POPULATION INVENTORY OF THE AISHIHIK WOOD BISON (*BISON BISON ATHABASCAE*) HERD IN SOUTHWESTERN YUKON 2014

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Summary and Key Findings

- Between 4-10 July 2014 an inventory of Aishihik bison was conducted.
- We used paint balls to mark 105 bison. We then did 3 independent aerial surveys to locate and count marked and unmarked bison; however, only the first 2 aerial surveys yielded usable data.
- A statistical model was used to estimate the population size and 90% probability upper and lower confidence limits.
- Our methodology was consistent with similar inventories done in July 2007, 2009 and 2011.
- We estimate that in July 2014 the Aishihik herd had 1470 bison (90% confidence intervals = 1306–1684). The most bison seen on one day was 810, and the minimum number known alive was 857.
- During the survey we observed that several marked bison moved out of alpine areas where they are easily found and counted. Therefore we suggest that the population estimate may be higher than reality.
- The percentage of calves observed during the census (22.7%) was higher than normal in 2014. This would contribute to the total population count being higher than it would otherwise.
- Our results suggest that the Aishihik herd has grown at a rate of about 6.1% since the last census in July 2011, despite an average annual harvest rate of about 10.4% during this time.
- The results will be used to inform managers and project partners on the population status of the herd, refine harvest models, and, ultimately, help with setting the annual allowable harvest for the next few years.

Table of Contents

List of Figures

List of Tables

Introduction

From 1998 to 2007 wood bison (*Bison bison athabascase*) of the Aishihik Herd in southwestern Yukon were inventoried annually, using the total count method, where the area was flown and all bison found that survey were tallied. This method had been used elsewhere to inventory bison (Fuller 1950, Wolfe and Kimball 1989) and was practical in Yukon during the early years because the herd was small and occupied a small area. In later years, however, total counts became more difficult because the herd had grown and begun to use habitats where they were increasingly difficult to locate and count. Moreover, total counts did not provide reliable information that was statistically robust and defensible. Because the herd was relatively small (fewer than 1000 animals), legally listed as a species at risk, and harvested at unsustainable rates (by design), it was crucial to closely track the size of the herd. Unfortunately, unlike moose (*Alces americanus*) or caribou (*Rangifer tarandus*), there was little information or experience counting bison in other jurisdictions. Biologists in the Northwest Territories use strip transects (Bradley and Wilmshurt 2005, Larter et al. 2007) or aerial quadrats (Larter et al. 2000) to count bison but those methods are not suitable for use in the Aishihik herd's mountain environment.

Mark-resight techniques simply rely on the ability to resight a marked subsample of the population, and allows for the estimation of population size based on the number of marked and unmarked animals seen. Statistical models can then be used to estimate the population size and associated confidence intervals. This technique has been successfully used to inventory a number of ungulate species, including caribou (Mahoney et al. 1998, Jung et al. 2000, Hegel et al. 2012), elk (*Cervus canadensis*; Skalski et al. 2005), sheep (*Ovis canadensis*; Neal et al. 1993), mountain goats (*Oreamnos americanus*; Pauley and Crenshaw 2006), and elephants (*Loxodonta africana*; Morley and van Aarde 2007). A particular strength of the method is that it is intuitive and therefore the results may be more easily accepted by community members.

In July 2007, we used a small subsample of radio-collared bison to test the use of mark-resight methods to inventory the herd. We found that this method would provide a robust and reliable estimate of the herd that was defensible and acceptable to bison management partners. The method was cost-efficient and provided estimates with acceptable confidence intervals (Hegel et al. 2012), relative to total counts and other methods used to inventory moose and caribou. Application of the method inspired enough confidence in the Yukon Bison Technical Team to recommend that the herd could be censused periodically rather than annually.

Here we report the results of the July 2014 inventory of the Aishihik Wood Bison Herd. This census builds upon those conducted in July 2007, 2009, and 2011, and is intended to inform managers and project partners on the population status of the herd.

