.1 Populations

We currently recognize the following birds as non-migratory, terrestrial birds:

- Ptarmigan
- Ravens

All populations are poorly defined due to lack of research on these species.

5.3.2 Total Allowable Harvest

No TAH is recommended for the harvesting of ptarmigan or ravens.

5.3.3 Sex-Selectivity of Harvest

No sex-selectivity of harvest is recommended for the management of ptarmigan or ravens.

5.3.4 Seasons of Harvest

We recommend a closed season for ravens. Although ravens are not of any conservation concern, there is concern that shooting of ravens as a pest species may be a dangerous practice or against the harvest ethics of some communities. We recommend that Exemption Permits to shoot ravens be issued as required (Licenses and Tags Regulation), and upon request by interested individuals or municipal authorities. We do not feel it necessary, for conservation purposes, to regulate harvesting of ptarmigan through a restriction on season of harvest.

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7.0 Appendix I: Summary of Species TAH in Table Format

See text for justification of recommended levels of TAH, items of special concern, and/or additional recommendations.

Species Population	Total Allowable Harvest	Sex Selective Harvest	Season	Additional Regulations
BIG GAME CARNIVORES				
Polar Bear Populations				
Norwegian Bay (Polar Bear 1)	4	2M:1F; no female with accompanying cubs	Open	See individual management plans. Mandatory reporting of harvest (sampling). Mandatory protection of females with accompanying offspring. Mandatory protection of any bear at or in a den.
Kane Basin (Polar Bear 2)	5			
Viscount Melville (Polar Bear 3)	3			
Lancaster Sound (Polar Bear 4)	85			
Baffin Bay (Polar Bear 5)	105			
Northern Beaufort (Polar Bear 6)	6			
M'Clintock Channel (Polar Bear 7)	3			
Gulf of Boothia (Polar Bear 8)	74			
Foxe Basin (Polar Bear 9)	106			
Davis Strait (Polar Bear 10)	46			
Western Hudson (Polar Bear 11)	56			
Southern Hudson Bay (Polar Bear 12)	25			
Grizzly Bear Populations				
Grizzly Bear/01	8	2M:1F; no female with accompanying cubs	Open	Mandatory reporting of harvest (sampling). Mandatory protection of females with accompanying offspring. Mandatory protection of any bear at or in a den.
Grizzly Bear/02	6			
Grizzly Bear/03	6			
Grizzly Bear/04	0			
Grizzly Bear/05	0			

Species Population	Total Allowable Harvest	Sex Selective Harvest	Season	Additional Regulations
Black Bear Populations				
Black Bear	No TAH	Unselective	Open	
***Canis* Populations**				
Wolf/01	No TAH	Unselective	Open	No one shall harvest, harass, or otherwise disturb wolves and their pups while denning and/or building a den.
Wolf-High Arctic	No TAH			
Coyote/01	No TAH			
Wolverine Populations				
Wolverine/01-KT	160	Unselective	01 Nov-15 Apr (Trapping) 01 Nov-30 Apr (Shooting)	Mandatory reporting of harvest (samples).
Wolverine/01-KV	40			
Wolverine/02-KT	50			
Wolverine/02-KV	15			
Wolverine/03	No TAH		Open	

Species Population	Total Allowable Harvest	Sex Selective Harvest	Season	Additional Regulations
BIG GAME UNGULATES				
Musk ox Populations				
MX/01	6	3M:3M or F	Open	
MX/02	0	Unselective		
MX/03	70	Unselective		
MX/05	27	Unselective		
MX/06	14	7M:7M or F		
MX/07	4	2M:2M or F		
MX/08	0	Unselective		
MX/09	32	Unselective		MX/09-RB quota = 20, MX/09-RA quota = 12.
MX/10	No TAH	Unselective		
MX/11	328	Unselective	01 Oct-15 Apr	MX/11-CM quota = 240, MX/11-QM = 66, MX/11-WC quota = 12, MX/11-EX quota tentatively 10.
MX/12	20	Unselective		
MX/13	101	Unselective		MX/13-NK quota = 41, MX/13-SK quota = 60, MX/13-TH quota = 0.

Species Population	Total Allowable Harvest	Sex Selective Harvest	Season	Additional Regulations
Caribou Populations				
Beverly	No TAH	Unselective	Open	
Qamaniriaq	No TAH	Unselective	Open	
Lorillard	No TAH	Unselective	Open	
Wager	No TAH	Unselective	Open	
Southampton Island	No TAH	Unselective	Open	
Coats Island	No TAH	Unselective	Open	
Ahiak	No TAH	Unselective	Open	
Bathurst	No TAH	Unselective	Open	
Bluenose East	No TAH	Unselective	Open	
Boothia Peninsula	No TAH	Unselective	Open	
Dolphin-Union	No TAH	Unselective	Open	
Northern Melville Peninsula	No TAH	Unselective	Open	
North Baffin	No TAH	Unselective	Open	
South Baffin	No TAH	Unselective	Open	
Northeast Baffin	No TAH	Unselective	Open	
Bathurst Island Archipelago	14	7 M:7M or F	Open	Sex selective harvest subject to management plan.
Somerset/Prince of Wales	0	Unselective	Open	
West Devon	2	Unselective	Open	
North Devon	0	Unselective	Open	
Ellesmere/Axel Heiberg	50	Unselective	Open	
Other Queen Elizabeth Islands	0	Unselective	Open	
Mansel Island	No TAH	Unselective	Open	
Belcher Islands	No TAH	Unselective	Open	

Species Population	Total Allowable Harvest	Sex Selective Harvest	Season	Additional Regulations
Moose Populations				
Moose	No TAH	Unselective	Open	
Deer Populations				
White-tailed deer	No TAH	Unselective	Open	

BIRDS

Birds of Prey Populations				
Gyrfalcon-Baffin	10	Unselective	01 Sept - 31 Oct	Mandatory reporting of harvest (samples), including the examination of harvested birds by personnel at the local wildlife office for identification and aging before shipping. Harvest of Snowy Owls shall be distributed as 5 birds per region (i.e., Kivalliq, Kitikmeot, and Baffin).
Gyrfalcon-Kitikmeot	5			
Gyrfalcon-Kivalliq	5			
Peregrine Falcon	0	Unselective	Open	
Snowy Owl	15	Unselective	Open	
Short-Eared Owl	0	Unselective	Open	
Bald Eagle	0	Unselective	Open	
Golden Eagle	0	Unselective	Open	
Rough-legged Hawk	0	Unselective	Open	
Harrier	0	Unselective	Open	
Osprey	0	Unselective	Open	
Resident Bird Populations				
Ptarmigan	No TAH	Unselective	Open	
Ravens	No TAH	Unselective	Closed	Wildlife management permits as required for localized control.

