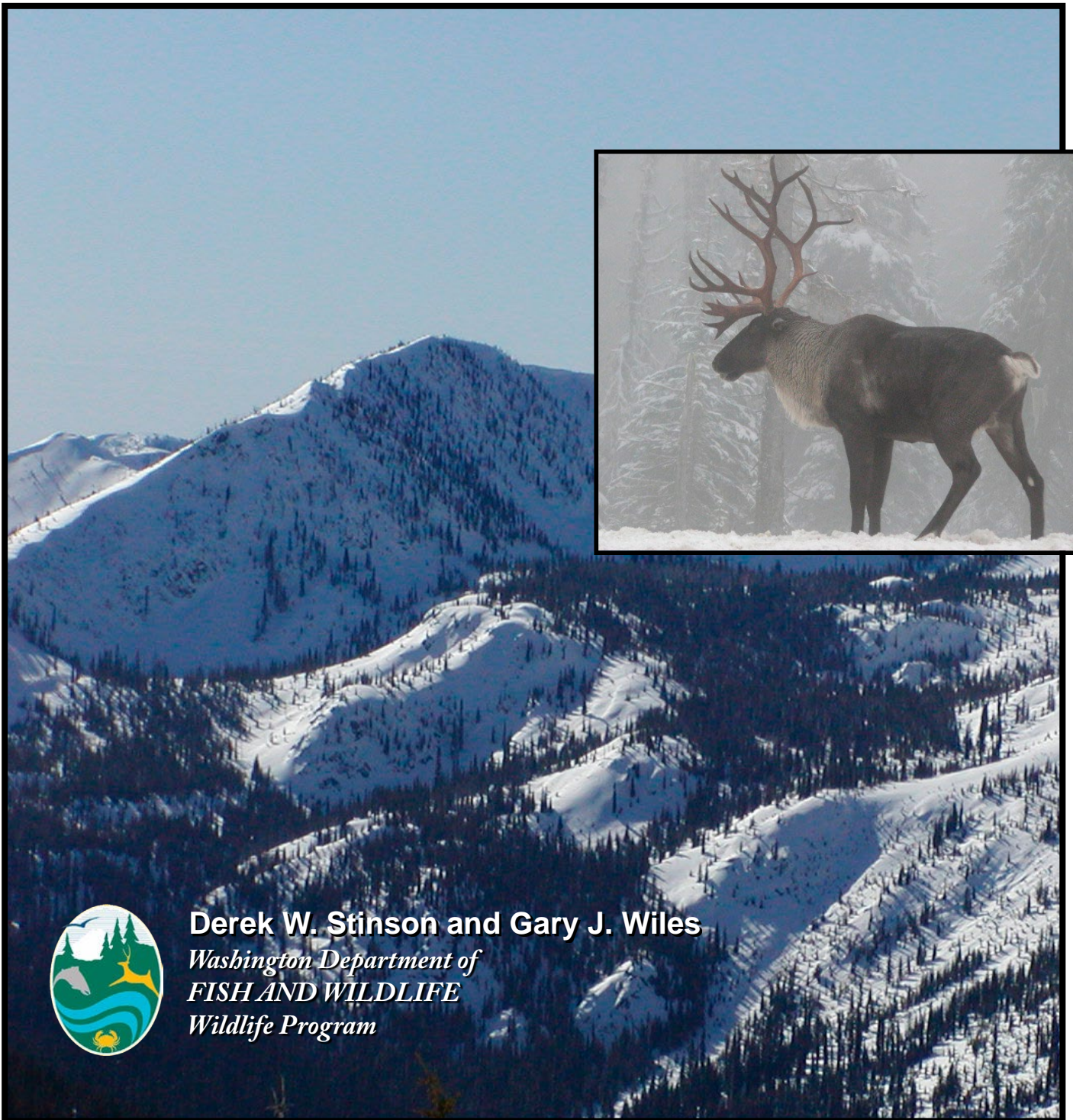


Periodic Status Review for the Woodland Caribou



Derek W. Stinson and Gary J. Wiles

*Washington Department of
FISH AND WILDLIFE
Wildlife Program*

The Washington Department of Fish and Wildlife maintains a list of endangered, threatened, and sensitive species (Washington Administrative Codes 232-12-014 and 232-12-011). In 1990, the Washington Wildlife Commission adopted listing procedures developed by a group of citizens, interest groups, and state and federal agencies (Washington Administrative Code 232-12-297). The procedures include how species listings will be initiated, criteria for listing and delisting, a requirement for public review, the development of recovery or management plans, and the periodic review of listed species.

The Washington Department of Fish and Wildlife is directed to conduct reviews of each endangered, threatened, or sensitive wildlife species at least every five years after the date of its listing. The reviews are designed to include an update of the species status report to determine whether the status of the species warrants its current listing status or deserves reclassification. The agency notifies the general public and specific parties who have expressed their interest to the Department of the periodic status review at least one year prior to the five-year period so that they may submit new scientific data to be included in the review. The agency notifies the public of its recommendation at least 30 days prior to presenting the findings to the Fish and Wildlife Commission. In addition, if the agency determines that new information suggests that the classification of a species should be changed from its present state, the agency prepares documents to determine the environmental consequences of adopting the recommendations pursuant to requirements of the State Environmental Policy Act.

This document is a draft periodic status review for the Woodland Caribou in Washington. It was reviewed by species experts and is available for a 90-day public comment period from 7 May through 5 August. All comments received will be considered during the preparation of the final periodic status review. The Department plans to present the results of this periodic status review to the Fish and Wildlife Commission at an upcoming meeting

Submit written comments on this document by 5 August 2022 via e-mail to: TandEpubliccom@dfw.wa.gov or by mail to:

**Conservation Assessment Section Manager, Wildlife Program
Washington Department of Fish and Wildlife
P.O. Box 43141
Olympia, WA 98504-3141**

This report should be cited as:

Stinson, D.W., and G.J. Wiles 2022. Draft periodic status review for the Woodland Caribou in Washington. Washington Department of Fish and Wildlife, Olympia, Washington. 23+iii pp.

Cover background photo of the southern Selkirk Mountains by Mike Borysewicz, U.S. Forest Service; cover photo of a bull woodland caribou in the southern Selkirk Mountains by Steve Forrest, Wikimedia Commons; inside title page illustration by beezart, Flickr Creative Commons.



This work was supported in part by personalized and endangered species license plates



DRAFT

**Periodic Status Review for the Woodland
Caribou in Washington**



Prepared by
Derek W. Stinson and Gary J. Wiles
Wildlife Program, Diversity Division
Washington Department of Fish and Wildlife
600 Capitol Way North
Olympia, Washington 98501-1091

May 2022

TABLE OF CONTENTS

EXECUTIVE SUMMARY	iii
INTRODUCTION	1
Description and Legal Status.....	1
Distribution	2
NATURAL HISTORY	2
POPULATION AND HABITAT STATUS	4
FACTORS THAT LED TO EXTIRPATION	6
Habitat degradation, fragmentation, predation, and human disturbance	6
Other factors affecting Southern Mountain Caribou.....	8
MANAGEMENT ACTIVITIES	9
CONCLUSIONS AND RECOMMENDATION.....	11
REFERENCES CITED.....	12
PERSONAL COMMUNICATIONS	19
APPENDIX A Management Area for the South Selkirk herd and Critical Habitat	20
APPENDIX B. Numbers of caribou in the South Selkirk subpopulation	21
APPENDIX C. PUBLIC COMMENTS.....	22

LIST OF FIGURES AND TABLES

Figure 1. Male woodland caribou.	1
Figure 2. Caribou (<i>Rangifer tarandus</i>) subspecies	2
Figure 3. Members of the South Selkirk subpopulation during the 2012 winter census.....	4
Figure 4. Deep-snow Mountain Caribou, or the Southern Mountain Caribou DU herds.	5
Figure 5. Number of caribou in the South Selkirk herd, 2009-2019.	6
Figure A. Management Area for the South Selkirk herd and Critical Habitat and the historical and recent distribution of Southern Mountain Caribou.....	20
Table B. Numbers of caribou and calf recruitment in the South Selkirk subpopulation during annual late winter censuses, 2000-2020.....	21

ACKNOWLEDGMENTS

Funding for the preparation of this periodic status review came from Washington endangered wildlife background license plates and Washington personalized license plates. Thanks go to the members of the Selkirk Caribou International Technical Work Group (SCITWG), whose documents greatly aided the preparation of this report. Dana Base, Leo DeGroot, Lydia Allen, Norm Merz, Kevin Robinette, Wayne Wakkinen, and Bart George were helpful with the 2017 status review. The 2022 update was improved by comments from Norm Merz, Bart George, Leo DeGroot, Brittany Morlin, Gary Bell, and Annemarie Prince.

EXECUTIVE SUMMARY

The South Selkirk subpopulation of Woodland Caribou (*Rangifer tarandus caribou*) was one of 17 herds of the Southern Group of the Southern Mountain Caribou or ‘Deep-snow Mountain Caribou’ ecotype. This subpopulation occurred in the southern Selkirk Mountains of southeastern British Columbia, northeastern Washington (in Pend Oreille County), and northern Idaho, and was the only remaining caribou herd that ranged into the contiguous U.S. The Southern Group/Deep-snow ecotype inhabits mountainous areas with deep snow accumulations and their winter diet is primarily arboreal hair lichens. They require large areas of old growth conifer forests throughout the year and migrate seasonally to different elevations and forest types to seek food and safe calving areas, and to avoid predators.

