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# MEMORANDUM

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| *TO*: | Doreen Parker McNeill<br>Management Coordinator | *DATE*: | 12 February 2018 |
| *THRU*: | Jeff Gross<br>Area Biologist – Tok | *TELEPHONE*:<br>*FAX*: | 907-883-2971<br>907-883-2970 |
| *FROM*: | Jeff Wells<br>Assistant Area Biologist<br>Division of Wildlife Conservation<br>Tok, Alaska | *SUBJECT*: | 2014 Chisana moose survey – final report<br>(Cooperative Agreement NPS H8W07110001) |

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In accordance with a cooperative agreement (Coop 15-035, H8W07110001) with the National Park Service, below is the final report on the moose survey completed in fall 2014 for use in the updated Chisana caribou herd management plan.

**Acknowledgments**

This survey was primarily funded by the U.S. National Park Service (NPS; Wrangell-St. Elias National Park and Preserve) and the Yukon government (Environment Yukon), with additional support from the Alaska Department of Fish and Game (ADF&G) and the U.S. Fish and Wildlife Service (USFWS; Tetlin National Wildlife Refuge). The NPS portion of the funding was conducted through the Pacific Northwest Cooperative Ecosystems Studies Unit (task agreement P14AC01344). We thank pilots Jake Combs (Fortymile Air), Leif Wilson (Fortymile Air), Paul Zaczkowski (Papa Zulu Air), Jim Ellis (USFWS), and Lynn Ellis (NPS). In addition, we thank ADF&G observers Bob Gingue, Jeff Gross, Jeff Wells, and Jesse Dunshie, NPS observer Judy Putera, and BLM observer Sarah Bullock. Lodging in Chisana was provided by the NPS (NPS cabins), and logistical support was provided by Chisana resident Adam Smitholum.

## Introduction

The Chisana caribou herd is a small international herd that ranges across the Yukon-Alaska border. Substantial resources have been devoted to the management of the Chisana caribou herd over the last several decades, including a captive rearing program during 2003–2006 that was meant to increase recruitment following a decline in the herd during the 1990s and early 2000s (Chisana Caribou Recovery 2010). A Chisana caribou herd working group was formed in 2009 to develop a management plan for the herd, and a 5-year plan was finalized in spring 2012 (Chisana Caribou Herd Working Group 2012; herby referred to as "the Plan"). The Plan identifies a variety of management objectives and strategies related to the herd, and Strategy 5.3 suggested conducting a moose survey within the range of the caribou herd.

The need for a further understanding of the moose population in this area was identified because an evaluation of predator-prey dynamics related to the caribou herd requires knowledge of other ungulate species within the herd's range, and recent moose population and demographic data was lacking. In addition, there is evidence that climate change has resulted in shrub expansion across northern Alaska (Tape et al. 2006). Therefore, this could result in an expansion of moose habitat into higher elevation areas, which in turn could affect moose and caribou population and predator-prey dynamics. Thus, the objective of this survey was to estimate moose abundance and composition within the range of the Chisana caribou herd.

## Study Area

The Chisana caribou herd range encompasses 4,865 $mi^2$ in east-central Alaska and southwestern Yukon (Figure 1). All areas of moose habitat within the range were included in the moose survey, with the exception of a portion of the area east of the White River and north of the Alaska Highway, where radiocollared Chisana caribou had not been located since prior to 1995. The total survey area was 3,551 $mi^2$, of which 1,640 $mi^2$ was within Alaska (largely within Alaska Game Management Unit 12) and 1,911 $mi^2$ was within the Yukon. This area is characterized by rugged and glaciated mountains with high peaks and the climate is classified as a dry, cold, and continental climate. Major river drainages within the area include the Donjek, Generc, White, Chisana, and Nabesna Rivers. Treeline typically occurs between 3,500–4,000 feet. Forested areas are largely dominated by white spruce (*Picea glauca*) in well-drained areas and black spruce (*Picea mariana*) in poorly-drained areas, while paper birch (*Betula papyrifera*), aspen (*Populus tremuloides*), and balsam poplar (*P. balsamifera*) also occur in lowland areas. Shrubs dominate the understory and riparian and subalpine regions and include willow (*Salix* spp.), dwarf birch (*Betula* spp.), soapberry (*Shepherdia canadensis*), and ericaceous shrubs. Sedge-tussock fields are common in poorly drained sites and gentle slopes.

