RESPONSE TO "MANITOBA CLEAN ENVIRONMENT COMMISSION HEARINGS ON BIPOLE III FOR PEGUIS FIRST NATION"

February 19, 2013

Responses provided by: Joro Consultants & Golder Associates

MOOSE

1. **Question/Statement: "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."- pg. 2**

Response:

There is variability in age of maturity within populations of wildlife species, which we also discussed in the presentation. Discounting error in the estimate, if we accepted that 36% of female moose are sexually mature at 1.5 years of age then it must be typical for a female moose to become sexually mature at a later age (i.e., 64% of female moose mature at 2.5 years or later). We suggested 2.5 years as the typical age of sexual maturity and we stand by that.

2. **Question/Statement: "Annual recruitment rate for moose...is missing for Manitoba populations...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"- pg. 2**

Response:

Mr. Soprovich is somewhat correct in his understanding that recruitment is generally accepted to coincide with survival to one year of age. A more complete definition is that calves should be considered new recruits of the population at one year of age or once they experience the same level of mortality as adults (Hatter and Bergerud, 1991). To clarify: a recruitment estimate from winter survey data is typically presented as a ratio, most often as calves per adult female (calf:cow ratio) though occasionally as calves as a proportion of the all animals observed (percent calves). A calf:cow ratio calculated in winter will be the same as a calf:cow ratio calculated several months later as long as the mortality rate is the same for adult females and calves (i.e., the denominator and the numerator in the equation are each multiplied by the same survival rate). This important clarification means that Mr. Soprovich's understanding of the implications of assessing recruitment during winter surveys is poor.

Several studies on moose survival and mortality report that moose calf mortality is high in the first few weeks of life after which their risk of mortality decreases tremendously (Stenhouse et al., 1995; Van Ballenberghe and Ballard, 1998; Dodge et al., 2004; Testa, 2004; Keech et al., 2011). Ballard et al. (1991) found that 94% of natural mortality for moose calves occurred by mid-July. A recent study on moose calf survival (Keech et al. 2011) tracked the fate of more than 400 moose calves and showed that calf survival from mid-winter to May was approximately 92%. Similar results were reported by Testa (2004). While adult survival may be slightly higher, the difference is small and winter calf:cow ratios are the standard measure of recruitment across North America. Winter surveys have many advantages over an attempt to survey animals in May: visibility in winter is better in the absence of leaves on deciduous trees, with snow as a background, and when tracks can be used to assist in locating animals; calves are generally still with their mothers; and surveys occurring close to the calving period can interfere with current year's calving success. The costs of research work and spring surveys are formidable and yield poor value in return for management purposes.

3. **Question/Statement: "The slide indicates Potential Population Growth of Up to 1.40 and commonly 1.10 - 1.20...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." - pg. 3**

Response:

Mr. Soprovich is correct in that populations may decline. "Potential" was used in the presentation to indicate the upper limit of potential population growth. Population decline and Lambda rates of less than 1.0 were discussed in all three presentations made on October 31, 2012.

To clarify: wildlife populations may have Lambda rates as low as 0.00, at which point they have been extirpated. Upper limits of potential population growth are as stated in the presentation.

We are in agreement that the moose population in GHA 14/14A declined between 2002 and 2011.

4. **Question/Statement: "Considering potential rates of decline along with increase is fundamental to understanding population stability "- pg. 3**

Response:

We agree, although would choose the term population dynamics rather than population stability. On October 31, 2012 population decline was discussed relative to both caribou and moose population dynamics.

5. **Question/Statement: "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)"- pg. 3**

Response:

Information request CEC/MH-III-049 reviews the role of thermal cover for moose and the potential effects of cover removal on moose population. In summary, because there will only be a relatively small amount of high-quality moose habitat removed for the creation of the 66 m ROW, the impact on thermal cover availability in any one moose home range in the Bipole III Study area is considered negligible. Information request CEC/MH-III-049 also reviews the role of thermal cover relative to current academic research, including Lenarz et al. (2010). In summary, this review finds that the ROW will provide high-quality forage for moose, in close proximity to thermal cover, located on the edge of the ROW.

