

**POPULATION INVENTORY OF THE
AISHIHIK WOOD BISON
(*BISON BISON ATHABASCAE*)
HERD IN SOUTHWESTERN YUKON
2011**

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July 2011

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**Yukon Department of Environment
Fish and Wildlife Branch
Technical Report TR-12-19**

Acknowledgements

We thank Todd Powell (YG - Fish and Wildlife Branch) for assisting with field logistics and participating in paint-balling. Troy Hegel (YG – Fish and Wildlife Branch) provided thoughtful advice on study design. We thank Linaya Workman and Harry Smith (Champagne and Aishihik First Nations), Dan Lindsey, Karen Clyde, Lorne Larocque, and Troy Pretzlaw (YG – Fish and Wildlife Branch) and Ken Knutson (YG – Conservation Officers Services Branch) for superb assistance with the resighting surveys. Canadian Helicopters and Capital Helicopters provided safe piloting during the course of the work. Funding was provided by Environment Yukon and Environment Canada’s Habitat Stewardship Program.

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Suggested citation:

JUNG, T. S., AND K. EGLI. 2012. Population inventory of the Aishihik Wood Bison (*Bison bison athabascae*) population in southwestern Yukon, 2011 Yukon Fish and Wildlife Branch Report TR-12-19. Whitehorse, Yukon, Canada.

Summary and Key Findings

- Between 18-25 July 2011 we conducted an inventory of Aishihik bison.
- We used paint balls to mark 101 bison. We then did 3 independent aerial surveys to locate and count marked and unmarked bison. A statistical model was used to estimate the population size and 90% probability upper and lower confidence limits.
- Our results were consistent with similar inventories done in July 2007 and July 2009, and with the estimated number of births and deaths (including harvest) since the 2009 census
- The results will be used to inform managers and project partners on the population status of the herd and help with setting the annual allowable harvest for the 2011/2012 to 2013/2014 bison seasons.
- We estimate that in July 2011 the Aishihik herd had 1230 bison (90% confidence intervals = 1106–1385). The most bison seen on one day was 647.
- The Aishihik herd continues to grow, but at a relatively slow rate, given that the herd has been harvested at about 10% per year since the last census in 2009.

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Introduction

Wood bison (*Bison bison athabascae*) were once abundant across much of Yukon. They had been present in Yukon throughout the Ice Age, and, along with caribou (*Rangifer tarandus*), survived the mass extinction of most large mammals 8 to 10 thousand years ago. By the 1900s, however, they were gone from much of their historic range, including Yukon. Habitat change and over-harvest were believed to have caused the historic decline. Concordant with their historic decline, wood bison are now listed as Threatened in the federal *Species at Risk Act*.

Beginning in 1980 a large conservation initiative was undertaken to return wood bison to portions of their historic range in northwestern Canada and interior Alaska. Yukon was part of this international initiative, and between 1988 and 1993, 170 animals were released into the wild from a temporary enclosure near the Nisling River (Yukon Wood Bison Technical Team 2011). Since then, the herd has grown and has been closely monitored to assess its population status and to provide current information to base an annual harvest by licensed hunters.

From 1998 to 2007 the herd was inventoried annually, using so-called total counts (Fuller 1950, Wolfe and Kimball 1989). This method was practical in 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, it was believed that 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, there was little information or experience counting bison in other jurisdictions. Biologists in the Northwest Territories use strip transects (Bradley and Wilmschurt 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 2011 inventory of the Aishihik Wood Bison Herd. This census builds upon those conducted in July 2007 and July 2009, 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 than 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 18 July 2011 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 about 10 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. Photo by T. Powell.

Three (3) independent resighting surveys were completed on 21, 22 and 24 July 2011. Resighting surveys were conducted by a crew of 3 observers and a pilot in a Bell Jet-Ranger helicopter. 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 at least 2 experienced members that were familiar with where to look for bison during the survey period. Crews were instructed to search an area of approximately 3,500 km² 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. Radio-collared bison ($n = 22$) were located on 22 July 2012 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. 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 3 resighting surveys to provide the final estimate and associated confidence intervals.

