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Re: South Peace Caribou Recovery following Five Years of Experimental Wolf Reduction

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Introduction

Caribou in Crises Due to Loss of Caribou Habitat

Scientists regard the decline of caribou herds as the toughest conservation challenge in North America. Caribou herds in British Columbia are facing a conservation crisis due to habitat destruction and climate change. Woodland caribou rely on lichen-rich mature and old coniferous forest, as lichen is their primary food source. Industrial logging, mining, oil and gas, and recreational activities have resulted in direct loss of caribou habitat as well as degraded and fragmented habitat. Consequently, the altered land is not capable of supporting caribou.

The urgency of the issue is dire. In British Columbia, caribou have declined from 40,000 in the 1900s to approximately 15,000 today, comprised of 54 herds of woodland caribou (FLNRO, 2018). Some caribou herds have already been extirpated in BC. Alteration of habitat has created a situation where if nothing is done immediately, more caribou herds will become extinct.

The altered land leads to another problem, which only compounds impacts on the caribou. The cleared land creates more open, early-successional vegetation, habitat preferred by moose, elk and deer. Moose, in particular are the primary prey species for wolves. Therefore, increased moose, elk, and deer lead to increased wolves. Subsequently, greater chances of wolf-caribou encounters occur in what is understood as human-mediated wolf predation. Wolf predation is not the underlying reason why caribou are declining. Caribou are declining due to loss of caribou habitat.

Intensive Wolf Kill Program

Due to the urgency, the BC government is undertaking reactive and intensive wolf control. The BC Ministry of Forests, Lands, Natural Resource Operations and Rural Development released a document in August 2019 titled *South Peace Caribou Recovery following Five Years of Experimental Wolf Reduction* (hereinafter referred to as the 'South Peace Study'). The South Peace Study documents results after three years of intensive wolf removal using controversial methods of aerial gunning and collaring of a 'judas wolf'. Collared judas wolves lead snipers to wolf packs, where the judas wolf is left alive only to witness its new pack massacred by aerial gun fire, year after year.

The South Peace Study claims that after three years of intensive wolf reduction to less than 2 wolves/1000 km², South Peace caribou populations increased by 49% (166 individuals in 2016 to 247 in 2019). This equates to an annual growth rate of 15%. Prior to the program, caribou were declining at a rate of 15% per year (625 in 2002 to 166 in 2015).

The South Peace Study recommended intensive wolf reduction (85% each winter) as an 'interim management tool' to reverse caribou declines.

The South Peace Study: Concerns

Caribou Will Continue to Decline Without Habitat

Caribou require caribou habitat. The changed landscape is what has led to both caribou declines as well as an increased abundance of wolves, which further compounds caribou decline. The South Peace Study recommends controlling a symptom: that is controlling the increased wolf population. The real issue is caribou habitat loss. Without it, caribou cannot survive.

The South Peace Study was a short, three-year experiment. It is not a surprise to see an immediate increase in caribou numbers following intensive reduction of wolves (85%). That is the nature of predator-prey dynamics when a predator is almost completely absent from the system. Naturally, there will be evidence of an initial increase in caribou numbers upon alleviating predation pressure. Degraded habitat still remains. There is a great possibility that this initial declining trend cannot be maintained and we are seeing an initial response upon relief of predation pressure. In the absence of both wolves and caribou habitat, caribou populations will continue to become more and more vulnerable. Over time, the cumulative impacts of declining caribou health mediated by habitat loss are likely to reveal an overarching declining trend in caribou populations.

Distraction from Habitat Protection

If the idea of culling wolves is to buy time while habitats are restored, this is a serious mistake. Culling wolves to buy time fosters conditions favourable for inaction, making the situation worse. Already, on-the-ground habitat protection and restoration are being ignored. Industrial forestry, mining, and oil and gas need to cease within critical caribou habitat and the disturbed land be returned back to caribou habitat. This would require the rightful legal protection of caribou and their critical habitat, which they are afforded under the Species at Risk Act (SARA). Still, BC has not implemented plans under the federal recovery strategy. Culling wolves only buys time for inaction. Results from studies such as the South Peace Study are commonly misused in politics. Studies that promote shortsighted wolf culls only perpetuate a problem while it is seemingly controlled, thus incentivizing industry and government to continue with the status quo.

By the time wolf culling stops having an effect, the severity of the ignored situation will be much greater, leading to the collapse of caribou in British Columbia. The only way to recover caribou to self-sustaining populations is to take serious action on protecting caribou habitat. We cannot afford to distract from this by hiding the problem under a short-term and deceptive approach. While the problem is seemingly under control, large amounts of money, time and resources consumed, which instead could be allocated

toward caribou habitat recovery.

