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BACKGROUND REPORT

SUBSTITUTING WOLF CULLS FOR HABITAT PROTECTION KILLS CARIBOU TOO

In 2018 Environment and Climate Change Canada (ECCC) declared that BC's endangered mountain caribou face imminent threat to their recovery under the *Species at Risk Act*. The BC government had protected some habitat and was killing wolves across large areas of BC, but the ECCC said wolf killing without additional habitat protection would not protect the caribou in the long term. BC's program was lacking in sufficient habitat protection. Without immediate new habitat protection, the federal government would have to issue an order to force BC to do so.

Within six months ten BC and Alberta biologists — most of whom had been advisors or managers to the two province's mountain caribou recovery programs — published a research paper in a prestigious scientific journal, presenting statistical evidence that the previous wolf culls had improved caribou populations, and that changes in forest cover had had no effect. (Serrouya et al 2019) Media statements by one of the co-authors said that intensified wolf killing and maternal pens for pregnant caribou was urgently needed, and further habitat protection would be ineffective. Headlines across Canada proclaimed that killing more wolves would save the caribou. And 498 wolves did die in the winter of 2019-20.

Meanwhile a team of six scientists from three universities, headed by a retired Canadian Wildlife Service biologist, spent over a year re-analyzing the data used by the government team and running their own analysis. Just yesterday they announced that the previous study had serious flaws. The data showed no statistical basis for wolf culls and maternal pens in the conservation of mountain caribou, and no basis for claiming that habitat protection would be ineffective. (Harding et al 2019)

Why did the BC government ignore the federal study, which cited years of research showing that mountain caribou decline in proportion to the increase in habitat disturbance, and rely instead on one study that found that habitat condition made no difference? The federal government had said that adequate habitat protection was lacking, but the study by the Serrouya team was touted in the media as meaning that wolf culls and maternal pens should be prioritized over habitat protection.

It is time for the BC government to stop cherry-picking science — listening only to science that would avoid having to protect more old-growth forest. The carnage of 498 dead wolves is a tragedy, but an equal — and perhaps more irreversible — tragedy is that not one of BC's southern mountain caribou herds has received an iota of new habitat protection since Environment Canada's intervention.

This is a chronicle of the three scientific reports on mountain caribou which, between 2018 and 2020, have had momentous repercussions in a long-time controversy over the relative value of predator culls, maternity pens and habitat protection for saving the mountain caribou. The reports are:

- "Imminent Threat Analysis" by Environment and Climate Change Canada, 2018.

- "Saving Endangered Species Using Adaptive Management", by R. Serrouya, D. Seip, D. Hervieux, B. McLellan, R.S. McNay, R. Steenweg, D. Heard, M. Hebblewhite, M. Gillingham and S. Boutin, *Proceedings of the National Academy of Sciences (PNAS)*, April 2019.

- "No Statistical Support for Wolf Control and Maternal Penning As Conservation Measures for Endangered Mountain Caribou," by L. Harding, M. Bourbonnais, A. Cook, T. Spribille, V. Wagner and C. Darimont, *Biodiversity and Conservation,* July 2020.

PREDATION OR HABITAT CONDITION: WHAT IS THE DOMINANT LIMITING FACTOR ON MOUNTAIN CARIBOU POPULATIONS?

This has been a central question in caribou biology for years, but it is the wrong question, an irrelevant question. Increased predation on mountain caribou cannot be separated from habitat condition. Regardless of what statistical analysis shows, there is wide consensus within the scientific community that habitat disturbance has *caused* the increase in predation on mountain caribou, so it is misleading to pit one against the other and let computers show us which makes the most caribou rise or fall. Habitat protection *is* predator control.

Nevertheless, for nearly forty years now, a number of BC caribou biologists have held that predation is the dominant — some said the only — limitation on mountain caribou. Amongst scientists this is known as the top-down theory, as opposed to the bottom-up theory that habitat controls caribou populations. Wolves and cougars are at the top of the food chain. The implications of the top-down theory are that we can degrade as much mountain caribou habitat as we want, and still have caribou if we will only kill their predators. BC caribou science includes a number of scientific journal articles over the years contending that loss of habitat has not been limiting to mountain caribou.

