



## FAX COVER SHEET

**TO:** Mr. Joe Tetlich  
Porcupine Caribou Management Board

**DATE:** January 8, 2010

**PHONE #:** 1-867-633-4780

**FAX #:** 1-867-393-3904

**# of PAGES:** 23

---

**FROM:** Jacquie Van Marck for Lisa Jarvis  
Executive Assistant to  
Deputy Minister Kelvin Leary  
Environment Yukon

**PHONE:** (867) 667-5460

**FAX #:** (867) 393-6213

### DESCRIPTION:

Please find attached the letter regarding the Summary of Responses from Yukon Government's Consultation on the Porcupine Caribou Interim Conservation Measures and Appendix A, B & C.

A hard copy of entire package in mail today.

This communication is intended for the use of the addressee **ONLY** and may contain information that is privileged and confidential. Further disclosure, dissemination, distribution, copying or use of this communication in whole or in part by any other person in any manner is strictly prohibited. If you have received this communication in error, please notify by telephone immediately and return the original message to us at the above address, at our expense.

If you have not received all of the faxed pages please call Lisa Jarvis at 667-5460(work) immediately.



Environment  
Office of the Deputy Minister

Box 2703, Whitehorse, Yukon Y1A 2C6

January 07, 2010

Mr. Joe Tetlich  
Porcupine Caribou Management Board  
Box 31723  
Whitehorse, YT Y1A 6L3

Dear Mr. Tetlich:

**Re: Summary of Responses from Yukon Government's Consultation on the Porcupine Caribou Interim Conservation Measures**

Further to Minister Taylor's letters to you dated September 25, 2009, and on behalf of Minister Taylor, I am replying in greater detail to your concerns raised during the Yukon government's consultation on the interim conservation measures for the Porcupine caribou herd (the "Herd").

Please accept my apologies for the delay in our response. Yukon government wanted to wait until the consultation had been completed, and until all parties' concerns were thoroughly reviewed and considered by our Government. Part of this assessment included reviews by scientific specialists outside of Yukon government.

This letter will address the three most common issues raised by the majority of the parties: conservation, the consultation process and the cooperative management process.

**CONSERVATION**

The *Porcupine Caribou Management Agreement* ("PCMA") defines "Conservation" to mean *"the management and use of the Porcupine caribou and its habitat which best ensures the long term productivity and usefulness of the Herd for present and future generations."*

The Yukon government's rationale for implementing mandatory harvest reporting and mandatory bulls-only harvest was based on our understanding of the Agreement's focus on ensuring conservation as well as a sustainable harvest. Our first priority is to conserve the Herd for present and future generations.

-2-

The high onus on conservation is intended to safeguard the Herd so it can continue to remain viable and productive and it can support the needs of user communities. If we do not implement conservation measures now we could be in a position in the near future of much more limited or non-existent harvesting opportunities, followed by very long periods of recovery.

We currently estimate the population of the Herd to be 90,000 and we also note that this is similar to the PCMB's estimate of 90,000 to 100,000 on their website. Both the biological and traditional information indicate a prolonged decline, more than seventeen years; a decline that we project will continue into the future, noting that the 1989 aerial census was 178,000.

The available harvest information, albeit fifteen years old, indicates an average annual harvest of 4000 caribou, of which approximately 80% are taken by Canadian aboriginal hunters. Additional harvest information indicates that approximately 60% of that harvest is made up of cows.

It must also be noted that climate change is anticipated to have an overall negative effect on the Herd's productivity in the future. More specifically, the effects of climate change are likely contributing to changes in the habitat and how the Herd uses its traditional range. For the past four years the Herd has not calved on its traditional calving grounds in Alaska and wildfires have burned a significant portion of the winter range in the Old Crow Flats. Also, the effects of hunting have increased with the completion of the Dempster Highway in 1979 (which runs through the core Canadian winter range) and the potential for additional harvest pressures resulting from reduced opportunities in adjacent declining herds.

Besides the human caused challenges, the Herd has its own natural limitations. It is naturally one of the least productive barren ground herds in North America in terms of calving rates and survival, which means that harvesting (composition and level) must be managed with extreme caution. The extensive range used by the Herd also exposes it to a wide variety and number of predators.

In addition to the many known limiting factors, there are poorly understood broader ecological forces impacting the Herd, as demonstrated by rapid declines in other caribou herds in both North America and around the world.

It was on the basis of these cumulative pressures facing the Herd, more than seventeen years of steady decline in the herd numbers and a significant harvest including the high proportion of cows in that harvest, that Yukon government was compelled to initiate actions intended to protect the productivity of the Herd.

-3-

We believe that a significant cow harvest, during the current decline in the population, is inconsistent with conservation. Yukon government's interim conservation measures strike a balance between ensuring proper conservation of the Herd while providing ongoing harvest opportunities in a manner that minimally restricts the exercise of harvesting rights compared to more restrictive alternatives such as quotas or a total allowable harvest.

Since the most recent harvest information is fifteen years old, acquiring current, accurate and verifiable harvest information is essential in order to fine tune caribou population projections, monitor the efficacy of the interim harvest regulations, and ultimately move towards conservation measures supported by all parties. The Yukon government was thus compelled to generate more current and accurate harvest information through a mandatory reporting requirement.

We have attempted to minimize interference with traditional and current harvesting practices by requiring only that harvests be reported and evidence of sex be provided in a reasonable time following harvest.

We acknowledge that the Yukon government has taken a somewhat different approach to protecting the Herd at the current population level, compared to that in the proposed Harvest Management Plan ("HMP") by the Porcupine Caribou Management Board ("PCMB"). Based on our experience with voluntary measures for both hunting and harvest reporting, the Yukon government does not have confidence in relying on voluntary measures, especially when significant change in harvesting practices is needed in a very short time over a large area with numerous users and considerable access.