Methods

We conducted a mark-resight census to estimate the size of the Aishihik Wood Bison Herd. We relied on paint-balled animals to represent the marked segment of the population. Paint-balling is a useful way to temporarily mark animals because a large percentage of the population can be quickly marked in a short time, with less stress then conventional marking techniques (e.g. radio-collars, ear-tags, etc.) because it does not require capturing animals (Skalski et al. 2005, Hegel et al. 2012). On 6 July 2014 we used an A-Star helicopter to locate and paint-ball bison from the air, using a Tippman A-5 paint-ball gun and blue-coloured paint-balls (Figure 1). We conducted previous trials in 2009 with captive bison at the Yukon Wildlife Preserve to determine that blue paintballs were the most visible, and that they would remain visible for up to 2 weeks in the summer if they were marked on the upper rear end area. When bison wallow they don't roll over completely, so the paint-ball marks located behind the hump are protected from getting covered with dirt. We aimed to mark each individual bison with 8-12 paint-balls each to facilitate resighting. Our goal was to mark about 10% of the bison in each group encountered.

Figure 1. Biologist marking bison with blue paint-balls from a helicopter.

Radio-collared bison were located on 2 July 2014 via a high altitude aerial survey in a Maule single-engine airplane equipped with 2 H-style antennas and a radio receiver. This aerial survey provided knowledge of where the herd was located during our census, to ensure that our study area boundaries coincided with the current distribution of the herd.

Three (3) independent resighting surveys were completed on 7, 8 and 10 July 2014. Resighting surveys were conducted by a crew of 3 observers and a pilot in a Bell Jet-Ranger helicopter. With one exception, each crew had different members and crews were not allowed to discuss bison locations with one another to ensure each resighting survey was done independently. Each crew had an experienced member that was familiar with where to look for bison during the survey period. Crews were instructed to search an area of approximately 3,500 km^2 where bison were believed to be seasonally congregated, based on information (local knowledge, aerial surveys, GPS-collar data) from July in other years. Census crews recorded the number of marked and unmarked animals in each group, as well as their geographic location using a GPS. Resighting crews never used radio-telemetry to help find bison. To obtain data on the composition of the population, crews recorded the number of adults and calves seen in each group.

A mark-resight population estimate and 90% confidence intervals were computed using the Joint Hypergeometric Maximum Likelihood Estimator algorithm for closed populations, using NOREMARK software (White 1996).

For comparative purposes, population estimates and 90% C.I. were also calculated using the Lincoln-Peterson Estimator algorithm. Each resighting survey was modeled separately, and then a global model was constructed using all resighting surveys to provide the final estimate and associated confidence intervals.

Results and Discussion

We marked 105 wood bison with paint-balls prior to the resighting surveys. Marked animals were distributed across the study area. Locations of marked bison approximated the distribution of 38 radio-collared bison during the census period.

The number of groups of bison observed during the resighting surveys varied between 20 and 44 (Table 1, Figures 1-3), with fewer groups being observed in later resighting surveys. The average percentage of calves observed during the surveys was 22.7%, notably higher than the 19.9% observed in the July 2011 census (Jung and Egli 2012).

The number of bison observed varied considerably between the surveys (297 to 810; Table 1). This is comparable to the 2011 census, where 293 to 647 bison were observed (Jung and Egli 2012). However the number of marked bison observed also ranged widely (10 to 54; Table 1). The minimum number

known alive was 857 (based on the number seen plus those paint-balled, but not observed).

We saw very few painted bison during the third resighting survey (10 July 2014; Table 1), and those that we did see had paint that was faded and sometimes difficult to see on the first pass by the bison. Moreover, we found very few bison in the alpine, where we had expected to seem them based on the previous paintballing and two resighting surveys. Together, these two observations cast doubt as to whether we were able to find marked bison, and when we did if they were in the forest and/or their marks may have been faded. Bison in the forest are harder to count, and it is difficult to determine with any certainty if they were painted, especially if there paint had faded significantly. Because of this, we concluded the third survey early and did not include these data in our population estimate modeling. To do so would have compromised the reliability of the estimate. We believe that many of the bison groups that were marked had left the alpine by 10 July 2014, likely because of the disturbance they received during the survey.

Modeling the two first resighting surveys independently provided population estimates that were similar (1466 and 1489; Table 1), but varied in their 90% confidence intervals. The statistical model that included both resighting surveys combined produced a population estimate of 1,470 bison, with 90% confidence intervals of 1,306–1,684).