The South Selkirk subpopulation may have numbered in the hundreds in the late 1800s, but decreased to an estimated 25–100 caribou between 1925 and the mid-1980s. Numbers ranged between 33 and 51 animals from 1991 to 2009 despite being supplemented with 103 caribou during two multi-year translocations in the late 1980s and 1990s. Additionally, the South Selkirk subpopulation became isolated from neighboring subpopulations by human activities and development, and likely had no immigration occurring in recent decades. The subpopulation declined rapidly from 46 in 2009 to 1 animal in 2018. With the South Selkirk subpopulation facing imminent extinction, the last remaining South Selkirk animal was translocated to a pen located north of Revelstoke, B.C., and was subsequently released to join the North Columbia subpopulation in April 2019, marking the extirpation of caribou in the South Selkirks. Overall abundance of Deep-snow Mountain Caribou has declined 45% since the late 1980s; of the 17 herds, six are extirpated and five have fewer than 50 animals, and they totaled about 1,250 in 2021.

Timber harvest converted much of the mid-elevation old-growth forests to younger age that brought higher densities of deer, moose, and elk. Roads and abundant prey brought predators (i.e., cougars, bears, and wolves), into closer proximity and more frequent contact with caribou, resulting in an unsustainable frequency of predation. Predation was considered the most important proximate factor in the extirpation of the South Selkirk subpopulation. Other threats to the subpopulation were small size and isolation of populations, highway collisions, human disturbance associated with winter backcountry recreation that affected habitat use and movements, and climate change.

Woodland Caribou are extirpated from Washington and are unlikely to become re-established without human intervention. Any reintroduction efforts should include a complete feasibility assessment including habitat availability, predator densities, and the habitat changes expected with climate change. It is recommended that the Woodland Caribou remain a state endangered species in Washington.

INTRODUCTION

This periodic status review briefly summarizes the biology, population status, and factors that affected the South Selkirk herd of Woodland Caribou (*Rangifer tarandus caribou*) that occurred in Washington and updates the previous summary by Wiles (2017). It also makes a recommendation about the species' current endangered status under state law.

DESCRIPTION AND LEGAL STATUS

Caribou are members of the deer family (Cervidae) and are distributed across much of the mountainous, boreal and tundra regions of North America. Adult males have large antlers reaching up to 3–4 ft (90–120 cm) in length, and females have smaller and simpler antlers. Males shed their antlers from November to April and females from May to June (USFWS 1994). Caribou have large, rounded hooves and large, widely separated dew claws that allow them to cross deep snow and wetlands. Woodland Caribou measure 3.6–4.6 feet (1.1–1.4 m) tall at the shoulder. Body coloration is dark brown, contrasting with a whitish neck, shoulders (sometimes extending to the flanks), rump, undertail, and patches above the hooves. Overall coloration becomes paler during the winter and spring, and adult males develop a distinctive white mane during the breeding season.



Figure 1. Male woodland caribou (USFWS photo).

The South Selkirk herd belonged to the 'Southern Group of the Southern Mountain ecotype' or the 'Southern Mountain Designatable Unit' [DU]; COSEWIC 2011) of Woodland Caribou. All caribou in British Columbia (B.C.) are 'forest-dwelling' Woodland Caribou (*R. t. caribou*) (Thomas & Gray 2002). Ray and others (2015) and Harding (2019) described the somewhat confusing changes in names and legal designations of Woodland Caribou populations. The Southern Group are the 'Deep-snow Mountain' ecotype (Serrouya and others 2012, Harding and others 2020), which are considered distinctive by remaining high in the mountains during winter where the snowpack allows them to forage on arboreal hair lichens, whereas other ecotypes forage predominantly on ground dwelling lichens in winter, which are accessible because of relatively shallow snow depths.

Deep-snow Mountain Caribou are an important species in the culture and history of the Ktunaxa Nation (including the Kootenai Tribe of Idaho and Confederated Salish and Kootenai Tribes), the Kalispel Tribe and other indigenous peoples.

Legal status. The Woodland Caribou was designated an endangered species by Washington in 1982 (WAC 232-12-014) and Idaho in 1977 (USGAO 1999). The South Selkirk subpopulation of Woodland Caribou was listed as endangered under the U.S. Endangered Species Act in 1983; this was subsequently revised to the Southern Mountain Caribou distinct population segment (DPS; USFWS 2019).

At the federal level in Canada, the Designatable Unit report (COSEWIC 2011), delineated a new population structure that resulted in the new ‘Southern Mountain Caribou DU9’ composed of 17 subpopulations from the former Southern Mountain population; the remaining subpopulations were assigned to the new Central and Northern Mountain DUs (the ‘Southern Mountain’ population of woodland caribou formerly included some Northern and Central Mountain herds). The new Southern Mountain Designatable Unit (DU9) was designated Endangered under COSEWIC (2014), but the Southern Group is listed as threatened under Species at Risk Act (SARA). DU9 is called the Southern Mountain Caribou-Southern Group by the B.C. Caribou Recovery Program, and is the ‘Deep-snow Mountain Caribou ecotype’ referred to in some literature (Serrouya and others 2012, Harding and others 2020).

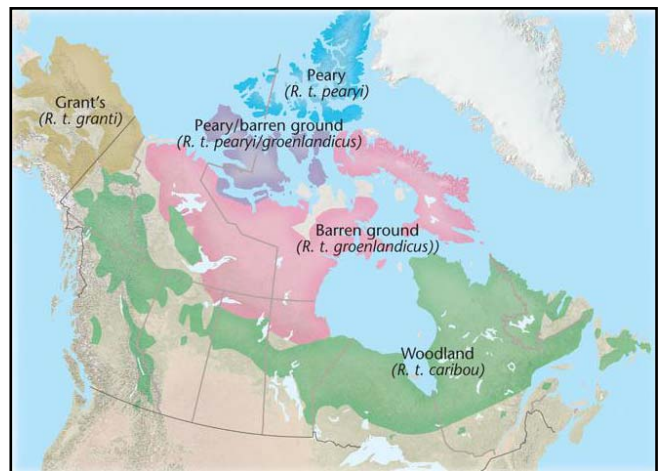


Figure 2. Caribou (*Rangifer tarandus*) subspecies (COSEWIC 2011, after Banfield 1961).

DISTRIBUTION

The Woodland Caribou (subspecies *R. t. caribou*) that formerly roamed northeastern Washington is found from southern B.C. northward to southern Yukon, and eastward to Newfoundland and Labrador (Fig. 2). It historically occurred as far south as Minnesota, Michigan, and northern New England until the late 19th or early 20th century (Banfield 1961; Miller 2003). The Deep-snow Mountain ecotype, or Southern Mountain Caribou-Southern Group live in the Interior Wet Belt ecosystem of the mountainous regions in southeastern and east central B.C. where winter snows are often 3–4 m deep. The recent range of the South Selkirk herd or subpopulation included portions of Pend Oreille County, Washington, and Boundary County, Idaho.

NATURAL HISTORY

Habitat needs and seasonal movements. The Deep-snow Mountain Caribou are associated with old growth (>140 yr) forests of cedar/hemlock (*Tsuga heterophylla*, *Thuja plicata*) and spruce/subalpine fir (*Picea engelmannii*, *Abies lasiocarpa*) in areas of wet and very wet biogeoclimatic subzones (Apps and McLellan 2006); they are more closely tied to old-growth forests than any other North American ungulate (Rominger and others 1996; Wittmer and others 2007; Apps and others 2013). They winter at high elevations for 3–4 months of the year where they feed exclusively on arboreal hair lichens found on standing or wind-fallen conifers (Rominger & Oldemeyer 1989; Servheen & Lyon 1989). This key winter

forage only grows in abundance in old forests and is accessible from atop the snowpack (Edwards & Ritcey 1960). Other important characteristics are remoteness from human presence, gentle slopes, low road density, and little motorized access (Apps & McClellan 2006).

Deep-snow caribou undertake elevational migrations as many as four times a year, selecting habitats that historically helped them avoid predators, while providing access to adequate forage. Early winter may be a critical time due to scarcity of forage and high energy cost of movement in deep soft snow. The dense canopies of old cedar-hemlock forest intercept snow, minimizing snow depths, allowing access to some green forage and reducing the energy costs of locomotion (Servheen & Lyon 1989). In early winter (Nov–mid-January), they inhabited elevations of 5,500–6,300 ft (1,676–1,920 m) with a mix of old-growth stands of cedar/hemlock with high canopy closure (76–100%) and more open stands of spruce/fir (Rominger & Oldemeyer 1989, Servheen & Lyon 1989, Kinley & Apps 2007). In late winter the Selkirk caribou moved to areas above ~6,000 ft with mature/old-growth spruce-fir stands with a more open canopy and a supportive snowpack that provided access to abundant arboreal lichens (Servheen & Lyon 1989). In spring (mid-April to early July), the caribou headed back down to mid-elevation forest with green forage (Freddy 1974; Scott & Servheen 1985, Servheen & Lyon 1989), but in late spring pregnant females returned to snow-covered high-elevation areas to calve where they could avoid the higher predator numbers of lower elevations. In summer (early July – mid-Sept), high elevation basins and other sites with lush forage (e.g., riparian strips, meadows) in mature and old stands of spruce/fir were used. In fall (Mid-September through October), the scarcity of green forage triggered a shift to lower elevations and denser canopied stands where deciduous forage is less susceptible to early frost. Fall habitats also contained more snags and deadfall with lichens that help caribou transition from green forage to lichens (Servheen & Lyon 1989).

