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**TECHNICAL REVIEW OF  
THE PROPOSED MANAGEMENT PLAN  
FOR THE BLUENOSE-EAST BARREN GROUND CARIBOU HERD  
(NWT ENVIRONMENT AND NATURAL RESOURCES)**

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**INTRODUCTION**

This review was initiated by a request from the ʔehdzo Got’ıne ʔotsé Nákedı (Sahtú Renewable Resources Board – SRRB) for a critical assessment of the western science behind the Bluenose-East herd management plan, as proposed by Environment and Natural Resources (ENR). The objective is to provide a synthesis addressing topics identified in the *List of Key Emerging Issues* developed by the SRRB based on discussions in the Sahtú Region over the past year, as well as Information Requests by Parties to the hearing. It is recognized that the community of Délıne has put forward a second proposal, but it will not be the focus of this review.

Surveys of the herd since 2010 have shown a steep decline in total numbers and the number of productive females. Given the steep decline and small size of the herd, ENR makes the case that

there is now a need to limit the harvest as one tool to help the numbers stabilize, to sustain the herd and to promote the recovery. It is proposed that hunters exclusively harvest young bulls to save the productivity of the cows and older bulls. This will provide much needed traditional food to communities and promote the recovery of the herd.

During this review, I was impressed with the discussions and transparency between co-management boards, the territorial government and the amount of community involvement. All parties are working towards a focused approach to reduce the stress on the Bluenose-East herd and to promote their recovery.

The impacts of the management action are potentially huge. If harvesting is not limited when the herd is at very low levels, then there is a chance that events like extreme weather or predation may reduce the numbers even further and the herd may become locally extinct. The recent paper by Adamczewski and co-workers (2015) looked at the history of the decline of the Beverly herd, and showed that a combination of harvesting, predation and other factors reduced the numbers to the point that the herd effectively disappeared. In a relatively short span of time of 10-15 years, the herd declined from 200,000 to virtually zero. This is probably one of the best documented examples of a herd being eliminated in modern times and shows how important it is to continue monitoring, and the importance of implementing management actions to provide protection to a herd.

Government scientists have conducted studies on the northern caribou herds since the 1940s. In the beginning their methods were poor, which led to huge errors in herd counts. In one example (Ruttan 2012), surveys in the early 1950's gave a total number of 680,000 barren-ground caribou in one year and 278,000 a few years later. Government agencies made the calculation that indigenous hunting must be taking roughly 100,000 caribou a year to explain the change in herd size. Programs were started to investigate the high harvest rates and to poison wolves. Studies later showed that the harvest was nowhere near those levels. The problem was very poor survey methods and the fact that a large portion of the herds was missed in the second survey. The current methods and technologies for surveying and for reporting harvests are far superior today, and similar errors of that magnitude are unlikely. But it's a valuable lesson that facts and methods need to be independently confirmed and verified on a continuing basis to ensure that management actions will lead to the necessary outcomes.

To develop this synthesis, I reviewed reports and publications located by on-line searches, including those by ENR scientists and in response to information requests, and critically judged whether the information is suitable for the management of the Bluenose-East herd. Many of the published studies were written by current and former ENR and Canadian Wildlife Service employees, academics and consultants hired by ENR with years of experience in caribou biology

and advanced analysis. Some of the work published in peer-reviewed journals is truly groundbreaking. The role of technology such as satellite data and remote sensing will make a significant contribution to the management of the herds (e.g., Chen et al. 2014).

However, there seems to be a disconnect between research and need for the tools necessary to actively promote recovery of the Bluenose-east herd. Developing surveying methods with finer and finer precision on herd indicators may not provide the information required to promote growth of the herd.

The Bathurst herd is the focus for much of the advanced analysis on factors affecting herd productivity and growth because of the history of research on the herd. Some of that analysis could now be used to add new information about the Bluenose-East herd and to direct resources toward specific questions. The natural history, ecology, biology and stresses of the annual migration cycle for one barren-ground herd might be significantly different between herds, but it provides a valuable starting point for research. Considerable work has been done on the factors that may be involved in the decline of the Bathurst herd. Possibly some of that work can be directed at looking at similar factors in the Bluenose-East with a view to proactively developing an approach to aid in the recovery of the two herds.

