Species Status Report

Northern Mountain Caribou (Woodland Caribou [Northern Mountain Population])

Rangifer tarandus caribou

Vadziah (Teetl'it Gwich'in/Gwichya Gwich'in)
Shúhta ʔepę́/Goʔepę́ (Shúhtaot'ıne)
Shíhta gǫʔədǝ́ (K'ashógot'ıne)
Bedzih (Shúhta Dene)
Kudzih (Kaska Dene)
Mbedzih (Dene Zhatie/Yati)

IN THE NORTHWEST TERRITORIES

NORTHWEST TERRITORIES SPECIES AT RISK COMMITTEE

ASSESSMENT – SPECIAL CONCERN

APRIL 2020

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ABOUT THE SPECIES AT RISK COMMITTEE

The Species at Risk Committee was established under the *Species at Risk (NWT) Act*. It is an independent committee of experts responsible for assessing the biological status of species at risk in the NWT. The Committee uses the assessments to make recommendations on the listing of species at risk. The Committee uses objective biological criteria in its assessments and does not consider socio-economic factors. Assessments are based on species status reports that include the best available Aboriginal traditional knowledge, community knowledge, and scientific knowledge of the species. The status report is approved by the Committee before a species is assessed.

ABOUT THIS REPORT

This species status report is a comprehensive report that compiles and analyzes the best available information on the biological status of northern mountain caribou in the NWT, as well as existing and potential threats and positive influences. Full guidelines for the preparation of species status reports, including a description of the review process, may be found at www.nwtspeciesatrisk.ca.

Government of Northwest Territories

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ASSESSMENT OF NORTHERN MOUNTAIN CARIBOU

The Northwest Territories Species at Risk Committee met on April 22, 2020 and assessed the biological status of northern mountain caribou in the Northwest Territories. The assessment was based on this approved status report. The assessment process and objective biological criteria used by the Species at Risk Committee are available at: www.nwtspeciesatrisk.ca.

Assessment: Special Concern in the Northwest Territories

Special Concern – May become threatened or endangered in the Northwest Territories because of a combination of biological characteristics and identified threats.

Reasons for the assessment: Northern mountain caribou fit criterion (b) for Special Concern.

(b) – The species may become threatened if negative factors are neither reversed nor managed effectively.

Main factors:

- The range of this species is remote and relatively undisturbed outside of localized areas. However, northern mountain caribou in the Northwest Territories are subject to a number of important threats.
- Northern mountain caribou are vulnerable to the effects of climate change, particularly the already noticeable decline in ice patches in the Mackenzie and Selwyn mountains. These areas, used to escape insects and cool down in the summer, are considered critical habitat components.
- Other threats include harvesting, recreation activities, resource development, and disrespectful harvesting behaviour. Although most of these threats are localized at the scale of the whole range of northern mountain caribou, they are expected to result in measurable negative impacts in some significant portions of the range, including within the calving and summering range of the Redstone herd, the largest herd in the Northwest Territories.
- There is strong local interest and support for management interventions in the range of northern mountain caribou. However, there exists strong concern that this is not being translated into meaningful management actions.
- Northern mountain caribou have a number of limiting biological characteristics that make them particularly vulnerable to the effects of climate change in particular (e.g.,

cold-adapted, reliance on ice patch habitat) and can limit population recovery in the event of a decline (e.g., low reproductive capacity, high levels of calf mortality).

- Northern mountain caribou have the potential to become Threatened if the effects of climate change continue within their habitat and localized threats are not managed effectively.

Additional factors:

- Population declines or displacement have been reported by Indigenous knowledge holders in the Sahtú and Gwich'in regions. This has been particularly noticeable over the last 10-12 years for the Redstone herd. However, much of the scientific population data are outdated.
- Although rescue from neighbouring populations is possible, the NWT contains the two largest subpopulations of northern mountain caribou in Canada and would more likely act as a source population.

Positive influences to northern mountain caribou and their habitat:

- Cross-regional community conservation planning, including the draft *Nı̀o Nę P'ęné Begháré Shúhta ʔepę́ Nareh?á – Trails of the Mountain Caribou Management Plan* and the *Doı T'oh Territorial Park and CANOL Heritage Trail Management Plan.*
- Two large protected areas (Nahanni National Park Reserve and Nááts'ı̨hch'oh National Park Reserve) protect almost 35,000km² in and adjacent to South Nahanni, Coal River, La Biche, and Redstone caribou ranges.
- Land protection is being pursued by the Tu Łidlini (Ross River) Dena Council in the Yukon, and the Tuĺıt'a and Norman Wells ʔehdzo Got'ı̨nę (Renewable Resources Councils) in the Sahtú region of the Northwest Territories, for important northern mountain caribou habitat such as seasonal ranges and calving grounds.
- Clean-up of some contaminated sites in parts of the range.
- A large portion of most ranges are remote and relatively undisturbed (i.e., not accessible by road).
- There are low levels of harvest in most areas of the range.
- In the NWT, northern mountain caribou ranges have low densities of other ungulates. This is positive in contrast to the southern portion of their distribution where higher densities of moose and deer support higher predator densities.

Recommendations:

- Much of the available population data for northern mountain caribou in the Northwest Territories are outdated. Enhanced monitoring and updated population estimates are essential to understand trends in herd composition and detect possible declines in herds.
- Enhance research on the effects of climate change on seasonal habitat and caribou health and behaviour.
- Further investigation of subpopulation and genetic structure of northern mountain caribou using the northern portion of the Mackenzie Mountains is needed.
- Further scientific and Indigenous knowledge research to document critical caribou habitat, such as calving grounds, is needed.
- Limit access to minimize disturbance to caribou habitat.
- Increase public and hunter education on the status of caribou to reduce damage to habitat and promote respectful caribou harvesting practices.
- Implement protective measures outlined in applicable management plans, such as the *Doi T'oh Territorial Park and CANOL Heritage Trail Management Plan*, immediately.
- Protect important areas left out of Nááts'įhch'oh National Park Reserve boundaries. Without conservation zoning or other protection, northern mountain caribou could be impacted by mineral exploration and development activities in these areas.
- Promote the use of Indigenous guardians to conduct monitoring of caribou and maintain the important relationship between northern mountain caribou and Indigenous peoples.

Executive Summary

Traditional and Community Knowledge	Scientific Knowledge
Description	
Northern mountain caribou are described as similar to, but larger than, other types of caribou. While the appearance of northern mountain caribou was not well covered in the sources reviewed for this report, differences in size, colouration, antler morphology, and behaviour are noted for the different herds, supporting the idea of herd complexes or more sub-herds than the herd definitions usually provided in the scientific literature for this area (e.g., Bonnet Plume, Redstone, South Nahanni).	Northern mountain caribou are medium-sized members of the deer family. Their colour can vary throughout the year and among individuals, but caribou are generally darker (tawny to dark brown) on their backs, sides, legs, and heads, with white on the neck, mane, snout, and on the rump just under the tail. Caribou are unique within the deer family in that both males and females grow antlers. Males have larger antlers than females and shed their antlers after the breeding season, while females generally shed their antlers after calving. Northern mountain caribou in the northern portion of the Mackenzie Mountains are smaller than their counterparts in the southern portion of the mountains but are larger than the neighbouring Porcupine barren-ground caribou population.
Distribution	
Several herds of northern mountain caribou are found within mountainous regions of the Northwest Territories (NWT) and eastern Yukon. Their range extends from the Arctic Red River in the north to Fort Liard in the south (see Figures 1 and 2 for place name locations). Gwich'in harvesters see northern mountain caribou around the head of the Hart, Wind, Gayna, Arctic Red, Cranswick, and Snake rivers, as well as the Ogilvie	Northern mountain caribou are almost exclusively found in western Canada in British Columbia (BC), NWT, and Yukon, with a small portion of the range overlapping eastern Alaska. In the NWT, northern mountain caribou occupy the western part of the territory in the Mackenzie Mountains area and are distributed across six subpopulation ranges: the Bonnet Plume, Redstone, Tay River, South Nahanni, Coal River, and La Biche ranges, all of which

Mountains. Shúhta Dene[1] knowledge indicates that there are at least five different groups or herds of northern mountain caribou using the K'á Tǝ́ area (an area of willow flats that is an important traditional use area for Shúhtaot'ıné, Métis (from Tuĺıt'a and Norman Wells), and Tu Łidlini Dena (from Ross River, Yukon)). In the Dehcho region, sources indicate caribou frequent the Prairie Creek area.	overlap both the NWT and Yukon. The Redstone, South Nahanni, and La Biche ranges lie primarily within the NWT, while the currently delineated ranges of the Bonnet Plume and Tay River subpopulations lie primarily within Yukon. The Coal River range is relatively equally distributed between the NWT and Yukon. The higher elevation portions of their ranges along the NWT/Yukon border are an area of overlap between several NWT/Yukon and Yukon subpopulations. Distribution of northern mountain caribou in the NWT is continuous, with adjacent ranges overlapping each other and ranges in Yukon. The current subpopulation range boundaries are based on a combination of radio-collared caribou locations and information from aerial surveys. Although the total distribution of northern mountain caribou in the NWT is likely mostly represented by the current combined subpopulation ranges, further refinement of subpopulation range boundaries and subpopulation structure is needed. There is some evidence that some NWT northern mountain caribou subpopulations could potentially be further divided into migratory and sedentary groups, and that northern mountain caribou occupy areas beyond the current southeastern range boundary.
Biology and Behaviour	
Northern mountain caribou move between a variety of widely scattered seasonal ranges:	Generation time for northern mountain caribou is approximately 9 years. Adult

[1] Includes Shúhtaot'ıné and Métis from Tuĺıt'a and Norman Wells (NWT), Tu Łidlini (Ross River) Dena, and other Kaska Dena (Yukon).

calving, post-calving, summer, and rutting range, generally in alpine habitats, and winter ranges, typically in forested habitats at lower elevations. Forage varies throughout the year, but primarily includes lichen, sedges/grasses, mushrooms, and willows. Other habitat features such as ice patches, wind-exposed ridges, and mineral licks are also important. Winter range is in areas of relatively low snow pack, and considered to be essential habitat by most knowledge holders. Different herds of northern mountain caribou have different behaviours and movement patterns. Some groups are more sedentary than others, primarily moving up and down in elevation but otherwise travelling little across the landscape, from season to season. These sedentary groups are usually referred to as woodland caribou. Others (mountain caribou) use major river drainages as migration corridors, and travel many miles over the course of a year. No comprehensive or definitive information on herd distribution or movement patterns was found in the sources, but some observations are provided. There is evidence for both 'mixing' as well as avoidance between northern mountain caribou and boreal woodland caribou. Grizzly bears and wolves are the usual main predators of mountain caribou. The inter-relationships among caribou, other ungulates, and wolves, often mediated by snow, are understood, but not well documented. Variations in environmental conditions, such as snow depth, the timing of	females usually do not start breeding until they are at least 2 years of age and typically give birth to one calf. Northern mountain caribou in the NWT breed in October and calves are born in late May/early June. Caribou generally form dynamic rutting aggregations, which can include one or more adult males and larger numbers of adult females. During calving, as an anti-predator strategy, female caribou use mountainous terrain where they space themselves away from each other, and from other prey and predators that are at lower elevations. Soon after calving, females and calves can form large post-calving aggregations, which break up into smaller groups by July. Although specific information is not available for NWT northern mountain caribou, most calf mortality occurs within the first few weeks of life, with predation as the leading cause of calf mortality. Predation is also typically the leading cause of adult mortality. The density of moose and other prey around northern mountain caribou ranges in the NWT is currently relatively low and unlikely to lead to altered predator/prey interactions that result in increased predation risk to caribou as they do in southern portions of northern mountain caribou distribution in Canada. Caribou are highly adapted to their environment and cold winter conditions. Their large feet, with prominent dew claws, act like snowshoes for walking in snow, and as shovels for digging through snow to access lichens growing on the ground. Their thick hollow hair provides insulation. During winter, northern mountain caribou mostly eat lichens and have adapted to extracting

snowfall and snowmelt, as well as human activities can further complicate the picture. Caribou may adapt their distribution, habitat use, behaviour, and/or group size in response to predation pressure. Caribou are particularly sensitive to noxious insects, notably warble flies, bot flies, and mosquitoes. Distribution and movements of caribou in the summer are heavily influenced by the occurrence of these insects. Caribou typically host warble fly larvae, the effects of which are not very well understood. There is increasing concern about the invasion of non-endemic parasites and diseases, to which caribou have not previously been exposed, that may weaken or kill caribou. Some elders are of the opinion that caribou do not accumulate fat in comparison to moose due to their more nomadic lifestyle. It is well-known that caribou body condition is influenced by the availability of, and access to, lichens. This is particularly evident in the winter when cows shift their diet almost entirely to lichens, which is associated with weight gain. Environmental changes that limit the distribution and abundance of lichens, or result in changes in snow conditions (depth and hardness) that impact cratering and movements, may have a significant impact on body condition, and therefore productivity.	the nutritional content from them. Lichens are slow growing and are poor competitors against other plants and mosses, and grow best where growing conditions for other plants and mosses is poor, and where they are not subjected to physical disturbances.
Population	
Shúhta Dene indicate that some caribou herds/sub-herds in the Macmillan Pass/K'á Tǝ́ area of the Mackenzie Mountains have declined, or vacated some preferred	The current population estimate for northern mountain caribou in the NWT is about 21,800 individuals, although most subpopulation estimates are outdated.

habitats, over the last several decades. The decline or displacement has been especially dramatic over the last 10-12 years. This was reported for the Redstone herd in particular. In addition to a decline in the number seen and the group size, Shúhta Dene elders and harvesters say there are fewer large bulls today than in the past. Gwich'in elders also note a decline in abundance. Knowledgeable people from both regions say these declines, or the displacement from key areas, correlate with increased hunting pressure, and the escalating use of off-road vehicles. Some outfitters operating in other areas of the Mackenzie Mountains have observed fluctuations in abundance and distribution, but have not observed an overall change or trend. They indicate that caribou can 'disappear' from certain areas from time to time, but do not know whether this is a localized decrease in abundance or a shift in habitat/range use. Changes in the demography of mountain caribou have not be rigorously assessed. In some areas, local hunters and observers have noted a decline in the number of large bulls, and concern has been raised that the loss of older and experienced caribou has a negative effect on productivity and movement patterns. The ratio of calves to cows in the summer and fall appears to change within years, and from year to year, but this is not unusual. There are few observations about sex ratio – the point at which disparate sex ratio limits birth rates or the timing of calving is not documented.	Population trend is unknown for the NWT population and for most subpopulations, except for the South Nahanni subpopulation, which is likely stable or possibly increasing. Population trend inferred from calf survival estimates based on observations from non-resident hunters suggests that the Redstone and Bonnet Plume subpopulations may be stable, although there has been a slight decline in calf survival since 1991. Most information on population size and trend is outdated and may not reflect the current population condition. Although population rescue from neighbouring subpopulations is possible, the NWT contains the two largest subpopulations of northern mountain caribou in Canada and would more likely act as a source population to rescue neighbouring or other smaller subpopulations. The condition of NWT northern mountain caribou subpopulations is crucial to the condition of the overall northern mountain caribou population in Canada.

Habitat	
Several key areas of caribou habitat are identified throughout the range of northern mountain caribou. These include some of the core seasonal ranges as well as isolated features within their range, such as mineral licks, summer ice patches, wind-exposed ridges, calving grounds, rutting grounds, and preferred or traditional movement and migration corridors. Winter range is considered critical habitat, particularly in years of deep snow. The Mackenzie Mountain range is considered relatively intact habitat; nonetheless, habitat fragmentation from infrastructure and industrial development as well as other human activity does impact some herds through elevated noise and increased hunting access/pressure. There is intensifying localized habitat destruction occurring in areas frequented by hunters on all-terrain vehicles, which is increasing as off-road vehicles become more common and more capable of penetrating the wilderness. This problem of increasing hunting pressure appears to be a result of caribou hunting closures elsewhere, and a shift in hunting pressure into accessible areas of the Mackenzie Mountains. Concern has also been raised about contamination due to pollution and dust created by human activities, but there has been no effort to measure these health effects. The impact of habitat loss and displacement due to human activity is thought to expose caribou to	During winter, northern mountain caribou in the NWT primarily use open spruce forests in valley bottoms where they forage mostly on lichens that grow on the ground. In low snow winters, some caribou in some ranges may remain at high elevations in alpine or subalpine habitat along the NWT/Yukon border or in Yukon. Low elevation winter ranges of the Redstone, South Nahanni, Coal River, and La Biche subpopulations are found exclusively in the NWT and are generally located in the eastern portions of their ranges. During spring migration, caribou generally use low elevation valley bottoms for travelling where snow depth is lower than it is at high elevations. Most northern mountain caribou in the NWT undergo long distance migrations and can travel up to 250 kilometers (km) between winter and summer ranges, while some individuals are more sedentary and remain close to their winter ranges all year round. Calving ranges for migrating caribou are found primarily in the western portions of ranges along the NWT/Yukon border. During calving, females are highly dispersed in mountains where they use subalpine open woodland, spruce-lichen woodland, subalpine shrubland, and alpine. During summer, caribou move to more open habitats at higher elevations and use snow patches to avoid insects. For the Redstone subpopulation, many caribou move east during summer and by the rut, are generally found in areas closer to their winter ranges. Caribou from the other

greater health risks as a result of stress, nutrition, and higher levels of predation. The greatest concerns about habitat change are related to climate change, such as increased wildfires (especially on winter range), decreased occurrence of ice patches (perhaps exacerbated by higher densities of noxious insects), unfavourable snow conditions (depth and hardness), and rapid run-off that creates dangerous river crossings. There are also complex predator/prey interactions associated with climate change that result in some species expanding their range northward into northern mountain caribou habitat, or endemic species shifting their distribution. For example, more willows at higher altitudes might result in moose shifting their distribution, with a corresponding shift in wolf distribution. Many knowledge holders indicate they are witnessing changes in caribou distribution and movement patterns in recent years, yet it remains unclear whether these changes are a result of environmental changes. Overall, Indigenous and non-Indigenous knowledge holders alike say that patterns in mountain caribou distribution and habitat use are hard to predict, as they often vary from year to year. It may be that one of the greatest threats of climate change is the unpredictable nature of these environmental changes, and an increasing frequency of unfavourable conditions, such as snow depth, snow crusting, delays in snow melt, etc. Perhaps caribou, conditioned by	subpopulations generally remain near their calving ranges during summer and fall. Most of the northern mountain caribou range in the NWT is relatively undisturbed. The main disturbances include fire and industrial activities (mineral exploration and mining, seismic lines, resource roads). Fire activity and seismic lines are located primarily in the lower elevation portion of the range along the eastern boundary, with most of the area burned in the 1990s. The North Canol Road and Canol Trail traverses the Redstone caribou range. Mineral exploration and mining activities are located primarily in the area around the NWT/Yukon border, especially in areas accessed by the South Nahanni Range Road and the North Canol Road. Available information on habitat trends in northern mountain caribou ranges in the NWT is limited. Also, there is not enough reliable technical information to assess whether the currently defined northern mountain caribou ranges in the NWT differ from the historical distribution. Differences between historically defined ranges and current ranges are more likely due to refinement of northern mountain caribou range boundaries in response to new and more detailed information becoming available, than to actual changes in distribution.

tradition, are unable to readily adapt to these changes.	
Threats and Limiting Factors	
Threats to caribou in the Mackenzie Mountains include excessive localized hunting pressure (including harvesting pressure, and all-terrain vehicle use causing displacement and habitat damage), industrial activities (including disturbance and increased road access), and environmental changes. Impacts of hunters and recreational activities are seen as increasing in some areas of northern mountain caribou range. There are indications that industrial exploration and development will increase in the near future; this is already underway in the Yukon portion of the range. Habitat change appears largely to be an outcome of climate change – greater frequency of wildfires, more frequent unfavourable snow conditions, shrubification, rapid snowmelt that results in dangerous river crossings, and in some cases a drying of the tundra. The timing of seasonal movements may be disrupted, leading to a chain of events that influence distribution. Ecological changes may also alter the distribution of ungulates and predators, further threatening caribou. For example, some elders are worried that earlier spring weather might bring bears out of hibernation earlier, creating greater predation pressure during the calving period. Also, as caribou begin to suffer from environmental changes, they may become	The greatest threat affecting northern mountain caribou across their distribution in Canada is wide scale habitat alteration and associated linear features resulting from human activities, which affect abundance, habitat use, and movements of predators and other prey. In the NWT, the main threats to northern mountain caribou include: predation; industrial activities, primarily mineral exploration and development and associated linear features (e.g., roads); hunting; and climate change. Roads and other linear features associated with industrial activities also result in increased predator travel rates and hunting efficiency, and increased access for humans that could result in displacement of caribou from preferred habitats and direct mortality from vehicle collisions, hunting, and poaching. Although the current harvest rate across the distribution of northern mountain caribou in the NWT is relatively low, both non-resident and resident harvests have increased in both the NWT and Yukon in recent years. Concentrated harvest associated with access roads could impact caribou that use these localized areas, especially for sedentary groups and for groups that demonstrate a high degree of fidelity to traditional rutting areas.

more susceptible to other factors, such as predation and parasites, and they may be less productive.	Climate change may result in changes in frequency and severity of natural disturbances, changes in vegetation composition, changes in distribution of other ungulates, increased incidence of icing, increased incidence of disease and parasites, degradation of permafrost, heat stress for caribou in summer, and reduced size, number, and persistence of snow patches.
Positive Influences	
Positive influences are most apparent in the form of a joint caribou planning initiative, initiated by the Sahtú Renewable Resources Board (SRRB) and the Tu Łidlini First Nation. A number of actions have been proposed that will likely have very positive outcomes, if the parties can agree to act. The parties to the joint caribou planning project include three communities in the Yukon and NWT, the Government of the Northwest Territories (GNWT), Yukon Government, Parks Canada, the SRRB, and a number of non-governmental organizations. Several projects, including signage and education, hunter permitting, and development of an Indigenous Guardians Program, have already been initiated and have brought public attention to the status of northern mountain caribou. There are also proposals to identify and establish Indigenous protected areas, to protect important northern mountain caribou habitat in the Yukon and NWT, as well as to help meet Canada's biodiversity targets. In addition to conservation planning, there has also been some clean-up of	The three primary positive influences to northern mountain caribou in the NWT are: the remote and undisturbed nature of a large portion of most ranges, two large protected areas (Nahanni National Park Reserve and Nááts'įhch'oh National Park Reserve), and inherently low densities of other ungulates.

contaminated sites in parts of northern mountain caribou habitat.	

Technical Summary

Question (TKCK; *Science*)	Traditional and Community Knowledge	Scientific Knowledge
Population Trends		
Generation time (*average age of parents in the population*) **(indicate years, months, days, etc.).**	Not reported from TK/CK sources.	9 years (from calculation in COSEWIC 2014).
Number of mature individuals in the NWT (or give a range of estimates).	Numbers not available from TK/CK sources.	Estimated more than 17,000.
Amount of change in numbers in the recent past; *Percent change in total number of mature individuals over the last 10 years or 3 generations, whichever is longer*.	Not available from TK/CK sources. However, some TK/CK sources indicate that northern mountain caribou numbers in certain areas are declining and have been declining since the 1930s. In particular, Shúhtaot'ıné, Métis, Tu Łidlini (Ross River) Dena, and other local knowledge holders in the Mackenzie Mountains attest that specific subpopulations of Redstone caribou have been in serious decline in the last 10-15 years. Some knowledge holders also indicate that there are fewer prime bulls in some locations in recent years.	Unknown (past population estimates for most subpopulations are not reliable enough to determine trend).
Amount of change in numbers predicted in the	Not available from TK/CK sources. However,	Unknown (no population viability analyses have been

near future; *Percent change in total number of mature individuals over the next 10 years or 3 generations, whichever is longer*.	Shúhtaot'ıné, Métis, Tu Łidlini (Ross River) Dena, and other local knowledge holders in the Mackenzie Mountains indicate that urgent action is needed to address declines in the herds they encounter, suggesting the near future will likely experience continuing declines if no action is taken.	conducted to predict future population change).
Amount of change happening now; *Percent change in total number of mature individuals over any 10 year or 3 generation period that includes both the past and the future*.	Some indication that the habitat is changing, and localized hunting pressure is increasing, but no certainty on how these changes are currently impacting caribou.	Unknown (a population trend could not be determined for a 10 year or 3 generation period).
If there is a decline (*in the number of mature individuals*), **is the decline likely to continue if nothing is done?**	Shúhtaot'ıné, Métis, Tu Łidlini (Ross River) Dena, and other local knowledge holders in the Mackenzie Mountains indicate that urgent action is needed to address recent, current, and future declines around Dechenla (Macmillan Pass/Caribou Pass area). It is likely that the source of current and recent declines will continue to impact northern mountain caribou.	Not applicable (a population trend could not be determined).
If there is a decline, are the causes of the decline reversible?	Some knowledge holders feel like over-harvesting and habitat damage from human activities is responsible for	Not applicable (a population trend could not be determined).

	some of the decline; those causes could be reversible. Other causes are less well understood; some, such as climate change, are unlikely to be reversible.	
If there is a decline, are the causes of decline clearly understood?	The interactions of specific causes of the decline are not clearly understood, but some factors are particularly worrisome – harvesting practices, industrial and linear developments, and climate-related environmental changes that are modifying habitat and potentially altering ecosystem processes, including the distribution of ungulates and predators.	Not applicable (a population trend could not be determined).
If there is a decline, have the causes of the decline been removed?	The decline is still occurring. Potential causes have not been removed.	Not applicable (a population trend could not be determined).
If there are fluctuations or declines, are they within, or outside of, natural cycles?	Shúhta Dene state that the land and the caribou have changed in a way that is worrisome. The changes are outside of normal population cycles.	Not applicable (a population trend could not be determined).
Are there extreme changes in the number of mature individuals?	Not available from TK/CK sources. However, the lack of specific mention may indicate that this sub-species does not typically experience extreme fluctuations.	Unknown.

	Outfitter knowledge of population fluctuations are that they are not extreme.	
Distribution Trends		
Where is the species found in the NWT? *Estimated extent of occurrence in the NWT (in km²).*	The Mackenzie Mountains are home to several herds of northern mountain caribou, covering a range that stretches from the Arctic Red River in the north to Fort Liard in the south. Individual First Nations and outfitters tend to encounter caribou from particular herds; no effort was made to use specific information to generate a comprehensive distribution from the TK/CK sources that were available.	Approximately 150,500 km².
How much of its range is suitable habitat? *Index of area of occupancy (IAO) in the NWT (in km²; based on 2 x 2 grid).*	Not available from TK/CK sources. However, there are concerns that some habitats are becoming less suitable due to climate change.	Approximately 122,000 km².
How many populations are there? To what degree would the different populations be likely to be impacted by a single threat? *Number of extant locations in the NWT.*	TK/CK sources indicate that there may be more than four herds and that the populations as currently understood by biologists may not accurately describe the herds of northern mountain caribou. Specific information about the degree to which each herd or group would be impacted by	Locations could not be determined.

	any threat was not available from TK/CK sources; however, the sources indicate that currently, the threats are acting differently on different herds. Over-harvest or poor harvest practices, for example, are seen in areas where motorized access is easier. As such, herds with motorized access may be at graver risk due to that threat. More global threats may impact all herds/groups more evenly.	
Is the distribution, habitat, or habitat quality showing a decline that is likely to continue if nothing is done? *Is there a continuing decline in area, extent, and/or quality of habitat?*	Northern mountain caribou distribution is changing, although it is unclear whether this change constitutes a decline. TK/CK holders indicate that ice patches (a habitat component of critical importance to northern mountain caribou) and glaciers are disappearing quickly due to environmental change. This habitat decline is expected to continue. Wildfires are increasing, which has a negative impact on habitat quality and availability. This trend is expected to continue. Negative impacts to habitat from human activities such	There is insufficient information to determine whether a continuing decline in area, extent, and/or quality of habitat is occurring.

	as off-road vehicle use and industrial resource development are also expected to continue. Migration routes are expected to change, for other reasons.	
Is the number of populations or amount of occupied area showing a decline that is likely to continue if nothing is done? *Is there a continuing decline in number of locations, number of populations, extent of occupancy, and/or IAO?*	The delineation of populations is not well covered in TK/CK research. The amount of occupied area is likely to be affected by wildfire and some harvesting practices if nothing is done.	There is no decline in the number of populations. There is insufficient information to assess whether there is a decline in extent of occupancy or IAO.
Are there extreme fluctuations in the range or the number of populations? *Are there extreme fluctuations (>1 order of magnitude) in number of locations, extent of occupancy, and/or IAO?*	Not available from TK/CK sources.	Unknown.
Are most individuals found within small and isolated populations? *Is the total population severely fragmented (most individuals found within small and isolated populations)?*	Not available from TK/CK sources.	No. Based on available information, subpopulations are moderate to large in size and with overlapping ranges.

Immigration from Populations Elsewhere		
Does the species exist elsewhere?	Northern mountain caribou are also found in Yukon and northern British Columbia.	Yes. Northern Mountain Caribou Designatable Unit (DU) are also found in Yukon and British Columbia.
Status of the outside population(s)?	Many Shúhta and Kaska Dena report declines in northern mountain caribou populations in their areas of Yukon. Published sources indicate that across northern, central, and southern mountain caribou populations alike, most traditional knowledge is in agreement that mountain caribou herds have been declining since the early 1900s.	Special Concern (COSEWIC 2014).
Is immigration known or possible?	Several herds occur in both the NWT and Yukon, with distributions that span these jurisdictional boundaries (information on these herds has been included together in this report and is not considered immigration but part of regular distribution and movement patterns). Information regarding immigration from northern British Columbia was not available from the TK/CK sources.	Immigration is possible.

Would immigrants be adapted to survive and reproduce in the NWT?	Not available from TK/CK sources.	Yes. Caribou in neighbouring Hart River and Finlayson caribou subpopulations in Yukon are genetically indistinguishable from NWT subpopulations. Ranges from neighbouring subpopulations are overlapping and share similar seasonal movement and habitat use patterns.
Is there enough good habitat for immigrants in the NWT?	Not available from TK/CK sources.	Yes. Most of the northern mountain caribou ranges in the NWT are very large with low levels of disturbance, which should provide adequate conditions to support immigrants.
Is the NWT population self-sustaining or does it depend on immigration for long-term survival?	Not available from TK/CK sources.	There is insufficient information to assess whether the NWT population is self-sustaining, but based on the estimated size of the population, it is likely capable of being self-sustaining.
Threats and Limiting Factors		
Briefly summarize negative influences and indicate the magnitude and imminence for each.	TK/CK holders are concerned about various threats, but the extent and interaction of these threats for each population are not clearly understood. Knowledge holders indicate that the most urgent threat is over-hunting and poor	The primary threats and limiting factors are: • Predation • Industrial activities (primarily mineral and hydrocarbon exploration and development) and associated linear features

	harvest practices, which have recently become more common in localized areas and are being exacerbated by all-terrain vehicle use, noise, and trails. This threat is already occurring and is causing serious impacts to herds that can be accessed by roads. Wildfire is damaging northern mountain caribou habitat, especially winter range. Wildfires are increasing in number and damage. This threat is already occurring and may be causing serious impacts to some herds. Climate-driven environmental change (e.g., warming, shrubification, shrinking ice patches and glaciers, variability in snow pack, timing of melt, icing), is already occurring and is believed to be causing serious impacts to some herds (e.g., changes to migration, displacement, insect harassment). Mineral exploration and development is increasing across the north, and the level of disturbance within northern mountain caribou range is expected to	• Hunting • Climate change • Fire • Recreational activities

	increase. Secondary effects of development are also a concern (e.g., increasing access for predators and hunters, increasing prevalence of moose and a corresponding increase in wolves). This threat is currently occurring and may be having a serious effect on the population. Other threats identified include lack of available research, poor policy coordination and implementation, and lack of capacity in organizations with management responsibility.	
Positive Influences		
Briefly summarize positive influences and indicate the magnitude and imminence for each.	The remoteness of northern mountain caribou habitat in the NWT is considered a strong positive influence on this species. Indigenous-led management is a positive influence that is already occurring (e.g., cross-regional community conservation planning, indigenous hunting permits). This kind of collaboration is a positive step toward protecting key caribou	Positive influences include the current remote nature of most of the area within ranges, protected areas, and low densities of other ungulates.

	habitat and minimizing impacts on caribou. Several already occurring or land use planning and conservation initiatives are expected to have a positive influence on northern mountain caribou with their implementation (e.g., Kaska Dena land use framework, *Tu Łidlini Land Use Plan*). Beyond facilitating habitat protection, these are expected to include initiatives related to harvest monitoring, access, education, communication, and habitat protection. Two protected areas (i.e., Nahanni and Nááts'ıhch'oh national park reserves) are helping protect important caribou habitats. In the future, if approved, the following areas could protect more key caribou habitat: Doı T'oh Territorial Park and the CANOL Heritage Trail (whose remediation is also a smaller positive effect) and several Indigenous protected areas proposed by the Ross River Dena Council and the Sahtú Renewable Resources Board.	

Table of Contents

PLACE NAMES

The below maps (Figures 1 and 2) can be referred to for both the Traditional and Community Knowledge and Scientific Knowledge components of this status report. They are intended to help provide context to readers who may be unfamiliar with the geographic features (e.g., mountains, rivers, lakes) and place names referred to in this status report.

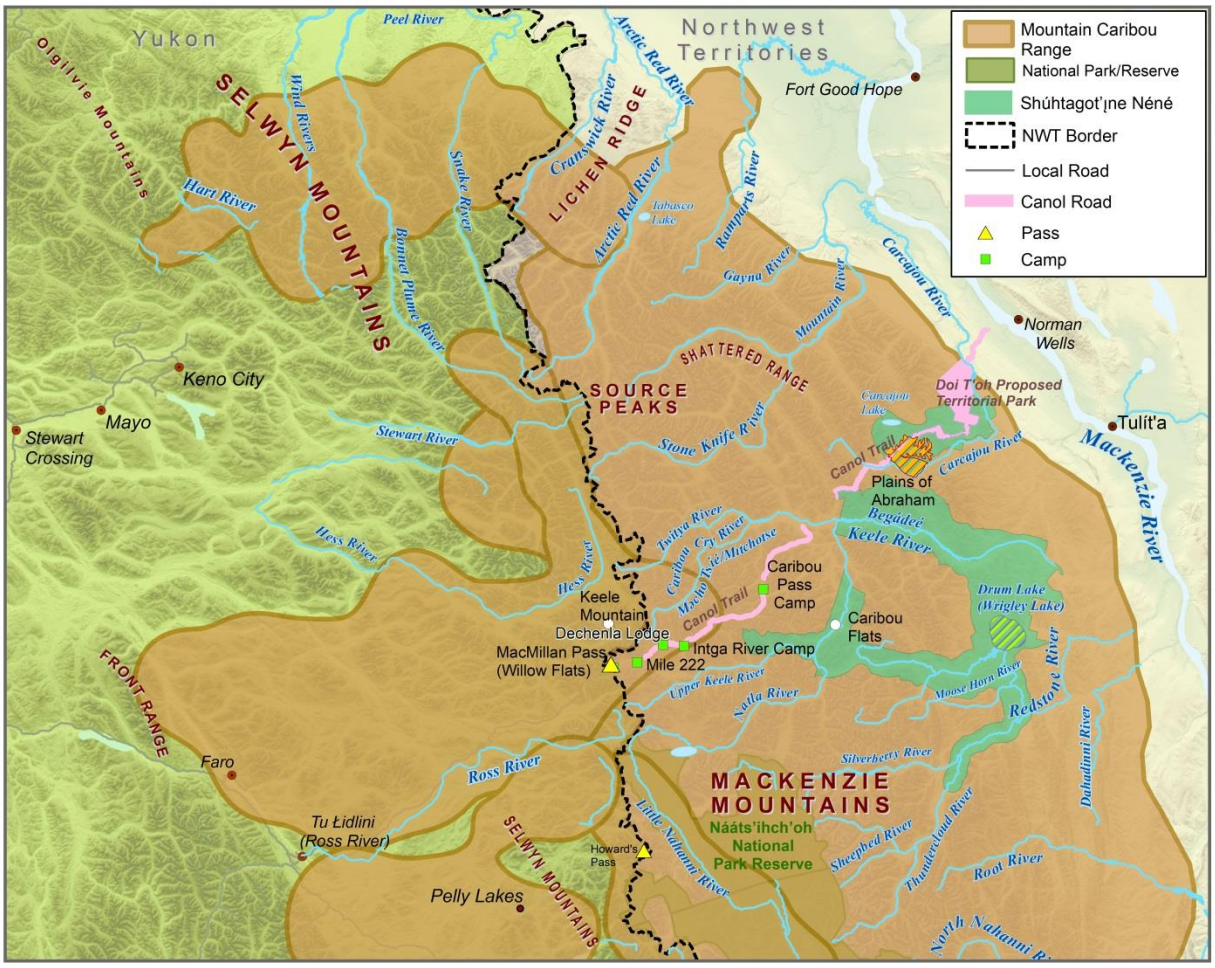

Figure 1. Geographic features and place names referred to in this status report that occur in the northern portion of northern mountain caribou range (range data from Government of the Northwest Territories [GNWT] [R. Gau, N. Larter, R. Popko], Government of Alberta [L. Neufeld, D. Hervieux, D. Cichowski], Government of British Columbia [BC] [D. Seip, T.M. Williams], and Government of Yukon [T. Hegel, K. Russell]) (map courtesy B. Fournier, Environment and Natural Resources [ENR]).

Figure 2. Geographic features and place names referred to in this status report that occur in the southern portion of northern mountain caribou range (range data from GNWT [R. Gau, N. Larter, R. Popko], Government of Alberta [L. Neufeld, D. Hervieux, D. Cichowski], Government of BC [D. Seip, T.M. Williams], and Government of Yukon [T. Hegel, K. Russell]) (map courtesy B. Fournier, ENR).

TRADITIONAL AND COMMUNITY KNOWLEDGE COMPONENT

Preamble

Regional/Cultural Background

In the Northwest Territories (NWT), First Nations that have traditional and community knowledge (TK/CK) of northern mountain caribou include the Gwich'in (Teetł'it Gwich'in and Gwichya Gwich'in), Sahtú Dene and Métis, Dehcho First Nations, Acho Dene Koe First Nation, and Nahanni Butte Dene Band. The locations of these First Nations are shown in Figure 3, along with the known scientific range for northern mountain caribou.

In Yukon, the Tr'ondëk Hwëch'in, First Nation of Na-cho Nyak Dun, Kaska Dena (including Ross River/Tu Łidlini Dena), and Liard First Nation tend to be most reliant on and knowledgeable about northern mountain caribou herds that are found (at least seasonally) in the NWT. Further details on the regional/cultural background of each Nation are provided in the pages that follow; information is organized geographically, moving from north to south.

First Nations from other areas also travel to the Mackenzie Mountains to harvest and have knowledge of these caribou; however, Indigenous knowledge that is specific to areas of caribou use that are far from the NWT border have not been included in this report.

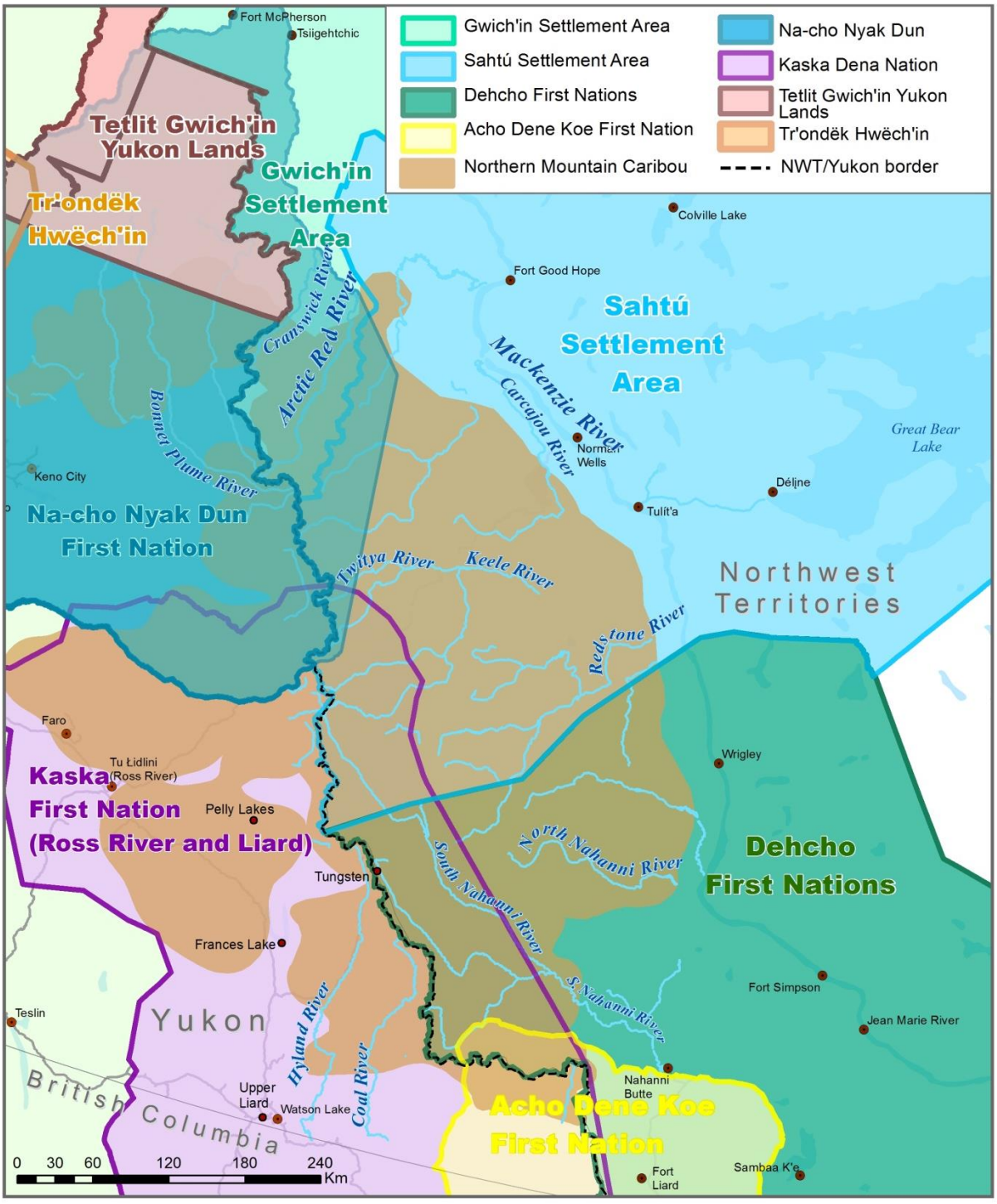

Figure 3. Map showing BC, Yukon, and NWT First Nations that regularly encounter and have knowledge of northern mountain caribou (NWT Centre for Geomatics 2007a and b; Natural Resources Canada [NRCan] 2008; Government of Yukon 2014). Caribou range is provided by scientific data as no TK/CK spatial data were available (data from GNWT [R. Gau, N. Larter, R. Popko], Government of Alberta [L. Neufeld, D. Hervieux, D. Cichowski], Government of BC [D. Seip, T.M. Williams], and Government of Yukon [T. Hegel, K. Russell]). Map courtesy of B. Fournier, ENR.