This theory has never characterized all BC government biologists. Today, most biologists recognize that both predation and habitat have critical influence. As a recent example, at a public meeting in Nakusp, BC in April 2019, BC caribou managers gave an expert and honest recital of mountain caribou biology and the threats to their existence. Unfortunately, this kind of science that integrates the whole ecosystem does not dominate the government's policies (or even much influence them).

Still, throughout the 1980s and 1990s BC Ministry of Environment (MOE) caribou biologists were not afraid or held back from saying that logging was threatening mountain caribou. And as late as 2002 caribou biologists on various government committees were listing and sometimes researching a range of influences that habitat has on mountain caribou, including food supply and snowpack considerations.

Then around 2000 several things happened: a virulently anti-environment government administration came to power; and the passing of Canada's *Species at Risk Act* (SARA) finally posed a real threat to the logging industry that its massive timber supply might be reduced to enable the caribou to survive. The various industries and vested interests fired up their machinery of lobbying and misinformation campaigns. All this has put major stress on BC's caribou science.

The impact of the SARA was that the BC government finally admitted publicly that: "Habitat loss and fragmentation has been identified as the underlying cause of mountain caribou population declines since 1995, with mortality by predators as the secondary cause." This statement was made on government approval of a Recovery Plan for the mountain caribou of the Interior Wetbelt ("Deep-Snow Mountain Caribou"). This resulted in apparently extensive new habitat protection.

But the impact of the anti-environment government was that the amount of habitat protection was inflated in a number of ways, such as the inclusion of already heavily fragmented areas, steep slopes, burns and high alpine not of much use to the caribou. When closely examined, some herds had more, others less,

some almost none, but overall there was not enough and endangered herds were sustaining ongoing destruction of their remaining habitat for another ten years, extirpating 4 subpopulations in the process.

Meanwhile, without public knowledge or public debate, responsibility for wildlife management including mountain caribou was quietly shifted from the Ministry of Environment, which has a mandate to protect wildlife, to the Forests Ministry, which does not. Since that time the BC government has been entrenched in an adamant refusal to protect additional habitat for the Deep-Snow Mountain Caribou.

It should be noted that last year there was significant additional protection for the Central Mountain Caribou of the Peace River Region. VWS believes that those herds have received consideration because they had never before had a real recovery plan or significant habitat protection. First Nations alone had been taking care of them — and with some success with their maternity pen — and the government had been disgracefully delinquent in recognizing the native people's rights.

However, the "Deep-Snow" ecotype of the Interior Wetbelt has its own equities. It is genetically distinct from other caribou, and has very different habits and different habitats. They are the only caribou in the world that spend winter in snow three to four metres deep in the subalpine regions of rugged mountains, where they survive solely on a diet of tree lichens. Scientists have classified them as unique, irreplaceable and endangered. But habitat for the Deep-Snow ecotype also includes valley-bottom Inland Temperate Rainforest — some of the most profitable forest to log in Canada, and the provincial government has been incorrigible in refusing to protect more of it.

With this refusal, the last 10-15 years have seen the emergence of quasi-scientific mantras so biased that at VWS we call them "scientific rhetoric". (According to the Cambridge Dictionary rhetoric is "clever language that sounds good but is not sincere or has no real meaning.")

For instance, for quite a few years now, caribou biologists have been telling the public that saving the endangered mountain caribou will require "pulling all management levers". They say this to convince people that killing of predators and alternate prey, and maternal pens for pregnant caribou, must be included in the caribou management regime. Strangely, when "all management levers" are listed, they never include increased habitat protection. Apparently we're to pull all management levers except those that would stop logging old-growth forest.