Species Population	Total Allowable Harvest	Sex Selective Harvest	Season	Additional Regulations
FURBEARERS				
Arctic Hare Populations				
Arctic Hare	No TAH	Unselective	Open	
Red Squirrel Populations				
Red Squirrel	No TAH	Unselective	Open	
Ground Squirrel Populations				
Arctic Ground Squirrel	No TAH	Unselective	Open	
Beaver Populations				
Beaver	No TAH	Unselective	Open	
Ermine and Weasel Populations				
Ermine, weasels, least weasel, mink	No TAH	Unselective	Open	
Fisher Populations				
Fisher Populations	No TAH	Unselective	Open	
Fox Populations				
Alopex (arctic/white) fox	No TAH	Unselective	Open	
Vulpes (red, cross, black and silver)	No TAH	Unselective	Open	

Species Population	Total Allowable Harvest	Sex Selective Harvest	Season	Additional Regulations
Lynx Populations				
Lynx	No TAH	Unselective	Open	
Marten Populations				
Marten	No TAH	Unselective	Open	
Mink Populations				
Mink	No TAH	Unselective	Open	
Muskrat Populations				
Muskrat	No TAH	Unselective	Open	
Otter Populations				
Otter	No TAH	Unselective	Open	
Skunk Populations				
Skunk	No TAH	Unselective	Open	
Lemming and Vole Populations				
Lemmings and Voles	No TAH	Unselective	Open	
***Marmota* Populations**				
Marmot, groundhog, woodchuck	No TAH	Unselective	Open	

8.0 Appendix II: Summary of BNL Calculations for Caribou

The Nunavut Land Claims Agreement (NLCA) requires that an Inuit Basic Needs Level (BNL) be established for a stock or population when the Nunavut Wildlife Management Board (NWMB) determines that a total allowable harvest (TAH) is required for a particular wildlife stock or population. For species ordinarily harvested by members of a single Hunters and Trappers Organization (HTO), the total allowable harvest shall be expressed as a community total allowable harvest. For species normally harvested by members of more than one HTO, the total allowable harvest shall be expressed as a regional total allowable harvest. Various methods for calculating the BNL are presented in the NLCA and all methods rely, in some way, on the Nunavut Wildlife Harvest Study (NWHS). The selection of the actual method to use depends on whether the population was subject to a TAH at the commencement of the NWHS. It is now possible to use the NWHS to project BNLs for various species. Here, we examine the data provided in the NWHS to derive BNL values for all Nunavut caribou populations. Note that these calculations were used in this report to facilitate recommendations on TAH (Section 3.2 of this report), which largely resulted in recommendations of No TAH for caribou populations (see Table 3.2 of this report). Note, however, it is the responsibility of the NWMB to determine BNL levels. *Our examples were developed for information purposes only and official BNLs for all Nunavut species are to be determined by the NWMB.*

For each community, BNLs were determined by: 1) calculating a broad community BNL (cBNL) for all caribou harvested, and 2) estimating the proportion of caribou harvested from various populations using the harvest location as a guide.

Community BNLs were calculated using the equation:

$$\text{cBNL} = \frac{\text{highest harvest in one year of harvest study + average annual harvest}}{2}$$

Proportions of caribou harvests were then used to segregate the cBNL into partial BNLs (pBNL). Community harvests were obtained and examined using the Geographical Information System (GIS) viewer provided by the NWHS. If possible, caribou were assigned to populations depending on the location of harvest. It was not always possible to assign all harvest events to a unique caribou population and, in these cases, harvest events were designated as originating from more than one herd (e.g., Kivalliq). The Baffin Region was not composed of discrete caribou populations and is, instead, composed of several management areas; based on the harvest location, harvested caribou were designated as originating from a particular management area. Also, in the Kitikmeot, since discrete population boundaries were not available, harvest records were examined and rough estimates of the harvest from each of the populations were determined. For populations utilized by more than one community, the sum of all relevant pBNLs were used to calculate the total BNL associated with that population.

The various BNL calculations were separated into the Baffin Region (Table 8.1), Kitikmeot Region (Table 8.2), and Kivalliq Region (Table 8.3). BNLs for different herds (populations) varied considerably with as little as one caribou for the West Devon Island Peary caribou

(Table 8.1) to almost 6000 Qamanirjuaq caribou (Table 8.3). For some herds (e.g., Wager and Ahiak caribou), harvesting occurred from communities from more than one region; hence, for these herds, the BNL was the sum of the BNLs from each of the regions.

Five Peary caribou management areas (Table 8.1, 8.2), the Bluenose East herd (Table 8.2), and one reindeer population (Table 8.1) were utilized solely by single communities. For these, the TAH was expressed on a community basis. For other caribou populations, the total allowable harvest was expressed on a regional basis.

Due to overlap of populations (herd ranges) and the number of herds present in Kivalliq (see Figure 3.2C in Section 3.2 of this report), a considerable amount of caribou harvested in Kivalliq were assigned to more than one herd and were counted towards the BNL associated with a particular caribou herd (Table 8.3). Additional information on herd distributions and further analysis of NWHS data may decrease the number of caribou assigned to more than one herd.

It should be emphasized that calculated BNLs are not authoritative. First, the NLCA states that BNLs should be calculated on a population basis. In this exercise, a broad community BNL was calculated on a species basis instead. To aid in the partitioning of the broad BNL, we segregated the harvest on a population basis assuming that the overall harvesting effort on various herds was consistent over each of the years of the NWHS. Deviation from this assumption could affect the BNL calculation for individual populations. Errors in segregation of the harvest to a particular herd are also likely and would lead to an erroneous BNL.

Nevertheless, the calculation of the BNL is a useful model to help conceptualize possible consequences of setting a TAH. For example, in the Kivalliq, where high overlap in caribou herd ranges occur, the setting of a TAH for one herd and not for an adjacent herd may make enforcement of regulations problematic. A Nunavut-wide genetics study may help the Wildlife Research Section of DoE determine the extent to which various caribou herds comprise independent populations.

Table 8.1. Baffin Region community BNLs broken down into separate management areas (BC = Barren-ground caribou; PC = Peary Caribou; RD = Reindeer).