The 2014 bison inventory provided a population estimate that was about 130 animals higher than expected, based on population modeling prior to the survey that used a population growth rate of 3-3.5% (approximately that observed between the 2007 and 2011 population censuses). The estimated July 2014 population size suggests a population growth rate of 6.1% per annum since the July 2011 estimate. It is possible that the 2014 population estimate is a bit too high, possibly because there were a higher number of calves born in 2014 than in most years, leading to a higher overall population estimate. Additionally, there may have been a bias in that many of the bison observed in resighting surveys were not subject to disturbance during paint-balling and the first resighting survey. We suspect that two consecutive days of being surveyed, followed by only a day interval before the 3rd day, may have caused some bison (likely those most disturbed, i.e. paint-balled) to move into the forest, possibly leaving the less disturbed (and unpainted) animals in the alpine, and available to be counted.

In summary, the population estimate obtained in this census is wholly plausible, however it is our opinion that it may be slightly overinflated because of the disturbance we caused to marked bison during the survey. We believe that the true population size lies more toward the lower end of the 90% confidence intervals of 1306-1684 animals in the population.

The 2014 inventory indicated that the herd had slowly grown since similar inventories in 2007, 2009 and 2011 (Figure 4). While the maximum

number of bison seen was just over half of the population estimate (857 of 1470), we have confidence in the results of the census and the statistical model that the true population size is between 1306-1684 (likely closer to the lower end of the confidence intervals). A further source of confidence in the results stems from the observation that while the number of bison seen in both of the first two independent surveys was quite different (298 vs 810), the estimated population size from each separate survey were similar (1466 vs 1489). This result indicates that the proportion of marked and unmarked bison observed was similar between these two surveys, likely because we paint-balled an adequate percentage of the population.

Our results also point to the value in conducting several independent resighting surveys to increase confidence in the results; however we recommend that in the future resighting surveys are separated by 1-2 days to reduce disturbance and displacement of bison.

Table 1. Survey effort and model results for 3 independent resighting surveys of marked (paint-balled) and unmarked Wood Bison of the Aishihik Herd, southwestern Yukon, July 2014.

Survey	Hours Flown	Number of Bison Observed	Number of Marked Bison	Number of Marks Seen	Minimum Number Known Alive	Estimated Population Size [1]	90% Confidence Intervals	Percent Calves
7 July 2014	7.1	810	105	58	857	1466	1291–1705	17.9%
8 July 2014	7.2	298	105	21	382	1489	1122–2087	26.8%
10 July 2014	6.3	297	105	10	392	-- [2]	--	23.5%
Combined Surveys					857	1470	1306–1684	22.7%

[1] Based on the Joint-Hypergeometric Maximum Likelihood Estimation model.

[2] Data from this survey were not reliable, so no population estimate was calculated.