Diet. During spring and summer, South Selkirk caribou ate grasses, sedges (*Carex* spp.), rushes (*Juncus* spp.), forbs, arboreal lichens, horsetails, shrub and tree leaves, and conifer needles and bark (Freddy 1974; Scott & Servheen 1985; Rominger and others 2000). Calving females fed on arboreal lichens on snow-covered ridgetops for 4–6 weeks (Scott & Servheen 1985). In the fall and early winter, the diet included shrubs (especially Oregon Boxleaf, *Paxistima myrsinites*), conifers, and forbs, but as snowpack accumulated it shifted to arboreal hair lichens (especially *Bryoria* spp.). By late winter when caribou can walk on top of deep snows, food consisted almost entirely of *Bryoria* lichens (Scott & Servheen 1985; Rominger & Oldemeyer 1990; Rominger and others 1996).

Home range and longer movements. Annual home ranges of animals in the South Selkirks averaged 51–67 mi² (131–173 km²; Scott & Servheen 1985). Aside from seasonal movements between habitats and elevations, deep-snow caribou are sedentary within their subpopulation ranges, and there is very little movement between subpopulations, indicating that many are now isolated (van Oort and others 2011; Serrouya and others 2012). Interchange among resident members of the South Selkirk subpopulation and the two nearest herds, the Purcells-South (30 mi [48 km] away, currently extirpated) and Nakusp (60 mi [97 km] away) was never detected after research began in the 1980s, with the exception of some translocated individuals (USFWS 2008).

Reproduction and social organization. Caribou have lower productivity than other North American cervids. Most females do not breed until 2.5 years old, although some yearlings may conceive if in good body

condition (Miller 2003). Rutting activity occurs from late September to late October, when dominant males defend small groups of 6–10 females (Johnson & Miller 1979; USFWS 1994; Cichowski and others 2004). Single calves are born from late May to early July (Cichowski and others 2004).

Unlike migratory caribou that can occur in large herds, Woodland Caribou form relatively small groups. Group size in the South Selkirk subpopulation ranged from single females during calving up to ~25 animals during the rut and late winter (Fig. 3; USFWS 2012). Membership within groups was somewhat fluid, with individuals of both sexes switching among groups over time (Cichowski and others 2004).



Figure 3. Members of the South Selkirk subpopulation during the 2012 winter census (photo by L. DeGroot, B.C. MFLRO).

Survival and predators. Female caribou can live 10–15 years and males 8–12 years (USFWS 1994). In deep-snow caribou subpopulations, mean annual survival among adult females varies from 55–96% (average = 83%; Wittmer and others 2005a; COSEWIC 2014). Calf mortality is highest ($\geq 40\%$) during the first few months of life (Seip and Cichowski 1996; COSEWIC 2014). Cougars (*Puma concolor*), Gray Wolves (*Canis lupus*), and bears (*Ursus americanus*, *U. arctos*) are the most important predators (Almack 2002; Apps and others 2013; DeGroot 2016); during a study by Katnik (2002), predation by Cougars seemed to be responsible for much of the mortality of the South Selkirk herd during June–October, 1998–2001. Other causes of death among deep-snow caribou include predation by wolverines (*Gulo gulo luscus*), malnutrition, vehicle collisions, and other accidents (e.g., avalanches, falls; USFWS 1994; Wittmer and others 2005a).

POPULATION AND HABITAT STATUS

Deep-snow Mountain Caribou. Deep-snow Mountain Caribou once ranged as far south as the Salmon River in Idaho (Evans 1960) and northwestern Montana (Banfield 1961). The historical occurrence of caribou in Washington extended as far west as Okanogan County (Taylor & Shaw 1929), but it is unknown to which subpopulation those animals belonged. Much of the historical range of Deep-snow Mountain Caribou is no longer occupied (I. Hatter, pers. comm., in Spalding 2000).

Most populations of Woodland Caribou have declined in abundance and distribution, especially in the southern portions of the range (Thomas & Gray 2002; Festa-Bianchet and others 2011; Ray and others 2015). In 2021, the 11 remaining herds of the Deep-snow Mountain Caribou (Southern Group of the Southern Mountain Caribou) were estimated to total 1,250 individuals (B.C. Caribou Recovery Program 2021), and 5 of the 11 were estimated to consist of <50 individuals, five had between 50 and 250 individuals, and one had ~405 individuals (B.C. Caribou Recovery Program 2021). The Central Rockies, George Mountain,

Monashee, Purcell Central, Purcell South, and South Selkirk herds are all considered extirpated (B.C. Caribou Recovery Program 2021) (Fig. 4).

South Selkirk subpopulation--historical.

Records from the 1800s indicate that caribou were abundant in the south Selkirk Mountains (Seton 1927; Layser 1974), with possibly “hundreds” of animals once present around Priest Lake, Idaho (Flinn 1956). Occurrence in Washington apparently declined rapidly, with several authors reporting caribou as being sparse or extirpated in the state for several decades after a major forest fire in 1915 (Taylor & Shaw 1929, Booth 1947, Dalquest 1948), although the reports obtained by Layser (1974) suggest somewhat greater presence during this period. Two estimates of the subpopulation placed total numbers at about 100 animals in the 1950s (Flinn 1956) and probably fewer than 50 animals from 1925 to 1971 (Freddy 1974). Reliable census data were not available until aircraft were used in surveys. This method, in combination with ground surveys, resulted in subpopulation estimates of about 25 caribou in 1973-1974 (Freddy 1974) and 26–28 caribou during 1983-1985 (Scott & Servheen 1985).

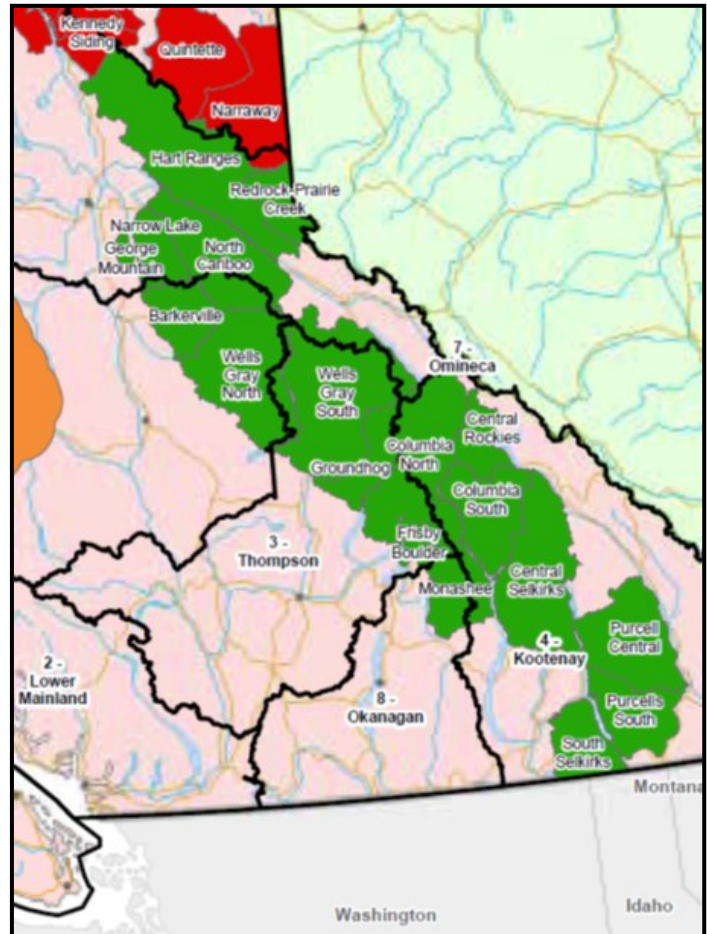


Figure 4. Deep-snow Mountain Caribou, or the Southern Mountain Caribou DU herds, = green (B.C. Caribou Recovery Program 2020).

South Selkirk augmentations. Two augmentation projects using caribou from other herds were conducted to supplement the South Selkirk herd (Compton and others 1995; Almack 2000). Translocation of 60 caribou into the subpopulation during 1987-1990 increased herd size to 47 by 1991 and temporarily established a second group of animals in Idaho (Warren and others 1996). The second augmentation brought 43 animals into Washington during 1996-1998. Translocated individuals generally experienced low survival rates due in part to high levels of predation and there was some dispersal of animals beyond the range of the subpopulation (Compton and others 1995; Warren and others 1996; Almack 2002). Also, the ‘hard release’ methods without any acclimation period may have contributed to the dispersal and significant mortality rate (B. George, 2022, pers.comm.)

South Selkirk subpopulation--recent. Surveys were conducted annually beginning in 1991. After 2009, South Selkirk caribou were only occasionally sighted in Washington or Idaho (SCITWG 2020). Subpopulation estimates were 33–51 caribou during 1991-2010, then declined rapidly to just 12 caribou by 2016 (Fig. 5).

The proximate cause of the decline was believed to be predation. Of the 43 known mortalities within this subpopulation, 27 were due to predation. The proportion of calves in the subpopulation during late winter surveys averaged 9.9% per year from 2004 to 2016, but 12–15% is believed needed to maintain a stable population with high adult survival. The herd declined from 11 to 3 animals from 2017 to March 2018, when 3 radio collared cows remained; one died due to Cougar

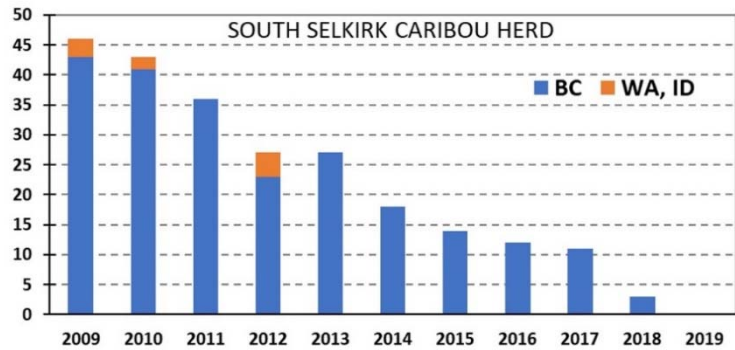


Figure 5. Number of caribou in the South Selkirk herd, 2009-2019.

predation, and 1 disappeared as the collar worked only briefly. With both the South Selkirk and South Purcells herds facing imminent extirpation, the B.C. government decided in late 2018 to capture the few remaining animals and move them to the larger Columbia North subpopulation. The sole remaining South Selkirk cow, along with a cow, calf, and two bulls from the South Purcells, were translocated to a pen north of Revelstoke, B.C., in mid-January and early March 2019. The caribou were translocated using a ‘soft release’ approach by temporarily holding them in a pen where they were fed and protected from predation so the animals had time to acclimate to the release site. They were released to join the North Columbia herd in April 2019.