Population	TAH Code	Community													Total Herd BNL
		Arctic Bay	Cape Dorset	Clyde River	Grise Fiord	Hall Beach	Igloolik	Iqaluit	Kimmirut	Pangnirtung	Pond Inlet	Qikiqtarjuaq	Resolute Bay	Sanikiluaq	
South Baffin	BC/12		589	87				1914	343	2367		74			5343
Northern Melville Peninsula	BC/10	2				912	211				2				3378
North Baffin	BC/11	1010		6			1597				2165		1		4779
Northeast Baffin	BC/13			282						2	14	100			398
North Devon	PC/04				2										2
Ellesmere/Axel Heiberg	PC/05				46										46
Wager	BC/04					21	1								22
Bathurst Island Archipelago	PC/01												6		6
West Devon	PC/03												1		1
Boothia Peninsula	PC-BC/01												14		14
Belcher Islands	RD/01													31	31
Community BNL	**-**	**1012**	**589**	**375**	**48**	**933**	**1809**	**1914**	**343**	**2369**	**2181**	**174**	**22**	**31**	**14020**

Table 8.2. Kitikmeot Region community BNLs broken down into separate management areas (BC = Barren-ground caribou; PC = Peary Caribou; RD = Reindeer).

Population	TAH Code	Community							Total Herd BNL
		Bathurst Inlet	Cambridge Bay	Gjoa Haven	Kugaaruk	Kugluktuk	Taloyoak	Umingmaktok	
Dolphin and Union	PC-BC/02	58	1232			506		201	1997
Bathurst	BC/08	47				35		12	94
Ahiak	BC/07			531				32	563
Wager	BC/04			109	505		755		1369
Boothia	PC-BC/01				5		66		71
Bluenose East	BC/09					1203			1203
Total Community BNL	**-**	**105**	**1232**	**640**	**510**	**1744**	**821**	**245**	**5297**

Table 8.3. The Kivalliq Region community BNLs segregated into separate herds (BC = Barren-ground caribou; PC = Peary Caribou; RD = Reindeer). Many caribou were not segregated to one possible herd due to the large overlap of herd ranges (Figure 3.2C) and the number of herds in Kivalliq.

Population	TAH Code	Community							Total Herd BNL
		Arviat	Baker Lake	Chesterfield Inlet	Coral Harbour	Rankin Inlet	Repulse Bay	Whale Cove	
Qamanirjuaq	BC/02	3680	158	373		1155		608	5962
Lorillard	BC/03		328	225		46			598
Southampton Island	BC/05			1	1704		27		1732
Wager	BC/04						942		942
2 Possible Herds	-	4	1286	199	1	101		6	1596
Three Possible Herds	-		490				1		491
Four Possible Herds	-		406						406
Total Community BNL	**-**	**3684**	**2668**	**798**	**1705**	**1302**	**970**	**614**	**11727**

9.0 Appendix III: Example Polar Bear Management Plan

POLAR BEAR MANAGEMENT
MEMORANDUM OF UNDERSTANDING

BETWEEN

Arctic Bay
Ikajutit Hunters' and Trappers' Organization

Grise Fiord
Iviq Hunters' and Trappers' Organization

Resolute Bay
Resolute Bay Hunters' and Trappers' Organization

Qikiqtaaluk Wildlife Board

and

The Department of Environment

FOR THE MANAGEMENT OF THE
"LANCASTER SOUND" POLAR BEAR POPULATION

January 30, 2004

The following Polar Bear Management Memorandum of Understanding (MOU) recognizes and respects both the Agreement between the Inuit of the Nunavut Settlement Area and her majesty the Queen in Right of Canada (The Nunavut Land Claims Agreement or NLCA), and the jurisdiction of the Nunavut Wildlife Management Board (NWMB) under the NLCA. Accordingly, this MOU shall, where appropriate, constitute recommendations for consideration by the NWMB.

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MEMORANDUM OF UNDERSTANDING FOR THE MANAGEMENT OF THE LANCASTER SOUND POLAR BEAR POPULATION

Section 1.0

Definitions/Assumptions

1.1 The species considered in this Memorandum of Understanding (MOU) is the polar bear (*Ursus maritimus*).

1.2 The polar bear population covered by this MOU is the Lancaster Sound Polar Bear Population, hereafter referred to as (LS) as shown in the map in Appendix 1. However, this MOU is for polar bear management practices within the (LS) population boundaries and the Nunavut Territorial borders only.

1.3 Outpost camps associated with a community, and not having organized their own Hunters' and Trappers' Organization (HTO), are considered part of the local HTO and party to this MOU.

1.4 "Conservative Harvest Rate" means the number of bears that can be taken per year with not more than 10% risk of a population decline that would require more than 5 years of harvest moratorium to recover to the current number over a 15-year period starting from the most recent population inventory. It is recognized that the population is expected to grow when harvested at the "Conservative Harvest Rate".

1.5 "Guided Harvest Rate" means the number of bears that can be taken without reducing the population below the target number. The "Guided Harvest Rate" is based on Inuit Qaujimajatuqangit (IQ), perception of trend, and probability of increase or decline. The "Guided Harvest Rate" must be consistent with the principles of conservation identified in the Nunavut Land Claim Agreement (NLCA).

1.6 "Total Allowable Harvest" (TAH) for the (LS) polar bear population means the number of polar bears that can be harvested annually at a sex ratio of 2 males per 1 female as established by the NWMB pursuant to Sections 5.6.16 to 5.6.18. For clarity (see also Section 1.10), the TAH identified in this MOU serves as a recommendation to the NWMB, and is understood to come into effect only after it is approved as a decision by the NWMB.

1.7 "Credit" is that part of an HTO's share of the TAH that is not harvested in the year it is allocated.

1.8 "Flexible Quota System" is protocol for ensuring that the kill of both males and females remains within the TAH for each sex.

1.9 "Target Number" is the management goal for the population size of the (LS) population.

1.10 This MOU supersedes any previous polar bear management agreement for the (LS) population, and will come into effect after it has been reviewed and accepted by the Nunavut Wildlife Management Board (NWMB).

1.11 The terms and conditions of this MOU will not be changed without the consent of all the signatories. This MOU may be reviewed anytime there is new information or a management issue. If one of the signatories wishes to revisit some aspect of the MOU, they shall provide notification to all other parties, and allow 90 days for a response. Once all the signatories have agreed to an amendment, it will come into effect after it has been reviewed and accepted by the NWMB.

1.12 For the purpose of this MOU, a Nunavut beneficiary shall be considered to include any person who has received assignment of rights to hunt polar bears and any person who has been designated as an Inuk as per the NLCA.