Results and Discussion

We marked 101 wood bison with paint-balls during 5.5 hours of flight time. Marked animals were distributed across the study area (Figure 2). Locations of marked bison approximated the distribution of 24 radio-collared bison during the census period (Figure 3).

The number of groups of bison observed during the resighting surveys varied between 14 and 38 (Table 1, Figure 4), with successively more groups being observed in later resighting surveys. The average percentage of calves observed during the surveys was 19.9%.

The number of bison observed varied considerably between the surveys (293 to 647), however the number of marked bison observed also ranged widely (26 to 52; Table 1). The minimum number known alive was 696 (based on the number seen plus those collared and paint-balled, but not observed). Modeling of each resighting survey independently provided population estimates that were similar (1,138 to 1,256), but varied in their 90% confidence intervals. The statistical model that included all 3 resighting surveys produced a population estimate of 1,230 bison, with relatively tight 90% confidence intervals (1,106–1,385).

The 2011 bison inventory provided a population estimate that indicated that the herd had slowly grown since similar inventories in 2007 and 2009 (Figure 5; Hegel et al. 2012). While the maximum number of bison seen was just over half of the population estimate (647 vs. 1,230), we have confidence in the results of the census and the statistical model. The derived population estimate was remarkably consistent with those from 2007 and 2009 and the demographics (estimated births and deaths) of the herd since 2009. A further source of confidence in the results stems from the observation that while the number of bison seen in each of the 3 independent surveys varied widely (up to 2.2 times difference between the lowest and highest count), the estimated population size from each separate survey were similar (within 10% of the estimated population size). This result indicates that the proportion of marked and unmarked bison observed was similar between 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.

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 2011.

Survey	Hours Flown	Number of Groups Observed	Number of Bison Observed	Number of Marked Bison	Number of Marks Seen	Minimum Number Known Alive	Estimated Population Size	90% Confidence Intervals	Percent Calves
Survey 1 21 July 2011	7.7	14	293	101	26	368	1138	892–1518	18.2%
Survey 2 22 July 2011	7.5	28	647	101	52	696	1256	1093–1482	23.3%
Survey 3 25 July 2011	7.7	38	404	101	33	472	1236	1005–1578	18.1%
Combined Surveys	-	-	-	-	-	696	1230	1106–1385	19.9%