6. **Question/Statement: "Important, in the context of moose populations in western Manitoba, are the critical winter habitats lacking from the slides"- pg. 3 AND "winter habitats include large expanses of willows, one of which is within two miles of the "new Moose Meadows alignment". "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."- pg.3**

Response:

Based on modeling of high quality habitat and results of aerial surveys, the identification of critical wintering habitats has not been overlooked or omitted. Willow areas are classified as shrublands and are also considered high quality habitat. These areas have been identified and mapped using the high quality moose habitat model applied to the LCCEB. Results of aerial surveys provide further verification of model assumptions and moose distribution relative to habitat and disturbed areas and is provided in the supplemental EIS. Moose were observed in both isolated willow areas in the most southerly portion of moose meadows, as well as in fragmented areas near disturbed areas and the agricultural fringe of GHAs 14 and 19A. Note the statement regarding vulnerability relates to logged areas where distance to cover is far greater than that of a linear feature such as a transmission line ROW. There are also greater opportunities for mitigation on a ROW in willow habitats as this type of vegetation can be maintained and not cleared, minimizing line of sight.

7. **Question/Statement: "Although empirical data are lacking, moose in western Manitoba do not prefer disturbed habitat, rather, if anything, they prefer dense understory hazel under aspen, and shrublands."- pg.4**

Response:

It is not clear how Mr. Soprovich arrived at his conclusions regarding selective behaviour by moose. Mr. Soprovich states that moose prefer dense understory hazel under aspen and shrublands and not disturbed

habitat. The latter part of this statement is contrary to what is known in the literature regarding moose habitat selection. Forestry and other disturbances result in early succession shrublands through silvicultural responses such as aspen suckering and broadleaf shrub release as a result of increased sunlight and disturbed soils. Numerous direct observations have been made of moose within disturbed habitats created by wildfire, cut overs, or road and linear development. Literature supports these observations, indicating that moose prefer the seral stage of vegetation that emerges after disturbance (Thompson and Stewart, 1998). Disturbances such as block clearcuts have the potential for creating moose habitat by opening patches in mature forests and allowing regrowth of low-growing high-quality browse plants (Thompson and Stewart, 1998). Fire is generally a favourable influence on moose habitat as it rejuvenates forest succession and is a key factor for high productivity in moose populations (Child, 1998).

The results of aerial surveys conducted by Manitoba Hydro in December 2012 in the Porcupine/Moose Meadows and in February 2013 in GHA 19-A illustrated preferred use of disturbed areas (shrublands). Conversely, moose presence in aspen stands as described by Mr. Soprovich in the Porcupine Mountain was observed to be very low. Note that Mr. Soprovich initially states that moose do not prefer disturbed areas, then identifies that high quality food habitat is created as a result of logging. We agree with the latter position as well in that moose are much less vulnerable to hunting in mature forest stands with dense understory than recently logged habitats.

8. **Question/Statement: "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 government assessment."- pg.4**
9. **Question/Statement: "The search (of the Mammals Technical Report) 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)."- pg.5**

Response to 8 and 9:

Mr. Soprovich has stated several critical concerns regarding habitat as a critical factor. He then states that the primary issue is not habitat. Based on our assessment of habitat availability in the GHAs potentially affected by Bipole III, Manitoba Hydro agrees with the statement regarding habitat not being a primary issue. Moose populations are managed at the GHA scale, the amount of fragmentation and increased access as a result of Bipole III will not increase the overall vulnerability of moose within these management areas. Based onadditional empirical analysis conducted, moose density is not a function of linear densities within the GHAs in western Manitoba. Additionally, the risk associated with increased predation by wolves has not been substantiated in this region and the literature is weak in regards to

moose population declines as a result of linear development. Wolves in this region also have a diverse food supply which includes white-tailed deer, elk and beaver. Wolf diet studies in RMNP indicate that elk comprises the majority of prey taken and consumed. Wolves have been shown to be generalists in Manitoba, using a wide variety of prey. Research conducted in western Manitoba has shown wolf diet to be comprised primarily of elk and beaver with other prey species identified to a lesser extent were moose. The results of the analysis of 369 wolf scats collected in RMNP from fall 2001 to summer 2003 identified the relative occurrence of food items in summer were: Elk (48.2%), beaver (33%), hare (8.9%), moose (7.1%) and white-tailed deer (2.7%). In winter, the relative occurrence of food items was: Elk (56.4%), moose (17.1%), white-tailed deer (13.2%), beaver (12.5%), and hare (0.8%). (Sallows, 2007).