Section 2.0

Objectives

2.1 To manage polar bears to simultaneously maximize benefits to beneficiaries of the NLCA; safeguard the interests of future generations of hunters; and ensure good conservation of polar bears by keeping the risk of population decline due to over-harvest within the acceptable level in accordance with the best information available, including comprehensive harvest statistics.

2.2 To encourage the collection of Inuit Qaujimajatuqangit and scientific information on a timely basis to guide management decisions.

2.3 To ensure that the (LS) polar bear population remains abundant and productive. The target number for the polar bear population of the (LS) population is (2500).

2.4 To identify a management approach that meet the needs and preferences of the hunters that harvest polar bears from the (LS) population and is also consistent with the NLCA and the Wildlife Act.

2.5 To conserve female polar bears in order to mitigate the impact of harvesting on the (LS) population, and encourage the number of polar bears in the (LS) population to attain and retain the target number. This requires harvesting the TAH at 2 or more males per female taken. It is recognized that it would be to the benefit of the (LS) population to keep the proportion of males harvested as high as possible.

2.6 To minimize detrimental effects of human activities, especially commercial activities, to the polar bears and polar bear habitat of the (LS) population.

2.7 To encourage the wise use of polar bears and all polar bear products of the (LS) population.

2.8 To identify research priorities and ensure participation of local people in research activities and the collection of harvest data for the (LS) population.

2.9 To hold management meetings with representatives of the parties to this MOU at least once every **7** years to review and update information and set direction for the continuing management of polar bears.

Section 3.0

Hunters' and Trappers' Organization (HTO) Determinations

3.1 As per the NLCA, the HTO may develop rules for non-quota limitations and manage harvesting among members.

3.2 Within one year of the signing of the MOU, the HTO will develop and record its rules for harvesting polar bears. Once these rules have been approved at a meeting of the members (e.g., an Annual General Meeting), the rules will be forwarded to the NWMB for their review and approval. Once the NWMB has approved of the proposed polar bear hunting rules, the rules will be considered to be part of this MOU and will be recorded in Appendix 4. ***Community HTO Polar Bear Hunting Rules***. As a courtesy, the HTO shall inform the Dept of Environment of any new rules or amendments to existing rules at least 30 days before the new rules come into effect.

3.3 The HTO will interpret and enforce these rules as internal business, but the rules will not be part of the regulations.

3.4 The polar bear harvest year shall be from July 1 to June 30 of each year. The HTO shall open and close their polar bear hunting season as they choose to optimize polar bear hunting for their community.

Section 4.0

Regional Wildlife Organization (RWO) Determinations

4.1 The relevant RWO will have the authority to distribute any accumulated harvest credits as required to cover accidental, defence, or illegal kills. The RWO may also return credits annually to augment a community's harvest. Credits may not be transferred between communities that share a population without the written consent of the community that accumulated the credit.

4.2 The Dept of Environment shall support the RWO by maintaining an up to date record of the harvest credits. The Dept of Environment will provide the RWO a summary of the harvest credits as part of the annual harvest report by July 1st each year. For clarity, the available credits will be automatically allocated to retain the full TAH for each community. The RWO shall provide the Dept of Environment with their decisions on credit allocations and the Dept of Environment shall retain and archive all administrative records. The full administrative records for harvest credits shall be available for the RWO on request. The Dept of Environment shall advise the RWO as requested on the optimal allocation of credits to maximize harvest opportunities for Nunavut beneficiaries.

Section 5.0

Regulations

5.1 Definitions

5.1.1 "Cub" means a young polar bear that is less than one year of age.

5.1.2 "Yearling polar bear" means a polar bear that is older than one year of age, but less than two years of age and is still with its mother.

5.1.3 "Two-year old" means a polar bear that is older than two years of age, but less than 3 years of age, and is still with its mother.

5.1.4 "Family group" means a group of polar bears that consists of a mother with a cub/cubs, a mother with a yearling/yearlings, or a mother with a two-year old/olds.

5.2 Evidence Age/Sex

5.2.1 The parts that evidence the age, species, and sex of a polar bear are teeth for the age; the jaw or skull for the species; and the baculum of the male polar bear for the sex. When the baculum has been lost or forgotten the DNA determination shall also constitute evidence of the sex. Where evidence is not provided, the kill will be counted as a female polar bear for TAH purposes.

5.2.2 It is recognized from traditional knowledge that polar bear cubs are born in November and December. The age of a cub will be determined by the degree of canine tooth eruption for cubs, and the annular rings for cubs, yearlings, and two-year olds when the skull, jaw or a tooth is present.

5.3 Prohibitions

5.3.1 No person shall hunt:

(a) Any member of a family group. If the female of a family group of cubs, yearlings, or two-year olds is killed, the cubs, yearlings, and two-year olds will be regarded as killed as well.

(b) A female polar bear that is using a den, or a female polar bear that is constructing a den.

5.4 Harvesting of Cubs and Yearlings

5.4.1 All polar bears that are not members of a family group (i.e., are by themselves) may be harvested. If a cub or yearling is found without its mother, it may be harvested, but it must be reported to the Wildlife Officer and the HTO as soon as possible.

5.4.2 The HTO may apply to the Minister for a Wildlife Management Permit to allow cubs or yearlings to be harvested for food and cultural purposes. The permit must be issued in advance with a copy to the Wildlife Officer, and the HTO must monitor the hunt to ensure that the female (mother) is not harmed.

5.5 Total Allowable Harvest (TAH)

5.5.1 (a) Determination of the TAH

For the first seven (7) years following an accurate population inventory, the TAH shall be set as the “Conservative Harvest Rate”.

For the next seven (7) years, or until a new population inventory has been completed, the TAH shall be set as the “Guided Harvest Rate”.

When there is no reliable population inventory information, the TAH shall be set as the “Guided Harvest Rate”.

Table 1:
The numbers attributed to Nunavut communities and any jurisdictions that share the (LS) polar bear population indicate the respective share of the Total Allowable Harvest (TAH) that is allocated to each community or jurisdiction that harvests from the (LS) population. These values represent the basic annual allocation of the TAH to the community. The actual number of tags received in any given year to Nunavut communities will not exceed this number (unless the RWO allocates credits from previous years), but may be decreased as required for over-harvest of males or females in any given year as per the Nunavut Flexible Quota System described in Appendix 2.