Habitat status. Of the 381,015 ha (941,507 ac) occurring within the South Selkirk subpopulation’s former range, 95% is owned by government agencies or conservation groups, and is managed with caribou needs in mind. About 65% of the forest habitat in Washington and Idaho was more than 100 years old and considered to be in relatively good condition (L. Allen, pers. comm.), although Apps and McLellan (2006) reported association with stands >140 years old, and modeling from telemetry data identified little ‘Priority 1’ habitat in Washington (Kinley and Apps 2007). There is also a general lack of suitable habitat at lower elevations, and caribou are disinclined to travel through valleys with human inhabitants, which prevents connectivity with other subpopulations.

FACTORS THAT LED TO EXTIRPATION

Habitat degradation, fragmentation, predation, and human disturbance

The old-growth forests required by Deep-snow Caribou have been affected by timber harvest and associated road building, utility corridors, wildfires, and insect outbreaks (Cichowski and others 2004; USFWS 2014). Timber harvest and fires have resulted in a mix of old and younger-aged stands and far greater fragmentation of habitat, especially at low and mid-elevations. In the southern Selkirks, fires decreased in frequency with fire suppression starting in the 1930s, but large burns still occasionally occur (e.g. 79,100 ac in 1967; 19,800 ac in 2003; Johnson 1976; Layser 1974; Allen 1999; USFWS 2014). Significant portions were harvested beginning in the early 1900s, with clearcutting of large blocks starting in the 1950s (COSEWIC

2014). Harvest has been reduced in the herd's range in more recent decades, but some timber harvesting was done in south Selkirk caribou habitat until 2008 (SCITWG 2020).

These changes reduced availability of the arboreal lichens that are an essential winter food (Apps & McLellan 2006; Wittmer and others 2007; Apps and others 2013), but more importantly, increased the abundance of deer (*Odocoileus* spp.), elk (*Cervus elaphus*), and moose (*Alces alces*) in caribou range. These other species attracted increased numbers of predators that then incidentally preyed on caribou (Bergerud & Elliot 1986; Seip 1992; Wittmer and others 2007; Apps and others 2013). Once altered, forestlands need 30–40 years to mature past the early seral stage to conditions that are less attractive to deer, elk, and moose; the forest stands most suitable for caribou are >140 years old (Apps & McLellan 2006). A critical survival strategy of mountain caribou seems to be to spread out in low densities over large areas of their high elevation habitat, where other ungulates and their predators are absent or rare (Bergerud & Elliot 1986; Seip & Cichowski 1996). This shift in predator-prey dynamics resulted in unsustainable levels of predation on caribou, especially in summer and fall, and has become the most important factor in the decline of mountain caribou subpopulations (Seip 1992; Wittmer and others 2005b, 2007; Apps and others 2013). Creation of linear openings (e.g., roads, seismic lines, utility corridors, pipelines) through older forest further contributed to this problem by allowing easier travel and use of higher elevations by wolves and bears (James & Stuart-Smith 2000; Whittington and others 2011; Ray and others 2015; SCITWG 2020). Apps and others (2013) found that wolf predation of deep-snow caribou occurred primarily in association with roads. Bears killed caribou in landscapes with greater road densities, and bears may have preyed on newborn calves in the Selkirks (L. Allen 2022, pers. comm.; T. Schneider, *comment in* SCITWG 2020). Road networks at mid to upper elevations and hardpacked winter trails or groomed for snowmobiles, gives wolves greater access to caribou habitat (Kinley 2008).

Roads degrade habitat quality and fragment habitats in previously intact landscapes (SCITWG 2020); remaining habitat may no longer be used by caribou, thus resulting in effective habitat loss (Joly and others 2006). Caribou generally avoid roads (Apps & McLellan 2006), and those with moderate traffic can further isolate populations (Dyer and others 2002), but even roads with little or no traffic can create recreational trails that negatively affect preferred summer ranges. The South Selkirk herd's range is also bisected by B.C. Highway 3, a well-traveled road built in 1963 over Kootenay Pass just north of the international border, making herd members vulnerable to automobile collisions (COSEWIC 2014). Caribou regularly crossed the highway (Johnson & Todd 1977, USFWS 1994), and several vehicle collisions with caribou were documented (e.g., Layser 1974; Johnson 1985; SCITWG 2020), most recently including three killed in the winter of 2008–2009 and one killed in 2015.

Backcountry recreation has dramatically increased in recent decades (e.g., snowmobiling, skiing, heli-skiing, snowshoeing, hiking) exacerbating these changes. Several studies have reported local displacement of caribou by snowmobiles (Simpson 1987; Simpson & Terry 2000; Mahoney and others 2001; Seip and others 2007). Displacement from high-quality habitats can force caribou into inferior habitats where they are at greater risk to predators or avalanches, and where conditions affect feeding and body condition through increased stress and energy expenditure (Seip & Cichowski 1996; Simpson & Terry 2000; Seip and others 2007; Freeman 2008; Kinley 2008; COSEWIC 2014; USFWS 2014). High elevation basins, preferred habitat of

cows with calves, are also popular recreation destinations for hiking and camping from July through October (USFWS 2012).

Fragmentation and disturbance. Fragmentation of forests by timber harvest, roads, and development in a landscape already fragmented by valleys also isolated caribou subpopulations from one another by creating habitat unfavorable to dispersal, thereby causing a breakdown in the metapopulation dynamics needed to sustain subpopulations (van Oort and others 2011). Similar issues have affected many caribou populations throughout their range; Festa-Biachet and others (2011) noted that the strong linear relationship between caribou recruitment and level of disturbance (anthropogenic and natural) within caribou ranges suggested a threshold of habitat alteration beyond which caribou populations may be unable to persist.

Small subpopulation size and isolation. The small size and isolation of the South Selkirk herd, as well as other small subpopulations, make them more vulnerable to increased predation, and the significance of chance events like avalanches, highway collisions, and demographic and genetic factors (e.g. skewed sex ratios, inbreeding and reduced fitness; Serrouya and others 2012, Weckworth and others 2013). Weckworth and others (2013) reported that the effective population size (N_e) of mountain caribou herds in west-central Alberta and eastern British Columbia was <0.5 (0.16–0.48) of the census size. Movement among subpopulations was a fraction of the level needed to stabilize smaller subpopulations, indicating little chance for demographic rescue (van Oort and others 2011; Serrouya and others 2012). Van Oort and others (2011) concluded that Deep-snow Mountain Caribou herds were not functioning as a classic metapopulation due to a lack of dispersal; rather, the situation was better described as an extreme non-equilibrium metapopulation, and a “geographic pattern of the extinction process”.

Other factors affecting the Southern Mountain Caribou DU

Adequacy of existing regulatory mechanisms. The South Selkirk subpopulation was protected through its endangered or threatened classifications under federal (U.S., Canada), state, and provincial laws. The USFWS designated 12,145 ha (30,010 ac) of national forest lands at or above 1,524 m (5,000 ft) elevation as critical habitat for caribou in Washington and Idaho under the Endangered Species Act (USFWS 2012, 2019). On the Canadian side habitat was protected in increments beginning in the 1990’s. By 2007 79% of the core habitat, was protected from further forest harvesting. These protections were not adequate to prevent extirpation, in part due to habitat alteration that preceded protections, and the multiple interacting factors that isolated the population and increased mortalities.

Climate change. Climate change will affect caribou populations (Price and others 2013; USFWS 2014) and would likely affect any future attempts to reintroduce caribou to the southern Selkirks. Warmer temperatures, changes in precipitation, greater fire frequency and severity, and increased tree mortality from insects, disease, and drought stress will probably alter habitat quality and availability for caribou. A reduced or more variable snowpack and earlier snowmelt could make arboreal lichens out of reach to caribou (Kinley and others 2007). A winter with especially deep snowpack can cause lichen dieback in the lower canopy (Goward 2003), and if followed by a shallow-snow winter, caribou may not be able to reach *Bryoria* lichens, their critical late winter food (Kinley and others 2007). Reduced access to *Bryoria* lichens

would affect the physical condition and survival of caribou during late winter and spring, critical times of the year for pregnant cows and their unborn calves. A resulting shift to lower elevations in search of food would increase their risk of predation (SCITWG 2020).

Reduced soil moisture under a warming climate regime may also affect the availability of preferred summer foods, especially as wet, high elevation habitats shrink, and if changes in plant phenology affect nutrient availability in all seasons. For example, a mismatch in timing between parturition and vegetation green-up in spring, or warmer temperatures may affect both plant protein and digestible energy as vegetation matures in the fall (Pettorelli and others 2007; Post & Forchhammer 2008; Cook and others 2016).