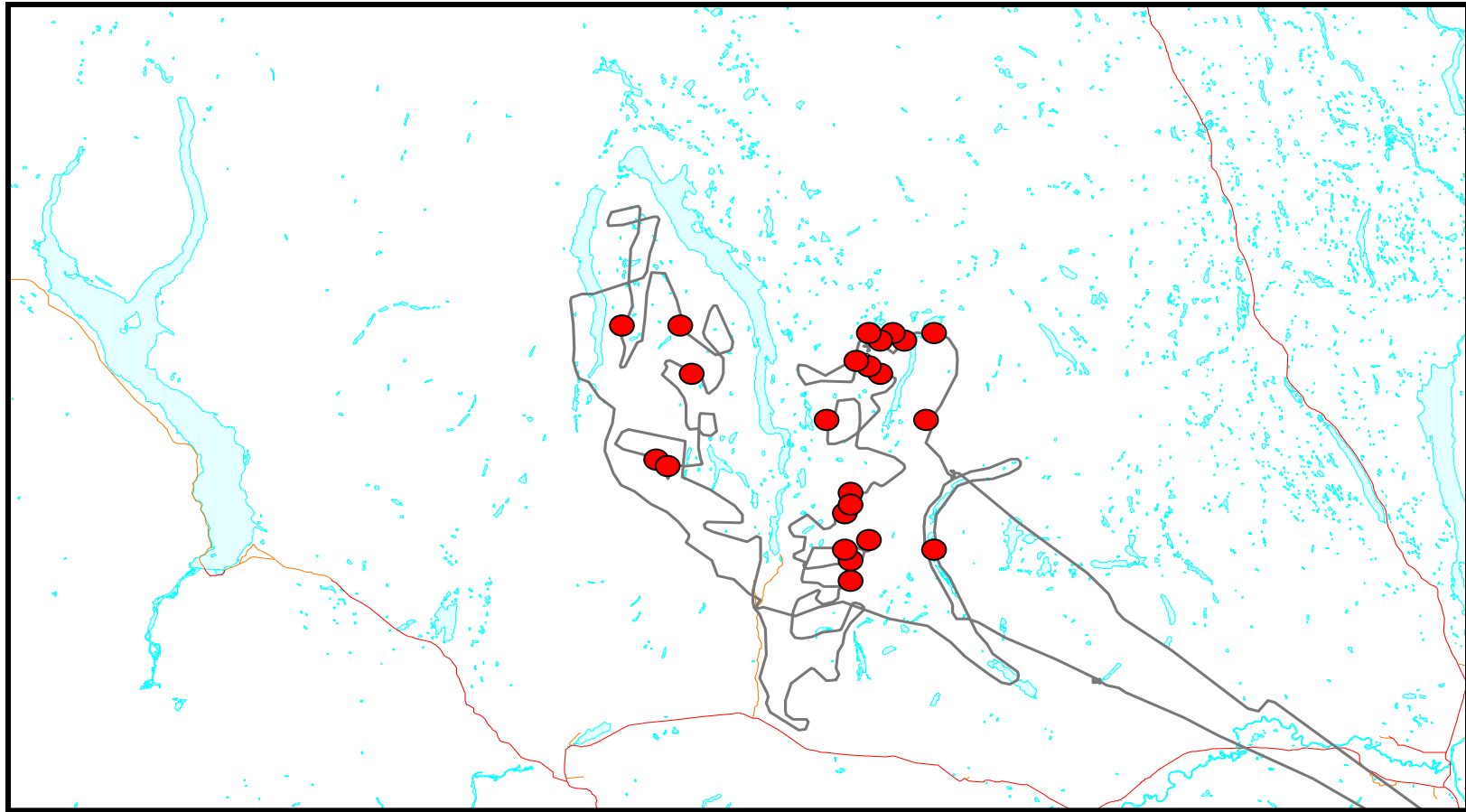


Figure 2. Flight path (solid gray line) and locations (dots) of where 101 wood bison were paint-balled in southwestern Yukon on 18 July 2011, prior to resighting surveys.