Allocation of the TAH (85) from the (LS) population. (N=2500)

NUNAVUT	TAH	TOTAL
Arctic Bay	18 + 7	25
Resolute Bay	35	35
Grise Fiord	25	25
TOTAL (LS)	**78 + 7**	**85**

5.5.2 Tags issued for the (LS) population may be used within the geographical area defined for this population and up to 30 km (17 miles) outside of the boundary after agreement has been reached with HTOs that are signatory to the polar bear management MOU in the adjoining populations.

5.5.3 Tags issued for Polar Bear Populations that border the (LS) population may be used up to 30 km (17 miles) inside of the (LS) population.

5.5.4 The 30 km (17 miles) rule does not apply to inter-jurisdictional borders unless there is a cross-boundary overlap agreement; it only applies to populations within the Nunavut Territory.

5.5.5 Unused tags will not be carried over for use in a subsequent hunting season. After June 30th, all unused tags will be turned over to the Dept of Environment. These returned tags will be counted as credits to the community and administered by the appropriate RWO.

5.6 Specimens/Information

5.6.1 The following shall be collected from each polar bear killed:

(a) Lower jaw;
(b) Ear tags, if present;
(c) Lip tattoos, if present;
(d) Evidence of sex (baculum), or as per Section 5.2.1, from all male polar bears;
(e) Any other polar bear specimens as agreed by the HTO or individual hunter for any additional studies. For clarity, this stipulation means that this MOU constitutes consultation and HTO support for all Dept of Environment research studies utilizing polar bear specimens available from harvested bears.

NOTE: The specimens identified in 5.6.1 (a,b,c,and d) are mandatory, however they can be returned if requested by the hunter. Returned specimens will be sent within 6 months of being received by the laboratory. If a polar bear with a radio collar is taken, the radio collar will be turned in to the local HTO for return to the research project. Any damage to the meat or hide from polar bear research activities will be compensated for by the research project as per Section 5.6.4.

5.6.2 The Dept of Environment agrees to compensate hunters for their work to collect and label the required specimens at the following rates:

(a)	Lower jaw or skull:	$45.00
(b)	Ear tags:	$30.00
(c)	Lip tattoos:	$40.00
(d)	Baculum:	$100.00

5.6.3 The hunter is required to provide the following data, which are recorded for each polar bear killed:

(a) Hunters name and full address including country;
(b) Date of kill;
(c) Location of kill;
(d) Sex;
(e) Tag number; and
(f) Any other information that is required by the Wildlife Officer.

5.6.4 Any damage to the hide from research activities will be compensated for based on the reduced amount of the hide's market value. When the meat has been made unfit for human consumption by chemical immobilization within one year of the date of harvest, $300.00 compensation will be paid to the hunter who harvested the polar bear.

5.6.5 The Dept of Environment will provide an annual report of population and community harvest statistics, and recommendations for the next year's TAH, by July 1st of each year for the HTOs and RWOs to review and to assist the NWMB in setting TAH for the following year.

5.7 Response to Population Depletion

5.7.1 This agreement recognizes that the estimates of population numbers, birth and death rates, and acceptable harvest levels are uncertain. For that reason there is a small chance that the population will decline. The Dept of Environment intends to conduct a population inventory every 15 years. If the new research indicates that the population has declined below 90% of the target number for any reason, a moratorium on harvesting will be implemented until the population is projected to have recovered, or until a new population estimate shows that it has recovered to its target number. If the new research indicates that the population has declined by no more than 10% of the target number for any reason, a reduction in TAH will be implemented that is projected

to be sufficient to allow the population to recover to the target number in 15 years or less.

5.8 Development of Regulations

5.8.1 The Dept of Environment will develop the wildlife regulations required to implement this MOU.

Section 6.0

Application of Tags to Total Allowable Harvest

(Administration of the Flexible Quota System)

6.1 All human caused polar bear kills will be taken from the TAH of the nearest community, or from a community within the (LS) population with unused tags, if that community agrees. In the event that the human caused mortality exceeds the TAH, additional tags will be issued and the number of additional tags issued will be deducted and counted as part of the next year's TAH. A naturally abandoned cub or yearling will be counted as a natural death. Polar bear cubs caught in traps set for other species shall be recorded as part of the human kill, but shall not be deducted from the TAH or the credits.

6.2 When a Nunavut beneficiary residing in a (LS) community kills a bear in (LS), the tag will come from their home community. If his/her home community has utilized all of its tags, the tag may be used from any available credits; or another (LS) population community with their consent; or from the next year's TAH.

6.3 When a female with accompanying cubs, yearlings, or two-year olds is killed in the defence of life or property, the cubs, yearlings, and two year olds are also regarded as killed (removed from the population). For TAH determination purposes, the cubs and yearlings will be counted as males, and require only half tag for each cub. The two-year olds will receive a full tag and be counted as their actual sex if killed, or one-half male and one-half female if they are not killed.

6.4 The number of TAH tags allocated in a given year depends on the communities share of the (LS) population’s acceptable annual harvest rate of both males and females, the actual number of males and females killed in the previous year, and the proportion of females in the total harvest in the previous year. The Nunavut Flexible Quota System determines the TAH for the current year as described in Appendix 2.

6.5 The implementation of the Nunavut Flexible Quota System will consider the current polar bear harvest credits (see Appendix 2). As per Appendix 2, no reductions in TAH will occur unless there are no polar bear harvest credits available to address the over-harvest. Unharvested males and females are considered as credits to address any problems resulting from over-harvest of males or females in a particular year, or can be

allocated in future years. In the case of one-half tag reductions to the TAH (i.e., cubs and yearlings that were still with their mother), no TAH reductions will be made until a whole tag (i.e., one full tag) reduction is required.

6.6 Community credits shall be used to cover defence, illegal, or accidental kills before the community TAH is reduced. The appropriate RWO will take the final decision after a review of the HTO request and a summary of the incident has been provided by the community Wildlife Officer.

6.7 The complete rules for administration of the Nunavut Flexible Quota System are contained in Appendix 2. The regulations will not be modified year by year, rather the polar bear TAH for a given year will be determined based on the Flexible Quota System described above and in Appendix 2.

6.8 Any person finding a dead polar bear should report the bear to the nearest HTO or Wildlife Officer, and if the hide or any parts have been taken, they shall be turned over to the Wildlife Officer for investigation. When the investigation is complete and it is concluded that the death was by natural causes, the hide and all parts of the bear will be returned to the nearest HTO, and it will not be counted against the TAH. The existing certification of wildlife regulations will apply to all natural kills. If the specimens identified in Section 5.6.1 are collected, the person shall be compensated according to Section 5.6.2 by the Dept of Environment.