Gwich'in

The Teetł'it Gwich'in (also spelled Tetl'it Gwich'in) currently reside in the NWT community of Fort McPherson, and the Gwichya Gwich'in in Tsiigehtchic, NWT, although they also live in other communities. Teetł'it Gwich'in traditional lands and traditional use extend far into the Yukon, and they are culturally, spiritually, and economically tied to the Peel River watershed. Gwichya Gwich'in traditional lands extend up the Arctic Red River and up the Mackenzie River, and both north and south of the Mackenzie River as well.

In the past, the Gwich'in seasonal round was variable and complex, and included travelling into the mountains for winters and passing spring at the edge of large rivers, which were navigated after the ice left in the spring. Some families also passed some seasons in the Travaillant Lake watershed. While in the mountains, the Gwich'in harvested caribou, moose, and sheep. The Gwich'in and caribou are deeply connected, and caribou are an important food source. Gwich'in families also relied upon, and continue to rely upon, fish, other large game (especially moose), and berries and roots (Benson 2008).

Teetł'it Gwich'in harvesters and elders have extensive knowledge of the Bonnet Plume and the Hart River herds, although they also travelled extensively in the Yukon, including to Dawson City (not shown on maps). The Gwichya Gwich'in have extensive knowledge of the Redstone and Bonnet Plume herds, drawn from their travels to, and stories about, the headwaters of the Arctic Red River. Although the Gwichya Gwich'in historically travelled through these areas regularly, in modern times travel 'up the Red' is rare. Neither the Gwichya Gwich'in nor the Teetł'it Gwich'in have continued to use northern mountain caribou as an important food source in recent decades, and for this reason much of the information available is either from stories based in the past, from elders' remembrances of their youth, or from a small number of individuals who have travelled up the Arctic Red River (Andre *et al*. 2006; Benson 2018).

Tr'ondëk Hwëch'in

The Tr'ondëk Hwëch'in are a Yukon First Nation based in Dawson City (not shown on maps). Their citizenship includes descendants of the Hän-speaking people, who have lived along the Yukon River for millennia, as well as a diverse mix of families descended from Gwich'in, Northern Tutchone, and other language groups (Tr'ondëk Hwëch'in Government 2018).

Northern mountain caribou are an important subsistence species for Tr'ondëk Hwëch'in citizens, especially when larger migratory herds of barren-ground caribou (i.e., Porcupine or Fortymile) are not available. Both the Hart River and Clear Creek northern mountain caribou herds range within Tr'ondëk Hwëch'in traditional territory, and a harvesting accord has been signed by the Tr'ondëk Hwëch'in and the First Nation of Na-cho Nyak Dun, which allows Tr'ondëk Hwëch'in citizens to harvest wildlife, including caribou from the Bonnet Plume and Redstone herds, found within Na-cho Nyak Dun traditional territory. Tr'ondëk Hwëch'in citizens have a long history of

traditional use and knowledge of these herds of northern mountain caribou (Ayoub pers. comm. 2018).

Because Tr'ondëk Hwëch'in citizens primarily harvest from the Hart River and Clear Creek herds – herds that are distant from the NWT portion of northern mountain caribou range – no Tr'ondëk Hwëch'in TK/CK has been included in this report for those herds.

First Nation of Na-Cho Nyak Dun

The First Nation of Na-cho Nyak Dun represents the most northerly community of the Northern Tutchone language and culture group. In the Northern Tutchone language, the Stewart River is Na Cho Nyak, or 'big river'. The First Nation of Na-Cho Nyak Dun's traditional territory includes parts of both the Yukon and NWT (First Nation of Na-Cho Nyak Dun 2018).

Historically, the First Nation of Na-Cho Nyak Dun lived and trapped throughout the area surrounding the present town of Mayo, Yukon, travelling throughout their traditional territory at various times of the year for hunting, fishing, and gathering. They are culturally affiliated with the Northern Tutchone people of the Pelly Selkirk, and the Carmacks Little Salmon First Nations. Some members of the First Nation of Na-Cho Nyak Dun trace their ancestry to the Gwitchin people of northern Yukon and the Mackenzie people of eastern Yukon (*Ibid.*).

Shúhta (Mountain) Dene – including Shúhtaot'ıné and Métis from Tulít'a and Norman Wells (NWT), Tu Łidlini (Ross River) Dena, and other Kaska Dena (Yukon)

Many Sahtú Dene and Métis from the communities of Tulít'a and Norman Wells in the Sahtú region of the NWT are Shúhtaot'ıné[2] or Shúhta Dene (Mountain People). They have close ties to the Tu Łidlini (Ross River) Dena and some other Kaska Dena Nations in the Yukon.

The Kaska Dena traditional territory spans parts of BC, Yukon, and the NWT (Dena Kayeh Institute 2010). The Kaska Dena are part of five Kaska First Nations: Liard First Nation and Ross River Dena Council in the Yukon, Dease River First Nation, Daylu Dena Council (encompassing enclaves at Fireside and Muncho Lake), and Kwadacha First Nation within BC (*Ibid*.).

Shúhta Dene from different communities have different dialects, but a shared culture and history. Their traditional territories span a large region of the Selwyn and Mackenzie mountains, including significant northern mountain caribou habitat (Andrews *et al.* 2012; Winbourne 2017a). Because of strong similarities between Shúhta Dene from different regions, for the most part, their information is included together in this report.

Shúhta Dene knowledge is handed down from a time when people followed a nomadic lifestyle, following the cycles of the seasons and animals and travelling many miles over the course of a

[2] Alternate spellings include Shúhtagot'ıné and Shúhta Got'ıné. For the purposes of this report, the term Shúhtaot'ıné includes Dene and Métis people from the Sahtú region.

year (Sahtú Land Use Planning Board [SLUPB] 2013; Ross River Dena Council [RRDC] N.D.; Winbourne 2017a; Andrew 2018). Traditional and community knowledge and archaeological evidence indicate that over countless generations, Shúhtaot'ıne have been mobile hunter-gatherers in the alpine environment – regularly travelling there to hunt northern mountain caribou (Andrews *et al.* 2012; Andrew 2018). Tu Łidlini (Ross River) Dena and other Kaska Dena in BC and Yukon also travel into the mountains to hunt caribou.

Shúhta Dene used to hunt caribou on ice patches primarily with projectile weapons (e.g., throwing darts, bows and arrows), but also used snares and caribou fences extensively (Andrews *et al*. 2012). This observation was recorded by Poole Field – a trapper and storekeeper who lived in the Ross River area in the early years of the twentieth century, and who wrote down his observations of traditional Kaska and Mountain Slavey lifestyles in letters to family and friends:

"Years ago when some of the oldest men alive today were young men, they claim there were no moose in this part of the country, but caribou were very plentiful. They used bows and arrows to hunt with, spears, snares and dead falls also. They would make long fences when the caribou and sheep came below timberline, sometimes packing poles to make their fences with up on top of the mountains. They would leave spaces big enough for a caribou or sheep to go through in their fences and set snares for them. Whenever a herd was sighted they would try to surround them and drive them through their fences." (RRDC N.D.: 11)

Liard First Nation

The Liard First Nation is a member of the Kaska Nation, whose traditional use area is primarily located between the Coastal and Rocky mountain ranges of southeastern Yukon and northern BC (not shown on maps). Liard First Nation members mostly live in Upper Liard and in and around Watson Lake, Yukon. Liard First Nation Kaska speak the Athabascan language and are related to the Tahltan and Tagish Athabascan, once known collectively as Nahani (Liard First Nation [LFN] 2018).

Dehcho First Nations

The Dehcho First Nations is a regional coalition representing the Dene (South Slavey people) and Métis people of the Dehcho region of the NWT. It is made up of ten First Nations bands and two Métis locals.

Acho Dene Koe First Nation

Acho Dene Koe First Nation traditional territory spans three jurisdictions: the NWT, northern BC, and southeastern Yukon. Today, most Acho Dene Koe members reside in the Hamlet of Fort Liard, NWT (Acho Dene Koe First Nation [ADKFN] 2018).

Nahıʔą Dehé Dene Band

The word nahanni comes from the word 'naha', meaning the people that roamed through the mountain and valley. The present-day community (Nahanni Butte) sits on the banks of the South Nahanni River, one kilometer (km) up-river from where the Liard and South Nahanni rivers meet, and 95km north of Fort Liard. The people of Nahanni Butte have always lived their lives on the land and are very traditional in their beliefs and way of life (Dehcho First Nations [DFN] 2018).

Non-Indigenous/Resident/Non-resident Hunters

In the first half of the twentieth century, few non-Indigenous residents hunted in the Mackenzie Mountains. Some arrived in the 1920s, following the discovery of oil along the Mackenzie River. In 1938, the entire 800km mountain range was designated the Mackenzie Mountains Game Preserve and was closed to both resident and non-resident hunting. Indigenous people continued to be able to harvest all game that was not listed by the federal government as being at risk (Deuling 2017).

In the mid-1960s, the region was opened to hunting by resident and non-resident sport hunters, and a system of licensed guides and guiding areas developed. By 1970, eight outfitting areas in the NWT had been legally delineated and regulated by the NWT *Wildlife Act*. Since that time, five of these areas have remained unchanged; three were affected by land appropriation in the Nahanni and Nááts'įhch'oh areas by Parks Canada Agency (Larter and Allaire 2016).

Spiritual/Cultural Importance

The majority of traditional knowledge information in this report comes from Shúhta Dene knowledge holders, with ancillary information coming from Gwich'in sources and other sources. For this reason, this section will focus on these communities.

Gwich'in

Both the Teetł'it Gwich'in and the Gwichya Gwich'in harvested northern mountain caribou. Teetł'it Gwich'in families could hunt northern mountain caribou opportunistically. Gwichya Gwich'in families travelled up the Arctic Red River to hunt northern mountain caribou and other animals in the mountains and in the front ranges, a traditional use pattern that was disrupted several generations ago.

However, the mountains were and are considered a 'larder' of sorts. In other words, an area that is always productive, unlike other areas where resources are cyclically unavailable (Benson 2008, 2018). Hunting was usually carried out by the men of the family, and hide processing and drymeat production by the women. Hides had many uses, including clothing and caribou skin tents. Northern mountain caribou cows were harvested year-round, and bulls were harvested starting in or after February. When northern mountain caribou were harvested (as with caribou from the barren-ground herds that the Teetł'it Gwich'in relied upon and are culturally connected

to), the Gwich'in would eat the meat fresh as well as make drymeat. Fresh caribou meat can also be stored and preserved under moss, with the permafrost acting like a freezer or fridge. Bones were also processed for grease, which could be stored and consumed later (Benson 2018). Caribou leg skins, with the special quality and direction of the hair, were useful for making containers and sleighs (Andre *et al.* 2006). Both the Gwichya Gwich'in and Teetł'it Gwich'in would hunt northern mountain caribou opportunistically during travel through the mountains to trade and visit in Dawson (*Ibid*.).

Gwichya Gwich'in elder John Norbert remembers a feast that his parents held for him after he killed his first caribou. The caribou was a northern mountain caribou and the feast was held in the headwaters of the Arctic Red River area, where Gwichya Gwich'in would meet in large 'gathering sites' with friends and family from communities up the Mackenzie River. The last time these gathering sites were used was in the 1960s (Benson 2018). The times spent at the gathering sites hunting together, playing games and celebrating, processing caribou into drymeat, and tanning hides were vital to re-establish connections between the Gwich'in and their extended family members, trading partners, and friends from nearby communities (Andre *et al*. 2006). K'ashógot'ı̨nę families from Fort Good Hope also travelled long distances south to visit Mayo, hunting caribou and other animals enroute. They would also go to the mountains purposefully to hunt caribou (Andre *et al*. 2006).

Shúhta (Mountain) Dene – including Shúhtaot'ı̨nę and Métis from Tulít'a and Norman Wells (NWT), Tu Łidlini (Ross River) Dena, and other Kaska Dena (Yukon)

Northern mountain caribou are of critical cultural and subsistence importance to Shúhta Dene; for many generations, people have travelled to areas in the Mackenzie Mountains to hunt northern mountain caribou and other animals (SLUPB 2013; Parks Canada 2017; Winbourne 2017a). Many continue to do so today.

Ice patch studies have revealed archaeological artifacts and biological specimens that demonstrate the deep relationship between mountain Dene and northern mountain caribou, dating back at least around 5,000 years (Andrews *et al.* 2012). Oral histories indicate times when caribou were scarce, yet they have always helped mountain people survive; understanding this historic relationship to northern mountain caribou is key to understanding the continued significance within Shúhta Dene culture and economy, and why taboos or Dene laws about hunting remain so important.

"All parts of the ʔepę́ were important, being used for many things besides food, including clothing, drum skins, lodge coverings, and dog packs. Babiche, made from the fresh hides, was braided into snares and strong rope. ʔepę́ bones were smashed into small pieces and boiled till the grease was released. The bone fat would rise to the top of the broth and be collected for food. ʔepę́ stomachs were used for collecting all the bone fat, making sure nothing was wasted. Stomach bags were also used for collecting blood, which was frozen and used later for soup." (Andrew 2018: 103)

"Caribou are critical to the health of the land and to our Dene culture. They are our food and our tools. Our music and our games come from caribou. Our people have harvested in this area forever and continue to depend on these caribou." (Josh Barichello and Norm Sterriah [Ross River Dena Land Stewardship Office] in Winbourne 2017b: 30)

Andrews *et al.* (2012) point out that Shúhtaot'ıne engagement with the landscape requires not only intimate knowledge of local ecology and the technology to make and use tools, but also the capacity to manage relationships with the powerful non-human and other spiritual entities that are responsive to human intent and action and are widespread throughout the Shúhtaot'ıne cultural landscape. Andrews *et al.* (2012) also indicate how Shúhtaot'ıne cultural understandings related to animals shape techniques for making a living in the alpine landscape. Like other subarctic hunting societies, Shúhtaot'ıne think of animals as other-than-human persons who give themselves to hunters in return for respectful treatment. Failure to observe practices that convey respect to animals and their remains, according to Shúhtaot'ıne elders, could incite the northern mountain caribou and other animals to leave the area.

Shúhta Dene hunter actions are governed by Dene ʔeʔa/ʔá nizin/a'i (traditional laws/respect) that include many rules around the proper way to harvest and utilize important animals like caribou (RRDC N.D.; Dena Kayeh Institute 2010; Andrew 2018; Sahtú Renewable Resources Board [SRRB] 2018). These teachings continue to be passed down to younger generations.

Special people known as mıdzita (caribou bosses or masters), were particularly good at dreaming caribou, and they had the ability to send caribou towards hunters or caribou drift fences (Andrews *et al*. 2012; Andrew 2018). The importance of the mıdzita to the caribou hunting practices of the Shúhtaot'ıne is indicated in the following story:

"Long ago, a big hunter, returning from an unsuccessful hunting trip, forcibly took some meat from a hunter with the power to dream caribou, a mıdzita. As a result of this event, the mıdzita refused to participate in caribou hunting. Instead, he went out alone and hunted ptarmigan to feed his family. Other members of the band, unable to kill caribou, began to get hungry. One day, the sister of the mıdzita, the wife of the man who had taken the caribou meat from him, physically grabbed her brother, saying, 'Look, your nephews are starving!' The mıdzita dropped to the ground and slept. He dreamed of ten caribou not too far from camp, and led them towards the hunters. From then on, the mıdzita was a highly respected member of the band." (Andrews et al. 2012: 37)

It is important to acknowledge how closely linked the land is to the relationship between Shúhta Dene and northern mountain caribou. Shúhtaot'ıne oral tradition relates that children with the potential to become mıdzita were left alone for several days to develop their power on Náát'ıhch'oh, a mountain with special power and an important dreaming place located near the continental divide (Andrew 2018; Andrews *et al.* 2012). Sites like Náát'ıhch'oh, Shúhtagot'ıne Néné, and the Mackenzie Mountains are culturally significant but also very important northern

mountain caribou habitat (SLUPB 2013; Parks Canada 2017). Like many other Indigenous peoples, Shúhta Dene tend to see themselves as part of the landscape, and draw very strong connections between the health of people, the health of caribou, and the health of the land (SRRB 2018). As a result, land protection is considered key to the health of Dene and caribou.

"Nı́o Nę P'ęnę́ is a series of ridges and peaks stretching from Twichya River down to the Redstone River and Náát'ıı̨ch'oh Mountain. Shúhtaot'ı̨ne elders say Nı́o Nę P'ęnę́ is like a backbone for Dene people – it holds everything in nature together. The area contains headwaters of several main rivers. Caribou migrate there from many different places. If disturbed too much, the animals won't come back." (SRRB 2018: 3)

"Migration routes are very important to the Shúhtaot'ı̨ne. We call them nı́oęnep'ęnę." (Andrew 2018: 104)

Examples like these show that making a living in a sacred landscape also requires techniques for managing relationships with the animal-persons, the land itself, and other spiritual entities that inhabit the landscape (Andrews *et al.* 2012). Because of this, for many Shúhta Dene, part of respecting and taking care of northern mountain caribou involves taking care of the land, including protecting critical parts of habitat such as calving grounds, migration routes, and mineral licks (Parks Canada 2017; Andrew 2018).

Source Summary and Gaps/Omissions

Major traditional knowledge sources for the Gwich'in and Shúhta Dene regions that were obtained in time for inclusion in this report included:

Andrews *et al.* 2012: The NWT Ice Patch Study gathered traditional knowledge in three different forums. First, the direct participation of a Shúhtagot'ıne elder in archaeological surveys provided information on traditional knowledge of hunting areas, hunting methods, travel routes, and ecology of mountain caribou. Second, in 2007 and 2008, a traditional knowledge study was conducted with Shúhtagot'ıne elders in Tulı́t'a, using semi-structured interviews and traditional land use mapping, to investigate oral traditions about hunting caribou in the mountains, especially on ice patches. The third forum was science camps held in the Selwyn Mountains in 2007 and 2008.

Benson 2018: This document contains previously-recorded Gwich'in traditional knowledge about mountain caribou. It is the best source of mountain caribou information from the Gwich'in Settlement Area, although some other information is included incidentally in a few other sources. The information in this report is provided in bullet points and organized by theme, with only minor interpretation. From the report, there are also the following caveats (Benson 2018: 1): "This report consists of solely the information about mountain caribou that was recorded incidentally during other projects. A greater amount of Gwich'in knowledge exists and has not

yet been recorded. This report contains information without context, without being compiled into a narrative format, and which has not yet gone through community verification."

Winbourne 2017a and b: Winbourne (2017a) is a consultant's report on a 2014 joint mountain caribou meeting between Shúhtaot'ıne, Métis, Tu Łidlini (Ross River) Dena, and other local knowledge holders, as well as representatives from all levels of government. The meeting focused primarily on descriptions of what types and magnitudes of impacts are being seen on northern mountain caribou populations and habitat in a traditional use area centered on Mile 222 in the Mackenzie Mountains. Winbourne (2017b) is a similar report on a second joint meeting held in 2016, but contains less traditional knowledge than the first source. For both reports, while a lot of TK/CK was presented and documented at the meetings, the information has not been verified through a formal process. However, with roughly 80 participants in the planning process, there has been a high level of community oversight in the work. TK/CK observations focus in particular on trends since 2006, but include information dating back 30-40 years.

Two possibly major sources of information were not acquired in time for inclusion in this report. These include:

- Tulita District Land Corporation. 2009. Spirit of the Mountains: Shúhtagot'ıne Néné and Nááts'ıhch'oh Traditional Knowledge Study.
- Ross River. 2008. Traditional Knowledge Study on Mountain Caribou.

No comprehensive sources of TK/CK were obtained for the following First Nations and should be considered information gaps:

- Tr'ondëk Hwëch'in
- First Nation of Na-cho Nyak Dun
- Dehcho First Nations
- Acho Dene Koe First Nation
- Nahanni Butte Dene
- Liard First Nation

One written source containing detailed local knowledge on northern mountain caribou was used in this report:

Winbourne 2019: Several outfitters in the Sahtú region were engaged regarding their knowledge of northern mountain caribou herds and management. Via telephone interviews, outfitters provided local knowledge on various topics relevant to this Species at Risk Committee (SARC) status report, including observations on relative abundance, herd distribution, and basic biology/ecology, as well as any threats and/or positive influences in their licence area. No spatial

work was done during the engagement and the results are limited by the numbers of participating outfitters.

There are some sources that could be considered overlap sources between scientific knowledge and TK/CK. The 2018 Sahtú Renewable Resources Board (SRRB) report on engagement with outfitters may have overlapping scientific and community knowledge information if the outfitters are familiar with and make use of scientific knowledge. In addition, Wilson and Haas (2012) defined and mapped important wildlife areas for several species in the NWT, including northern mountain caribou. The information is based on local observations, TK/CK, and scientific information, and as such, is considered overlap information.

Species Overview

Names and Classification

Common Name (English)	Northern mountain caribou (woodland caribou [northern mountain population])[3]
Common Name – French:	Caribou des bois (population des montagnes du nord)[4]
Scientific Name	*Rangifer tarandus caribou*
Teetł'it/Gwichya Gwich'in	Vadzaih
Shúhtaot'ıne[5]	Shúhta ʔepę́ / goʔepę́
K'ashógot'ıne	Shı́hta gǫʔedǝ́
Shúhta Dena[6]	Bedzih
Kaska Dena	Kudzih
Dene Zhatie/Yati[7]	Mbedzih

Names have not yet been found in sources for the following First Nations:

- Tr'ondëk Hwëch'in
- First Nation of Na-Cho Nyak Dun

[3] In this report, woodland caribou (northern mountain population) are referred to as northern mountain caribou.
[4] COSEWIC (2014).
[5] In this report, the spelling of Shúhtaot'ıne is used to refer to Mountain Dene from around Tuĺıt'a and Norman Wells. An alternate spelling in some of the literature is Shúhtagot'ınę. In this report, this dialect is attributed as (S).
[6] Shúhta Dena is spoken by people from Tu Łidlini (the community of Ross River, Yukon) and attributed as (SD) in text where distinctions are made. Kaska Dena (KD) is spoken within the community of Tu Łidlini, as well as more broadly throughout the traditional territory.
[7] Dene Zhatie/Yati is the Dene language of the Dehcho region.

- Acho Dene Koe First Nation
- Nahanni Butte Dene
- Liard First Nation

The names provided here are general terms for referring to northern mountain caribou within the first languages. It is important to note that within Indigenous cultures that have a relationship with caribou, there are typically many different ways to characterize or describe caribou individuals and their roles within the herd. This observation is from Shúhtaot'ıne elder Leon Andrew:

"There are many names to describe differences of gender and age among ʔepę́. For example, male ʔepę́ are called mıhcho, young bulls are called yárego, females are called mıdzıh, a calf is called ʔezhah, and a cow and calf together are called mıdzı dezhá. We hunt the mountain woodland ʔepę́ which we call shúhta goʔepę́." (Andrew 2018: 104)

In the Sahtú region, some sources indicate that people consider boreal woodland caribou and northern mountain caribou to be basically the same, with no real differences between them (Olsen *et al*. 2001); shúhta ʔepę́ are only distinguishable by their large size and close association with the mountains (Polfus 2016). While Shúhtaot'ıne and Métis from Tuĺıt'a and Norman Wells, and Tu Łıdlini (Ross River) Dena, generally consider northern mountain caribou to be all of one type, differences are noted among herds in terms of body size, coloration, markings, antler size and configuration, hoof prints, and in behaviour and movement patterns (McDonald *et al*. 2010; Winbourne 2017a). Information on naming and classification for northern mountain caribou specifically was not found for regions other than the Sahtú in the sources reviewed for this report.

In research combining results from genetic analysis and TK/CK studies in the Sahtú region, Polfus (2016) found that scientific and TK/CK classifications for different types of caribou are similar for the most part. That is, broad classifications distinguish caribou as boreal, northern mountain, and barren-ground. However, the TK/CK research results indicate that there may be more extensive overlap and known mixing between barren-ground and northern mountain caribou populations (historically and currently) (described by local Dene people) than is generally supported by science (*Ibid*.).

Polfus (2016) learned from several Fort Good Hope elders that a large herd of barren-ground caribou had crossed the Mackenzie River and headed into the foothills of the mountains as recently as the 1940s. No one ever saw the entire herd return or migrate back across the river. One elder related the following in Dene language:

"There was a lot of them, I have witnessed the caribou crossing…ice, even though it was broken up, there was lots of them… Many years ago, the caribou crossed to the other side… They have been gone a long time and people are saying that they have become lots again and they have

been using that area for calving… This is according to the elders and they also say that they will never disappear." (Gabe Kochon [Fort Good Hope] in Polfus 2016: 57)

In addition, some Shúhtaot'ıne elders describe a type of caribou in the mountains referred to as tęnatł'ǝa (S) that is distinct from boreal, mountain, and barren-ground caribou (Polfus 2016): "In the old days, sometimes we would see a ʔepę́ from the north, a migratory ʔepę́, which we called tenatłea (long-distance runners). The elders say that tenatłea come from the ocean shore" (Andrew 2018: 104). The tęnatł'ǝa were said to migrate long distances, and were identifiable by particular morphological markings (Polfus 2016). They are thought to represent an important component of caribou biodiversity not currently identified by scientific taxonomies (Polfus 2016). The Tu Łidlini elders similarly refer to an uncommon race of caribou that is very small and has largely disappeared (Barichello pers. comm. 2019).

Several outfitters are also able to describe differences in northern mountain caribou morphology and behaviour/movement patterns that likely indicate different herds or sub-herds within the Redstone and Nahanni complexes (Winbourne 2019).

Description

Teetł'it Gwich'in sources characterize northern mountain caribou as big animals, bigger than barren-ground caribou (Benson 2018). Gwichya Gwich'in also note that northern mountain caribou are large (Andre *et al.* 2006). Teetł'it Gwich'in elder Robert Alexie was able to identify differences in the appearances of northern mountain caribou from different herds, or perhaps different habitats/altitudes; northern mountain caribou from the Snake River area (Bonnet Plume herd) are smaller than those herds that stay further south, which are composed of bigger animals (Katz 2010; Benson 2018). Note that it was possible but not likely that Alexie was discussing Porcupine caribou (Benson 2018). Tu Łidlini elders also comment on size differences among different northern mountain caribou herds (Barichello pers. comm. 2019). Outfitters similarly describe some differences in body size among northern mountain caribou herds or sub-herds (Winbourne 2019).

In their work with knowledge holders from Fort Good Hope and Colville Lake, Johnson and Ruttan (1993) recorded participants' descriptions of northern mountain caribou as follows:

"…a large 'yellowish coloured' type that 'stays' in the Mackenzie Mountains and has habits similar to barren-ground caribou, including staying in large groups and migrating back and forth between alpine tundra for the summer and the foothills and lowland forests for the winter." (1993: 127)

Outfitters are able to provide descriptions of the caribou they see in the areas they are familiar with; some specific observations about differences in morphology are provided about the Nahanni Complex in the *Distribution* section, as these are strongly informed by differences in movement patterns and seasonal habitat use (Winbourne 2019).

"We always see the same caribou – going by their body size and horn size I think it's the same caribou each year. They change their migration patterns but other than that there's no reason to think it's different caribou. When you compare to caribou from the Aishihik herd in the Yukon they are way bigger over there, and the horn size is way bigger too." (Werner Aschbacher [South Nahanni Outfitters Ltd.] in Winbourne 2019: 9)

Other observations north of Nahanni Butte indicate that there are caribou in that area that aren't like northern mountain caribou; they are observed gathered in groups in the mountainous, treed areas and described as more like a woodland caribou with stunted antlers and very heavy bodies. They are seen between Nahanni Butte and Fort Simpson along the mountain edge and travel to Trout Lake down from the mountains (Winbourne 2019).

More details on herd-specific characteristics and movements are included in the *Movements* section of this report. Photographs of northern mountain caribou in their Mackenzie Mountain habitat are included in Figures 4 and 5.

Figure 4. Bull caribou near Dechenla Lodge. Photo reproduced with permission from Norman Barichello.

Figure 5. Mixed group of northern mountain caribou, north of Dechenla Lodge, in hills on the edge of the Mackenzie Mountains barrens. Photo reproduced with permission from Norman Barichello.

Distribution

The Mackenzie Mountains are home to several herds of northern mountain caribou, covering a range that stretches from the Arctic Red River in the north to Fort Liard in the south. Individual First Nations tend to encounter caribou from particular herds; as a result, no comprehensive information was found regarding overall distribution in the sources reviewed for this report. Some information is provided below for the Gwich'in, Sahtú, Kaska, and Nahʔą Dehé regions.

No detailed spatial information on northern mountain caribou herd distribution was available in the sources reviewed for this report.

Northern Range

Teetł'it Gwich'in elders and harvesters indicate that there are groups of caribou around the heads of the Hart and Wind rivers, and the Snake River, year-round. Northern mountain caribou are also found in parts of the Ogilvie Mountains. One August, a herd of 15 or 20 large cows was seen in the drainages between the Gayna and Arctic Red rivers. Gwichya Gwich'in elders and harvesters indicate that northern mountain caribou are found in the mountains at the headwaters of the Arctic Red and Cranswick rivers (Benson 2018). Elders recall hearing that

northern mountain caribou would be sought first in the headwaters of the Cranswick River, and if none were found, they would move to the headwaters of the Arctic Red River (Andre *et al*. 2006).

Two different herds of caribou have been described within the Arctic Red River Outfitting area, distinguished by differences in behaviour. Bonnet Plume caribou are found in the southern/ southwestern half of the area around the Source Peaks and headwaters of major drainages such as the Arctic Red, Mountain, Hess, Snake, and Bonnet Plume rivers (Winbourne 2019). These caribou tend to stay in high elevation habitat, moving south in the fall to rut at around 7,000 feet (2,100 meters) elevation. Caribou from the Redstone Complex are encountered in the north and northeast of this outfitting area; they move north into the foothills, congregating at 2,000 feet (600 meters) to rut as snow comes to higher areas, and spend the early part of the winter there. These two groups of caribou do not mix during the rut (*Ibid*.).

Central Range

In the Keele River area, caribou distribution is described as 'even' with variation in the areas used year to year (Winbourne 2019). They travel along ridges on both sides of the Keele River, as well as the Ekwi and Natla rivers (*Ibid*.).

Knowledge provided by Tu Łidlini (Ross River) Dena elders indicates that there are likely at least five different groups of northern mountain caribou that converge in the K'á Tǝ́ area (at and around Dechenla, which is an extensive high-elevation plateau) (Winbourne 2017a)[8]. These herds come from many different directions in the Yukon and across the Mackenzie Mountains. Based on herd-specific observations provided by Tu Łidlini elders, and in some cases the observation of radio-collared caribou, there may be caribou from as many as six herds (distinguished based on where they winter) observed in the K'á Tǝ́ area, as follows:

1. Keele River (near confluence of Twitya and Ekwi rivers)
2. Redstone
3. Finlayson (radio-collared animals observed)
4. Bonnet Plume
5. Tay River
6. Nahanni (radio-collared animals observed) (Barichello pers. comm. 2019)

[8] Macmillan (Mac) Pass or Mile 222 is a location regularly frequented by Tu Łidlini Dena and Shúhtaot'ıne, who generally refer to the broader general area as Dechıl̨ǫ (S/SD) or Dechenla (Kaska Dena), meaning 'the land at the end of or at the edge of the spruce trees or treeline' (Winbourne 2017b). In this report, the name Dechenla is used to encompass northern mountain caribou habitat including the area around Macmillan Pass, Caribou Pass, K'á Tǝ́ (Willow Flats), Dechenla Lodge (Mile 212), and the Mackenzie Mountains barrens.

One Tu Łidlini elder described caribou coming from the northwest as being small caribou (also with different antler characteristics than other herds); this is consistent with Gwich'in descriptions of caribou within the Bonnet Plume herd (Barichello pers. comm. 2019). More details are provided on these caribou in the *Movements* section.

An outfitter with experience in the Gayna River area describes two distinct herds there:

"For a while there was talk about a separate 'Mountain River Herd'; I would tend to agree that the caribou we see are not the same ones that are in big numbers down on the Redstone. There really is no science to back up that theory but I am quite sure they are separate herds. In September and October, when there are huge bunches gathering down at the Redstone, the northern herds are congregating on the Front Range… I am sure that there are caribou that wander back and forth so there will be genetic [similarity], but for the most part these are separate herds. I am not even sure that referring to them as separate herds is accurate – they wander so much during the fly season in the summer that there are undoubtedly animals that travel as far as the Redstone and vice versa." (Harold Grinde [Gana River Outfitters Ltd.] in Winbourne 2019: 8)

Southern Range

Some traditional knowledge on northern mountain caribou was recorded during research conducted for the Prairie Creek Mine and proposed access road in the Dehcho region, when team members and elders from Nahanni Butte stated that there were caribou in the area of concern. Park staff had observations of caribou that included animal sightings, shed antlers, and tracks – those observations were mostly during summer with some winter observations. Hunting outfitters reported the largest numbers in the Prairie Creek area during fall in that study (ENR 2016).

South Nahanni Outfitters has their main camp on a tributary of the Root River and they indicate that they mostly encounter caribou from the Redstone herd in that area, and only a few Nahanni caribou (Winbourne 2019). Nahanni Butte Outfitters, operating in the south Nahanni area, have a different experience, and describe variation among three distinct groups of caribou as follows:

1. North side of Nahanni River – In the Prairie Creek area and drainages north of the Nahanni River. They seem to be the same caribou as on the Keele River – they are the same size, have the same body, and are not as big as the caribou south of the Nahanni River. Their distribution is all along the Yukon/NWT border.

2. South side of the Nahanni River – Have distinctly bigger bodies than those seen on the north side of the river.

3. The Flat River group – A third group around the Flat River, to the west and northwest corner of their hunting area, that is even bigger-bodied than those on the south side of the Nahanni River. They are not very plentiful, but very large, and their distribution is all along the mountains towards Cantung (Winbourne 2019).

These groups of caribou do not seem to mix, and caribou do not seem to move between the north and south sides of the Nahanni River very much (*Ibid*.).

Search Effort

Indigenous and local residents of both the NWT and Yukon hunt northern mountain caribou for subsistence. In addition, non-resident sport hunting occurs in the Mackenzie Mountains annually, mostly during the months of August and September. ENR reports that resident harvest is almost exclusively of males and comes from five herds in the NWT: Redstone, Bonnet Plume, South Nahanni, Labiche, and Coal River (the alignment of the harvest with different herds is likely based on where the harvest occurs in relation to the suspected distribution of these herds) (Larter 2018). Because much of northern mountain caribou habitat isn't accessible by road, TK/CK information on distribution tends to be 'patchy'. Detailed TK/CK was only available from Shúhta (Mountain) Dene and to a lesser extent, Gwich'in regions, in the sources reviewed for this report.

Figure 6 shows scientific understandings of the northern mountain caribou herds that are regularly encountered by Yukon and NWT First Nations.

Figure 6. Map showing scientific understandings of the northern mountain caribou herds that Yukon and NWT First Nations tend to encounter and have knowledge of. Data for First Nations shapefiles from NWT Centre for Geomatics (2007a and b), NRCan (2008), and Government of Yukon (2014). Caribou range data from GNWT (R. Gau, N. Larter, R. Popko), Government of Alberta (L. Neufeld, D. Hervieux, D. Cichowski), Government of BC (D. Seip, T.M. Williams), and Government of Yukon (T. Hegel, K. Russell). Map courtesy of B. Fournier, ENR.

Shúhta (Mountain) Dene – includes Shúhtaot'ıne and Métis from Tulít'a and Norman Wells (NWT), as well as Tu Łidlini (Ross River) Dena and other Kaska Dena (Yukon)

As noted in *Regional/Cultural Background*, the Shúhtaot'ıne lived, travelled, hunted, and trapped in the Mackenzie, Selwyn, and Ogilvie mountains (between 61° and 66°N), and from the Mackenzie River valley in the east to the Stewart, Ross, Pelly, and Hess river valleys in the Yukon to the west (Andrews *et al*. 2012). Based on their cumulative experience on the land, Ross River Dena and Shúhtaot'ıne alike have a wealth of traditional knowledge about northern mountain caribou (RRDC N.D.; Winbourne 2017a).

Tom Andrews and his Shúhtaot'ıne colleagues documented many important caribou harvesting locations and other archaeological sites along the travel corridors. Shúhtaot'ıne river names such as Məcho Tsı́é/Mıtchotse[9] (Caribou Cry River) reflect the fact that caribou are known to migrate to and use these areas in the fall (Andrews *et al*. 2012; Winbourne 2017a). Sites such as Ɂepé Ɂehda (Caribou Flats) were chosen because of the predictable presence of caribou at certain times of the year (Andrews *et al.* 2012).

"Important elements of the subsistence-settlement system included, for example, the fall caribou hunt in the Ɂepé Ɂehda area, winters spent hunting in the winter range of the Redstone caribou population, and spring hunting in the Ɪts'édéé Ɂǫtaı ('moose antler pass or summit') area, but, in contrast to the contact-traditional seasonal round, did not involve extended visits to the Mackenzie lowlands. Instead, as the spring turned to summer, we suggest that the Shúhtaot'ıne began to move towards the K'atieh area, perhaps traveling up the Begádeé [Keele River] and Túoch'ee Tuwé Nıl̨ı̨ne [Natla] valleys from their spring hunting areas." (Andrews et al. 2012: 34)

Traditional use data recorded by Andrews *et al*. (2012) provide a detailed picture of the Shúhtaot'ıne alpine subsistence-settlement system. In particular, a high density of features along Begádeé (the Keele River) in the vicinity of Ɂepé Ɂehda (Caribou Flats or caribou mineral lick) relates, in part, to the importance of the fall caribou hunt (*Ibid*.). Within the Sahtú region, K'áhsho Got'ıne̹ from Fort Good Hope also use northern mountain caribou, but workshops conducted in Sahtú communities in 2000 indicated that fewer northern mountain caribou are harvested now than in the past (Olsen *et al*. 2001).

By the early to mid-19th century, Shúhtaot'ıne began to adapt their seasonal movements to visit fur trading posts in the valley, often spending the summer months fishing and hunting near Tulít'a. They would then travel by foot into the mountains to hunt and trap for seven to eight months of the year. People would return to the lowlands once rivers were navigable (around late May) using moose skin boats (Winbourne 2017a). Shúhtaot'ıne still spent a large part of the year living as mobile hunter-gatherers in the Mackenzie Mountains up until the 1960s, hunting

[9] Spelled Mı̨hchotsée Nı̨lı̨ne in Andrews *et al.* (2012).

northern mountain caribou, as well as harvesting numerous other resources (Andrews *et al*. 2012).

While today most Shúhtaot'ıne are settled in Tuĺıt'a, many continue to make annual trips into the mountains to harvest bush resources (Andrew 2018). Some Shúhtaot'ıne from Tuĺıt'a and Norman Wells continue to rely on a fall hunt of northern mountain caribou as an important part of their yearly harvest. For example, areas proposed for the Doı T'oh Territorial Park and the CANOL Heritage Trail have been in continuous use by Mountain Dene for hunting, fishing, and trapping (Downie *et al*. 2007). Mountain Dene from Tuĺıt'a regularly conduct a community hunt for northern mountain caribou at Drum Lake, a known wintering ground for these caribou, as well as at Caribou Flats (Olsen *et al*. 2001; Larter and Allaire 2017).

There is also consistency of use at other traditional harvesting areas such as K'á Tә́ (Willow Flats). Located near the headwaters of the Keele, Caribou Cry, Ross, and MacMillan rivers, K'á Tә́ is an especially rich part of the mountain landscape, known not just for its high numbers of northern mountain caribou, but also moose, migratory birds, and healthy populations of fish and beaver. Shúhta Dene from both the Yukon and NWT continue to travel to this site on an annual basis for harvesting purposes (Winbourne 2017a and b; SRRB 2018).

Shúhtaot'ıne detailed knowledge of caribou behaviour and the landscape strongly informs hunting strategy and success; for example, known mineral licks are also important sites where Shúhtaot'ıne hunters can predictably intercept and harvest large game like northern mountain caribou, and knowledge of migration routes and seasonal abundance enable Shúhtaot'ıne to make substantial harvests (Olsen *et al*. 2001; Andrews *et al*. 2012).

Macmillan Pass/K'á Tә́ is another important area intersected by the CANOL road and trail, and regularly frequented by Shúhtaot'ıne and Tu Łidlini and Kaska Dena. Because this area is accessible by road, many Shúhtaot'ıne Dene continue to use this area year after year and have traditional campsites here.

Tu Łidlini and Kaska Dena seasonal use patterns in the Mackenzie Mountains are similar to those described for Shúhtaot'ıne. Traditionally, they too followed a nomadic lifestyle, sustained by the land, and following the animals with the circle of the seasons, using different means of travel (e.g., snowshoes, moose skin boats, pack dogs (RRDC N.D.)). Many of these traditional ways have been carried into the present, albeit using newer technology such as trucks and all-terrain vehicles (ATVs) to access traditional camp sites. Tu Łidlini and Kaska Dena have, for many generations, moved into the Selwyn-Mackenzie mountains typically around late summer/early fall, and continue to come to K'á Tә́ in that season to hunt caribou (RRDC N.D.).

Gwich'in

Northern mountain caribou were seen by the Teetł'it Gwich'in around Snake River, in the current range of the Bonnet Plume herd (Benson 2018). Previous generations of Teetł'it Gwich'in families would know they could find abundant northern mountain caribou at the confluence of the Peel and Bonnet Plume rivers, to the point that they used caribou corrals to hunt them in relatively large numbers. After the corrals were constructed, the caribou were herded or chased into them and then killed with snares or spears (Profeit-LeBlanc 1994).

According to Gwichya Gwich'in elders, there were 'lots' of northern mountain caribou found in the headwaters of the Arctic Red River, which is within the current extent of the Bonnet Plume and Redstone herds. If a hunter wanted to seek out northern mountain caribou, they didn't have to go far to find them. Gwichya Gwich'in families would include a trip up the Arctic Red River to the mountains as part of their annual movement patterns. They chose routes and locations based on their knowledge of the location and abundance of northern mountain caribou and other resources. Also, they would meet friends and family at large gathering sites. The location where the caribou were likely to be found was well-known and the animals were considered an important part of Gwich'in subsistence (Benson 2018). In recent decades, due to shifting demographics and travel styles, Teetł'it and Gwichya Gwich'in focus their caribou harvest much more on barren-ground caribou, so much of the information available from Gwich'in traditional knowledge sources is from stories of the past or from a few individual harvesters who have made trips into the mountains to harvest these caribou.

Recreational Users and Non-Indigenous Harvesters and Outfitters

Northern mountain caribou are one of the more desired species sought by non-resident hunters (Larter and Allaire 2017). Non-resident hunters can only hunt northern mountain caribou with registered guides within outfitting concessions in the NWT. They access the herds using fixed-wing aircraft, helicopters, ATVs, boats, and horses. There are eight outfitters operating in the NWT portion of northern mountain caribou range. Outfitter areas are shown in relation to caribou herds in the NWT in Figure 7.

