

## **Presentation at Manitoba Clean Environment Commission Hearings on Bipole III For Peguis First Nation**

**Dan Soprovich, M.Sc.  
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### **Introduction**

My name is Dan Soprovich and I live in Swan River in western Manitoba. I have a Masters of Science in Zoology from the University of Manitoba, as well as a B.Sc. from the same University. I have worked for Ducks Unlimited Canada, Canadian Wildlife Service, and other research and natural resource management agencies. I worked for Manitoba Natural Resources from 1981 to 1995, during which time I was a Regional Wildlife Technician, Population Ecology Biologist, and, during my last four years, the Regional Wildlife Biologist out of Swan River. I have been consulting and teaching since then, including most recently coordinating the assessment of an approximately 45 MW small hydro development in British Columbia. I am currently employed half-time as Lands Manager for Wuskwi Sipiik First Nation near Swan River. I am co-chair and founding member of Moose For Tomorrow of western Manitoba, and sit on the Western Region Moose Advisory Committee.

Recently I have provided technical reviews for Peguis First Nation regarding proposals under the Environment Act. Today I am presenting for Peguis First Nation about select species topics relative to the EIS for Manitoba Hydro's Bipole III project. It should be noted that Manitoba First Nation members have the right to hunt on Crown land in our province. In addition to the ability to exercise these rights, Peguis First Nation is concerned about the impacts Bipole III will have on certain species, including moose.

### **Moose**

I will begin my presentation today speaking to some of the slides in the presentation on moose provided by Hydro and its consultants, Joro and Wildlife Resource Consulting. I understand that this has been an issue of considerable discussion. I think it is important to provide the Commission with some context, as it is clear that the Hydro position has been misinformed and I am uncertain if Manitoba Conservation has provided its position.

I will very briefly provide the perspective of someone who has been on the ground in the region trying to get Manitoba Conservation to do its job. For many years, a number of us have been very concerned about moose populations in our region, and have been making our position known to government bureaucrats and politicians.

Sometime around early 2010, some of us came to the conclusion that matters had to be forced, and we initiated the group Moose For Tomorrow. The group includes members of several First Nations, the Manitoba Metis Federation, and a number of concerned stakeholders and citizens.

We began to push the moose issue culminating in a meeting we coordinated in Swan River where former Minister Bill Blaikie attended to hear our concerns, and where some 200 or so people attended. The meeting began with a prayer by Elder Buddy Brass from Wuskwi Sipiik First Nation, and then Buddy talked about how, when Manitoba

Conservation had come out to the Nation to meet some years previously, he had asked for a five year closure to the hunting of moose in the Porcupine Mountain. One of our members heard Mr. Blaikie ask his staff where the Porcupine Mountain was, and it became apparent immediately that Mr. Blaikie had not come prepared to talk about concerns for the entire region, likely because his staff had not appropriately briefed him.

A number of members of Moose For Tomorrow, and others, spoke to different concerns, including the low populations and management by Manitoba Conservation. By the time Mr. Blaikie left, he had a clear understanding of the local users perspectives, including the need for sustainable management of the regional populations and the closure of areas to all hunting.

Independently, and before the government of Manitoba took action, the Wuskwi Sipihk First Nation demonstrated leadership by instituting a ban on all moose hunting on its >40,000 acres of lands. Manitoba Conservation, under the leadership of Mr. Blaikie, consulted with First Nations and Metis in the area, and a ban on all forms of moose hunting emerged. First Nations and Metis made the sacrifice to not hunt moose, in an effort to bring the populations back, and hunting effectively ceased beginning in 2011 and including the fall and winter of 2011.

The Duck Mountain Moose Advisory Committee was struck; it took some time for Manitoba Conservation to understand that it was more than just the Duck Mountain that was in play, and the name was subsequently changed to the Western Region Moose Advisory Committee.

We currently consider moose management in an area including and from Game Hunting Area 12 in the north to Game Hunting Area 19A in the south. This includes the Porcupine Mountain and the Duck Mountain, and lands north, east, between, and south of the Mountains. And so this is where we find ourselves today ... in short, our coalition and collective actions forced Manitoba Conservation to address the decline in the moose populations by closing Game Hunting Areas to hunting, and now we are collectively working moving forward to develop long-term management plans.