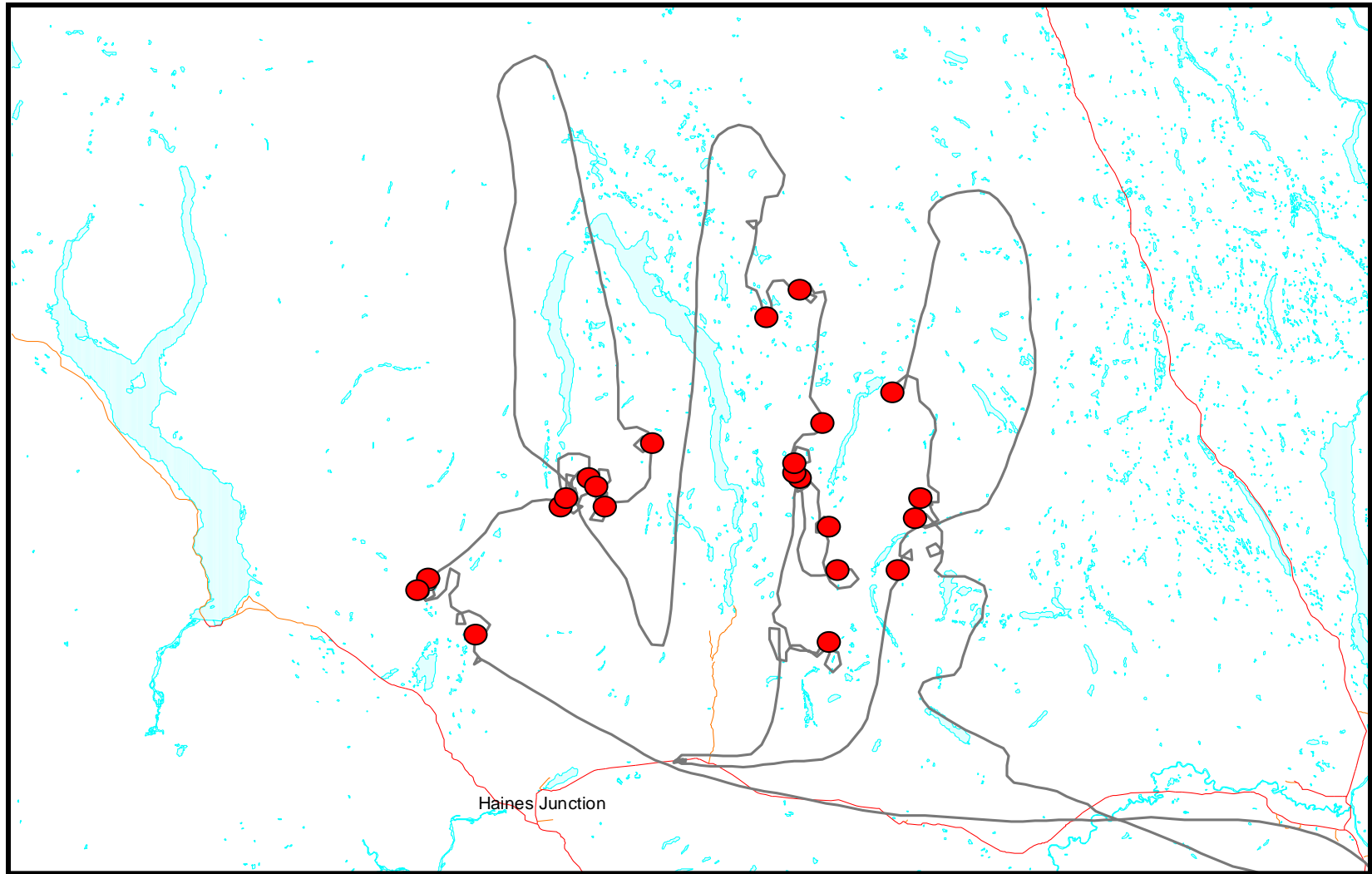


Figure 3. Aerial telemetry flight line (solid gray line) and locations (dots) of 24 radio-collared wood bison in southwestern Yukon, 22 July 2011.