#### **↓ Consultation**

It is our view that we have carried out the consultation in accordance with the definition of consultation in the Final Agreements and that we have met our consultation obligation. Our perspective is that we gave (a) sufficient notice of consultation; (b) a reasonable time period; (c) the opportunity to present views; and (d) full and fair consideration regarding the interim measures. All feedback was carefully considered throughout the consultation process that is outlined in Appendix A.

Yukon government also initiated discussions with Yukon First Nations prior to the formal consultation period. In late 2008, the Premier and three Yukon First Nation Chiefs met to discuss the need to implement interim conservation measures for the Herd. As a result, a working group of senior government officials from Yukon government, Vuntut Gwitchin First Nation (VGFN), Tr'ondëk Hwëch'in (TH), First Nation of Na-Cho Nyäk Dun (NND) was established to discuss a possible bulls-only harvest, legislative mechanisms (both Yukon government and self-governing First Nations) and harvest reporting mechanisms (tags, etc). Documents and records of discussion were exchanged and there was considerable dialogue respecting these potential measures. In addition, the Minister

-4-

attended the PCMB meeting in January, 2009 to indicate that interim measures needed to be advanced while the HMP continued to be developed. PCMB members, by virtue of the PCMA, are "representatives" of the parties, and heard the direct concern and interests expressed by the Minister, to whom the board would make its recommendations.

The initial notice of consultation dated March 27, 2009 identified Yukon government's intent to consult on the interim measures and included information on the purpose and a timeline for consultation, initially ending May 29, 2009. The consultation period was extended twice (June 30, July 31) to allow parties time to consider the information the department provided and to open up a dialogue through face to face meetings or correspondence. Yukon government also held meetings after the formal consultation time period.

During the formal consultation period ending July 31, 2009, and shortly thereafter, Yukon government heard from VGFN, TH, NND, Inuvialuit Game Council (IGC), and the Gwich'in Tribal Council (GTC), as well as the Wildlife Management Advisory Council (North Slope) (WMAAC(NS)) and the PCMB.

As part of the consultation process Yukon government has given full and fair consideration to the concerns raised and has, where appropriate made accommodations in relation to our management decisions. The following examples demonstrate this:

- 1) Yukon government included a provision in the Porcupine Caribou Subsistence Harvest Regulation (the "Regulation") that provides for an automatic review and possible amendment of the interim measures after a HMP is accepted by the parties, in order to support its implementation.
- 2) Yukon government included provisions in the Regulation that provide for cooperative arrangements and agreements with the parties that satisfy the objectives of these measures in an effective and verifiable manner. Yukon government remains willing to consider such arrangements or agreements and are currently in discussion with one First Nation related to a specific Memorandum of Understanding.
- 3) Yukon government provided additional scientific rationale ("Scientific Rationale for implementing conservation measures to protect the Porcupine Caribou Herd") for the interim measures after receiving requests from some FNs for justification.
- 4) Yukon government contracted an additional objective review of the proposals from Dr. James Schaefer, Professor of Biology, from Trent University (attached in Appendix B).
- 5) At the request of two First Nations, Yukon government provided funding to assess the scientific logic in the rationale paper. The report is contained in Appendix C, identified as the "EDI report".

-5-

- 6) Yukon government modified the original proposal from a mandatory tag system to a less onerous mandatory reporting system.
- 7) The consultation period was extended twice to allow parties time to consider the information Yukon government provided and to provide more direct dialogue through face to face meetings or correspondence.

As a result of the input received, the legislation enacted to implement interim measures has been the least restrictive to achieve its conservation objectives.

The interim measures give harvesting priority to First Nations and the Inuvialuit. There is no restriction on the number of caribou aboriginal groups can harvest while non-aboriginal harvest opportunities are reduced by half. It is estimated that the non-aboriginal harvest of 240 caribou will likely drop to half that level while the aboriginal harvest could remain at its historical average of 4000 caribou.

It should be noted that Yukon government has also received strong support for the interim measures from VGFN. Also, although opposition was expressed to the way Yukon government advanced the interim measures, there was unanimous support for some form of conservation measure to protect the Herd from further decline.

#### **↯ Cooperative Management**

The Yukon government respects the collaborative and cooperative processes associated with the management of the Herd and will continue to work towards achieving a HMP that reflects an acceptable long term harvest management approach that is supported by all participating parties.

It must be noted that the Yukon government has been engaged in the collaborative processes established in the PCMA for a number of years on this particular issue. At the onset of the harvest management discussions Yukon government transferred one of its two assigned seats on the PCMB to the TH to allow it to have an equal voice on the PCMB. Also, the Yukon government, through its member on the PCMB, initiated the HMP concept and was instrumental in securing additional funds for the PCMB harvest management planning process, as well as additional core funding to the PCMB.

Yukon government has demonstrated flexibility and co-operation throughout the HMP process, but has maintained that there is a critical need for effective conservation measures at the current population level.

It is our view that the interim measures are complementary to the HMP process. They are intended to address the pressing need for conservation until an effective HMP has been approved by all parties. The interim measures were modelled on the first draft of the HMP which called for mandatory bulls-only harvest for the current herd size. The draft HMP has taken over five years to be developed, including a scoping document, and

-6-

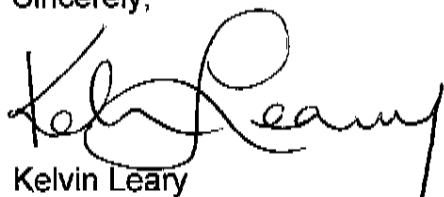
currently the responses from all parties have ranged from not supporting the HMP to requesting its immediate endorsement.