## ISSUE: CARIBOU MONITORING APPROACHES AND OPTIONS

There has been a lot of discussion in the scientific literature about the best methods for monitoring herds and the best statistical analysis to count barren-ground caribou during its annual migration cycle. Methods differ depending on the objective of the study and logistics and the time of the year that the count occurs, for example during calving or post-calving. The methods must be consistent with previous surveys. In 2010, 2013 and 2015, ENR surveyed the Bluenose-East using a calving ground survey, with data from studies at other times of the year to estimate bull:cow ratios. This type of survey is best for counting the number of females, survival of females since the last count and calf numbers.

In general, ENR does an excellent job with the technical components of designing the research, counting the herd and analyzing the result. The accuracy and precision of the herd metrics are critical to accurately assess the current status and productivity of the herd. The latest surveys of the Bluenose-East herd have been conducted as calving ground surveys, with supporting studies during the rut for bull:cow ratios.

ENR requested an independent review of methods used to survey caribou from the Alberta Research Council in 2009 (Fisher et al. 2009). The study concluded that ENR uses appropriate methods to collar and survey the herds, although they should use more collars to reduce the

uncertainty for some indicators, such as female survival. They also determined that the evidence was conclusive that the northern herds were truly declining and that it was unlikely they missed large groups, or that there was significant movement between herds. ENR has recently shown again that there is little movement between herds and that all major NWT herds were declining at the same time. The independent review was a valuable contribution to NWT caribou management because it provided a transparent, independent assessment of methods and an independent confirmation of some findings.

The accuracy and precision of the surveys on the calving ground depends on the numbers of collars on the adult females. A report for ENR by Rettie (2008) estimated that roughly 60 collars are required for counting Bluenose-East caribou during calving, but it would take at least 80 to accurately determine survival rates of cows, an important measure of the ability of the herd to recover. Fewer collars would result in large uncertainty for some measurements. In 2013, 31 collars were fitted on cows with another 19 on bulls, although they were not part of the survey. In 2015, 30 collared females were tracked and 24 bulls were collared although they again were not part of the calving ground survey. These numbers are probably the minimum for accurate counting of females and estimates of productivity.

## ISSUE: HABITAT CONCERNS

Habitat and the condition of the range are critical for the health and condition of individual caribou and the productivity of the herd. The range provides food and nutrition, protection from predators and areas to escape from flies in the summer. Work by Carruthers and co-workers (1986) reported that bulls and cows with young in the Bluenose herd used different areas of the winter ground, probably due to the females using open areas to escape from wolves. Little work has been published on the Bluenose range since then.

In a significant paper, Chen et al. (2014) used satellite data to show that indicators of range quality, such as forage biomass and quality, can predict a large portion of the changes in productivity (as defined by calf:cow ratios, survival rates and abundance) of the Bathurst herd. Good range quality in one year resulted in a better chance of favourable calf:cow ratios two years later. This study was an excellent combination of modern technology with survey data to show that summer range quality has a clear beneficial impact on the productivity of the herd and helps provide impetus for protection.

The technical report on the state of information on the Bluenose herds by Davison 2015 indicates that there are no currently no data on the habitat quality for the Bluenose-East herd. It is reasonable to assume that range quality may degrade when the herd is at a maximum and the density is high, however other factors such as drought, fire and climate change may reduce or slow the ability of

the range to recover. The work by Chen and co-workers indicate that it may be possible to use satellite data or other remote methods with ground surveys to develop indicators of habitat quality, similar to those developed for the Bathurst herd.

The issue of fire destroying large portions of range is a serious concern for hunters and communities in the Sahtú. In its response to the second Information Request from the SRRB, ENR indicates that work by Don Thomas suggests that fire does not degrade the use of the range by caribou as much as expected over the long-term. This is supported by Anderson and Johnson (2014) who showed that caribou avoided burn areas shortly after the burn, then began using the area the next year as regrowth began. Fire does not appear to be as large an issue for distribution of the herd as expected.

Habitat quality and quantity are critical factors in the maintenance and recovery of the herd but how important this is for the Bluenose-East herd is still an open question. Possibly the work of Russell into environmental trends will shed some light on the current status of habitat indicators such as moisture and vegetation. It might be possible to do rapid surveys of range quality through satellite surveys, similar to those used by Chen and co-workers, if methods can be optimized.