South Peace Study Does Not Account for Increased Stressors of Climate Change

External stressors on the caribou populations due to climate change are expected to increase, and are not taken into account in the South Peace Study's predictions. Particularly, the frequency of forest fires, starvation, disease, weather events, and temperature changes are expected to increase. Climate change has significant impacts on habitat, and caribou health and resiliency. The South Peace Study does not consider how this might lead to uncertainty in wolf cull efforts. With the total stress on caribou increasing, actions must be taken now to protect critical habitat so that populations can be resilient to stressors induced by climate change. Culling wolves will not provide the resiliency to caribou necessary to endure climate change stressors.

Predictions Extrapolated Based on Only Three Years of Data

The prediction made in the South Peace Study (Figure 1) is based on extrapolating population growth rate from three years of study into the next thirty years. This simplistic extrapolation is problematic since it is critical that ecological forecasting be probabilistic (Eacker *et al.*, 2019; Dietze *et al.*, 2018) and based on demographic modeling (Severud, DelGiudice, & Bump, 2019).

The South Peace Study assumed that what happened in three years will continue into the future based only on the observed population growth rate. It is important to incorporate multiple population demographic parameters into models when making predictions. Further, ecological systems are dynamic and complex with interactions including multi-prey and multi-predator relationships, which often regulate each other. In addition, the dynamics of vegetation-herbivore relationships are dependent on habitat variability and vegetation food source availability which are moderated by weather and climatic changes. Variations in weather, habitat conditions, and behaviour of predators and prey ensure that the relationships will be varied and difficult to predict and interpret. Probabilistic modelling provides a distribution of possible outcomes, which captures uncertainty and variability in the system (Dietze *et al.*, 2018).

The method applied in the South Peace Study makes inferences inherent with doubt and skepticism, since uncertainty and variability were not accounted for and addressed. Caribou may be limited by other factors in the system, which can change over time. Predominantly though, caribou are limited by the availability of resources and nutrition since they don't have the minimum required habitat range.

The recommendations specify continuing the intensive wolf cull "until caribou populations approach a self-sustaining status (approximately 1,000 individuals)". This implies wolves would be culled intensively for the next 30 years in order to reach self-sustaining populations of caribou. The excessive resources consumed by these efforts over thirty years would be more appropriately allocated toward a sustainable solution that would result in the restoration of caribou habitat and sustainable caribou populations.

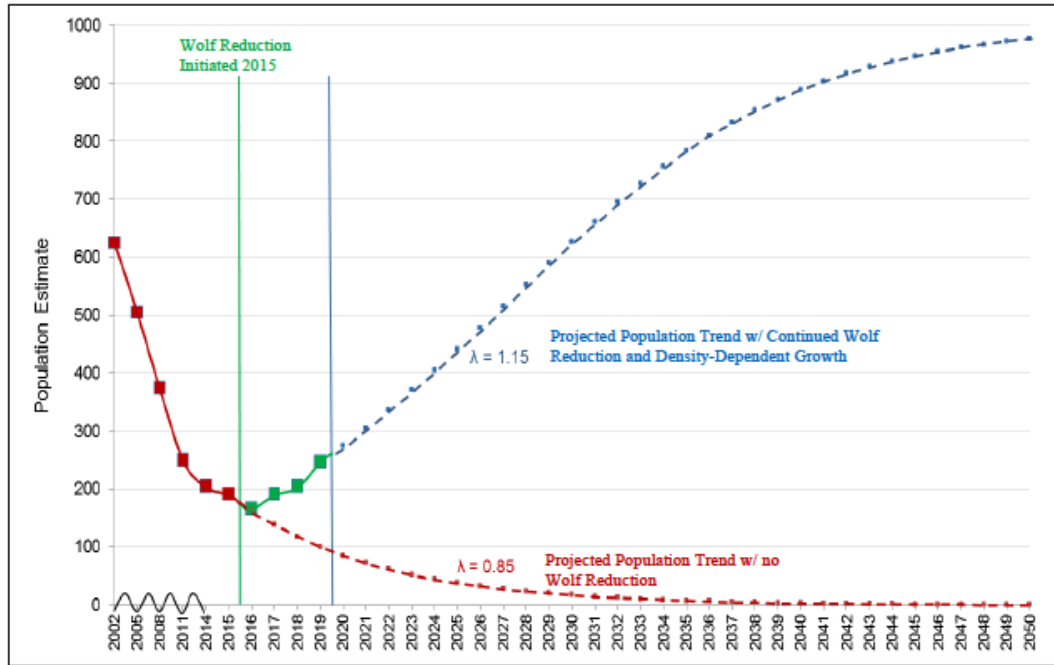


Figure 1. South Peace Study Extrapolation from Three Years of Data - for three south Peace Caribou herds (Klinse-Za, Kennedy Siding, and Quintette) prior to, and in response to, intensive wolf reductions (FLNRO, 2019)