## Moving Forward

We would now like to move forward and finalize discussions on a HMP, particularly those components related to lower population issues. Yukon government believes that the draft HMP contains a good framework to build upon. I am confident that there will be an opportunity to continue to develop the plan and recommend that the HMP process should move forward on two fronts, first, to resolve the differences of opinion on effective management actions at the current population level and, second, to work out how the provisions in the orange and red zones will be implemented. Of particular importance are the measures that must be undertaken if the population declines to 75,000 caribou. The importance of having agreed-upon measures that can be acted on swiftly if population numbers continue to decline towards this "trigger" milestone cannot be overemphasized. Yukon government and others must be fully prepared to respond to such conditions if they are encountered in the near future.

Yukon government believes it is in everyone's best interest and in that of the Porcupine caribou, to continue to work towards the completion and implementation of a HMP.

Sincerely,



Kelvin Leary  
Deputy Minister, Environment Yukon

cc. Elaine Taylor, Minister of Environment  
Government of Canada  
Government of Northwest Territories  
Yukon Fish and Wildlife Management Board  
Gwich'in Renewable Resources Board  
North Yukon Renewable Resources Council

## Appendix A

### List of meetings, letters, and emails associated with consultations on the interim measures.

PRE-CONSULTATION PERIOD		
<p>PCMB passed a unanimous motion in 2006 that the Porcupine Caribou Herd was in need of conservation. Work began in 2007 on a HMP at Yukon Government's urging. The expected time frame was one year. Yukon Government briefly considered whether interim conservation measures could be established during the summer of 2008, but decided to wait another year to see if the HMP could be completed. In winter of 2008-2009 Yukon Government began initial conversations with the Yukon First Nations about the need to establish some interim conservation measures for the PCH in absence of an agreed HMP. The Minister met with the PCMB in January of 2009.</p>		
START OF FORMAL CONSULTATION PERIOD (March 30, 2009)		
All parties	letter to (March 30)	notification of consultation period (March 30 to May 29)
NND/TH	letter to (April 2)	
IGC	letter from (April 27)	
NND/TH	letter from (April 29)	
PCMB	letter from (April 29)	
WMAC(NS)	letter from (April 30)	
GTC	letter from (May 21)	
VGFN	letter from (May 25)	
ORIGINAL END DATE OF FORMAL CONSULTATION PERIOD (May 29, 2009)		
PCMB	face to face meeting in Whitehorse (June 2)	
All parties	letter to (June 4 and 9)	notification to extend consultation period to June 30
All parties	letter to (June 4)	provision of "Scientific Rationale" paper
WMAC(NS)	face to face meeting (June 6)	
GTC	email from (June 9)	
NND/TH	letter to (June 9th)	
PCMB	letter from (June 12)	
NND/TH	letter from (June 16th)	
IGC	face to face meeting Sachs Harbour (June 16)	
PCMB	letter from (June 26)	
FIRST EXTENDED END DATE OF FORMAL CONSULTATION PERIOD (June 30, 2009)		
GRRB	letter from (July 2nd)	
IGC	letter from (July 21)	
All parties	letter to (July 22)	notification to extend consultation period to July 30
WMAC(NS)	letter from (July 24)	
NND/TH	face to face meeting in Dawson (July 24)	
END DATE OF FORMAL CONSULTATION PERIOD (JULY 30, 2009)		
All parties	letter to (September 8)	
GTC/GRRB	face to face meeting in Inuvik (September 11)	
All parties	letter from (September 15)	notice of approved regulations
NND/TH	letter from (September 25)	
REGULATION APPROVAL (September 28, 2009)		
YUKON CONTINUING TO WORK WITH ALL PARTIES		



## Rationale for Implementing Conservation Measures for the Porcupine Caribou Herd

Yukon Government, May, 2009

Reviewed by James A. Schaefer

June 2009

---

Caribou, it goes without saying, are central to the lives of northern people. At the same time, managing a large migratory caribou herd is complex – challenges that can often be traced to scale. For instance:

- Caribou are the most mobile land animals on the planet. Because of these wide-ranging habits, multiple jurisdictions, communities (even nations) often need to cooperate.
- The implications of management decisions are often long-term. While the rise and fall of migratory caribou herds is pronounced, delay in management actions can exacerbate fluctuations in wildlife populations (Ferguson & Messier 1996).

Here, I review the interim measures proposed for the Porcupine Caribou Herd (PCH). The PCH is one of the best studied (and most important) herds in the world. In short, the Government of Yukon is proposing “to dampen the rate of decline and promote the recovery potential of the PCH” with “a mandatory bull-only harvest for all hunters and a mandatory tag system for all hunters” including “mandatory harvest reporting”.

The rationale for stabilizing herd size is not merely scientific, but there is (to my mind) sufficient reasons for doing so. Indeed, as the document notes, the prospects of climate change, increases in hunter access and looming developments (especially oil and gas) may make this most recent low in the PCH qualitatively different from previous fluctuations. Loss of habitat may be particularly problematic, especially given the temporal and spatial scales of caribou biology. The document notes correctly: “It is hard to protect habitats caribou that caribou used to use but no longer use” (p.24) – a major risk to herds in the future.

To understand whether these measures will be effective, I first provide a quick overview of caribou demography.

### *Dynamics of Migratory Caribou*

The numerical changes of migratory caribou populations are legendary. In a review of the dynamics across several herds, Gunn (2003) concluded that caribou fluctuations appear to have a periodicity of 40-70 years and, moreover, the herds that grow most quickly also appear to decline most quickly. In Newfoundland, for instance, caribou numbers increased dramatically during the latter half of the 20<sup>th</sup> century – for some herds, as much as 100-fold in 40 years – and are now falling at approximately 10% per year, a halving time of just 7 years (J. Schaefer, unpublished data). Moreover, there is remarkable synchrony of *Rangifer* herds worldwide. Most, like the PCH, are declining (Vors & Boyce 2009).