## ISSUE: HARVEST MANAGEMENT

*“Conclusions drawn by directly linking the harvest regulation with changes in caribou productivity thus could be misleading, without first quantifying and removing the impacts of natural factors (Chen et al. 2014)”.*

There is a general consensus within the wildlife managers on the numbers of individuals that can be removed from a herd and still be able to sustain total numbers. In essence, the number of young recruited into a herd must equal or exceed the number of females that are removed, by natural means or harvesting.

The consensus is that herds can accept harvesting at a constant rate of 5-8% of the total numbers when the herd is large and expanding, but that number should be reduced (e.g., to the proposed 2.5%) when the herd is declining or at very low numbers. The lower the value, the more rapidly the herd should recover, all other factors being equal. The harvesting of immature bulls is also a reasonable compromise to provide caribou to communities while reducing pressure on the herds. This is consistent with caribou management methods in Alaska, Quebec and Nunavut.

In its Appendix to the Technical Summary, ENR outlines a Rule of Thumb for harvest recommendations. The main factors affecting harvest rates are:

- 1) The current trend in the population size (increasing or decreasing)
- 2) The rate of harvest in relation to the herd size (as a percent)

### 3) The sex ratio of the harvest.

There is very little information supplied as to how the Rule of Thumb is applied, and how the data are used is poorly described. Factors such as the impact of predators, herd accessibility, environmental factors such as extreme weather events are considered, but not in a transparent way. I recommend that ENR not use the Rule of Thumb approach without a lot more consultation and work to define how it is used and what the data requirements are. At all times, the methods used to establish harvest limits should be clearly defined and transparent.

ENR has discussed managing the three Bluenose herds as a single metapopulation, but have shown that the preferred method is to manage them as three separate herds. Management of herds as metapopulations is recommended when the herds have strong enough similarities that management of the group saves resources and improves management outcomes. There are enough differences among the three Bluenose herds in terms of calving grounds, habitat and migration routes, and areal coverage during the annual migration cycle that ENR should manage them as individual herds. This is also the view outlined by ENR in its response to the information requests.

## ISSUE: PREDATOR CONTROL

ENR has outlined a cautious approach to predator management. It is clear that predators (wolves, grizzly and black bears, golden eagle) can have a significant impact on the calf mortality and the survival of mature cows. There are several examples of wolf control resulting in the recovery of smaller herds (e.g., in Alaska and Quebec), followed by declining numbers after the control of wolves is lifted. The strongest proponent of the effects of predation by wolves is Bergerud (1988, 1996) who estimated that wolves at a density above 6.5/1000 square 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 to estimate that wolves kill roughly 7,600 bulls and cows per year, primarily during fall and winter. These numbers accounted for about for about 7.4% of the herd when it was at a minimum of 120,000. The number of adults killed did not change with the size of the herd. Predation by wolves was also implicated in the loss of the remnants of the Beverly herd.

The predation rates on the Bluenose-East herd, and the stage of the annual migration where the herds are most sensitive to predation losses, are unknown (Davison 2015). In the ACCWM management document, management actions to understand and control predation when the herd size is low are to review results of research and monitoring program and consider predator management. There is no attempt to start by quantifying the losses to predators. Without this critical information, harvesting is assumed to be the primary factor responsible for the losses of

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females. It is difficult to understand why ENR hasn't at least monitored the losses due to predation and have a good idea of the numbers involved. I'm not recommending predator control, but do suggest that ENR conduct surveys to measure the losses due to predation throughout the migration cycle to arrive at estimates of the losses to calves and cows.

## ISSUE: EFFECTS OF DEVELOPMENT

It is difficult to synthesize research on the effects of development on caribou herd status. In 2004 we worked on a project for the Arctic Monitoring and Assessment Program on the effects of oil and gas development in the Arctic on caribou. Most of the studies we reviewed were conducted near the oil and gas fields of Prudhoe Bay in Alaska and the TransAlaskan pipeline. The opening of the resource during the 1980s and 1990s resulted in a massive development of roads, camps, airstrips and oil and gas facilities. Despite this, three of the major caribou herds increased in size over the twenty years, while the Porcupine herd, which was not near the oil and gas fields, decreased in size. Pictures of herds near the oil and facilities published by industry showed the public that oil and gas activity and caribou can co-exist.

