

Note

Cougar (*Puma concolor*) predation on Northern Mountain Caribou (*Rangifer tarandus caribou*) in central British Columbia

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Abstract

Caribou (*Rangifer tarandus*) populations are sympatric with Cougars (*Puma concolor*) in only a few areas, primarily in western Canada. Records of Cougar–Caribou interactions are limited and no published accounts describe Cougar predation on the shallow-snow, terrestrial-lichen-eating Northern Mountain Caribou (*Rangifer tarandus caribou*), referred to as Designatable Unit (DU) 7 by the Committee on the Status of Endangered Wildlife in Canada. In 2018 and 2019, two incidents of confirmed Cougar predation on radio-collared Caribou were documented in the declining Itcha-Ilgachuz subpopulation in west-central British Columbia. To the best of our knowledge, this is the first published record of Cougar predation on DU7 Northern Mountain Caribou. Increased landscape disturbance and climate change may be increasing apparent competition between deer (*Odocoileus* spp.), feral Horses (*Equus ferus caballus*), and Caribou, leading to Cougar predation in areas of Caribou range where it previously has not been documented. Cougar predation may become a conservation concern, as declining Caribou herds are susceptible to any increased predation pressure.

Key words: Predator–prey dynamics; apparent competition; feral Horses; Cougar; *Puma concolor*; Northern Mountain Caribou; *Rangifer tarandus caribou*; British Columbia

Northern Mountain Caribou (*Rangifer tarandus caribou*; Designatable Unit [DU] 7; COSEWIC 2011) are a discrete and evolutionarily significant population that primarily eat terrestrial lichens in winter in shallow snow areas in British Columbia (BC), Yukon, and Northwest Territories. This DU has been assessed as Special Concern (COSEWIC 2014). Wolves are the primary predator for DU 7 Caribou (COSEWIC 2014). There is no published information on Cougar (*Puma concolor*) predation on the shallow-snow, terrestrial-lichen-eating Caribou that make up DU 7, although there are multiple records of Cougar predation on deep-snow, arboreal-lichen-eating Caribou (Kinley and Apps 2001; Wittmer *et al.* 2005a,b; Apps *et al.* 2013). Incidents of Cougar predation on Caribou north of our study area are rare, and we are aware of only one documented case. This occurred in northern BC in the Kennedy Siding subpopulation (Seip and Jones 2018), which are DU 8, Central

Mountain Caribou. Cougars have not been implicated in any Boreal Caribou mortalities in BC (Culling and Cichowski 2017). Here, we report incidents of Cougar predation on Northern Mountain Caribou.

Northern Mountain Caribou includes the Itcha-Ilgachuz subpopulation (COSEWIC 2011, 2014), which occurs on the Cariboo-Chilcotin Plateau in the central interior of BC. This subpopulation declined by over 80% between 2003 and 2019 (estimated 2800 Caribou in 2003 and 385 in 2019; Shores 2019). Wolf predation is the proximate cause of mortality for this subpopulation (Shores 2019), as it is for other Caribou subpopulations in Canada (Wittmer *et al.* 2005a; Hervieux *et al.* 2013; Serrouya *et al.* 2019). The Itcha-Ilgachuz subpopulation occupies a multi-predator, multi-prey system that includes Moose (*Alces americanus*), White-tailed Deer (*Odocoileus virginianus*), Mule Deer (*Odocoileus hemionus*), Mountain Goat (*Oreamnos americanus*), feral Horse (*Equus*

ferus caballus), Gray Wolf (*Canis lupus*), Grizzly Bear (*Ursus arctos*), Black Bear (*Ursus americanus*), and Wolverine (*Gulo gulo*), in addition to Cougar. In the Itcha-Ilgachuz Caribou range, elevations are ~850–2410 m above sea level. The low-elevation winter range for this subpopulation, at 51–53°N, is dominated by dry forests of Lodgepole Pine (*Pinus contorta* Douglas ex Loudon) and abundant wetlands with localized stands of Engelmann Spruce (*Picea engelmannii* Engelmann). Land use varies from provincial parks and wilderness areas to sites of intensive timber harvesting. Wildfire and Mountain Pine Beetle (*Dendroctonus ponderosae*) infestations have also caused significant landscape disturbance in the subpopulation's range (Goward 2000; Armleder and Waterhouse 2008).