## **Moose – Caribou Comparison Presentation**

### **First slide.**

The Manitoba Hydro / Joro slide indicates that the **Age of Maturity** of moose is 2.5 years. I am unsure how Hydro defines age of maturity; however, wildlife ecologists typically define this as the age of sexual maturity. The **following slide**, for Manitoba and from a 1992 paper by Dr. Vince Crichton of the Manitoba Department of Natural Resources, indicates that 36% of the 1.5 year old moose were pregnant in the sample from the province.

**Annual Recruitment Rate (calves surviving per female)** for moose. This population management parameter is missing for Manitoba populations, in that surveys are typically conducted some 4 or 5 months prior to when one would recruit the calves into the population at one year of age. Therefore the statistic would change between when it is collected in Manitoba and when one would recruit calves into the population. The moose study being championed for the Duck Mountain population by Moose For Tomorrow and the Manitoba Wildlife Federation would examine this data gap.

The slide indicates **Potential Population Growth Rate (Lambda)** of “**Up to 1.40**” and “**Commonly 1.10 – 1.20**”, but does not provide the complete picture in that it fails to provide population growth rates for populations that are declining.

For example, the growth rate for the declining GHA 14/14A ‘population’ in western Manitoba, using the data in a slide in the Moose Presentation and for the period 1992 to 2011, is 0.84.

Another example is for adult moose in a population in Minnesota, which, per Lenarz et al. (2009), declined precipitously (0.67 to 0.98 annually over a 6 year period, with an estimate of 0.85 over the long-term). Considering potential rates of decline along with increase is fundamental to understanding population stability.

### **Moose Presentation**

**Slide “Late winter cover important”.** I want to emphasize the importance of cover during the winter and summer, and particularly in the context of global warming. Moose will overheat, and then must use energy to thermoregulate, at about 14 C in the summer and –5 C in the winter. Under such conditions, appropriate cover can be selected to keep from overheating. There is correlative evidence to suggest that the recent crash of a moose population in Minnesota was a function of warm temperatures over the period of the crash (Lenarz et al. 2010).

**Manitoba Hydro/ Joro Slide “Prefer disturbed habitats, respond to new growth from fires and forest harvest and renewal” and “Mature mixed forests (white spruce/aspen) with riparian areas ...”.**

**Manitoba Hydro/ Joro Slide “Young deciduous and mixed forest providing high quality and abundant browse – aspen, willow, hazel, dogwood, maple, etc.”.**

Important, in the context of moose populations in western Manitoba, are the critical winter habitats lacking from the slides.

- Key wintering habitats within GHAs 12 and 14/14A include large expanses of willows, areas that might have been designated as shrublands in the presentation comparing moose to caribou. I have hunted such an area on two occasions in GHA 14/14A; on both occasions we saw moose and on one occasion were harvested a bull. That area is within two miles of the new ‘Moose Meadows’ alignment. I have also been into such areas on the south side of the Red Deer River. These often relatively isolated areas are far more important than, for example, logged areas that result in lots of browse but also high vulnerability of moose to hunting. I have also seen extensive shrublands east of Cowan and south of the Highway to Camperville, within GHA 19A. These shrublands are similarly important for moose.
- **Browse Line Slide.** This spring I met with managers at Elk Island National Park, and hiked ~16 km through the south end of the Park. Within this area, where predators are few, there were very high populations of moose, elk, bison and deer; moose populations were >10 per square km at the time that I was there. This slide demonstrates extensive browsing of dense hazel shrubs found beneath the canopy of a mature aspen forest. One can see the ‘browse line’ where the hazel shrubs have been eaten off. My brief tour suggested that the moose preferred the hazel in

this habitat over willow shrubland, as I saw a number of areas of willow that had been relatively lightly browsed. The important point here is that in western Manitoba there are many areas where dense hazel is found beneath an aspen overstorey, and where, when moose populations are high, moose browse extensively in these areas and a browse line results.