6.9 The TAH will not be reduced in future years just because the full TAH is not taken in any given year. Unused tags will be recorded as credits and can be reallocated in subsequent years at the discretion of the appropriate RWO**.**

Section 7.0

Research and Management

7.1 The intention of the Dept of Environment is to conduct population inventory studies every 15 years to determine the numbers, and rates of birth and death for the (LS) population. Harvest statistics will continue to be collected. The results of these studies will guide future management of this population. The intended date to begin the next (LS) population inventory is 2012 (in spring).

7.2 Community residents (priority to HTO members) shall have the opportunity to participate in polar bear research projects.

7.3 This MOU shall constitute consultation and support for the periodic polar bear population inventory studies identified in Section 7.1. These studies shall be done in partnership with the relevant HTOs and RWOs.

7.4 When a tooth referred to in Section 5.2.1 is not available for the purpose of determining the age, the age of a cub shall be determined by expert testimony (i.e., Qaujimanilik) if there is any question.

7.5 When tag is used for a defence or accidental kill by a non-Nunavut beneficiary, it reduces polar bear harvest opportunities for Nunavut beneficiaries who have been identified as requiring the TAH in Article 5.6.5 of the NLCA. Compensation for that loss is required from the party whose activities caused the destruction of the bear. The parties of this MOU call upon the NWMB as the primary instrument of wildlife management to identify the most appropriate administrative process to ensure that communities that lose tags to non-beneficiary polar bear kills are fairly compensated.

(a) All polar bears killed in or during polar bear research activities or Dept of Environment approved activities (i.e., research permit issued) will receive a tag from the nearest community and the community will be compensated at $5,000.00.

(b) Currently the direction of the NWMB and the RWOs is that the hide, meat, and all parts from emergency kills (i.e., accidental, defence, or research kill) will be returned to the HTO. When there is an irregular kill, the investigating officer will seize the parts of the bear necessary to complete the investigation. The specimens identified in Section 5.6.1 shall be collected and the DSD shall provide compensation to the HTO as per Section 5.6.2. When it has been determined that the kill was an accidental, defence, or research kill, the Wildlife Officer shall ensure that all seized parts from that kill shall be turned over to the local HTO. The cleaning and drying of the hide will be arranged and paid by the HTO because the HTO shall retain the hide.

(c) If there is any dispute on the disposition of the hide, meat, or parts of the bear from an emergency kill, the decision on the disposition of all bear parts is deferred to the appropriate RWO.

(d) There shall be no payment to the HTO or the hunter for specimens, or for cleaning and drying the hide of a bear taken illegally. As per the Wildlife Act, all seized parts from bears taken illegally shall be disposed of as directed by the appropriate judicial authority.

7.6 HTOs and the Dept of Environment will:

(a) Research and develop better methods to:
  i) Deter problem bears,
  ii) Prevent polar bear damage to property,

iii) Prevent loss of meat caches to polar bears. and

(b) Work co-operatively with all jurisdictions that share this population to reduce human impacts from research, tourism, and problem bear control activities.

7.7 Within one year from the signing of this document, the Dept of Environment will ensure that a community based polar bear deterrent plan had been formulated and implemented.

7.8 The terms and conditions of this MOU will also apply on lands within National Parks, Federal Bird Sanctuaries, and National Wildlife Areas.

7.9 If a bear is found that is near death from natural causes, and will not recover, a hunter may take this bear as a humane action. The Wildlife Officer will require the carcass and the hide from the hunter for purposes of conducting an investigation to determine if it was a humane kill. A humane kill will be considered a natural death and will not be taken off the TAH, and the hide and all parts will go to the HTO after the Wildlife Officer has seized the hide and carcass and completed the investigation.

7.10 The HTO may, at their discretion, use a portion of the community TAH for sport hunting. The Dept of Environment will assist any HTO that wishes to develop polar bear sport hunts for their community.

7.11 A polar bear co-management agreement should be developed that includes all jurisdictions that harvest from the (LS) population.

7.12 Inuit Qaujimajatuqangit (IQ) will be incorporated in polar bear management.

(a) The rules established by the HTO to regulate local hunting practices will reflect the wisdom, spirit and information of IQ.

(b) It is recognized that information about denning areas, feeding areas, season concentration areas, behaviour, and the general ecology of polar bears is held collectively by the Inuit, but much of this information has not become a part of the scientific information. The Dept of Environment will support and endeavour to collect and archive the information relevant to conservation and public safety.

(c) Recognizing that information about polar bear population demography (i.e., analysis of the standing age distribution and mark-recapture data) and population boundaries (i.e., observations of the movements of marked bears and radio collared bears) is not a part of IQ, and recognizing that IQ is a living and evolving knowledge system. The scientific information on population dynamics and population boundaries will be transferred by improved communications, and by ensuring participation of local people in research projects and management decisions. The goal is that one day all the information about polar bears will be held in common as science, TEK, and IQ.

Section 8.0
Lancaster Sound Population Signature Block

x_____ date:_____ Qaumayuk Oyukukuk
Chairman
Ikajutit Hunters' and Trappers' Organization (Arctic Bay)

x_____ date:_____ Jaypatee Akeeagok
Chairman
Iviq Hunters' and Trappers' Organization (Grise Fiord)

x_____ date:_____ Isaac Kalluk
Chairman
Resolute Bay Hunters' and Trappers' Organization

x_____ date:_____
Joannie Ikkidluak
President
Qikiqtaaluk Wildlife Board

x_____ date:_____
Olayuk Akesuk
Minister
Department of Environment
Government of the Nunavut Territory

Appendix 1.
LANCASTER SOUND (LS) Polar Bear Population

Boundary was based on the movements of satellite radio-collared polar bears, mark-recapture movements, and guided by the hunting practices and information of local people.

Appendix 2.

Rationale and Administration of the Flexible Quota System

INTRODUCTION

The flexible quota system for polar bears assumes that the annual maximum sustainable yield of males and females for a given population has been divided between the communities that share that population. Each community receives its share of the maximum sustainable harvest of males and females as an annual baseline allocation. For polar bears, the maximum harvest that can be sustained is realized when the harvest is 2 males for every female. However, not every community can harvest exactly 2 males per female every year. In some years, the full allocation may not be taken. In other years the kill may exceed the annual base allocation of males or females. The flexible quota calculation takes into account:
1) Any "credits" from previous years when not all the bears were harvested,
2) The total number of males killed or removed from the population, and;
3) The total number of females killed or removed from the population.