Given this multi-prey system in western Manitoba and dependence on elk and to a much lesser extent moose, the impacts to moose as a result of predation are likely overstated. Having analyzed available moose population data against landcover data for western Manitoba, we agree that habitat is not limiting for these moose populations, nor is there any evidence that habitat shortage was related to the recent moose population declines in western Manitoba. As Manitoba Hydro is required to consider the effect of its transmission line on VECs, an assessment of population-habitat relationships was required.

10. **Question/Statement: "The primary issue, relative to the Bipole III and moose in the region, is not habitat." "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"- pg.5**

We disagree with Mr. Soprovich that wolf predation has been proven as a key agent of moose population decline in western Manitoba. There are numerous research studies that characterize the effects of predation on moose populations. Gasaway et al. (1992, p. 16) show recruitment of 0.22 calves per cow during a period of decline and associate a period with 0.64 calves per cow with a population irruption. They later note (Gasaway et al. 1992, p. 27) that predation was the primary cause of calf mortality during population decline. Keech et al. (2011) reported calf survival rates of 0.30 when predators were present. In western Manitoba, moose surveys conducted by MCWS since 1990 (n=19) had a mean calf:cow ratio of 0.52, higher than might be expected in populations with high levels of predation.

We cannot rule out hunting as a key source of mortality leading to moose population declines in western Manitoba, though population modelling indicates licensed hunting can account for only a portion of moose mortality.

11. **Question/Statement: "The Bipole ROW will be considerably different from other ROWs, such as Highway 10 and existing Manitoba Hydro ROWs "- pg.5**

Response:

Agree that Bipole ROW will be considerably different from other ROWs; however, Mr. Soprovich is incorrect in stating that Bipole III will be "very wide" compared to other ROW's. The ROW width of PTH 10 combined with other linear features that parallel it varies from 60 to 150 meters or more in the area from Mafeking south to Birch River. Visibility along a highway and its ROW would be similar to that of a cleared transmission ROW, however PTH 10 contains a paved highway. With re-growth of ROW vegetation, line of sight reduces significantly. PTH 10 is adjacent to high density moose areas along the eastern slopes of the Porcupine Mountains. Mr. Soprovich also states that moose will be attracted to the transmission line ROW, which is contradictory to previous statements that "moose in western Manitoba do not prefer disturbed habitat, if anything, they prefer dense understory hazel under aspen and forests with hazel in the openings". We would agree that moose may be attracted to the ROW, however Mr. Soprovich's statement regarding ease of kill along transmission lines via "pushing" moose is subjective and no data are provided to support this hypothesis.

12. **Question/Statement: "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." "Manitoba Hydro and its consultants appear to have almost ignored the central issue for moose"."- pg.5**

Response:

We assessed historical moose densities relative to a number of access and landscape metrics. No significant relationships among the variables tested could be found. Corridor density and moose density are not statistically correlated in western Manitoba based on historical and current information.

13. **Question/Statement: "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."- pg.5 AND "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"- pg.6**

Response:

No empirical data exists to confirm this annual migration hypothesis. Results of aerial surveys do not provide any evidence of moose migration. Based on the results of aerial surveys in GHA 14 and 13 in the Moose Meadows area conducted on December 5 and 6, 2012, moose distribution was consistent with that observed by MCWS for aerial surveys conducted in late January of 2011. A subsequent aerial reconnaissance flight conducted on February 4, 2013 in the Moose Meadows area yielded no evidence of significant moose distribution from high density moose areas previously identified. Results of public

consultation and ATK revealed different opinions regarding moose migration from the Porcupine or Duck Mountain areas. Results of surveys do not support this hypothesis. If the migration theory is true, the AFPR would result in moose having to cross several ROWs in closer proximity to human development in order to migrate into the Moose Meadows area.