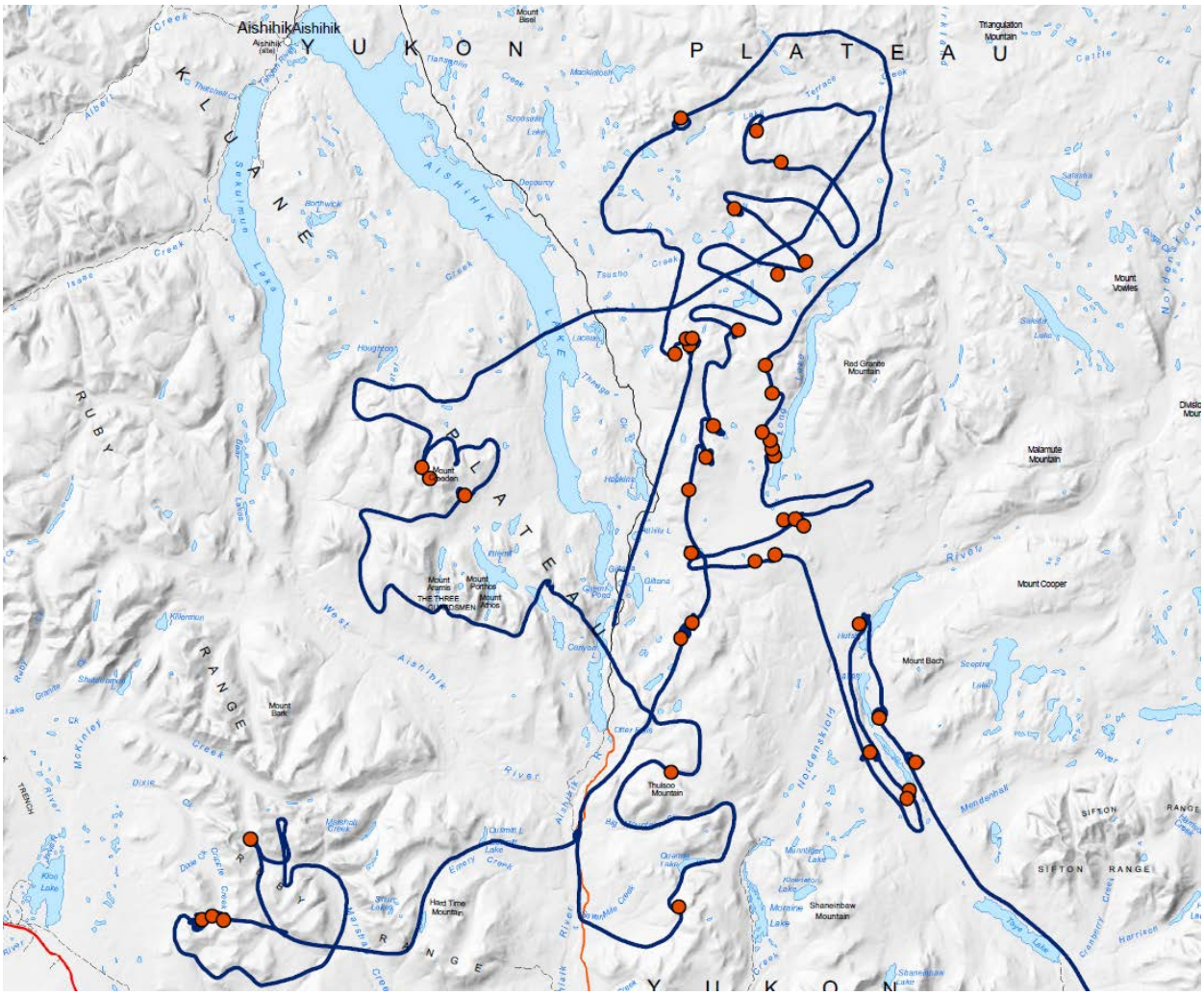

Figure 2. Flight line (dark blue) and observations of wood bison groups (red circles) from the 7 July 2014 resighting survey of the Aishihik Herd, southwestern Yukon.