The risk of catastrophic loss of spruce/fir forests seems to be significant given the predicted increases in wildfire, insect outbreaks, and plant diseases that are expected with earlier spring snowmelt, higher summer temperatures and lower summer precipitation (Woods and others 2010; Utzig and others 2011; Halofsky and others 2018). Relatively open, old spruce/fir forests typically have the highest *Bryoria* lichen biomass (Campbell & Coxson 2001) and climate envelope modeling suggests that spruce/fir forests will likely decline throughout deep-snow caribou range in response to changing climatic conditions (Utzig and others 2012a,b). All climate scenarios projected increases in average area burned by the 2050s, with 3 to 5 times greater area burned than during 1961-1990 (Utzig and others 2011). Available evidence suggests that climate change may already be contributing to increased outbreaks of various bark beetles and defoliators (Utzig and others 2012b).

Avalanches. Mountain Caribou use relatively gentle sloped areas in the cirque basins and ridges during the winter, which are generally not particularly prone to avalanches. In the southern Selkirk Mountains, avalanches are common and the risk to caribou can be increased due to displacement to more avalanche prone habitats as a result of snowmobile and other winter recreation activities (Simpson 1987; Seip & Cichowski 1996). Avalanches killed the last five caribou in the Banff subpopulation, as well as individuals in the Jasper subpopulation and near Revelstoke (Seip & Cichowski 1996; Hebblewhite and others 2010).

MANAGEMENT ACTIVITIES

Conservation planning. Recovery planning for the South Selkirk subpopulation was a multi-partner effort involving agencies, tribes/first nations, and conservation groups in both the U.S. and B.C. A U.S. federal recovery plan was issued in 1985 and updated in 1994 (USFWS 1985, 1994). Similar recovery strategies were developed for the entire Southern Mountain Caribou DU in B.C., including the South Selkirk herd (e.g., MCTAC 2002; Environment Canada 2014). The Selkirk Caribou International Technical Working Group (SCITWG) worked on recovery planning and information sharing; biologists with the Kootenai Tribe of Idaho led the group in completion of a management plan (SCITWG 2020).

Habitat protections and management. Regulatory mechanisms were in place to protect approximately 88% of the caribou management area identified (SCITWG 2020). In Washington and Idaho, measures protecting habitat for the South Selkirk subpopulation began in the late 1970s; this included protection of older stands and generally addressing caribou seasonal habitat needs on national forests (USFWS 2014). In 2012, the

USFWS designated 12,145 ha (30,010 ac) of national forest lands as critical habitat for caribou in Washington and Idaho (USFWS 2012, 2019). The Salmo-Priest Wilderness in Washington overlaps part of the critical habitat and has stringent habitat protections, and efforts to provide secure habitat for Grizzly Bears resulted in a reduction in road densities on national forests. Recent revisions of forest plans for the Colville and Idaho Panhandle national forests allow fires to fulfill their natural ecological roles but call for suppression or managing fires as needed to maintain caribou habitat. Some timber harvest (e.g., thinning, selection harvest of immature stands) is allowed on national forest lands in the subpopulation's recovery area to enhance habitat conditions for caribou (IPNF 2015; CNF 2016). Timber harvest continued on Idaho state lands and private lands within the herd's range in Idaho and Washington. Although the Idaho Department of Lands had no policies specifically protecting caribou habitat on its lands, it did consult with the Idaho Department of Fish and Game on proposed timber sales affecting wildlife. British Columbia began restricting timber harvest in this area in the late 1990s and harvest stopped in core habitat in 2008 (SCITWG 2020). Additionally, approximately 95% of the land base in the Canadian portion of the Management Area had some level of management regulation to protect caribou habitat value, including 146,622 ha (362,311 ac) of provincial crown lands and 51,095 ha (126, 205 ac) of Nature Conservancy of Canada lands (NCC 2015; SCITWG 2020).

Predator management. Predator reduction programs and liberalized hunter harvest of other ungulates have shown some success in temporarily increasing or stabilizing the sizes of mountain caribou subpopulations (COSEWIC 2014; Hervieux and others 2014; Hayek and others 2016). Control of predators in the British Columbia portion of the herd's management area included the killing of 27 wolves from five of the six packs between 2015 and 2018 (SCITWG 2020). British Columbia and Idaho also provided liberal hunting and trapping seasons for wolves. Wolves are protected in Washington, but wolves can be locally controlled where they are determined to be a primary limiting factor of at-risk ungulate populations, such as the South Selkirk subpopulation (Wiles and others 2011). No general reduction of Cougars was done, though they were responsible for 19 of 43 known mortalities of radio-collared South Selkirk caribou from 1987-2018 (SCITWG 2020). All three jurisdictions allow harvest of Cougars and Black Bears within the herd's range, but none expanded hunting opportunities for deer, moose, or elk specifically to benefit caribou (D. Base 2016, pers. comm.; W. Wakkinen 2016, pers. comm.; T. Szkorupa 2016, pers. comm.). Festa-Biachet and others (2011) suggested that predator control could "buy time" for caribou, but large areas of low industrial activity need to be maintained, or predator control merely delays extinction. Harding et al. (2020) stated that there was no statistical support for wolf control and maternal penning.

Translocations and maternal penning. After the translocation of caribou from British Columbia described above (Almack and others 2002), WDFW monitored 52 animals with telemetry for five years. The translocated individuals generally experienced low survival rates due to predation and a few dispersed to other subpopulations (Compton and others 1995; Warren and others 1996; Almack 2002). Both maternal penning and predator exclusion fencing were planned for the South Selkirk subpopulation (SCITWG, unpublished meeting notes), and a maternal pen was erected north of Revelstoke in 2014. Maternal penning involves capturing pregnant female caribou in late spring and holding them in a secure enclosure with natural habitat (typically 7–17 ac in size) until their calves become less vulnerable to predators at one

to several months of age. Another maternal pen was erected for pregnant cows in 2018 by the Kalispel Tribe, but the herd numbers fell from 11 to 3 cows, so the plan changed to translocation.

Recreation management. Reductions in public access through road closures, restrictions on snowmobile use, and other motorized restrictions were used to protect caribou from recreational disturbance. In Washington and Idaho, the South Selkirk subpopulation had theoretically benefited from various year-round or seasonal restrictions on human activity since the 1980s, which were enacted to protect either caribou or Grizzly Bears, or through designation of the Salmo-Priest Wilderness. Between 2005 and 2007, a court injunction restricted snowmobiles and trail grooming on 96,957 ha (239,588 ac) of U.S. Forest Service lands to protect caribou (USFWS 2014). Legal snowmobile closures were enacted in portions of the habitat in B.C. in 2005 and expanded in 2015

CONCLUSIONS AND RECOMMENDATION

The South Selkirk subpopulation of caribou occurred in the southern Selkirk Mountains of southeastern British Columbia, northern Idaho, and northeastern Washington. Herd size greatly declined after the late 1800s and may not have exceeded 100 individuals after 1920, and thereafter, continued to decline. The herd failed to recover despite habitat protection efforts in recent decades and two multi-year augmentations in the 1980s and 1990s. As the population declined in the mid-2010's, the use of areas in Idaho and Washington became sporadic. Numbers fell rapidly from 46 animals in 2009 to just one known animal in fall 2018 which was translocated to another herd in early 2019, marking the extirpation of caribou from Washington.

Habitat changes from timber harvest, fires, roads, and utility corridors increased the numbers of deer, elk and moose in the herd's range. Predator numbers, including re-establishing Gray Wolf and Grizzly Bear populations, increased along with these other ungulates, and roads facilitated greater predator access to higher elevations. The unsustainable levels of predation of caribou by cougars, bears and wolves that resulted is considered the main factor in the decline after 2009. Other factors that contributed to the herd's decline included highway mortality, disturbance from recreation, and isolation from other neighboring subpopulations.

Given the projections for climate change, the outlook for a caribou herd in Washington in the future is probably poor. Caribou are unlikely to re-establish in Washington without assisted reintroduction, which should not be considered without a comprehensive feasibility assessment of habitat availability and the habitat changes anticipated with climate change. It is recommended that Woodland Caribou remain listed as a state endangered species in Washington.

REFERENCES CITED

The references cited in the *Periodic Status Review for the Woodland Caribou* are categorized for their level of peer review pursuant to section 34.05.271 RCW, which is the codification of Substitute House Bill 2661 that passed the Washington Legislature in 2014. A key to the review categories under section 34.05.271 RCW is provided in Table A.

Table A. Key to 34.05.271 RCW Categories:

34.05.271(1)(c) RCW	Category Code
(i) Independent peer review: review is overseen by an independent third party.	i
(ii) Internal peer review: review by staff internal to the department of fish and wildlife.	ii
(iii) External peer review: review by persons that are external to and selected by the department of fish and wildlife.	iii
(iv) Open review: documented open public review process that is not limited to invited organizations or individuals.	iv
(v) Legal and policy document: documents related to the legal framework for the significant agency action including but not limited to: (A) federal and state statutes; (B) court and hearings board decisions; (C) federal and state administrative rules and regulations; and (D) policy and regulatory documents adopted by local governments.	v
(vi) Data from primary research, monitoring activities, or other sources, but that has not been incorporated as part of documents reviewed under the processes described in (c)(i), (ii), (iii), and (iv) of this subsection.	vi
(vii) Records of the best professional judgment of department of fish and wildlife employees or other individuals.	vii
(viii) Other: Sources of information that do not fit into one of the categories identified in this subsection (1)(c).	viii

Reference	Category
Allen, L. R. 1999. The effects of 115 years of vegetation change on woodland caribou habitat in the Selkirk Mountains of Idaho. M.S. thesis, University of Idaho, Moscow, Idaho.	viii