14. **Question/Statement: "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"- pg.6**

Response:

Moose populations in Manitoba are managed at a GHA scale. Correspondingly, population and recruitment data are gathered and were analyzed at this scale. .

15. **Question/Statement: "MCWS has not had reports of brainworm or CWD in western MB- This is incorrect"- pg.6**

Response:

Mr. Soprovich is misinformed on the matter of Chronic Wasting Disease (CWD). Chronic wasting disease has never been detected in Manitoba in any species (Manitoba Conservation and Water Stewardship 2012; Ken Rebizant, personal communication 2012; Todd Shury, personal communication 2012).

We stand by our statement in our presentation that there were no reports of brainworm in moose or caribou available from MCWS. After further requests, Manitoba Conservation was unable to provide any records of moose from western Manitoba infected with *P. tenuis*. A single record of a moose from Manitoba exists at the Canadian Cooperative Wildlife Health Centre (CCWHC); the animal had been collected in 2008, south of study area, near Cromer, Manitoba (Bollinger, personal communication 2012). An inquiry to the Saskatchewan government yielded 6 confirmed reports of moose infected with *P. tenuis* in Wildlife Management Zones in eastern Saskatchewan adjacent to the Manitoba border (Rob Tether, personal communication 2013); the confirmed cases were reported between 1996 and 2011 and are from as far north as Manitoba GHA 12 and as far south as Manitoba GHA 27. It seems reasonable that there may occasionally be cases of *P. tenuis* in moose in the study area, but MCWS has failed to document any evidence of the disease. .

16. **Question/Statement: "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."- pg.7**

Response:

Mr. Soprovich`s beliefs about what happened in the Duck Mountains in 1995/1996 are without support of empirical data. Aerial survey results for GHA 18 show an estimate of 3289 (±19%) moose in 1993 (similar to Mr. Soprovich`s 3209) and 3066 (±29%) moose in 1998. The confidence intervals in these estimates are broad and any crash and recovery of the GHA 18 moose population is unsupported by data. Mr. Soprovich`s logic is unclear, though his suggestion that the population might have been at a peak presupposes a density-dependent cause of mortality but he makes no reference as to what that might be.

17. **Question/Statement: "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 rations 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"- pg.8**

Response:

Mr. Soprovich did not provide a citation for the Minnesota work mentioned in this section, so we returned to his previous reference of a paper by Lenarz et al. (2010). The Lenarz et al. (2010) paper is a poor example to select for the role of adult survival in population growth as it represents a population on the edge of the distribution range for moose; in other words, a little further south and conditions do not support moose at all. In most of their distribution across North America, there are relatively consistent survival rates of near or above 90% for adult female moose: Alberta (89-92%, Mytton and Keith 1981); Yukon (91%, Larsen et al. 1989); Alaska (>90%, Ballard et al. 1991, Testa 2004, Keech et.al 2011). The populations in the Yukon and Alaska studies noted above were subject to predation by wolves and bears; hunting related mortality was excluded from survival analysis in all cases. In the Minnesota case cited by Mr. Soprovich, adult female survival ranged from 0.74 to 0.85. Consistent and high adult survival rates are vital to population stability for large herbivores; they are also common (Gaillard et al. 1998), including for moose as supported by the citations above, though not the example Mr. Soprovich chose. When adult survival is high and constant, fecundity and juvenile survival determine variation in annual growth (Gaillard et al. 1998).

18. **Question/Statement: "There would be an important reduction in food where the ROW crosses shrublands, as these stable sources would now be killed by chemicals "- pg.9**

Response:

Mr. Soprovich states above that the habitat is not limiting, now he is. As noted in CEC/MH-VI-208 and CEC/MH-II-022b. Negative impacts on wildlife health are not expected from the limited application of herbicides used for vegetation control during the Bipole III operational period. All herbicides that are employed by Manitoba Hydro are done so in accordance with their recommended and Provincially permitted rates and under normal circumstances

19. **Question/Statement: "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"- pg.9 AND "Movement by wolves are certain to be facilitated by the corridor, and therefore their ability to predate will also be facilitated"- pg.9**

Response:

This is a similar question to #11. The following provides additional supporting evidence.