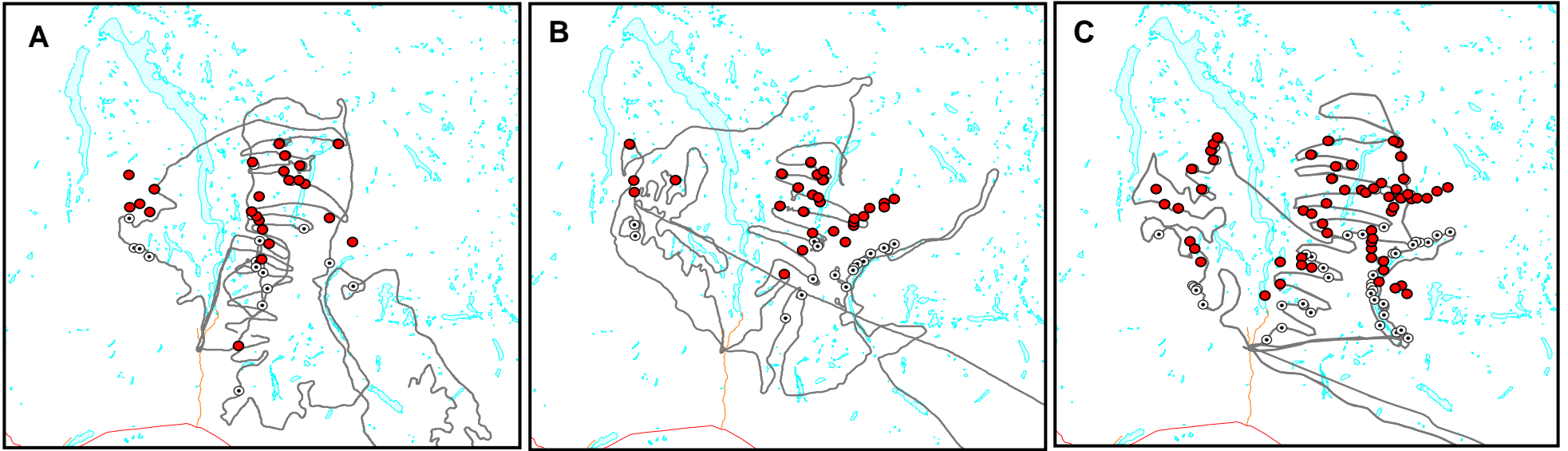


Figure 4. Flight lines flown during 3 independent resighting aerial surveys of wood bison in southwestern Yukon, 21 (A), 22 (B), and 25 July 2011 (C).