Almack, J. A. 2000. Mountain caribou recovery in the southern Selkirk Mountains of Washington, Idaho, and British Columbia. Progress Report, October 1998–March 2000. Washington Department of Fish and Wildlife, Olympia, Washington.	ii
Almack, J. A. 2002. Mountain caribou recovery in the southern Selkirk Mountains of Washington, Idaho, and British Columbia. Progress Report, January 1–December 31, 2001. Washington Department of Fish and Wildlife, Olympia, Washington.	ii
Apps, C. D. and B. N. McLellan. 2006. Factors influencing the dispersion and fragmentation of endangered mountain caribou populations. <i>Biological Conservation</i> 130:84-97.	i
Apps, C. D., B. N. McLellan, T. A. Kinley, and J. P. Flaa. 2001. Scale-dependent habitat selection by mountain caribou, Columbia Mountains, British Columbia. <i>Journal of Wildlife Management</i> 65:65–77.	i
Apps, C. D., B. N. McLellan, T. A. Kinley, R. Serrouya, D. R. Seip, and H. U. Wittmer. 2013. Spatial factors related to mortality and population decline of endangered mountain caribou. <i>Journal of Wildlife Management</i> 77:1409-1419.	i
Banfield, A. W. F. 1961. A revision of the reindeer and caribou, genus <i>Rangifer</i> . National Museum of Canada Bulletin 177:1-137.	i
B.C. Caribou Recovery Program. 2021. Population Estimates for Caribou Herds of British Columbia. October 2021 (Table). British Columbia Caribou Recovery Program. https://bcwf.bc.ca/wp-content/uploads/2021/12/BC_caribou_herds_population_estimates_2021-12-02.pdf	viii
Bergerud, A. T. and J. P. Elliot. 1986. Dynamics of caribou and wolves in northern British Columbia. <i>Canadian Journal of Zoology</i> 64:1515–1519.	i
Booth, E. S. 1947. Systematic review of the land mammals of Washington. Ph.D. thesis, State College of Washington, Pullman, Washington.	i
Campbell, J., and D.S. Coxson. 2001. Canopy microclimate and arboreal lichen loading in subalpine spruce-fir forest. <i>Canadian Journal of Botany</i> 79:537-555.	i
Cichowski, D., T. Kinley, and B. Churchill. 2004. Caribou, <i>Rangifer tarandus</i> . In <i>Accounts and measures for managing identified wildlife</i> . British Columbia Ministry of Environment, Victoria, British Columbia.	viii
CNF (Colville National Forest). 2016. Draft Colville National Forest proposed land and resource management plan. Colville National Forest, Colville, Washington.	i
Compton, B. B., P. Zager, and G. Servheen. 1995. Survival and mortality of translocated caribou. <i>Wildlife Society Bulletin</i> 23:490-496.	i
Cook, J.G., R.C. Cook, R.W. Davis, and L.L. Irwin. 2016. Nutritional ecology of elk during summer and autumn in the Pacific Northwest. <i>Wildlife Monographs</i> 195: 1-81.	i
COSEWIC. 2011. Designatable units for caribou (<i>Rangifer tarandus</i>) in Canada. Committee on the Status of Endangered Wildlife in Canada, Ottawa, Ontario.	i
COSEWIC. 2014. COSEWIC assessment and status report on the caribou <i>Rangifer tarandus</i> , northern mountain population, central mountain population, and southern mountain population, in Canada. Committee on the Status of Endangered Wildlife in Canada, Ottawa, Ontario.	i

Dalquest, W. W. 1948. Mammals of Washington. University of Kansas Publications, Museum of Natural History 2:1-444.	i
DeGroot, L. 2016. 2016 caribou census: South Selkirk Mountains. British Columbia Ministry of Forests, Lands and Natural Resource Operations, Nelson, British Columbia.	vi
Dyer, S.J. J.P. O'Neill, S. M. Wasel. S. Boutin. 2002. Quantifying' barrier effects of roads and seismic lines on movements of female woodland caribou in northeastern Alberta. Canadian Journal of Zoology 80, 839-845.	i
Edwards, R. Y. & Ritcey, R. W. 1960. Foods of caribou in Wells Gray Park, British Columbia. Canadian Field-Naturalist 74: 3-7.	i
Environment Canada. 2014. Recovery strategy for the woodland caribou, southern mountain population (<i>Rangifer tarandus caribou</i>) in Canada (proposed). Species at Risk Act Recovery Strategy Series, Environment Canada, Ottawa, Ontario.	i
Evans, H. F. 1960. A preliminary investigation of caribou in northwestern United States. M.S. thesis, University of Montana, Missoula, Montana.	i
Festa-Bianchet, M., J. C. Ray, S. Boutin, S. D. Côté, and A. Gunn. 2011. Conservation of caribou (<i>Rangifer tarandus</i>) in Canada: an uncertain future. Canadian Journal of Zoology 89: 419–434.	i
Flinn, P. 1956. Caribou of Idaho. Idaho Fish and Game Department, Boise, Idaho.	vi
Freddy, D. J. 1974. Status and management of the Selkirk caribou herd, 1973. M.S. thesis, University of Idaho, Moscow, Idaho.	i
Freeman, N. L. 2008. Motorized backcountry recreation and stress response in mountain caribou (<i>Rangifer tarandus caribou</i>). M.S. thesis, University of British Columbia, Vancouver, British Columbia.	i
Goward, T. 2003. On the vertical zonation of hair lichens (<i>Bryoria</i>) in the canopies of high-elevation oldgrowth conifer forests. Canadian Field-Naturalist 117(1):39-43.	i
Halofsky, Jessica E.; Peterson, David L.; Dante-Wood, S. Karen; Hoang, Linh; Ho, Joanne J.; Joyce, Linda A., eds. 2018. Climate change vulnerability and adaptation in the Northern Rocky Mountains. Gen. Tech. Rep. RMRS-GTR-374. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. Part 1. pp. 1–273.	i
Harding, L.E. 2020. Which Caribou? Misnaming Caribou Population Units Leads to Conservation Errors. Journal of Ecosystems and Management 19(1):1–11.	i
Harding, L.E., M. Bourbonnais, A.T. Cook, T. Spribille, V. Wagner, C. Darimont. 2020. No statistical support for wolf control and maternal penning as conservation measures for endangered mountain caribou. Biodiversity and Conservation 29:3051–3060	i
Hayek, T., N. Lloyd, M. R. Stanley-Price, A. Saxena, and A. Moehrensclager. 2016. An exploration of conservation breeding and translocation tools to improve the conservation status of boreal caribou populations in western Canada: pre-workshop document. Centre for Conservation Research, Calgary Zoological Society, Calgary, Alberta.	viii

Hebblewhite, M., C. White, and M. Musiani. 2010. Revisiting extinction in national parks: Mountain Caribou in Banff. <i>Conservation Biology</i> 24(1): 341-344.	i
Hervieux, D., M. Hebblewhite, D. Stepnisky, M. Bacon, and S. Boutin. 2014. Managing wolves (<i>Canis lupus</i>) to recover threatened woodland caribou (<i>Rangifer tarandus caribou</i>) in Alberta. <i>Canadian Journal of Zoology</i> 92:1029-1037.	i
IPNF (Idaho Panhandle National Forests). 2015. Land management plan, 2015 revision: Idaho Panhandle National Forests. Idaho Panhandle National Forests, Coeur d'Alene, Idaho.	i
James, A. R. C. and A. K. Stuart-Smith. 2000. Distribution of caribou and wolves in relation to linear corridors. <i>Journal of Wildlife Management</i> 64:154–159.	i
Johnson, D. R. 1976. Mountain caribou: threats to survival in the Kootenay Pass region, British Columbia. <i>Northwest Science</i> 50:97-101.	i
Johnson, D. R. 1985. Man-caused deaths of mountain caribou, <i>Rangifer tarandus</i> , in southeastern British Columbia. <i>Canadian Field-Naturalist</i> 99:542-544.	i
Johnson, D. R. and D. R. Miller. 1979. Observations on reproduction of mountain caribou. <i>Northwest Science</i> 53:114-117.	i
Johnson, D. R. and M. C. Todd. 1977. Summer use of a highway crossing by mountain caribou. <i>Canadian Field-Naturalist</i> 91:312-314.	i
Katnik, D. R. 2002. Predation and habitat ecology of mountain lions (<i>Puma concolor</i>) in the southern Selkirk Mountains. Ph.D. dissertation, Washington State University, Pullman, Washington.	i
Kinley, T. A. and C. D. Apps. 2007. Caribou habitat modeling for the South Selkirk ecosystem including habitat assessments for the Priest Lake endowment lands. Sylvan Consulting, Invermore, British Columbia.	vi
Layser, E. F. 1974. A review of the mountain caribou of northeastern Washington and adjacent northern Idaho. <i>Journal of the Idaho Academy of Science, Special Research Issue</i> 3:1-63.	i
Mahoney, S. P., K. Mawhinney, C. McCarthy, D. Anions, and S. Taylor. 2001. Caribou reactions to provocation by snowmachines in Newfoundland. <i>Rangifer</i> 21:35-43.	i
MCTAC (Mountain Caribou Technical Advisory Committee). 2002. A strategy for the recovery of mountain caribou in British Columbia. British Columbia Ministry of Water, Land and Air Protection, Victoria, British Columbia.	i
Miller, F. L. 2003. Caribou, <i>Rangifer tarandus</i> . Pages 965-997 in G. A. Feldhamer, B. C. Thompson, and J. A. Chapman, editors. <i>Wild mammals of North America: biology, management, and conservation</i> . Johns Hopkins University Press, Baltimore, Maryland.	i
NCC (Nature Conservancy of Canada). 2015. Darkwoods. Nature Conservancy of Canada, Toronto, Canada. http://www.natureconservancy.ca/en/where-we-work/british-columbia/featured-projects/darkwoods/ Accessed 29 December 2016.	viii