## Methods

Moose abundance and composition was estimated using the geospatial population estimator (GSPE) method (Kellie and DeLong 2006). There were a total of 566 moose survey units (SU),

which ranged in size from 6.2–6.4 $mi^2$, within the survey area, of which 308 had not been surveyed recently using the GSPE method. These SUs were stratified with 2 Cessna 185s using 2 observers in addition to the pilot in each aircraft. One pass was made through the center of each SU at approximately 120–160 mph at an altitude between 800 and 1,500 feet above ground level. Observers recorded moose that were observed, moose sign (e.g., tracks), and habitat, and this information was then used to assign a stratification to each SU. SUs were stratified as either high density if they were likely to contain >3 moose or as low density if they were likely to contain ≤3 moose. In addition, several of the SUs that had been previously surveyed were reclassified as a different strata based on previous survey information.

A simple random sample of 128 SUs (80 high density and 48 low density) were selected using Microsoft Excel® software, and an additional 32 SUs (20 high density and 12 low density) were selected to fill gaps in randomized coverage for a total sample of 160 SUs (28% of the total SUs in the survey area). Surveys were flown with 3 PA-18 Super Cubs and 1 CubCrafters Top Cub with a target search intensity of between 6–7 minutes/$mi^2$. The total number as well as the sex and age classification of moose in each group was recorded. Moose were classified as: cow, calf, yearling bull with spike or forked antlers, yearling bull with palmated antlers <30″, bull with antlers ≥30″ but less than 40″, bull with antlers ≥40″ but less than 50″, or bull with antlers ≥50″. During and/or following the completion of each SU, survey conditions were rated as either poor, fair, good, or excellent based upon snow (age and cover), light (intensity and type), and wind (strength and turbulence). Population and ratio estimates (along with 90% binomial confidence intervals [CI]) were calculated using the WinfoNet GSPE software (DeLong 2006). Population estimates are reported as an "observed" estimate due to the lack of a survey-specific sightability correct factor (SCF).

**Results**

Stratification flights were completed during 9–11 November and total flight time (including ferry time) was 20.3 hours. Of the 566 SUs within the survey area, 251 were classified as high density, and 315 were classified as low density. Survey flights were completed during 14–23 November. Although 160 SUs (100 high density and 60 low density) were selected for sampling, fog in two SUs during the survey resulted in the selection of alternate SUs while in the field. Although this did not change the total number of SUs sampled, it did result in one more high density and one less low density SU than originally selected. For the SUs in which survey conditions were recorded (155 of 160), 28, 69, 57, and 1 were recorded as excellent, good, fair, and poor, respectively. Suboptimal survey conditions were largely a result of snow cover and snow age. Although snow cover was complete in some areas, portions of the survey area, particularly those portions within the upper Beaver Creek and lower White River drainages, had poor snow cover. This was partially due to low snowfall prior to the survey. However, some of these areas are prone to strong winds and typically have poor snow cover even when surrounding areas have good snow conditions. Furthermore, warm temperatures during the survey, particularly at higher elevations, created patchy snow conditions on some south facing slopes. Lastly, with the exception of the final day of surveying, snow age was greater than 1 week old.

The target search intensity of between 6–7 minutes/mi$^2$ was achieved. Search time per SU with 100% moose habitat averaged 6.1 min/mi$^2$ ($n$ = 59), while overall search time, when taking into account the estimated proportion of moose habitat in each SU, averaged 7.05 min/mi$^2$. Total survey flight time (including ferry time) was 121.1 hours.

A total of 410 moose were observed during the survey. The observable moose population and density estimate for the survey area was 1,137 moose (±19%, 90% CI) and 0.32 moose/mi$^2$ respectively (Table 1). The density estimate within the Alaska portion of the survey area was higher than the density estimate for the Yukon portion of the survey area. The bull-to-cow (bull:cow) ratio estimate was 49 bulls:100 cows and the calf-to-cow (calf:cow) ratio estimate was 14 calves:100 cows. Bull:cow ratios were similar on the both the Alaska and Yukon portions of the survey area, while the calf:cow ratio estimate was higher on the Yukon compared to the Alaska portion of the survey area.

**Discussion**

This survey was the first to estimate moose population and composition within the entire range of the Chisana caribou herd. However, previous surveys have been completed within portions of the range. On the Alaska side, the NPS completed a moose survey in fall 1998 within a 352 mi$^2$ area in the vicinity of Chisana and estimated moose density, bull:cow, and calf:cow ratios at 0.8 moose/mi$^2$, 65 bulls:100 cows, and 34 calves:100 cows respectively (C. D. Mitchell, Wildlife Biologist, Wrangell-St. Elias National Park and Preserve, unpublished 1998 Chisana area moose survey report, Copper Center). However, this survey was largely focused in areas that contained the most number or concentrations of moose and did not include large swaths of low-density moose areas (e.g., lowland black spruce) that were included during the 2014 survey. Therefore, as the author states, the density estimate from the 1998 survey is likely biased high and does not accurately represent the entire area as a whole. In addition, the USFWS (Tetlin NWR) conducts moose surveys to the north of the Nutzotin Mountains every 3–5 years, and a portion of this survey area overlaps with the 2014 survey. Similar to the 1998 NPS survey and the most recent USFWS survey, which estimated the bull:cow ratio at 52 bulls:100 cows in 2012, the bull:cow ratio estimate during the 2014 survey was moderately high, which likely reflects the relatively low hunting pressure this area receives. The calf:cow ratio estimate from the Alaska portion of the 2014 survey was lower than other recent estimates from the USFWS survey area as well as from other survey areas from within Game Management Unit 12.