The Porcupine herd is a reiteration of these global trends, although the PCH appears to

fluctuate within a more modest range of abundance (Gunn 2003). Indeed, the pace of the most recent decline of the PCH (3% per year) matches its previous growth (4% per year). These rates are low in comparison to other herds where growth may reach 12% per year (Bergerud et al. 1983, Messier et al. 1988).

The sequence of demographic events – the phases of growth to cessation of growth to decline – is predictable. Productivity and calf survival are first to exhibit evidence of density-dependence (Fancy et al. 1994, Crête et al. 1996), followed by adult female survival (Crête et al. 1996). Calf recruitment appears, therefore, to be an earlier indicator of the direction and tempo of population trends. As the document correctly notes, however, the magnitude of population growth is most sensitive to the survival of adult females (Fancy et al. 1994).

There is no clear consensus, yet, on what sets the upper bound on these populations – i.e., what regulates migratory caribou herds (Whitten 1996, Bergerud 1996). Evidence is accumulating, however, (particularly from the George River and smaller Newfoundland herds; Messier et al. 1988, Couturier et al. 1990, Mahoney & Schaefer 2002) that summer forage is regulating. This is demonstrated by recent reductions in calf weights, poorer nutrition, diminished adult body size, fewer male antler points, and changes in migration leading to less time on the summer and calving range.

In contrast, the document states: “All evidence suggests that the PCH are not limited by food, or any other factor that hunting could compensate for” (p.17). While I am not intimately familiar with the dynamics of the PCH, Allaye-Chan & White (1992, in Whitten 1996) reported the declining physiological condition of females as the herd reached its peak – precisely the expectation if food was regulating. Clearly, an updated synthesis is needed to understand better the recent dynamics of the herd, especially during this period of decline.

#### *Proposed Management Measures for the Porcupine Herd*

A model was developed by the Government of Yukon to provide some scientific rationale for sex-selective harvest. Management scenarios were assessed – i.e., the effects of changing the total harvest and the harvest sex ratio on caribou numbers. Where possible, population parameters were derived from the PCH itself. In my view, the inputs to the model seem reasonable, including the more pessimistic mortality rate (19%) for females. The model demonstrated that, with a sex-selective harvest (20% female, 80% male) at the current total of 4,000 animals per year, the population would continue to decline, then stabilize at approximately 85,000 caribou.

Such a harvest strategy has often been used in the management of ungulates (Milner et al. 2007). Because of the polygynous breeding systems for these species (where one male can inseminate many females), a larger sustainable harvest should be realizable. McLoughlin et al. (2005) also modelled these effects on caribou. They concluded, similarly, that “progressively biasing the harvest sex ratio toward males increased the total number of females and males (albeit at reduced ages) ... and hence likelihood of population persistence.” However, they also reported that the overall annual harvest rate, more so than the degree of male-bias, was the primary contributor to changes in probability of persistence. A sustainable hunt depends more on the total harvest.

In my view, two assumptions of the PCH model are worthy of further scrutiny: (1) that harvest is additive to natural mortality, and (2) that the number of bulls in the population are not a constraint on the proportion of cows pregnant in the fall.

*Additive harvest mortality.*— There is very little evidence (to my knowledge) that has quantified compensatory versus additive hunting mortality for any wildlife population. The assumption, however, is crucial. If harvesting is totally additive, then the document is likely correct that “there is no sustainable harvest for the PCH given the population has been in a steady decline since 1992” (p.18). Hunting would merely accentuate the rate of decline.

However, if summer food is regulatory, then hunting mortality is likely at least partially compensatory; the PCH may respond positively to harvest. Indeed, some evidence from the George River and Middle Ridge herds has showed modest improvement in body condition and recruitment after these herds declined. If so, the population projections for the PCH in the document are likely pessimistic. On the other hand, with the potential for lagged effects and slow recovery of forages, the scope for compensatory hunting mortality would be more pronounced during the increase phase, rather than decline. In the case of the George River herd (RGCH), Crête et al. (1996) wrote: “Managers can actually have very limited influences on the RGCH as it has been naturally regulated by forage on the summer range.”

Finally, to underscore the complexity of the issue, the compensatory response from a strongly male-biased harvest may be less than harvesting of females. This is because males typically segregate from females during calving and post-calving (Bergerud 1996), when compensatory effects might be most pronounced.

In the end, we (as biologists) must acknowledge insufficient evidence to adjudicate on the issue of additive or compensatory mortality. It remains a source of uncertainty for managers.

*Males not limiting to reproduction.*— One potential hazard of male-biased harvesting is reduced productivity should males become limiting to otherwise reproductive females. Such hypothesized effects include failure to breed or delayed breeding, leading to asynchronous or delayed births and, ultimately, lower recruitment. Indeed, there is some evidence of such detrimental impacts in ungulates (Milner et al. 2007).

In Newfoundland, Bergerud (1974) investigated these effects on caribou where a sex-selective harvest reduced the tertiary sex ratio (adult males to adult females) to as low as 1:5. While there were increases in rutting group size, in the proportion of medium-sized stags and in time-during-courtship, there was no apparent decrease in pregnancy. Only once the sex ratio became even lower (1:12; on a small island population) did the proportion of males appear insufficient for mating all females (Bergerud 1974).

### *Final Comments*

The interim measures proposed by the Yukon Government seem reasonable and scientifically justified. Care will be needed, however, to monitor the sex ratio of the harvest and the population. Evidence suggests that an adult sex ratio of 1 male:5 females should not be detrimental to population growth (Bergerud 1974). Of course, population rate-of-growth should

be monitored, too, to gauge the effectiveness of these interim measures as well as the trends and prospects for the PCH.