Moose Response to Linear Features

Peer-reviewed research pertaining to the distance of disturbance effects from roads, specifically on moose, is sparse. Of the available studies, several show that moose searches for forage may take them near roadways and trails (Gillingham and Parker, 2008; Laurian et al., 2012). Roads and areas along the roads may offer some benefits to moose given roads can create highly desirable resources or microhabitats that are otherwise rare (Laurian et al., 2008). There is conflicting evidence regarding whether moose actually avoid areas near roads or whether they are in fact attracted to them. Laurian et al. (2008) found that moose avoid roads up to 500 m on each side; however, 20% of the moose in their study approached within 50 m of a road while searching for forage. Wasser et al. (2011) found moose select for forage over security from predators as moose were shown to select for habitat with shrubs, areas of recent wildfires (within 40 years), areas near water and areas of less coniferous cover.

Increased Wolf Predation as a result of Linear Features

Research which quantifies the relationship between linear corridors, moose, and increased wolf predation is limited. Road avoidance by wolves suggested moose were actually safer in areas closer to roads within areas where this research was conducted (Kunkel and Pletscher, 2000). This research suggested that roads associated with logging, result in prime moose foraging habitats, resulting in healthy moose which have a greater likelihood for escape from predators. However, roads, trails and streams characterized by low

human activity resulted in increased probability of moose predation by wolves (Kunkel and Pletscher, 2000).

Further research has explored the relationship between wolf predation rates on caribou with respect to linear features. McCutchen (2007) summarized findings from several studies which found a correlation between corridor density, wolf use of the linear corridors, and an increased mortality in caribou. Caribou mortalities as a result of wolf predation tend to be closer to linear corridors than live caribou locations, potentially as a result of higher incidental predation events (James and Stuart-Smith, 2000). However, Latham et al., 2011 found no evidence that caribou mortalities occurred closer to the industrial linear features they studied (Latham et al., 2011). Despite the potential increase in wolf use of linear corridors, there is evidence that prey tend to avoid these linear features (usually by 250m (Dyer et al., 2001)), potentially minimizing the effects of wolf line use, though caribou may on occasion use the corridors for ease of travel and high quality forage (James and Stuart-Smith, 2000). A similar study of wolf-caribou interactions as a result of landscape management performed in Quebec showed that caribou avoided roads from spring to early winter and that wolves used roads from spring to rut. In the late winter both caribou and wolves used roads in proportion to availability (Courbin et al., 2009). Of importance to note, is research has suggested that although wolves were shown to use linear corridors, they were not travelling into areas which they didn't previously use, but rather were merely able to travel more efficiently through the area (James and Stuart-Smith, 2000). Furthermore, research conducted in Manitoba has shown that although linear corridors can improve wolf movement across an area, human development may also work to fragment wolf home ranges and genetic relatedness; thus, human development may work to restrict wolf movement rates and dispersal, depending the area (Stronen et al. 2012). Overall, research suggests there is little to no empirically or theoretically established wolf-line-caribou relationship (McCutchen, 2007; Whittington et al., 2011).

20. **Question/Statement: "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"- pg.10 AND "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."- pg. 10**

Response:

We did not ignore the issue of corridor density and undertook additional empirical analysis to assess linear density effects on Moose populations. Refer to response number 12.

CARIBOU

21. **Question/Statement: "Per a key word search, neither 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"- pg.11 AND " 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?"- pg.11 AND "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"- pg.11**

Response:

The Bipole III Caribou Technical Report and Supplemental Reports reference methods and software used by Schindler et al. (2006) which identify input parameters tested and selected. These references describe how core use areas are calculated using methods employed by Van der Wal (2004). A similar clarification is provided in IR CEC/MH-Caribou-3. In summary, the input parameters and methods used in the Bipole III assessment yield a larger and more robust estimate of core use and do not result in small core areas as suggested by Mr. Soprovich.