Beginning in 2018, 80 global positioning system (GPS) radio collars (Lotek Globalstar Lifecycle, Lotek Engineering, Newmarket, Ontario, Canada, and GmbH Vertex Lite Iridium, Vectronic Aerospace, Berlin, Germany) were deployed throughout this subpopulation to infer proximate causes of death, as well as to assist population inventory. Collars were deployed primarily on females (52 of 80, 65%). All GPS collars were equipped with a mortality sensor and were pre-programmed to emit a mortality notification via email and text message when collar movement did not occur over six hours (Severud *et al.* 2015; Jung *et al.* 2018). A helicopter was used to access mortality sites within 24 h of receiving a notification. Although Cougars predominately kill ungulate prey, particularly deer (*Odocoileus* spp.; Robinson *et al.* 2002), scavenging on ungulate carcasses has been reported (Bacon *et al.* 2011). Staff responding to mortality events associated with GPS-collared Caribou were experienced in assigning cause-specific mortality; thus, a distinction could be made between predation and scavenging.

On 27 March 2018, S.C.W. and a conservation officer investigated a mortality alert received the previous day for an adult male Caribou. The carcass was partly cached under snow and covered with hair sheared from the Caribou (Figure 1a), a characteristic Cougar caching behaviour (Murphy and Ruth 2009). From observed tracks and sign, it was determined that the kill was made by a female Cougar with at least two kittens. Pre-mortem haemorrhaging was observed around the neck, and suffocation was determined to be the cause of death.

The following year, on 26 March 2019, while investigating another mortality event of a GPS-collared Caribou, we flushed a Cougar from the kill site (Figure 1b) as we approached by helicopter. Ground inspection revealed the carcass of a female Caribou cached under the root system of a fallen Lodgepole Pine and

partly covered by pine needles and brush (Figure 1c). By following tracks, we located the point of initial contact and a drag trail made when the Cougar moved the Caribou carcass under a spruce tree. Hair was sheared from the Caribou carcass at this location before it was moved under the Lodgepole Pine. As in the 2018 predation event, pre-mortem haemorrhaging was evident around the neck. Both predation events occurred within 11 km of each other.

Cougar predation on this Caribou subpopulation was first reported in March 2012 (Cichowski and MacLean 2015), although details on the mortality investigation are lacking and scavenging cannot be ruled out. Our more recent observations are the first to confirm Cougar predation on DU 7 Northern Mountain Caribou; no others have been documented in the Yukon (M. Suito pers. comm. 6 August 2020), northeastern BC (M. Bridger pers. comm. 5 August 2020), northwestern BC (A.-M. Roberts pers. comm. 5 August 2020 and C. Thiessen pers. comm. 10 August 2020), or the Northwest Territories (É. Lamontagne pers. comm. 10 August 2020).

Although multiple factors contribute to Caribou population declines, the ultimate cause is believed to be anthropogenic disturbances. The conversion of old growth forests to early seral habitats as a result of industrial development has supported an increase in Moose and deer populations and an expansion of their distribution (Serrouya *et al.* 2017). This has led to increased apparent competition with Caribou via unsustainable predation rates by predators, such as wolves and Cougars (Latham *et al.* 2011; Wittmer *et al.* 2013; Serrouya *et al.* 2017). (Apparent competition is a form of competition between species indirectly competing with another species, whereby both serve as prey of a predator.) The northern expansion of Cougars and White-tailed Deer caused by climate and landscape change has been documented in other regions of Canada (Jung and Merchant 2005; Dawe *et al.* 2014; Knopff *et al.* 2014); it is possible that a similar dynamic is occurring in the Itcha-Ilgachuz subpopulation range.

Despite the lack of estimates of Cougar density in the Itcha-Ilgachuz Caribou range, local residents have indicated increased Cougar activity in recent years (McNay and Cichowski 2015). White-tailed Deer are also relatively recent in this area, with increasing observations from local residents and the opening of a hunting season in 2003 for the management unit (MU) that encompasses the Itcha-Ilgachuz range (MU 5-12; McNay and Cichowski 2015). Furthermore, a large population of feral Horses overlaps low-elevation winter habitat of Itcha-Ilgachuz Caribou and has been increasing since 1991 (Youds *et al.* 2011). Predators, such as Cougars, may be maintained by fe-

