BRIEFING NOTE ON KEY MANAGEMENT ISSUES FOR THE BLUENOSE-EAST BARREN GROUND CARIBOU HERD

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SUMMARY

The marked decline of the Bluenose-East (BNE) herd since 2010 has led to a caribou conservation proposal from the community of Délı̨nę entitled *Belarewíle Gots'ę̀ Ɂekwę́* which includes a number of measures including a harvest management code, as well as a proposal from the Environment and Natural Resources (ENR) to limit the annual harvest of the herd to a total of 950 bulls, or roughly 10% of the bulls present in the herd (2.5% of the total herd).

Macdonald (2016) reviewed ENR census methods for the Ɂehdzo Got'ı̨nę Gotsę́ Nákedı (Sahtú Renewable Resources Board – SRRB) for technical rigour, and with a second objective to assess the status of the *List of Key Emerging Issues* developed by the SRRB as they relate to the condition of the BNE herd. The review found that ENR's survey methodology was consistent

with scientific standards, had been independently reviewed (Fisher *et al*. 2008), and that the decline in numbers and the herd vital statistics collected during surveys were accurate. There was little information on other factors such as the possible impacts of bull-only harvest, and the condition of habitat and losses due to predators in relation to the BNE herd. These factors may affect how the strategy of harvest limits will impact the recovery time and the long-term productivity of the herd. The harvest limits proposed will impact the use of the resource by Sahtu beneficiaries.

This briefing note examines several additional key factors influencing the BNE herd that are not addressed in the ENR proposal but have been identified as concerns both within the Délı̨nę plan and at the March 1-3, 2016 public hearing in Deline. Currently available evidence regarding the barren-ground caribou ecotype of *Rangifer* indicates that populations in decline require time without disturbance and with suitable habitat to be able to stabilize herd numbers and to recover to former levels.

In the absence of herd-specific data in a number of key areas, this report provides a summary review of the current scientific understanding of barren-ground caribou ecology as it may apply to management of the BNE herd, with respect to the following topics:

- The status of the BNE herd
- The use of collars
- Bull-only harvest or selective harvest
- Predator control
- Cumulative effects
- Climate change

The 2015 survey of the BNE showed a decline which has continued since 2010. Several indicators collected during the survey show low female pregnancy rates and survival and low calf numbers that suggest that the herd will continue to decline. Harvest limits may have been involved in slowing the decline of the Bathurst and Bluenose-West herds, and may slow the decline of the BNE, however the harvest of young bulls may also have long-term effects on the viability of the herd. External factors such as climate change and cumulative impacts of several stressors may continue to impact the herd. Protection of the critical habitat of the BNE from development should be a priority to allow the herd to recover in its natural state.

THE STATUS OF THE BLUENOSE-EAST HERD

The herd has declined from 114,000 in 2010 to 38,592 in 2015, indicating a decline of roughly 50% and an annual rate of decline of adult females of 29% (Boulanger *et al*. 2014, 2016). In addition, several indicators of herd condition (e.g., female survival, pregnancy rate, calf:cow ratio, calf recruitment) from the 2015 survey were below the levels that are needed for the herd to remain stable in numbers, or to begin increasing. Pregnancy rates and survival of adult

females were <70%, well below the levels necessary for a stable herd. These latest results indicate that the herd is continuing to decline and that steps need to be taken to stop the loss of individuals and to allow the herd to recover.

The ENR proposal is primarily focused on the view that the survival of the productive adult female age class should be improved by reducing their harvest. The decline in the Bluenose-West and Bathurst herds appears to have slowed in recent years due to improved recruitment of calves into the herd and possibly as a result of reduced harvest (Davison 2015). However questions remain regarding the impacts of selective harvesting of a large proportion (roughly 10%) of bulls in the herd, the potential impact of other factors that might reduce the effectiveness of harvest limits, and whether the reduced harvest rate is sufficient to allow the BNE herd to recover.