22. **Question/Statement: "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"- pg. 11**

Response:

The description of the sources of data for the historical and the evaluation ranges within the Project Study Area are described in Section 3.3 – Caribou Telemetry Studies of the Bipole III Caribou Technical Report. As defined by the Bipole III Supplemental Caribou Technical Report an evaluation range is a defined as the geographic area that represents the home range of a local population of boreal woodland caribou through interpretation of current GPS telemetry data using a Minimum Convex Polygon (MCP). The MCP for The Bog evaluation range represents the most current understanding of range occupation. The Bog Evaluation range is approximately **32%** larger than the historical range reported by Manitoba Conservation (2006) and also includes areas into Saskatchewan which were included in the range assessment. A MCP is defined as the home range or total space used by an animal and is produced using creating a polygon around all locational data points for that animal (Mohr, 1947). It is an overestimation of their home range as it includes areas of non-use (Worton, 1987). As stated in the Bipole Technical Reports and elaborated on in IR- CEC/MH-Caribou-3, the use of this current telemetry data in conjunction with a 70% kernel analysis provides a slight over-estimate of the core area, but accounts for all of the observed variation in this estimate across populations.

23. Question/Statement: "I would be surprised if the selection of caribou to collar was done according to a rigorous methodology designed to reduce biased estimates "- pg. 12

Response:

Manitoba Conservation and Water Stewardship worked closely with collar companies and consultants to develop annual caribou collaring programs. Collars are intended to provide a representative sample of the total population across ranges. Caribou presence and future locations of collars were determined through a combination of aerial scouting flights, aerial telemetry, and traditional knowledge. Collars were dispersed on females in groupings of caribou that were chosen randomly to include the overall caribou range. It is a standard practice to maintain between 20 and 24 collared animals on a landscape per year (Gustine et al 2006; Mcloughin et al 2003; Pinard et al 2012). Thus, a minimum of 20 collars were maintained per range. These techniques were used throughout boreal woodland caribou range and are consistent with capture companies that work for all jurisdictions based on a standard methodology.

Collar bias is often an issue when it comes to estimating population size and age-sex ratios. In this study, we are not estimating population size but are determining core use areas and movement patterns. Collar bias is often associated with the transfer of locational fixes due to geographic or landscape barriers (Friar et al., 2004). If there are missing fixes in the data set for this study, they would not impede the determination of core areas or general movement patterns of the animals.

24. Question/Statement: "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 made Shell redo its cumulative effects assessment because it had ignored, among other factors, future fires.""- pg. 12

Response:

Joro conducted a comprehensive historical fire assessment as supplementary information and included the context of the CEA on caribou. The Environment Canada 'Recovery Strategy for the Woodland Caribou (*Rangifer tarandus caribou*), Boreal population, in Canada' (2012) incorporated a threshold of sustainability including natural disturbance. Future fire was not modeled; rather it was built into the assessment threshold. The National Recovery Strategy (Environment Canada, 2012) identified 65% undisturbed habitat as the threshold for a range to be 60% self-sustaining. The assessment framework addressed the "*adequacy of the current range conditions to support a self-sustaining population based on three lines of evidence: percent total disturbance, population growth and population size*" (Environment Canada, 2011). Effects of any disturbance such as forestry, mining, and linear development including roads, railways, and transmission lines. Natural disturbance such as fire was also considered and included

all burned areas less than 40 years old. The approach to the cumulative effects assessment involved both determining the existing disturbance regime and the potential disturbance regime in the foreseeable future (5 years as determined by Hydro).

By referencing the Supplementary Boreal Woodland Caribou report for Bipole III (2012), methods for long-term fire analysis can be found. Fire periods or cycles were measured for each ecodistrict for the total burned area and percentage of the ecodistrict burned. Time periods were identified by the amount of area burned in relation to the ecodistrict <1% burned, 1 - 5% burned, and >5% burned and any periods with > 5% burned were used to identify major fire periods. A cycle of 25-30 years was most common, with the Bog evaluation range having little fire activity and Wabowden and Reed Lake having a distinct fire cycle pattern.

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