Furthermore, I concur with the plan with regard to the need for:

- Mandatory restrictions, rather than voluntary measures. There is ample evidence (greenhouse gas emissions are a prime example) of the inadequacy of volunteerism to meet environmental challenges. Of course, the degree to which parties can reach consensus on the necessity for these measures will be important to their implementation. The document correctly identifies the need for wide consultation.
- A system for accurate reporting of harvest. While hunting is the chief management tool for migratory caribou, harvest mortality is often the most poorly estimated population parameter. An empirical assessment of wounding losses would constitute an important part of this estimate. Indeed, in Labrador our estimate (20%; similar to 15% here) was little more than a plausible guess. Of course, the biological outcome – regardless of whether an animal is harvested or mortally wounded and not recovered – is the same.

Finally, I recommend that these measures be implemented in the framework of adaptive management (White et al. 2001). That is, they need to be monitored for their effectiveness with focused, scientific studies. In addition to harvest estimates, such monitoring should include the condition, age, and size of adult females (from hunter jawbones, for instance), calf recruitment and adult sex ratio (from classifications in late winter). The response of the PCH will be the ultimate gauge of conservation success.

#### *Literature Cited*

- Bergerud, A. T. 1974. Rutting behaviour of Newfoundland caribou. In: V. Geist and F. Walther (editors). *The Behaviour of Ungulates and its Relation to Management*. Pages 395-435. IUCN, Morges, Switzerland.
- Bergerud, A. T., M. J. Nolan, K. Curnew, and W. E. Mercer. 1983. Growth of the Avalon Peninsula, Newfoundland caribou herd. *Journal of Wildlife Management* 47:989-998.
- Couturier, S., J. Brunelle, D. Vandal, and G. St-Martin. 1990. Changes in the population dynamics of the George River caribou herd, 1976-84. *Arctic* 43:9-20.
- Crête, M., S. Couturier, B. J. Hearn, and T. E. Chubbs. 1996. Relative contribution of decreased productivity and survival to recent changes in the demographic trend of the Rivière George caribou herd. *Rangifer*, Special Issue 9:27-36.
- Fancy, S. G., K. R. Whitten, and D. E. Russell. 1994. Demography of the Porcupine caribou herd, 1983-1992. *Canadian Journal of Zoology* 72:840-846.
- Ferguson, S. H., and F. Messier. 1996. Can human predation of moose cause population cycles? *Alces* 32:149-161.

- Gunn, A. 2003. Voles, lemmings and caribou – population cycles revisited? *Rangifer*, Special Issue 14:105-111.
- Mahoney, S. P., and J. A. Schaefer. 2002. Long-term changes in demography and migration of Newfoundland caribou. *Journal of Mammalogy* 83:957-963.
- McLoughlin, P. D., M. K. Taylor, and F. Messier. 2005. Conservation risks of male-selective harvest for mammals with low reproductive potential. *Journal of Wildlife Management* 69:1592-1600.
- Messier, F., J. Huot, D. Le Hénaff, and S. Luttich. 1988. Demography of the George River caribou herd: evidence of population regulation by forage exploitation and range expansion. *Arctic* 41:279-287.
- Milner, J. M., E. B. Nilsen, and H. P. Andreassen. 2007. Demographic side effects of selective hunting in ungulates and carnivores. *Conservation Biology* 21:36-47.
- Vors, L. S. and M. S. Boyce. 2009. Global declines of caribou and reindeer. *Global Change Biology* (in press).
- White, G. C., D. J. Freddy, R. B. Gill, and J. H. Ellenberger. 2001. Effect of adult sex ratio on mule deer and elk productivity in Colorado. *Journal of Wildlife Management* 65:543-551.
- Whitten, K. R. 1996. Ecology of the Porcupine caribou herd. *Rangifer*, Special Issue 9:45-52.



**EDI ENVIRONMENTAL DYNAMICS INC.**  
*Natural Resource Consultants*

402 HAWKINS ST • WHITEHORSE, YT • Y1A 1X8 • P: (867) 393-4882 • F: (867) 393-4883

---

Roberta Joseph  
Fish and Wildlife Branch  
Tr'ondëk Hwëch'in  
Dawson City, YT  
(867) 993-7107  
roberta.joseph@gov.trondek.com

26 September, 2009

**Re: Technical Review of Porcupine Caribou Herd Interim Conservation Measures**

You requested a technical review of the document "*Rationale for implementing conservation measures to protect the Porcupine Caribou Herd (Environment Yukon, Yukon Government In prep "For Discussion Purposes Only", July 21, 2009)*" (the document). As per your correspondence of August 6, 2009, and follow-up conversations following our first draft on September 9, 2009 you requested an analysis of the following:

- The scientific approach of conservation of the Porcupine Caribou Herd;
- Whether or not the management models used on page 21–23 are reasonable or questionable;
- The indicators used in the Caribou Calculator (*e.g.*, cow/calf ratios, calf mortality rates, cow mortality rates, body conditions, etc.) in terms of reasonability, and if other indicators should be considered (*e.g.*, current harvesting rates);
- If the management recommendations are reasonable based on all of the facts; and
- Whether or not the degree of conservation concern warrants the interim conservation measures (*i.e.*, mandatory requirements for bulls and harvest reporting).

In the document below we have addressed your requests, and have focused our attention on the key points of your concerns. Specifically, our review comments on the following:

1. The modeling approach used to facilitate discussion (Section 3 of this report);
2. The variables used in the Caribou Calculator (Section 4 of this report);
3. Other variables that could be considered (Section 5 of this report);
4. The management scenarios and recommendations resulting from the modeling exercise (Section 6 of this report); and
5. Additional items relevant to the discussion (Sections 7 and 8 of this report).