Key Message

The decline in the BNE since 2010 is similar to the declines observed in the Bluenose-West and Bathurst herds, as well as *Rangifer tarandus groenlandicus* herds elsewhere in the Arctic. The declines are probably natural in origin, and may be related to global weather patterns, however it is important to reduce harvests and disturbance of the herd to allow it to stabilize and begin recovery.

THE USE OF COLLARS

Virtually all estimates of the status of the NWT barren-ground caribou herds are based on survey methods using electronic collars on a small number of males and females. There is general consensus among Sahtú organisations opposing the use of collars, on the basis that they harm the caribou[1]. Collars became widely used in the 1970s as electronics allowed tracking of individual animals using VHF, or pulse, collars. Individual animals were located using a hand-held receiver with a directional antenna. ENR now uses GPS (satellite) collars that are generally smaller, but require larger-lasting batteries. In the 2015 census of the BNE herd calving ground survey, ENR used 30 GPS collars on females and 24 collars on bulls (Boulanger *et al*. 2016). In general, more collars help with the precision of estimates of survival and total numbers (Rettie 2008, Fisher *et al*. 2009), although residents of the Sahtu would like to see collars eliminated and new methods found to provide the same information.

The rationale for the use of collars to count individuals in the BNE herd is based on the behaviour of adult female migratory barren-ground caribou to aggregate into clearly defined groups during calving (Fisher *et al*. 2009). This grouping behaviour in the same area annually, in an area defined as the calving grounds, is attributed to favourable habitat for food and predator avoidance at a critical time in the annual cycle. Collars placed on individual adult females are

[1] Letter to Minister Miltenberger from Behdzi Ahda First Nation, Délı̨nę First Nation, SRRB, and Sahtú Secretariat, Inc., June 10, 2015.

used to locate and photograph all calving groups during peak calving to ensure that all adult females are surveyed. Additional surveys in the autumn are used to count bulls to provide the estimates of all 1+ year-old individuals in the herd.

Relatively few western science studies have been conducted to determine the effects of the collars on the caribou. A study by Rasilius *et al*. (2014) reported that heavy GPS collars reduced the survival of collared caribou that are in poor body condition and in a declining herd by roughly 18%. They concluded that during a population decline, when survival and reproduction are already low, the added weight of the collar may be significant stress to the animal (Rasilius *et al*. 2014). These authors, and others (Haskell and Ballard 2007), suggest that the reduced survival of the collared individuals may bias the estimation of vital statistics, such as rates of reproduction, for the herd. Hebblewhite and Haydon (2016) caution on the use of the collars, but suggest that their advantages (e.g., accurate survey of the herd) outweigh their potential problems.

The consensus appears to be that the collars provide a valuable tool for assessing the status of the herd, but they may reduce the survival of the collared animals marginally. The estimation of vital statistics needs to take into account potential biases caused by the collars. ENR has had their survey methods reviewed (Fisher *et al*. 2008) and refined (Rettie 2008) and any bias is likely accounted for in their demographic models. Currently there is a tradeoff between herd management and the welfare of the collared animals. ENR is also investigating other methods, such as direct tissue samples from harvesters, faecal sampling, genomics assays and other techniques to provide a comprehensive view of caribou body condition and to ensure collar data are interpreted and validated appropriately.

Key Message

From a scientific point of view, collars currently provide the best option for accurate counts of large, discrete migratory caribou herds such as the BNE herd, although ENR is working to improve methods toward reducing and eliminating the use of collars.

BULL-ONLY HARVEST OR SELECTIVE HARVEST

Several questions have been raised about the potential impact of a bull-only harvest on the recovery and long-term productivity of the BNE herd. Given the composition of the herd in 2015, 950 bulls would be roughly 10% of the bulls in the population, a large proportion of any specific age/sex class.

Several studies have been conducted on the conservation of herds where selective harvesting occurs due to trophy hunting or similar practices. Trophy hunting of mature males is usually conducted on species such as Dall's sheep and mountain goats, where only males are taken from the population. Male-only harvests shift the sex ratios towards females and, depending on the ages of the harvested males, may also shift the age of the remaining males lower.