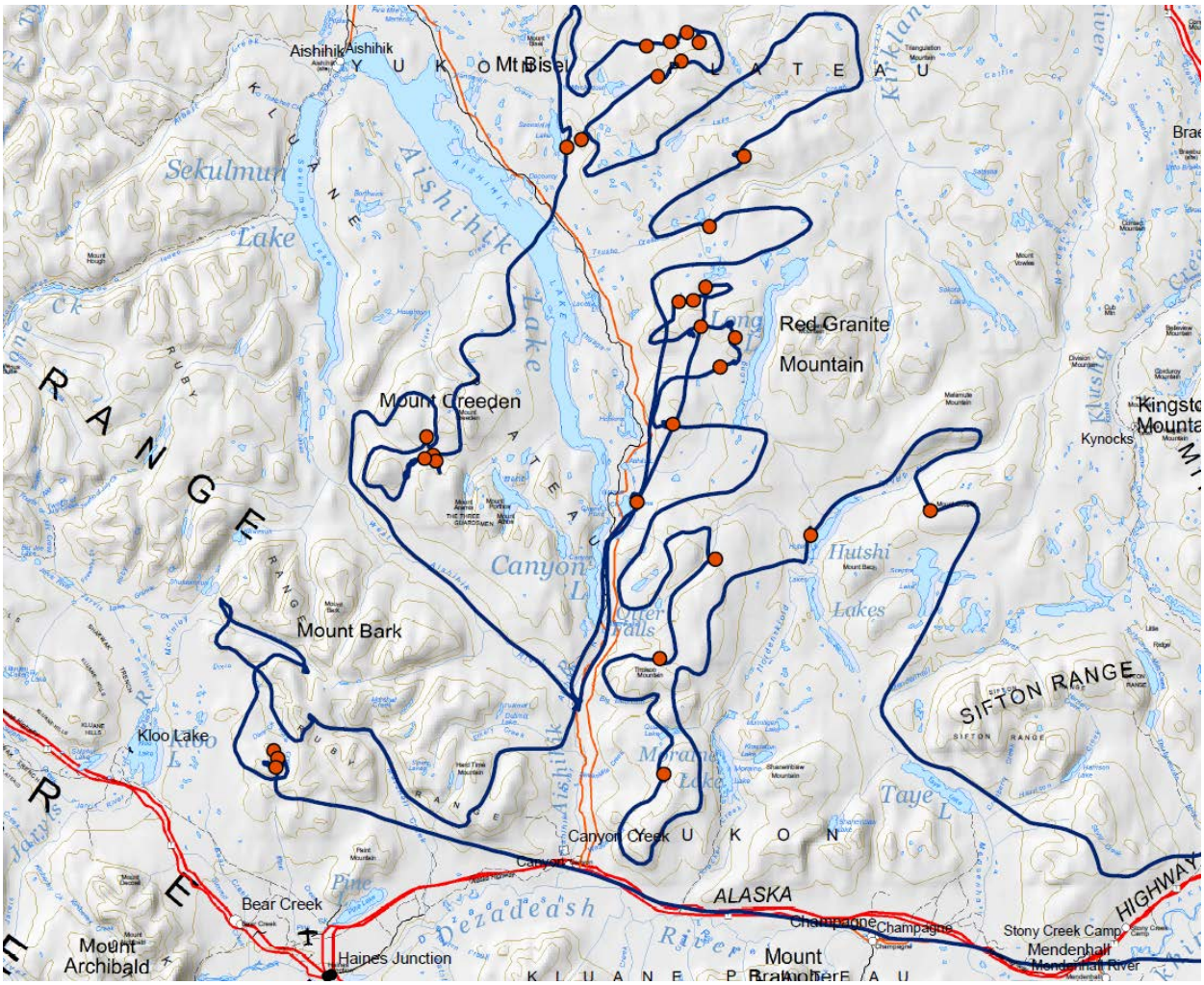

Figure 3. Flight line (dark blue) and observations of wood bison groups (red circles) from the 8 July 2014 resighting survey of the Aishihik Herd, southwestern Yukon.