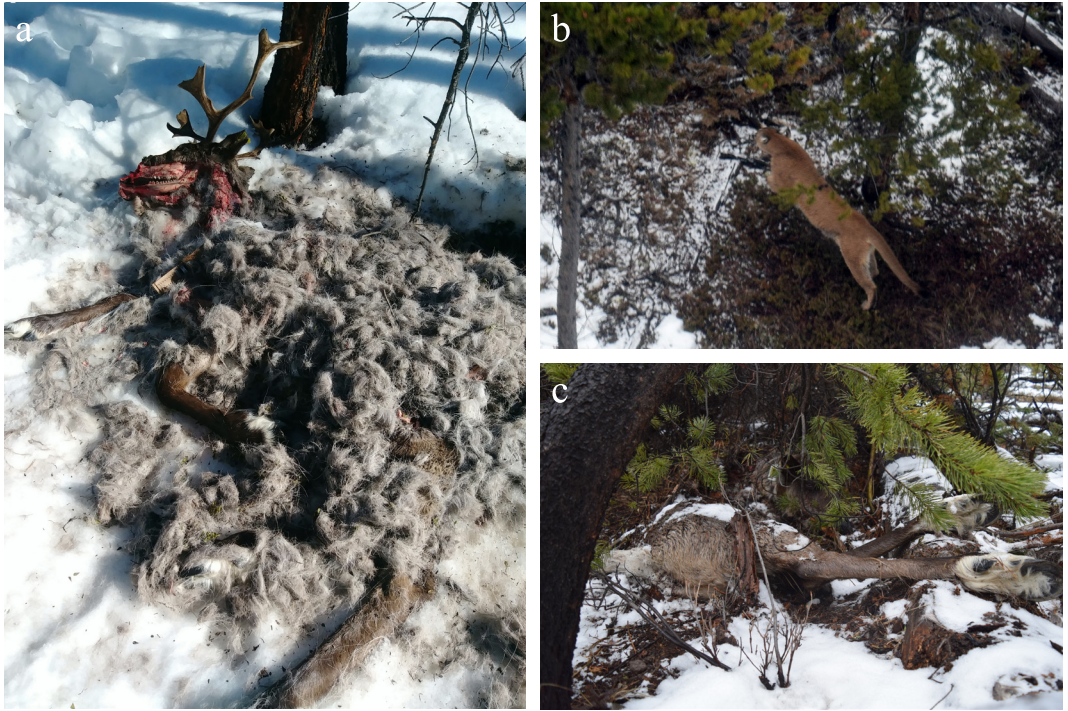


FIGURE 1. a. A radio-collared male Northern Mountain Caribou (*Rangifer tarandus caribou*) carcass investigated on 27 March 2018. b. The Cougar (*Puma concolor*) responsible for predating the female Caribou in c, flushed from the kill site by our helicopter, 27 March 2019. c. A radio-collared female Caribou cached by a Cougar and investigated on 27 March 2019. Photos: S. White.

ral Horses that provide an alternative resource subsidy (Newsome *et al.* 2015). Cougar predation on feral Horses has been documented (Turner *et al.* 1992) and predation on their foals is a population-limiting factor (Greger and Romney 1999). The presence of an abundant non-native prey species has been identified as a primary factor in the decline of native species (DeCesare *et al.* 2010; Wittmer *et al.* 2013) and can support other Cougar populations (e.g., Osorio *et al.* 2020). Cougars have been shown to have a negative impact on populations of secondary prey species through apparent competition (Kinley and Apps 2001; Robinson *et al.* 2002; Serrouya *et al.* 2015), and the predation impact of an individual Cougar can have a significant impact on small ungulate populations (Festa-Bianchet *et al.* 2006).

Although Moose are the primary drivers of apparent competition in Wolf-Caribou-Moose systems (Seip 1992; Serrouya *et al.* 2017), it is possible that an apparent competition dynamic between deer or Horses and Cougars is contributing to decline of Northern Mountain Caribou at the southern extent of their range. Given the steeply declining trajectory of the Itcha-Ilgachuz subpopulation, further research is

warranted to understand how the abundance and distribution of feral Horses and White-tailed Deer could be exacerbating apparent competition with Caribou and potentially accelerating declines in Northern Mountain Caribou populations.

Author Contributions

Writing – Original Draft: S.C.W. and C.R.S.; Writing – Review & Editing: S.C.W., C.R.S., and L.D.; Conceptualization: S.C.W. and C.R.S.; Investigation: S.C.W. and C.R.S.; Funding Acquisition: C.R.S. and L.D.

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