The announcement of the Recovery Plan in 2007 was perhaps the last time that a public document from the BC government frankly acknowledged that habitat loss was the primary cause of caribou decline, and predation was secondary. Today the government line, repeated by its biologists, is that habitat loss is the ultimate cause, but predation is the "proximate" cause of caribou decline. "Proximate" cause then becomes the sole focus. If habitat impacts are mentioned at all, it's to say that when forest is removed, it brings wolves. That caribou need forests for other reasons is not commonly acknowledged.

This summarizes the systemic issues that brought us to 2019. At that time caribou researchers achieved what seemed to be a pinnacle of proof that predation is the dominant limiting factor on caribou populations, and changes in habitat condition have little effect: a sophisticated statistical analysis. Their research report in the *Proceedings of the National Academy of Sciences* (PNAS) journal made clear its relevancy to these issues:

> "The primary hypothesis was that population declines could be reversed by removing the proximate limiting factor, excessive predation, because broad-scale ecosystem restoration would take decades to achieve. We included early seral forest as a covariate to test the alternate hypothesis that the degree of ecosystem alteration would influence population response. This design essentially contrasts the proximate limiting factor of predation with the ultimate factor of ecosystem alteration."

The results of the statistical analysis attributed 44.2% of the change in herd dynamics to population management techniques (wolf culls, maternal penning, moose culls, etc), whereas only 4.2% correlated with alterations in forest cover. This was the ultimate basis for sweeping media claims that emerged from the study.

PREDATOR CONTROL AS A SUBSTITUTE FOR HABITAT PROTECTION

The PNAS journal article did contain a couple of statements indicating that intensified predator control was meant to be additive to habitat protection. Although these statements were contradictory to other aspects of the report, they were there. But none of these perspectives made it into the extensive media reports on the study. Habitat protection was more blatantly dismissed and predator culls came across more as a substitute for habitat protection than an addition; most certainly, that is the way government sees it.

Although it has made a few exceptions, the Valhalla Wilderness Society generally opposes predator control. These programs are carried out with no environmental impact assessments. The impacts on the wolves or on ecosystems are never considered. Nevertheless virtually all BC government and federal government biologists — and many not in government — support wolf culls for caribou. Many others do not and point to massive, deleterious impacts on ecosystems. *But those impacts are doubled when predator culls are used — and inflated to ever enlarging proportions — to aid and abet the destruction of another species' habitat.*

Since caribou recovery programs began in BC, the public has been given the impression by government that predator control and habitat protection are interchangeable; that to recover caribou we have a choice of whether to kill wolves or protect habitat, and that killing wolves can offset the caribou decline caused by logging the habitat; or that killing more wolves means we can save caribou while protecting less forest. Numerous public statements made by BC caribou biologists, inadvertently or otherwise, have contributed to this misperception.

But killing predators does nothing to reduce the other mortalities from habitat loss. And the whole focus on provable mortalities has prevented adequate research into the invisible impacts of habitat loss related to food supply, body condition, stress hormones, and reproductive failure.

THE IMMINENT THREAT DETERMINATION

In late 2017 VWS and three other parties filed separate legal petitions to the Minister of Environment and Climate Change Canada (ECCC), under the Species at Risk Act, providing scientific evidence that the Deep-Snow Mountain Caribou of the Interior Wetbelt faced imminent threat to their survival.

In mid-2018 the Minister of Environment and Climate Change (ECCC) issued a determination of "imminent threat" to the recovery of Southern Mountain Caribou. This included the Deep-snow Mountain Caribou of the Interior Wetbelt, the Central Mountain Caribou of the South Peace region, and part of the Northern Mountain Caribou. In media statements, the ECCC urged immediately increased protection, and left no question that new habitat protection was to be included:

> " 'Immediate intervention is required to allow for eventual recovery', says a department document … Emergency protection orders allow Ottawa to control activity on critical habitat that is normally governed by the provinces. That would include energy development, forestry and agriculture … 'There is a high degree of urgency. There is, at most, a few months to do the work,' said Wilkinson [parliamentary secretary to Environment Minister McKenna]."
>
> Canadian Press, May 4, 2018 (6)