---

PRINCE GEORGE, BC • VANCOUVER, BC • WHITEHORSE, YT • GRANDE PRAIRIE, AB

WWW.EDYNAMICS.COM



EDI Environmental Dynamics Inc. (EDI) appreciates the opportunity to conduct this technical review for the Tr'ondëk Hwëch'in. Alastair Franke (PhD), a research associate with EDI from Edmonton, Alberta was the lead reviewer, and Michael Setterington (M.Sc., R.P.Bio.) prepared the report. We trust that the following material will meet your requirements for a consultation process.

## 1 OVERVIEW

The document illustrates existing concerns regarding the long-term observed decline in the Porcupine Caribou Herd (PCH), and the continued future decline as suggested using population modeling. The concern has prompted managers and stakeholders to consider imposing harvest regulations. Several scenarios are presented to illustrate how that decline can be minimized, and presents a rationale for implementing conservation measures to mitigate declines primarily using sex-selective harvest as a management tool. This is generally in agreement with the recommended Harvest Management Plan which suggests a voluntary bull-only harvest and voluntary harvest reporting. The key difference of the Interim Measures is the implementation of a mandatory bull-only harvest and mandatory harvest reporting through implementation of a tag system.

We are in agreement with the Discussion Paper's statement that the current version of the Caribou Calculator should only be used to inform discussion on which subsequent management decisions can be made. The document states that the model is under development, that additional data will help refine out-puts (predictions), and that results of scenarios from the current version of the Caribou Calculator should be only used to inform stakeholder discussion on which subsequent management decisions should be made. To that end, we review the utility of this approach to arrive at the rationale for implementing the conservation measures of a mandatory bull-only harvest and harvest reporting.

## 2 REVIEW METHODS

The conduct of this review required several tasks:

1. Initial review of the Interim Conservation Measures as a stand-alone document;
2. Review of the June 2009 version of the recommended *Harvest Management Plan for the Porcupine Caribou Herd in Canada*;
3. Preparation of an initial draft and review/concurrent communications with yourself to clarify direction of review;
4. Review of relevant literature such as photocensus summaries, calving summaries, and publications on Porcupine Caribou Herd demography;



5. Attendance at a presentation by YG Environment on the rationale for Yukon Governments' transitional conservation measures to protect the Porcupine Caribou Herd; and
6. Access to and review of the "Caribou Calculator."

For the remainder of this document we provide an overview of the modeling approach, a review of the model and a description of the model and its variables as we understand them, a review of the management implications resulting from the model outputs, a presentation of our conclusions as they relate to the validity of the interim conservation measures, and suggestions on future topics of discussion regarding the Porcupine Caribou Herd.

### 3 MODELING APPROACH

Models are often used to simplify, represent and communicate complex systems or processes. They can be classified as one of four possible types depending on our understanding of the system (*e.g.*, Porcupine Caribou herd population dynamics), and the quality and quantity of existing data (*e.g.*, cow mortality; Holling 1978; Figure 1). It appears that the PC Herd size model falls within region 2 — the problem is relatively well (but not thoroughly) understood, but supporting data are sparse.

Management decisions and resulting actions are often required despite the lack of data and limited understanding of the problem (as is the case here). The issue becomes more about improving knowledge of the system (*i.e.*, shifting from regions 1, 2 and 4 to region 3), rather than asking whether or not the model accurately represents the system.

The Caribou Calculator is a stage structured life history model and has used typical life history variables common to models of this type (*i.e.*, age specific mortality rates combined with age specific birth rates). Although there are only four age classes (calves, 1 year olds, 2 year olds and 3 years or older), this is a well known modeling approach and poses little concern particularly in cases where the life history inputs change little with age. Model outputs are presented fairly within this context and warnings to the contrary should prevent users from over-stating the influence of model outputs on policy or management decisions.



DRAFT

PCH Conservation Measures Technical Review

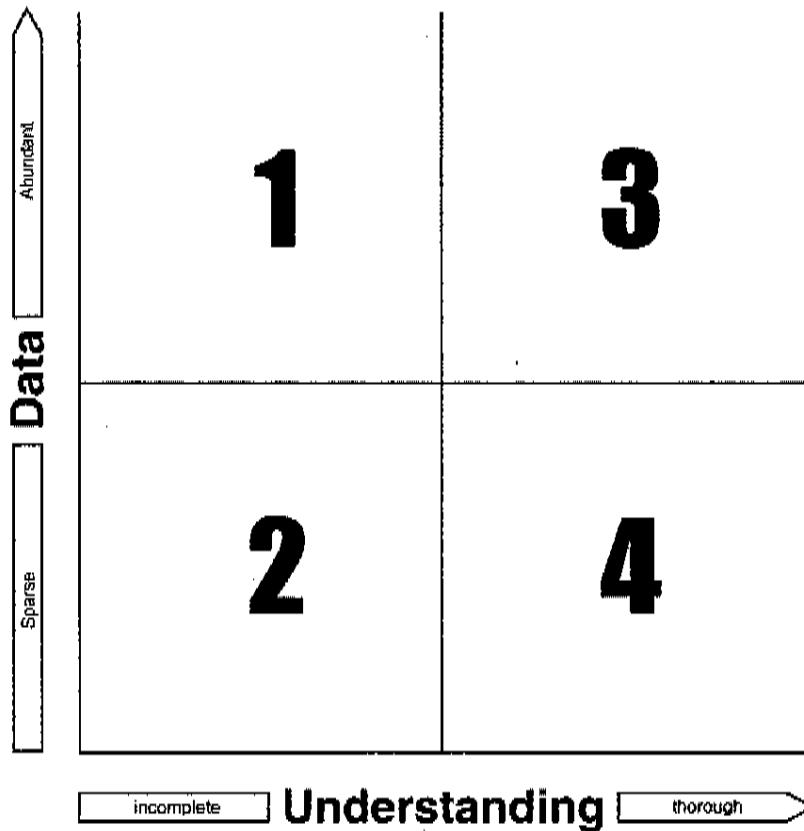


Figure 1. A four-category classification of modeling problems (adapted from Holling 1978).