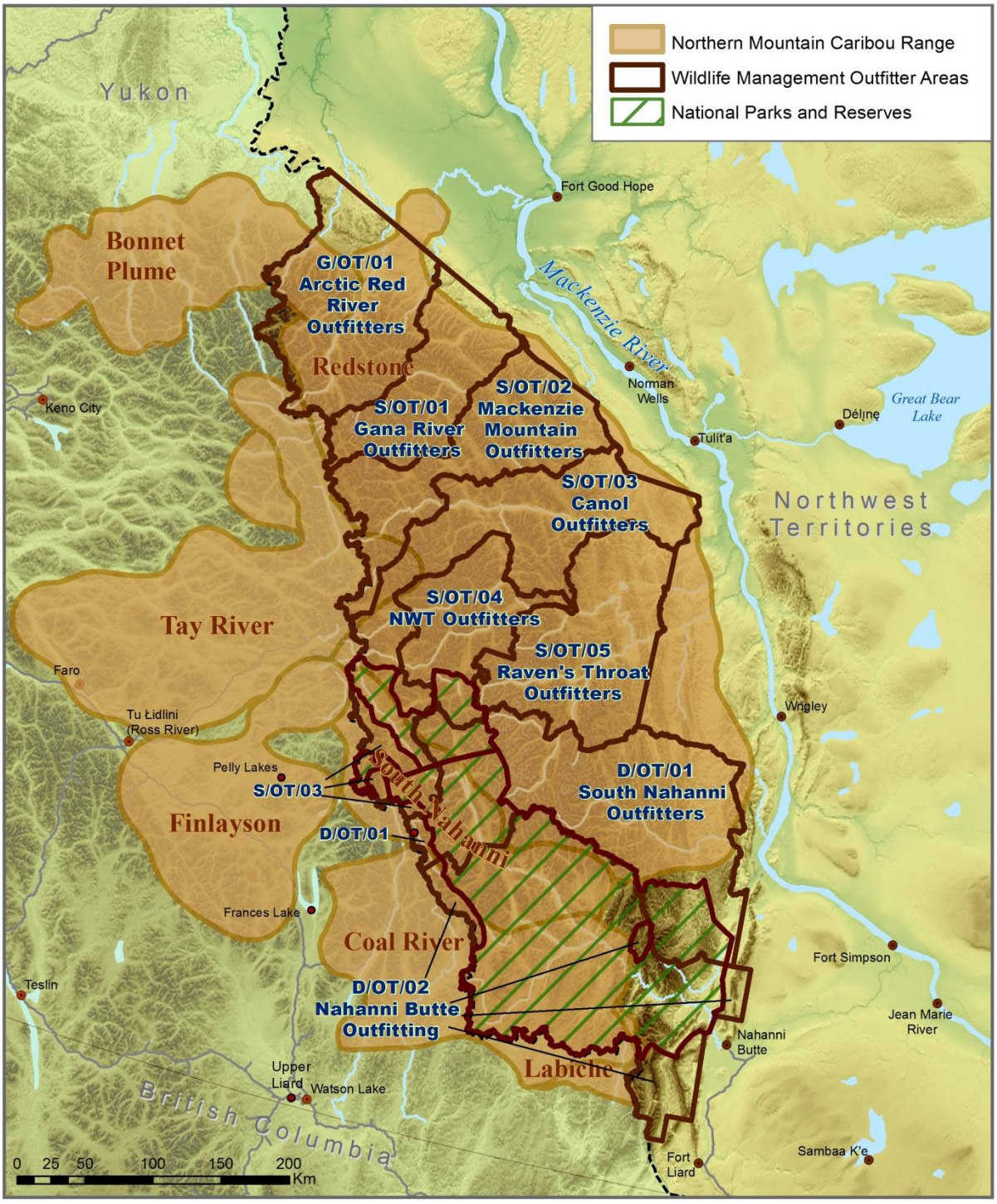

Figure 7. Map showing outfitter areas within northern mountain caribou range in the NWT in relation to known scientific ranges for these herds (NWT Centre for Geomatics 2014). Caribou range data from GNWT (R. Gau, N. Larter, R. Popko), Government of Alberta (L. Neufeld, D. Hervieux, D. Cichowski), Government of BC (D. Seip, T.M. Williams), and Government of Yukon (T. Hegel, K. Russell). Map courtesy of B. Fournier, ENR.

Outfitters often spend decades observing caribou during the seasons they are at their camps and many have in-depth knowledge of caribou in their concessions during the hunting season. Some of the rich information held by outfitters has been documented, but direct observations are mostly restricted to the period between late July and early October (Winbourne 2019).

Sahtú residents' use of the CANOL trail and surrounding area is for general recreation including hunting, hiking, camping, and snowmobiling (Downie *et al*. 2007). Resident licensed hunters tend to spend time and hunt in the area accessed by the North CANOL Road. Summer road access is possible to Mile 222 along the North CANOL Road through the Yukon. Two airstrips are located in the Macmillan Pass area, one north of the pass at Mile 222 and the other just south of Macmillan Pass. Both support air charter service.

The CANOL roadway allows easy access by horseback and one outfitter continues to rely on the roadway to offer horseback hunts (Downie *et al.* 2007). Other non-guided hunters usually access the area by ATV. The dominant use of the CANOL Heritage Trail corridor at the present time is for guided trophy hunting and Sahtú Dene and Métis subsistence wildlife harvesting. Some outfitting facilities are located directly within the corridor and regularly utilize the corridor; however, guided non-resident hunting operations are practiced across large outfitter concessions well beyond the corridor park (Downie *et al.* 2007).

Access for hunting in the southern portion of the corridor and surrounding area has typically been from the southwest directly along the CANOL road. Trucks are typically replaced by ATVs at Mile 222 where travel becomes very difficult by truck. Access for hunting from the Norman Wells area is by air and is less directly connected to the CANOL corridor. Typically, people who are doing other, non-hunting, recreational activities come in from Norman Wells and use the northern portions of the area, accessing them from the same air sites (Downie *et al.* 2007).

The Dechenla Lodge and Wilderness Resort is located east of the Yukon-NWT border, on a high elevation plateau between the Selwyn Mountains to the west, and a series of ranges that belong to the Mackenzie Mountains to the east. The lodge has been operated as a naturalist lodge since 1980 and is currently co-owned by the Kaska First Nation and the Barichello family – who also seasonally inhabit the lodge. The lodge caters to nature groups, hikers, birders, etc., as well as hosting other programs and retreats (Downie *et al.* 2007; Dechenla Lodge 2018). The operating season is typically July through early September (Downie *et al.* 2007). Staff of the lodge have extensive knowledge about northern mountain caribou and the environment in the vicinity, based on their experience in the area.

Biology and Behaviour

Habitat Requirements

Northern mountain caribou habitat is likely dictated by the availability of food and minerals, and the risk of predation, mediated by snow conditions and noxious insects (Barichello pers. comm. 2019). Northern mountain caribou use a variety of ranges throughout the year (Dena Kayeh Institute 2010; Winbourne 2019). Calving, post-calving, summer, and rutting range are generally in alpine habitats. As snow depth increases after the rut, caribou migrate to lower elevation, forested winter ranges. Each range is separated by elevation or distance. While maintaining the entire range is considered important for survival of the herds, the forested winter range, migration corridors, and calving/post-calving ranges are specifically prioritized for protection under the Kaska Dena land use framework (*Ibid*.).

The information presented here for eastern Yukon and the western NWT is for the most part consistent with Indigenous traditional knowledge regarding habitat use reported for northern BC in the Committee on the Status of Endangered Wildlife in Canada's (COSEWIC) (2014) assessment and status report on northern mountain caribou. Caribou are typically restricted to low elevation forested areas during the late winter. They begin to move out of these areas in April and May, and disperse in small groups at higher elevations in late May, at the time of calving. This strategy of dispersing above the valleys is likely a strategy to minimize encounters with wolves, who at this time are concentrated at den sites at lower elevations (*Ibid*.).

Cows aggregate into post-calving groups after calving, in open areas where there is ample food and where wolves can be spotted a long way off (Barichello pers. comm. 2019). In July, caribou scatter across the mountains to areas where there are wind-exposed ridges and snowpacks to minimize insect harassment, adjacent to lush alpine meadows. In late summer (after the insect period) they converge in open areas (predator avoidance) where there is an abundance of willows. Here, the bulls join them in advance of the rut. After the rut, and likely prompted by snow conditions, caribou move back down to low elevation forested areas with available lichen and suitable cratering conditions (*Ibid*.). Some caribou may move back to higher elevations for the rest of the winter, if snow conditions permit (COSEWIC 2014; Winbourne 2019). Also, there have been suggestions that if snow conditions are favourable, caribou will remain near the treeline during the winter (Barichello pers. comm. 2019).

Northern mountain caribou food is considered to be broadly available in the areas where they live, and if a particular area has been well-grazed and there isn't enough food left to eat, caribou will move on (Benson 2018). During consultations for Nááts'įhch'oh National Park Reserve, Shúhtaot'įne participants said that it was important that planning take into consideration caribou feeding areas and seasonal changes in vegetation (Uunila pers. comm. 2018). Gwich'in harvesters and outfitters say that caribou are sometimes seen at salt or mineral licks, but

generally not as often as sheep (Benson 2018; Winbourne 2019). In addition, participants in a joint planning process for caribou in the Mackenzie Mountains also identified ice patches and mineral licks as important habitat (Winbourne 2017a). More specific information on caribou habitat is provided according to seasonal ranges in the sections that follow. Seasonal range use, as described in the text, is briefly summarized by area/feature in Table 1. Information about caribou movements between seasonal ranges is provided in *Movements*.

Table 1. Summary of seasonal range use by area/feature, as described in the text. Spatial descriptions for much of this seasonal range are not currently available and have therefore not been mapped.

Area/Feature	Spring (calving)	Summer	Fall (rut)	Winter	Migration	Unspecified
Arctic Red River		x	x	x	x	
Bonnet Plume River		x	x			
Caribou Cry River (Məcho Tsı́é/Mıtchotse)	x		x			
Cranswick River		x				
Ekwi River					x	
Flat River						x
Gayna River		x	x	x		
Hart River	x	x	x	x		
Hess River			x			
Keele River (Begádeé)	x		x	x	x	
Liard River						x
Little Nahanni River	x	x	x		x	
Moose Horn River		x				
Mountain River		x	x			
Nahanni River						x
Natla River (Túoch'ee Tuwé Nı̨lı̨ne)	x				x	
Peel River						x
Ram River			x			
Ramparts River			x	x		
Redstone River		x	x			
Root River			x			
Sheepbed River		x			x	
Silverberry River		x			x	
Snake River	x	x	x	x		
South Nahanni River	x	x	x	x		
Stone Knife River			x			
Thundercloud River					x	
Twitya River	x					
Wind Rivers	x	x	x	x		
Wrigley Creek			x			
Bell Heather Lake			x			
Carcajou Lake	x	x	x	x		

Area/Feature	Spring (calving)	Summer	Fall (rut)	Winter	Migration	Unspecified
Drum/Wrigley Lake (Tets’exeh)				x		
O’Grady Lakes	x					
Poacher Lake			x			
Tabasco Lake						x
Virginia Falls				x		
Caribou Mountains (not shown on maps)						x
Front Range			x			
Keele Mountain						x
Lichen Ridge				x		
Mackenzie Mountains		x	x	x		
Ogilvie Mountains						x
Selwyn Mountains		x	x			
Shattered Range				x		
Source Peaks		x	x			
Arctic Red River outfitting area		x	x			
CANOL Heritage Trail			x			
Dechenla/K’á Tǝ́/Macmillan Pass (Willow Flats)	x	x	x			
Dechenla Lodge		x	x			
Doı T’oh Territorial Park			x			
Į̨ıts’édéé Ɂǫtaı (moose antler pass or summit) (not shown on maps)	x				x	
Gana River outfitting area		x		x		
Kaska land use framework				x		x
Moose Ponds	x	x				
Nááts’ı̨hch’oh	x					
Naatsàk (not shown on maps)				x		
Nahanni National Park Reserve				x		
Pətłánejo (Caribou Flats)		x	x	x		
Plains of Abraham	x					
Prairie Creek Mine and access road		x	x	x		
Shúhtagot’ıne Néné (Mountain Dene Land) (not shown on maps)	x		x	x	x	
South Nahanni outfitting area		x	x		x	

Area/Feature	Spring (calving)	Summer	Fall (rut)	Winter	Migration	Unspecified
ʔepé ʔehda (Caribou Flats or caribou mineral lick)	x		x	x		

Spring Range and Calving Grounds

As winter turns to spring, northern mountain caribou begin to migrate towards their calving areas and summer range, and traditionally, Shúhtaot'ıne followed them into the higher mountains to hunt. Shúhtaot'ıne elders identified the area around Ɉts'édéé ʔǫtaı (moose antler pass or summit) and areas along Begádeé (the Keele River) as important migration corridors and places for spring caribou hunting (Andrews *et al.* 2012). The ʔepę́ ʔehda (Caribou Flats) has also long been an important area for Shúhtaot'ıne to harvest northern mountain caribou in the spring (*Ibid*.).

For the last few years, Gana River Outfitters have been in their licence area in spring and have noticed that in April the timber on the valley sides is 'tracked up' – that is, in years with little snow, you can see old tracks from months before, and caribou seem to spend a lot of time in the scattered and heavy timber. While they may be in alpine habitat, they are not on the windy mountain tops, but just above the treeline (Winbourne 2019).

The Kaska Dena land use framework states that calving sites are scattered across a large area at upper elevations (Dena Kayeh Institute 2010). The framework emphasizes that it is how the caribou use the range that is important to understand; that is, female caribou with calves are usually found at high elevations in alpine habitats in small groups, with some use in coniferous islands at treeline, and females without calves and males are usually found at lower elevations of alpine and upper slope forests during the peak of calving (approximately May 15 to June 15) (*Ibid*.).

Photographs included in Figures 8 and 9 show northern mountain caribou in spring habitat near Dechenla Lodge following calving.

Figure 8. Cows with young calves are often visible from Dechenla Lodge during the early summer. They come to Dechenla to seek out snow-free patches with good forage. The area also provides high visibility for predators. Photo reproduced with permission from Norman Barichello.

Figure 9. Caribou cows feeding on a mountain slope near Dechenla Lodge in late spring. Photo reproduced with permission from Norman Barichello.

Summer Range - Including Ice Patches

Around the headwaters of the Arctic Red River, northern mountain caribou are known to go very high up in the mountains in the summers; they do not always stay in the valleys, although there are caribou (and sheep) tracks and other 'signs' in the valleys in the summer. The caribou can get up the steep slopes as they are agile and can easily climb (Andre *et al.* 2006; Benson 2018). One August, a herd of 15 or 20 large cows was seen in the drainages between the Gayna and Arctic Red rivers (Benson 2018). When there is a summer with a lot of rain, the caribou's habitat will be lush and support healthy animals (*Ibid*.).

Arctic Red River Outfitters has observed that caribou within the Bonnet Plume and Redstone herds are dispersed throughout the high country using alpine and sub-alpine environments in summer (Winbourne 2019). Use of different habitats within this area depends on precipitation and temperature, noted as follows:

"If we're having a wet summer and the bugs aren't bad, they come down – they'll do this very quickly – if it's hot and dry they are up high escaping bugs and eating sedges. With cold wet weather, they will drop 3,000 to 4,000 feet [900-1200m] in elevation suddenly and come down to eat the lichen. But they rely heavily on alpine vegetation in the summer – it provides good nutrition

and allows them to escape the bugs." (Tavis Molnar [Arctic Red River Outfitters Ltd.] in Winbourne 2019: 21)

More information on caribou habitat use and movements within and out of the mountains in the headwaters of the Arctic Red River area is included in the *Movements* section.

The headwaters near the Gayna River are consistently important summer range, as well as the headwaters of the Cranswick River – where large concentrations of caribou are often seen in summer (Winbourne 2019). Again, habitat use is influenced by weather – most caribou are found in high terrain when it's hot, but there will also be individuals in breezy rocky habitat or on gravel bars to keep bugs away (*Ibid*.). Overall, Gana River Outfitters stresses use of high terrain:

"You'll see them right on the tops of mountains. I've seen them above the sheep up on the cliffs; I saw a group some wolves had chased way up high in the cliffs where we couldn't follow. They will go right to the top in the summer and you'll find the sheep a thousand feet [300m] below them." (Harold Grinde [Gana River Outfitters Ltd.] in Winbourne 2019: 23)

Oral tradition and current TK/CK indicate that K'á Tǝ́[10] is an important traditional use area for Shúhta Dene during the summer months due in part to the consistent abundance of caribou found there (Andrews *et al.* 2012; Winbourne 2017b). The summer habitat at K'á Tǝ́ includes an extensive high elevation plateau along the continental divide, surrounded by broad valleys of willow and shrub birch, above which are lush alpine meadows, persistent snowpacks, and wind-exposed slopes (Andrews *et al*. 2012; Barichello pers. comm. 2018). Figure 10 shows caribou at Dechenla Lodge in the Mackenzie Mountains during summer months.

[10] Spelled K'atieh in Andrews *et al.* (2012).

Figure 10. Northern mountain caribou at Dechenla Lodge during mid-summer. Photo reproduced with permission from Norman Barichello.

Traditional knowledge indicates that ice patches in the Mackenzie and Selwyn mountains provide important summer habitat for northern mountain caribou, who rely on them to minimize harassment from insects and for cooling during hot weather (Andre *et al*. 2006; Andrews *et al*. 2012; Benson 2018). Some ice patches in the Selwyn Mountains contain layers of caribou dung dating from the recent past to approximately 5,000 years before present, supporting oral histories about Shúhta Dena, caribou, and ice patches having a long-term relationship (Andrews *et al.* 2012).

Further south in their range, northern mountain caribou bulls are found in alpine areas of the Sheepbed and Silverberry drainages in July and August (Winbourne 2019). South Nahanni Outfitters hunts bulls in these drainages in July and August. Figure 11 shows caribou in typical alpine habitat during summer months.

Figure 11. Caribou use high alpine areas in the summer months. This photograph was taken in mid-July at an elevation of approximately 7,000 feet (2,100m). Photo reproduced with permission from Werner Aschbacher.

Fall

Generally, northern mountain caribou stay in the mountains to avoid insect harassment until fall, then begin heading toward their rutting ranges (Winbourne 2017a; Benson 2018). One important area of fall habitat has been identified near Poacher Lake by Arctic Red River Outfitters; the area is described as high country that is a really important rutting area for the Bonnet Plume herd, where they regularly see 300 to 500 caribou rutting (Winbourne 2019). However, it was also indicated that the Redstone herd uses all of the major drainages within a high ridge of plateau coming off the mountains to the north (*Ibid*.).

A little further south in the Gana River Outfitting Area, they have noticed that in the fall the bulls start to spend more time in the trees; they can be observed in the timber and brushy draws rubbing their antlers and browsing (Winbourne 2019). The high elevation plateau in the K'á Tǝ́ area – the Mackenzie Mountains barrens – is known to be an important location for northern mountain caribou at this time of year. While they may be seen to use this area at any season of the year, they are found in especially high numbers here in late August and September, when

they seek out the willows and mushrooms the area provides (Winbourne 2017a). This area is shown in Figure 12.

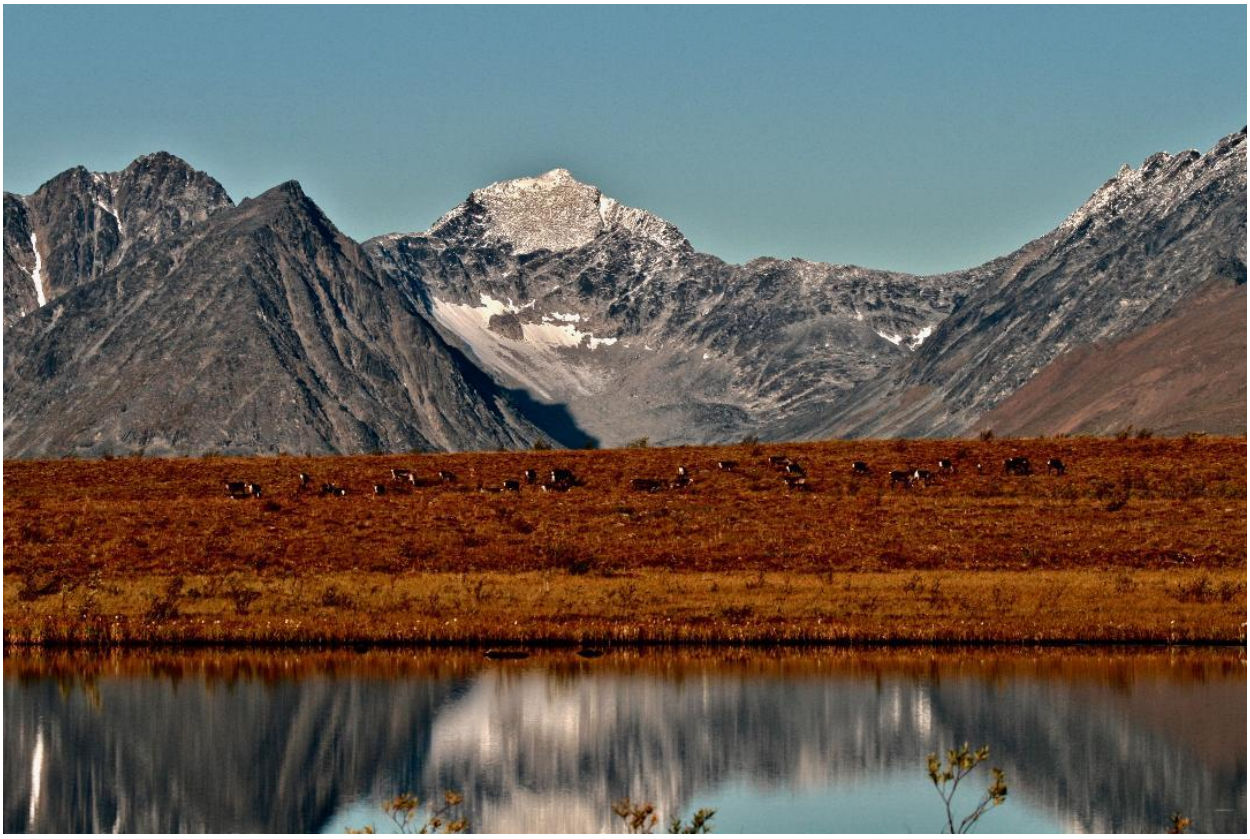

Figure 12. Northern mountain caribou seen near Dechenla grazing in their preferred fall habitat. Photo reproduced with permission from Norman Barichello.

The ʔepę́ ʔehda area (Caribou Flats) is also an important area for northern mountain caribou in the fall (Andrews *et al*. 2012).

Redstone caribou are observed to gather in large herds and stay at the headwaters of the Root River, Bell Heather Lake area (high alpine, no trees), and Wrigley Creek headwaters (north of the Prairie Creek mine area) in fall (Winbourne 2019). Figures 13 and 14 show northern mountain caribou in typical habitat once they have started to gather for the rut.

Figure 13. In early September, Redstone caribou in the Root River area are typically observed at the bottom of high alpine valleys. Photo reproduced with permission from Werner Aschbacher.

Figure 14. Caribou gathering to rut in typical habitat on a plateau at approximately 5,000 feet (1,500m). Caribou arrive mid-September and are mostly gone by October 10. Photo reproduced with permission from Werner Aschbacher.

Outfitters are able to share many observations about caribou habitat use and requirements during fall; further details are provided in the *Movements* section.

Winter Range

The Kaska Dena land use framework outlines northern mountain caribou winter ranges as distinct areas having lower snowfall than surrounding areas, with repeated use by the herd, although core use within a range can change with snow conditions, fires, overgrazing, or changes in population. Northern mountain caribou movements and winter range use are a complex relationship related to snow cover, lichen abundance, moose, wolves, direct and indirect disturbances, and forest succession (Dena Kayeh Institute 2010).

The Kaska Dena framework identifies some key winter habitats, including open canopy spruce–lichen stands, black spruce wetlands or muskegs with arboreal lichen, and lakes with mineral overflow (Finlayson herd range, central to southeastern Yukon) (Dena Kayeh Institute 2010).

An important winter range identified for northern mountain caribou by Gwich'in participants is the Arctic Red River/Ramparts River; in winter, caribou move out of the mountains along these rivers into lower elevation areas (Benson 2018). Also in the Gwich'in traditional territories, the

area around the headwaters of the Snake River is known to be 'not too cold' in February, and caribou can be found here (Benson 2018). Other northern mountain caribou in the Arctic Red River headwaters area move out from rocky mountain habitat to the lower, treed front range, where they can more easily find winter feed, and where it's easier to move around (Benson 2018).

In the Sahtú, Shúhtaot'ıne elders sometimes refer to the area encompassing Tets'exeh (Wrigley or Drum Lake) and Hayhook Lakes (not shown on maps) as 'the place of caribou'; the name refers to the winter range of northern mountain caribou (Andrews *et al.* 2012). Workshop participants from Tuĺıt'a and Norman Wells also reported that northern mountain caribou winter at Drum Lake during earlier interviews (Olsen *et al*. 2001).

There are fewer winter range observations from outfitters as they are not generally in their licensing areas during that season; however, early spring visits can indicate where the caribou have been in recent months by how the ground has been disturbed or by finding shed antlers (Winbourne 2019). Within the range of the Bonnet Plume herd, outfitters find shed antlers in high country, on exposed ridges and basins where the wind exposes the feed. Within Redstone range they see shed antlers out in the tundra and the scrub spruce – those caribou rely heavily on boreal lichens in the winter time. This winter habitat use was described as follows:

"As you get snow accumulations they eat the lichens off the trees. We've seen them do that in September, every ten years or so when we have an unusual big early dump of snow. All the caribou emptied out, they blew by the normal foothills where they rut, and went way out into the tundra, into the spruce where they were eating. They weren't cratering like they usually do at that time of year, but eating the arboreal lichens." (Tavis Molnar [Arctic Red River Outfitters Ltd.] in Winbourne 2019: 22)

It was stressed that for these caribou it's critical to have unobstructed access to that type of habitat; disturbing them while they are out there, or while moving to that habitat, could pose a serious challenge to their survival as they would struggle to contend with the deep snow. "If they got pushed back into the high country, they'd just start losing condition immediately," (Tavis Molnar [Arctic Red River Outfitters Ltd.] *in* Winbourne 2019: 23). One example of this type of critical winter habitat would be the Ramparts River headwaters – the habitat there is typically important rutting range in September, but in heavy snow years they travel down the watershed to the spruce forest (*Ibid*.).

Movements

Northern Range

Gwich'in harvesters have observed that around the headwaters of the Arctic Red River, northern mountain caribou move seasonally between the high, rocky, mountains and the lower, hilly front ranges. They travel to the mountains either before or after calving in May and stay there until fall, as it's cooler and easier to escape insects. They don't just stay in the valleys – they are known to go very high up in the mountains, to the peaks. They travel far into the mountains – for example, up around the headwaters of the Snake River, across the Yukon border. Caribou travel in such a way as to leave long-lasting trails worn into the soil, visible in the ground even from the air (Benson 2008). There are also northern mountain caribou that stay around Snake River in the winter, and another group that stay around the Shattered Range (Andre *et al.* 2006; Benson 2018).

In August or September, the caribou that overwinter in the front ranges head out of the mountains. They gather together around Naatsàk (not shown on maps) and other locations (Andre *et al.* 2006). They leave the mountains as it's not easy to get feed in the winter in the mountains, and also because getting around in the winter in the mountains is very difficult (Benson 2018). Sonny Blake ([Tsiigehtchic] *in* Andre *et al.* 2006: 30) indicated that there's "one herd that lives in the Mackenzie Mountains. I'd consider it Woodland Mountain Caribou. But during the winter, they winter in the Lichen Ridge area, from around Snake River, the Gayna River". He said they winter 20 or 30 miles from the mountains. They gather in the front range around August, and migrate towards the mountains after having their young in the front range in spring. He said that bulls will leave the mountains before the cows do, and that there are salt licks in the mountains.

Tavis Molnar also knows caribou movement patterns in this area, having spent 25 years outfitting there; he said there is seasonal variation in how they congregate in the area of the Arctic Red River Outfitting licence (Winbourne 2019). Caribou are very dispersed in their summer range, living like sheep – often higher than sheep in the basins – and they are split off into very small groups, especially the bulls – often the bulls are solitary or 2-3 are found together. Cows tend to be congregated into small groups of 5-20 animals on their summer range; they are very dispersed and can be seen almost everywhere in the mountains. Other animals are more sedentary. The bulls don't move much at that time of the year and may spend the whole summer in one area (*Ibid*.).

Around the third week of August, when bulls come out of velvet, there is a sudden change in distribution and behaviour – the bulls can become difficult to find, they move down out of their summer range and into scattered timber or valley bottoms with high willows to strip their velvet. After this they form larger groups – at this point bulls and cows are still segregated – they stage

up in certain areas as they get ready to move to their rut ranges. At that time of year, caribou are in groups of 10-30 caribou, and congregations of up to several hundred (Winbourne 2019).

As the weather changes – with hard frosts, plants freezing at high elevations, and snow on the ground – caribou all leave the summer range and large congregations start to form, including bulls and cows. At that point, bulls are sparring and herding cows. Once rutting groups establish (by the second week of September), they remain committed to that area. However, that area varies from year to year. More caribou arrive and the groups continue to increase in size through September. The groups are typically between 40-200 animals on the ridges – this is both the Bonnet Plume and Redstone herds (Winbourne 2019).

By the time Arctic Red River Outfitters leave the area (early October), it is the peak of the rut.

"They are fully engaged by the beginning of October and starting to really hurt each other. We're seeing lots of bulls getting injuries, breaking antlers. Most mature bulls have broken antlers and injuries by the beginning of October." (Tavis Molnar [Arctic Red River Outfitters Ltd.] in Winbourne 2019: 14)

Central Range

In the Keele River area, caribou herds tend to be small in summer and the majority are found in higher elevation valley bottoms with small groups of bulls in higher terrain. They are observed steadily travelling and feeding, and use the Keele, Ekwi, and Natla rivers in the area to migrate. "There are caribou throughout the whole area but they do funnel along the rivers. If you fly the Keele you see layer after layer of trails on the mountain sides" (Jim Lancaster [Nahanni Butte Outfitters Ltd. and NWT Outffitters Ltd.] *in* Winbourne 2019: 15).

By early September, these caribou start to herd up more, into clusters of 20-30 caribou, but they are still constantly moving, with different caribou passing through the area every day.

"We say they sort of move west to east a little bit, but at the same time, you could put people into any valley in our territory and they'll see caribou. They don't disappear, you see caribou everywhere as it's prime caribou area. Towards the end of season we notice more on the east side of territory – lots of them, but I'm not sure that's every year. Some years it's not like that." (Jim Lancaster [Nahanni Butte Outfitters Ltd. and NWT Outfitters Ltd.] in Winbourne 2019: 15)

For the Mountain River herd, outfitters have observed that caribou movements are largely unpredictable:

"I would caution you that after 23 years in the Mackenzie Mountains there is one thing that you can count on with caribou – they never do the same thing for very long. From my observations over the years the numbers are strong – the herds are healthy, and their travel patterns are constantly changing. They never do the same thing two years in a row; they're always doing something different. They are totally unpredictable, so it's hard to put your finger on where and

when they'll be. Their number one strategy for success is they are completely unpredictable." (Harold Grinde [Gana River Outfitters Ltd.] in Winbourne 2019: 16)

Harold referenced a story (also found in Deuling 2017) in which the caribou were observed to leave the NWT and go to the Yukon; the trend in the 1970s and 1980s was for the caribou to leave the Gana River Outfitting area by mid-August and move to the Hess River in the Yukon. This is no longer the pattern:

"I've been in the territories since '96 and in that period of time, the caribou have done exactly the opposite in the summers. They move from the Source Peaks – the highest peaks are along the border, most of the glaciers and headwaters are there – towards the north and east." (Harold Grinde [Gana River Outfitters Ltd.] in Winbourne 2019: 16)

Another change noted was that in the past caribou tended to be on glaciers along the Source Peaks as high as they could get, fighting flies in the hot weather, but in recent years there have been fewer and fewer caribou on the glaciers in the summer. When asked about it, a nearby outfitter reported that thousands of caribou were on the cliffs of the Front Range above Norman Wells – a place where they had never been reported before; he observed it was a hot, dry year, and the bugs must have been very bad (Winbourne 2019).

In another example, the same outfitter stated that normally by mid-September in the Gana River licence area there aren't a lot of caribou – they've moved northeast towards the Front Range, but one year they didn't show up on the Front Range, and were instead found on a high plateau/timber-covered pass between the Stone Knife and Ram drainages. While there was evidence of them having been there in the past (e.g., tracks and shed antlers), the animals had not been using the area during recent decades (Winbourne 2019).

"I'd guided in that valley for many years and saw caribou trails pounded into the hillsides and across the ridgelines that are a foot wide and foot deep, but not seen a sign of them for years – not a track, not a single caribou. Then that one year, there were these big herds. Every ridge, every range has trails pounded into it, and some probably haven't seen a caribou in 20 years, but in times and at places they will come through. We can't ever expect they will be there all the time." (Harold Grinde [Gana River Outfitters Ltd.] in Winbourne 2019: 17)

Currently, caribou have used the area consistently over the last few years; they are seen scattered over about five miles, travelling in bunches. It was noted that they also leave this area very quickly; within 12 hours they may be completely gone from the area (Winbourne 2019).

Shúhta Dene knowledge holders say that the Mackenzie Mountains are home to several herds of northern mountain caribou – some of which are more sedentary, travelling little from season to season, and other herds that are migratory, moving longer distances and gathering into large groups seasonally. They come from different areas, travelling to the high elevation plateau at

Dechenla for the habitat provided there, then dispersing again in different directions as winter approaches (Winbourne 2017a).

Regarding the annual caribou migrations in this area, elder Leon Andrew notes that Shúhtaot'ıne always look at the female as the leader. During spring migration, for example, the females leave for their summer grazing habitat in April, and in May when all the ice starts to melt, the males arrive. In the fall time when the snow arrives, all the females come back from different areas of the mountains to Pətłánejo (Caribou Flats), and the males arrive afterward. Snow used to regularly come around September 20-25, triggering migration and the rutting seasons; nowadays, the snow is coming at unexpected times - sometimes late, sometimes early. If the snow arrives early, the females will start to move into their wintering grounds early (Andrew pers. comm. 2019).

Norman Barichello has spent summers with his family in the Mackenzie Mountains since 1976. He has extensive knowledge of northern mountain caribou and their movements, informed by personal experience, his work with the Ross River Dena Lands Stewardship Office and Traditional Knowledge Program, as well as close relationships with knowledgeable people in Tu Łidlini (Ross River) and other Kaska Dena communities (Winbourne 2017a). His observations of fall caribou movements around Dechenla are as follows:

"We are at Mile 212 – it's ten miles from the Tischu River airstrip and as you go from the Yukon side, you climb up to that high elevation plateau. It's right there at the [top of the plateau where] the lodge sits… [The area is] really important for caribou in the fall; in August, they start moving in. There's a lot of willows up there and, as you know, the caribou are [shifting their diet] to willows and mushrooms, and so they come up in that area in big numbers in August. That's [when] we really notice them, but any time of year we used to notice them, and not so anymore. Even in the fall now, we just don't notice those numbers. Big bulls used to come late in August or early September, with the big white manes, they'd start coming up out of the Caribou Cry River. Again, we just don't see that anymore." (Norman Barichello [Dechenla Lodge] in Winbourne 2017a: 9)

During a 2014 joint mountain caribou stewardship meeting with representatives of the Tu Łidlini (Ross River) Dena and Shúhtaot'ıne from Tuĺıt'a and Norman Wells, Mr. Barichello described the movement patterns of the herds observed in the Dechenla area. His observations are included below in their entirety (*in* Winbourne 2017a: 40), but are relevant to *Population – Abundance* and *Trends and Fluctuations*, so summarized points are included there also. There are some indications that movement patterns are changing; further comments regarding trends in northern mountain caribou movements are included in *Distribution Trends*.

"When we talked to the elders, we identified four or five herds using that particular area. One of them is a herd that seems to come along the Keele River and go into the Yukon Territory [to] the flanks of the Keele Mountain, [and over to] the Twitcha and west of the Caribou Cry River – that Twitcha area in particular. Those caribou, from what I understand, seem to be doing much better.

People see them, the helicopter pilots coming back and forth, report more of them in that area. It seems to me it might be a herd or part of this complex that actually comes along the Keele [and up into the top end of the Twitya and Caribou Cry rivers].

Then there's a group that I think are probably what we've always called the Redstone that probably come across a little further south. They come up the [upper] Keele, that highland country [near] the border of the Northwest Territories and Yukon. [It's here] where they are finding all the artifacts. [It's this group of caribou that appears in decline], based mostly on what I am seeing and people who are in helicopters in the area. That group of caribou seems like it's gone or moved off or in decline.

I also noticed that it's not been a sudden change in distribution – [not] like they are there one year and not the next. My observation in that area is it's been about a six to eight years [since 2006/2008] and perhaps even a little more gradual decline. Like I said, we used to see caribou in July every day. It gets a little less every year and this year we went two and half weeks without seeing a caribou, so it seems more of a gradual change in numbers. Again, I don't know if that reflects on change in distribution or population sites.

There is also one of the herds that Robertson mentioned, the Finlayson caribou herd. We've actually observed [collared caribou] from the Finlayson herd. Robertson had some concern that they continue on and don't go back to the Finlayson area to winter. Again there has been some documentation to that kind of mixing. I don't know to what extent it might occur based on the research that was done.

Then there are caribou that the elders speak of that have a different antler morphology. The antlers are more tightly together and they come in from the Bonnetplume country. Again, this is another group that uses that area, although we've no idea to the degree to which they use it or not."

Southern Range

Further south in their range, northern mountain caribou bulls are found in alpine areas of the Sheepbed and Silverberry drainages in July and August (Winbourne 2019). Their pattern is to stay high up in the mountains all day, then come down to feed in the valley bottom at night.

"Maybe it has to do with the mosquitoes and the wind or something. You also have to consider there's a ton of grizzly bears; in a 20 minute flight you count three bears - so there's no shortage there. That might have an impact. But that's where they hang out in those areas – each creek, on the headwaters, you find the bulls. The cows are either lower or in totally different areas; they're in herds of 100 to 200 with the young bulls, but the mature bulls are somewhere else. And every year it's different – not for the bulls so much, but for the cows. One year they're in that mountain range for a month, another year it's totally deserted and they're somewhere else. Once you find them there, then they could be gone in a day. The trails are worn in – three feet [1 meter] wide and sometimes a foot deep – they'll be totally fresh and you still just can't find them. They can vanish

within a day or two. We're not talking about just one or two caribou but 100-200 caribou." (Werner Aschbacher [South Nahanni Outfitters Ltd.] in Winbourne 2019: 25)

The bulls are usually seen in groups of 5-15 animals, at times as many as 20, and they mingle – for example, if on one side of the valley there's a little group, they stand there all day and fight the flies, then in the evening they start moving and they all mix in the valley bottom, then might split into different groups the next day (*Ibid*.).

In September and October, the bulls seem to 'disappear' for a period of time in that area.

"In the last week of August all the bulls disappear from the high alpine and for 10 to 14 days you don't know where they are; they're completely gone. You don't find them travelling, in river beds, or on mountain tops. …Then they show up in river bottoms, when they start travelling south to gather [around the] headwaters of the Root River – but in between I cannot tell you where they are. That's the last eight years anyway; before that it was different – they disappeared from the mountain tops and showed up on the river bottoms, right in camp actually at that time. That was their regular pattern – they came down from the Silverberry, Thundercloud, and Sheepbed rivers and travelled down the creeks and that's where you'd find them. But it's different now." (Werner Aschbacher [South Nahanni Outfitters Ltd.] in Winbourne 2019: 18)

Werner surmises that the bulls gather in October and then move but cannot be sure of the locations. Cows have different movement patterns in the South Nahanni area; they tend to be found in bigger herds and their locations change from year to year – possibly this is a survival strategy. In September, cows join up with bulls, and mature bulls form harems with many cows and calves. They travel south past the South Nahanni Outfitter base camp then gather in bigger herds and typically spend time in the headwaters of the Root River, Bell Heather Lake area (which is high alpine, no trees), and Wrigley Creek headwaters (north of the Prairie Creek mine area). However, like further north, these areas can change from year to year (Winbourne 2019).

Also within the range of the Nahanni northern mountain caribou herds, Jim Lancaster reports that caribou tend to come out of the timber valleys and congregate on the rounded mountain tops along the Yukon border after about September 10; their numbers grow until the hunters leave the area around September 25. These are mixed herds of bulls and cows, seen in groups of 20-50 animals. Jim points out that it's later in the season when they are there, "If you flew along the Yukon border in July/August you wouldn't see many caribou at all. There's too much timber and they're not on the ridge tops. They are there all the time, they are just not congregated so you can't see them in the forest" (Jim Lancaster [Nahanni Butte Outfitters Ltd. and NWT Outfitters Ltd.] *in* Winbourne 2019: 21).

In the Caribou Mountains in southern NWT/northern Alberta (not shown on maps) where boreal woodland caribou are typically found, large groups of woodland caribou are occasionally seen. These may be northern mountain caribou (Schramm and Krogman 2001; Schramm 2002).

Life Cycle and Reproduction

The Dehcho Land Use Planning Committee (2006) identifies woodland caribou breeding season (both boreal and northern mountain ecotypes) as early October to early November, and calving season as mid-May to mid-June. Gwichya Gwich'in elders also agreed that the caribou calve in May or perhaps June, although indicated they are not usually in the mountains during those times to witness it. One harvester said they calve in the mountains where it's very high up (Benson 2018).

The composition of caribou groups changes seasonally (Benson 2018; Winbourne 2019). Most harvesters and hunters indicate that summer groups are usually made up of cows and calves, and small groups of bulls spend the summer together. Cows, calves, and immature and mature bulls all start to come together in September for the rut (*Ibid*.).

Observations of both the Bonnet Plume and Redstone herds in the Arctic Red River Outfitting area note that body sizes and age classes appear to be stable and there are just as many mature bulls as in the past; the proportion of mature bulls (i.e., 5-14 years old) has been stable over the last 25 years. There may be small fluctuations from year to year, as different age classes move through the herd – for example, if there was poor calf survivorship eight years ago, then there will be fewer bulls that age another year (Winbourne 2019).

Physiology and Adaptability

Northern mountain caribou are agile and can easily climb high onto the mountainous peaks of their range. They also move very quickly, like all caribou. Increases in hunting pressure will make northern mountain caribou more 'wild' and less approachable. If caribou cows see anything unfamiliar, they will spook and flee, taking their calves with them (Benson 2018).

Northern mountain caribou can easily move through any type of terrain in their range, such as treed areas, open areas, and so on (Benson 2018). Northern mountain caribou shed their hair coat in the spring (*Ibid*.).

In the headwaters of the Arctic Red River (Bonnet Plume or Redstone herds), Gwich'in harvesters see northern mountain caribou in groups of 20 or 30, or even up to 100 or more. Also, the size of groups is seasonal in this area. In the summers in the mountains, they stay in smaller groups. They tend to come together into bigger groups when they move to their winter habitat in the front ranges (Benson 2008, 2018).

An outfitter in the Arctic Red River area described the health of Bonnet Plume or Redstone caribou as follows:

"Their general health appears to be very good; I have no concerns about that. This year in particular we were all commenting that we saw groups of cows and calves early September and not only good numbers of calves, but really fat calves. It was the same with bulls this year – they

are really fat. I have no concerns about nutrition and how they're able to use their habitat. I don't see significant signs of disease – just the normal parasites, warbles, etc. – in either of the subpopulations. There's nothing we've seen to be concerned about at all." (Tavis Molnar [Arctic Red River Outfitters Ltd.] in Winbourne 2019: 29)

This theme was echoed in the south Nahanni area, where the caribou are also said to look healthy. In the rut the bulls don't tend to have as much fat on them, but in August "they're nice and fat and their coats are shiny" (Werner Aschbacher [South Nahanni Outfitters Ltd.] *in* Winbourne 2019: 31).