The media statements by ECCC made it clear that the province's recovery actions had been short on habitat protection:

> "Friday's release acknowledges Alberta and B.C. are taking some steps to help the herds, but concludes they aren't doing enough. 'Such measures are not currently complemented by the significant habitat protection or restoration measures necessary to improve the likelihood of recovery in the long term.'"
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> *National Post*, May 4, 2018 (7)

The Minister's decision was accompanied by an Imminent Threat Assessment, an extensive federal analysis which noted that intensive killing of predators and competitive prey, and maternity pens, produced only short term results that would disappear if these interventions were ever stopped, as they did not provide habitat for the animals to sustain themselves in the future:

> "In the majority of cases where short-term trends appear to be stabilizing or increasing, the trend is recent and attributed to intensive predator management, sometimes combined with maternity pens and management of primary prey. ***In the past, the cessation of such actions in the absence of appropriate ecological conditions has resulted in a continuation of caribou declines***." (Emphasis added)
>
> "Imminent Threat Assessment", ECCC, Pg 9

> "The immediate interventions required include habitat management measures (i.e. ***no further net increase in disturbance of critical habitat*** **and restoration of disturbed habitat**, such that cumulative effects are reversed) and population management measures (e.g. predator/alternate prey management, maternity penning)". (Emphasis added.)
>
> —Ibid, Pg 15

Instead of issuing an order, the federal government entered into two years of negotiations with BC, to produce a draft "Section 11 Agreement" (based on Section 11 of the federal *Species at Risk Act*). This was to be British Columbia's "commitment" to the federal government to correct the situation. In April of 2019 the two governments sent their biologists on a tour of BC communities to gather public input on the Agreement.

THE ADAPTIVE MANAGEMENT STUDY BY SERROUYA ET AL: SHORT-TERM VERSUS LONG-TERM CONSIDERATIONS

In March 2019, about three weeks before the public meetings were to begin on April 1, the *Publication of the National Academy of Scientists* (PNAS) published the research paper by the ten biologists, some of whom had prescribed and/or managed the predator-prey culls and maternity pens on which the study was based. They did allow that habitat protection would eventually be needed, but stated up front in their report:

> "[T]he classic solution of protecting remaining critical habitat will not save most caribou populations because of the time needed to recover old forests and the continental scale of disturbance. In such cases, population management is needed until protection and recovery of habitat *overcome the legacy of industrial development*." (Emphasis added) (10)

This is a confused statement because "remaining critical habitat" infers intact habitat, and protecting it would not require recovery. Old forests don't need to be recovered. The statement might be substantially cleared up if they said that many of the herds they looked at don't have enough habitat left to make any

substantial difference if it were protected. But some do, and they live in the Interior Wetbelt where the habitat is mature or old-growth Inland Temperate Rainforest.

Some problems in the report by Serrouya et al characterize most BC caribou biology. For the last ten years various BC caribou researchers and managers have repeatedly said "there isn't time for habitat protection to work" or that it's "too slow". In the past VWS has tried to inform some of them that habitat protection is not aimed at producing immediate population increase. How could it do that? Habitat protection would not give caribou anything they don't already have. VWS has three park proposals in mountain caribou habitat. Their purpose is to keep the caribou from losing more habitat and suffering further decline, past the point of where true self-sustaining recovery is feasible. Once the decline is arrested, hopefully surrounding habitat that has been logged can be recovered and the herd can increase gradually.

When the BC government, following release of the report by Serrouya et al, announced expanded predator control, saying that habitat protection was too slow, VWS sent the following comment:

> "A 40-year running history shows that habitat protection takes too long because the government drags its feet and finds every pretense in the book to avoid doing it. While we wait, it is signing logging and road building permits. The trees that form the functional parts of the habitat for caribou are being hauled away. Once large amounts of the habitat have been clearcut, the government claims it would take too long to wait for the trees to grow back, so predators must be shot from helicopters. So what appears to be proposed here is massive, institutionalized, long-term extermination of wolves, and perhaps of cougars — with no review or consideration of the ecological damage that would ensue, let alone informing the public of the environmental impacts."