ADMINISTRATION / ACCOUNTING

The flexible quota system is nothing more than system for administering the portion of the total population maximum sustainable yield that has been allocated to a given community. First the sustainable yield of males and females for a given population must be identified. Next the total sustainable yield must be divided among the communities that share a given population. Then the base annual allocation for each community is established and the flexible quota system is used to adjust the TAH as required to keep the kill within sustainable limits.

Simulation modelling has shown that, for polar bear populations about twice as many males as females can be harvested. The sustainable number of females is defined as the number that can be removed without causing a decline in the number of females in the population. However, it is different for the males. Because the males do not produce the cubs, twice as many can be taken. A 2M:1F harvest sex ratio does reduce the number of males in the population to about 70% of the number that would be present if the harvest was unselective. The mean age of the males in the population is also reduced by about 2 years. However, this has the effect of focusing the harvest on younger males in the more abundant age classes. We assume that the females can still find mates and that younger bears mate just as successfully as older bears. The available data support this. There is no evidence of diminished reproduction, even in populations where it is clear that over-harvesting has depleted the males. Males are reproductively mature by the time they are 4-5 years old, and on average females are only available to mate every two years because of extended parental care.

The annual base allocation value is an annual allotment that does not vary. However, if a community over-harvests either males or females in a given year, that over-harvest must be compensated for by reducing the annual actual allocation. The actual allocation is reduced two

ways. The first was is a simple numerical reduction to "pay back" the over-harvested males or females. The second is that if the females are over-harvested, then the community has shown it cannot harvest at a 2M:1F sex ratio. The current allocation for females always gives the maximum number of females that can be taken. However, when an over-harvest of females has occurred in the previous year, the current allocation for males is based on both:

1) The current allocation of females, and
2) The actual proportion of females in the harvest (P_F).

The current allocation of males is determined by the equation for calculating the sex ratio:
P_F = # Females / # Males

Males = # Females / P_F

The value of P_F cannot be less than 0.33 or the take of males would be too large (unsustainable). For that reason, if the actual PF value is less than 0.33, we still use 0.33. If the actual value of P_F is greater than 0.33, the actual value is used.

The actual sex ratio is only taken into consideration when the kill of females has exceeded the sustainable number (i.e., the actual allocation for that year). This is to avoid penalizing a community that shuts down the harvest when the last female has been taken. It is the number of bears taken that really matters. The proportion of females in the harvest is only an indication of what the sex ratio for the next year will be. As long as a community has not exceeded the allowable kill of males or females, there is no reduction in TAH, regardless of the sex ratio of the kill.

Credit is given for any unused current allocation of males and females. The credits can be either male or female. Credits are specific for a given population and cannot be used for other populations. Credits belong to the community that did not fully utilize its actual allocation. A community can use its credits to compensate for over-harvest in a given year. Also, credits can be provided to other communities that share a given population if both communities agree. The community that has over-harvested must request the credit of the appropriate sex from a community that has such credits. If a female credit is requested, a male credit must be exchanged because there cannot be more negative male credits than positive female credits. It is sustainable to over-harvest the males as long as an equivalent number of females are also under-harvested. As long as there is at least one positive female credit for each negative male credit, there is no reduction to the TAH. This means that as long as the total TAH is not exceeded, and as long as the females are not over-harvested, the TAH for the following year will stay at the maximum base allocation.

Credits are a special case because they represent individuals that were not taken, so they are in addition to the estimated population. Credits are administered separately. There is an assumed loss rate of 4% per year for male credits because 4% is the natural mortality rate. There is an assumed increase of 3% per year for female credits because that is the zero-harvest natural population growth rate. Females produce both males and female offspring so the female increase of 3% per year also applies to the males. However, the male increment is 3% times the

number of females since it is the females that produce the cubs. Credits accumulate until the next population inventory, and then they are zeroed because the total population is taken into effect when the new TAH is determined. When the credits are not used, the population will increase allowing larger quotas for future generations.

The rules for how the kill is counted are given in the polar bear MOU for each population are also listed above. They are repeated here using slightly different language:

1. All human caused mortality to polar bears will be taken from the TAH of the nearest community. In the event that the human caused mortality exceeds the TAH, extra tags will be issued, and the TAH for the following year will be correspondingly reduced as per the flexible quota system.

2. A naturally abandoned cub will be counted as a natural death and not counted against the TAH.

3. Any bear that is found near death can be killed as a humane action and, once the Wildlife Officer has certified that the bear was near death, the humane kill will not be counted against the TAH.

4. When a Nunavut beneficiary kills a bear, the tag will come from that person's home community if that community has a TAH in the population that the bear was harvested from. Otherwise, the nearest community must provide the tag.

5. When a female with cubs, yearlings, or juveniles is killed; the cubs, yearlings and juveniles are also regarded as killed (even if they run away). For TAH determination purposes, the cubs and yearlings are counted as all males and only ½ tag each. The juveniles are counted as whole tags of whatever sex they are. If the cubs run away after the female is killed, the cubs are counted as ½ tag and all male, however the yearlings and the juveniles are counted as whole tags for each, and the sex is counted as ½ male and ½ female.

6. The credits are available to address all types of kills, including accidental, illegal, and defence kills.

7. If a community shuts down it's harvest after exceeding the maximum allowable females, the unused tags are counted as harvested males **for calculating the proportion of females only** so as not to penalize the community for shutting down the harvest before filling all the tags. If a community does not exceed the current allocation for females, for TAH calculation purposes the harvest sex ratio is assumed to be 0.33 (i.e., 2M:1F).

8. The community credits accumulate until the next population inventory results are final. Then all credits are set back to zero because the new TAH is based on the new population information, and all of the sustainable take is allocated as

the new TAH. Any credits will be realized as TAH increases if the population information was accurate and the credits are not used. The communities then resume collecting credits from the new start, as before.

9. Each year male credits are reduced by 4% per male because of natural mortality. Each year female credits are increased 3% per female and male credits are increased 3% per female because of the natural (no-harvest) population growth rate.

Here is an example to show how the calculations are made:

The flexible quota system has been in use since 1996, and is well tested. The lessons learned have been incorporated into the new computer program, and hopefully the more fully developed system will be sufficient for all cases.

The 1999/2000 Coral Harbor harvest is a good example of the general principles.

The base allocation is 26 males and 13 females.
The allocation for 1999/2000 was 26 males and 13 females.
The credits going into the harvest year were 8.67 males and 2.33 females.
The kill for 1999/2000 was 21.5 males and 16 females.

The first step was to deal with the over-harvest of the females.
There were 2.33 credits to cover the over-harvest of 3 females.
That left 0.67 female over harvest to be covered from the next year's allocation of 13 females.