Gwichya Gwich'in harvesters felt that northern mountain caribou at the headwaters of the Arctic Red River were in good shape (i.e., they had a lot of fat), but this can vary throughout the seasons. One harvester, Frederick Blake Jr., worked with an outfitter in the area and indicated that in the spring, caribou were thin and didn't have much fat. However, come fall time they would have a lot of fat stores for heading into the winter (Benson 2018).

It was also pointed out that antler size isn't a good indicator of health or other trends, as it can vary from year to year depending on feed quality and conditions (Winbourne 2019).

"They put antler mass on in June. You see the best expression of antler growth in years with a later spring; it has to do with the timing of green up. Feed quality is highest when they're putting on the most antler mass. In early springs feed is already senescent by the time they're putting on antler mass and bugs are a factor. So, bugs might already be a problem, and if they're spending so much time trying to avoid insects, they're putting less energy into antler growth. So, we can see a bull with 30% less antler mass one year, depending on spring conditions, and the next year, he's back to normal." (Tavis Molnar [Arctic Red River Outfitters Ltd.] in Winbourne 2019: 30)

For the Mountain River herd, calf numbers are observed to vary from year to year. Generally, when caribou cows are in singles or pairs they don't have a calf with them; larger groups usually have good numbers of calves with them (Winbourne 2019).

One outfitter stressed that "nothing rules a caribou's life as much as warble fly" (Harold Grinde [Gana River Outfitters Ltd.] *in* Winbourne 2019: 30). Warble flies can cause a caribou to abandon feeding, run for miles, and lose weight. In warm years, where there are more hours of active fly time, it can have a negative effect on caribou condition. As a result, caribou are seen to seek out windy or cooler places when flies are active (*Ibid*.).

Harold summarized that because success in reproduction has to do with body condition and various stressors, he considers fly harassment to be the biggest stressor on whether animals have the fat reserves and milk they need to reproduce. Nonetheless, outfitters in the Gana River hunting territory do not tend to see skinny caribou or animals in poor body condition; instead, they usually look fat and healthy (Winbourne 2019).

Caribou have a unique ability to convert lichens to energy, but they don't build fat reserves like moose do (possibly because of their nomadic lifestyle) (Barichello pers. comm. 2019). Access to lichens, particularly in the winter, is essential to caribou. Also, lichens grow very slowly and so damage to lichen pastures can take many decades to recover. These physiological constraints underline the significance of habitat stability and snow conditions (to maintain access to lichens) to caribou. Furthermore, caribou have relatively low reproductive capability – they rarely produce twins, and they typically begin breeding in their third year. Population recovery, then, is slow (*Ibid*.).

Diet and Feeding Behaviour

Generally, caribou eat white 'caribou moss', caribou lichen, and grasses. They are seen foraging in shrubby mountain birch, willows, grass, and lichen-covered habitat (Benson 2018; Winbourne 2019). In the winter, they can feel and smell the moss under the snow, as it has a certain elasticity. They dig out 'big bunches' of the moss from the snow to eat (Katz 2010; Benson 2018).

Bonnet Plume and Redstone caribou in the Arctic Red River area are seen to have a diverse diet in summer, when they are eating lichen, sedges, and grasses. It was noted that they don't eat as much lichen in hot, dry weather:

"If we're having a wet summer and the bugs aren't bad, they come down – they'll do this very quickly – if it's hot and dry they are up high escaping bugs and eating sedges. With cold wet weather, they will drop 3,000 to 4,000 feet [900-1,200m) in elevation suddenly and come down to eat the lichen. But they rely heavily on alpine vegetation in the summer – it provides good nutrition and allows them to escape the bugs." (Tavis Molnar [Arctic Red River Outfitters Ltd.] in Winbourne 2019: 21)

With the coming of September, as the caribou need to be in certain areas for the rut, their food becomes less diverse as they are almost exclusively eating lichens that are available on ridges. In Bonnet Plume range, they spend some time on exposed ridges and basins where the wind exposes the feed; in Redstone range they are out in the tundra and the scrub spruce, feeding on arboreal lichens in the winter time (*Ibid*.).

Redstone caribou in the Keele River area are most often seen feeding on lichen and different types of brush; the habitat there is shrubby vegetation and not much forest (Winbourne 2019).

Some of the unpredictability of northern mountain caribou movements might be in part a strategy to not over-graze the habitat on which they rely. Harold Grinde [Gana River Outfitters Ltd.] explained that because they feed a lot on lichen, which is quite a delicate food source, they tend to do things differently from year to year, in order to not deteriorate their food source. They do rely on lichen a lot but are not totally dependent on it; he sees them eating other vegetation such as willows and sedges, and has seen some years where caribou have pawed up a fescue/grass airstrip trying to eat the forage there (Winbourne 2019).

Norman Barichello [Dechenla Lodge] has observed that caribou in the K'á Tǝ́ area appear to be eating mostly sedges, grasses, and forbs in the spring and early summer, then shift their diet to willow shoots and mushrooms in late-August and early September, typically in areas of wet tundra; they then return to a diet of mostly lichens and perhaps some evergreen prostrate shrubs. Mr. Barichello noted these observations are not substantiated with a rigorous study of caribou feeding habits in the area (Barichello pers. comm. 2019).

There are also occasions where caribou have eaten all the sedges or the muskrat push-ups around the edges of sloughs and lakes in April. They seem to congregate in areas like that – possibly sourcing a mineral in the dirt or something else of nutritional value in the push-up at that time of year (Winbourne 2019).

Years with less snow in the winters are easier on caribou for getting enough to eat, and it is harder to escape predation with heavy snow cover, as noted under *Interactions*. Northern mountain caribou taste different than other caribou due to their diet (Benson 2018).

Interactions

Caribou relationships with both wolves and moose are not well documented (Dena Kayeh Institute 2010). It is thought that wolves focused on moose will prey on caribou opportunistically; it is also thought that caribou will use large patches of forest in the winter that provide sufficient lichen abundance for food, but that they are spatially separated from moose winter habitat. This approach, along with staying in small groups, could reduce predation (*Ibid*.).

Another factor in this relationship is the impact of deep snowfall years. It is believed that wolf predation is higher on moose and caribou in those years. However, it could also have a beneficial effect to caribou by reducing wolf numbers if the moose population crashes, meaning there might then be fewer wolves around hunting caribou (Dena Kayeh Institute 2010).

In the mountains at the headwaters of the Arctic Red River, there appear to be many wolves. Wolf packs tend to have 4-6 members, and the wolves themselves are very large. They will hunt calves and even adult northern mountain caribou. Wolves are more successful predating northern mountain caribou during winters with more snow, as the wolves can chase and tire out the caribou more easily. The wolves themselves save energy by using caribou trails. Wolves appear to prefer caribou over sheep as prey. During years with little or no snow, it's hard on wolves, because they can't hunt any of their preferred prey as easily (Benson 2008, 2018).

Outfitters shared many observations and opinions regarding how northern mountain caribou avoid predators such as wolves (Winbourne 2019). They point out that weather changes and predator pressure will cause caribou to move very quickly and for very long distances; this is because when the caribou congregate, so do the wolves, and once they start pressuring them, the caribou will move. Tavis Molnar [Arctic Red River Outfitters Ltd.] has seen 100 caribou make

a 300-mile loop to 'shake off' the wolves. He says they can travel far and fast, and go through the high country when they do this; it's possible the wolves get distracted by other prey they encounter – that is not clear, but whatever happens, Tavis states that the behaviour must be of enough value to justify the energy expenditure.

Being more dispersed and at higher elevations is a way for caribou to experience less wolf predation. However, there may be a gradual shift in the way caribou are behaving in the fall in the Arctic Red River area as the moose population has been increasing.

"The moose population has been steadily increasing since the late 1990s – the reason is likely changing weather patterns, from what I've seen. Grizzly bears used to be the most significant predator of moose in that country – there are a LOT of grizzly bears. We were seeing very low calf survival – by summer we see very few moose cows with calves that survived. When moose are congregated in spring calving, it's easy for the boars [male grizzly bears] to go cow to cow and eat the calves. Changing spring conditions have likely allowed cows to be more dispersed when they drop their calves and that's increased their survivorship over the last 20 to 25 years." (Tavis Molnar [Arctic Red River Outfitters Ltd.] in Winbourne 2019: 26)

Tavis hypothesized that the increase in moose is likely due to changes in feed quality, timing of spring, and how the land is thawing. He has observed that wolf densities have increased at the same time as moose densities in that area, and that pack sizes have also increased. Generally, wolves reliant on moose have larger pack sizes than those that rely on caribou or sheep. In the north Mackenzie Mountains, there are now more large moose-hunting wolf packs than previously (Winbourne 2019).

One Kaska elder described the interactions between moose, caribou, wolves, and snow. He said that wolves typically depend on moose, and deep snow favours wolves. In deep snow years, the predation rate on moose increases. This often results in a significant decline in moose numbers and a temporary increase in wolves (Barichello pers. comm. 2019). At a point when moose become harder to find, wolves shift their attention to caribou, and this can result in the decline of the caribou population. As ungulates decline, wolves decline. Tu Łidlini elders also had more concern about the effects of wolf predation on caribou, in areas where caribou and moose were both common (*Ibid*.).

In regards to grizzly predation, grizzlies are seen to kill a significant number of caribou in the summer and fall, when they kill mature animals as well as calves, but they are likely not as significant a predator in the spring. Spring comes quite late in the Arctic Red River area, so bears are concentrated at lower elevations. Caribou are thought to calve at higher elevations in this country. Nonetheless, some grizzlies likely take a higher toll on calves than others, "Some boars [male grizzly bears] just get really good at eating calves, and exist almost exclusively off of that protein source in the spring" (Tavis Molnar [Arctic Red River Outfitters Ltd.] *in* Winbourne 2019: 27).

Grizzly bear abundance has always been high in this area, but the current densities are the highest some outfitters have ever seen and may be changing caribou distribution patterns.

"In the upper Cranswick in the early 1990s there used to be quite a few moose, caribou, and sheep. Caribou would come out on the Cranswick River to the foothills and rut there. There's such a density of grizzlies in the upper Cranswick – we've observed them many, many times chasing and harassing caribou – I think [the caribou] just moved out. We still see [caribou] up high in the Cranswick in their summer range – they use that high country then come out further southeast – likely to avoid grizzlies in the lower Cranswick. That is, rather than migrating down in elevation, down the Cranswick River in the fall – they used to do that to move into the lower country – now they'll still be on summer range in the headwaters, but go south and east through high country, and then go north in the smaller drainages. They are establishing rutting groups at higher elevations and more dispersed than they used to be. I think this is likely due to grizzly bear density on the lower Cranswick. There are wolves as well. That's the only area we've seen a decline in moose numbers and I think it's due to the predator densities there." (Tavis Molnar [Arctic Red River Outfitters Ltd.] in Winbourne 2019: 27)

It is important to stress that while predation is a limiting factor, it is not considered a threat as long as things are in balance; it can become an issue when the ecosystem has been disturbed in some other way, like other stressors added so that caribou can no longer handle the predation.

"It's only a threat in combination with human disturbance. Anything that inhibits their ability to be mobile or avoid predation will be critical. You see that in the Yukon with mining activities, or overhunting." (Tavis Molnar [Arctic Red River Outfitters Ltd.] in Winbourne 2019: 28)

Outfitters also see a lot of predation in the Keele River area and consider it fairly normal.

"I don't see anything different. There have always been predators. I don't know if there are more grizzlies in the mountains or not… I think it's the same. You see a lot of grizzlies – on a flight you often see ten or more grizzlies but I think it's always been like that. I don't think anything's changed." (Jim Lancaster [Nahanni Butte Outfitters Ltd. and NWT Outfitters Ltd.] in Winbourne 2019: 28)

Wolves often seem to use big rivers to hunt, pushing caribou down into the water then waiting. In the Nahanni Butte Outfitting area, Jim Lancaster points out that they tend not to have the same valleys with the big rivers like they do in the Keele River area, so caribou movement patterns and predation are different. While there are a lot of wolves, predation is different because there aren't the river bottoms. Golden eagles have also been observed killing mature caribou (Winbourne 2019).

Gwich'in harvesters feel that caribou and moose don't 'mix up' or spend time together as the caribou are too noisy for the moose (Benson 2018). Northern mountain caribou share their habitat with many animals with cultural importance, including porcupine, sheep, and moose,

and smaller animals and fur bearers, such as groundhogs, foxes, mink, wolves, marten, ptarmigan, and others (Andre *et al*. 2006).

Northern mountain caribou and moose are considered important carrion species for wolverines. Wolverines will scavenge wolf-killed carcasses (Cardinal 2004). At least one Gwich'in elder indicated that lynx could kill caribou by stalking or hiding in the brush and pouncing on their backs and then biting at their necks (Benson 2018). Grizzly bears will also hunt northern mountain caribou, and will follow them on their seasonal migration from the mountains to the front ranges, where the cooler weather brings the grizzlies into the valleys (Andre *et al.* 2006; Benson 2018). It should be noted that the gut-piles and abandoned meat from hunter-killed caribou and moose is a strong attractant to grizzly bears – some refer to gun shots as a dinner gong for grizzly bears. This being the case, the problem of excessive hunting pressure could be aggravated by greater numbers of grizzly bears (Barichello pers. comm. 2019).

Some elders have commented on the interaction of northern mountain caribou with boreal caribou. Gwich'in elders indicated that northern mountain caribou and boreal woodland caribou do not like to 'share' territory, and the presence of boreal caribou can keep northern mountain caribou from migrating into an area seasonally (Benson 2018). However, boreal caribou can interact with northern mountain caribou in the Mackenzie Mountains in Dehcho lands. Dehcho traditional knowledge indicates they interact in the mountains, especially in the river valleys and foothills along the eastern edges of the mountain range. In addition, northern mountain caribou living in the Nahanni National Park Reserve may interact with boreal caribou west of the Liard River (DFN 2011).

Direct human effects on caribou occur through hunting and other human activities that may disturb caribou, such as associated snowmobile/ATV use (Dena Kayeh Institute 2010). K'ashógot'ıne interviewees from Fort Good Hope who had access to sheep, moose, and caribou preferentially hunted caribou (Andre *et al.* 2006).

The caribou around Snake River are healthy in part because they are not regularly harvested, so they are not 'bothered' (Benson 2018). The caribou at the headwaters of the Arctic Red River are also healthy, possibly in part due to the protection offered by how inaccessible they are (Benson 2008).

As noted in *Spiritual/Cultural Importance* and *Threats and Limiting Factors*, Indigenous communities and caribou share a sacred relationship that entails a responsibility to act as stewards on the part of the many Indigenous communities.

State and Trends

Population

Abundance

The COSEWIC assessment report (2014) summarizes that across northern, central, and southern mountain caribou populations alike, most Indigenous traditional knowledge is in agreement that mountain caribou herds have seen a steady decrease since the early 1900s, first with the arrival of moose and increase of wolves in the 1930s, and then associated with habitat loss and increases in predation in the 1940s. The population decline may have represented a true decline or may have been indicative of migration northwards. Prior to the 1900s, caribou were described as blackening a mountainside (*Ibid*.).

No further information on overall northern mountain caribou population abundance was found in the sources reviewed for this report, but comments on relative abundance or trends in specific areas or herds are included below, in *Trends and Fluctuations*.

Trends and Fluctuations

Northern Range

Teetł'it Gwich'in elder Robert Alexie Sr. indicated that in the past, there were many more northern mountain caribou than in recent times. The Hart River herd was populous and extensive. The current herd is a remnant (Benson 2018).

Gwichya Gwich'in elder Annie Norbert indicated that in previous generations and up to her times, travelling through the area as a young person, the northern mountain caribou at the headwaters of the Arctic Red River were always abundant, and 'never scarce' or absent. Hunting pressure may have reduced the number of caribou in this area in the early part of the 1900s, and once the hunting pressure reduced after about 1960, the caribou numbers started to climb, and became more abundant over the decades (Benson 2018).

Over his 25 years of observations and experiences in the Source Peaks area, Tavis Molnar's impression is that northern mountain caribou in the NWT constitute an extremely stable population.

"I haven't seen giant fluctuations in overall population density. Even the bull to cow ratios – you see short term fluctuations in calf survival and recruitment, but it doesn't seem to last for multiple years in a row so doesn't seem to affect the population density at all in the long term. If anything, we'd consider the population to be currently increasing based on the calf survival that we're seeing right now – we have seen really good calf numbers in the last couple of years." (Tavis Molnar [Arctic Red River Outfitters Ltd.] in Winbourne 2019: 11)

Central Range

Elder Leon Andrew [Norman Wells] has observed some changes in abundance in the Carcajou herd in the mountains across from Norman Wells, around Canol Lake.

"In the mid-1970s I saw a bunch there of about 14-20 mountain caribou. Nobody bothers with that group, and it seems that the population has been expanding since about 2000: they number about 100-150 animals today. Nowadays people are starting to harvest them, and I'm concerned there will be an impact." (Andrew pers. comm. 2019)

In the Keele River area, there is no evidence of a change in abundance over the last five years and the population is described as very stable. The Mountain River herd also appears to have been stable over the last 20 years; while the caribou may move to a different area at times, their abundance does not seem to have changed (Winbourne 2019).

In contrast, many Shúhta Dene state that the land and the caribou have changed in a way that is worrisome in recent years. While oral histories, place names, and archaeological evidence indicate a level of predictability in the past, now there is uncertainty about what the caribou are doing and where they may be going. Overall, people say they are seeing fewer caribou and/or witnessing them moving away from their usual areas (Winbourne 2017a). Dorothy Dick described the experience of her family around Dechenla as follows:

"For a number of years, I have been going up there and doing a lot of hunting – me and my family, my sisters, my brothers, my parents, my grandmother, my great-grandmother, Grandpa Mac… My mother went up there in 1944 or something like that. She said that in front of the lodge it was just black with caribou and moose – back then there was a lot. Then she went up there, it must be about five years ago, and they didn't see anything. She said it's really bad because there's no animals around and people have to go a long way to get their caribou. Myself and my sisters, my daughters, we all have concerns about the caribou herds. We rely on the caribou up there.

The first year I went up there in 1975, where the lodge is situated now, we used to see hundreds of caribou, right from the border on to Caribou Pass – lots of caribou and moose. I usually go up there every year and get my caribou. We always see caribou every time we go up there, but in the last maybe five years, we haven't seen anything. For the last five years I have to travel away from the road. I have to walk into the mountains and get caribou. I know that the caribou really is depleting, and it's depleting rapidly. That's from talking to people from Ross River and Watson Lake and the Northwest Territories.

I've been involved with caribou since 1994. I've done caribou surveys, moose surveys, sheep surveys, goat surveys, but the caribou herd in the Northwest Territories is going down every year and it's getting worse and worse." (Dorothy Dick [Ross River] in Winbourne 2017a: 12)

Biologist and lodge owner Norman Barichello has counted the number of caribou that they can see from Dechenla Lodge for decades. He shared these observations in 2014:

"I first came to the Mackenzie Mountains close to the border in 1976 and [since 1990 I've been there] every summer. I've observed some great big changes up there. When I was there in '76, you could go into some of these high elevation cirques up around Caribou Pass and see 40 big bulls in one group. We would see caribou every day in July, and in August you can see them on the hour. For contrast, we were just up there for two and a half weeks and we saw one caribou on the drive out. There has been a steady decline in the number of caribou we're seeing. Probably six to eight years ago, the caribou have just been gradually disappearing. We've noticed that the calf:cow ratios vary from year to year but it seems reasonable: there's no reason to fear the cows aren't having calves. In any case, there is a big change in caribou." (Norman Barichello [Dechenla Lodge] in Winbourne 2017a: 13)

Mr. Barichello emphasizes that he does not know if the decline in observations represents a change in distribution or population size (Winbourne 2017a).

In 2018, Norman Barichello spent the period from late June to mid-September at Dechenla and saw less than 30 caribou all summer; he remarked that they were possibly the same ones seen repeatedly (Barichello pers. comm. 2018). Based on herd-specific observations provided by Mr. Barichello in *Movements*, information on population trends seen at Dechenla may be summarized as follows:

1. Keele/Twitya/Caribou Cry River area – seem to be doing much better than others
2. Redstone – have moved away or decline, especially since 2006/2008
3. Finlayson – no comment on abundance
4. Bonnet Plume – no comment on abundance
5. Tay – no comment on abundance

Southern Range

Overall, South Nahanni Outfitters report that they used to see a lot more caribou in their area eight to ten years ago. Werner Aschbacher described occasions when caribou would gather in late September/early October, with an estimated 500-700 caribou on the Root River headwaters. In 2018, Werner saw about 250 animals in that area, yet points out it is possible that the caribou have moved elsewhere (Winbourne 2019).

South Nahanni Outfitters describe changes in Redstone herd migration patterns, saying the caribou are using different valleys and rivers now than they did 15 years ago. Because of these shifts in movement patterns, it's difficult to know what is happening with overall numbers of caribou.

"I'd say there's less caribou now, but I'd be careful with that because in our case we're looking for mature bulls, and we don't have the herd sizes we had four to six years ago. But when I talk to [a neighbouring outfitter] he says he's never seen as many caribou in his life – it's only his third year

there, but he said they're everywhere, just mingling around. So maybe they don't come down to us like they used to. Maybe if the fall is warmer or something, it makes them more stationary or something? I don't know. He says he has no shortage and finds the mature bulls very easily. In our case we used to do way better. But I'm leery to say that because it could be three to four years when they aren't coming to us, but then they'll come again. So it's hard to tell if the numbers are up or down, but in our case it's for sure lower than it used to be." (Werner Aschbacher [South Nahanni Outfitters Ltd.] in Winbourne 2019: 13)

Jim Lancaster has spent 23 years operating Nahanni Butte Outfitters and says he has seen the caribou population in that area go up and down significantly over that period of time. The population had formerly been high, then it went down about five years ago, and is now returning to former levels of abundance. He also pointed out that it could be that the animals moved elsewhere and did not actually decline (Winbourne 2019).

Population Dynamics

No information on northern mountain caribou population dynamics was found in the sources reviewed for this report, other than observations of variable year-to-year calf:cow ratios, and the disappearance of big bulls in the K'á Tǝ́ area (see next section).

Other

Shúhta Dene worry not just about the declines in northern mountain caribou abundance that they are witnessing, but also that they are seeing fewer big bulls and animals with large antlers. As noted in *Movements*, large bulls used to arrive in August or early September. This is no longer seen (Winbourne 2017a). Parks Canada research (2017) documented observations of decreases in antler size from harvesters in Tu Łidlini (Ross River, Yukon) and Norman Wells, NWT, alike.

"I have been up there since the late '70s. I was a very young man back then, but I have seen animals all over. I have seen moose in almost every little pasture and I've seen caribou all over the place. We have seen caribou by the hundreds just passing through. Right now, we see caribou but not very much. Maybe we seen one bull caribou and maybe 30 or 40 caribou and only one little bull caribou. You don't hardly see any more big caribou." (Gordon Peter [Ross River] in Winbourne 2017a: 16)

Norman Barichello has also observed that the big bulls that used to come to Dechenla from the Caribou Cry River in late August or early September are not seen anymore (Winbourne 2017a).

Habitat

Habitat Availability

As described in *Habitat Requirements*, northern mountain caribou move through several different types of seasonal ranges based on the specific conditions each provides throughout

the year. They also require isolated features within their range, such as mineral licks, ice patches, calving grounds, and safe movement and migration corridors.

In the Gwich'in Settlement Area, summer grazing areas where the Arctic Red and Cranswick rivers flow out of the mountains are considered key habitat for caribou that must be protected, as well as the headwaters of the Gayna River (Andre *et al*. 2006; Winbourne 2019). Tabasco Lake was also noted as being good for caribou harvesting, as well as for many other animals, including sheep and moose (Andre *et al.* 2006). In fall, there are important areas near Poacher Lake (not shown on maps), described as high country that includes important rutting areas for the Bonnet Plume herd, where 300-500 caribou regularly rut (Winbourne 2019). Critical fall/winter habitat includes the Ramparts River – where the headwaters are typically important rutting range in September, but in heavy snow years caribou travel down the watershed to the spruce forest (Winbourne 2019).

In the Sahtú Settlement Area, suitable northern mountain caribou habitat is found throughout the Mackenzie Mountains and Shúhtagot'ıne Néné[11] (Mountain Dene Land) (SLUPB 2013). This includes migration routes, calving grounds, and rutting/wintering grounds for the Redstone herd, and Bonnet Plume general range, as well as mineral licks. The Keele River also provides important northern mountain caribou wintering grounds (*Ibid*.).

Wilson and Haas (2012) defined and mapped important wildlife areas for several species in the NWT, including northern mountain caribou. The information is based on local observations, TK/CK, and scientific information[12]. The following seven areas may be considered important for northern mountain caribou:

- Headwaters of Arctic Red River and Ramparts River
- South Nahanni summer and rut range
- South Nahanni winter range
- Coal River – LaBiche winter range
- Caribou Pass
- Drum Lake (Wrigley Lake)

[11] Shúhtagot'ıne Néné is identified as Conservation Zone #40 in the Sahtú Land Use Plan (SLUPB 2013). It lies within the Mackenzie Mountains and includes two sections: the northern portion of the Canol Trail and Dodo Canyon, and parts of the Keele River (Begáádeé), Redstone and Ravens Throat rivers (Tátsók'áádeé), Drum Lake, June Lake, and Caribou Flats.

[12] Information in Wilson and Haas (2012) is based on discussions between 2006 and 2009 with communities, co-management boards, departmental staff, and others, as well as review of available reports. Note: some unique areas considered to be important for multiple wildlife species were also mapped, including warm and hot springs and mineral licks – these areas are considered sensitive and were not included here. All information provided by Wilson and Haas (2012) has been summarized in Table 1, including scientific knowledge; explanations for boundary delineations given in Wilson and Haas (2012) have not been included in this table.

- Redstone calving and early-midsummer range

These areas are shown in Figure 15 and described in Table 2.

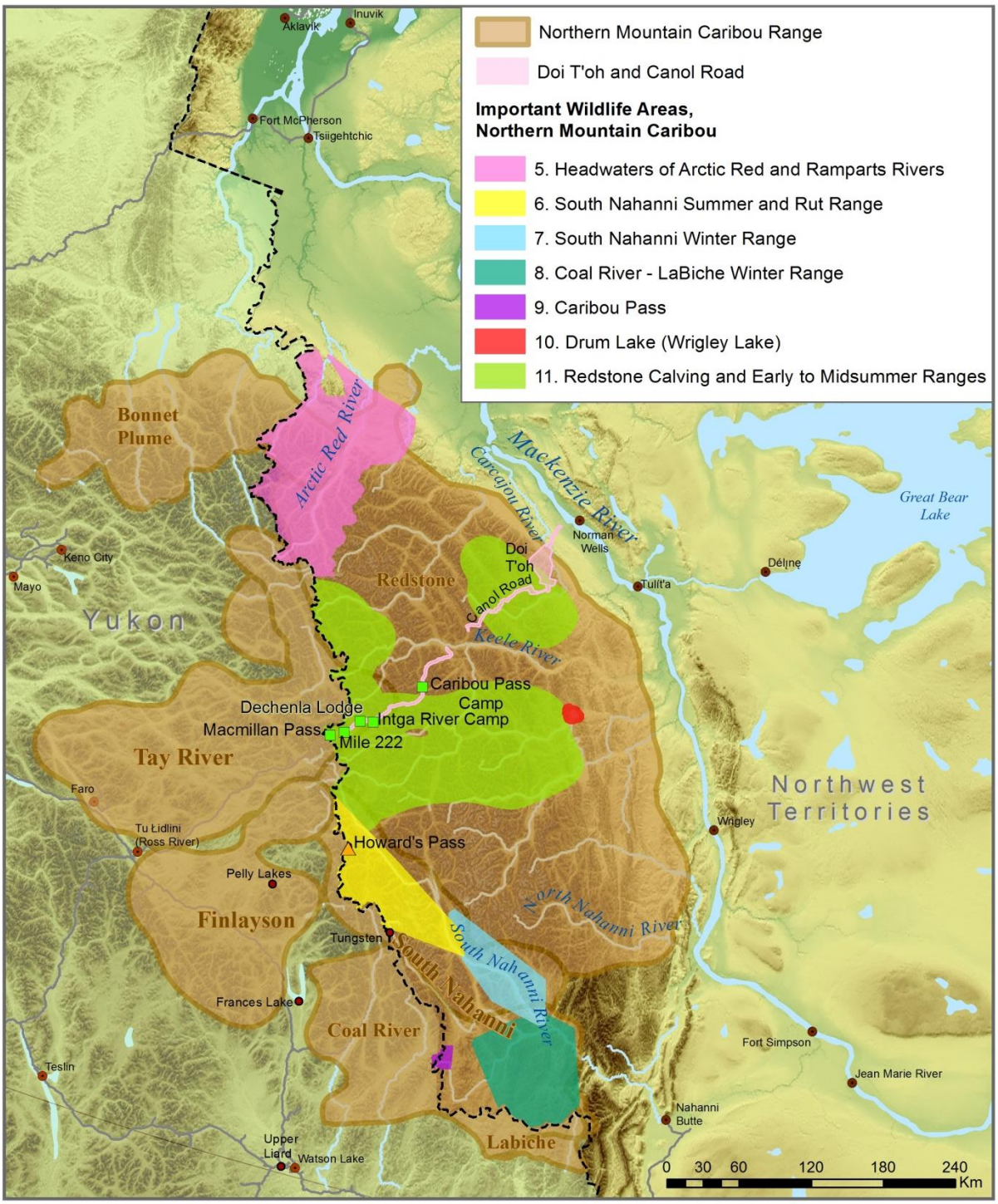

Figure 15. Important wildlife areas identified for northern mountain caribou in the NWT shown in relation to known scientific ranges. Reproduced with permission from Wilson and Haas (2012).

Table 2. Wilson and Haas (2012) results for important wildlife areas for northern mountain caribou.

ID#	Criterion Satisfied	Size	Substantiation
5	Headwaters of Arctic Red and Ramparts rivers[13]		
	#2 (place where animals consistently occur in relatively large numbers)	13,010 km²	• This area is known as a concentration area for northern mountain caribou. • The caribou in this area belong to the Bonnet Plume herd, which is shared with the Yukon Territory. In the winter, the caribou are found in the eastern foothills where the Arctic Red and Ramparts rivers flow out of the Mackenzie Mountains. • Gwich'in Settlement Area portion: ○ In the Gwich'in Settlement Area, the greatest densities of northern mountain caribou occur along the front ranges of the Mackenzie Mountains in the winter and the headwater areas of the Arctic Red River in the summer. ○ Surveys in 1980-1982 identified the upper Arctic Red River as a traditional core wintering area with a consistently high concentration of caribou. In one winter with deep snow, large numbers of caribou wintered in the foothills region of the Arctic Red River where there was relatively low snow accumulation. ○ In 2006, a late winter survey found a concentration of 1,000 northern mountain caribou in groups of 5 – 200 individuals along the Arctic Red River inside the Gwich'in Settlement Area. ○ One harvester noted that there are abundant northern mountain caribou trails at Tabasco Lake. • Sahtú Settlement Area portion: ○ A late winter survey in 2006 found extensive caribou cratering in the foothills around the headwaters of the Ramparts River, indicating long-term winter occupation by northern mountain caribou. ○ The headwaters of the Ramparts River has been mapped as important wintering habitat for northern mountain caribou and as a caribou hunting area.
6	South Nahanni summer and rut range[14]		
	#1 (area that many animals use traditionally, around the same time each year)	5,319 km²	• Northern mountain caribou of the South Nahanni herd (also known as the Upper Nahanni herd) return to calving, post-calving, and rutting sites within this area year after year. • An analysis of locations from 45 collared adult female caribou of the South Nahanni herd from 1995-2001 showed that most animals moved into the upper part of the South Nahanni River watershed during the calving period and remained in this same

[13] Expert(s) originally recommending inclusion: Gwich'in Renewable Resource Council members.
[14] Expert(s) originally recommending inclusion: Wildlife Conservation Society researcher.

			area during the summer and the fall rut. They seemed to show a high degree of fidelity for these areas.
7	South Nahanni winter range[15]		
	#2 (place where animals consistently occur in relatively large numbers)	3,551 km²	• Northern mountain caribou of the South Nahanni herd (also known as the Upper Nahanni herd) are relatively concentrated within this area in winter. • In the Mackenzie Mountains, caribou forage primarily on terrestrial lichens, either on windblown alpine sites or in mature conifer forests at lower elevations where the snow is shallow. When snow is deep caribou are forced down out of the mountains into smaller core areas with less snow. Therefore, northern mountain caribou tend to clump together in late winter and many herds are the most spatially concentrated at that time. • An analysis of locations from 45 collared adult female caribou of the South Nahanni herd from 1995-2001 showed that, in most years, the herd wintered in the montane spruce-lichen woodlands along the South Nahanni River valley above Virginia Falls and the lower reaches of the adjacent Clearwater-Cathedral Creek basin. The herd appeared to show strong fidelity to this winter range between years. • This area is in a snow shadow, meaning that snowfall is relatively light, and has abundant lichens. This unique combination of conditions makes it good winter habitat for northern mountain caribou.
8	Coal River - LaBiche winter range[16]		
	#2 (place where animals consistently occur in relatively large numbers)	6,289 km²	• Northern mountain caribou of the Coal River and LaBiche groups (collectively known as the Lower Nahanni herd) are relatively concentrated within this area in winter. • In the Mackenzie Mountains, caribou forage primarily on terrestrial lichens, either on windblown alpine sites or in mature conifer forests at lower elevations where the snow is shallow. When snow is deep caribou are forced down out of the mountains into smaller core areas with less snow. Therefore, northern mountain caribou tend to clump together in late winter and many herds are most spatially concentrated at that time. • A study of satellite-collared adult female caribou of the Coal River and LaBiche groups from 2000 to 2007 showed that they spent the winter (December 1 – April 15) in this area, which is located in a 'snow shadow' in the lee of prevailing winter storms. Caribou distribution in winter was influenced by snow depth. In early winter, Coal River caribou coalesced into a tighter distribution south of and inside Nahanni National Park

[15] Expert(s) originally recommending inclusion: ENR staff and Wildlife Conservation Society researcher.
[16] Expert(s) originally recommending inclusion: Wildlife Conservation Society researcher.

			Reserve. LaBiche caribou stayed around the territorial border when snowfall was relatively light, but moved toward and into the park in years with heavier snowfall. By late winter, both groups were usually restricted to low-elevation spruce forests with shallower snow depth inside or adjacent to the park. The distributions of both groups overlapped during this period.
9	Caribou Pass[17]		
	#2 (place where animals consistently occur in relatively large numbers)	278 km²	• Northern mountain caribou are concentrated in this area when they migrate across the Yukon-NWT border in spring and fall. • A study of satellite-collared adult female caribou of the Coal River group (part of the Lower Nahanni herd) from 2000 to 2007 showed that, when they migrated westward in spring, they used a variety of routes. However, nearly all of these routes converged at the continental divide in the vicinity of Caribou Pass. When they migrated back into the NWT in the fall, they used different pathways, but these routes again converged in the vicinity of Caribou Pass. • High numbers of caribou have been noted by a trapper who uses the area.
10	Drum Lake (Wrigley Lake)[18]		
	#2 (place where animals consistently occur in relatively large numbers)	248 km²	• The area around Drum Lake, also known as Wrigley Lake, is known as an important winter concentration area for northern mountain caribou of the Redstone herd. • According to traditional knowledge, the Drum Lake area is important winter range. • Aerial surveys in the 1970s and 1980s suggested that a major portion of the Moose Horn caribou population (a subgroup of the Redstone herd) resided in the general vicinity of Drum Lake during the winter months, although Drum Lake itself seemed to be at the eastern extent of the winter range with more caribou observed to the west and south. • Not all sources support a concentration of caribou in this area. A study of collared caribou from 2002 to 2007 showed that they occasionally passed through the Drum Lake area but did not show a particular concentration of activity there. • A model of northern mountain caribou habitat predicts that the Drum Lake area contains a high proportion of preferred habitat overall and especially in winter. • According to traditional knowledge, Drum Lake is an important area for caribou hunting. • In the winter, caribou are found between Drum Lake and Caribou Flats on the Keele River and are thus easily accessed

[17] Expert(s) originally recommending inclusion: Dehcho community representatives and Wildlife Conservation Society researcher.

[18] Expert(s) originally recommending inclusion: Sahtú community members and Environment Canada staff.

			from Drum Lake. An archaeological survey also found two caribou fences approximately 30 km southwest of Drum Lake.
11	Redstone calving and early-midsummer ranges[19]		

	#1 (area that many animals use traditionally, around the same time each year)	29,390 km²	• Northern mountain caribou of the Redstone herd appear to return to these calving and post-calving areas year after year.
			• An analysis of locations from 10 collared adult female caribou from 2002 to 2007 showed 3 groups with significantly different calving areas: a group that calved mostly to the north of the Keele River (4 collared individuals), a group that calved mostly to the south of the Keele River (4 collared individuals), and a relatively sedentary group that spent the entire year in the Carcajou Lake area (2 collared individuals). The general areas occupied in early-midsummer (June 24 – July 21) were very similar to the areas occupied during calving (May 27 – June 23), except for the southern group, which expanded eastward towards the Moose Horn and Redstone Rivers. Collared caribou showed high fidelity to calving areas on a herd basis, indicating that they returned to the same general areas year after year but used different specific sites within those areas. Fidelity to early midsummer areas was moderate but still higher than for winter. Caribou locations were also relatively concentrated within these calving and early midsummer ranges compared to in other seasons.
			• Additional support for calving at certain locations within these areas:
			  ○ The area east of Macmillan Pass that includes O'Grady Lakes and the headwaters area of the Keele, Twitya, and Caribou Cry rivers is well known as a calving area for northern mountain caribou.
			  ○ In the 1970s and 1980s, calving was observed near O'Grady Lakes, Natla River and its headwaters, Keele River headwaters, Mackenzie Mountain barrenlands, and the Plains of Abraham.
			  ○ The areas around O'Grady Lakes and the Mackenzie Mountain barrenlands provide subarctic tundra habitat for calving.
			• Additional support for use of certain locations within these areas during the post-calving period:
			  ○ In 1980, major post-calving concentrations were observed around O'Grady Lakes, Mackenzie Mountain barrenlands and north of Caribou Pass, and caribou were also seen in the Caribou Flats area.
			  ○ The Moose Horn headwaters area is known as summer range.

[19] Expert(s) originally recommending inclusion: ENR staff.

			○ Areas along the Yukon-NWT border, west of Caribou Flats and north of Caribou Pass[20], contain snow fields and high, windswept ridges that provide escape from insect harassment. ○ A model of northern mountain caribou habitat predicts a relatively high amount of preferred post-calving habitat in areas near the Yukon-NWT border. ○ The Caribou Flats area attracts many caribou due to its saline-rich streams.

Other areas mentioned for northern mountain caribou in Wilson and Haas (2012) include two possible calving grounds:

- Plains of Abraham – northern mountain caribou have been observed calving here.
- Moose Ponds – large northern mountain caribou herds have been observed here and the area overlaps with calving and early-midsummer range for the Redstone caribou herd.

Shúhta Dene stress the importance of the Macmillan Pass/K'á Tǝ́ area as northern mountain caribou habitat, as it is recognized as being special for caribou from a lot of different places. In early June, it is a post-calving gathering place; there also used to be lots of caribou gathering there before the rut in August/September. The caribou that come to Macmillan Pass then spread out in different directions, going to a lot of different places in the winter (Winbourne 2017b).

Habitat Fragmentation

No traditional knowledge on habitat fragmentation was found in the NWT or Yukon sources reviewed for this report. Some, however, believe that the activities along the CANOL Heritage Trail (particularly near the NWT-Yukon border) may be displacing caribou away from this area – perhaps a functional loss of habitat (Barichello pers. comm. 2019).

The COSEWIC assessment report (2014) for mountain caribou includes Indigenous traditional knowledge suggesting that habitat fragmentation resulting from roads, railways, and industrial development has negative effects on caribou and habitat through elevated noise, dust, pollution, and contaminants; these effects can then result in population decline or abandonment of range (i.e., 'chase' caribou northwards). This information was shared by Indigenous traditional knowledge holders in BC, but would likely have some relevance to Yukon and NWT populations as well.

In documenting a history of outfitters who have worked in the Mackenzie Mountains, Deuling (2017) characterizes the Mackenzie Mountain range and its environs as a largely unfragmented habitat:

[20] Note: The Caribou Pass mentioned above is near the Canol Trail and is different from the Caribou Pass mentioned in the important wildlife area entitled "Caribou Pass" (ID: 9).

"The vast majority of the Mackenzie range remains true wilderness, with only two roads penetrating its borders. The CANOL (Canadian American Norman Oil Line) Road, built to service an oil line from Norman Wells, NWT, to a refinery in Whitehorse during WWII is partially maintained on the Yukon side but exists only as a trail in the NWT. Farther south, another partially maintained road accesses the NWT from north of Watson Lake to the small mining community of Cantung, which lives and dies by the market price of tungsten. That is it; there are no other roads." (2017: xvi)

However, more recent concerns about motorized vehicle use can be found under *Habitat Trends* and *Threats and Limiting Factors*.

Habitat Trends

Local knowledge holders that are familiar with the Mackenzie Mountains are reporting several different types of changes they are seeing in northern mountain caribou habitat. Of prime concern are ice patches – these critical components of northern mountain caribou summer habitat are disappearing quickly (Winbourne 2017a). There is also increasingly widespread habitat destruction occurring in areas frequented by hunters on ATVs.

"We don't see the snow packs the same – they're disappearing, as the glaciers are disappearing. You could always see caribou on snow packs. Now we really have to look hard on those snow packs to see caribou. As far as the hunting that's going on and the quad use, we never used to see the quad use up there and now we are very concerned about the amount of trails that are on that high elevation plateau. That's a piece of tundra up there and it's underlain by permafrost, so when you get quads running around there, they compact the soil and melt the permafrost, and then you get mud holes. As they're used more and more there are side trails to by-pass the mud holes. It's just really a lot of damage on that tundra area. You only have to fly over it to see how much damage it is and the alpine area is the same way. There are phenomenal changes." (Norman Barichello [Dechenla Lodge] in Winbourne 2017a: 13)

"Climate change is starting to change the landscape – it changes water quality, the plants, a lot of things that are happening now." (Norman Sterriah [Ross River] in Winbourne 2017a: 14)

People are also very concerned about habitat changes caused by wildfire.

"Climate change is starting to change the landscape. Climate change changes water quality, the plants, a lot of things that are happening now. There are more impacts happening. We talk about fires and what it's doing. We have raised this with the forest management branch, ENR, anybody that comes to visit us. We say we have to do something about these fires that are burning out key winter habitats. Maybe that's one of the problems. We know it's one of the problems that is preventing caribou from coming back to these areas. Science says it takes about 60 years for lichen to grow back. These large areas is where these lichen have burnt out and 60 years is a long time. We have to find ways to fight those fires." (Norman Sterriah [Ross River] in Winbourne 2017a: 21)

More details on impacts to caribou and their habitat attributed to climate change are provided in *Threats and Limiting Factors*.

Distribution Trends

Over the last 25 years there have been changes in northern mountain caribou distribution trends and movement patterns in the Arctic Red River outfitting area. While old trails are evident in the landscape, indicating former travel routes, caribou have not been seen to use them.