Pettorelli, N., F. Pelletier, A. von Hardenberg, M. Festa-Bianchet, and S.D. Cote. 2007. Early onset of vegetation on growth vs. rapid green-up: Impacts on juvenile mountain ungulates. <i>Ecology</i> 88: 381-390.	i
Post, E., and Forchhammer, M.C. 2008. Climate change reduces reproductive success of an Arctic herbivore through trophic mismatch. <i>Philos. Trans. R. Lond. Soc. Ser. B</i> , 363(1501): 2367–2373. doi:10.1098/rstb.2007.2207.	i
Price, D. T., R. I. Alfaro, K. J. Brown, M. D. Flannigan, R. A. Fleming, E. H. Hogg, M. P. Girardin, T. Lakusta, M. Johnston, D. W. McKenney, J. H. Pedlar, T. Stratton, R. N. Sturrock, I. D. Thompson, J. A. Trofymow, and L. A. Venier. 2013. Anticipating the consequences of climate change for Canada’s boreal forest ecosystems. <i>Environmental Reviews</i> 21:322-365.	i
Ray, J. C., D. B. Cichowski, M.-H. St-Laurent, C. J. Johnson, S. D. Petersen, and I. D. Thompson. 2015. Conservation status of caribou in the western mountains of Canada: protections under the Species At Risk Act, 2002-2014. <i>Rangifer, Special Issue</i> 23:49-80.	i
Rominger, E. M. and J. L. Oldemeyer. 1989. Early-winter habitat of woodland caribou, Selkirk Mountains, British Columbia. <i>Journal of Wildlife Management</i> 53:238-243.	i
Rominger, E. M., C. T. Robbins, and M. A. Evans. 1996. Winter foraging ecology of woodland caribou in northeastern Washington. <i>Journal of Wildlife Management</i> 60:719-728.	i
Rominger, E. M., C. T. Robbins, M. A. Evans, and D. J. Pierce. 2000. Autumn foraging dynamics of woodland caribou in experimentally manipulated habitats, northeastern Washington, USA. <i>Journal of Wildlife Management</i> 64:160-167.	i
SCITWG (Selkirk Caribou International Technical Work Group) 2020. South Selkirk caribou management plan.	vi
Scott, M. 1985. The woodland caribou. Pages 495-507 in A. S. Eno and R. L. Di Silvestro, editors. <i>Audubon wildlife report 1985</i> . National Audubon Society, New York, New York.	i
Scott, M. D. and G. Servheen. 1985. Caribou ecology, July 1, 1982 to June 30, 1985. Job Completion Report, Pittman-Robertson Project No. W-160-R-12, Idaho Department of Fish and Game, Boise, Idaho.	vi
Seip, D. R. 1992. Factors limiting woodland caribou populations and their interrelationships with wolves and moose in southeastern British Columbia. <i>Canadian Journal of Zoology</i> 70:1494–1503.	i
Seip, D. and D. B. Cichowski. 1996. Population ecology of caribou in British Columbia. <i>Rangifer, Special Issue</i> 9:73-80.	i
Seip, D. R., C. J. Johnson, and G. S. Watts. 2007. Displacement of mountain caribou from winter habitat by snowmobiles. <i>Journal of Wildlife Management</i> 71:1539-1544.	i
Serrouya, R., D. Paetkau, B. N. McLellan, S. Boutin, M. Campbell, and D. A. Jenkins. 2012. Population size and major valleys explain microsatellite variation better than taxonomic units for caribou in western Canada. <i>Molecular Ecology</i> 21:2588-2601.	i

Servheen, G. L. and L. J. Lyon. 1989. Habitat use by woodland caribou in the Selkirk Mountains. <i>Journal of Wildlife Management</i> 53:230-237.	i
Seton, E. T. 1927. Lives of game animals. Volume 3. Doubleday, Page & Company, Garden City, New York.	i
Simpson, K. 1987. The effects of snowmobiling on winter range use by Mountain Caribou. Wildlife Working Report WR-25. Prepared for Ministry of Environment and Parks, Wildlife Branch, Nelson, B.C. 18 pp.	viii
Simpson, K. and E. Terry. 2000. Impacts of backcountry recreation activities on mountain caribou: management concerns, interim management guidelines and research needs. Wildlife Working Report No. WR-99, British Columbia Ministry of Environment, Lands and Parks, Victoria, British Columbia.	i
Spalding, D. J. 2000. The early history of woodland caribou (<i>Rangifer tarandus caribou</i>) in British Columbia. Wildlife Bulletin No. B-100, Ministry of Environment, Land and Parks, Victoria, British Columbia.	i
Taylor, W. P. and W. T. Shaw. 1929. Provisional list of land mammals of the state of Washington. Occasional Papers of the Charles R. Conner Museum 2:1-32.	i
Thomas, D. C. and D. R. Gray. 2002. COSEWIC assessment and update status report on the woodland caribou <i>Rangifer tarandus caribou</i> in Canada. Committee on the Status of Endangered Wildlife in Canada, Ottawa, Ontario.	i
USFWS (U.S. Fish and Wildlife Service). 1985. Selkirk Mountain caribou management plan/recovery plan. U.S. Fish and Wildlife Service, Portland, Oregon.	i
USFWS (U.S. Fish and Wildlife Service). 1994. Recovery plan for woodland caribou in the Selkirk Mountains. U.S. Fish and Wildlife Service, Portland, Oregon.	i
USFWS (U.S. Fish and Wildlife Service). 2008. Southern Selkirk Mountain caribou population (<i>Rangifer tarandus caribou</i>), 5-year review, summary and evaluation. U.S. Fish and Wildlife Service, Spokane, Washington.	i, v
USFWS (U.S. Fish and Wildlife Service). 2012. Endangered and threatened wildlife and plants; designation of critical habitat for the southern Selkirk Mountains population of woodland caribou; final rule. Federal Register 77(229):71042-71082.	v
USFWS (U.S. Fish and Wildlife Service). 2014. Endangered and threatened wildlife and plants; 12-month finding on a petition to delist the southern Selkirk Mountains population of woodland caribou and proposed rule to amend the listing; proposed rule, 12-month petition finding. Federal Register 79(89):26504-26535.	v
USFWS (U.S. Fish and Wildlife Service). 2019. Endangered and threatened wildlife; Endangered Species status for Southern Mountain Caribou Distinct Population Segment. Federal Register 84 (191):52598-52661.	v
USGAO (U.S. General Accounting Office). 1999. Endangered species: caribou recovery program has achieved modest gains. GAO/RCED-99-102, U.S. General Accounting Office, Washington, D.C.	i

Utzig, G., J. Boulanger and R.F Holt. 2011. Climate Change and Area Burned: Projections for the West Kootenays. Report #4 from the West Kootenay Climate Vulnerability and Resilience Project. Available at: www.kootenayresilience.org	vi
Utzig, G. and R.F. Holt. 2012a. An ecosystem vulnerability and resilience assessment for West Kootenay Ecosystems. Report # 7 from the West Kootenay Climate Vulnerability and Resilience Project. Available at www.kootenayresilience.org	vi
Utzig, G., R.F. Holt, H. Pinnell and C. Pearce. 2012b. Climate Change and West Kootenay Ecosystems. Summary. West Kootenay Climate Vulnerability and Resilience Project. Available at www.kootenayresilience.org	vi
van Oort, H., B. N. McLellan, and R. Serrouya. 2011. Fragmentation, dispersal and metapopulation function in remnant populations of endangered mountain caribou. <i>Animal Conservation</i> 14:215-224.	i
Warren, C. D., J. M. Peek, G. L. Servheen, and P. Zager. 1996. Habitat use and movements of two ecotypes of translocated caribou in Idaho and British Columbia. <i>Conservation Biology</i> 10:547-553.	i
Weckworth, B. V., M. Musiani, A. D. McDevitt, M. Hebblewhite, and S. Mariani. 2012. Reconstruction of caribou evolutionary history in western North American and its implications for conservation. <i>Molecular Ecology</i> 21:3610-3624.	i
Whittington, J., M. Hebblewhite, N. J. DeCesare, L. Neufeld, M. Bradley, J. Wilmshurst, and M. Musiani. 2011. Caribou encounters with wolves increase near roads and trails: a time-to-event approach. <i>Journal of Applied Ecology</i> 48:1535–1542.	i
Wiles, G. J. 2017. Periodic status review for the woodland caribou in Washington. Washington Department of Fish and Wildlife, Olympia, Washington. 24 pp.	iv
Wiles, G. J., H. L. Allen, and G. E. Hayes. 2011. Wolf conservation and management plan for Washington. Washington Department of Fish and Wildlife, Olympia, Washington.	ii, iii, iv
Wittmer, H. U., B. N. McLellan, D. R. Seip, J. A. Young, T. A. Kinley, G. S. Watts, and D. Hamilton. 2005a. Population dynamics of the endangered mountain ecotype of woodland caribou (<i>Rangifer tarandus caribou</i>) in British Columbia, Canada. <i>Canadian Journal of Zoology</i> 83:407-418.	i
Wittmer, H. U., A. R. E. Sinclair, and B. N. McLellan. 2005b. The role of predation in the decline and extirpation of woodland caribou. <i>Oecologia</i> 144:257–267.	i
Wittmer, H. U., B. N. McLellan, R. Serrouya, and C. D. Apps. 2007. Changes in landscape composition influence the decline of a threatened woodland caribou population. <i>Journal of Animal Ecology</i> 76:568–579.	i
Woods, A.J., D. Heppner, H. Kope, J. Burleigh, and L. Maclaughlan. 2010. Forest health and climate change: a British Columbia perspective. <i>For. Chron.</i> , 86:412–422.	i