Male caribou are important for social structure of the herd, and their removal may destabilize social structure, change the ratio of sexes in offspring, depress the recruitment of calves and cause changes in the habitat selection by reproductive females (Milner *et al*. 2007) and may cause genetic drift in the population (Sæther *et al*. 2009). Mating behaviour is also slightly different in the different age groups of males, with older males mating during peak estrous (the time of sexual receptivity in the females), while younger males mate earlier and later during the rut (Tennenhouse *et al*. 2012).

These studies indicate that the removal of a large proportion of males may have a significant impact on the productivity of the BNE herd over the long-term due to genetic and social factors. The Bluenose-West herd stabilized at roughly 20,000 individuals when recruitment improved and at roughly the time that limits were placed on harvesting (Davison 2015. The long-term consequences of the bull-only harvest, and how the effects may be expressed, are largely unknown.

Key Message

Evidence from studies on selective hunting of populations show that the removal of a significant proportion of a sex or age class can significantly impact the ecological, social and genetic structure of a population. The current view is that the removal of younger bulls of the BNE will have little impact on the viability of the herd and will help retain the productive adult cows, while allowing access to harvested caribou. This view needs to be supported by field studies, and the viability of the herds monitored.

PREDATOR CONTROL

The extent of losses of adult females in the BNE herd due to predation by wolves, grizzly bears and other predators is still a major question. ENR estimates the annual survival of females in the BNE herd in 2015 at about 72%, much lower than the level of 80-85% required to sustain the herd. The two main routes of cow mortality are predation and harvesting.

The nature and timing of losses in the BNE herd from predation are not known (Davison 2015). The impacts of wolf predation on caribou herds have been underscored by Bergerud (1988, 1996) who estimated that wolves at a density above 6.5/1000 sq kilometers will cause a herd to decline, while lower densities of wolves will allow the herd to increase. Hayes and Russell (1998) used field data from the Porcupine herd (>100,000 individuals) to estimate that wolves kill roughly 7,600 bulls and cows per year, primarily during fall and winter. An Alaskan study reported that grizzly bears killed from 2 calves per day for males to over 6 calves/day for females with cubs, over the 2 weeks of the study (Young and McCabe 1997).

ENR has responded to pressure to reduce predation by improving its wolf harvest program, however there is no evidence that the program will reduce losses to wolves in the BNE herd because the program is not focussed on wolves associated with any particular herd. ENR data on wolf and grizzly numbers submitted to the Wek'èezhìı Renewable Resource Board in response to an Information Request shows a significant number of wolves in the range of the BNE herd (Figure 1) and grizzlies (Figure 2; data are for 2008 and 2010).

A recent study of wolf distribution near the Bathurst herd indicates that as the herd declined and spent more time in its northern range in the summer, the pressure from wolves was reduced due to the increased distance between the wolf denning areas and the herd (Klaczek *et al*. 2015). Several examples of increasing caribou herd numbers through wolf control generally involve woodland caribou which cover a much smaller range and in which the wolf packs involved are clearly defined. As the number of caribou in the BNE, Bathurst and Beverly herds decline, it is likely that the numbers lost due to wolves will also decrease as the difficulty to locate the remainder of the herd becomes more difficult.

Figure 1 Numbers of wolves on the BNE range. Data provided by ENR to the Wek'èezhìı Renewable Resource Board.