#### 4 VARIABLES USED IN THE CARIBOU CALCULATOR

This section summarises our understanding of the variables and their interaction within the context of their use in the Caribou Calculator (2009 v6 3 crn).

In general the variables used in the Caribou Calculator are consistent with those used in other models (particularly stage structured models), and are sufficient to make the type of population projections presented in the Interim Measures and elsewhere (e.g., PCMB Harvest Management Plan). The following variables, and the methods used to derive values, are used in the Caribou Calculator:

1. Number of cows is simulated by adding together all cows in each age class (1, 2, 3 years and older) that have survived in any given year.
2. Birth rates are measured empirically and are estimated from the number of collared cows that have calves in any given year.



3. Calf survival is measured empirically and are estimated from cow/calf surveys annually, survival to 9 months of age (*i.e.* the number of calves per 100 cows) is generally considered the best indicator. This value is estimated in the model by calculating the product of 3 calf-specific life history stages (post calving, fall and winter, post migration).
4. Cow survival is measured empirically and is estimated from known mortality of collared caribou.
5. Although local knowledge suggests that approximately 4,000 animals are harvested annually, values for this component of the model remain largely unknown for most years. For this reason it is *important to establish current and on-going harvest levels.*

The model indicates that herd decline can be mitigated by managing three main components (the total number of animals harvested, the ratio of males to females and wounding loss) either in combination or individually. Alternate management scenarios can be compared within the model by varying these components and simulating herd size into the future.

Though managers of the resource are working with the best available knowledge, it is entirely possible that current harvest estimates (*i.e.*, total number of individuals and sex ratio) are inaccurate, and by extension, so too are the model outputs. For example, the total harvest may currently be significantly lower than those values used in the model. Improved precision with regard to harvest estimates would improve predictions of herd size, reduce uncertainty surrounding the sensitivity of herd dynamics to harvest, and would allow managers to prescribe better harvest levels, and provide additional insight into conditions under which the herd can grow.

## 5 KEY MODEL VARIABLE CONSIDERATIONS

Management of the PCH, much like other wildlife populations, has taken place within the context of incomplete knowledge. Therefore, stakeholders responsible for joint management of the herd have based future management decisions upon two main guiding values (Conservation and the Precautionary Principle) and a simulation model (the Caribou Calculator).

These guiding values take into account empirical knowledge (*e.g.*, herd vital rates), common sense (wounding loss), rule-of-thumb knowledge (*e.g.*, annual harvest estimates), and hunches (*e.g.* increased cow mortality under future climate change). The approach is sound and was presented almost 30 years ago by Romesburg in an influential article published in the *Journal of Wildlife Management* (*Wildlife Science: Gaining Reliable Knowledge*, Romesburg 1981).

Simulations indicate that cow mortality less than 15% on average results in positive herd growth (*i.e.*, herd numbers increase), while values of 17% or greater result in negative growth (*i.e.*, herd numbers decrease). Stakeholders have agreed (at the October 2007 workshop in Inuvik) to using a mortality rate of 19% to account for the negative effects associated with weather that are likely to co-occur with climate change.

Stakeholders should challenge the validity of the cow mortality assumption as the literature indicates that higher annual variability in local weather patterns is a likely outcome of climate change, which may result in greater variability with regard to both cow and calf survival (*i.e.*, 19% mortality would

DRAFT

PCH Conservation Measures Technical Review



not occur consistently in each year). This would translate to very good years where large numbers of calves and cows survive and very bad years where mortality of both cows and calves is high.

Regardless, there appears to be broad-based agreement in support of the guiding principles, and for the scenario outputs resulting from simulations using the Caribou Calculator. As stated, the simulation model indicates that total herd size is most sensitive to annual mortality of cows, and any management tool that has the potential to reduce cow mortality should be implemented and monitored closely.

Therefore, *implementation of a sex-based harvest (bulls-only), whether mandatory or voluntary, is prudent and should be implemented with the highest scientific rigor possible.* Stakeholders should challenge themselves with the responsibility for ensuring that the critically needed information (data) is recorded accurately and completely. Without these data and additional annual photocensuses, stakeholders will not have the ability to determine if a bulls-only harvest (and the assumed increase in number of cows) is related to herd dynamics or whether the bulls-only harvest should be maintained into the future. Without this information, implementation of a bulls-only harvest is meaningless for those responsible for managing the herd and for those for whom the herd is a food source.

In addition, we recommend that the stakeholders give consideration to assessing which biological data (*i.e.* key variables) are required to answer the following questions, as they may dictate future recommendations with regard to ongoing implementation of a bulls-only harvest policy:

1. Assuming satisfactory compliance and reporting under a bulls-only harvest, what variables other than cow survival might explain *continued herd decline* as determined by a photocensus?
2. Assuming satisfactory compliance and reporting under a bulls-only harvest, what other variables than cow survival might explain an *immediate and dramatic increase* in herd size as determined by photocensus?
3. Assuming satisfactory compliance and reporting under a bulls-only harvest, and an *increasing trend in herd-size*, how will the sex-biased harvest be implemented to *distinguish between a real effect and a normal cyclic event*?

## 6 MANAGEMENT RECOMMENDATIONS RESULTING FROM THE MODELING EXERCISE

In general, the results of the modeling exercise conducted are consistent with standard modeling procedures, and projections are quite plausible given the suite of underlying assumptions and limited input data available. In addition, the management recommendations that have been made in the context of the modeling exercise are valid.