"Twenty-five years is a relatively short time in the scale of a caribou population; it's easy to see the old trails, and they indicate movement of large numbers of caribou over long periods of time, even though you don't see them using those trails now. We have seen over the last 25 years, maybe due to weather or predator distribution and density, but Redstone caribou are little bit later coming out to the north, and they don't usually come right out in as big numbers as they used to. They're establishing higher up and are more dispersed – it could be a lot of reasons… changes in predation, everything's tied together." (Tavis Molnar [Arctic Red River Outfitters Ltd.] in Winbourne 2019: 15)

This is also documented for the south Nahanni area, where distribution and migration patterns have changed and caribou are seen using different valleys and rivers than they did 15 years ago (Winbourne 2019).

As mentioned above, some Tu Łidlini (Ross River) Dena say they are witnessing recent changes in caribou use of winter habitat due to the impacts of wildfire in the region.

"…we let these fires burn out of control that's out of town and what's happening is they are burning the caribou winter habitat. So by government letting this happen, a lot of these caribou are moving away from the wintering groups. Eventually in the summertime, they end up in a different place. One place that I always hunted for years there were just herds of caribou. You had your pick. I have been up there for two years in a row now and I am going to go back this year and one thing I don't see is those herds of caribou anymore. The Tay River herd winter grounds are completely burned right out except for the west. The same thing up by Marjorie Lake and up the North CANOL. Those are all wintering grounds. By the government letting that happen, they are contributing to the relocation of the caribou herd." (James Dick [Ross River] in Winbourne 2017a: 21)

There are also observations from Tuĺıt'a hunters that northern mountain caribou migration routes and movements around the Keele River and Caribou Flats in the Sahtú have changed in recent times (Olsen *et al.* 2001; Winbourne 2017b). By 2000, harvesters in Tuĺıt'a were reporting fewer animals at Caribou Flats in the fall compared to previous years (Olsen *et al.* 2001).

"It's hard to monitor these caribou. Some years there are nothing, some years a lot. They are changing their movements – now they've moved down from the Flats lower than I've ever seen in 19 years. It's probably all the same caribou moving back and forth, so while our main concern is

the Keele River, what's happening around us does have an impact on the caribou we hunt." (Rocky Norwegian [Tulít'a] in Winbourne 2017b: 12)

Shúhtaot'ıne oral histories indicate that the caribou used to travel much further north in their migrations. Now there is some uncertainty about what the caribou are doing and where they may be going, but people say they are witnessing them move away from their usual areas (Winbourne 2017a).

Gwich'in hunters recall hearing about longer-term distribution or population changes as well. In the 1800s, northern mountain caribou came over into the NWT by crossing the Peel River and occupying lands that are currently used by boreal woodland caribou. This pattern changed around 1900, as northern mountain caribou do not like sharing territory. Additionally, as noted in *Population*, the Hart River herd previously had a much bigger distribution (Benson 2018).

Threats and Limiting Factors

Human effects on caribou may be both direct, such as harvesting, and indirect, for example, range loss caused by human activities, roads in winter ranges, and aircraft overflights (Dena Kayeh Institute 2010). In regards to winter habitat or range loss, it is often the degree and pattern of habitat loss that is of concern. Roads in winter range are a main concern because of animals being sedentary, limited by snow, attracted to the road salt and then vulnerable to being hit by traffic, or potentially hunted (*Ibid*.). Roads are also believed to become travel corridors for wolves, bringing them into greater contact with northern mountain caribou during the winter (Barichello pers. comm. 2019).

For the most part, outfitters report concerns they have about potential threats to northern mountain caribou, stressing that currently, the populations appear to be doing well, but if human activity or climate change add stressors there could be important negative impacts (Winbourne 2019).

"We've seen such a stable caribou population there I've seen nothing to think there's a threat to them by predation or habitat change. They're healthy and thriving in that part of the country. But if you took that away from them, their ability to adjust their movement patterns…the only thing that could interfere would be human disturbance, like through oil and gas exploration or mineral development. That could be serious. They wouldn't be able to mitigate predation or find suitable areas for feed, or even if they could, it could increase the energetic cost to do so, and the added stress might not be sustainable." (Tavis Molnar [Arctic Red River Outfitters Ltd.] in Winbourne 2019: 34)

Shúhtaot'ıne, Métis, Tu Łidlini (Ross River) Dena, and other local knowledge holders in the Mackenzie Mountains attest that specific herds of northern mountain caribou are gravely at risk, and urgent action is required (Winbourne 2017a and b, 2018).

"We are here because we are seeing a dramatic decline in caribou numbers over the last 10-20 years. We don't know exactly what the cause is, maybe they are moving and it is natural, but we blame over-hunting. Some other factors may be from climate change – like melting snowpacks, increased forest fires, and loss of habitat from the shrub line moving up. There is also more industrial disturbance. But the elders see the decline in caribou happening at the same time as this massive increase in resident hunters from the NWT. The caribou are staying away from the CANOL Road corridor, and we are seeing fewer big bulls. Hunters come in groups of four or five and they want two or three caribou each. It's having a devastating effect on the game, there are too many ATV trails in the alpine, and it is displacing local hunters from their traditional camps. We see meat wastage, disrespectful hunting practices, and bears learning to come to kill sites to take what's left behind when they hear shots." (Josh Barichello [Dechenla Lodge] and Norman Sterriah [Ross River] in Winbourne 2017b: 30)

Human activities and industrial presence are intensifying in some areas. Dena familiar with the K'á Tǝ́ area say that each year, as hunting is reduced on other species (e.g., for many barren-ground caribou herds in the NWT), more and more hunters come from other areas to harvest northern mountain caribou and moose. Impacts are intensified close to the harvester location, but as helicopters fly people into remote areas and four-wheel vehicles range off-road, the habitat destruction is thought to be increasingly widespread (Winbourne 2017a). Mineral exploration and development are also expanding in certain areas, along with roads and other infrastructure that could exacerbate these impacts (*Ibid*.). Outfitters also identified a scarcity of game (including northern mountain caribou) along the CANOL Road between Ross River, Yukon and the NWT border (Winbourne 2019).

There is also a concern with forestry as it may change predator-caribou relationships. Increasing logging in a winter range could increase moose forage and increase the number of wolves in the area (Dena Kayeh Institute 2010). However, as there are not many forestry-related activities in the NWT range of northern mountain caribou, this has not been included for discussion here. The COSEWIC report (2014) also points out the indirect and cumulative effects that anthropogenic disturbance can have on caribou populations through habitat changes that favour predators; wolves are listed as the primary predator of caribou in the northern mountain population, yet it is also noted that caribou are a secondary prey species in the diets of predators, following moose and deer. Because predation was not described as a major threat by knowledge holders in the sources reviewed for this report, it has not been included here. Instead, threats are included based on their prioritization under several regional processes. For example, the SRRB has listed the following three factors as growing risks for a number of northern mountain caribou herds:

- The impacts of visitors in the K'á Tǝ́ area.
- The Mackenzie Valley Review Board Environmental Assessment and approval of the Howard's Pass Access Road Upgrade Project.

- The proposed amendment to the Sahtú Land Use Plan following the creation of Nááts'ı̨hch'oh National Park Reserve, which excluded areas of northern mountain caribou habitat that knowledge holders consider important (SRRB 2018).

Both the Howard's Pass development and the park amendment decisions are seen as threats due to the failures to protect important caribou habitat.

During joint stewardship planning work with the SRRB, Tuĺıt'a and Norman Wells renewable resources councils (RRCs), and the Ross River Dena Council, the following nine points were identified as threats to northern mountain caribou and the Mountain Dene way of life (Simmons pers. comm. 2018):

- Changing environment from climate change
- Poor hunting practices
- Lack of awareness and respect for Dene/Métis laws
- Increased motorized access, noise, and disturbance
- Lack of use and transmission of traditional knowledge
- Mining and exploration
- Poor policy coordination and implementation
- Lack of capacity
- Contaminants

A lack of research about these caribou is also considered a problem in both the Sahtú and Gwich'in regions; this includes uncertainty about what the total harvest of northern mountain caribou is as well as a lack of adequate documented traditional knowledge about shúhta goʔepę́ (Benson 2018; Simmons pers. comm. 2018; Winbourne 2019; Andrew pers. comm. 2019). Lack of knowledge impairs the ability to determine threats and respond appropriately.

The sacred relationship that Indigenous communities have with caribou is being changed by non-Indigenous policy, climate change, and other factors. This changing relationship is a threat to caribou, as upkeep of the human side of the relationship (including travel to and through the area, harvest, and seeking/passing along information) is an important factor in monitoring and protecting caribou (Andre *et al.* 2006). For example, without Gwich'in and K'ashógot'ı̨ne harvest, the caribou at the headwaters of the Arctic Red River may 'get sick' (*Ibid*.). Also, traditional management practices (based on respect and traditional knowledge and yielding immediate actions), have been replaced by science-based management systems that are influenced by politics. In this current management system, knowledge takes time to acquire, and actions typically come too late, or not at all (Barichello pers. comm. 2019).

In 2001, people from six Shúhta Dene communities worked with government staff to analyze cumulative impacts on northern mountain caribou (Olsen *et al.* 2001). Workshop participants were asked to state their opinions about several factors known to impact northern mountain caribou and rate the relative magnitude of that impact as major, minor, or no impact. Some of the comments recorded by respondents included:

"Most impacts [on mountain caribou] to date are relatively small, but potential impacts are high, much depends on management. Less potential for oil and gas, and associated pipelines in mountain areas. Also somewhat less forestry potential, but some in Fort Liard and Nahanni areas. Climate change is suspected to dramatically alter fire regimes which could impact winter ranges. Mining activity [and] associated roads have high impact potential." (Olsen et al. 2001: 18)

Results are summarized in Table 3.

Table 3. Cumulative impacts on northern mountain caribou based on responses from 14 workshop participants in Fort Good Hope, Dél̨ı̨nę, Colville Lake, Tuĺıt'a, Norman Wells, and Ross River, as well as the Yukon Government, Resources, Wildlife and Economic Development (RWED) (Government of the Northwest Territories (GNWT)), Nahanni National Park Reserve, and the Association of Mackenzie Mountain Outfitters. Numbers given are % responses (Olsen *et al.* 2001).

	Major impact	Minor impact	No impact	Unknown
Predators	50	29	14	7
Hunting	36	36	29	0
Climate change	36	43	0	21
Highways	36	21	29	14
Seismic	29	29	21	21
Contaminants	14	57	7	21
Forestry	14	36	43	7
Pipelines	14	50	29	7
Tourism	0	64	21	14

Overall, in the recent TK/CK sources reviewed for this report, the top three threats consistently identified can be categorized as follows:

- Impacts of hunters/visitors and hunting pressures (harvest pressure, disturbance and placement, lack of respect)
- Industrial activities (disturbance and habitat loss)
- Environmental change (changes in habitat quality, ecological dynamics, and movement patterns)

Further details on each threat are provided below. Threats have been assessed by the Species at Risk Committee to inform the assessment of northern mountain caribou. The *Threats Assessment* is included in *Appendix A*.

Impacts of Hunters/Visitors and Hunting Pressure

Recent sources of TK/CK suggest that the most urgent problems impacting northern mountain caribou today stem from poor harvesting practices (Winbourne 2017a). Many of the comments about increased hunting pressure and habitat damage caused by hunting come from the Tu Łidlini Dena and other members of the Kaska Nation. The traditional territory of the Tu Łidlini Dena is located in the eastern Yukon and includes three roads popular with hunters – the north and south CANOL highways, and the Campbell Highway (Barichello pers. comm. 2019).

Tu Łidlini Dena from Ross River are concerned about the increasing number of hunters they see travelling to the Macmillan Pass/K'á Tǝ́ area from elsewhere. They say the increase has coincided with harvesting restrictions and population declines of barren-ground and boreal caribou in the NWT – as harvesting becomes more restricted there, more hunters are making the over-land trip to the Mackenzie Mountains to hunt (Winbourne 2017a). The impacts are described as immediate, growing, and expected to intensify if access to the area improves, such as through upgrades or further developments to the north CANOL road and/or Howard's Pass access route.

"I think the greatest difference in the hunting is the number of hunters from Yellowknife and Hay River. It's been a growing phenomenon and we've seen 50-plus licensed hunters that have come into the area – that's on top of First Nation hunting. We see camps up there where trailers are brought up, they convert into cabins, deep freezes, lighting and they look like small cities out there. There's been a noticeable difference in the degree of hunting. We are concerned with the disrespectful hunting practices we see. We are also very concerned about safety. It's almost like we need some kind of a hunting manual for some of these hunters. They're from somewhere else. They've had no history in the area. It's almost like they need an education in how to respect the land and the wildlife, how to hunt and how to look after the kill. We also have real concern about the mine down the road, and about the upgrading of the North CANOL Road to become an all-season road, to fix the grade so that you could probably get up there in three hours. Unless the hunting and quad use is regulated somehow, I would forecast that you would have major wildlife problems above and beyond what we see right now. It would mean people could go in there any time of the year." (Norman Barichello [Dechenla Lodge] in Winbourne 2017a: 13)

"I know in the last few years there have been a lot of hunters from Northwest Territories coming up – from Yellowknife – it started with like five people and then every year it doubles. One year we had 50 hunters from Yellowknife. They come up with quads, four-wheelers, side by sides – all of these kinds of things." (Dorothy Dick [Ross River] in Winbourne 2017a: 12)

Worries center on too many caribou being harvested overall, and that big bulls/animals with large antlers are being taken the most (Winbourne 2017a). However, with regard to the Howard's Pass Access Road – also known as ʔepé Nı̨nareh?á ʔetené? (Caribou Crossing Trail) – there is a specific concern about motorized vehicle access and industrial traffic, as the road parallels the Little Nahanni River for a portion of its length and that valley includes a portion of the South Nahanni herd's calving, summer, and rut ranges (Parks Canada 2017). This is an important area for the South Nahanni herd, and caribou migrate across the road at specific times during the year. Currently, a restricted activity permit is required for anyone using the Howard's Pass Access Road within Nááts'ı̨hch'oh or Nahanni National Park Reserve (*Ibid*.).

Tu Łidlini Dena report that there has been a shift from more traditional hunting methods to the use of disruptive technology like ATVs (quads or four-wheelers), helicopters, and planes (Winbourne 2017a). As a result, there is a lot of noise, a lot of habitat disturbance, and many disrespectful practices taking place, like wasting caribou meat and wounding animals.

"When I first went out there about 35 years ago, I seen a lot of moose, caribou and everything. A lot of game, grizzly bears, wolves. I went back there last year and you should see some of the vehicles, the license plates on them – Alberta, Alaska, British Columbia. Some of those guys are packing freezers in their trailers, Argos. This has got to stop. I have seen the racks that come out of that place. Three or four caribou racks on there, bull moose. And you wonder why they're disappearing up there. They migrate through the Cantung road. I went up there last year and hardly seen any. I hope we get things done to alleviate some of these problems because I would like to see my grandkids go out there and harvest wild game like I did once." (Jerry Dickson [Ross River] in Winbourne 2017a: 15)

Figure 16 shows trailers with off-road machines and caribou racks at the side of the North CANOL road.

Figure 16. Trailers with ATVs and caribou racks from hunters on the North CANOL road. Reproduced with permission from Josh Barichello.

The impacts seen at Mile 222 are not restricted to road access however. Gwich'in land users have seen skidooers chasing northern mountain caribou (Environment Canada 2010) and there are concerns about people harvesting by boat in other parts of the Sahtú region.

"The concerns that people have about harvesting and harvest monitoring at Mile 222 are the same concerns that Tulít'a has for the Keele River and Caribou Flats. We hunt there every year; it's where we get our food from. We are seeing boats coming out of that area and we don't know who they are, what or how many animals they harvested. It would be nice to have someone at the mouth of the Keele checking permits and monitoring the harvest, especially during the fall season. It would be nice if the RRCs can start taking that role on to have someone monitor these areas and have a position for these people. I think there is a role for the Renewable Resources Board in keeping count of those also." (Rocky Norwegian [Tulít'a] in Winbourne 2017b: 12)

Participants in the joint meetings from Norman Wells, Tu Łidlini (Ross River), and Tuĺit'a all identified roads and hunter access as a major problem for northern mountain caribou (Winbourne 2017b). In addition to enabling hunters to access caribou, motorized vehicles are going off-road and causing habitat damage. People are concerned that this is going to become a bigger problem if road access is increased and as hunting gets restricted elsewhere in the NWT (*Ibid*.).

Some outfitters also consider increased recreational activity as a threat, especially where it is occurring along rivers, such as the Keele and Nahanni (Winbourne 2019).

Industrial Activities

Road access into the Mackenzie Mountains came about with the CANOL Project – a project to get oil from Norman Wells to Whitehorse, to serve the war (World War II) effort in Alaska. The corridor for the pipeline was selected by Dene guides along a traditional, well-travelled trail between the Mackenzie Valley and the Yukon. The road was completed in 1943 with the joining of the Yukon and NWT highways at Macmillan Pass. There are numerous oil spills and contaminated wastes from past mining and military operations along the route. Federal programs continue to target the clean-up of these materials (Winbourne 2017a).

"The Second World War junk is laying around here all the way up to Whitehorse all the way to Norman Wells. The most dangerous part for caribou or moose is that telephone strands. That telephone strands runs all the way back into Norman Wells. There's piles and piles of old drums. Some are half full with some kind of chemical and all these camps over to NWT is all polluted with oil since 1942. Now what I want to talk about is the part where the caribou calving grounds are. The caribou calving grounds start from [Green Branch?] all the way up over towards the next river. There's maybe 100,000 cans and drums and stuff all through that part. Now all these things, what happened is when they drain and it comes summer, all these things go into the water and goes into the river that goes down to Fort Norman, down the Mackenzie. All these polluted stuff is going to that area there. You've got to have somebody do something with the poison stuff in that area. There is one little area where you see dead marten, dead wolverine. We have to deal with these things first. We have to look at the land itself." (Robertson Dick [Ross River] in Winbourne 2017a: 19)

"Over a 20-mile stretch of road that I'm familiar with, I've seen over 12 to 15 caribou and moose [tangled]. What happens is, if the poles fall down and the wire is suspended, when the animals hit it, they get into a frenzy and they tangle but it's usually where the poles have fallen and you have suspended line, I think. I've noticed three of them in the vicinity of Caribou Pass over at Godland Lakes and between Godland and Caribou Pass probably another half a dozen anyway. Down between 222 and mile 212, again I think I've seen about four of them. Quite a few. At mile 208 to mile 216, we removed the wire actually. We coiled it all up and dumped it in a gravel pit. It was part of a program we offered to clean it up. We also gathered up drums with fuel or grease or any petroleum products in them. We identified over 50 drums that had either grease or diesel or crude oil [or remnants of fuel] right at [mile] 208. Of course, what happens is when the bung comes off the water [enters the drum] …the oil surfaces to the top. At 208 in particular, there are some sites [where the soil is like] plasticine. They have had a lot of seepage in that area." (Norman Barichello [Dechenla Lodge] in Winbourne 2017a: 19)

Significant progress has been made on cleaning up many of the contaminated sites along the CANOL road; more information is provided in *Positive Influences*.

Any new roads built for industrial activities within northern mountain caribou range will increase access to sensitive caribou populations and habitat. The Howard's Pass Access Road is likely to contribute to recreational use of the Macmillan Pass/K'á Tǝ́ area; staff of Nááts'įhch'oh National Park Reserve are already hearing of overland travel to Mile 222 facilitated by this road. Access is expected to increase on this route in the future, thereby potentially increasing impacts on caribou both through increased harvest and habitat destruction (Winbourne 2017b).

Some forms of resource development can cause impacts to northern mountain caribou in their alpine range, where caribou may be displaced from preferred habitat by mineral exploration activities, seismic line activities, and even commercial tourism, especially when repeated aircraft overflights are occurring (Dena Kayeh Institute 2010). The Kaska Dena land use framework suggests that activities should be limited during the calving season (May 15 – June 15) in known core calving ranges of herds (*Ibid*.). Shúhtaot'įne, Métis, Tu Łidlini (Ross River) Dena, and other local knowledge holders say they are seeing a steady increase in industrial activities that can have negative consequences for northern mountain caribou, and are concerned about the cumulative effect from the many types of impacts (Winbourne 2017a).

Currently, several mining companies have interests in the Macmillan Pass area. The proposal to upgrade the north CANOL road to a year-round haul road is also of concern, as are the broader, indirect impacts that could result from the developments (Winbourne 2017a).

"There are all kinds of developments happening, all kinds of mining claims. With development comes challenges. They are going to upgrade this road to a haul road; it's going to be year-round. We have North American Tungsten up here, Colorado down here, [Hudson] Bay right in here. There are others we haven't really talked about – Eagle Plains, Overland Resources, Silver Range – I don't know how many. Down here we have Three Aces, lead/zinc right in here, Selwyn Mine, precious metals in here, tungsten in here. There's a lot of interest. Howard's Pass is a huge concern to us also. It's a mega project. They are talking about hydro, the haul roads, pipelines, service roads, railroads – everything that will serve a mine over a period of maybe 50-plus years. We are talking about airports that will handle 737s, narrow [gauge] railroads. What kind of impact is that going to bring to us, not only population-wise but also social and economic problems?" (Norman Sterriah [Ross River] in Winbourne 2017a: 18)

"In the land use planning, Ross River has identified, from day one, the area up at [MacPass] as a special area. It's been identified by Parks Canada as a candidate parks. It's been identified as an United Nations biological program site. It's been identified by the territorial government. It's been identified by a group of scientists as an important area. I believe the Sahtú have even identified it as part of the three rivers candidate for protection. So there is absolutely no debate about the special nature of it. The problem Ross runs into, in terms of protecting it now, is [that] there is some advanced exploration and companies have been given certain rights to operate and short of going to court, it might be difficult to pull those areas away [withdraw the mineral claims]. That's why some of those areas [should] have special operating conditions, because under the revision

of the [Quartz] Act, there's a provision that allows for the government to establish special operating [areas], where they impose a much higher bar on what can take place in those areas. We've demanded of the government at we sit down and decide how those areas best be managed. We're hoping to get into that debate down the road with the government to [adopt higher standards of operation] in these special areas where there is advanced stages of exploration." (Norman Barichello [Dechenla Lodge] in Winbourne 2017a: 37)

As noted above, proposed amendments to the Sahtú Land Use Plan, which followed the creation of the Nááts'ıhch'oh National Park Reserve, are of significant concern to the SRRB (SRRB 2018). The amendments would leave critical caribou habitat such as calving grounds open to industrial resource development.

"When we were participating in the Naats'ihch'oh Park [process], we put on the table maybe extending the park…north as far as the Keele area up to Caribou Cry in that direction. That hasn't gone anywhere. The elders group said we should extend that just to address what you heard yesterday and today about the impacts we are experiencing – the caribou and the livelihood. During our comprehensive land claims discussions before it fell apart, there was a [proposed] Special Management Area, to try to protect as much of that portion of the land as possible." (Norman Barichello [Dechenla Lodge] in Winbourne 2017a: 33)

Linear disturbances on the landscape can threaten northern mountain caribou, as these features can present as an obstacle to caribou movement and increase access for both human and animal predation.

"I think linear development is probably something that can be a hazard for caribou. If I make a skidoo track they'll trot down it for miles and use it. But I've also seen a caribou come out of the timber, look at it, and jump back because it's unknown, and they will go for miles coming down and checking, but afraid to cross or jump over it. Once they do, they're fine, but it does represent something unknown and their fear of the unknown…they tend to be very cautious. They can get used to it, but it is something that I think we should be cautious about – roads and linear development – that can definitely affect them." (Harold Grinde [Gana River Outfitters Ltd.] in Winbourne 2019: 35)

Overflights and helicopter activity can also pose a threat to northern mountain caribou. Two years ago, in the Source Peaks, in an area where caribou congregate in the summer, one outfitter saw 13-14 dead caribou at the base of a cliff, and suggested that was not likely a natural occurrence.

"I believe somebody flew over and spooked them. They were all in a pile at the bottom of the cliff and there were grizzlies there eating them. I don't think that would be a natural occurrence, not even wolves. I think that was a low flight of a helicopter. [Caribou] love to stand on a top of a cliff to fight flies, and if someone buzzed them close and then panicked, that's the only thing I could see that would cause that to happen." (Harold Grinde [Gana River Outfitters Ltd.] in Winbourne 2019: 35)

Some traditional knowledge on northern mountain caribou was recorded in the Dehcho region during research conducted for the Prairie Creek Mine and proposed access road (ENR 2016). Team members and elders from Nahanni Butte stated that there were caribou in the area of concern, and that caribou are important to protect. Members shared traditional knowledge of caribou in the area and expressed concerns with development activities, as well as negative impacts of collaring for research purposes (*Ibid*.).

Environmental Change

Knowledge holders familiar with the Mackenzie Mountains say they are witnessing several types of direct and indirect impacts on caribou in that area that are due to climate change. Some of these include (Winbourne 2017a; Benson 2018; Barichello pers. comm. 2019):

- Changes to timing of spring thaw and fall freeze-up.
- More frequent unfavourable snow conditions (e.g., increased icing events that create difficulties for caribou to get to their food through the snow crust).
- Shrubification.
- Rapid snowmelt that results in dangerous river crossings, and in some cases a drying of the tundra.
- Warmer summer months making it difficult for caribou to get away from insects.
- Greater frequency of wildfires that can destroy core winter habitats and the lichen the caribou depend on for food. They can also cause travel disruptions if the fires go through migration corridors.

The timing of seasonal movements may also be disrupted, leading to a chain of events that influence distribution. Ecological changes may also alter the distribution of ungulates and predators, further threatening caribou. For example, some elders are worried that earlier spring weather might bring bears out of hibernation earlier, creating greater predation pressure during the calving period. Also, as caribou begin to suffer from environmental changes, they may be more susceptible to other factors, such as predation and parasites, and they may be less productive (Barichello pers. comm. 2019).

Participants in the 2014 joint mountain caribou meeting also talked about changes in animal populations related to climate change. They mentioned high numbers of grizzly bears hunting caribou as a concern, as well as impacts that species like muskoxen and bison can have on caribou when they move into an area (Winbourne 2017a).

"Grizzly bears in Western Canada are a concern. Up at the border they are protected and there's a growing number of grizzly bears and it's outnumbering the moose and caribou. There's way, way too many. I think Tulít'a recommended they be protected on settlement lands up there. So nobody

can hunt them there. They should open that for a hunt until the numbers are down a little bit. The other reason is because they have no food, they will suffer as a result." (Mary Maje [Ross River] in Winbourne 2017a: 33)

Outfitters also pointed out that if climate change results in a warming trend in summer that increases fly activity, there could be an impact on caribou body condition (Winbourne 2019).

Positive Influences

Generally, outfitters indicate that the pristine nature and remoteness of habitat in the NWT is a strong positive influence for northern mountain caribou. The Mackenzie Mountains span an extremely large area and are influenced by relatively little human access and activity; if this remains the case, caribou are thought to be able to continue to survive (Winbourne 2019).

Cross-regional Community Conservation Planning in the Mackenzie Mountains

Shúhtaot'ıne, Métis, Tu Łidlini (Ross River) Dena, and other local knowledge holders on both sides of the Yukon/NWT border have been trying to draw attention to northern mountain caribou conservation issues in the Mackenzie Mountains for many years, and began holding regular joint stewardship meetings in 2014. Due to their long historical and cultural connection to northern mountain caribou and the land around Macmillan Pass/K'á Tǝ́, they have a keen interest in cooperating and collaboratively working toward common stewardship goals. They feel that the management actions they have prioritized will ensure long-term sustainability for northern mountain caribou populations (Winbourne 2017a and b; SRRB 2018).

The draft *Nıo Nę P'ęné Begháré Shúhta Ɂepę́ Nareh?á – Trails of the Mountain Caribou Management Plan* was ready for community review in fall 2017. It is an Indigenous-led plan that outlines a vision, scope, values to be protected and sustained, threats, and ways of monitoring progress[21]. The plan has six main program areas, including (SRRB 2018):

1. Development of a land-based Indigenous Guardian and healing program.
2. Reducing disturbance of Shúhta GoɁepę́.
3. Protecting land through protected areas.
4. Education and communication of Dene/Métis laws.
5. Indigenous resource laws and agreements.
6. Keep moving forward (evaluation and learning).

[21] While the draft plan has not yet been released publicly, interim reports, newsletters, and posters outlining the plan contents and progress made to date are available on the SRRB website: http://www.srrb.nt.ca/index.php?option=com_content&view=article&id=378&Itemid=1739

The draft plan is currently being revised following extensive community review and comment. It will then be reviewed by the governments of the NWT and Yukon. Once all parties approve the plan, it will be submitted for approval and forwarded to the federal Minister of Environment for approval (SRRB 2018).

In addition to the long-term planning work being done in the area, Sahtú and Tu Łidlini Dena organizations also prioritized some immediate actions to initiate as soon as possible, including:

1. Monitoring the harvest – find ways to estimate the total number of gudzih/shúhta goʔepę being harvested in the Mackenzie Mountains.
2. Restricting access and educating hunters – to limit damage to habitat and poor harvesting behaviours, develop and post signage about private lands as soon as possible.
3. Communication and finding support – reach out to other departments, organizations, companies, researchers, and individuals to get support for management actions.
4. Protecting habitat – there are many different things impacting caribou; ensuring they have good habitat will be very important to their survival.

Since the 2017 joint workshop held at Dechenla, progress has been made on each of these priority areas (Simmons pers. comm. 2018). Two examples of actions that have already been undertaken are the development of Indigenous hunting permits in the Ross River traditional territory and work towards further land protection; some details are included below.

Indigenous Hunting Permits

The Ross River Dena Council (RRDC) has been involved in court disputes with the Yukon Government over how much say it has over hunting levels in their traditional territory. In the past two years, it also warned that members fed up with over-hunting might set up road blockades to prevent outside hunters from accessing popular hunting areas (CBC 2018a).

In order to address elders' concerns about moose and caribou population numbers, and to increase awareness about hunting in the non-Kaska community, in June 2018, the RRDC took out a full page advertisement in a Whitehorse newspaper stating that non-Kaska hunters will need a permit from the First Nation before hunting on their traditional territory in 2018 (CBC 2018a). The advertisement listed 11 places for a moratorium on hunting, due to the tremendous pressure felt in certain important places in Ross River Dena territory (RRDC and Ross River Dena Elders Council [RRDEC] 2018).

In response to objections from the RRDC, the Yukon Government cancelled permits for the Finlayson caribou hunt for 2018, and urged licensed hunters to cooperate with the Ross River Dena. While territorial hunting regulations still apply, and those stipulate that the moose and caribou hunting seasons close on October 31 (not September 15), the government asked hunters

to voluntarily comply with the RRDC requests (CBC 2018b). It is expected that Tu Łidlini (Ross River) Dena will increasingly assert Dene ʔeʔa/ʔá nizin (law/respect) and attempt to provide education to non-Dene hunters in the future.

Proposed Indigenous Protected Area

As part of the cross-regional planning work mentioned above, the Tu Łidlini (Ross River) Dena Council and the SRRB are pursuing additional land protection for important caribou habitat such as seasonal ranges and calving grounds through Indigenous protected areas (Simmons pers. comm. 2018). At the time of writing, it is not possible to estimate how many square kilometers this initiative will ultimately protect. Some of the areas proposed for further protection in the NWT as Indigenous protected areas are included in proposed amendments to the existing Sahtú Land Use Plan, namely those areas that were excluded from the Nááts'ı̨hch'oh National Park Reserve (Winbourne 2017b).

Doı T'oh Territorial Park and CANOL Heritage Trail

Doı T'oh Territorial Park and the CANOL Heritage Trail are proposed as Recreation Parks under the *Territorial Parks Act*. Permitted uses will be similar to existing uses. A management plan for the areas was approved by the Minister of Industry, Tourism and Investment in 2007. It has not yet been resolved whether any hunting activities will take place within park boundaries. Because most of the CANOL trail is on federal Crown land, a land transfer agreement between the Government of Canada and the GNWT is required prior to park development (Winbourne 2017b).

The main use of the trail corridor is currently hunting, both guided trophy outfitted hunting and Sahtú Dene and Métis subsistence wildlife harvesting. Some outfitting facilities are located directly within the corridor; some camps and access activities rely on the corridor but are outside of it. The other existing commercial operation in the area is Dechenla Lodge, a naturalist's lodge located on the plateau adjacent to Macmillan Pass. Sahtú residents' use of the trail and surrounding area is for general recreation including hunting, hiking, camping, and snowmobiling. Hunting access in the southern portion of the corridor and surrounding area has typically been from the west directly along the CANOL road by truck or ATV through Macmillan Pass, from Yukon. Hunters are both Indigenous and non-Indigenous. Access for hunting from the Norman Wells area is by air and is less directly connected to the park. However, some aircraft landing sites and camp areas within the park have been used, including Dodo Lake and Linton Lake. Typically, other recreational users originate in Norman Wells and use the northern portions of the area, utilizing similar air access sites (Downie *et al.* 2007).

A resolution was put forward by Sahtú participants at the 2016 joint mountain caribou meeting that protective measures outlined in the *Doı T'oh Territorial Park and CANOL Heritage Trail Management Plan* be implemented immediately. The Tuĺıt'a Land Corp., Fort Norman Métis

Land Corp., Norman Wells Land Corp., and Tuĺıt'a District Land Corp. have been requested to consider formally supporting such interim measures, so that the working group can develop implementation mechanisms as soon as possible (Winbourne 2017b).

Existing and Proposed Parks and Protected Areas

Nahanni and Nááts'ı̨hch'oh National Park Reserves

Part of the northern mountain caribou range in the NWT is protected within Nahanni and Nááts'ı̨hch'oh national park reserves; combined, they protect 35,000km² of the south Nahanni watershed (Canadian Parks and Wilderness Society [CPAWS] 2018). Nááts'ı̨hch'oh was established as a national park late in 2014. Many Shúhtaot'ı̨ne were consulted and their knowledge used in the park's development as it is a very special area to Shúhta Dene as well as many types of fish, birds, and animals. The final park boundary left 70% of the overall mineral potential outside the park, and 44% of the calving grounds within (Nááts'ı̨hch'oh National Park Reserve [NNPR] 2018).

Shúhtaot'ı̨ne have expressed concerns that some land identified as important to caribou during park consultations – possibly even the calving grounds for northern mountain caribou – was later excluded from park boundaries. Without conservation zoning or other protection, the caribou could be impacted by mineral exploration and development activities in these areas. People are currently lobbying the relevant Sahtú organizations in an attempt to protect these additional lands (see *Proposed Indigenous Protected Area* above) (Winbourne 2017b; Simmons pers. comm. 2018).

Gu Cha Duga 'For the Grandchildren' – Kaska Dena Protected Areas and Proposed Indigenous Protected Area

The Dena Kayeh Institute has developed a Kaska Dena land use framework that includes community-based natural resource development policies, management practices, and land use zoning (Dena Kayeh Institute 2010). It is a framework intended to be used with governments and the natural resource industry sectors in collaborative management of Kaska lands and resources. Kaska land use zoning, for the area south of the Ross River area, identifies a network of Kaska protected areas, special management areas, and site-specific features with specific management approaches. The general management approach, for the southern Kaska, aims to concentrate human activities while maintaining large areas of undisturbed lands and water (*Ibid*.). Tu Łidlini elders and land stewards developed their own land use plan to protect lands from mineral development (exploration and mine development). Initially they proposed 27 polygons of land protection across the Ross River area, together with lands that would be designated as Special Operating Areas. Also, the elders insisted that the remaining land be managed by a standard set of practices developed jointly by the Yukon Government and the Ross River Dena (Barichello pers. comm. 2019).

The northern mountain caribou herds are of such significance to the Kaska Dena that the core winter ranges of all herds have been designated as Kaska protected areas both in the land use framework (Dena Kayeh Institute 2010) as well as the *Tu Łidlini Land Use Plan* drafted in 2015 (Barichello pers. comm. 2019). The land use framework also stressed that permanent roads should not be built across core winter ranges, and provided other mitigative measures for human activities in seasonal ranges (*Ibid*.).

CANOL Wire Clean-up and Remediation Project

Crown Indigenous Relations and Northern Affairs Canada (CIRNAC)'s Contaminants and Remediation Division has partnered with the GNWT's Department of Industry, Tourism and Investment to provide funding for a capacity-building and training program in the Sahtú region to address the wire that had been impacting caribou along the CANOL trail. The Dɔı T'oh Territorial Park Corporation led the wire clean-up program, which was completed in 2017. Copper-coated steel wire was cut, coiled, and securely stored at transfer locations, where it is being removed as part of remediation activities (McMillan pers. comm. 2018).

Through the three-year wire clean-up program, approximately 80 tons of wire was cleared from over 350km of the CANOL trail. A total of 55 antlers were recovered (46 caribou and 9 moose).

Although several salvage operations have been conducted, remnants of the pipeline's construction and operation remain scattered along the trail, including oil tanks, buildings and bridges in disrepair, abandoned pipeline, contaminated soil, and rusted machinery. Under the *Federal Contaminated Sites Action Plan* (FCSAP), CIRNAC has undertaken a risk management and remediation program to address the environmental and human health concerns along the corridor. In August 2017, Public Services and Procurement Canada awarded the contract for the CANOL Trail Remediation Project to Englobe Corp. on behalf of CIRNAC (*Ibid*.).

Remediation activities began in June 2018, with an expected completion date of March 31, 2020. Crews worked along the first half of the trail, from Norman Wells to Twitya River (Mile 131) early in the summer of 2018 and were transitioning to work in and around Mile 222 near the Yukon border. Work will wrap up in September for the winter and will continue until June 2019 to complete the remaining sites along the mid-trail. As part of the FCSAP procedures, CIRNAC will monitor the site once remediation is complete and ensure that remediation activities perform as planned (*Ibid*.).

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Alestine Andre	Retired, formerly Heritage Researcher, Gwich'in Tribal Council – Department of Cultural Heritage
Dr. Deborah Simmons	Executive Director, Sahtú Renewable Resources Board
Louise Reindeer	Tuĺıt'a District Land Corporation
Amy Amos	Executive Director, Gwich'in Renewable Resources Board
Darren Taylor/Alice McCulley	Director, Natural Resources Fish and Wildlife Projects and Coordinator, Tr'ondëk Hwëch'in Government, respectively
Dawna Hope	Lands and Resources Manager, First Nation of Na-cho Nyak Dun
Roxanne MacLeod	Resource Person, Gwichya Gwich'in Renewable Resources Board
Jacqueline Spies	Acting Band Manager/Manager of Community Services, Acho Dene Koe First Nation
Raymond Kaslak	Nahanni Butte Dene Band
Norman Barichello	Technical Advisor to Ross River Dena Council Traditional Knowledge Program and Lands Department, and co-owner of Dechenla Lodge with Kaska Dena Council
Megan Williams	Heritage Manager, Vuntut Gwitchin
Sue Mackenzie	Planner, Gwich'in Land Use Planning Board

Territorial Government Contacts

Nic Larter, PhD	Manager (former), Wildlife Research and Monitoring, Environment and Natural Resources – Dehcho, Fort Simpson, NT.

Federal Government Contacts

Audrey Steedman	Parks Canada Agency
Laani Uunila Faye Deon-Eggertson	Parks Canada Agency

Sarah-Lacey McMillan	Project Officer, CANOL Remediation Project, Contaminants and Remediation Division, NWT Region, Crown-Indigenous Relations and Northern Affairs Canada

Other Species Experts

Jim Lancaster	Nahanni Butte Outfitters Ltd. and NWT Outfitters Ltd.
Werner Aschbacher	South Nahanni Outfitters Ltd.
Harold Grinde	Gana River Outfitters Ltd.
Tavis Molnar	Arctic Red River Outfitters Ltd.
Stan Stevens	Mackenzie Mountain Outfitters (1978) Ltd.
Dr. Jean Polfus	Postdoctoral Fellow, Trent University
Trevor Lantz	Associate Professor, Arctic Landscape Ecology Lab, University of Victoria

BIOGRAPHY OF PREPARERS

The research and information compilation undertaken for the ***Species Status Report for Northern Mountain Caribou (Woodland Caribou [Northern Mountain Population]) in the Northwest Territories: Traditional and Community Knowledge Component*** was conducted by a team made up of Janet Winbourne and Kristi Benson. Ms. Benson and Ms. Winbourne have extensive experience assessing published and unpublished TK/CK for appropriate quality in methodology and reporting, including ethical considerations. They are familiar with TK/CK protocols and procedures, and have advised on those protocols in the NWT, including recommendations to the Species at Risk Committee. They have been working together since 2004 and have previously prepared TK/CK components for five species status reports in the NWT, including muskoxen, wolverine, woodland caribou (boreal ecotype), Dolphin and Union caribou, and wood bison. Further details on each team member are included below.

Janet Winbourne B.Sc., M.E.S., R.P.Bio., Ethnobiologist was the primary contact for the contract authority and functioned as the project manager and lead author for this work. Ms. Winbourne has led or collaboratively-led similar TK/CK research and documentation teams for numerous projects throughout coastal BC and the NWT, including the TK/CK species status report work mentioned above. She has extensive expertise in TK/CK, and provided input in revising the Species at Risk Committee's TK/CK status report guidelines in 2014, and advised on the inclusion of TK/CK in three caribou conservation planning projects in the NWT in the last five years.

Ms. Winbourne has an academic background in biology and environmental studies, specializing in Indigenous peoples and resources. She is a registered professional biologist and has 20+ years of experience researching and documenting TK/CK in arctic, sub-arctic, and coastal environments. From 2013-2018 she worked as the Technical Writer/Traditional and Community Knowledge Expert for the Advisory Committee for Cooperation on Wildlife Management, where her main task was to ensure that TK/CK was satisfactorily represented in ***Taking Care of Caribou: the Cape Bathurst, Bluenose-West and Bluenose-East Barren-Ground Caribou Herds Management Plan***. She was also the lead author on ***We have been Living with the Caribou all our Lives*** – a report on information recorded during community engagements for the Plan.

Since 2014, Ms. Winbourne has been participating in cross-regional, community-led conservation planning for caribou in the Mackenzie Mountains, and last year co-authored the ***Nío Nę P'ęnę́ Begháré Shúhta Goʔepę́ Nareh?á – Trails of the Mountain Caribou Management Plan*** along with representatives of the Tu Łidlini (Ross River) Dena, Shúhtaot'ı̨nę, and Métis. She has attended several community meetings and workshops focusing on mountain caribou in the NWT and Yukon as part of this work, and has been compiling and using TK/CK on this topic in

reporting and promotional materials associated with the project. She has a strong familiarity with TK/CK about this population of caribou as a result of this work.

Kristi Benson, B.A., M.A. Heritage Specialist identified sources of information, including published literature and unpublished literature. She also identified additional knowledgeable individuals and agency contacts. She led the work to identify and search available bibliographic, research licence, and other relevant databases, as well as any outreach and information compilation undertaken in the Gwich'in Settlement Area. Ms. Benson co-authored report drafts with Ms. Winbourne.