We often see a dense hazel understory in mature and old-growth aspen forests in the Duck Mountain, the Porcupine, GHA 14, etc. The next time you drive through Riding Mountain Park, look for these areas and you will see them. These areas persist in time much longer than do logged or burned areas, and therefore represent more stable habitat. And under some conditions such areas can then become shrublands.

Although empirical data are lacking, moose in western Manitoba do not prefer disturbed habitat, rather, if anything, they prefer dense understorey hazel under aspen, and shrublands. Also of high importance to moose is relatively open canopy coniferous forest with hazel in the openings. Old growth balsam fir-dominated forest with a balsam fir understory is important locally; at one time 4% of the AAC in Mountain Forest Section was balsam fir. Moose are far less vulnerable to hunting in these habitats than in logged habitats. If high quality winter food habitat is created via logging, but such habitat becomes a population sink for an area because the moose are highly vulnerable to hunting, this is hardly a good thing for the moose population. In fact, to address that very problem, the Western Region Moose Advisory Committee is presently considering the option of concentrating logging, rather than dispersing it, to attempt to mitigate the moose vulnerability problem that comes with logging. The bottom line is that I have to conclude, based on this Manitoba Hydro presentation by Joro and Wildlife Resource Consulting, and my experience in western Manitoba, that Manitoba Hydro does not understand the habitat use of moose in western Manitoba, nor the relative value of moose habitat in western Manitoba. This is hardly a foundation for good environmental assessment.

I wish to address one other point here. I understand, based on the transcripts, that a wildlife specialist for the Manitoba Metis Federation pointed to the problem of using untested habitat models. I have not yet reviewed the habitat models in question; however, I note that I discussed the general failure of Manitoba habitat models and the scientific evidence respecting such models at the Wuskwatim hearings. I expect that the models used for Bipole III would have problems given the failure to recognize the importance of some aspen forests in western Manitoba. I further note that the models could have been tested using available data, if Hydro had wanted to do so.

**Manitoba Hydro Slide “Hunting ...Access density across moose range linked to decline.”.** It is not just access density that is the issue. Moose are extremely vulnerable to hunting within logged areas, where they come to feed and are often quite exposed in the open environment of the cutover. It is for this very reason that Manitoba Conservation attempts to limit the size of the cutblocks, in an attempt to mitigate vulnerability. I must indicate that the massive increase in logging and access in the Duck Mountain with the advent of Louisiana-Pacific Canada Ltd. in the 1990's is one factor, and perhaps the primary factor, for the demise of the Duck Mountain moose population. Habitat effectiveness is a concept that is used to integrate effects like disturbance with habitat. One discounts habitat if, for example, it will not be used by a species, or will be used to a lesser extent, due to the impact of disturbance. For

example, in the recent assessment that I coordinated in British Columbia, linear corridors were classified, for example with temporary trails being different from main roads, and habitat effectiveness was calculated based on the relative impact of different classes to grizzly bears and the corridor density.

There is a body of scientific literature on the impacts of corridors on animals. For example, I am aware of scientific publications that link ruffed grouse density to proximity to roads, and elk density and vulnerability to hunting to road density. I did not read the Mammals Technical Report; however, I did search the Technical Report on the terms 'effectiveness', 'vulnerability', 'road density', and 'corridor density'. The search indicates that Hydro's consultants did not conduct any kind of empirical assessment as to how moose habitat would be degraded as a result of the corridor, either in isolation or in combination with other nearby corridors (i.e., cumulative impacts).

**The primary issue, relative to the Bipole III and moose in the region, is not habitat.** Habitat is not even close to limiting in any substantive way. For example, for Game Hunting Area 14/14A, given that the population is almost extirpated, habitat is not likely to be a limiting factor for many decades, if ever again. The real issue is increases to the vulnerability of moose to hunting and predation by wolves, and how that will bear on our ability to bring these populations back and to maintain them in the future.