Influence of Wolf Presence on Aerial Survey Estimations of Caribou

Aerial survey methods in estimating caribou population numbers are often criticized for poor accuracy (Eacker *et al.*, 2019; Patterson *et al.*, 2014; Severud, DelGiudice, & Bump, 2019; Thomas, 1996). Detectability in aerial surveys can range from 25% to 80% and be influenced by a number of factors: vegetation cover, type of aircraft, observer experience, time of day and year, altitude, speed, temperature, and animal group size (Patterson *et al.*, 2014). Some aerial population estimates have even found species to be stable over a number of years when in fact; there was a sharp decline (Severud, DelGiudice, & Bump, 2019).

Coupled with this, the presence of wolves influences the distribution, behavior and foraging of ungulates (Licht *et al.*, 2010). The South Peace Study does not acknowledge or discuss the influence that wolf density might have on aerial survey interpretations. Could it be possible that at the beginning of the three-year program when wolves were abundant, that caribou were more inclined to take cover? Conversely, when wolves were removed, might caribou be spending more time out in the open? How would this influence aerial surveys and the interpretations made in the South Peace Study? There is a possibility that after the three years of wolf killing, caribou were simply more visible and easily seen. This would inflate caribou counts in relation to counts when the study was initiated.

Potential for More Small and Numerous Wolf Packs

The South Peace Study describes that multiple years of wolf reduction commonly leads to wolves recolonizing in smaller pack sizes, which is expected based on breeding and dispersion behavior of wolves. The report states:

“Small and numerous wolf packs increase the difficulty of removing a high proportion of wolves, as they are more challenging to locate than larger packs and have less-established territories.”

The report does not offer any reasoning as to why this wouldn't be an issue in this case. Small and more numerous packs will inhibit the effectiveness of this flawed approach.

Small and more numerous packs is a well-documented outcome of wolf culls. What might the implications of this be on the greater ecosystem? There is potential for this to lead to the opposite of the intended outcome. Small, numerous packs that create even greater predation pressure on caribou populations.

As a critical factor to the success of the program, the South Peace Study points to “radio collaring of most, if not all, wolf packs within the treatment area”. With more small and numerous wolf packs, this would not only be an increasingly difficult feat, but if the collared wolf was left alive in each pack, there would be many more collared wolves, well dispersed across the landscape, which would prey on caribou. If the radio collared wolves were also killed every year, there would be no means in locating the numerous and small wolf packs.

Low Caribou Calf Survival

The South Peace Study indicates that the causes of calf mortality have not been investigated across the South Peace caribou herds. Further, results of the South Peace Study showed low caribou calf recruitment despite intensive wolf reduction. Calves released to the wild from maternity pens had significantly higher survival rates (77%) than wild calves (15%). One of the final recommendations was to “consider research opportunities to investigate causes of caribou calf mortality (i.e. predation by bears or other predators, health-related causes, etc.)”.

It is understood that wild caribou calves have compromised health due to lack of availability of essential resources that can only be provided by caribou habitat. Woodland caribou are an indicator species, meaning that their state of health reflects the overall health of the ecosystem. The significantly higher survival rate of calves released from maternal penning in comparison to wild calves is evidence that the caribou continue to be under great stress overall due to loss of critical habitat.

Primary Prey Response: More Moose Invite Wolves

The South Peace Study discusses the potential problem of increased primary prey such as moose, deer, and elk as a potential outcome to the removal of wolf predation pressure. If moose abundance were to increase to great enough densities, this would facilitate the annual wolf re-colonization and recovery, which would be further detrimental to caribou populations. Increased moose populations, the preferred prey of wolves, would only make it easier to invite wolves onto the landscape where caribou reside.