The overall conclusion of the modeling exercise indicates that adult female mortality is a significant driver of population decline. As such, policy and management actions undertaken to reduce mortality on adult female caribou as suggested by the model is called-for. However, decision makers should bear in mind that the model outputs are the result of underlying assumptions and inputs. Considerable stakeholder effort should be given to discussion of the validity of the model assumptions and the accuracy of data inputs.



For example, the model assumes that harvest mortality is additive to natural mortality and independent of density (*i.e.*, hunting is additive no matter how many caribou there are). Although neither of these conditions necessarily reflects biological reality, their combined effect is presented clearly in this modeling approach. It is the responsibility of managers and stakeholders to consider that harvest of adult female caribou may be compensatory to natural mortality. It is incumbent upon managers and stakeholders to consider the implications of alternate mechanisms regulating abundance (*e.g.*, compensatory mortality, density dependence) and formulate predictions prior to analysis of data collection (*i.e.*, after management actions have been implemented).

To fill data gaps associated with the current version of the Caribou Calculator, careful consideration should be given to which variables are lacking in the context of the management actions. For example, the Caribou Calculator indicated that population growth is sensitive to adult female mortality. Reducing mortality on females is predicted to increase the number of calves and ultimately increase recruitment. It therefore stands to reason that follow-up monitoring should specifically measure number of cows, number of calves and the degree to which these calves are recruited. In addition, one would predict that the age distribution of the population should shift toward younger individuals (*i.e.*, stable age distribution).

## 7 CONCLUSIONS

1. The Interim Conservation Measures document is a technically-justified document that presents well-documented arguments based on all known available information.
2. There is a conservation concern for the Porcupine Caribou Herd, and that conservation concern has been acknowledged by the PCMB. The concern is that if the decline proceeds as predicted, there will be a significant decrease in the population beyond previously documented levels. This decline appears to be a result of increased human activity, climate changes, and harvest within the PCH range. Given the relatively slow progress to date in instituting management actions since the decline was first observed, the degree of conservation concern warrants immediate management action.
3. The only tools available to wildlife managers at this time are the imposition of bulls-only harvest, and mandatory reporting of harvest.
4. Mandatory harvest reporting (tags) will provide the necessary key information for population projections presented in the Caribou Calculator.
5. Comparison of harvest management on the Porcupine Caribou Herd to management of other barren-ground caribou herds (*e.g.*, Forty-mile herd) offer little additional insight to the relevance of the Interim Conservation Measures for the PCH. More importantly to those who use the herd as a food source, by implementing a "bulls-only" harvest, the measures proposed here



allow for no reduction in the total number of caribou harvested annually and avoid designating a potentially contentious Total Allowable Harvest negotiation (a Land Claims issue).

6. The argument of whether or not mandatory or voluntary harvest is required is beyond the scope of this technical assessment. There is no doubt that reporting is required so that accurate harvest statistics can be included in the Caribou Calculator. Whether accurate information can be collected on a voluntary versus mandatory basis is outside of the scope of this review. Regardless, *accurate harvest reporting is warranted.*

## 8 PROGRESSING DIALOGUE

Simulation models are often very useful tools for collating large amounts of information and conducting “thought experiments” that allow managers to quickly investigate “what if” scenarios. Unfortunately, dialogue frequently begins to focus on the model *per se* rather than on broader issues and how the model might be used to further knowledge of the system. In this section we present a flow chart that is intended to help simplify the management choices and advance dialogue beyond the model.

In this case, the central issue relates to whether the agreed upon conservation concern warrants a bulls-only harvest, and valid arguments can be made that result in drawing very different conclusions despite examination of the same data. For example, one may look at the data and conclude that there is no problem; *i.e.* the herd has had fewer individuals previously, ungulate populations are known to cycle naturally and the downward trend appears to be slowing. Alternately, one may take the view that there is a problem given that a long-term decline is clearly present and conclude that precaution is required in the face of an uncertain future and that our best knowledge indicates further declines.

Unfortunately, these different views can set the stage for entrenched positions and complex negotiations. Rather, the focus should be on discovering which of the two views most closely approximates the real world. The first step is to acknowledge that either view could be right. The next step is to scrutinize each view with regard to the implications of either outcome. For example, the view that there is no immediate conservation concern could be either right or wrong. It stands to reason that if this view is correct, then no management action is necessary. Alternately if those that hold this view are incorrect, then some action is required to rectify or mitigate the concern, and a list of potential management options should be considered. Some options may be immediately excluded due to financial, social or other reasons (for example, predator control is perceived by the Yukon Government as unacceptable). Once the list of available management options is finalized, it is incumbent upon managers to monitor the results of any policy that is implemented and to use these results as feedback to better the overall understanding of the system.

*DRAFT**PCH Conservation Measures Technical Review*

## 9 SUGGESTED FURTHER READING

- Beddington, J. R., and R. M. May. 1977. Harvesting populations in a randomly fluctuating environment. *Science* 197:463–465.
- Haydon, D. T., and J. Fryxell. 2004. Using knowledge of recruitment to manage harvesting. *Ecology* 85:78–85.
- Holling, C. S. 1978. *Adaptive Environmental Assessment and Management*. John Wiley and Sons, London
- Lande, R., B.-E. Saether, and S. Engen. 1997. Threshold harvesting for sustainability of fluctuating resources. *Ecology* 78:1341–1350.
- Nichols, J. D., M. J. Conroy, D. R. Anderson, and K. P. Burnham. 1984. Compensatory mortality in waterfowl populations: a review of the evidence and implications for research and management. *Transactions of North American Wildlife and Natural Resources Conference* 49:535–554.
- Romesburg, C.S. 1981. Wildlife Science: Gaining Reliable Knowledge. *The Journal of Wildlife Management* 45(2): 293–313.
- Sedinger, J. S., and E. A. Rexstad. 1994. Do restrictive harvest regulations result in higher survival rates in mallards? A comment. *Journal of Wildlife Management* 58:571–577.