Another classic government reply to requests for more habitat protection is: "You could stop all logging and industry today, and it would take decades for the habitat to recover, and you would still need predator control and other management." So then, let's log the rest???

Then there's the excuse that: "it's a long-term solution". The biologists claim that they are in too big of an emergency to consider long-term solutions. Our answer has been to point out that the habitat for the long-term is being logged *now* at a rapid rate. Why isn't that an emergency?

The federal Imminent Threat Assessment recognized this problem. It allowed that predator control was aimed at short-term reversal of declines, but it said that long-term considerations must be undertaken at the same time:

> "While population management [i.e., predator control and maternity pens] is having a positive *short-term* effect in some local population units, ***such measures are not currently complemented by the significant habitat protection or restoration measures necessary to improve the likelihood of recovery in the long term***." (Emphasis added)
> — "Summary of imminent Threat Analysis", ECCC, 2018

VWS understands why wildlife biologists and people running caribou recovery want predator control though we don't often agree with them. But we do not understand how they can dismiss the value of protecting the remaining intact habitat, and give the public the impression that more habitat protection can be safely deferred to the distant future — while in fact it is being logged now.

ENGULFING MEDIA CAMPAIGN AS PUBLIC MEETINGS APPROACH

> ***"****An extensive study of caribou herds across British Columbia and Alberta suggests a way to reverse a long and steady decline of the endangered species — kill more wolves and moose and pen pregnant cows. 'It's go hard or go home,' said Rob Serrouya, a University of Alberta biologist and lead author of the study released Mon-*

> *day in the Proceedings of the National Academy of Sciences.* ***'Unfortunately, it's that black or white.'"***
>
> *— Times Colonist, Vancouver Sun, CBC, National Observer, National Post, et al.*, March 11, 2019

On the same day the ten author's paper was published — and only three weeks before the beginning of the public meetings on two government-to-government caribou agreements — articles on the Serrouya study hit the news media across Canada with headlines such as:

- *"Study Finds Ways To Reverse Caribou Decline" (Canadian Press);*
- *" 'It's that black or white': Wolves must die to save Canada's caribou" (Calgary Herald, March 12, 2019);*
- *"Increase Wolf Culls, Pen Pregnant Cows To Save Endangered Species" (CBC, National Observer, Vancouver Sun, March 11, 2019).*

With the public meetings scheduled to begin on April 1, this barrage of media coverage fed into an inflammatory resistance to habitat protection that had already begun and was well organized from the Peace Region to the Kootenays.

Once the meetings began, the study by Serrouya, et al, was still being mentioned in the same news articles that reported that the caribou plan would "cost hundreds of jobs" and had spawned inflammatory resistance. Coverage by star reporter Vaughn Palmer in the Vancouver Sun made sure to quote Dr. Serrouya stating that habitat protection would not work:

April 15, 2019, Vancouver Sun

> "But recent research suggests that habitat protection is not likely to be all that effective in reversing the decline of caribou populations in the area. 'The classic solution of protecting habitat will not save most caribou populations because of the time needed to recover old forests and the continental scale of disturbance, concluded a team of researchers headed by Robert Serrouya of the University of Alberta and including Dale Seip from the BC Environment Ministry.'"

April 11, The Star, Vancouver

> "For University of Alberta's Caribou Monitoring Unit director, Rob Serrouya, it's no surprise that the government's recovery plan has inflamed controversy.
>
> "No other critter has as much potential to constrain so much of the economy, because of the habitat caribou need — which sits right on valuable forest stands and valuable oil and gas deposits," Serrouya, a consulting biologist for the Revelstoke Caribou Rearing in the Wild Society, told the Star in an interview.
>
> "The government has to decide the sliding scale between managing predators and prey, versus constraining more resource use."