Ms. Benson has over 15 years of experience in conducting anthropological, oral history, traditional knowledge, archaeological, heritage policy, Geographic Information System, and other culture/heritage projects. Her experience in the heritage field has taken place primarily in the NWT, focusing on the western Arctic, but she has worked across Canada. Ms. Benson has acted as research manager for numerous projects specifically relating to species at risk. As noted above, she has worked collaboratively with Ms. Winbourne on several species status reports (TK/CK component), as well as numerous other projects. Ms. Benson also conducted research, prepared relevant reports, and managed the review process (including verification sessions) for numerous research projects with the Gwich'in Social and Cultural Institute/Department of Cultural Heritage, including the *Gwich'in Traditional Knowledge of the Rat River Char* study, the *Gwich'in Traditional Knowledge of Boreal Woodland Caribou* study, *Barren Ground Caribou Herd Delineation*, Gwich'in traditional knowledge about swallows, *Gwich'in Knowledge of Grizzly Bears*, *Gwich'in Traditional Knowledge: Nèhtrùh (Wolverine)*, *Gwich'in Traditional Knowledge of Bluenose West Caribou*, and *Gwich'in Knowledge of Insects*. Ms. Benson has conducted numerous studies with the Gwich'in Social and Cultural Institute since her first association with them in 2004. She has also worked with the Inuvialuit and in the Sahtú, and works with scientists and communities across the NWT through various contracts with the Aurora Research Institute.

SCIENTIFIC KNOWLEDGE COMPONENT

Species Overview

Names and Classification

Scientific Name:	*Rangifer tarandus* (Bradley *et al*. 2014)
Common Name (English):	Northern mountain caribou
Common Name (French):	Caribou des bois (population des montagnes du nord)
Populations/subpopulations:	Bonnet Plume, Redstone, Tay River, South Nahanni, Coal River, La Biche
Synonyms:	Caribou, woodland caribou (northern mountain population)
Class:	Mammalia
Order:	Artiodactyla
Family:	Cervidae, deer
Life Form:	Animal, vertebrate, mammal, deer, caribou

Systematic/Taxonomic Clarifications

All caribou and reindeer in the world belong to one species, *Rangifer tarandus*. In Canada, Banfield (1961) classified caribou into four extant subspecies, including the "woodland caribou" (*R.t. caribou*), of which northern mountain caribou were considered a part, based on skull measurements, pelage, hoof shape, and antler shape. The Committee on the Status of Endangered Wildlife in Canada [COSEWIC] (2011) concluded that Banfield's subspecies classification was out-of-date with respect to current science and defined 12 Designatable Units (DUs) in Canada. DUs are 'discrete and evolutionarily significant units of a taxonomic species' (COSEWIC 2013) and for caribou are based on information on phylogenetics (evolutionary lineage), genetic diversity and structure, morphology, movements, behaviour and life history strategies, and distribution (COSEWIC 2011). Caribou in this report are referred to as 'northern mountain caribou' and are part of the Northern Mountain DU (DU7; COSEWIC 2014) (see Figure 17 in *NWT Distribution*).

Description

Northern mountain caribou are medium-sized members of the deer family. Their colour can vary throughout the year and among individuals, but caribou are generally dark (tawny to dark brown) on their backs, sides, legs, and heads, with white on the neck, mane, snout, and on the

rump just under the tail. Caribou are unique within the deer family in that both males and females grow antlers. Males have larger antlers than females and shed their antlers after the breeding season, while females generally shed their antlers after calving. Northern mountain caribou in the northern portion of the Mackenzie Mountains are smaller than their counterparts in the southern portion of the mountains. In the north, adult females weigh about 115 kilograms (kg) and stand about 115 centimeters (cm) at the shoulder, and adult males weigh about 150 kg and stand about 125 cm at the shoulder (Collin 1983; Farnell and Russell 1984). Adult females in the Nahanni area in the south weigh about 125 kg and stand about 127 cm at the shoulder (Gullickson and Manseau 2000; Hegel *et al.* 2016). Northern mountain caribou in the northern portion of the Mackenzie Mountains are larger than the neighbouring Porcupine barren-ground caribou population (Farnell and Russell 1984).

Distribution

Continental Distribution

Northern mountain caribou (DU7) are almost exclusively found in western Canada in British Columbia (BC), the Northwest Territories (NWT), and Yukon, with a small portion of the range overlapping eastern Alaska. The Boreal DU (DU6) lies adjacent to the east and northeast, and the Barren-ground DU (DU3) lies adjacent to the north and partially overlaps the northwestern-most portion of northern mountain caribou distribution (see Figure 17 in *NWT Distribution*).

NWT Distribution

In the NWT, northern mountain caribou are distributed across six ranges in the western part of the territory in the Mackenzie Mountains area (Figure 18). The six ranges include the Bonnet Plume, Redstone, Tay River, South Nahanni, Coal River, and La Biche, all of which overlap both the NWT and Yukon. Distribution of northern mountain caribou in the NWT is continuous, with adjacent ranges overlapping each other. Although the Coal River and La Biche subpopulations' winter ranges overlap, they are considered separate subpopulations based on spatial separation during multiple seasons (Weaver 2008). The NWT distribution of northern mountain caribou is also continuous with other northern mountain caribou subpopulation ranges in Yukon, including Hart River and Finlayson (see Figure 17). Northern mountain caribou are found throughout their ranges, but the higher elevation portions of their ranges along the NWT/Yukon border tend to be occupied more during summer than winter.

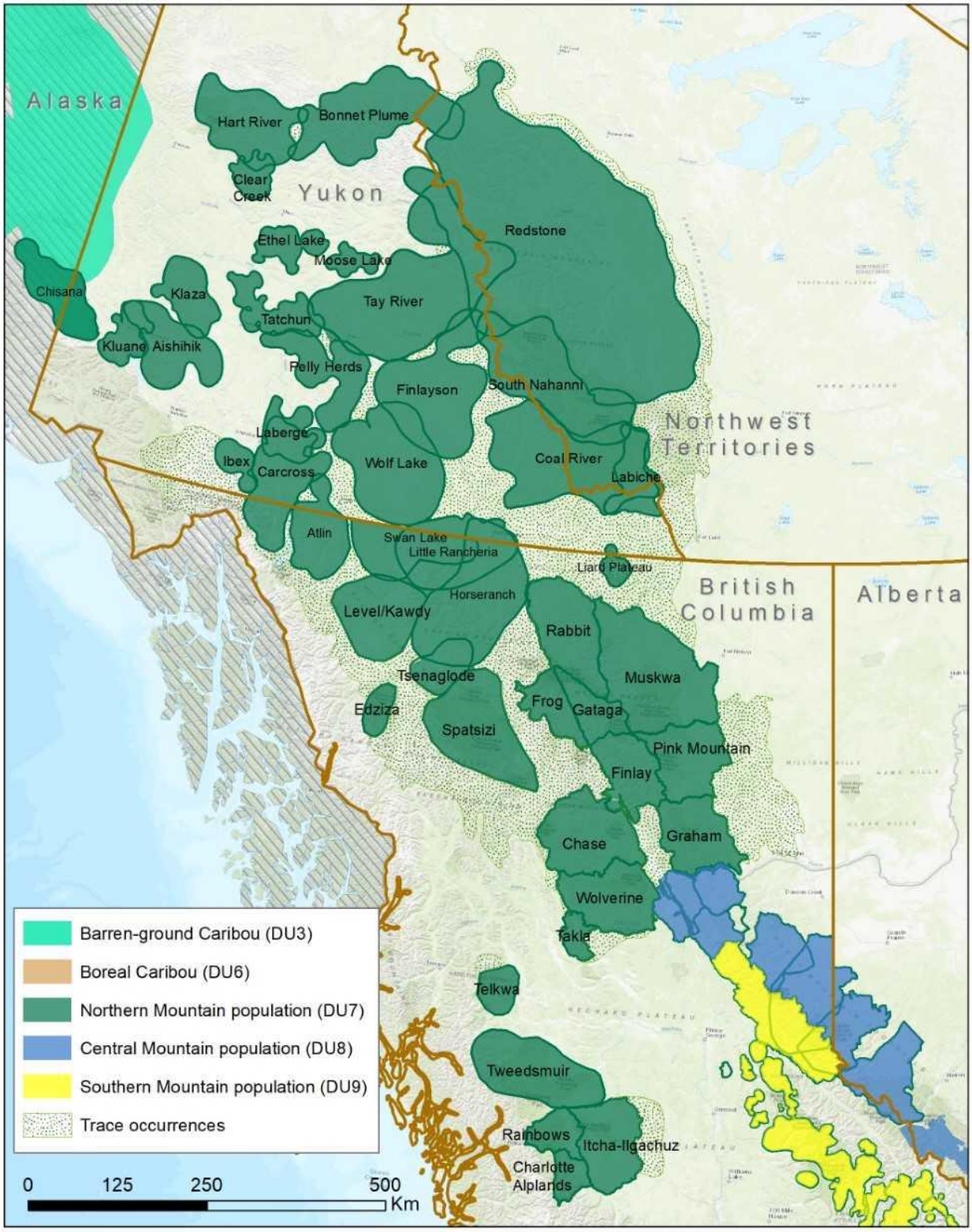

Figure 17. Distribution of northern mountain caribou subpopulations in North America. DUs in map legend refer to COSEWIC's Designatable Units for caribou (COSEWIC 2011). Caribou in this report are part of DU7, Northern Mountain population (COSEWIC 2014). Caribou range data from the Government of the Northwest Territories

[GNWT] (R. Gau, N. Larter, R. Popko), Government of Alberta (L. Neufeld, D. Hervieux, D. Cichowski), Government of BC (D. Seip, T.M. Williams), and Government of Yukon (T. Hegel, K. Russell). National distribution from Environment and Natural Resources [ENR] (2014). Map courtesy B. Fournier, ENR.

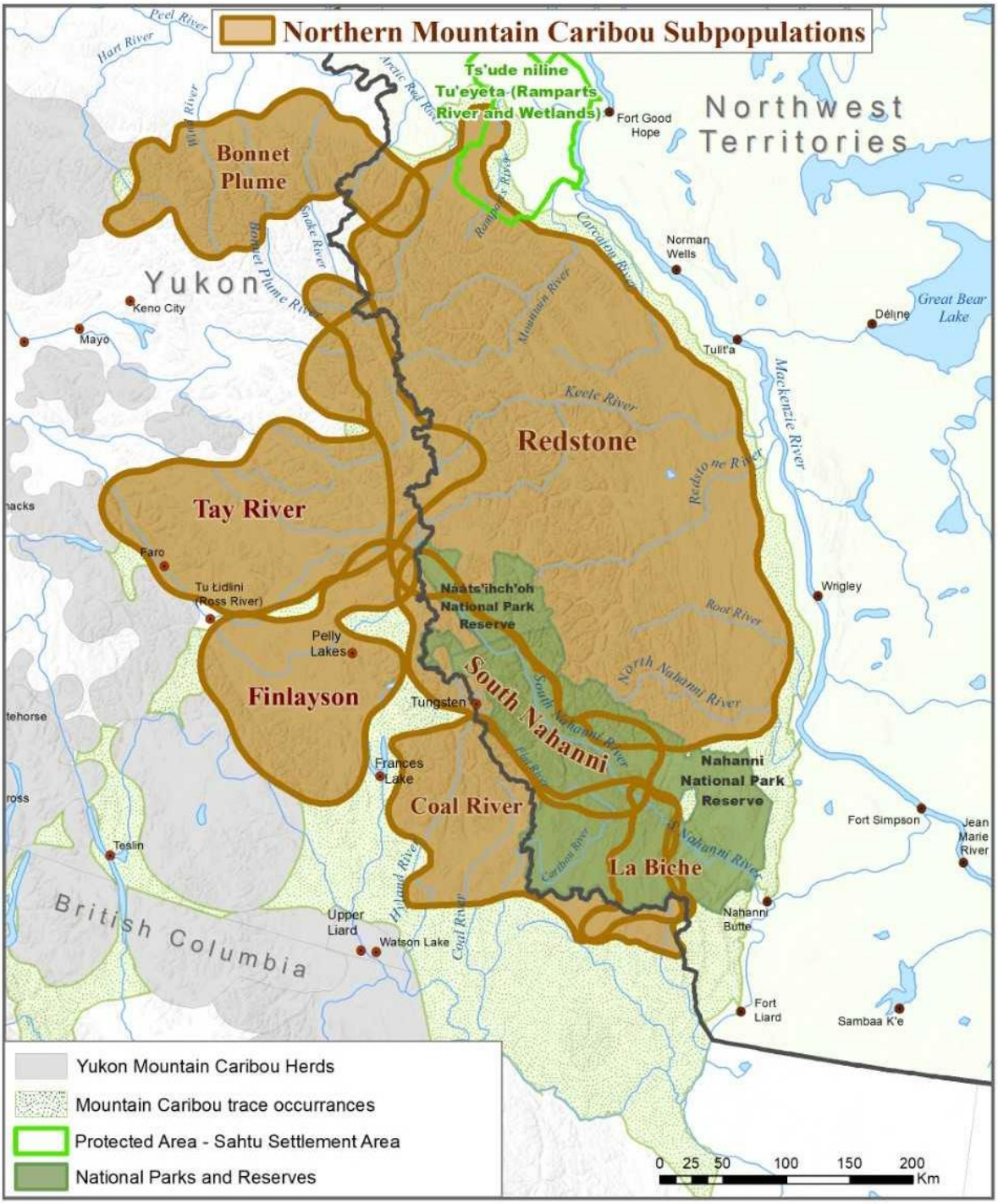

Figure 18. Distribution of northern mountain caribou in the NWT. Caribou range data from GNWT (R. Gau, N. Larter, R. Popko), Government of Alberta (L. Neufeld, D. Hervieux, D. Cichowski), Government of BC (D. Seip, T.M. Williams), and Government of Yukon (T. Hegel, K. Russell). Map courtesy B. Fournier, ENR.

The Species at Risk Committee (SARC) defines the 'extent of occurrence' as 'the area included in a polygon without concave angles that encompasses the geographic distribution of all known populations of a species' (SARC 2015). The extent of occurrence for northern mountain caribou in the NWT is about 150,500 square kilometres (km^2) (clipped to the NWT border), and was calculated based on a minimum convex polygon drawn around the total combined area of northern mountain caribou subpopulation ranges within the NWT.

'Area of occupancy' is defined as 'the area within 'extent of occurrence' that is occupied by a species, excluding cases of vagrancy' (SARC 2015). The area of occupancy for northern mountain caribou in the NWT is about 119,000 km^2, and was calculated as the total combined area of northern mountain caribou subpopulation ranges within the NWT. The 'index of area of occupancy' (IAO) is a measure that aims to provide an estimate of area of occupancy that is not dependent on scale. The IAO is measured as the surface area of 2 km x 2 km grid cells that intersect the actual area occupied by the wildlife species (i.e., the biological area of occupancy) (SARC 2015). The IAO for northern mountain caribou in the NWT is about 122,000 km^2.

Locations of 10 adult female caribou radio-collared in the Redstone range in the early 2000s suggest that there may potentially be three groups within the Redstone range: two migratory groups in the western portion of the range with one centered around the Mountain River in the north and the other centered around the Redstone River in the south, and one relatively sedentary group in the Carcajou River area (Figure 19; ENR unpubl. data)[22]. Letts *et al*. (2012) found that there were no distinct genetic clusters among caribou sampled in the Redstone subpopulation, suggesting that it likely functions as one large diverse subpopulation. However, it is unclear whether the caribou sampled included individuals from all three groups. The potential groupings of caribou in the Redstone range are based on only 10 radio-collared caribou, which is less than 0.1% of the subpopulation. Based on the small sample size of radio-collared caribou and the genetic information available, there is not enough evidence at this time to confidently conclude that these groupings are three separate subpopulations.

[22] In Collin (1983), Olsen (2002), and Creighton (2006), the area that includes the sedentary group in the Carcajou River area and the migratory group in the Mountain River area is referred to as the Carcajou River range, and the area that includes the migratory group in the Redstone River area is referred to as the Moose Horn River range.

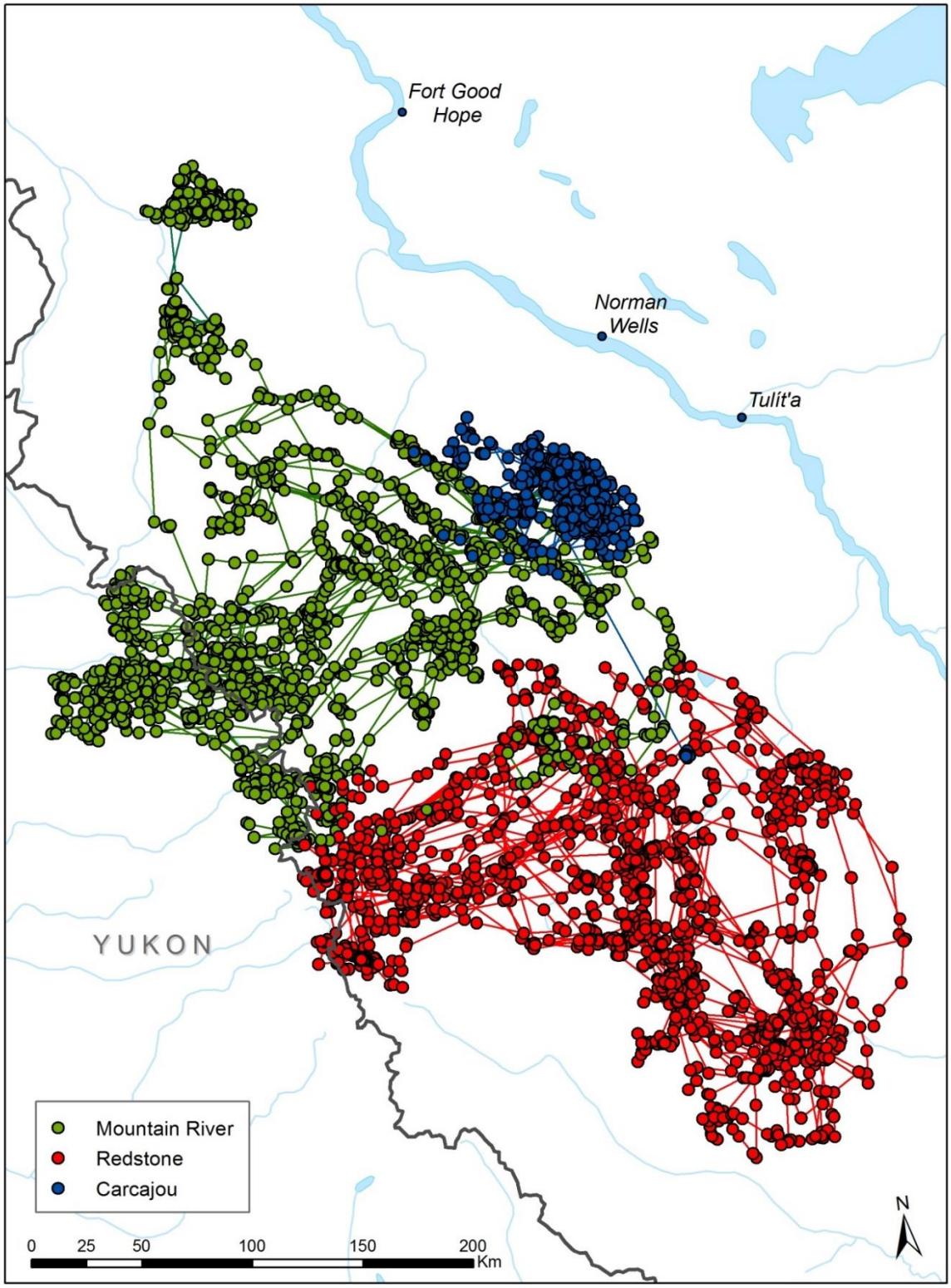

Figure 19. Distribution of locations of Geographic Positioning System (GPS) collared caribou in the Redstone range 2002-2005 (ENR unpubl. data). As noted in the text above, the separation into three groups is based on 10 radio-collared Redstone caribou, which is less than 0.1% of the subpopulation. There is not enough evidence at this time to confidently conclude that these groupings are three separate subpopulations.

Preliminary information from caribou recently radio-collared in and around the Prairie Creek area in Nahanni National Park Reserve in February 2015 and December 2015 suggest that there potentially may be relatively sedentary groups of caribou in the Prairie Creek area and the area to the east, and that movements of other caribou may be most consistent with Redstone caribou (Tate 2016; Parks Canada 2017a). However, this is based on only one year of data from 18 radio-collared caribou. The Prairie Creek area and the area to the east do not fall within any of the currently delineated ranges, and lie closest to the Coal River and La Biche ranges.

Recent information from radio-collared studies in Yukon has resulted in expansion of the Tay River caribou range into the NWT (Environment Yukon unpubl. data 2018a). The revision to the range boundary is believed to be due to better available information based on satellite radio-collared caribou, rather than to an actual range expansion (Russell and Russell pers. comm. 2018). The current Tay River range boundary, as shown in Figures 17 and 18, is an interim boundary; Environment Yukon expects further boundary revisions based on additional caribou that were radio-collared in winter 2018/19.

Currently delineated ranges and preliminary information from caribou recently collared with satellite GPS radio-collars suggest that the area along the NWT/Yukon border from Howard's Pass north to the headwaters of the Bonnet Plume River is an area of overlap between several subpopulation ranges.

Location(s)

SARC defines 'location' as 'a geographically or ecologically distinct area in which a single threatening event can rapidly affect all individuals of the species present. The size of the location depends on the area covered by the threatening event and may include part of one or many subpopulations. Where a species is affected by more than one threatening event, location should be defined by considering the most serious plausible threat (SARC 2015). Northern mountain caribou subpopulations in the NWT are widely distributed over large ranges during summer and use multiple wintering areas across their ranges during winter. The most serious plausible threats to northern mountain caribou in the NWT are predation, hunting, industrial activities and associated road access, and climate change. Because northern mountain caribou are widely dispersed throughout most of the year, and not enough information is available on areas where they concentrate, the number of locations cannot be determined at this time.

Search Effort

Distribution of northern mountain caribou in the NWT is based on aerial surveys and radio-collared caribou studies. Prior to the mid-1990s, northern mountain caribou distribution for NWT ranges was largely based on periodic aerial surveys that covered portions of ranges (e.g., Simmons 1969a, 1970a; Farnell and Nette 1981; Lortie 1982; Farnell and Russell 1984). In April 1980 and 1981, 25 caribou (21 females, 4 males) from the Bonnet Plume subpopulation were

captured in Yukon and fitted with very high frequency (VHF) radio-collars (Farnell and Russell 1984). The radio-collared caribou locations from 18 radio-telemetry flights were combined with distribution surveys in March 1980, 1981, 1982, and July 1980 to determine distribution of the Bonnet Plume subpopulation (Farnell and Russell 1984). In July 1981, six female caribou were fitted with radio-collars in the Macmillan Pass area, and subsequent radio-telemetry flights confirmed the caribou using the Macmillan Pass area were part of the Redstone subpopulation (Farnell and Nette 1981). Current distribution of Redstone caribou is based on locations of 10 satellite GPS-collared caribou from the early 2000s (ENR unpubl. data). Current distribution of South Nahanni, Coal River, and La Biche caribou is based on a combination of locations of VHF collars from the late 1990s and satellite GPS radio-collars from the early 2000s (Gullickson and Manseau 2000; Weaver 2006, 2008). The current interim distribution of the Tay River subpopulation is based on recent locations from satellite GPS radio-collars (Environment Yukon unpubl. data 2018a).

Although the total distribution of northern mountain caribou in the NWT is likely mostly represented by the current combined subpopulation ranges, further refinement of subpopulation range boundaries and subpopulation structure is needed. For the Bonnet Plume subpopulation, the current range boundary is based on limited VHF radio-collared caribou data from the 1980s and periodic aerial surveys. Data from those radio-collared caribou suggests that Bonnet Plume caribou use the portion of their range within the NWT primarily during winter; however, caribou in that study were all radio-collared in Yukon (Farnell and Russell 1984). Shaw and Benn (2001) counted over 500 caribou between the Cranswick and Ramparts rivers in September 2000. The current range map shows the Ramparts River area in the Redstone range, the headwaters of the Arctic Red River in an area of overlap between the Bonnet Plume and Redstone ranges, and the Cranswick River area in the Bonnet Plume range. One of the 10 radio-collared caribou in the Redstone subpopulation used the area around the headwaters of the Ramparts River in summer/fall (Creighton 2006). Further studies (e.g., using satellite radio-collars) would help verify whether caribou that use the northern portion of northern mountain caribou range in the NWT in late summer belong to the Bonnet Plume or Redstone subpopulations, or to a yet unidentified subpopulation. Additional satellite radio-collared caribou information currently being collected for the Tay River subpopulation could result in a further re-alignment of the Tay River range in the NWT. For the Redstone subpopulation, information from 10 satellite radio-collars suggests that the subpopulation possibly could be split into three groups: two migratory groups and one sedentary group (see Figure 19). However, given the small sample of 10, which represents 0.1% of the total estimated population, there is not enough evidence to confidently conclude that these groupings are three separate subpopulations, and there could potentially be additional groups that have not been identified. This knowledge gap is especially important when considering sedentary groups, which are more vulnerable to localized threats. Recent satellite radio-collared caribou data in the Nahanni area

suggests that there also potentially may be sedentary groups in that area, and that northern mountain caribou are found in areas further east beyond currently defined range boundaries. Additional radio-collared caribou and genetic information is needed to verify whether suggested groupings can be considered as separate subpopulations, and whether portions of currently defined subpopulations are sedentary.

Biology and Behaviour

Habitat Requirements

The text below describes seasonal range use by subpopulation. A summary of this discussion is included in Table 4, at the end of this subsection.

During winter, northern mountain caribou in the NWT primarily use open spruce forests in valley bottoms where they forage primarily for terrestrial lichens (Simmons 1970a; Lortie 1982; Farnell and Russell 1984; Gullickson and Manseau 2000; Weaver 2006, 2008; O'Donoghue 2013). Other winter forage includes horsetails, graminoids, evergreen shrubs, and forbs (Farnell and Russell 1984; Gullickson and Manseau 2000).

In the Bonnet Plume range, the primary wintering area in the NWT is the Arctic Red River/Cranswick River area (Simmons 1969a; Lortie 1982; Farnell and Russell 1984; Popko 2006 *in* Canadian Wildlife Service [CWS] 2007). During a deep snow winter, the foothills in the Arctic Red River area had relatively shallow snow and were heavily used by caribou (Farnell and Russell 1984). The foothills region in the Ramparts River area has also been identified as important wintering habitat (Popko 2006 *in* CWS 2007; Wilson and Haas 2012).

In the Redstone range, core wintering areas include the north and south Redstone-Keele-Twitya-Ekwi rivers areas, the Wrigley (Drum) Lake area, the Little Keele-Carcajou rivers area, and the headwaters off the North Nahanni and Root rivers and off Thundercloud Creek (Simmons 1970a; Archibald 1974 *in* Farnell and Nette 1981; Olsen *et al*. 2001; Weaver 2006; Creighton 2006). Caribou also use mineral licks primarily in the Keele, Mountain, and Redstone drainages during winter (Lortie 1982).

In the South Nahanni range, core wintering areas include the montane/lowland sections of Clearwater Creek, Cathedral Creek, South Nahanni River valley, the Swan Lakes area, and the west side of the South Nahanni River in the Dolf Mountain area (Gullickson and Manseau 2000; Weaver 2006). The southern boundary of the winter range for this subpopulation appears to be the Flat River (Weaver 2006).

The core winter range for the Coal River and La Biche subpopulations is the lower South Nahanni River, with the Coal River caribou focusing their activities in the western area near the confluence with the Flat River, and the La Biche caribou focusing their activities in the eastern

portion of the area around the confluence with the Mary River (Weaver 2006, 2008). During some low snow winters, some La Biche caribou remain at high elevations in alpine or subalpine habitat along the NWT/Yukon border or in Yukon (Weaver 2006, 2008).

There is also an increasing body of information (survey, radio-collared caribou, and remote camera data) indicating that caribou winter in the Prairie Creek area and the area to the east, and close to the NWT/Yukon border in the area along the Howard's Pass Access Road (Weaver 2006; Churchill 2007; Farnell 2013; Tate 2016; Parks Canada 2017a; Parks Canada unpubl. data 2018). In addition, about 50 caribou were observed in the Little Nahanni River area (in the area now around kilometer 20 on the Howard's Pass Access Road) during a survey in early to mid-March 1969, prior to construction of the road (Simmons 1969a).

Although caribou move between summer and winter ranges, individual caribou do not necessarily return to the same wintering areas each year (Farnell and Russell 1984). Fidelity to wintering areas varies among individuals within subpopulations, and may also be influenced by snow accumulation, as demonstrated by La Biche caribou (Weaver 2006, 2008). Caribou in the South Nahanni range show strong fidelity to their late winter range (Gullickson and Manseau 2000).

Low elevation winter ranges of the Redstone, South Nahanni, Coal River, and La Biche subpopulations are found exclusively in the NWT.

During spring migration, caribou generally use low elevation valley bottoms for travelling where snow accumulation is presumably lower than at high elevations, and move fairly quickly on their way to calving areas (Gullickson and Manseau 2000; Creighton 2006; Weaver 2006, 2008). In the Bonnet Plume range, caribou were found to use alpine and windswept tundra habitats during late March and April and those that wintered in the NWT moved in a westerly direction along the relatively snow-free area on the northern flank of the Wernecke Mountains (Farnell and Russell 1984). Migrating caribou in the Bonnet Plume range form groups of up to 300 animals (Farnell and Russell 1984). In the Redstone range, caribou move west and northwest from winter ranges to calving areas, and spring migration routes include the Arctic Red, Mountain, Twitya, Ravens Throat, Silverberry, Moose Horn, Keele, and Natla rivers (Archibald 1974 *in* Farnell and Nette 1981; Creighton 2006; Weaver 2006). During some years, Redstone caribou have started moving west in mid-March (Simmons 1969a). The primary spring migration route for South Nahanni caribou follows the South Nahanni river up to higher elevations in the Mackenzie Mountains, although some caribou do not migrate far and remain near their winter range (Gullickson and Manseau 2000; Weaver 2006). During spring migration, Coal River caribou move in a westerly direction along a variety of low elevation routes, many of which converge in the Caribou Pass area to cross the territorial divide into Yukon (Weaver 2008). La Biche caribou move in a southerly direction during spring migration, initially up May Creek

and then over to and up the three main branches of the Meilleur River to mountains along the NWT/Yukon border (Weaver 2008).

During calving, females are highly dispersed in mountains and female caribou display some fidelity to previous calving locations (Farnell and Russell 1984; Gullickson and Manseau 2000; Weaver 2008). Dispersal in mountains is an anti-predator strategy where caribou forgo forage quality at lower elevations to calve in areas where predation risk is lower (Bergerud *et al.* 1984). Therefore, during calving, caribou require undisturbed areas where they can distance themselves from other prey and predators. In the Bonnet Plume range, only one radio-collared caribou calved in the NWT at the headwaters of the Cranswick River; however, all radio-collared caribou in that study were captured in Yukon in April or July (Farnell and Russell 1984), so calving/summer distribution in the NWT may not be represented by that radio-collared caribou sample. Caribou have been reported to summer in the mountains at the headwaters of the Arctic Red River by Arctic Red River Outfitters (Shaw and Benn 2001); however, there is no technical information on use of the NWT portion of the Bonnet Plume range during calving. Bonnet Plume caribou that calved in Yukon were found primarily at high elevations in very steep confined side valleys and cirque basins (Farnell and Russell 1984). In the other subpopulation ranges, most calving occurs in the NWT/Yukon border area of the Mackenzie Mountains (Farnell and Nette 1981; Gullickson and Manseau 2000; Creighton 2006; Weaver 2006, 2008; ENR unpubl. data). For the Redstone subpopulation, caribou calve as far northwest as the area west of Einarson Lake in Yukon, and additional calving grounds are also found in the headwaters of the Keele, Natla, Tsichu, and Caribou Cry rivers, the headwaters of the South Nahanni River (also known as the Moose Ponds), and in the Carcajou Lake area (Farnell and Nette 1981; Kershaw and Kershaw 1982a, 1983; Creighton 2006; Weaver 2006; ENR unpubl. data). Most caribou in the South Nahanni range calve in the area between the upper reaches of the South Nahanni River and the NWT/Yukon border, although some caribou also calve in the southern part of the Ragged Range, the south end of Mount Hamilton Gault, and the Swan Lakes area (Gullickson and Manseau 2000; Weaver 2006). Habitats used during calving include subalpine open woodland, spruce-lichen woodland, subalpine shrubland, and alpine (Weaver 2006). In the Coal River range, calving caribou are highly dispersed on mountain plateaus in the Coal River and Hyland River watersheds in Yukon (Weaver 2008). During calving, La Biche caribou concentrate on mountain plateaus at the head of the La Biche River and Whitefish River basins in Yukon (Weaver 2008). Coal River and La Biche caribou demonstrated high fidelity to calving areas and were found most frequently in open spruce forests near treeline and in rocky alpine (Weaver 2008). Some caribou are also found in the Prairie Creek area and the area to the east during calving (Parks Canada 2017a).

By mid-June, female caribou and calves group up into post-calving aggregations (Collin 1983; Gullickson and Manseau 2000). By late June, post-calving aggregations break up into smaller

groups (Ion and Kershaw 1989). Bulls appear to move to calving/summer ranges later than females (Ion 1986). During summer, caribou move to more open habitats at higher elevations and use snow patches to avoid insects (Gill 1978, Kershaw and Kershaw 1982a, 1983; Collin 1983; Ion and Kershaw 1989; Gullickson and Manseau 2000; Creighton 2006; Weaver 2008). By mid-August, snow patches are generally restricted to higher elevations and occur primarily on north, northeast, or east aspects (Ion and Kershaw 1989). In the Macmillan Pass area, snow patches only persisted to mid-August at elevations >1,750 metres (m) (Ion and Kershaw 1989). Snow patch use is more pronounced during warmer days and during mid-day (Ion and Kershaw 1989). Caribou move out of valleys (<1,700 m) and onto snow patches at higher elevations (>2,000 m) by mid-morning and then descend again in late afternoon or early evening (Ion and Kershaw 1989). This pattern occurs primarily on warm, sunny days with low wind speeds (Ion and Kershaw 1989). For the Redstone subpopulation, many caribou move east during summer and by the rut, are generally found in areas closer to their winter ranges (Creighton 2006; Weaver 2006; Parks Canada 2017a). In the northern part of the Redstone range and in the Bonnet Plume range, caribou use the areas between Cranswick Creek near the NWT/Yukon border and the Ramparts River during late summer (Shaw and Benn 2001). For South Nahanni, Coal River, and La Biche subpopulations, post-calving, summer, and rutting areas are generally similar to calving ranges, except some caribou move short distances from post-calving/summer areas to rutting areas (Gullickson and Manseau 2000; Weaver 2006, 2008). All three subpopulations show strong fidelity to rutting areas, and the Coal River and La Biche subpopulations also show strong fidelity to summering areas (Gullickson and Manseau 2000; Weaver 2006, 2008). For the South Nahanni, Coal River, and La Biche subpopulations, fall migration routes were similar to spring migration routes except that caribou did not appear to be limited by snow and used higher elevation habitats than during spring migration (Weaver 2006, 2008). Some caribou are also found in the Prairie Creek area and the area to the east during summer and fall (Parks Canada 2017a).

Table 4. Summary of seasonal range use by subpopulation, as described in the preceding text. Spatial descriptions for much of this seasonal range use are not currently available and have therefore not been mapped.

Subpopulation	Spring (calving)	Summer	Fall (rut)	Winter	Migration
Bonnet Plume	Calving/summer distribution may not be represented by radio-collared sample.	Reported in the mountains at the headwaters of the Arctic Red River. Use areas between Cranswick Creek near the NWT/Yukon border and the Ramparts River.	None noted in text.	Arctic Red River/ Cranswick River area (primary wintering area in the NWT). The foothills region in the Ramparts River area (important wintering habitat).	Those that winter in the NWT – movement in westerly direction along northern flank of Wernecke Mountains.
Redstone	Calving as far northwest as area west of Einarson Lake in Yukon. Additional calving grounds: headwaters of the Keele, Natla, Tsichu, Caribou Cry, and South Nahanni rivers, and in the Carcajou Lake area.	Move east during summer and by the rut, are generally found in areas closer to their winter ranges.	None noted in text.	Core wintering areas: north and south Redstone-Keele-Twitya rivers areas, the Wrigley (Drum) Lake area, and the headwaters off the North Nahanni and Root rivers and off Thundercloud Creek. Use mineral licks primarily in the Keele, Mountain, and Redstone drainages.	Move west and northwest from winter ranges to calving areas. Spring migration routes include the Arctic Red, Mountain, Twitya, Ravens Throat, Silverberry, Moose Horn, Keele, and Natla rivers.
South Nahanni	Most calve between the upper reaches of the South Nahanni	Post-calving, summer, and rutting areas are generally similar to calving ranges, except some caribou move short distances		Core wintering areas: montane/ lowland sections of Clearwater	Primary spring migration route follows the South Nahanni River up to

Subpopulation	Spring (calving)	Summer	Fall (rut)	Winter	Migration
	River and the NWT/Yukon border. Some calve in southern part of Ragged Range, the south end of Mount Hamilton Gault, and the Swan Lakes area.	from post-calving/ summer areas to rutting areas.		Creek, Cathedral Creek, South Nahanni River valley, the Swan Lakes area, and the west side of the South Nahanni River in the Dolf Mountain area. Southern boundary of winter range appears to be the Flat River.	higher elevations in the Mackenzie Mountains. Fall migration routes similar to spring, except that caribou did not appear to be limited by snow and used higher elevation habitats.
Coal River	Calving caribou are highly dispersed on mountain plateaus in the Coal River and Hyland River watersheds in Yukon.	Post-calving, summer, and rutting areas are generally similar to calving ranges, except some caribou move short distances from post-calving/ summer areas to rutting areas.		Core winter range in lower South Nahanni River, focusing their activities in the western area near the confluence with the Flat River.	During spring migration, movement in a westerly direction along a variety of low elevation routes, many of which converge in the Caribou Pass area to cross the NWT/Yukon border. Fall migration routes similar to spring, except that caribou did not appear to be limited by snow and used higher elevation habitats.
La Biche	During calving, caribou concentrate on mountain plateaus at the head of the La Biche River and	Post-calving, summer, and rutting areas are generally similar to calving ranges, except some caribou move short distances from post-calving/ summer areas to rutting areas.		Core winter range in lower South Nahanni River, focusing their activities in the eastern portion of the	Move in a southerly direction during spring migration, initially up May Creek and then over to and up the three main

Subpopulation	Spring (calving)	Summer	Fall (rut)	Winter	Migration
	Whitefish River basins in Yukon.			confluence with the Mary River. During some low snow winters, some remain at high elevations in alpine or subalpine habitat along the NWT/ Yukon border or in Yukon.	branches of the Meilleur River to mountains along the NWT/Yukon border. Fall migration routes similar to spring, except that caribou did not appear to be limited by snow and used higher elevation habitats.
Subpopulation not specified	Some caribou are also found in the Prairie Creek area and the area to the east during calving, summer, fall, and winter. There is also evidence that caribou winter close to the NWT/Yukon border in the area along the Howard's Pass Access Road. About 50 caribou were observed in the Little Nahanni River area (km 20 on the Howard's Pass Access Road) during a survey in early to mid-March 1969, prior to construction of the road.				n/a

Movements

Most northern mountain caribou in the NWT undergo long distance migrations and can travel up to 250 km between winter and summer ranges, while some individuals remain close to their winter ranges all year round (Gullickson and Manseau 2000; Creighton 2006; Weaver 2006, 2008; Parks Canada 2017a). Movement rates during spring migration average 4.8, 4.7, and 3.7 km/day for the Redstone, Coal River, and La Biche subpopulations respectively (Weaver 2008; Nagy 2011). Sedentary groups have been identified in the Carcajou Lake area in the Redstone range, and between the South Nahanni and Flat rivers in the South Nahanni range (Gullickson and Manseau 2000; Weaver 2006; ENR unpubl. data). There may also be sedentary caribou in the Prairie Creek area and the area adjacent to the east; a single caribou radio-collared in the Prairie Creek area remained relatively sedentary for one year, but the subpopulation this caribou was associated with could not be determined (Tate 2016; Parks Canada 2017a).

Movement behaviour varies slightly among subpopulations. In the Redstone range, some caribou in the Redstone River area start moving west towards calving areas by mid-March during some years (Simmons 1969a), but the bulk of spring migration occurs from mid-April to mid-May (Creighton 2006; Nagy 2011). After remaining relatively sedentary during calving in late-May/early-June, movement rates increase again in late June/July with many caribou starting to move in an easterly direction to summering areas that are closer to winter ranges (Creighton 2006; Nagy 2011; Parks Canada 2017a). Movement rates increase again in late September/early October prior to the rut and then again post-rut as they continue on to winter ranges (Creighton 2006; Nagy 2011; Parks Canada 2017a). In the South Nahanni, Coal River, and La Biche ranges, caribou migrate between winter ranges and calving ranges from mid-April to mid-May, then most caribou remain in the areas near calving ranges throughout the summer and fall, before moving back to winter ranges after the rut (Gullickson and Manseau 2000; Weaver 2006, 2008).

Life Cycle and Reproduction

The breeding season for caribou in the NWT occurs in October, with the southern subpopulations breeding in late September/early October and the Redstone subpopulation breeding in mid-late October (Table 5; Weaver 2006, 2008; Nagy 2011). Caribou generally form dynamic rutting aggregations, which can include one or more adult males and larger numbers of adult females (Bergerud 1974a). Adult females usually do not breed until they are at least 2 years of age (28 months) with some not breeding until they are 3 years old (40 months; Bergerud 1974b). Gestation is about 229 days (Bergerud 1974b), with the peak of calving estimated at May 21-22 for the Bonnet Plume subpopulation (Farnell and Russell 1984), May 27 for the South Nahanni subpopulation (Envirocon 1981 *in* Gullickson and Manseau 2000), and June 3 for the Redstone subpopulation (Nagy 2011). During calving, adult female caribou are highly dispersed in high elevation mountainous terrain as an anti-predator strategy (Bergerud *et al*. 1984).

Females typically give birth to one calf and twinning is rare (Bergerud 1974b). Calves are fairly mobile within hours after birth and usually stay with their mothers until the mother calves the following year. Most calf mortality occurs within the first few weeks of life, with predation as the leading cause of calf mortality (Adams *et al.* 1995). Although there have been no formal studies on causes of calf mortalities for NWT northern mountain caribou subpopulations, one dead calf found in the Redstone subpopulation range in October 2002 had been killed by a grizzly bear (*Ursus arctos*; Olsen 2002). With an older age of first breeding and calf production limited to only one calf, caribou have a low reproductive rate compared to other deer species, such as moose (*Alces alces*), which can start breeding as yearlings, and which frequently have twins (Bergerud 1974b). A low reproductive rate, coupled with high levels of calf mortality, could result in a slow rate of population recovery following a decline. Generation length based on International Union for the Conservation of Nature (IUCN) calculations is 9 years (COSEWIC 2014).

Table 5. Activity periods identified for Redstone (Nagy 2011), Coal River, La Biche (Weaver 2008), and South Nahanni (Weaver 2006) subpopulations.