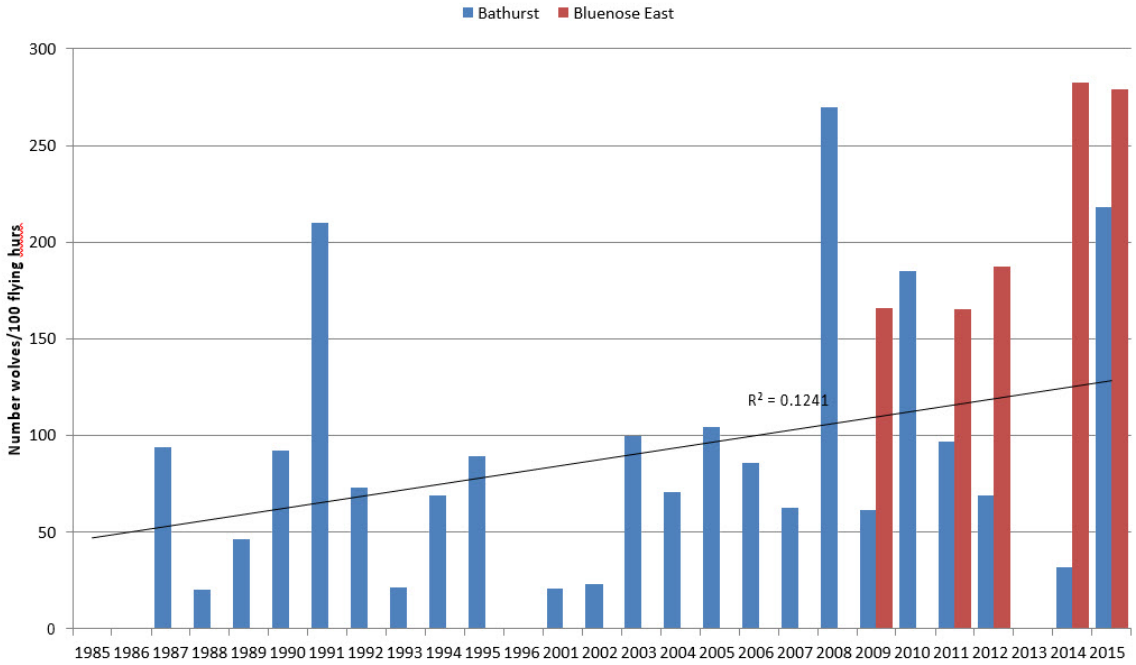
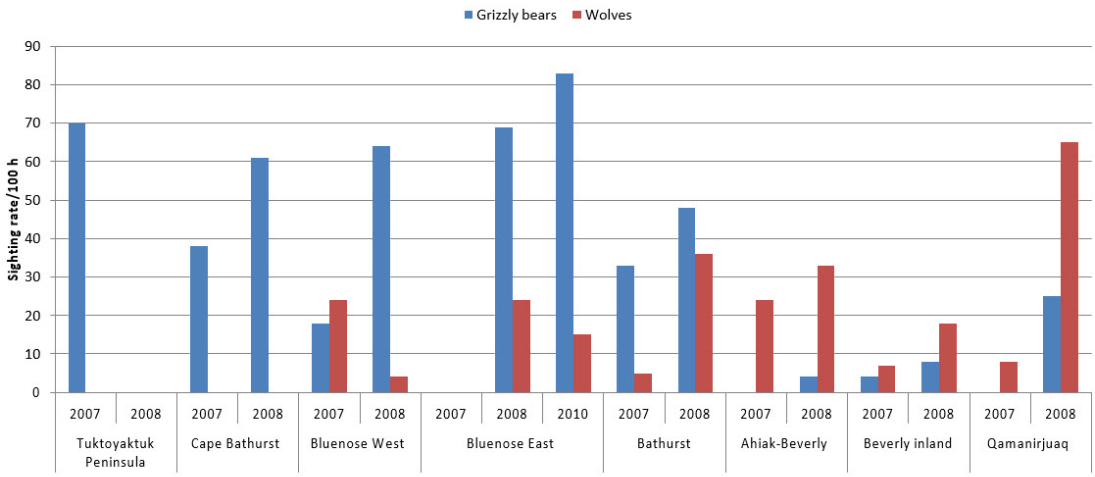


Figure 2: Numbers of grizzly bears and wolves on the BNE range. Data provided by ENR to the Wek'èezhìı Renewable Resource Board.



Key Message

Although the number of BNE caribou lost to predation is unclear, wolves and grizzly bears are known to kill a large number of calves and cows annually. Wolves are harvested for fur by some individuals, however the concept of wolf control on a large scale to protect the BNE is not supported by Sahtu residents and the current ENR program of wolf harvest is unlikely to affect the predation on the BNE. Losses by predation will probably decline as the smaller herd becomes less accessible and the wolf population also declines.