**The Bipole RoW will be considerably different from other RoWs,** such as Highway 10 and existing Manitoba Hydro RoWs. It will be very wide and moose will be seen from quite far away. It will attract moose at certain times, e.g., for some years between times of spraying trees and shrubs with chemicals to kill them. Access along the RoW will be easy for many areas, and it is anticipated that without legislation a well used snowmachine route will develop. It will be easy for some groups of hunters to kill moose, e.g., via 'pushing' moose across the line and posting shooters on the corridor.

Despite its very different nature, and on the basis of my search of the BiPole III Mammals Technical Report, it appears that Hydro and its consultants did not conduct any kind of habitat effectiveness assessment for moose, or any kind of assessment of the impact of corridor density. Hydro and its consultants seem to have focused the greatest amount of its effort on the habitat, which is not an issue in GHA 14/14A and likely GHA 12 in the near term. Manitoba Hydro and its consultants appear to have almost ignored the central issue for moose.

### **Slide "GHA 14 and 14A Major Fire Years"**

#### **Seasonal Movement**

Further to the above, what also appears to be missing from Hydro's understanding of moose in western Manitoba is the seasonal movement of moose off the slopes of the Porcupine and Duck Mountains, and into Game Hunting Areas 12 to the north and northwest of the Porcs, into GHAs 14/14A to the east of the Porcs, and into GHAs 14/14A and 19A to the north and northwest of the Ducks.

It is well known by the local people who spend time on the land that moose move off the slopes and into the surrounding lowlands during the winter. From 1991 to 1995, when I was Regional Wildlife Biologist, it was not uncommon to observe where someone had shot a moose off of Highway 10 to the north of Swan River, or to see moose on the

Highway or near the Highway. Sometime around 1996 or 1997, two or three people were killed near the Porcupine Mountain when they hit a moose on the Highway. Although empirical data are lacking, there is no question in my mind that sometimes significant numbers of moose move onto the lowlands.

I have observed, with my hunting partners, evidence of considerable mortality north of the Porcs in GHA 12, mortality that was likely associated with a big die-off of moose in 1995/96, and of which some moose would have come from the Porcupine Mountain. The bottom line is that the Bipole III corridor will increase vulnerability at the Regional scale, as moose move off the Porcs and Ducks during the winter.

Further to this, some broader scale of assessment is needed, as a 3 mile buffer is clearly not adequate from this perspective. It is habitat on the eastern side of the present Bipole III corridor that would be most critical in this regard, as opposed to habitat on the western side, because moose will be moving across the corridor to this habitat. There will continue to be migration across the corridor to the Moose Meadows and other areas, and therefore increased vulnerability of moose that summer in the Porcs. I note that, for BC, female home range that encompasses a development is deemed to be an appropriate scale for cumulative effects assessment by Tony Hamilton of the BC Ministry.

**Slide “Disease and parasites .... MCWS has not had reports of brainworm or CWD in western MB.”.**

This is incorrect, at least as I understand “western MB”. Per an email from parasitologist Dr. Vince Crichton on November 19, 2012, “this is simply pure nonsense – just like they have stated in one of their documents that there is no CWD there – nonsense.”. Among other details, Dr. Crichton indicated that from 40% to 60% of the white-tailed deer in the Swan-Pelican were infected with brainworm, as outlined in a paper published in 2003 in the Journal of Wildlife Diseases by Wasel, Samuel, and Crichton. There are a number of cases where moose have been killed by Natural Resource Officers because of suspected brainworm. I recollect one from the east side of Duck Mountain between 1991 and 1995 when I was the Regional Wildlife Biologist; a moose from the southeast corner of the Porcupine Mountain was killed by Resource Officers last week because of suspected brainworm.

**Slide “Moose Hunting ... Open ...”.**

The Western Region Moose Advisory Committee recommended to Manitoba Conservation, based on the observations of people on the ground, closure of GHA 12 to hunting prior to the 2012 recreational hunting season. Government did not accept this recommendation, the area is to be surveyed this year, and we will see who was right.

**Slide “Enforcement ... Addition of two new natural resource officers”.**

It appears that Hydro’s consultants are basing their information on a poor understanding of an obsolete Manitoba Conservation press release. When Manitoba Conservation made the announcement prior to the last election, the program included areas in western Manitoba and eastern Manitoba, with one officer for western Manitoba and one for eastern Manitoba. The program also added one biologist for western Manitoba.