Redstone		Coal River, La Biche		South Nahanni	
Activity period	**Timing**	**Activity period**	**Timing**	**Activity period**	**Timing**
Calving	26 May – 11 June	Calving	26 May – 5 June	Calving	21 May – 5 June
Post-calving	12 June – 23 June	Summer	6 June – 25 Sept	Post-calving (summer)	6 June – 24 Sept
Early summer	24 June – 23 July				
Mid-/late summer	24 July – 11 Sept				
Fall	12 Sept – 8 Oct	Rut	26 Sept – 10 Oct	Pre-rut/rut	25 Sept – 15 Oct
Breeding	9 Oct – 25 Oct				
Late fall	26 Oct – 25 Nov	Fall	11 Oct – 30 Nov	Fall migration	16 Oct – 31 Dec

Early/mid-winter	26 Nov – 10 Mar	Early winter	1 Dec – 31 Jan	Winter	1 Jan – 15 April
Late winter	11 Mar – 24 Apr	Late winter	1 Feb – 15 Apr		
Spring migration	25 Apr – 25 May	Spring	16 Apr – 25 May	Spring migration	16 April – 20 May

Adult sex ratios based on aerial and ground surveys during fall and late winter range between 31 and 51 bulls:100 cows (*Appendix A*, Table A1), and based on observations by non-resident hunters from 1991 to 2017, averaged 30 and 81 bulls:100 cows for the Redstone and Bonnet Plume subpopulations, respectively (Larter 2018a).

Ages of northern mountain caribou in the NWT based on caribou harvested by Indigenous harvesters in February-March (1968-1972) and non-resident hunters in fall (1967-1971, 1975, 2011-13) suggests that the adult females can live up to at least 15 years of age and adult males can live up to at least 13 years of age (*Appendix A*, Table A2; Collin 1983; Larter and Allaire 2017). Age structure of harvested animals may be more indicative of age class selection by hunters rather than population age structure (e.g., non-resident hunters likely selected older-aged males than Indigenous harvesters); nonetheless, most caribou harvested were 7-8 years of age or younger (*Appendix A*, Table A2).

The only available adult survival estimates for NWT northern mountain caribou are for the South Nahanni subpopulation, with an average annual survival rate of radio-collared adult female caribou of 89% (Gullickson and Manseau 2000). Cause of mortality could not be determined for any of the mortalities. Survival rates of caribou radio-collared more recently in the South Nahanni and Coal River subpopulations are not yet available (Hegel *et al*. 2016).

The primary proximate cause of adult mortalities in NWT ranges is uncertain. For most northern mountain caribou populations in ranges south of the NWT, wolf predation (*Canis lupus*; Farnell and McDonald 1988; Hayes *et al*. 2003; McNay 2009), along with bear, wolverine (*Gulo gulo*), and cougar (*Puma concolor*) predation, is significant (Cichowski and MacLean 2005; Gustine *et al*. 2006; McNay 2009; Milakovic and Parker 2013).

Physiology and Adaptability

Caribou are highly adapted to their environment and cold winter conditions. Their large feet, with prominent dew claws, act like snowshoes for walking in snow, and as shovels for digging through snow to access terrestrial lichens. During winter, adult reindeer/caribou fur includes thick hollow guard hairs with air-filled cavities and thin woolen underfur, providing insulation,

which is the primary mechanism for how adult reindeer thermoregulate in the cold (Soppela *et al.* 1986). Their hollow fur also keeps them buoyant when swimming.

During winter, northern mountain caribou in the NWT forage primarily on lichens (Farnell and Russell 1984; Gullickson and Manseau 2000). Although lichens are low in protein content (Scotter 1965; Rowe 1984; Nieminen and Heiskari 1989), they are highly digestible by caribou (Person *et al.* 1980; Thomas *et al.* 1984), which allows caribou to maximize extraction of nutrients from this food source and exploit a niche that other ungulates are less able to exploit. Caribou have also adapted to the low protein content of lichens by conserving nitrogen by recycling urea (Parker *et al.* 2005).

Unlike other members of the deer family, female caribou grow antlers. Presence of antlers on females likely evolved in response to competition for access to feeding craters during winter. In group situations, a caribou can be displaced from a feeding crater that it dug by another caribou. At winter feeding sites in Quebec, female caribou with antlers were successful in almost all their interactions at feeding craters with males that had shed their antlers, even though the males were larger in body size (Barrette and Vandal 1986).

Plasticity in winter range/habitat use could help caribou respond to variable environmental conditions. Although individual caribou often return to the same general wintering areas each year, fidelity to specific areas within those wintering areas is variable. Some northern mountain caribou in the NWT may switch both winter ranges and wintering strategies between years. In the La Biche range, individual caribou wintered in low elevation forests along the South Nahanni River one year, then wintered on high elevation windswept alpine slopes along the NWT/Yukon border during a shallower snow year the following year (Weaver 2006, 2008).

Interactions

In the Mackenzie Mountains in the NWT, northern mountain caribou are one component of a predator-prey system that also includes moose, Dall's sheep (*Ovis dalli dalli*), mountain goats (*Oreamnos americanus*), wolves, grizzly bears, black bears (*Ursus americanus*), wolverines, and lynx (*Lynx canadensis*). Cougars may also be present in the Nahanni area (Gau and Mulders 2001). White-tailed deer (*Odocoileus virginianus*) and elk (*Cervus elaphus*) appear to be becoming more abundant in the Mackenzie Mountains area (Veitch 2001). An elk was harvested on the North Nahanni River in September 2005 (Larter pers. comm. 2019). Northern mountain caribou forage primarily on lichens during winter and do not compete directly with other ungulates for food resources. In the southern portion of northern mountain caribou range in Canada, 'apparent competition' between caribou and other prey species occurs indirectly through sharing a common predator (Holt 1984). Increases in other prey can lead to increases in predator numbers and subsequently to increased predation on caribou and potentially to population declines. In the NWT, moose densities vary throughout their range, with the highest

surveyed densities around Fort Good Hope, Norman Wells, and Tuĺit'a (11-17 moose/100km^2) (Brackett *et al.* 1985; Jingfors *et al*. 1987; Latour 1992; MacLean 1994; Veitch *et al*. 1995; Veitch 1998; Swallow *et al.* 2003). Compared to densities of moose in the southern portion of northern mountain caribou range (23-137 moose/100 km^2; BC Ministry of Forests, Lands and Natural Resource Operations 2015) this is still quite low, and therefore apparent competition is less likely to occur in the NWT unless moose and/or deer densities increase substantially.

Lichens, the primary winter food source of caribou, are poor competitors against vascular plants and mosses, and are most abundant on sites where growing conditions for other plants and mosses is poor (Johnson 1978). Lichens are also slow growing and *Cladina* spp., the preferred caribou terrestrial forage lichens, often do not become abundant following fire disturbance until >10-60 years post-disturbance or longer (Scotter 1964; Maikawa and Kershaw 1976; Black and Bliss 1978; Carroll and Bliss 1982; Klein 1982; Coxson and Marsh 2001; Seccombe-Hett and Walker-Larsen 2004; Jandt *et al*. 2008; Collins *et al.* 2011; Russell and Johnson 2018).

Caribou are affected by a number of insects, parasites, and diseases. Flying insects include mosquitoes (Culicidae), black flies (Simuliidae), horseflies (Tabaninae), deer flies (Chrysopsinae), warble flies (*Hypoderma tarandi*), and nose bot flies (*Cephenemyaa trompe*) (Carrière pers. comm. 2019). During summer, biting insects influence habitat selection with caribou moving to higher elevations during the day to access snow patches (Ion and Kershaw 1989; see also *Habitat Requirements*). Although no information is available on prevalence of the winter tick (*Dermacentor albipictus*) on northern mountain caribou in the NWT, increasing prevalence of winter tick on boreal caribou in northeastern BC and the NWT has been observed (Culling and Cichowski 2017). *Neospora caninum* is a protozoan parasite that was detected in 4/37 northern mountain caribou sampled in the Sahtú area (Carlsson *et al.* 2015a). Northern mountain caribou in this region were also tested for exposure to diseases including brucellosis (0/37), alphaherpes virus (26/37), bovine parainfluenza type 3 (0/22), pestivirus (present), and *Erysipelthrix rhusiopathiae* (3/36) (Carlsson *et al*. 2015a). Blood samples from caribou from Indigenous late winter hunts in the mid- to late 1960s also tested negative for brucellosis (Simmons 1970b). In the South Nahanni subpopulation, none of the 25 caribou sampled tested positive for bovine viral diarrhea virus, parainfluenza 3 virus, or bovine respiratory syncytial virus, but 9 (36%) had been exposed to infectious bovine rhinotracheitis virus, and 3 (12%) had been exposed to brucellosis (Gullickson and Manseau 2000).

STATE AND TRENDS

Population

Abundance and Trends

The current population estimate for northern mountain caribou in the NWT is about 21,800 individuals, of which more than 17,000 are mature individuals (Table 6). The NWT contains 40-44% of the estimated 50,000 to 55,000 northern mountain caribou in Canada and North America, including the two largest subpopulations: Redstone and Bonnet Plume. Almost half of the territory's population is represented in the Redstone subpopulation, and Redstone and Bonnet Plume combined make up almost 70% of the NWT population. The remote and vast nature of northern mountain caribou ranges in the NWT makes it logistically difficult to conduct population surveys and to estimate population size. Most of the population estimates for northern mountain caribou subpopulations in the NWT are outdated (Table 6). There has been only one population estimate for four of the subpopulations (Bonnet Plume, Redstone, Coal River, La Biche), all of which are at least 6 years old, and two of which are over 20 years old. All four estimates are based on minimum counts from aerial or ground surveys, which were then extrapolated to estimate population size. The population estimate for the Redstone subpopulation was based on a ground survey that was conducted opportunistically in the fall of 2012, which yielded a minimum population estimate. The South Nahanni subpopulation is the only subpopulation with a mark/re-sight estimate, which uses the proportion of radio-collared caribou seen during a census to estimate the total population size and confidence limits around the estimate (Hegel *et al.* 2016). It is also the only subpopulation with a previous population estimate (2001; Gunn *et al.* 2002); however, differences in study design for the two surveys makes it difficult to infer any trend in population size (Hegel *et al.* 2016).

Table 6. Estimates of the number and trends of mature and total individuals in northern mountain caribou subpopulations in the NWT.

Subpopulation	Year	Population Estimate		Estimate Type	Current Trend	Long-term Trend	Source
		Total	Mature				
Bonnet Plume	1982	5,000[1]	4,200[2]	Minimum count + expert opinion	Stable[3,4]	Unk[3]	Farnell and Russell (1984)
Tay River[5]	1991	3,758	2,907	Stratified random quadrat	Unk[3]	Unk[3]	COSEWIC (2014)
Redstone[6]	2012	>10,000	>7,300[2]	Ground survey + extrapolation	Stable[3,4]	Unk[3]	COSEWIC (2014)
South Nahanni	2009	2,105	1,886[7]	Mark/re-sight	Stable	Unk	Hegel *et al*. (2016)
Coal River	2008	450[8]	413	Minimum count + extrapolation	Unk[3]	Unk[3]	COSEWIC (2014)
La Biche	1993	450[9]	388	Minimum count + extrapolation	Unk[3]	Unk[3]	COSEWIC (2014)
Total		**>21,763**	**>17,094**				

[1]Based on 1,074 caribou counted during a survey in April 1982 and extent of snow tracking sign (Farnell and Russell 1984).
[2]COSEWIC (2014) calculated the number of mature individuals for the Bonnet Plume and Redstone subpopulations by applying the average % adults from hunter observations from 1991 to 2010 from Larter (2012) to the total population estimate.
[3]From COSEWIC (2014); long-term trend based on trend over 3 generations (27 years).
[4]Current trend based on Larter (2018a) average % calves from 1991-2016 during fall hunter observations.
[5]Based on 23 radio-collared caribou surveyed between 1989-1996 (Kuzyk and Farnell 1997).
[6]Based on a ground survey that was conducted at 64°21'58"; 127°22'22", opportunistically in the fall of 2012, which yielded a minimum population estimate (Popko pers. comm. 2019).
[7]Based on % mature adults counted in the 2009 survey (Hegel *et al.* 2016).
[8]Estimate based on 341 caribou counted in 2008 (Environment Yukon unpubl. data).
[9]Estimate based on 348 caribou counted in 1993 (Environment Yukon unpubl. data).

Current and long-term population trends for most northern mountain caribou subpopulations in the NWT are unknown (Table 6; COSEWIC 2014). For the Bonnet Plume and Redstone subpopulations, the percent of calves seen by non-resident hunters during fall hunts was used as an index to assess current population trends (COSEWIC 2014). Bergerud (1996) recommends a 15% calf recruitment rate to achieve population stability. From 1991 to 2016, percent calves averaged 15% for the Bonnet Plume subpopulation and 26% for the Redstone subpopulation

(Larter 2018a). Because some mortality likely occurs over winter, actual late winter calf recruitment for the Bonnet Plume subpopulation may be less than 15%. From 1991 to 2016, there was a slightly decreasing trend in calf:cow ratio and percent calves for both the Bonnet Plume and Redstone subpopulations, with the greatest decline observed from 2009 to 2016 and the recent decline more pronounced in the Redstone subpopulation than the Bonnet Plume subpopulation (Larter 2018a). A decline in the calf:cow ratio and percent calves could suggest a population decline (Larter 2018a). For the South Nahanni subpopulation, although differences in study design make it difficult to infer a population trend between 2001 and 2009, Hegel *et al*. (2016) suggest that the subpopulation is likely stable and possibly increasing.

Population Dynamics

Pregnancy rates for caribou are generally high. For the Redstone subpopulation, Collin (1983) reported pregnancy rates of adult female caribou from hunter-killed samples in late winter of 91% for 43 female caribou older than two years of age; Olsen *et al.* (2001) reported 93%. Pregnancy rate based on serum progesterone levels for 25 radio-collared caribou in the South Nahanni subpopulation was 72% (Gullickson and Manseau 2000). Most calf mortality occurs during the first few weeks of life (Adams *et al.* 1995). Information on calf survival and recruitment estimates for northern mountain caribou subpopulations in the NWT prior to 1995 is limited (*Appendix A*, Table A3). Late winter surveys in the Bonnet Plume range in 1981 and 1982 show high late winter calf recruitment, which was likely indicative of an increasing population (*Appendix A*, Table A3; Farnell and Russell 1984). Most of the calf survival surveys conducted in the Redstone, South Nahanni, and Coal River ranges were conducted during the fall. Although additional calf mortality is expected through the winter, an average fall calf survival ratio of 20 to 25 calves:100 cows is considered sufficient to support a stable population growth rate (Environment Yukon 2016). Fall calf survival rates for samples of the Redstone subpopulation in 2000 and 2002 were sufficient or exceeded that threshold (*Appendix A*, Table A3). Fall calf survival rates in the South Nahanni and Coal River ranges were highly variable between 1995 and 2011, ranging from 10 to 30 for the South Nahanni subpopulation, and 12 to 40 for the Coal River subpopulation (*Appendix A*, Table A3). The 2010 and 2011 rates for Coal River, and the 2010, 2011, and 2014 rates for South Nahanni were the highest rates for those two subpopulations; however, rates for surveys conducted between 2000 and 2009 for South Nahanni and for the 2008 survey for Coal River indicated a declining trend. All northern mountain caribou subpopulations that were surveyed in 2008 in Yukon showed low fall calf survival (Hegel *et al.* 2016).

Fall calf survival information has also been collected since 1991 for the Bonnet Plume and Redstone subpopulations based on non-resident hunter questionnaires (Larter 2018a). The calves:100 cows ratio from 1991 to 2016 averaged 33 for the Bonnet Plume and 46 for the Redstone subpopulations (Larter 2018a), both of which exceed the recommended 20-25

(Environment Yukon 2016). However, there is some evidence that both the calves: 100 cows ratio and % calves has declined slightly since 1991, with the greatest decline occurring from 2009 to 2016 and with the recent decline more pronounced in the Redstone subpopulation than in the Bonnet Plume subpopulation (Larter 2018a). For information on adult mortality, see *Interactions*.

There is no information available on immigration or emigration rates between ranges; however, with overlapping ranges, individuals from neighbouring ranges could potentially move into a new range.

Other than calf:100 cows ratios based on non-resident hunter observations in the Mackenzie Mountains (Larter 2018a), and fall calf survival rates for the South Nahanni subpopulation (Farnell 2015; Hegel *et al.* 2016), all available information on population size and trend is at least seven years old and may not reflect the current population condition.

Possibility of Rescue

Northern mountain caribou ranges in the NWT overlap Finlayson and Hart River northern mountain caribou ranges in Yukon. Most of these subpopulations typically undergo long distance movements between winter and summer ranges and do not demonstrate high fidelity to wintering areas, suggesting that there is a high likelihood that immigration from neighbouring ranges could occur. Seasonal movements and habitat use by Yukon subpopulations are similar to those of subpopulations in the NWT and currently, subpopulation ranges in the NWT are large and primarily undisturbed; therefore, it is highly likely that individuals from Yukon would be able to survive and reproduce in the NWT.

The Finlayson and Hart River subpopulations in Yukon are genetically indistinguishable from the Bonnet Plume, Redstone, South Nahanni, and Tay River subpopulations, suggesting that they have not experienced isolation from each other (Zittlau 2004; Khun *et al.* 2010). In addition, with respect to evolutionary lineages (phylogenetics), almost all northern mountain caribou in those subpopulations belong to the same Beringian-Eurasian lineage (BEL) (Zittlau 2004; Polfus *et al*. 2016). Phylogenetically, nearby boreal and barren-ground caribou appear to be more closely related to each other than to northern mountain caribou in the Mackenzie Mountains (Polfus *et al.* 2016). However, nine caribou sampled from the Ramparts River area in April 2014 were genetically more similar to barren-ground caribou than to other northern mountain or boreal caribou sampled (Polfus *et al.* 2016). This coincides with a traditional knowledge account of a historic movement of a large group of barren-ground caribou (Polfus *et al.* 2016). Stevens (1959) also noted that "…barren-ground caribou in some numbers have crossed the Mackenzie River at Fort Norman as recently as 1946". Further investigation of subpopulation and genetic structure of northern mountain caribou using the northern portion of the Mackenzie Mountains is needed (see also *Distribution – Search Effort*).

Although immigration is possible and neighbouring subpopulations are genetically and phylogenetically similar to NWT subpopulations, the NWT contains the two largest subpopulations of northern mountain caribou in Canada and would more likely act as a source population to rescue neighbouring or other smaller subpopulations. Currently, most of the northern mountain caribou subpopulations in the southern portion of their distribution in central BC are declining, and population status and trend for many subpopulations in northern BC are unknown and/or population estimates are outdated (COSEWIC 2014). The most significant threat to northern mountain caribou in the southern portion of their range is habitat alteration and linear features associated with industrial activities, and resulting increases in abundance of predators and prey, and predator efficiency (COSEWIC 2014). The condition of NWT northern mountain caribou subpopulations is therefore crucial to the condition of the overall northern mountain caribou population in Canada.

Habitat

Habitat Availability

Information on habitat availability is limited for northern mountain caribou in the NWT. Collin (1983) generated 17 image classes from visual interpretations of 1:250,000 scale LANDSAT imagery for a portion of the Redstone caribou range. The area mapped represented only 5% of the Moose Horn portion of the range. Creighton (2006) used satellite imagery and satellite radio-collared caribou data from the Redstone subpopulation to predict habitat availability in the Mackenzie Mountains but the classification was only successful for overall and winter habitat and further refinement of the technique was suggested. Most of the low elevation areas to the north and east of the Mackenzie Mountains were identified as winter habitat as well as valley bottoms associated primarily with the Arctic Red River, Mountain, Keele, Redstone, Raven's Throat, and South Nahanni rivers (Creighton 2006).

Seven important wildlife areas (IWAs) have been identified for northern mountain caribou in the NWT (Wilson and Haas 2012; see Figure 15 in *TK/CK Component* of this report). The headwaters of the Arctic Red and Ramparts rivers host a known concentration of caribou both during winter and fall. Three of the IWAs represent winter ranges, including South Nahanni winter range, Coal River – La Biche winter range, and Drum Lake (Wrigley Lake), which is an important wintering area for Redstone caribou. Caribou Pass is an area of concentration during migration for the Coal River subpopulation, where migration routes converge for access through the NWT/Yukon border. The South Nahanni summer and rut range, and the Redstone calving and early-midsummer ranges, are important areas in the western mountains near the NWT/Yukon border where caribou return to for calving and early summer range, and, in the South Nahanni summer and rut range, also for rutting range.

Habitat Fragmentation

Most of the northern mountain caribou range in the NWT is relatively undisturbed. The main disturbances include fire and industrial activities (mineral exploration and mining, seismic lines, resource roads). Fire activity is located primarily in the lower elevation portion of the range along the eastern boundary, with much of the area burned in 1995 and 1998 (Table 7; Figure 20). Some areas in the southern portion of Nahanni National Park Reserve have also been burned, primarily by fires prior to 1985. The fires in the Flat River and Mary River drainages may have affected migration patterns of the South Nahanni subpopulation (Gullickson and Manseau 2000). There has been almost no fire activity in the mountainous portions of the Redstone range in the NWT since 1965. Caribou generally avoid young burned areas, but can travel through them (Thomas *et al.* 1998).

Table 7. Total area burned within NWT northern mountain caribou range by decade and by subpopulation (calculated from fire data provide by M. Coyle, Geomatics Analysis, ENR).

Decade	Area burned (km²; all subpopulations)	Subpopulation	Total area burned within subpopulation range (km²), 1966-2019
1966-1969	352.13	**Redstone**	101,645.49
1970-1979	2338.86	**La Biche**	5,770.98
1980-1989	2567.33	**South Nahanni**	16,796.05
1990-1999	6443.04	**Coal River**	21,420.40
2000-2009	434.77	**Tay River**	31,694.33
2010-2019	418.47	**Bonnet Plume**	18,110.01
		Finlayson	18,862.44

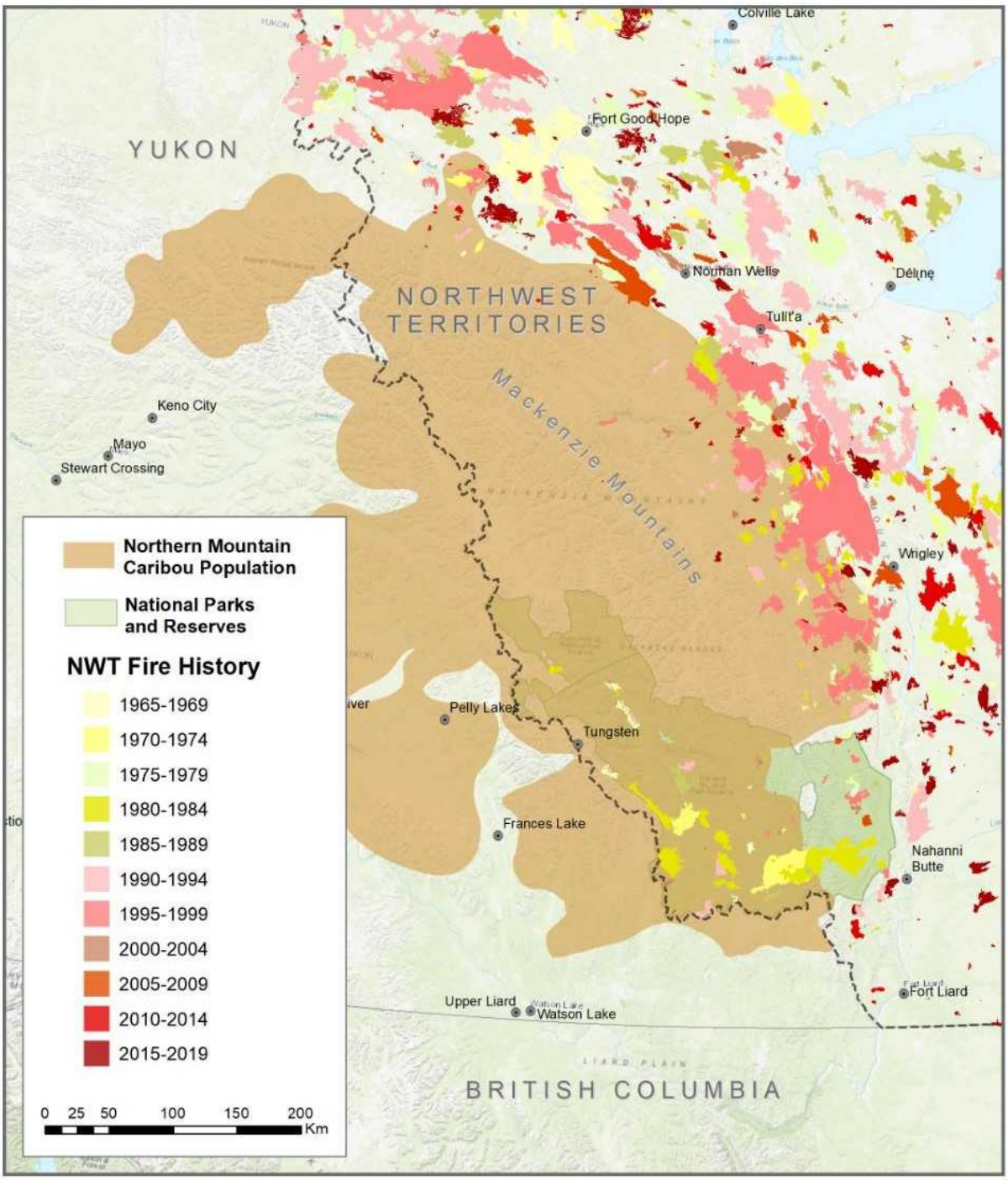

Figure 20. Fire activity in the NWT portion of northern mountain caribou range (fire history data provided by M. Coyle, Geomatics Analyst, ENR) (map credit: B. Fournier, ENR).

Seismic lines are also located in the low elevation portions of the range along the eastern, northeastern, and northern boundaries of the range (Figure 21). The North Canol Road and Canol Trail traverse the Redstone caribou range. Mineral exploration and mining activities are

located primarily in the area around the NWT/Yukon border, especially in areas accessed by the South Nahanni Range Road and the North Canol Road and Canol Trail (Figure 21).

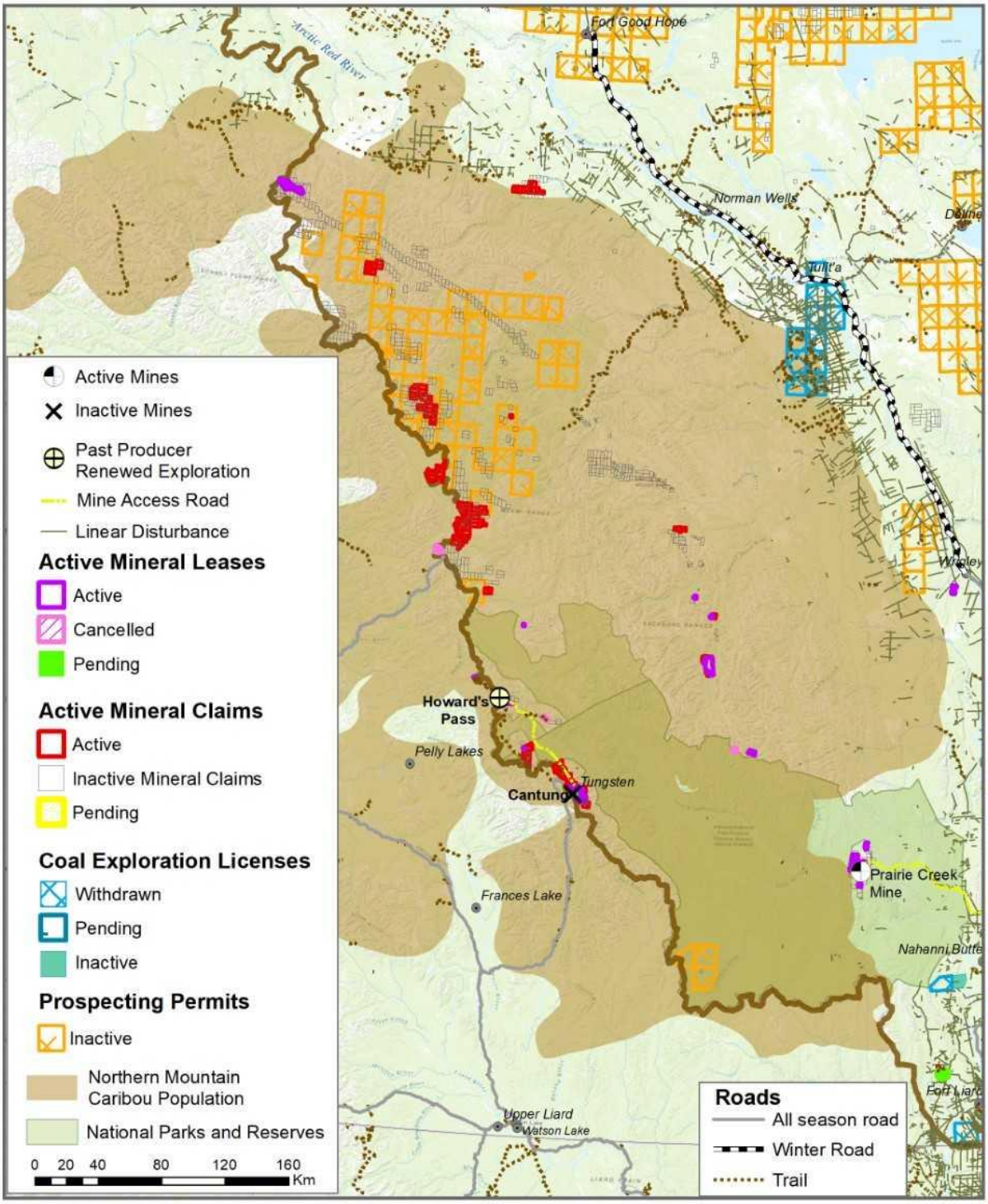

Figure 21. Industrial activities in the NWT portion of northern mountain caribou range. Active/past mine data current to 2018, provided by the NWT Geological Survey. Mine leases and claims data current to 2019, provided by

the NWT Mining Recorder's Office. Coal exploration data current to 2000, provided by the NWT Centre for Geomatics. Seismic lines from Pasher *et al*. (2013).

Habitat Trends

Available information on habitat trends in northern mountain caribou ranges in the NWT is limited. Inferences from fire disturbance data suggest that most of the fire disturbance in the ranges occurred in the 1990s. Since then, the amount of area burned has decreased, but this could partially be due to less area being available for burning following the fires in the 1990s (Table 7; Figure 20). Information on habitat trends over time due to industrial activities is not readily available. Potential habitat trends due to climate change are discussed in *Threats and Limiting Factors – Climate Change*.

Distribution Trends

At the range scale, there is not enough reliable technical information to assess whether the currently defined northern mountain caribou ranges in the NWT differ from the historical distribution. Differences between historically defined ranges and current ranges are more likely due to refinement of northern mountain caribou range boundaries in response to new and more detailed information becoming available, than to actual changes in distribution. Historical information on caribou distribution in the Mackenzie Mountains is limited. Rand (1944) did not see any caribou in the NWT portion of his drive across the Canol Road in late August/early September 1944, but described the area between Macmillan Pass and Moss Creek as good caribou range. During ground and aerial surveys in the Redstone and South Nahanni ranges in July/August 1957, caribou were seen above treeline, especially in the area around O'Grady Lakes, and at least 19 caribou were seen in the mountains around the upper South Nahanni River in the area near Glacier Lake (Stewart 1957; Stevens 1959). The spruce-lichen forests in the Flat River area were described as being able to support large numbers of caribou, and the Drum (Wrigley) Lake area was reported to be consistently used by caribou during winter (Stewart 1957; Stevens 1959). During a fixed-wing (Otter) aerial reconnaissance survey August 9-16, 1963, only 30 caribou were seen but their distribution was considered widespread throughout the Mackenzie Mountains based on presence of caribou trails (Flook 1963).

Winter and summer ranges in the Redstone caribou range were first delineated based on aerial surveys of caribou and Dall's sheep conducted from 1968 to 1970, including about 310 caribou counted in the Stelfox Mountain and Dal Lake survey areas in early to mid-April 1968, about 820 counted along the Redstone, Keele, and Twitya rivers, about 30 counted in the Carcajou River area in early to mid-March 1969, about 820 caribou counted in the Wrigley Lake and Redstone/Keele/Twitya rivers area, and about 50 caribou counted in the Carcajou River area in late February/early March 1970 (Simmons 1968; 1969a, c; 1970a). Winter range included low elevation valley bottoms along the South Redstone (Raven's Throat), North Redstone (Redstone), Keele, Ekwi, and Twitya rivers, and in the Wrigley Lake and Carcajou River areas

(Simmons 1970a). Some wintering caribou were also observed in the area along the Little Nahanni River, downstream from Flat Lakes (Simmons 1969a), in a survey block on the Yukon side of the NWT/Yukon boundary near Tungsten (Simmons 1969c), in survey blocks between the headwaters of Caribou Creek and the Flat River, and between the Flat River, South Nahanni River, and Hole in the Wall Creek (Simmons 1969c). Simmons (1968) delineated the summer range to include the area along the NWT/Yukon boundary as far north as the headwaters of the Mountain River, east to the upper portion of the Keele River, and southeast to the Dal Lake and Silverberry River area.

Williams and Heard (1986), in their review of global caribou/reindeer populations, showed distribution of northern mountain caribou in the NWT as four discrete (non-overlapping) ranges that also overlapped Yukon (Bonnet Plume, Redstone, Finlayson, Nahanni). Boundaries were drawn at a coarse scale, with the Bonnet Plume range extending further east into the NWT than the current range, and a small portion of the Finlayson range extending further east into the NWT. The Redstone range was much smaller than the current range, occupying only the central portion of the current range. The Nahanni range included most of the current South Nahanni and Coal River ranges. By 1996, the eastern boundary of the Bonnet Plume range was shifted to the west, the Redstone range was re-oriented into a more north/south distribution, and the northeastern boundary of the Finlayson range was contracted so that it no longer overlapped the NWT (Farnell *et al.* 1998). The Nahanni range was similar to the previous delineation, but the La Biche range was added as a separate range. Ranges were still represented as four discrete ranges (Farnell *et al.* 1998). Studies of radio-collared caribou in the late 1990s and early to mid-2000s led to further revisions to range boundaries, including the addition of the Coal River caribou range, overlapping ranges for the South Nahanni, Coal River, and La Biche subpopulations, and expansion of the Redstone range to overlap both the South Nahanni and Bonnet Plume ranges.

Based on available technical reports, there is not enough information to assess whether there have been any localized changes in caribou distribution in the Mackenzie Mountains.

Threats and Limiting Factors

The greatest threat affecting northern mountain caribou across their distribution in Canada is wide-scale habitat alteration and associated linear features resulting from human activities, which affect abundance, habitat use, and movements of predators and other prey (Festa-Bianchet *et al.* 2011). In the southern portion of northern mountain caribou range, the primary industrial activity conducted on caribou ranges is forest harvesting, which results in increased early seral habitat favored by moose, and ultimately in increased predation risk to caribou (COSEWIC 2014). Roads and other linear features associated with industrial activities also result in increased predator travel rates and hunting efficiency, and increased access for humans that

could result in displacement of caribou from preferred habitats and direct mortality from vehicle collisions, hunting, and poaching (COSEWIC 2014). Unlike the southern portion of northern mountain caribou range in BC, moose densities are much lower in the NWT and there is no forest harvesting on northern caribou ranges. In the NWT, the main threats to northern mountain caribou include: predation; industrial activities, primarily mineral exploration and development and associated linear features (e.g., roads); hunting; and climate change.

Threats have been assessed by SARC to inform the assessment of northern mountain caribou. The *Threats Assessment* is included in *Appendix A.*

Predation

Predation is the primary direct cause of mortality for caribou populations (Festa-Bianchet *et al.* 2011). Although there is no technical information on the causes of mortality of northern mountain caribou in the NWT, the primary known cause of adult female mortality for most northern mountain caribou populations is wolf predation (Farnell and McDonald 1988; Hayes *et al.* 2003; McNay 2009), with bear, cougar, and wolverine predation locally or seasonally important (Cichowski and MacLean 2005; Gustine *et al.* 2006; McNay 2009; Milakovic and Parker 2013). Rate of wolf predation and wolf densities within northern mountain caribou range in the NWT is poorly understood and although linkages between anthropogenic linear development and increased predation on caribou have been inferred elsewhere (James and Stuart-Smith 2000, Neufeld 2006, and Latham *et al.* 2011a *in* SARC 2012), it is unclear if this mechanism is happening in the case of northern mountain caribou. There have been no recent wolf surveys in northern mountain caribou range in the NWT.

Industrial Activities – Mineral and Hydrocarbon Exploration and Development

Most active mineral claims, mineral leases, and mines in northern mountain caribou range in the NWT are located near the NWT/Yukon border (see Figure 21). There are also active coal exploration licenses along the eastern boundary of northern mountain caribou range. In the Yukon portion of Bonnet Plume range, mineral exploration and staking has increased significantly since the mid-2000s (O'Donoghue 2013). Seismic lines from hydrocarbon exploration are present along the northeastern and eastern portions of the range (see Figure 21).

There is a long history of mineral and hydrocarbon exploration and development in the Mackenzie Mountains. Roads associated with industrial activities include the Canol Road, Nahanni Range Road, Howard's Pass Access Road, and Prairie Creek Road (see Figure 21).

The Canol Road and pipeline was built in the early 1940s during World War II to supply oil from Norman Wells to Whitehorse to support construction of the Alaska Highway and other wartime efforts (Finnie 1945). The road is 232 km long between Ross River, Yukon and the NWT/Yukon border, and 372 km long from the NWT/Yukon border to Norman Wells. Construction on the road and pipeline began in the winter of 1942/43 and the pipeline was completed in February

1944 (Finnie 1945). The pipeline was abandoned in April 1945 and some of the equipment (e.g., engines) and an unknown amount of pipe was salvaged; however, much of the equipment, including abandoned vehicles, structures, and caches of oil and fuel barrels remained (Aboriginal Affairs and Northern Development Canada-Contaminants and Remediation Directorate [AANDC-CARD] 2015). By November 1945, road conditions had deteriorated with damage to the bridge across the Carcajou River rendering it unsafe for vehicle traffic, and the pipeline and telephone line were broken/down in a few places within 45 km of Norman Wells (Wood 1945). Salvage operations continued until at least 1953 and much of the oil in the pipeline was spilled during salvage operations (Kershaw and Kershaw 1982b). Currently, only the Yukon portion of the road is drivable as far as the NWT border since part of the road was washed out in the Macmillan Pass area in 1987 or 1988. The NWT portion of the road (Canol Trail) has not been maintained, but is used as a route for recreational travel with the roadbed in reasonable condition in some areas, and indistinguishable in others. Some brush cutting has occurred recently along the Canol Trail between miles 1 and 25 (AANDC-CARD 2015). Hazards from the Canol pipeline project included contamination from fuel, oil, batteries and building materials (e.g., asbestos, lead paint), and entanglement of wildlife in the downed telephone wire (AANDC-CARD 2015). From 2015 to 2017, telephone wire was removed from 322 km along the Canol Trail, and a 3-year remediation project was initiated in 2018 to reduce major environmental and human health risks associated with the abandoned pipeline and related infrastructure (INAC 2019).

The Mactung tungsten deposit is located in the NWT near the NWT/Yukon border, just north of the Canol Trail (Silke 2009; Wardrop 2009). The deposit was discovered in 1962 and an 11 km access road was built from the Canol Road to the deposit in 1970 (Wardrop 2009). The property was dormant from 1985 to 2005 (Wardrop 2009). Caribou are found in the area around the deposit, as well as in the mountains surrounding the deposit, the access road, and the Canol Trail, based on observations and surveys conducted during summer months (Archibald 1973; Miller 1976; Gill 1978; Kershaw and Kershaw 1982a, 1983; EBA 2007; Wardrop 2009) and as late as October (EBA 2007). No caribou were found in the area during winter surveys in 1982 and 1983 (Kershaw and Kershaw 1982a, 1983). A new 35 km access road has been proposed originating from the North Canol Road in Yukon, which accesses the property along tributaries of the Hess River (Wardrop 2009). The GNWT bought the Mactung deposit in 2015 when North American Tungsten filed for bankruptcy and as of February 2019, is still actively seeking to sell the property. When the deposit sells, increased activity is expected in the area.

The Nahanni Range Road (not shown on maps in this report) (~196 km long) is an all-season road that was built in Yukon in the early 1960s to develop the Cantung tungsten mine at Tungsten, NWT, and has been in use most of the time since. Construction on the mine and the townsite of Tungsten began in 1961 and the mine became operational in 1962 (Silke 2009). The townsite

expanded to include a K-8 then K-9 grade school and in 1983 a new recreation centre was opened. When the mine was shut down in 1986, the townsite was also shut down. During subsequent periods of mine operation, the bunkhouses in the town were used for accommodation (Silke 2009). As a result of American Tungsten filing for bankruptcy in 2015, ownership of the mine was transferred to the Government of Canada, which is actively seeking to sell the mine. When the mine sells, increased activity is expected in the area. A proposal to upgrade the 180 km Yukon portion of the road (Yukon Government 2016) was approved by the Government of Canada in 2017.

The Howard's Pass Access Road (HPAR) (Figure 21) is a 79 km road that starts at km 188 on the Nahanni Range Road near Tungsten, and runs northwest to Howard's Pass along the NWT/Yukon border to access a zinc-lead deposit that straddles the NWT/Yukon border in the Selwyn Mountains (SLR Consulting 2015). It was built between 1972 and 1983 as an all-weather access road (Selwyn Resources 2008). Most of the road (60 km) traverses through the expanded Nahanni National Park Reserve (km 14 to 36) and through Nááts'ıhch'oh National Park Reserve (km 36 to 60; SLR Consulting 2015). Except for Indigenous traditional users, users of the HPAR within Nahanni National Park Reserve or Nááts'ıhch'oh National Park Reserve are required to obtain a restricted activity permit from Parks Canada (Parks Canada 2017b). The road was upgraded to a single lane all-season road in 2014 (DeMars *et al.* 2018). Further upgrading the road to a two-lane road has also been proposed to support mineral exploration activity for the Selwyn Project (zinc, lead, silver), which is located in Yukon (SLR Consulting 2015; DeMars *et al.* 2018). The HPAR was plowed in winter 2013/14 during construction, but currently the road is used and maintained primarily during summer (Thompson pers. comm. 2018). About 100 trucks (carrying zinc and lead concentrates, equipment, fuel, and other supplies) are predicted to travel on the road each day in each direction when the Selwyn mine (if approved) is in operation (SLR Consulting 2015). West of Howard's Pass, an additional 144 km of winter trail (adequate for use by bulldozers) were established in Yukon between Howard's Pass and Anniv Camp and Don's Camp (not shown on maps in this report) from 2005 to 2008 (Selwyn Resources 2008). Between 1998 and 2012, 20 of the 59 radio-collared caribou monitored in the South Nahanni subpopulation crossed the HPAR at least once with an average of 7.6 crossings/individual (range: 1-23; DeMars *et al.* 2018). Crossings occurred between the last week in April and the first week in January, but the peak of crossings occurred during spring migration in late May, and during fall migration in mid-October (DeMars *et al.* 2018). The majority of crossings (95%) occurred between 10 km and 70 km, and 87% occurred within the two national park reserves (DeMars *et al.* 2018). Spatially, crossings peaked near 20 km and 42-44 km, with the 20 km area used more frequently during fall and the 42-44 km are used more frequently during spring (DeMars *et al*. 2018).