The South Peace Study acknowledges this as a problem and also points out that there is a lack of baseline data for moose populations within the study area. Therefore, we do not currently have an understanding of the response of moose populations to the wolf cull. There is great potential in this case that the moose population is growing due to the lack of predation by wolves, such that over a certain density would

support increased recovery rates of wolves. Essentially, the wolf cull program would be a wasted effort, as primary prey would constantly allow for recovery. Why are moose in caribou habitat to begin with? The reason is alteration of habitat to that which is more favourable to moose as well as deer and elk, all three the primary prey of wolves.

The report further highlights the great social and logistical challenges with reducing moose densities through licensed hunting, which stems predominantly from First Nations' right for abundant moose populations to meet their food, social and ceremonial needs. Later in the final recommendations, licensed hunting of moose is recommended.

Removing the Majority of Wolves from the Landscape: Unintentional Outcomes

Wolves are an integral part of the ecosystem. Creating a situation where wolves are nearly absent is cause for great concern. In many North American ecosystems, the absence of top-level predators has resulted in overabundant ungulate populations, cascading negative impacts on plant communities, and the loss of biodiversity and ecosystem processes (Licht *et al.*, 2010). The absence of wolves leads to degraded and simplified ecosystems (Soulé *et al.*, 2003). Simple manipulations of a single species can have profound unintended consequences, which may even counter the intended conservation objective (Johnson, Mumma, & St-Laurent, 2019).

The most credible example of the far-reaching importance of wolves as a keystone species is the Yellowstone National Park success story. Without wolves, the entire ecosystem was out of balance. As told by the Guardian in a celebrated success story "coyotes ran rampant, and the elk population exploded, overgrazing willows and aspens. Without those trees, songbirds began to decline, beavers could no longer build their dams and riverbanks started to erode. Without beaver dams and the shade from trees and other plants, water temperatures were too high for cold-water fish" (The Guardian, 2020). The ecosystem rebounded quickly with willows, aspens, songbirds, beaver, eagles, foxes and badgers returning and riverbanks stabilized. There are likely a myriad of other effects.

In British Columbia, removing wolves as the top predator from the ecosystem would have inevitable and far-reaching implications to ecosystem structure and biodiversity. When caribou habitat is adequate and balanced predator-prey dynamics are maintained, wolves play a key role in keeping caribou herds healthier and stronger by eliminating sicker, weaker animals. The complexity of the ecosystem is beyond our understanding and the risk of creating severe imbalance and further degrading ecosystems by disturbing a complex system is great.

Impacts to Wolf Physiology and Social Structure

Heavily hunted wolves have elevated stress hormones and reproductive steroids than wolves with lower hunting pressure (Bryan, 2014). This may reflect increased reproductive effort as well as social instability. The stress hormone cortisol was much higher in a population of wolves killed as part of a control program. Altered physiological responses potentially could have long-term implications on wolf populations.

The Wolf Kill Program is Unethical and Unjustifiable

The South Peace Study consistently refers to the importance of ‘humaneness’ for the program, arguing aerial shooting as a way of quickly dispatching wolves’. They examined the level of humanness with a subsample of cases:

“Of the documented subsample of 98 wolf removals, the vast majority of wolves were dispatched instantaneously or within seconds following one well-placed shot or a quick succession of multiple shots. Only six wolves took longer than 30-seconds to expire after an initial shot, and only one wolf was never visually confirmed to have expired after being shot (although it appeared to have expired out of sight in a tree well).”

Dr. Sara Dubois, the BC SPCA’s chief scientific officer stated that, *“Killing from helicopters, even by the most skilled marksman, causes excessive stress during chase and there is no way to confirm death was quick and painless.”* The stress of being chased by a loud flying metal object and loud gunshots would be felt by the whole pack.

The examination of the level of humanness by those involved with the program is inherently biased. There is no way of knowing the level of suffering experienced by the wolves. It is easily conceivable that a number of wolves would experience unimaginable agony. Further, wolves are highly social beings, and the experience of the judas wolf witnessing the bloody obliteration of their pack year after year would be nothing short of traumatizing. This is not conservation.

In British Columbia, the vast majority of the general public (90%) opposes culling predators to protect endangered species (Dubois and Harshaw, 2013). The success of a plan is contingent on the acceptability of society. Recovery of the Fortymile caribou in Yukon is an example of a success story. The recovery plan entailed habitat protection, reduced caribou harvest, and nonlethal wolf control. The plan itself was developed by a team representing all interests, and not just government. The team understood that lethal measures of predator control was not socially acceptable, and therefore was not an option (Gronquist, Haynes, and Gardner, 2005). The success of the plan highlights the importance of a consensus-based planning, public participation and support, and non-lethal predator control. Social acceptance is vital to the success of any strategic management plan. It is clear, the wolf kill program outlined in the South Peace Study does not have the support of British Columbians.