- While Manitoba Conservation did add one officer and one biologist to western Manitoba, two officers from the Swan River office retired around Christmas of last year and around May of this year. The net result is that we are presently down one officer from prior to the announcement, and two officers relative when staffing occurred after the announcement.
- While Manitoba Conservation did add one biologist, the Regional Wildlife Manager out of Brandon retired some months ago, and those duties are being handled out of the Swan River office at present. The net result is no additional biologists, and considerably less institutional experience.
- As Craig Stevens from Wuskwi Sipiik First Nation has noted, “Biologists and Natural Resource Officers do not make baby moose.”.

**Slide “Restricting access and closing roads”.**

Wuskwi Sipiik First Nation has been trying to get a road at Antler Corner closed for some time. A letter from the Chief was sent to Manitoba Conservation in July of this year, and I have had to raise the issue twice at Moose Advisory Committee meetings. I was told on Tuesday that the road would be closed soon. I suspect that money has been a driver/constraint given the financial difficulty of the government.

**Slide “Fire Forestry”.**

The slide demonstrates the present Manitoba Hydro line that cuts through the northeast section of the Duck Mountain. During the winter, at least some portions of the line are packed by snowmachines and wolves travel along the packed trail.

**Slide “Historical Data: Porcupine Mountains Provincial Forest”.**

A later slide in the presentation concludes **“Slight decrease Porcupine moose population – slightly lower than 20 year high”.**

This is a good example of how timing of data collection can influence one’s understanding. There was a huge die-off of moose in winter 1995/spring 1996 in the Duck Mountain. A survey conducted earlier, in 1993, yielded a point estimate of 3,209 moose when the population was quite high. I believe that the peak moose population occurred just prior to the die-off, had recommended that more moose should be taken via hunting as I thought that a crash might be imminent, and believe that we may have had 5,000 moose in the Mountain prior to the crash.

It is likely that the moose population of the Porcupine Mountain was impacted similarly in 1995/1996; however, there are no direct population data (i.e., survey data) for the GHA. If there were, a significant decline in the Porcupine Mountain ‘population’ would likely be apparent for the Porcs, as is the case for the Ducks. Some five years or so ago, I was privileged to attend a meeting at Wuskwi Sipiik First Nation at the invitation of Elder Buddy Brass. At the meeting, Manitoba Conservation attempted to convince the Nation to take less moose, to which Elder Brass indicated that Conservation should close the season for five years.

**Slide “Days per Tagged Moose” (Analysis by Soprovich)**

This led me to conduct the following analysis for the Porcupine Mountain 'population'. I obtained Manitoba Conservation hunter questionnaire data and calculated the number of days, on average, that it had taken for recreational hunters to kill one moose for the years 1993 to 2006. The underlying assumption is that, if there are lots of moose it will take few days, and if there are few moose it will take a lot of days. This kind of statistic can be used as an index to population density or population size. I have used this statistic to demonstrate the major die-off of moose in the Duck Mountain in 1995/1996, and there is scientific evidence to support use of the index. One can see that Manitoba Conservation's own data indicate a declining population from 1993 to 1997 (for fall, from 18.1 to 24.1 days to kill a moose; for winter, from 4.6 to 11.2 days to kill a moose), in support of my belief that the Porcupine Mountain population was larger, and perhaps considerably so, in 1993 as compared to 1997 when the survey was done. As an aside, some 6 or so years ago, these same kind of data for the Duck Mountain 'population' over the same period were presented by myself to former Conservation Minister Stan Struthers to demonstrate the decline of that 'population'.