Why shouldn't loggers be upset about habitat protection if they believe that habitat protection and predation are on a sliding scale: more predation means less habitat protection? The Environment Canada Imminent Threat Assessment had already demolished this claim idea, but it received no media attention.

WHAT THE STUDY AND THE MEDIA REPORTS DIDN'T SAY

The Valhalla Wilderness Society believes that the genuine improvements cited by Serrouya et al., due to wolf culls and maternity pens, should have been reported to the public. It's important to the public debate, and the biologists who recommended and ran these wolf culls have as much right to report their encouraging news as anyone else. But it should have been reported in context with the limitations of the study, and while acknowledging the cases where population management has failed — of which there are notable cases in BC.

Why were the years of wolf sterilization for the Quesnel Highlands herd, that failed to produce a significant increase in the herd, excluded from the study? Why were the problems with the Revelstoke maternity pen not disclosed? That was one of only two maternity pens in the province, and the only one in the range of the Deep-Snow Caribou. It was abandoned after five years of operation, reportedly due to too many caribou mortalities inside the pen. At least 17 caribou died within the pen between 2014 and 2018. (1)

What is especially lamentable is that the study by the Serrouya team included only 18 of 42 herds, and only 5 of those 18 herds actually increased in number, and only one of the five was of the Deep-Snow ecotype. Unfortunately, there were generalized statements made in the media that reflected certainty, and that were used by government to make decisions about many herds. But the research report did not provide a basis for that kind of certainty.

VWS's review of the research paper found that analysis based strictly on numbers can gloss over relevant details. For instance, the most intense wolf culling included in the study was for Alberta's Little Smoky herd, but it had no significant effect on herd growth. (2) According to Environment Canada, 95% of the herd's habitat is "disturbed". (3) Witnesses say it is the most devastated caribou habitat there is.

Over 840 wolves were killed in the first seven years up to 2012. Both wolves and moose were shot from helicopters and carcasses loaded with strychnine poison were strewn across the range. The culls have continued ever since.

The original research report on the first seven years stated that the poisoned baits were set to be selective for wolves, but the baits also killed 91 ravens, 36 coyotes, 31 foxes, 8 martens, 6 lynx, 4 weasels and 4 fishers — all of which died an agonizing death. (4) In addition, during the six years of the project, hunters and trappers killed 100 wolves. And shooting moose from helicopters is a ghastly prospect.

Because this herd has had 95% of its habitat disturbed, Environment Canada (2011) assessed it as "very unlikely" to maintain a self-sustaining population in absence of "active management intervention" (predator control and penning). The existence of the herd will be dependent on the predator culls for the foreseeable future. And the destruction of the last remaining habitat for this herd continued despite the findings of Environment Canada and the predator culls.

The Little Smoky herd was not counted as "improved", but the degree to which it contradicts the conclusions of the study, that habitat condition has no effect on caribou populations, is rather stunning.

There were other details about the Serrouya team's study that disturbed VWS reviewers and made us feel that numbers don't tell the entire truth. For instance, the Columbia North was characterized as increased after a moose/wolf cull, which makes this herd part of the media enthusiasm for the success of the cull.

However, an important part of the context on these herds is that they received very little habitat protection from the 2007 recovery program; the protection they received was already highly fragmented, and their unprotected habitat has been logged relentlessly ever since.

In 2016, with poor results of the moose reduction and maternity pen, Dr. Serrouya and a colleague released a plan for a direct wolf cull by helicopter.(5) The plan stated that:

> "continued forest harvesting of critical habitat will further benefit the growth of moose, deer and predator populations, and fragment habitat that increases predation on caribou … The early seral conditions at low elevation are rapidly changing and will become less beneficial to moose and deer. *If logging could be further decreased, the problem with competitive prey and predators would diminish in time*."