Not only is the wolf cull unethical, it is unjust. Innocent wolves are paying the ultimate price for a human caused problem. This is not a sustainable solution from an ecological or social perspective.

British Columbia Not Addressing Habitat Loss

Logging is still occurring in critical habitat. Habitat restoration and protection are not being taken seriously. The federal recovery strategy for Woodland Caribou specifies that caribou require a minimum of 65% of their habitat to achieve recovery (Environment Canada, 2014).

The 2017-2018 BC Provincial Caribou Recovery Program Annual Report indicates that a mere 6.7 kilometers of road was ‘deactivated’ and remediated 5 kilometers of other terrain in BC caribou habitat, occurring in the Southern Mountain Caribou range. All other habitat protection and management actions listed pertained mainly to ‘plans’ and were not actual completed habitat restoration actions, despite the

allocation of \$2 million to the Habitat Conservation Trust Fund (FLNRO, 2018).

Why aren't real, concrete conservation actions being implemented to protect and restore caribou habitat?

Non-lethal Interim Solutions

Blocking linear developments

Linear features such as access roads, seismic lines and recreational trails provide movement corridors for wolves, allowing access to caribou. Recent research conducted within Woodland Caribou range in Alberta used motion-triggered cameras to understand habitat use by predators and prey in caribou habitat. The research found that blocking linear developments by spreading logs was effective at managing predator use at small spatial scales (Keim *et al.*, 2019b). The research recommended that wildlife managers in Canada employ an experimental study at a larger scale to determine if this linear restoration approach can reduce the intensity of predator usage.

Aside from winter oil exploration, even snowmobiling increases the usage intensity by wolves by creating packed snow conditions that enable ease of travel in winter and compacting soil which suppresses vegetation growth in the summer (Keim *et al.*, 2019a). The study suggests promoting recreational snowmobiling on existing linear features outside of a caribou habitat as a mitigation strategy. The benefits of this are two-fold as it would reduce disturbance within caribou range as well as draw wolf packs away from caribou. Monitoring habitat use by caribou, wolves, and other predators and prey with motion-triggered cameras would be valuable in determining what locations where mitigation would be most effective (Keim *et al.*, 2019a).

Blocking linear features is not habitat restoration, but it provides a means to limit caribou-wolf encounters.

Another study found that the greatest reductions in wolf travel speeds on linear disturbances occurs when the average vegetation height is greater than 50 cm. Further, wolf travel speeds are similar to that of intact forest when the average height of vegetation is greater than 4.1 m on at least 30% of a linear feature (Dickie *et al.* 2017).

Call for More Innovative Interim Ideas

Restoration of caribou habitat back to previous conditions is the only way to allow caribou to flourish. Old-growth forests take more than a century to re-establish, so innovative interim solutions are required as caribou habitat is restored. Solutions must be non-lethal in order to be acceptable to society and to avoid unintended ecological consequences. The key is to discourage wolf-caribou encounters to prevent predation events. Wolves do not have to be killed to achieve this goal.

Conclusion

For a species to survive, they require suitable habitat. Recovery means self-sustaining caribou populations. The wolf kill program is unsustainable, uncertain, unscientific, unethical, unacceptable to British Columbians, and simply unjust.

The wolf cull is clearly not a sustainable solution to the caribou crisis. The outcomes of the wolf cull may very well have negative impacts on the ecosystem and the caribou. The fact is, as long as the habitat remains viable wolf habitat, new wolves will continually recolonize, likely in smaller pack sizes. Constant killing of wolf packs on a yearly basis is an enormous waste of resources, with no gain in terms of caribou habitat conservation.

There are numerous flaws apparent in the South Peace Study. First and foremost, the wolf cull is a distraction and is simply not a reliable or sustainable solution to the issue. Loss of critical caribou habitat is the heart of the issue. It is imperative that caribou habitat is restored and that concrete and tangible actions are taken now. All stakeholders know and have agreed, including government and the authors of the South Peace Study, that caribou habitat needs to be restored and protected.

Recommendations

- Intensive habitat restoration and protection for long-term sustainability of caribou herds
- Block and restore linear features
- Monitor caribou herds and wolves using motion-triggered cameras to provide further insight into where mitigation would be most effective
- Innovative interim solutions (non-lethal) are quickly needed to deter wolf-caribou encounters. Exploration of ways to limit the instances of interaction between wolves and caribou is key. This innovation could be achieved using technology and other creative methods

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