### **Quick Population Response**

While one has to be quite cautious with moose population estimates from surveys, because they are estimates and because the percentage of moose missed (bias) can vary considerably between surveys, the data do not suggest a quick turnaround of the Duck and Porcupine 'populations'. Using only the point estimates, we have seen a drop of more than 200 (27%) for the Porcupine Mountain and an increase of only 117 (8.7%) for the Duck Mountain, **AFTER** one year of 'business as usual' and one year of closure to recreational and rights-based hunting and a wolf control program. Further to this, the experience in other areas in Manitoba has often been one of long-term depressed populations. Therefore, at this time, the data and experience do not support Hydro's contention, in another slide, that "**Demonstrates potential for quick population response if hunting closures are successful**" in relation to "**Cow calf ratios are within historic averages**". In fact, respecting calves per 100 cows, which is the measure used in Hydro's slides, the conclusion relative to the major decline in Minnesota was that it was adult survival rate that drove lambda, the rate of increase, and that reproduction had little impact.

Note the Confidence Intervals on this slide, i.e., the upper and lower bars representing, presumably, the range for which there is a 95% probability of encompassing the actual number of moose in the population. This provides an understanding of the statistical precision of the estimate.

### **Slide. "Historical Data: Porcupine Mountains Provincial Forest .... Calves per 100 cows".**

Note that there are no Confidence Intervals for this statistic, unlike the case for the population estimates. CIs were not calculated for a number of reasons for these data. For the great majority of the years, the precision would have been very poor, as sample sizes were often very small and constrained by budget. Sampling was generally restricted to specific known wintering areas, and therefore the sample was collected according to a methodology that would not strictly allow for statistical analysis. Consequently, while the measures fluctuate quite a bit in the chart, there might have been little real difference on the ground for the population. I note that when I worked as the Population Ecology Biologist for Manitoba Natural Resources, I drafted an analysis

plan for these very data, because it was understood that the data had significant limitations. The plan was under review prior to organizational change, and the analysis was never conducted. This statistic is no longer collected according to that methodology.

#### **Slides “Historical Data Game Hunting Area 14”.**

I analyzed the data and wrote the survey report for 1983, and designed the survey, was the crew leader, analyzed the data, and wrote the report for 1992. Relative to the population numbers, there are issues of comparability for a number of reasons, including the fact that the two early surveys were by fixedwing whereas a helicopter was used in the later two surveys. Furthermore, the 2011 estimate represents an extrapolation from 109 to 148 because a significant portion of the area was not surveyed. Relative to the **slide of calves per 100 cows**, it should have been possible to calculate the statistical precisions. Certainly the precisions would have been much poorer than for the population estimates (i.e., much wider Confidence Intervals), and perhaps this is why they are not presented. I note that Manitoba Conservation held a recreational season in the fall of 2010 prior to the survey. Given the clear lack of conservation involved, perhaps a better name for organization would have been the Department of ‘Let’s Kill the Last Moose in Game Hunting Areas 14/14A” or “Almost Completely Asleep at the Switch”.

**Slide ”Habitat Loss ... is ...converted from “cover” to “food”.** This is certainly not true at all times; for example, the development proposes to spray the RoW with chemicals to kill young growth. Consequently there would be times when there would be no food. I saw this recently south of Grand Rapids where the Hydro RoW had been sprayed and all of the shrubs were dead. There would be an important reduction in food where the RoW crosses shrublands, as these stable sources would now be killed by chemicals.

#### **Slide “Increased harvest of moose outside of closed areas due to hunting closures”.**

This appears to suggest that there is no hunting and killing of moose within the closed areas; this is not true. While hunting has declined substantially, there certainly are moose being killed. For example, last Sunday on the way home from Winnipeg, I observed the remains of a dead moose in the south ditch of the road from Camperville to Cowan, likely within a mile of the new alignment in that area. While I could not spend the time to determine which Game Hunting Area it was killed in, the road is the boundary between a closed and open area. While I was stopped on the road, a lady came by and indicated that the moose had been shot from the road. I further note that our people on the ground indicate that the moose population of GHA 19A is considerably depressed. **Far more important than present mortality levels within the closed areas is the extent to which the corridor will adversely impact on mortality going forward, as we work with Manitoba Conservation to try to ensure that populations are managed in a sustainable manner.**

**Slide “Limited evidence in literature of increased predator effects as a result of transmission line RoW.”.** Movements by wolves are certain to be facilitated by the corridor, and therefore their ability to predate will also be facilitated. We see this relative

to movements for the present Hydro RoW across the northeastern portion of the Duck Mountain, where wolves are known to use the RoW for travel.