CUMULATIVE IMPACTS

Cumulative impacts is a general term used to describe the additive effect of a number of small stressors on an animal population. With the BNE herd, the cumulative impacts may be caused by a combination of changes to habitat, predation, development in the migration route, disease and contaminants. Most viable populations are able to withstand the changes caused by any of these stresses, however if several stresses are active at once, or the population is declining as part of a natural trend, then cumulative impacts may have a significant effect on herd status.

One potential stress on herd behaviour is the response of caribou to disturbance caused by development of roads, communities, mines and related infrastructure. An assessment of the impacts of the Diavik, Ekati and Snap Lake mines on distribution of the Bathurst herd showed that Zones of Influence (ZOI) ranged up to 50 km (Boulanger *et al*. 2012). Smaller ZOIs were observed for the smaller mines (Dominion Diamond 2014). Fortin *et al*. (2013) showed that this avoidance by caribou could result in an aggregation of caribou at the margin of the ZOI, which

could result in increased predation in the area. Johnson and Russell (2014) showed that the Porcupine herd avoided communities to a large extent when monitoring of the herd began in the 1980s, but less so in recent years, possibly due to the process of habituation.

Together these studies indicate that human activity and development cause short-term behavioural response and possibly the abandonment of areas of the seasonal range (Johnson and Russell 2014). The studies point to the need to ban development in critical areas of the migration cycle and the need to protect a critical portion of the BNE range from development and disturbance of the herd. Methods need to be developed to monitor, mitigate and manage cumulative effects (Gunn *et al*. 2014) in light of increasing development in the range of the BNE herd.

Key Message

The concept of cumulative impacts encompasses the overall effects of a number of small stressors on a population. For example, human activity and disturbance, changes to habitat, insect harassment, contaminants or nutritional deficiency and disease are examples of stressors that my combine to reduce the productivity and viability of the BNE. At present no indicators have been developed to monitor cumulative impacts in the herd and no cumulative impact assessment has been conducted on the BNE – from a scientific perspective, these would need to be undertaken as a basis for considering cumulative impact management measures.

CLIMATE CHANGE

The range of the BNE herd covers roughly 300,000 km^2 of the NWT and Nunavut, with spring, summer and fall herd distribution in NWT and Nunavut, and overwintering areas almost exclusively to the south of Great Bear Lake (Fig 2, Davison 2015). During its annual cycle, the herd travels through several ecozones, including the southern Arctic zone above the tree line during calving, and the Taiga Shield and Taiga Plains below the treeline (ESWG 1995).