A 220 km winter road was constructed in 1968 between the Prairie Creek mine site (zinc, lead, silver) and the Mackenzie Highway, 70 km northwest of Fort Simpson (Ker, Priestman & Associates Ltd. 1980; Silke 2009). Construction of a new 160 km winter road from the mine site to the Liard Highway was started in 1980 and the road was used in 1981 and 1982 before the mining company went into receivership (Ker, Priestman & Associates Ltd. 1980; Canadian Zinc Corporation 2015) and the road fell into disrepair in some areas. In 2018, the Government of Canada approved upgrading the road to an all-season road. Total length of the upgraded road, which includes some realignments, will be ~185 km between the mine site and the Liard Highway, with approximately 85 km traversing Nahanni National Park Reserve (Canadian Zinc Corporation 2015). Although the road does not overlap any currently delineated northern mountain caribou ranges, recently, radio-collared caribou have crossed the road on a number of occasions (Parks Canada 2017a); five caribou were seen along the road alignment during a winter survey in 2007 (Churchill 2007) and several caribou were photographed at remote camera locations along the road alignment within Nahanni National Park Reserve between June and September in 2012 (Tate 2016). In addition, caribou or caribou sign were detected in 20% of sampled survey blocks along the road alignment, especially in the area within 10 km of the mine site (Golder Associates 2014). Recent radio-collared caribou data also show that caribou use the area around the mine during all seasons (Tate 2016; Parks Canada 2017a).

In addition to mining developments/mineral exploration discussed above, mineral exploration has occurred and is also currently occurring in other areas within the Mackenzie Mountains (see Figure 21). In the NWT, advanced exploration programs have been conducted at the following sites within northern mountain caribou range (GNWT 2015a): Crest (iron) in the Bonnet Plume range along the NWT/Yukon border; Gayna River (zinc, lead) in the Redstone range near the Gayna River; Bear-Twit (lead, zinc) in the Redstone range near the confluence of the Twitya River and Hay Creek; Coates Lake/Redstone (copper, silver) in the Redstone range near Coates Lake; Jay (copper) in the Redstone range near the Keele River just north of Stelfox Mountain; and Lened (tungsten) in the South Nahanni range near Lened Creek. Additional mineral exploration activities have occurred and are currently occurring in the Yukon portions of northern mountain caribou ranges, with concentrations of current claims around the North Canol Road (e.g., Macmillan Pass Project), the Nahanni Range Road and HPAR, and in the area around the headwaters of the Stewart River.

Although there is limited information about the effects of industrial activities on northern mountain caribou specifically in the NWT, potential effects of mineral and hydrocarbon exploration and development on northern mountain caribou include: habitat alteration, displacement of caribou, direct and indirect mortality associated with access roads (e.g., improved access for hunters), and increased wolf travel rates/predator efficiency on linear features. Activities associated with mineral and hydrocarbon exploration and development,

including fracking associated with hydrocarbon development, can result in mechanical disturbance to habitat. Currently there is no fracking taking place in the NWT (Ransom pers. comm. 2019). Terrestrial lichens are sensitive to mechanical disturbance; for instance, they can take >10-60 years post-disturbance or longer to recover from fires, although this time to recovery may be shorter when the disturbance doesn't remove all the lichen (Scotter 1964; Maikawa and Kershaw 1976; Black and Bliss 1978; Carroll and Bliss 1982; Klein 1982; Coxson and Marsh 2001; Seccombe-Hett and Walker-Larsen 2004; Jandt *et al*. 2008; Collins *et al.* 2011; Russell and Johnson 2018). Disturbance to high elevation habitat, regardless of presence of lichens, could also require long recovery times due to harsh growing conditions. In Nahanni National Park Reserve, organic material was removed in alpine treeline habitat during construction of the Prairie Creek road in 1981, and 30 years after the road was abandoned, there was still no recovery of lichens, mosses, white spruce (*Picea glauca*), Labrador tea (*Rhododendron groenlandicum*; syn *Ledum groenlandicum*), glandular birch (*Betula glandulosa*), or lingonberry (*Vaccinium vitis-idaea*) (Cameron 2015; updated species names from Carrière pers. comm. 2019). Disturbed soils in some habitat types could also lead to increased production of shrubs and other vegetation favored by other prey such as moose. Industrial activities, including activities associated with roads, could result in displacement of caribou out of preferred habitats and into areas/habitats with potentially higher mortality risk. Northern mountain caribou tend to avoid roads (Polfus *et al.* 2011), despite the presence of preferred habitat close to the road (Florkiewicz *et al*. 2007). Radio-collared South Nahanni caribou move faster when crossing the HPAR than prior to or following crossing (DeMars *et al*. 2018). Also, encounter rates between caribou and wolves increases closer to roads (Whittington *et al.* 2011). Mineral exploration and development in northern mountain caribou ranges is concentrated near the NWT/Yukon border, which is an area consistently used by caribou during calving. Dispersal in mountains is an anti-predator strategy of caribou (Bergerud *et al.* 1984), and most calf mortality occurs during the first few weeks of life (Adams *et al.* 1995); therefore, activities that result in displacement of calving caribou could result in increased mortality risks at a time when caribou calves are already highly vulnerable to mortality. Roads and other linear corridors that can support vehicle traffic, could result in direct mortality due to collisions with vehicles, and increased levels of legal hunting and/or poaching. One of the highest levels of northern mountain caribou harvest in Yukon is along the Nahanni Range Road (Hegel *et al.* 2016). Roads and linear features also influence predator travel. During winter, wolves travel farther and faster on both packed and unpacked linear corridors and wolves use linear features as travel routes (James 1999; James and Stuart-Smith 2000; Neufeld 2006; Dickie *et al.* 2016). Wolves also travel twice as fast on conventional seismic lines than in forests during summer (Dickie *et al.* 2016).

Hunting

NWT

The Mackenzie Mountains Game Preserve was established in 1938, and hunting and trapping were open only to Dene living in the Mackenzie Valley (Simmons 1969b; Latour and MacLean 1994). Game Preserve status ended in 1953, and the area was opened up for resident hunting that year, for non-resident hunting in Game Management Zone 19 in 1965, and for non-resident hunting in Game Management Zone 12 in 1967 (Simmons 1968, 1969b; Latour and MacLean 1994). Originally, six guide-outfitters were granted tenures to guide non-residents, but area-based tenures did not come into effect until 1971 when boundaries of eight guide-outfitter zones were legally established (Latour and MacLean 1994). From 1965 to 1968, most (78%) of the non-resident harvest of northern mountain caribou was concentrated around hunting camps located along or near the Canol Trail and almost half of the caribou harvested were less than six years old (Simmons 1969b). From 1972 to 1975, the distribution of the non-resident caribou harvest expanded to the north and east and was concentrated along major navigable rivers and lakes, with fewer caribou harvested along the Canol Trail (Collin 1983). In 1976-1979, non-resident caribou harvest further expanded, this time to the southwest, and increased again along the Canol Trail (Collin 1983). From 1979 to 1991, much of the non-resident harvest continued to be localized around major guide-outfitter base camps, especially in the guide-outfitter zones with the highest harvests (Latour and MacLean 1994). Resident and non-resident hunting were eliminated from the area covered by Nahanni National Park Reserve when it was established in 1976. Nahanni National Park Reserve was expanded in 2009 (Parks Canada 2010) and Nááts'įhch'oh National Park Reserve was established in 2014 (Parks Canada 2017b). Both those areas were closed to resident and non-resident hunting in 2016 (Larter and Allaire 2017).

Non-resident and resident hunters are permitted to hunt one northern mountain caribou per year (GNWT 2018). Although there is no restriction on the sex of the caribou taken, most resident and non-resident hunters select bulls (Larter *et al.* 2018). There are no formally established limits on the total number of northern mountain caribou that each guide-outfitter can take each year.

Non-resident harvest in the Mackenzie Mountains increased between 1965 and the early 1990s (Figure 22), then averaged 165 bulls per year from 1991 to 2017 (Larter *et al.* 2018). The highest harvest during that period was 195 bulls in 2017, and three of the four highest harvests occurred during the three most recent years of data collection: 2015-2017 (Larter *et al.* 2018). Resident harvest was estimated as 20-25 animals annually from 2001 to 2010, and about 45 animals annually from 2011-2015 (Larter *et al.* 2018). Closure of the Nahanni National Park Reserve expansion and Nááts'įhch'oh National Park Reserve to resident and non-resident hunting in 2016 did not appear to affect the total number of caribou harvested by non-residents in the broader Mackenzie Mountains (Figure 22).

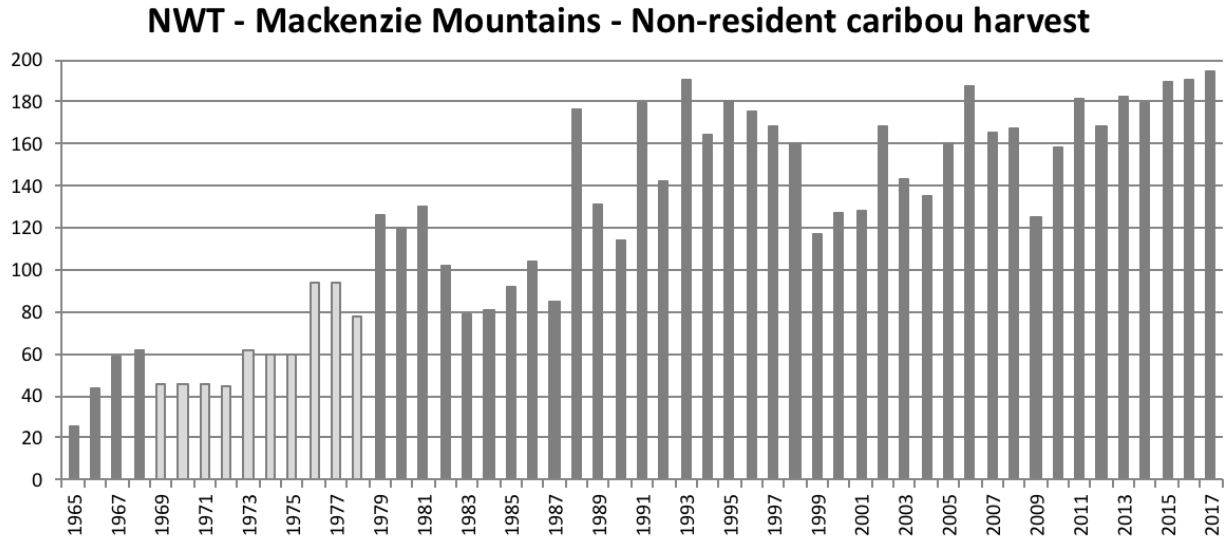

Figure 22. Number of caribou harvested by non-resident hunters in the Mackenzie Mountains, 1965-2017. Data sources include: 1965-1968 (Simmons 1969b), 1969-1978 (Collin 1983), 1979-1990 (Latour and MacLean 1994), 1991-2017 (Larter *et al.* 2018). Light grey shading indicates years when the harvest estimates did not include the South Nahanni, Coal River, La Biche, and Bonnet Plume ranges, and the southern portion of the Redstone range. Data from 1969 to 1971 were only provided for the 3-year period; annual harvest for each of those three years is shown as the average annual harvest for the 3-year period.

There is little information available on Indigenous harvest in technical reports. From the 1950s to the 1970s, most Indigenous hunting in the Mackenzie Mountains was conducted by residents of Tulít'a (Collin 1983). Indigenous caribou hunting in the late 1960s was conducted during winter (February to March) primarily in the headwaters of the Keele, Natla, and Redstone rivers, and in the Wrigley Lake area (Simmons 1970a; Collin 1983). The caribou harvest was estimated as 216 in 1964 and 143 in 1965 (Collin 1983). For the six years prior to and including 1970, Indigenous harvest was estimated between 60 and 100 caribou each year, with at least 80 harvested in 1970 (Simmons 1970a). Most caribou harvested (79%) were females (Collin 1983). Since caribou hunting in the Redstone River area was becoming more difficult, hunters may have shifted to the Carcajou River area in the early 1970s, which was also an area that was hunted in the 1930s (Simmons 1970b). At least 34, 107, and 80 caribou were harvested in 1985, 1987, and 1999, respectively (Olsen 2000). In 2000, Indigenous harvest was estimated as 80-130 caribou by Veitch *et al.* (2000), and as 160 by Olsen (2000). In the Gwich'in Settlement Area, 10-15 woodland caribou were harvested annually by subsistence harvesters up to 2001 around the communities of Tsiigehtchic and Fort McPherson, but it is not known if those caribou were boreal caribou or northern mountain caribou (Shaw and Benn 2001). In the Sahtú area, at least 2 male caribou were harvested during hunts in September 2009, at least 18 male and 4 female caribou were harvested during hunts in April and September 2013, and at least 10 male and 5 female caribou were harvested during hunts in March and April 2014 (Carlsson *et al.* 2015b).

YUKON

In the Yukon portion of the transboundary northern mountain caribou ranges, caribou are hunted by Indigenous subsistence hunters and licensed resident and non-resident hunters. Licensed resident hunters are permitted to hunt 1 bull caribou per year (Environment Yukon 2018). Licensed hunting of female northern mountain caribou in Yukon was closed in all ranges by 1987 (Milligan 2018).

From 1995 to 2012, annual licensed harvest for the South Nahanni subpopulation averaged 13.1 (7.5 residents, 5.6 non-residents) and for the Coal River subpopulation averaged 10.4 (5.9 residents, 4.4 non-residents; Hegel *et al.* 2016). The annual combined licensed harvest was variable during that time period but generally declined from 1995 to the late 2000s for both subpopulations, then increased dramatically from four in 2009 to 15 in 2011 for the South Nahanni subpopulation, and from three in 2010 to 12 in 2012 for the Coal River subpopulation (Hegel *et al.* 2016). Harvest on the Coal River subpopulation continued to increase between 2013 and 2016, and was variable but remained close to or above the 2012 harvest level on the South Nahanni subpopulation (Environment Yukon unpubl. data 2018b). The greatest level of harvest for both subpopulations from 2008 to 2011 occurred along the Nahanni Range Road, and the harvest at the top end of the road in the South Nahanni caribou range was one of the highest harvest levels for northern mountain caribou in Yukon (Hegel *et al.* 2016).

From 1960 to 1981, average annual licensed harvest for the Bonnet Plume subpopulation was estimated at 17 for non-residents (range: 0 to 30) and one for residents, and Indigenous harvest was believed to be extremely light or nonexistent (Farnell and Russell 1984). From 1995 to 2016, average annual total harvest (First Nation licensed residents, First Nation non-licensed residents, residents, non-residents) was 23 for Bonnet Plume, 28 for Redstone, 26 for Tay River, and 3 for La Biche (Environment Yukon unpubl. data 2018b).

SYNTHESIS

Although the current harvest rate across the distribution of northern mountain caribou in the NWT is relatively low, both non-resident and resident harvests have increased in both the NWT and Yukon in recent years. Concentrated harvest associated with access roads could impact caribou that use these localized areas, especially for sedentary groups and for groups that demonstrate a high degree of fidelity to traditional rutting areas.

The Yukon Government (2016) recommends an adult sex ratio of 30 bulls:100 cows to ensure that all females have the opportunity to reproduce. A typical adult sex ratio for a moderately hunted subpopulation in Yukon is about 40 bulls:100 cows (Hegel *et al.* 2016). As of 2014, the adult sex ratios from fall and winter surveys conducted in NWT northern mountain caribou ranges was >30 bulls:100 cows with most ratios suggesting moderately hunted subpopulations (see *Appendix A*, Table A1). However, the most recent adult sex ratios based on survey data for

the South Nahanni subpopulation is five years old, and for all other subpopulations is at least eight years old and may not reflect the current situation. The most recent adult sex ratios for the Coal River subpopulation (2008-2011) averaged 33 bulls:100 cows, which is lower than that observed in moderately hunted subpopulations (Hegel *et al.* 2016). The most recent adult sex ratio for the South Nahanni subpopulation (2014) had also dropped down to just over 30 bulls:100 cows (see *Appendix A,* Table A1). Adult sex ratios for the Bonnet Plume and Redstone subpopulations, based on non-resident hunter observations, averaged 81 and 30 bulls:100 cows respectively from 1991-2010 (Larter 2018a). There was no overall trend for the Redstone subpopulation and an increasing overall trend for the Bonnet Plume subpopulation, although there was a declining trend from 1991-1999 for both subpopulations (Larter 2018a).

Climate Change

Climate change has already affected areas in and around northern mountain caribou ranges in the NWT. In Norman Wells, since the late 1950s, mean annual, winter, spring, summer, and fall temperature has increased by 2.0°C, 2.9°C, 3.0°C, 1.1°C, and 1.9°C, respectively (GNWT 2015b). With respect to precipitation, Norman Wells has experienced an increase in fall and winter precipitation, and a decrease in spring and summer precipitation (GNWT 2015b). Reduced size, number, and persistence of snow patches, which are essential summer habitat for northern mountain caribou, is already being observed in the Mackenzie and Selwyn mountains (MacKay *et al.* 2019).

Climate change may result in changes in frequency and severity of natural disturbances, changes in vegetation composition, changes in distribution of other ungulates, increased incidence of icing, and increased incidence of disease and parasites (Vors and Boyce 2009). Other potential effects of climate change include: degradation of permafrost (including possible slumping); and heat stress for caribou in summer. With warmer, drier summers, an increase in wildfire frequency and severity is expected, resulting in abrupt changes in vegetation composition (Price *et al.* 2013). Even without natural disturbance events, vegetation composition is expected to change as warmer conditions result in increased productivity, which could support vegetation favored by other prey species. Increased shrub growth has already been observed in alpine and Arctic tundra ecosystems (Myers-Smith *et al.* 2011). Increased shrub abundance could outcompete lichens and support higher densities of other ungulates. Increased rain/freeze events can further limit availability of terrestrial lichens by creating icing conditions that make it difficult for caribou to detect and forage for terrestrial lichens. Icing could also be advantageous for wolves, if snow conditions allow wolves, not caribou, to run on top of the crust. Climate change could also alter the parasites and diseases that affect caribou. For some parasites, life cycles could potentially be shortened, and/or ranges could extend northward. Insect harassment could potentially increase at the same time that snow patches become less available for caribou to use to avoid them, which can lead to increased energy expenditure by caribou during the insect season. Most

of the northern mountain caribou range in the NWT overlaps the continuous permafrost zone, with lower elevation areas along the eastern portion of the range overlapping the extensive discontinuous permafrost zone (NRCan 1995). Climate change could result in permafrost degradation, which could lead to changes in vegetation species composition (Price *et al.* 2013). Habitat alteration due to fire and anthropogenic disturbances can further exacerbate permafrost degradation.

Other Threats

Other threats to northern mountain caribou include natural disturbances, recreational activities (including introduction and spread of invasive plant species), and contaminants. The primary natural disturbance in northern mountain caribou ranges is fire. Caribou use of burned areas is generally low (Hebblewhite *et al.* 2010; Robinson *et al.* 2010), but caribou have been known to travel through extensive burns (Thomas *et al.* 1998). Like other habitat alteration, fire can eliminate lichens from a site and can create conditions that support vegetation that is favored by other ungulates.

Recreational activities are generally more concentrated in areas with ground access. In northern mountain caribou range in the NWT, recreational activities beyond existing roads and trails is likely low. However, increasing recreational use of drones, including for hunting purposes, could result in disturbance/displacement of caribou and higher mortality rates due to hunting. Invasive plant species could result in increased competition with lichens, which could lead to declines in lichen abundance. Although there is no information on invasive species in NWT northern mountain caribou ranges, they will likely have the greatest effects along access routes, including roads and trails.

Levels of cadmium were found to be lower for caribou than for moose sampled in the Mackenzie Mountains (Larter *et al.* 2016). Although kidneys from caribou showed minor histological changes, kidney function was not expected to be affected (Larter *et al.* 2016). Cesium-134 was not detected in any caribou sampled in 2011 but was detected in one of the caribou sampled in 2012 and 2013 (Larter *et al*. 2016). Cesium-134 levels are the result of the Fukushima reactor accident in March 2011 (Larter *et al*. 2016). Cesium-137 was detected in 27 of 28 caribou sampled and is primarily a remnant of the nuclear weapons tests in the 1960s. The levels of Cesium-134 and Cesium-137 were low and risks to caribou were considered negligible (Larter *et al.* 2016).

Positive Influences

The three primary positive influences on northern mountain caribou in the NWT are: the remote and undisturbed nature of a large portion of most ranges, two large protected areas (Nahanni National Park Reserve and Nááts'įhch'oh National Park Reserve), and inherently low densities of moose, deer, and elk. Although industrial activities occur in NWT northern mountain caribou

ranges, and the Canol Road/Trail bisects the Redstone caribou range, most of the industrial activities (mineral exploration and development, seismic lines) have occurred or are occurring along the periphery of the ranges, leaving large areas within the ranges that are not accessible by road. To augment that, Nahanni National Park Reserve and Nááts'ıhch'oh National Park Reserve together protect 34,850 km² in and adjacent to South Nahanni, Coal River, La Biche, and Redstone caribou ranges, securing for the future those portions of the ranges. However, the HPAR and the approved all season Prairie Creek Road traverse portions of the national park reserves. The final positive influence is the current low density of moose in the area. Northern mountain caribou ranges in the southern portion of their distribution support higher densities of moose, and face significant threats from altered predator/prey interactions caused by habitat alteration due to industrial activities. Currently, the low moose densities in northern mountain caribou ranges in the NWT contribute to range conditions that are more favorable for caribou persistence.

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STATUS AND RANKS

Region	Coarse filter (Ranks) To prioritize[23]	Fine filter (Status) To provide advice	Legal listings (Status) To protect under species at risk legislation
Global	G5T5[24] (2016) (NatureServe)	Not applicable	Not applicable
Canada	N5[25] (2015) (NatureServe Canada)	Special Concern (2014) (COSEWIC)	Special Concern (2005) (SARA)
Northwest Territories	**Sensitive (2015) (NWT General Status Ranking Program)**	**Special Concern (2020) (SARC)**	**Not listed**
Adjacent Jurisdictions			
United States	N1N2[26] (1997) (NatureServe)		
Alberta	S1S2[27] (NatureServe Canada)		
British Columbia	SNR[28] (NatureServe Canada)		
Yukon Territory	SNR (NatureServe Canada)		

[23] All NatureServe codes are as defined in Definitions of NatureServe Conservation Status Ranks: http://help.natureserve.org/biotics/Content/Record_Management/Element_Files/Element_Tracking/ETRACK_Definitions_of_Heritage_Conservation_Status_Ranks.htm#NatureSe.

[24] G5T5 – Secure (at very low risk of extinction or elimination due to a very extensive range, abundant populations or occurrences, and little to no concern from declines or threats).

[25] N5 – Secure (at very low or no risk of extirpation in the jurisdiction due to a very extensive range, abundant populations or occurrences, with little to no concern from declines or threats).

[26] N1N2 – Critically Imperiled to Imperiled (at very high or high risk of extirpation in the jurisdiction due to restricted range, few population or occurrences, steep declines, severe threats).

[27] S1S2 – Critically Imperiled to Imperiled (at very high or high risk of extirpation in the jurisdiction due to restricted range, few population or occurrences, steep declines, severe threats).

[28] SNR – Unranked (national or subnational conservation status not yet assessed).

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APPENDIX A – ADDITIONAL INFORMATION

Threats Assessment[29]

Threats have been classified for northern mountain caribou as a whole, insofar as those threats may be relevant to the status of the population in the NWT. The threats assessment is based on whether threats are considered to be of concern for the sustainability of the species over approximately the next 10 years.

This threats assessment was completed collaboratively by members of the NWT Species at Risk Committee, at a meeting on June 20, 2019 and updated following a public comment period in July-December 2019. The threats assessment will be reviewed and revised as required when the status report is reviewed, in 10 years or at the request of a Management Authority or the Conference of Management Authorities. Parameters used to assess threats are listed in Table 8.

Table 8. Parameters used in threats assessment.

Parameter	Description	Categories
LIKELIHOOD		
Timing (i.e., immediacy)	Indicates if the threat is presently happening, expected in the short term (<10 years), expected in the long term (>10 years), or not expected to happen.	Happening now Short-term future Long-term future Not expected
Probability of event within 10 years	Indicates the likelihood of the threat to occur over the next 10 years.	High Medium Low
CAUSAL CERTAINTY		
Certainty	Indicates the confidence that the threat will have an impact on the population.	High Medium Low

[29] This approach to threats assessment represents a modification of the International Union for the Conservation of Nature's (IUCN) traditional threats calculator. It was originally modified for use in the Inuvialuit Settlement Region Polar Bear Joint Management Plan (Joint Secretariat 2017). This approach is considered easier to use and understand, and is more representative of the threats in the NWT. This modified threats assessment approach was adopted as the standard threats assessment method by the Species at Risk Committee and Conference of Management Authorities in 2019.

MAGNITUDE		
Extent (scope)	Indicates the spatial extent of the threat (based on percentage of population area affected)	Widespread (>50%) Localized (<50%)
Severity of population-level effect	Indicates how severe the impact of the threat would be at a population level if it occurred.	High Medium Low Unknown
Temporality	Indicates the frequency with which the threat occurs.	Seasonal Continuous
Overall level of concern	Indicates the overall threat to the population (considering the above).	High Medium Low

Overall Level of Concern

The overall level of concern for threats to northern mountain caribou are noted below. Please note that combinations of individual threats could result in cumulative impacts to northern mountain caribou in the NWT. Details be found in the *Detailed Threats Assessment*.

Overall level of concern:

- **Threat 1 – Climate change** **Medium**
- **Threat 2 – Predation** **Low**
- **Threat 3 – Resource development** **Low-Medium**
- **Threat 4 – Harvest and recreation** **Low-Medium**
- **Threat 5 – Pollution** **Low**

Detailed Threats Assessment

Threat #1. Climate change (ice patches, snow pack, increased insect harassment, precipitation, temperature, shrub encroachment, timing of seasonal events, fires).	
Specific threat	Threats associated with climate change include increased wildfires (especially on winter range), decreased occurrence of ice patches (the impact of which could be exacerbated by higher densities of insects), unfavourable snow conditions (depth and hardness), changes in vegetation conditions, increased incidence of disease and parasites, degradation of permafrost (slumping), and rapid run-off which creates dangerous river crossings. There are also complex predator/prey interactions associated with climate change that may result in some species expanding their range northward into northern mountain caribou habitat, or endemic species shifting their distribution (e.g., more willows at higher altitudes might result in moose shifting their distribution, with a corresponding shift in wolf distribution). It may be that one of the greatest threats of climate change is the unpredictable nature of these environmental changes, and an increasing frequency of unfavourable conditions, such as snow depth, snow crusting, delays in snow melt, etc. The timing of seasonal movements may be disrupted, leading to a chain of events that influence distribution. Some elders are worried that earlier spring weather might bring bears out of hibernation earlier, creating greater predation pressure during the calving period. Many of these changes are already occurring (e.g., wildfire frequency/intensity, increased warble fly disturbance, increasing moose/predator populations, disappearance of ice patches) and are believed to be causing serious impacts to some populations.
Stress	Environmental changes that limit the distribution and abundance of lichens (e.g., shrubification, fires), or result in changes in snow conditions (depth and hardness) that impact cratering and movements, may have a significant impact on body condition, and therefore productivity. Northern mountain caribou rely on ice patches to minimize harassment from insects and for cooling themselves during hot weather. These are considered critical habitat components in summer habitat. Warble flies can cause a caribou to abandon feeding, run for miles, and lose weight. Because success in reproduction has to do with body condition and various stressors, fly harassment can be an important stressor and influence reproductive success. Hot weather can result in heat stress. There may be a gradual shift in the way caribou are behaving in the fall in the Arctic Red River area as the moose population has been increasing.
Extent	Widespread
Severity	Medium

Temporality	Continuous
Timing	Happening now
Probability	High
Causal certainty	Medium
Overall level of concern	**Medium**

Threat #2. Increasing predator populations.	
Specific threat	Predation is the leading cause of calf and adult mortality. Wolves are the main predator of northern mountain caribou, with bear, wolverine, and cougar predation significant in some ranges. Although predation is natural and under natural conditions, caribou populations should be able to sustain themselves even with predation pressure, there are some indications of increasing grizzly bear populations. Grizzly bear abundance has always been high in some areas, but in the north Mackenzie Mountains, the current densities are the highest some outfitters have ever seen and may be changing caribou distribution patterns. Some concerns have been expressed regarding increasing densities of other ungulate species (i.e., moose, white-tailed deer, and elk). However, the density of moose and other prey around northern mountain caribou ranges in the NWT is currently thought to be relatively low and unlikely to lead to altered predator/prey interactions.
Stress	Direct mortality is the primary consequence of predation. Distribution, habitat use, behaviour, and/or group size may be altered in response to predation pressure.
Extent	Widespread
Severity	Unknown-Low
Temporality	Continuous
Timing	Happening now
Probability	Medium
Causal certainty	Low

Overall level of concern	**Low**

Threat #3. Resource development.	
Specific threat	Most northern mountain caribou range in the NWT is relatively undisturbed. Mineral exploration and mining activities are located primarily in the area around the NWT/Yukon border, especially in areas accessed by the South Nahanni Range Road and the North Canol Road, which is an area consistently used by caribou during calving. There are indications that industrial exploration and development will increase in the near future; this is already underway in the Yukon portion of the range. Of particular concern is the advanced mineral exploration in the Macmillan Pass area (Fireweed Zinc) and the potential development of the MacTung property nearby. Currently, several mining companies have interests in the Macmillan Pass area (North American Tungsten, Colorado, Crest, Gayna River, Bear-Twit, Coates Lake/Redstone, Jay, Lened, Hudson Bay, Eagle Plains, Overland Resources, Silver Range, Three Aces, Selwyn mine, and other lead/zinc/precious metal interests). Roads in NWT northern mountain caribou range include the Canol Road, the Nahanni Range Road, Howard's Pass Access Road, and the Prairie Creek Road. A new 35 km access road has been proposed originating from the North Canol Road in Yukon to access the Mactung property. When the Cantung and Mactung properties sell, increased activity is expected along those access roads. There is particular concern about the Howard's Pass Access Road as it parallels the Little Nahanni River for a portion of its length and that valley includes a portion of the South Nahanni subpopulation's calving, summer, and rut ranges.
Stress	There is limited information about the effects of industrial activities on northern mountain caribou in the NWT. Potential effects include: habitat alteration, displacement, direct and indirect mortality associated with access roads (e.g., improved access for hunters), and increased predation. Northern mountain caribou tend to avoid roads. Roads in winter range are a main concern because animals tend to be more sedentary, limited by snow, attracted to road salt, and then vulnerable to being hit by traffic or potentially hunted. Activities that result in displacement of calving caribou could result in increased mortality risks at a time when caribou calves are already highly vulnerable to mortality. In alpine range, caribou may be displaced from preferred habitat by resource exploration and development. Terrestrial lichens are also sensitive to mechanical disturbance. Disturbance to high elevation habitat, regardless of the presence of lichens, could also require

	long recovery times due to harsh growing conditions. Disturbed soils in some habitat types could also lead to increased production of shrubs and other vegetation favoured by other prey such as moose.
Extent	Localized over the whole range of the species, but the threat is substantial in the calving and summering areas of the largest subpopulation in the NWT
Severity	Low
Temporality	Seasonal-Continuous
Timing	Happening now
Probability	Low-Medium
Causal certainty	Low
Overall level of concern	**Low-Medium**

Threat #4. Harvesting and recreation (increased pressure, poor/disrespectful/non-traditional harvesting practices, bear attractants).	
Specific threat	Indigenous and local residents of the NWT and Yukon hunt northern mountain caribou for subsistence. In addition, non-resident sport hunting occurs in the Mackenzie Mountains annually, mostly during the months of August and September. Resident harvest is almost exclusively of males. Non-resident hunters can only hunt mountain caribou with registered guides within outfitting concessions in the NWT. Non-resident and resident harvest is limited to one northern mountain caribou/year. There are eight outfitters operating in the NWT portion of mountain caribou range. There are no formally established limits on the total number of northern mountain caribou that each guide-outfitter can take each year. Although resident and non-resident harvest is relatively low, it has increased in recent years. There is little information available on Indigenous harvest. Harvest and displacement are exacerbated by the use of ATVs, planes, and helicopters, and facilitated by trails. As a result, there is a lot of noise, a lot of habitat disturbance, and many disrespectful practices taking place, like wasting caribou meat and wounding animals. There is intensifying localized habitat destruction occurring in areas frequented by hunters on ATVs, which is increasing as off-road vehicles become more common and more capable of penetrating wilderness. The Howard's Pass access road is likely to contribute to recreational use of the Macmillan Pass area; staff of Nááts'įhch'oh National Park Reserve are already hearing of overland travel to Mile 222 facilitated by the

	road. There are also concerns about harvesting by boat in some parts of the Sahtú and reports in the Gwich'in region of skidooers chasing mountain caribou. Poor harvesting practices are tied to a lack of awareness and respect for Dene/Métis laws. This threat is already occurring and is causing serious impacts to subpopulations that can be accessed by roads. In the NWT, recreational activities beyond existing roads and trails is likely low. The changing relationship between people and caribou is a threat, as upkeep of the human side of the relationship (including travel to and through the area, harvest, and seeking/passing along information) is an important factor in monitoring and protecting caribou.
Stress	Increases in hunting pressure are tied to observed population declines and avoidance in some areas. Concentrated harvest associated with access roads could impact caribou in these localized areas. Overflights and helicopter activity can disturb and spook caribou. This is tied to population declines and vacated preferred habitats over the last several decades. The impact of habitat loss, and displacement due to human activity, is thought to expose caribou to greater health risks as a result of stress, nutrition, and higher levels of predation. Off-road vehicle use can also compact soil and damage underlying permafrost, resulting in damaged, muddy areas. Side trails then develop as users attempt to avoid the mud, resulting in further habitat damage.
Extent	Localized in the whole range of the species, but substantial in portions of the Redstone range, the largest subpopulation in the NWT
Severity	Unknown
Temporality	Continuous
Timing	Happening now
Probability	High
Causal certainty	Low
Overall level of concern	**Low-Medium –** In some localized areas there could be a major impact.

Threat #5. Pollution (historic oil spills, contaminated sites, and waste).	
Specific threat	There are numerous oil spills and contaminated wastes from past mining and military operations along the CANOL route. Government programs continue to target the clean-up of these materials.
Stress	Local degradation of habitat and potential to impact the health of northern mountain caribou. There are also concerns with caribou becoming entangled in discarded wire, although most of this has now been cleaned up.
Extent	Localized
Severity	Low
Temporality	Continuous
Timing	Happening now
Probability	High
Causal certainty	Low – regarding impact to the population
Overall level of concern	**Low**

Scientific Knowledge Component – Additional Details

Table A1. Adult sex ratios calculated from surveys conducted on northern mountain caribou subpopulations in the NWT.

Subpopulation	Year	Month	% bulls	Bulls/ 100 cows	Total classified	Total Counted[1]	Source
Late winter							
Bonnet Plume	1981	April	20	42	792	896	Farnell and Russell 1984
Bonnet Plume	1982	April	23	50	1,074	1,074	Farnell and Russell 1984
Bonnet Plume	2011	March	NA	NA	NA	671	O'Donoghue 2013
Redstone	2000	March	12	35	233	233	Olsen *et al.* 2001
Fall							
Bonnet Plume?[2]	2000	September	58[3]	214[3]	380	546	Shaw and Benn 2001
Redstone	1999	August	25	43	2,659	2,659	Veitch *et al.* 2000
Redstone	2000	October	30	51	665	1,081	Olsen 2000
Redstone	2002	September	NA	31	1,186	1,186	Olsen 2002[4]
Redstone	2002	September	NA	43	963	971	Olsen 2002[4]
South Nahanni	1995	October	24	38	813	813	Gullickson and Manseau 2000
South Nahanni	1996	October	28	47	739	739	Gullickson and Manseau 2000
South Nahanni	1997	October	20	32	733	733	Gullickson and Manseau 2000
South Nahanni	2000	October	NA	33	549	549	Gunn *et al.* 2002
South Nahanni	2001	September	27	40	758	781	Gunn *et al.* 2002
South Nahanni	2008	Rut	NA	NA	389	389	Farnell 2009
South Nahanni	2008	September	NA	36	245	245	Hegel *et al.* 2016
South Nahanni	2009	October	NA	41	518	518	Hegel *et al.* 2016

South Nahanni	2010	October	NA	26[4]	385	385	Hegel *et al.* 2016
South Nahanni	2011	October	NA	44	484	484	Hegel *et al.* 2016
South Nahanni	2014	October	19	31	431	431	Farnell 2015
South Nahanni	2015	October	16[6]	22[6]	201[6]	201[6]	Farnell 2015
Coal River	2008	October	NA	34	341	341	Hegel *et al.* 2016
Coal River	2009	October	NA	32	148	148	Hegel *et al.* 2016
Coal River	2010	October	NA	33	207	207	Hegel *et al.* 2016
Coal River	2011	October	NA	32	271	271	Hegel *et al.* 2016
Post-calving[7]							
Redstone	1980	June	12	7	612	613	Collin 1983
South Nahanni	2007	June	53	30	200	200	SLR Consulting 2015
South Nahanni	2007	July	32	18	603	603	SLR Consulting 2015
South Nahanni	2008	July	23	15	665	665	SLR Consulting 2015
South Nahanni	2009	July	18	12	602	602	SLR Consulting 2015
South Nahanni	2010	July	31	18	559	559	SLR Consulting 2015
South Nahanni	2012	July	20	14	654	654	SLR Consulting 2015
South Nahanni	2013	July	19	13	452	452	SLR Consulting 2015
South Nahanni	2014	July	17	11	640	640	SLR Consulting 2015

[1]All surveys were aerial surveys except for Shaw and Benn (2001) and Veitch *et al.* (2000), which were ground surveys.

[2]This survey was conducted between Ramparts River and Cranswick River but it is unclear whether the caribou belonged to the Bonnet Plume or Redstone subpopulation or both (see also *Distribution – Search Effort*).

[3]During this ground survey, bulls and calves were the easiest age/sex classes to classify (Shaw and Benn 2001), which likely resulted in biased sex/age ratios for the classified data.

[4]Two surveys were conducted in October 2002, one in the Moose Horn area (1,186 counted) and one in the Carcajou area (971 counted).
[5]The 2010 bulls:100 cows ratio was considered an outlier because the ratio for the other 3 years (2008, 2009, 2011) were similar and it was unlikely that the ratio fluctuated that dramatically from year to year (Hegel *et al.* 2016).
[6]Inclement weather prior to and during the early part of the survey may have driven caribou downslope into the trees and therefore the data may not be fully representative for population trend analysis (Farnell 2015).
[7]The bulls:100 cows ratio observed from post-calving surveys is not considered to represent actual sex ratios, but rather is considered indicative of the later arrival of bulls in the calving/summering areas.

Table A2. Age classes from a sample of female and male caribou harvested by Indigenous harvesters from February to March 1968-1972, and by non-resident hunters during fall 1967-1971 from the Redstone subpopulation (Collin 1983; Larter and Allaire 2017).

	Indigenous harvest				Non-resident harvest					
	Feb-March 1968-1972[1]				1967-1971[1]		1975[2]		2011-13[2]	
	Female		Male		Male		Male		Male	
Age Class (years of age)	No.	%	No.	%	No.	%	No.	%	No.	%
1	13	11	4	13	2	1				
2	9	8	3	10	5	4	1	2	1	3
3	17	14	5	16	12	8	2	4	1	3
4	17	14	7	23	22	15	2	4	3	9
5	18	15	6	19	24	17	16	31	7	22
6	6	5	4	13	29	20	9	17	5	16
7	9	8	2	6	23	16	12	23	5	16
8	8	7			8	6	6	11	6	19
9	5	4			7	5	2	4	2	6
10	4	3			10	7				
11	4	3					1	2	2	6
12	3	3					1	2		
13	5	4			1	1				
14										
15	1	1								
Total	119		31		143		52		32	
Average	5.4		3.9		5.8		6.2		6.5	

[1] From Collin (1983).
[2] From Larter and Allaire (2017).

Table A3. Percent calves and calves/100 cows from surveys conducted in northern mountain caribou ranges in the NWT.

Subpopulation	Year	Month	% calves	Calves/100 cows	Total classified	Total counted [1]	Source
Late winter							
Bonnet Plume	1981	April	22	47	792	792	Farnell and Russell 1984
Bonnet Plume	1982	April	25	54	1,074	1,074	Farnell and Russell 1984
Bonnet Plume	2011	March	NA	NA	NA	671	O'Donoghue 2013
Redstone	2000	March	8	22	233	233	Olsen *et al.* 2001
Fall							
Bonnet Plume?[2]	2000	September	12[3]	45[3]	380	546	Shaw and Benn 2001
Redstone	1999	August	17	28	2,659	2,659	Veitch *et al.* 2000
Redstone	2000	October	12	20	665	1,081	Olsen 2000
Redstone	2002	September	NA	37	1,186	1,186	Olsen 2002[4]
Redstone	2002	September	NA	39	963	971	Olsen 2002[4]
South Nahanni	1995	October	11	17	813	813	Gullickson and Manseau 2000
South Nahanni	1996	October	12	20	739	739	Gullickson and Manseau 2000
South Nahanni	1997	October	16	26	733	733	Gullickson and Manseau 2000

South Nahanni	2000	October	10	15	549	549	Gunn *et al.* 2002
South Nahanni	2001	September	6	10	781	781	Gunn *et al.* 2002
South Nahanni	2008	Rut	NA	17	389	389	Farnell 2009
South Nahanni	2008	September	NA	10	245	245	Hegel *et al.* 2016
South Nahanni	2009	October	NA	16	518	518	Hegel *et al.* 2016
South Nahanni	2010	October	NA	26	385	385	Hegel *et al.* 2016
South Nahanni	2011	October	NA	25	484	484	Hegel *et al.* 2016
South Nahanni	2014	October	19	30	431	431	Farnell 2015
South Nahanni	2015	October	12[5]	17[5]	201[5]	201[5]	Farnell 2015
Coal River	2008	October	NA	12	341	341	Hegel *et al.* 2016
Coal River	2009	October	NA	23	148	148	Hegel *et al.* 2016
Coal River	2010	October	NA	40	207	207	Hegel *et al.* 2016
Coal River	2011	October	NA	35	271	271	Hegel *et al.* 2016
Post-calving							
Redstone	1980	June	32	56	612	613	Collin 1983
South Nahanni	2007	June	15	25	200	200	SLR Consulting 2015
South Nahanni	2007	July	25	44	603	603	SLR Consulting 2015
South Nahanni	2008	July	17	25	665	665	SLR Consulting 2015

South Nahanni	2009	July	21	27	602	602	SLR Consulting 2015
South Nahanni	2010	July	21	37	559	559	SLR Consulting 2015
South Nahanni	2012	July	14	19	654	654	SLR Consulting 2015
South Nahanni	2013	July	21	31	452	452	SLR Consulting 2015
South Nahanni	2014	July	27	44	640	640	SLR Consulting 2015

[1]All surveys were aerial surveys except for Shaw and Benn (2001) and Veitch *et al*. (2000), which were ground surveys.

[2]This survey was conducted between Ramparts River and Cranswick River but it is unclear whether the caribou belonged to the Bonnet Plume or Redstone subpopulation or both (see also *Distribution – Search Effort*).

[3]During this ground survey, bulls and calves were the easiest age/sex classes to classify (Shaw and Benn 2001), which likely resulted in biased sex/age ratios for the classified data.

[4]Two surveys were conducted in October 2002, one in the Moose Horn area (1,186 counted) and one in the Carcajou area (971 counted).

[5]Inclement weather prior to and during the early part of the survey may have driven caribou downslope into the trees and therefore the data may not be fully representative for population trend analysis (Farnell 2015).