**Slide “Effects from increased hunting not expected due to FPR paralleling existing linear development where access already exists.”.** The Bipole III corridor is not very close to existing corridors in various places. Ignored is the issue of corridor density, for which there should have been empirical analysis; I assume that there exists relevant data in the scientific literature for moose. Furthermore, the 66 m Hydro RoW is considerably different from the existing RoWs.

**Slide “Evaluation of Alternative Routes”.** Where is the empirical vulnerability assessment (corridor density, etc.)? This is critical. The evaluation appears to conduct cursory analysis of the fundamental issue, while giving considerable attention to habitat when it is not close to be limiting at this point in time in GHA 14/14A and will not be for much greater than a decade.

### **Caribou Presentation**

**Slide “Manitoba Hydro Process for Evaluation Caribou – outcome”.**  
**“Range fragmentation ... include unknown effects of linear development and access”.** There is science on the effects of linear development and access, including in relation to avoidance and predation, for woodland caribou ... as I reported on for the Wuskwatim hearings.

**Slide “Initiate monitoring on local populations to determine effects of disturbance on predation rates, movements and range occupation”.** I wonder if the proponent would be able to derive good estimates given the sample sizes involved, but would need to look at this in detail. I wonder about capture mortality in these caribou studies; e.g., for four moose studies in North America, the capture mortality was 6.5% to 9.8% for young calves, and 0.7% to 4.8% for adult, near-yearling, and yearling moose.

**Slide “Historical caribou research data”.**

I am familiar with some of these data for the Naosap, Kississing and Reed Lake herds, as I conducted analysis of at least some of the data. I point out that biases can exist relative to issues with sampling (e.g., for the caribou data that I examined, some periods of time were represented to a greater extent in the dataset thereby distorting, for example, core home range estimates). In 2004, I wrote two reports on the sampling problems, titled “Assessment of the Potential of Variable Sampling Intervals to Bias Estimates of Caribou Spatial Distribution - On the Basis of Movements by GPS” and “Assessment of the Potential of Partial Years to Bias Estimates of Caribou Spatial Distribution - On the Basis of Movements by GPS and VHF Caribou”. It would not surprise me to see similar problems with the analysis conducted by Hydro; however, I have not had the time to review the analysis, given the constraints of funding for this Project.

**Slide. “Multi species aerial surveys”.**

The slide indicates that an adaptive kernel method was used. Examination of the Supplemental Caribou Technical Report revealed the statements that “This method was used by Schindler (2006)” and “Using this method, adaptive kernel analysis for each

animal by winter month and all animals by winter month were conducted using the Home Range Extension (HRE) in ArcEdit (Rogers and Carr, 1998)".

I googled for Rodgers and Carr, noting here that the citation should have been Rodgers with a d; what came up was Rodgers and Kie, "HRT: Home Range Tools for ArcGIS. Users Manual. Draft August 10, 2011". I did not spend time going through additional pages in the google search to look for Rodgers and Carr, given the time constraints. However, I assume that the Rodgers and Kie manual would be an updated version of the earlier software, and consistent in approach.

Importantly, the draft User's Manual states "**Because different computer software programs may produce large differences in home range estimates ... we have attempted to provide all of the options offered in earlier programs for calculation of the estimator and values input for the various parameters.**". This is critical, because what the manual is indicating is that the size of the output home range will depend on (a) the analytical method selected and (b) the input parameters for the analysis. Per a key word search, neither of the Manitoba Hydro caribou reports provides an indication of the method selected or the input parameters for analysis. The technical reports are therefore grossly deficient respecting methodology.

Why is this important? Among other matters, the Technical Report presents estimates of core areas using the kernel method. How do we know that Manitoba Hydro and its consultants did not select a method or methods that result in relatively small core areas, thereby limiting the potential for suggested impacts of the line?