The plan also cites a substantial amount of motorized recreation that continues in the habitat of Frisby-Queest and South Columbia herds, and in part of the North Columbia herd range. In fact, the authors point out that:

> "high levels of heli-skiing and snowmobiling may be having some effect *although there has been limited research on this topic*. Researchers have documented less caribou use in areas of high snowmobile activity and higher stress hormones in areas of heli-ski and snowmobile activity compared to areas without mechanized recreation." (Emphasis added)

In 2018 BC released draft "Herd Plans". They show that the 2007 recovery plan left a quarter to a third or more of the remaining "core" habitat unprotected for some herds. The Hart Ranges, Wells Gray South, Wells Gray North, Columbia North, Columbia South and Central Selkirk herds are all examples of declining Deep-snow Caribou herds whose habitat is still being clearcut.

- The draft herd plan for the Columbia River region admits that 35-40% of remaining old-growth forest habitat of the Columbia North and South herds remains unprotected, and logging is ongoing. Years of predator and competitive prey culls and a maternity pen have only managed to hold the Columbia North herd more or less stable while logging companies haul out truck after truck of old-growth forest that is crucial to the caribou's long-term survival.

- The Hart Ranges herd faces 78 planned cutblocks and a pipeline; what it will be getting is no new habitat protection, but slaughter of 80% of its wolves.

- The Wells Gray South herd has clearcutting over an area as large as 500 football fields throughout their core critical habitat.

"NO STATISTICAL SUPPORT FOR WOLF CONTROL AND MATERNAL PENNING AS CONSERVATION MEASURES FOR ENDANGERED MOUNTAIN CARIBOU"

This re-analysis of the data by Dr. Harding and his colleagues is extraordinary, as it is the very first time that a study on BC mountain caribou has received intense scrutiny by a multi-disciplinary team of six independent scientists.

To VWS reviewers, who have no expertise in statistical analysis, one of the key things we wished to learn about the Serrouya team's analysis was whether it was thorough and complete enough to warrant the sweeping claims that were based on it, or whether public, media and governmental opinion are being swayed by a study with inadequate data or flawed methodology. The Harding group found that:

- Serrouya et al. used four different ecotypes of caribou in their analysis. Much of the variation in the response of various herds to various management techniques is due to different ecotypes, but the original analysis was not designed to detect these relationships.

- The Serrouya team had reported that their various population treatments (wolf culls, moose culls, maternal pens) accounted for 44.2% of the changes in herd dynamics, whereas changes in forest cover accounted for only 4.2%. The Harding group identified an omission in the statistical analysis method which, when added, indicated that the population treatments were no more effective than forest cover changes or random chance. This alone annulled the claims that were made in the media.

- Using the same data and methods described by Serrouya et al. to evaluate the influence of habitat condition, the review team could not reproduce the same results. They also cited a number of criticisms of the methods.

- The analysis did not include snowmobiling, heli-skiing or habitat protection as factors that might have influenced changes in herd populations.

The multi-disciplinary research team that reviewed the study by Serrouya et al included a retired Environment Canada biologist and manager, several biologists with statistical analysis expertise, and an expert in lichens, the primary food of mountain caribou, and old-growth forest. Their report restores dimension to BC wildlife biology, especially with the light they throw on the differences between the Deep-Snow Mountain Caribou and the central and northern herds. They point out that the Deep-Snow ecotype may be more vulnerable to forest removal and to weather and snowpack conditions than the central and northern ecotypes. Further, wolves are not the primary predators of the Deep-Snow Caribou. A combination of cougars, bears and wolverines account for most of the verified mortalities.

Lastly, the review authors do note the "exclusion of any meaningful consideration of the 'bottom-up' habitat requirements of caribou." The Adaptive Management study by Serrouya et al started with a classic top-down hypothesis, searching for that one "limiting factor" which alone could reverse the caribou decline, and predicting that it would be predation. BC caribou science has been composed almost exclusively of biologists specializing in animal population dynamics. An infusion of expertise that would bring focus on the whole ecosystem is critically necessary, especially because the mountain caribou is only one of many species at risk in the ecosystems that they occupy.

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