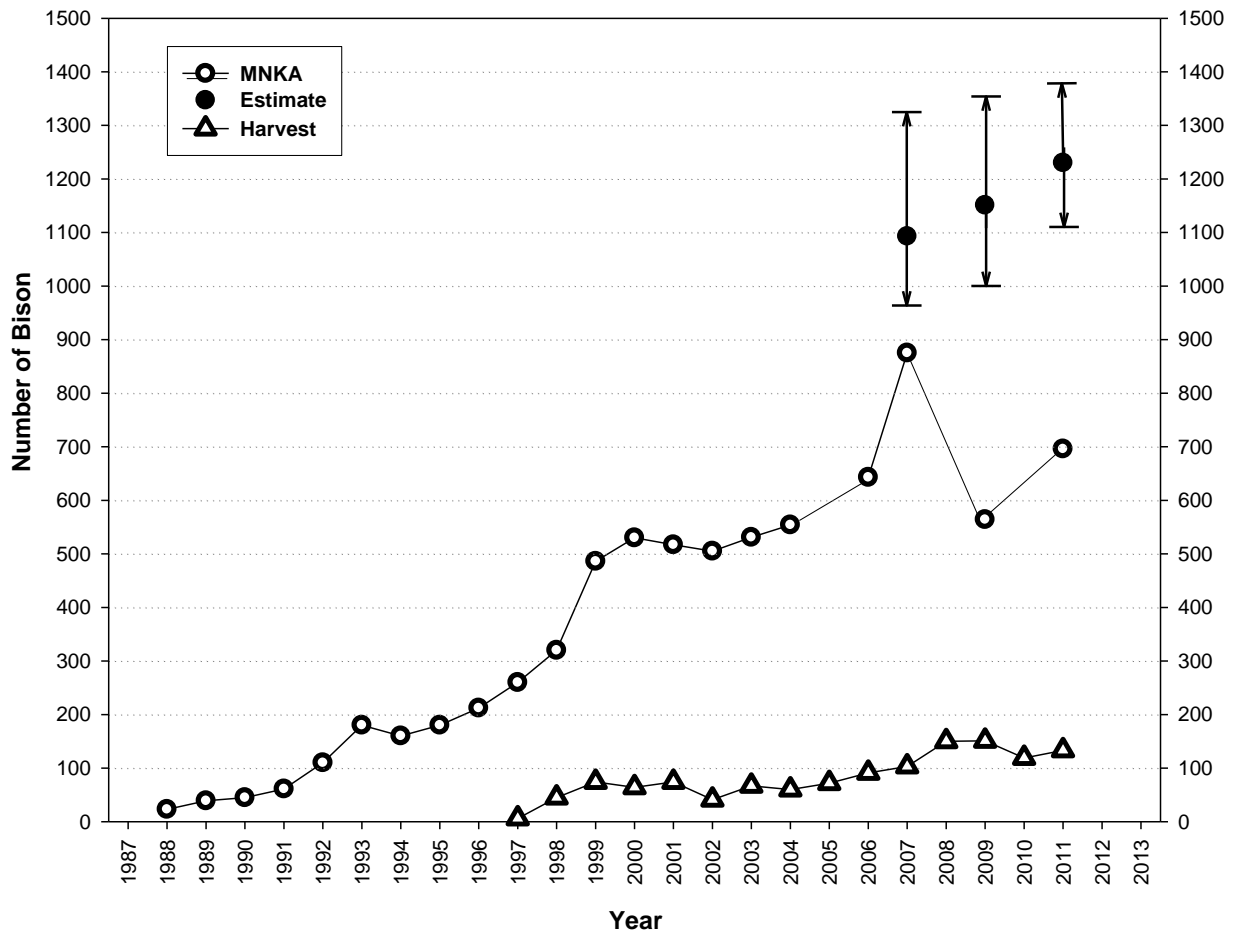


Figure 5. Estimated population size of the Aishihik Wood Bison Herd, southwestern Yukon, 1988–2011.

Literature Cited

- BRADLEY, M., AND J. WILMSHURST. 2005. The fall and rise of bison populations in Wood Buffalo National Park: 1971 to 2003. *Canadian Journal of Zoology* 83:1195–1205.
- FULLER, W. A. 1950. Aerial census of northern bison in Wood Buffalo Park and vicinity. *Journal of Wildlife Management* 14:445–451.
- HEGEL, T. M., K. RUSSELL, AND T. S. JUNG. 2012. Using temporary dye marks to estimate the size of a woodland caribou (*Rangifer tarandus*) herd in southwestern Yukon, Canada. *Rangifer Special Issue* 20:219–226.
- LARTER, N. C., A. R. E. SINCLAIR, T. ELLESWORTH, AND C. C. GATES. 2000. Dynamics of reintroduction in an indigenous large ungulate: the wood bison of northern Canada. *Animal Conservation* 4:299–309.
- LARTER, N. C., D. G. ALLAIRE, AND T. S. JUNG. 2007. Population survey of the Nahanni wood bison population, March 2004. Northwest Territories Department of Environment and Natural Resources Manuscript Report No. 176. 20 pp + appendices.
- JUNG, T. S., T. E. CHUBBS, R. D. OTTO, F. R. PHILLIPS, AND C. G. JONES. 2000. Population census of woodland caribou (*Rangifer tarandus*) of the Red Wine Mountains Herd in central Labrador. Unpublished report. Newfoundland and Labrador Inland Fish and Wildlife Division. 16 pp.
- MAHONEY, S. P., J. A. VIRGL, D. W. FONG, A. M. MACCHARLES, AND M. MCGRATH. 1998. Evaluation of a mark-resighting technique for woodland caribou in Newfoundland. *Journal of Wildlife Management* 62:1227–1235.
- MORLEY, R. C., AND R. J. VAN AARDE. 2007. Estimating abundance for a savanna elephant population using mark-resight methods: a case study for the Tembe Elephant Park, South Africa. *Journal of Zoology* 271:418–427.
- NEAL, A. K., G. C. WHITE, R. B. GILL, D. F. REED, AND J. H. OLTERMAN. 1993. Evaluation of mark-resight model assumptions for estimating mountain sheep numbers. *Journal of Wildlife Management* 57:436–450.
- PAULEY, G. R., AND J. G. CRENSHAW. 2006. Evaluation of paintball mark-resight surveys for estimating mountain goat abundance. *Wildlife Society Bulletin* 34:1350–1355.
- SKALSKI, J. R., J. J. MILLSPAUGH, AND R. D. SPENCER. 2005. Population estimation and biases in paintball mark-resight surveys of elk. *Journal of Wildlife Management* 69:1043–1052.
- WHITE, G. C. 1996. NOREMARK: Population estimation from mark-resighting surveys. *Wildlife Society Bulletin* 24:50–52.
- WOLFE, M. L., AND J. F. KIMBALL. 1989. Comparison of bison population estimates with a total count. *Journal of Wildlife Management* 53:593–59