In the absence of information on the specific analytical methods selected, we do not know if this is the case, i.e., if a liberal approach was taken, or alternatively if a conservative approach was taken. Perhaps the details are in Schindler (2006); however, such critical details should not have been left to a reference. Of particular importance to this matter, given that there are a number of methods available for use and that different methods are used within the scientific literature, there should have been some explanation as to why the given method was selected. The original method used by ArcGIS was based on a paper by Worton (1989). Worton subsequently, in a 1995 paper, recommended alterations because his earlier method considerably underestimated home ranges or core areas. Finally, it is my understanding that Hydro's consultant used the Worton (1989) method for analysis of caribou data from eastern Manitoba. Similar to the possible situation for Manitoba Hydro, if that was the case, the analysis would have produced underestimates of home ranges and core areas, and would have suggested smaller areas of impact for the forestry industry.

**Slide ... "Study Area ... Study Evaluation Ranges"**. For The Bog herd, the evaluation range excluded some of the historical range. A more conservative and less risky approach would have included some of that range, if supported by past data. This is so because the additional collection of data by Hydro and its consultants might well have yielded use of that area by caribou, and/or Hydro's conclusions respecting range may have been a function of sample size and/or the locations where caribou were sampled from.

That is, herd range size will be a function of the number of collars put on animals, where within the range the collars are put on, and the number of years of monitoring. I wonder if the apparently much expanded range use post-construction in the slide "**Wuskwatim**

**Case Study: Summer Pre and Post**” is simply the result of more years of data and/or more collared caribou. I would be surprised if the selection of caribou to collar was done according to a rigorous methodology designed to reduce biased estimates.

**Slide ... “Survival and recruitment ... adult survival (minimum sample 20)”.**

I wonder if a basis was provided for the number 20 within the Technical Reports; for our moose study proposal for the Duck Mountain, we used an empirical basis to derive a sample size target of 40 cow moose.

**Slide ... “Cumulative Effects – Boreal Woodland Caribou”.**

The cumulative effects assessment ignores future fires, and an assumption on future fires should be included. I.e., it appears that the analysis assumed that there would be no fires in the boreal forest in the future.

Recently, for the Shell Canada Jackpine development proposal in the oilsands, the federal review panel made Shell redo its cumulative effects assessment because it had ignored, among other factors, future fires. The subsequent analysis came to considerably different conclusions respecting cumulative effects. I strongly urge members of the CEC panel to examine the Jackpine situation, starting with the good work of the Pembina Institute coalition. Further to this, global warming is likely to have an impact on the dynamics of fire in the boreal forest, and should not be ignored. For the recent assessment that I coordinated in BC, we evaluated the impact of two warming scenarios, ‘business as usual’ being one scenario. Given the impact of fire on caribou habitat, the potential impact of global warming should have been considered by Manitoba Hydro.

**Slide ... “Current Disturbance”.** I am unsure why 40 years was selected, and will need to look at the Technical Reports. Is this for both conifers and hardwoods? What about the change from coniferous to deciduous systems over time given the provincial regeneration standard? **“Future Disturbance”.** Unsure about the land coming ‘online’ in 5 years at 35 to 40 years. Unsure why this year class was selected. Also, logged areas could still have well used roads through them at >40 years post-logging; for example, the roads that I have been on recently south of the Red Deer River and near Plummers Marsh. Such adjacent forested areas are certainly not undisturbed; this goes to the concept of habitat effectiveness. And also to improved access for predation and moose/wolves/caribou dynamics in relation to changes to forest type.

**Slide ... “Threat Summary – Boreal Woodland Caribou ... Predation rates not expected to increase given minimal habitat loss.”.**

There are several cumulative effects issues, one of them being quite important, that are not addressed here. One is that the forestry development can improve habitat conditions for moose and tends to alter caribou – moose – wolf dynamics. This is so because forestry development tends to alter conifer forests towards deciduous stands; indeed, the provincial standard for forest renewal allows as acceptable an approximate 25% alteration in the pre-logged natural forest towards hardwoods. Over time, this could considerably alter the forest ecosystems of an area. Again, logged forests may continue to have good roads through them well past 40 years post-logging; I can take you to examples of this right now just south of the Red Deer River. These will serve as travel corridors for wolves under a number of conditions, thereby facilitating predation.