On the Yukon side, several previous moose surveys have been completed within portions of the Chisana moose survey area. During 1998 and 1999 Environment Yukon conducted GSPE moose surveys within a 2,121 mi$^2$ area around Beaver Creek, of which 895 mi$^2$ overlapped with the Chisana survey area. Density, bull:cow ratio, and calf:cow ratio estimates from these surveys were all higher than those estimated during the Chisana moose survey and ranged from 0.46–0.58 moose/mi$^2$, 70–88 mature bulls:100 mature cows, and 32–38 calves:100 mature cows (unpublished Environment Yukon report titled “Moose counts in the Beaver Creek Area, 1997–

1999" obtained from Susan Westover, Moose Technician, Whitehorse, Yukon). However, it is important to note that the ratio estimates reported by Environment Yukon are slightly different than those reported during the Chisana moose survey (e.g., mature bulls:mature cows vs. total bulls:total cows).

Conversely, estimates from Environment Yukon surveys in 2011 and 2014 between the White River and Kluane Lake along the Alaska Highway are more similar to estimates from the Chisana moose survey. The survey conducted in 2011 used the GSPE technique and spanned 2,230 $mi^2$, of which 605 $mi^2$ overlapped with the Chisana survey area. The estimated density within the Koidern Moose Management Unit (MMU), which encompasses 723 $mi^2$ in the northwestern section of the Yukon survey area, was 0.54 moose/$mi^2$ while the mature bull: mature cow and calf:mature cow ratio estimates were 49:100 and 28:100, respectively (unpublished Environment Yukon report titled "Moose Survey: Burwash Early Winter 2011" obtained from Susan Westover, Moose Technician, Whitehorse, Yukon). The survey conducted in 2014, which used generalized linear models to estimate moose numbers and composition, spanned 2,863 $mi^2$, of which 911 $mi^2$ overlapped with the Chisana survey area. The estimated density within the Koidern MMU was 0.34 moose/$mi^2$ while the mature bull:mature cow and calf:mature cow ratio estimates were 41:100 and 28:100, respectively (S. Czetwertynski, Ungulate Biologist, Yukon Environment, Whitehorse, personal communication). Overall, the density and composition estimates obtained from the 2014 Chisana survey were similar to or lower than previous moose surveys conducted within overlapping or adjacent areas within the Yukon Territory. However, the amount of overlap between the previous surveys and the Chisana survey was relatively small and varied from 31–36% of the portion of the Chisana survey area located within the Yukon.

The results of this survey suggest that the moose population within the range of the Chisana caribou herd is similar, at least in terms of density, to other areas within interior Alaska and Yukon. In addition, the results are consistent with populations held at low-density dynamic equilibrium, in which populations are largely limited and held at stable but low densities by predators (Gasaway et al. 1992). The bull:cow ratio was moderately high, which suggests that most of the area receives relatively light hunting pressure, while the calf:cow ratio was relatively low, which suggests the population had moderately low recruitment during summer–fall 2014. Since this is the first comprehensive moose survey within this entire area, an analysis of changes in abundance or other population characteristics is not possible. However, the relatively precise abundance and ratio estimates from this survey will allow for this analysis following future surveys.

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Figure 1. Sampling design for the Chisana moose survey during 9–23 November 2014. High-stratum units are shaded in red, and the annual range (based upon radio collar locations during 1988–2008) of the Chisana caribou herd is outlined in black-red. Survey units that were sampled are outlined in bold and include 101 high-stratum units and 59 low-stratum units.