13-0.67 = 12.33 as the 2000/2001 allocation of females.

Next the TAH for 2000/2001 has to be determined.

The females are known (12.33), so it is a matter of determining the total number of tags that can be allocated without exceeding the sustained yield of females (12.33) and males (26) for the 2000/2001 harvest season.

When the kill of females exceeds the sustained yield and the credits are not sufficient to cover the over-harvest, the TAH for the next year is calculated using the actual sex ratio of the harvest rather than the 0.33, which was exceeded. The reason for this is to avoid allocating too many tags causing an even larger over-harvest of females the next year.

The actual sex ratio was 13/37.5 = 0.34666.

However, we the community did not fill all of it's tags. If the full 39 had been killed, and the last 1.5 had been males ... the sex ratio would have been better. We do not want to penalize the community for stopping the harvest as a conservation measure, so we assume the unused tags were males for the purpose of calculating the sex ratio. This is not in the MOUs, but it gives

communities that stop harvesting the benefit of the doubt as an incentive to STOP HARVESTING once the last female has been taken.

The effective sex ratio is 16/39 = 0.41025.

The TAH for next year is based on the following relationship:

Maximum Females Taken = TAH* Proportion Females

We know the Maximum Females Taken = 12.33
We know the sex ratio from last year was 0.41025
The TAH is given by:

TAH = Maximum Females Taken / Proportion Females
= 12.33/0.41025
= 30.05

By convention we round up the total to 31 with a recommendation that the kill not exceed 12 females and 19 males.

We keep track of all the fractions so the communities always get their full allocation and full credits. However, the recommended tags are always whole numbers that, if followed, will result in the full TAH for next year.

IMPORTANT: The sex ratio consideration is only implemented when the kill of females exceeds the available allocation and credits. That means that if Coral could obtain a transfer of 0.67 females credit from some other Lancaster Sound Population community, they would receive their full TAH of 39. They are being reduced both by number of females allowed AND by the 0.41025 sex ratio. However, Coral should be warned that the larger TAH also increases the risk of over-harvesting females.

The credits for males and females are based on the base allocation and actual kill. In most cases a reduced TAH is because of an over-harvest problem with females, and that is why the male credits seem to accumulate more than female credits. When the total TAH is reduced because of over-harvest of females and failure to harvest at the 2M:1F sex ratio, the determination of male credits is based on the base allocation provided there was no over-harvest of males the previous year. Thus the full credits from the estimated maximum sustained yield are correctly accounted for.

Here is a final simple recommendation that will prevent any reductions in the TAH from the flexible quota system: **Stop hunting when the last female is taken.**

If there are any difficulties in using or understanding this program or the counting rules, please contact your local Wildlife Officer, or the Polar Bear Biologist.

Appendix 3.
Harvest Risk Management Protocol

Management decisions on polar bears are guided by the information available. One of the most important management decisions is the number of males and the number of females that can be harvested. Because the TAH is a number, the decision is based mainly on the quantitative data on polar bear population demography (population number and natural rates of birth and death). However, the demographic information is not always available for each population. Even when the demographic information is available it is not perfect, it is uncertain. Research programs that provide the demographic estimates also provide a measure of the uncertainty of the estimates produced by the study.

There are two ways that the demographic data can be "checked". The first is to see if the estimates make sense. If the natural rates of birth and death would not sustain a polar bear population even if there were no harvest, then they are probably not correct. If the population estimate suggests that the current harvest would be reducing the population, but the population is known to be extending its range and increasing its numbers, then the population estimate is probably not correct. These qualitative "reality checks" are useful to avoid serious management mistakes, but do not provide the necessary quantitative information for a sound decision on the TAH.

Even when the full demographic information has been collected, and the parameters seem to make sense; the variance of the estimates of birth and death and population numbers (i.e., variance) document that these estimates are not exact, but rather have varying degrees of uncertainty. A variance estimate is a measure of how much the parameter might be off. This kind of uncertainty is quantitative, and we can accommodate it.

Our population inventory programs provide good estimates of demographic parameters. We then use the computer to simulate the future under many, many scenarios. Each scenario is a "what if" run. Each run takes a different set of parameter values that are based on the variance estimates. This method of exploring different outcomes based on the uncertainty of the main factors is called the Monte Carlo method. When it is applied this way it is also sometimes called Population Viability Analysis or a Bayesian probability estimate.

Most times population viability analysis is concerned with avoiding reducing the population so much that it goes extinct. In our case, we want to avoid reducing the population below levels that would be "unacceptable". By "unacceptable", we mean reductions that would require a long time for the population to recover. The decision of what constitutes "unacceptable" is subjective, and would be identified through consultations with hunters and Nunavut's co-management process. Even after the unacceptable level of reduction has been agreed and accepted, there is always some risk that the population may decline to a value less than the agreed level. The co-management authorities must also agree on the acceptable level of risk that there is a reduction worse than the one judged to be acceptable.

Our recommendation for large and productive populations is that the harvest and total kill be limited to a number that gives 90% certainty that the population will not decline to a level that

would take more than 5 years to recover. When independent information provides a strong reason to believe that the population can sustain a larger harvest, a minimum of 80% certainty can be tolerated. The certainty estimates require a population inventory cycle of not longer than 15 years. When the information on the population is very uncertain, fewer bears can be harvested. This means that there is value to the community (larger TAH) for good information. It also means that if the information is dated and suspect, as it is for many of Nunavut's polar bear populations, that the TAH will be reduced as a result. Both conservation polar bears and TAH are enhanced by good information, and compromised by poor information.

When there is no commitment for a population inventory cycle, or the population has such low numbers that it is not cost-effective to maintain a periodic inventory schedule, a more conservative harvest management is required. The criteria for these populations will be 95% certainty that the population will not decline to a level that would take more than 5 years to recover over a 75-year time interval. If monitoring of these small populations can occur more frequently, these criteria can be relaxed accordingly.

A final issue is that many of Nunavut's polar bear populations are shared with other jurisdictions. There is little value in reducing Nunavut TAHs if other jurisdictions that share polar bear populations with us continue to over-harvest polar bears and refuse to accept their financial obligations for the population inventory cycle. An essential component to risk management is that it must be accepted and implemented over the entire range of the population to be fair and effective.

This harvest policy commits the GN to a polar bear research program sufficient to conducting a population inventory of its large populations every 15 years. There must also be a comprehensive harvest collection program, and inter-jurisdictional agreements between Nunavut to participate in and cost-share the inventory and harvest monitoring programs for shared populations.