PERSONAL COMMUNICATIONS

Lydia Allen
U.S. Forest Service, Northern Region
Missoula, Montana

Dana Base, District Biologist (retired)
Washington Department of Fish and Wildlife
Colville, Washington

Leo DeGroot
British Columbia Ministry of Forests, Lands and
Natural Resource Operations
Nelson, British Columbia

Bart George
Wildlife Program Manager
Kalispel Tribe Department of Natural Resources

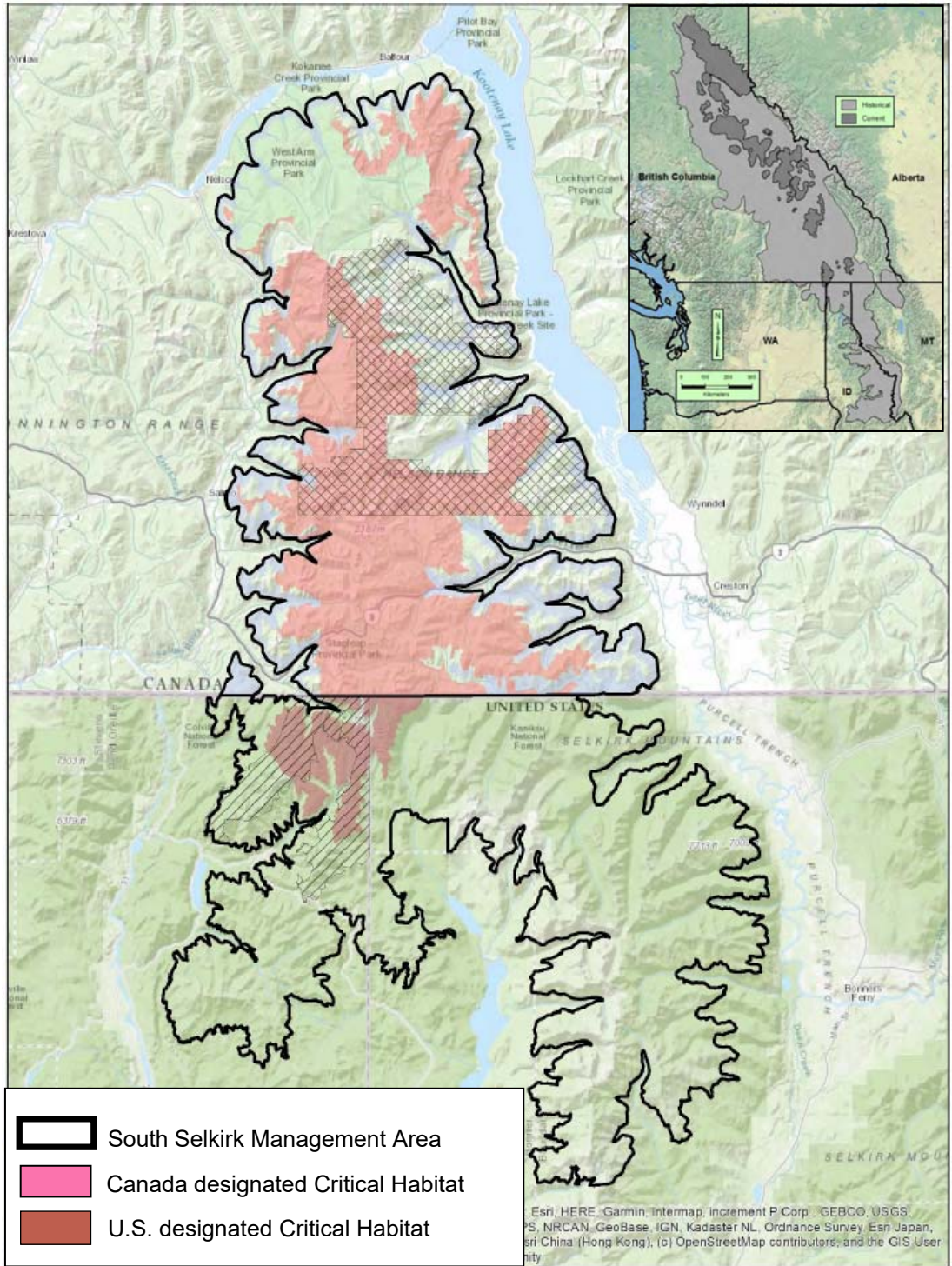
Norm Merz
Fish and Wildlife Department
Kootenai Tribe of Idaho
Bonners Ferry, Idaho
(now with Idaho Department Fish and Game)

Tara Szkorupa
Ministry of Forests, Lands and Natural Resource
Operations
Cranbrook, British Columbia

Wayne Wakkinen (retired)
Idaho Department of Fish and Game
Coeur d'Alene, Idaho

APPENDIX A MANAGEMENT AREA FOR THE SOUTH SELKIRK HERD AND CRITICAL HABITAT

Figure A. Management Area for the South Selkirk herd and Critical Habitat and the historical and recent distribution (inset) of Southern Mountain Caribou DU9 (SCITWG 2020).



APPENDIX B. NUMBERS OF CARIBOU IN THE SOUTH SELKIRK SUBPOPULATION

Table B. Numbers of caribou and calf recruitment in the South Selkirk subpopulation during annual late winter censuses, 2000-2020. Data from the 2004-2016 annual census reports and SCITWG (2020), and Wiles (2017).

Year	Number of caribou counted			Calf recruitment	
	British Columbia	Idaho and Washington	Total	Number of calves	% calves in subpopulation ^a
2000	31	3	34	6	17.6
2001	-	-	no census ^d	-	no census ^d
2002	32	2	34	9	26.5
2003	40	1	41 ^e	4	10.0 ^f
2004	30	3	33	2	6.7 ^f
2005	33	2	35 ^g	- ^c	- ^c
2006	36	1	37	6	17.2 ^f
2007	41	2	43	4	9.3
2008	43	3	46	5	10.9
2009	43	3	46	5	10.9
2010	41	2	43	3	7.0
2011	36	0	36	3	8.3
2012	23	4	27	1	4.3 ^f
2013	27	0	27	4	14.8
2014	18	0	18	1	5.6
2015	14	0	14	1	7.1
2016	12	0	12	2	16.7
2017	11	0	11	-	-
2018	3	0	3	0	-
2019	1	0	1	-	-

^a Calf counts may have become more accurate beginning in about 2004, when the use of high quality digital photography was incorporated into the annual censuses (L. DeGroot, pers. comm.). It is unknown whether this has changed the percentage of calves detected in the subpopulation.

^b Years in which augmentations of the subpopulation occurred (see Table 1). Augmentations were conducted after the late winter census in all three years, thus census results were not affected until the following year.

^c No animals were classified by age group.

^d Survey not conducted due to inadequate snow levels.

^e Some double counting probably occurred, thus the count result is not reliable.

^f Not all animals were classified by age group, thus recruitment estimates are not based on the total count.

^g Not a complete count, thus count results are considered minimal.

APPENDIX C. PUBLIC COMMENTS

Public comments received during the 90-day public review period for the draft *Periodic Status Review for the Woodland Caribou in Washington* conducted from xxxxxx to yyyyyy. The comments presented here are summaries of the remarks provided by one or more people.

WASHINGTON STATE STATUS REPORTS, PERIODIC STATUS REVIEWS, RECOVERY PLANS, AND CONSERVATION PLANS

Periodic Status Reviews

2021	Ferruginous Hawk
2021	Humpback Whale
2021	Gray Whale
2021	Stellar Sea Lion
2021	Greater Sage-grouse
2020	Mazama Pocket Gopher
2019	Tufted Puffin
2019	Oregon Silverspot
2018	Sea Otter
2018	Pygmy Rabbit
2017	Sharp-tailed Grouse
2017	Fisher
2017	Blue, Fin, Sei, North Pacific Right, and Sperm Whales
2017	Woodland Caribou
2017	Sandhill Crane
2017	Western Pond Turtle
2017	Green and Loggerhead Sea Turtles
2017	Leatherback Sea Turtle
2016	American White Pelican
2016	Canada Lynx
2016	Marbled Murrelet
2016	Peregrine Falcon
2016	Bald Eagle
2016	Taylor's Checkerspot
2016	Columbian White-tailed Deer
2016	Streaked Horned Lark
2016	Killer Whale
2016	Western Gray Squirrel
2016	Northern Spotted Owl
2016	Greater Sage-grouse
2016	Snowy Plover
2015	Stellar Sea Lion

Conservation Plans

2013	Bats
------	------

Status Reports

2021	Oregon Vesper Sparrow
2019	Pinto Abalone
2017	Yellow-billed Cuckoo
2015	Tufted Puffin
2007	Bald Eagle
2005	Mazama Pocket Gopher, Streaked Horned Lark, and Taylor's Checkerspot
2005	Aleutian Canada Goose
1999	Northern Leopard Frog
1999	Mardon Skipper
1999	Olympic Mudminnow
1998	Margined Sculpin
1998	Pygmy Whitefish

Recovery Plans

2020	Mazama Pocket Gopher
2019	Tufted Puffin
2012	Columbian Sharp-tailed Grouse
2011	Gray Wolf
2011	Pygmy Rabbit: Addendum
2007	Western Gray Squirrel
2006	Fisher
2004	Sea Otter
2004	Greater Sage-Grouse
2003	Pygmy Rabbit: Addendum
2002	Sandhill Crane
2001	Pygmy Rabbit: Addendum
2001	Lynx
1999	Western Pond Turtle
1996	Ferruginous Hawk

Status reports and plans are available on the WDFW website at: <http://wdfw.wa.gov/publications/search.php>