Some field studies showed that there were changes within the Central Arctic herd which indicated displacement to avoid roads and human activity. Cows with young were displaced from calving grounds (Cameron et al. 2005), however the herd was still increasing in size despite not using its prime calving area. Other studies (Boulanger et al. 2012) have shown changes in distribution of the Bathurst herd near diamond mines, with a zone of influence of about 14 km from the mines. Similar changes in herd movements were observed near communities in the Porcupine herd (Johnson and Russell 2014).

These studies show that communities, roads and other developments can cause major changes in the distribution of migrating herds and possibly cause them to move from preferred calving grounds. Although there is currently no development in the Bluenose-East calving grounds, camps, mines and other development in the range of the herd may change migration routes. ENR is currently developing guidelines to reduce stress from industrial activity. This is one factor that may require the government to restrict development in some cases or regulate activities such as plane and helicopter flights and other activities to reduce stress on the herd.

## ISSUE: CUMULATIVE EFFECTS

Cumulative effects on caribou can be defined as effects which are caused by the combined results of past, current and future stresses. With caribou, the cumulative impacts may be caused by a combination of small changes to habitat, predation, development in the migration route, disease and possibly contaminants. Small changes may add together to cause a loss of sustainability in the

herd. Gunn and co-workers (2014) provide a framework for understanding and mitigating cumulative impacts on the Bathurst herd in the presence of development. Methods to mitigate cumulative impacts to caribou herds include modifying timing and location of disruptive activities (e.g., flights, ground traffic) and modifying the footprint of a project.

There do not appear to be any studies to quantify natural and man-made cumulative effects in the Bluenose-East herd and it follows that there have been no recommendations to mitigate impacts. The most effective way to study cumulative effects is to determine one or more indicators that are associated with the health of the herd, and to monitor those indicators with changes in climate, habitat, human activity and development.

## ISSUE: DISEASE AND PARASITES

The presence of disease and parasites in caribou affects both the health of the individuals and their use by harvesters. The University of Calgary has maintained an active research program to record the presence of parasites, some of which have been shown to be increasing, probably due to a warming climate. The researchers have also documented the presence of new species of parasites. The activity of warble and biting flies in the summer also greatly reduce the condition of females and result in the herds aggregating and moving to open areas to avoid the activity. There are indications that flies may increase in numbers with a warming climate.

Community-based monitoring of harvested caribou is an important channel for providing the status of the condition of cows and bulls. It is important to note that the reduced hunting on the Bluenose-East herd will also reduce the number of harvesters on the land and thereby reduce the reporting of caribou conditions to the community monitoring program being envisioned in Délı̄ne's *Belarewı̄lé Gots'é Pekwé* proposal.

## CONCLUSIONS

To summarise the results of the review, the table below shows the current state of information on the Bluenose-East herd, and whether information is available which can be used to sustain and promote the recovery of the herd.

The major issue with the current management strategy for the Bluenose-east herd is that most of the resources appear to be invested in counting and monitoring the herds, and extracting information on herd composition. Tools or approaches to actively manage the herds are limited to harvest controls. Because of the lack of information in some areas, such as predation or habitat quality, the only control that ENR has over herd management is the harvest rate. Controlling the harvest is now critical to recovery of the herds but information is lacking in these other areas.

In its response to the second Information Request from the SRRB, ENR outlined additional approaches, such as guidelines for industry working in the area and submissions to environmental assessments. These are important steps, and the development of policies to sustain the herd are an important part of the strategy, but current knowledge of the herd from research programs and communities will help direct management activities in the appropriate area. Because of the cultural, social and nutritional importance of caribou to communities and indigenous culture, there needs to constant technical oversight and communication before management actions are implemented.

Factor/Measurement	Information available
Numbers of caribou	Yes
Condition of the females and herd composition	Yes
Harvest	Yes
Predation (wolves, bears, wolverines)	Unknown
Industrial development	Moderate (currently unlikely an issue with the Bluenose-East)
Habitat (including fire), climate change	Unknown
Cumulative impacts	Unknown
Disease/Parasite/Biting Flies	Moderate (some research available)

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