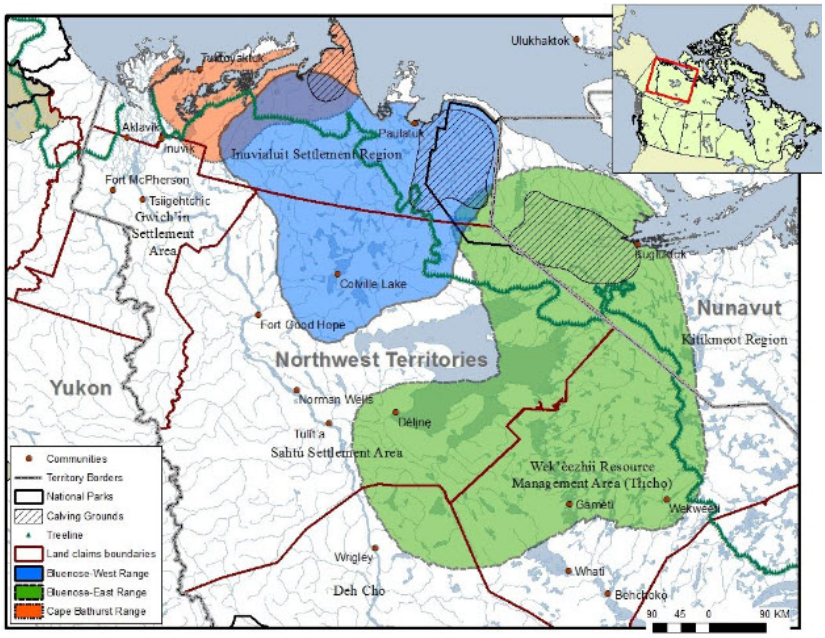


Figure 2 Range of the Bluenose-East herd (green). Calving ground are shown as hatched area (from Davison 2015, after Nagy 2011).

Several scientific assessments conclude that there are a large number of ongoing changes in the physical and biological systems in response to increasing ambient temperature. The report Snow, Water, Ice and Permafrost in the Arctic (SWIPA), published by the Arctic Monitoring and Assessment Program (AMAP 2011), and the Arctic Climate Impact Assessment (ACIA 2005) evaluate studies reporting changes in the Arctic, many of which are attributed to climate change. Observed changes in the physical and biological systems of the Arctic are significant and indicate that the BNE herd needs to recover in an environment undergoing major change. Increasing incidence of fire, for example, due to warmer temperatures and drier conditions may have significant impacts on the quality of the range. A list of environmental changes that have been observed occurring are listed in Table 1. The cumulative impact of these changes on the BNE herd is not known.

Table 1 Summary of some changes observed in the Arctic in response to a warming climate (ACIA 2005, AMAP 2011).

Effects in the Physical Environment	Effect	How will it impact Barren-ground caribou
Physical Environment		
Permafrost	Thawing of permafrost	Makes migration more difficult with thawing surface layer
Precipitation	Warmer temperatures and loss of sea ice increases humidity in air masses	May result in increase of freezing rain and increased depth of snow. Feeding and

Effects in the Physical Environment	Effect	How will it impact Barren-ground caribou
	moving out of the Arctic Ocean and increases on-shore precipitation	movement by caribou in winter more difficult
Ambient Temperature	Warming of surface temperatures above historic levels	Ambient temperature in Arctic has increased by 1-2 degrees C in the past decades, greater than the amount in southern regions.
Drought	Some areas may experience drier conditions due to warmer temperatures	The quality of food may decline; increased chance of fire.
Surface water flow	Thawing permafrost releases pore water that flows into streams, rivers and lakes.	Water released from permafrost increases the turbidity and solids in local streams and rivers.
Ice	Ice-up is later in fall and thaw occurs earlier in spring	Migration rates and routes may be affected due to changing conditions of land and surface waters
Biological System		
Plant green-up in spring	Time of green-up becomes earlier with increasing ambient temperature	Early green-up provides favourable nutrition in early spring but the timing in relation to calving is changed.
Plant species	Increasing numbers of grasses and shrubs	New plant and animal species could mean changes in diet in herbivores and loss of some food species
Invasive species	Southern species expanding their range into the NWT, or from southern to northern NWT	Invasive species of plants or animals may displace resident species.
Distribution of species	As climate changes, the ranges of species change as conditions become less extreme	Changes in major species, such as moose, muskox and grizzly bear may cause competition with barren-ground herds
Insect harassment	Increased harassment with warmer drier conditions	Insect harassment increases with warmer conditions causes loss of condition in caribou.
Disease and parasitism	Increase in disease/parasitism as warmer climate improves survival of intermediate stages in the environment	Higher incidence of disease; increased parasitism and new species of parasites reduce body condition of caribou.

Key Message

Studies have shown that the onset of climate change in northern Canada has caused major changes in the physical environment and biological community in the terrestrial system that will impact the environment in which the BNE lives. Rapid changes in summer and winter precipitation, ambient temperature regimes, species composition of vegetation and animals will require acclimation by the BNE. These environmental changes are a critical consideration for the BNE where the timing of major life history events such as calving, migration and the rut require synchronization with environmental cues. Major cross-

disciplinary research initiatives are necessary to better understand climate change impacts and management implications.

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