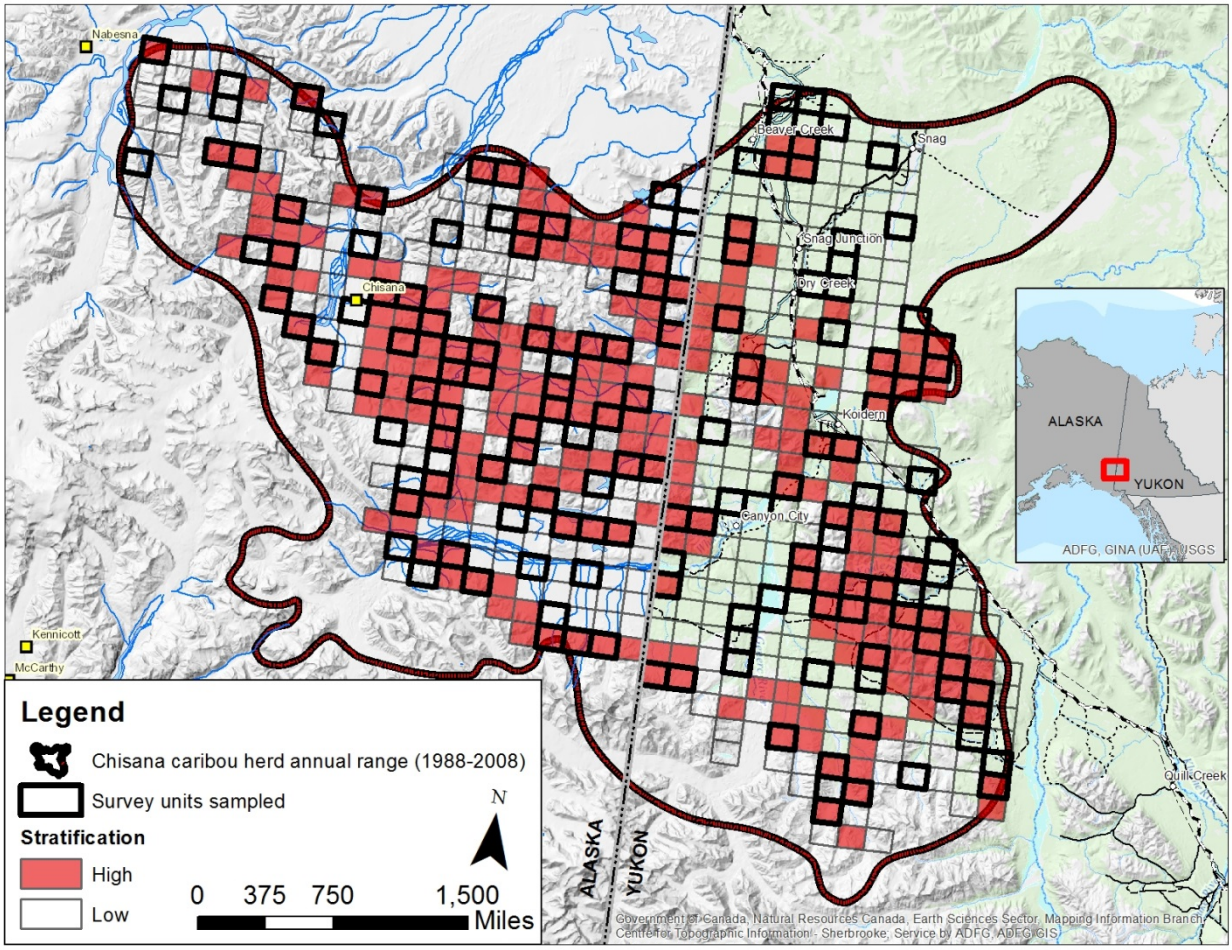

Table 1. Moose composition and population estimates for the Chisana moose survey, fall 2014[a].

| Area | Bulls:100 cows[b] | Calves:100 cows[b] | Yearling bulls:100 cows[b] | Total moose observed | Observable moose population estimate[b] | Observable moose density estimate (moose/mi$^2$)[b] |
|---|---|---|---|---|---|---|
| Alaska | 50 (10.0) | 11 (3.3) | 6 (2.7) | 260 | 673 (155) | 0.41 (0.09) |
| Yukon | 49 (14.4) | 19 (7.4) | 9 (4.4) | 150 | 464 (139) | 0.24 (0.07) |
| Entire area | 49 (8.9) | 14 (4.0) | 7 (2.7) | 410 | 1,137 (216) | 0.32 (0.07) |

[a] Sampled using the geospatial population estimator (GSPE) sampling method (Kellie and DeLong 2006).

[b] 90% confidence interval, plus and minus the estimate, in parentheses.

Appendix A-1. Chisana moose survey project costs, fall 2014.

| Category | Description | Total |
|---|---|---|
| Aviation[a] | Chartered flights | $22,131 |
| Food | Camp food | $805 |
| Fuel[b] | Aviation fuel | $1,857 |
| Logistical support | Chisana resident | $1,250 |
| Miscellaneous | Transporting supplies to Chisana, etc. | $1,174 |
| Total | | $27,217 |

[a] Costs associated with the non-chartered aircraft (National Park Service and U.S. Fish and Wildlife Service aircraft) not included.

[b] Remainder of fuel supplied by National Park Service in Chisana.