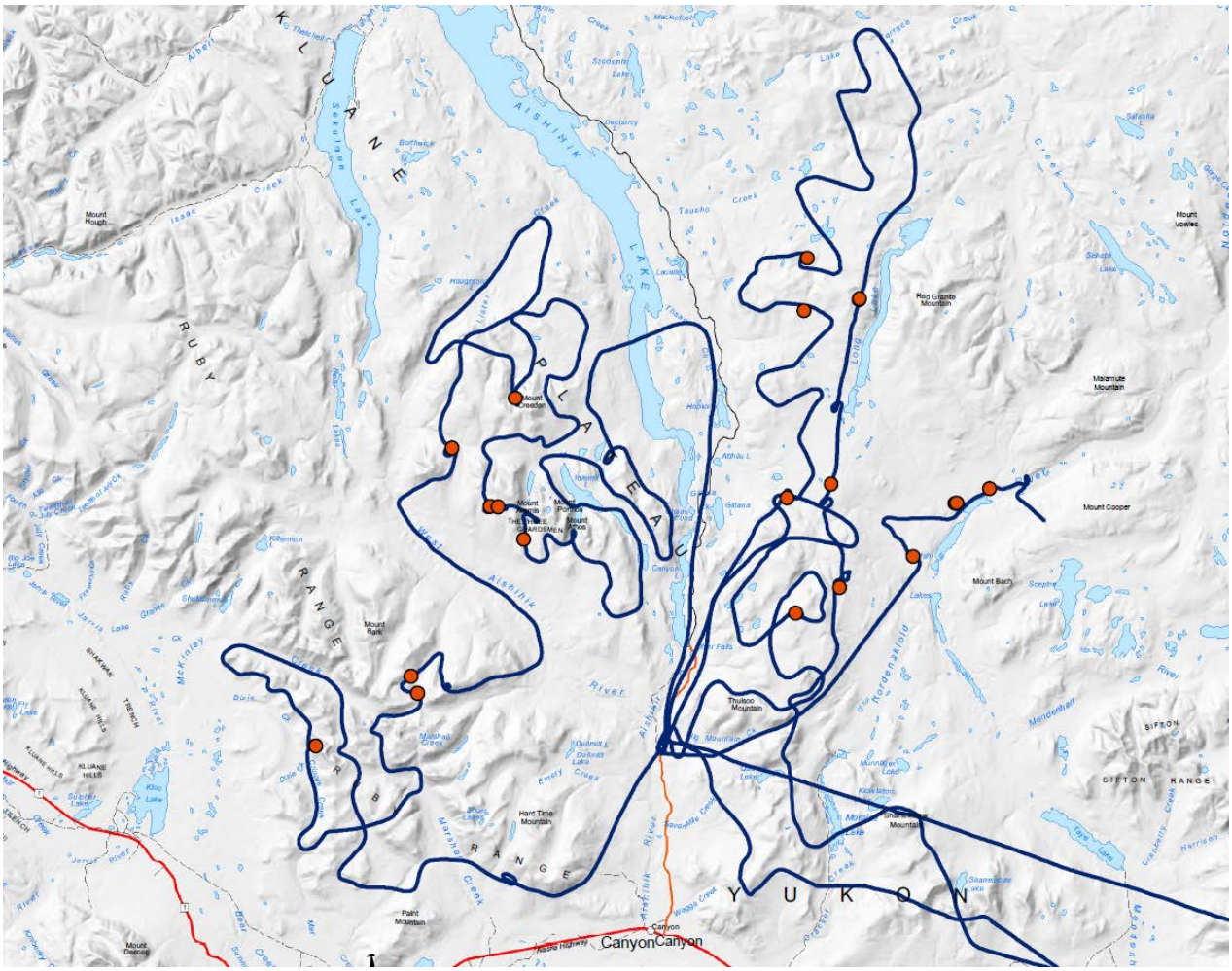

Figure 4. Flight line (dark blue) and observations of wood bison groups (red circles) from the 10 July 2014 resighting survey of the Aishihik Herd, southwestern Yukon.

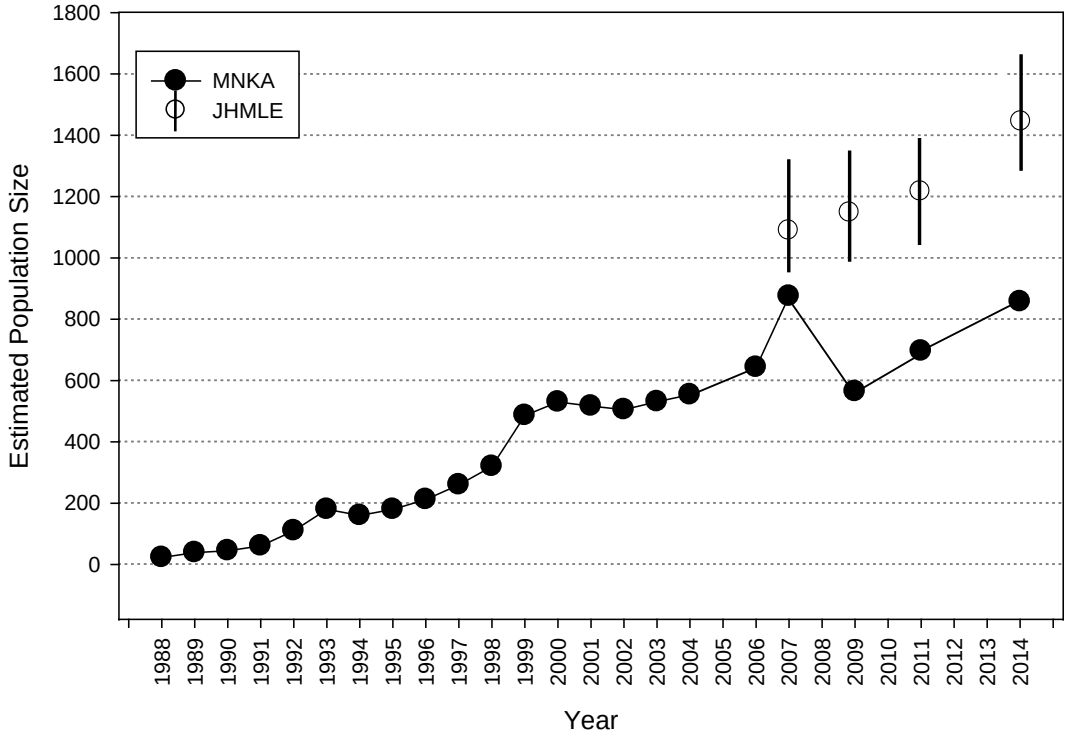

Figure 5. Estimated population size of the Aishihik Wood Bison Herd, southwestern Yukon, 1987–2014.

MNKA = minimum number known alive. JHMLE = population estimate obtained from the joint hypogeometric maximum likelihood estimation method, with the vertical lines representing the 90% confidence limits.

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