POPULATION SURVEY OF THE NAHANNI WOOD BISON POPULATION MARCH 2004

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ABSTRACT

Wood bison (*Bison bison athabascae)* in Northern Canada were nearly eliminated during the late 1800s. As part of a program to establish a minimum of three free-ranging populations of wood bison in their historical range, the Nahanni wood bison population was established in 1980. Twenty-eight wood bison from Elk Island National Park (EINP) were released into the Nahanni Butte area, with supplemental releases in 1989 and 1998 of 12 and 59 individuals. Limited aerial surveys to monitor population monitoring were conducted in the 1990s. In March 2004, we conducted the first systematic aerial line transect survey of the Nahanni wood bison winter range, covering an area of 5082 km^2 of the southwestern Northwest Territories, southeastern Yukon Territory, and northeastern British Columbia. The 2004 population estimate was 399 non-calf bison (CV = 0.32). We also flew a reconnaissance survey along the Alaska Highway corridor from Liard Hotsprings, British Columbia to Lower Post, Yukon Territory, in the winter range of the Nordquist wood bison population, but only 6 bison were observed.

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INTRODUCTION

Wood Bison (*Bison bison athabascae)* of the boreal forest in northwestern Canada were nearly eliminated during the late 1800s, with populations persisting only in the area between Great Slave Lake and the Peace-Athabasca Delta (Ogilvie 1893). Recovery efforts for wood bison, initiated by the Canadian Wildlife Service (CWS), Parks Canada Agency, and territorial and provincial wildlife management agencies in western Canada, led to the establishment of the Nahanni wood bison population in 1980, when an initial 28 wood bison from Elk Island National Park (EINP) were released into the Nahanni Butte area near the Mackenzie Mountains in the southwestern Northwest Territories (NT) (Gates et al. 2001; Fig. 1). The introduced founder population dispersed into northeastern British Columbia (BC). Supplemental releases of 12 and 59 animals in 1989 and 1998, respectively, bolstered the population, which has established itself along both sides of the Liard River valley from the Blackstone River southward to northern BC. In 1998 the Nahanni population was estimated to number *ca*. 160 individuals (Gates et al. 2001). A more detailed accounting of the establishment of the population can be found in Larter and Allaire (2007).

An estimated 30 wood bison occur along the Liard River from the mouth of the Beaver River, BC, to the border with the NT (Fig. 1). Approximately half of these are animals that, at one point, had dispersed as far south as Fort Nelson after being released near Nahanni Butte in April of 1998 (J. Nishi pers. comm.; Government of British Columbia 2002).

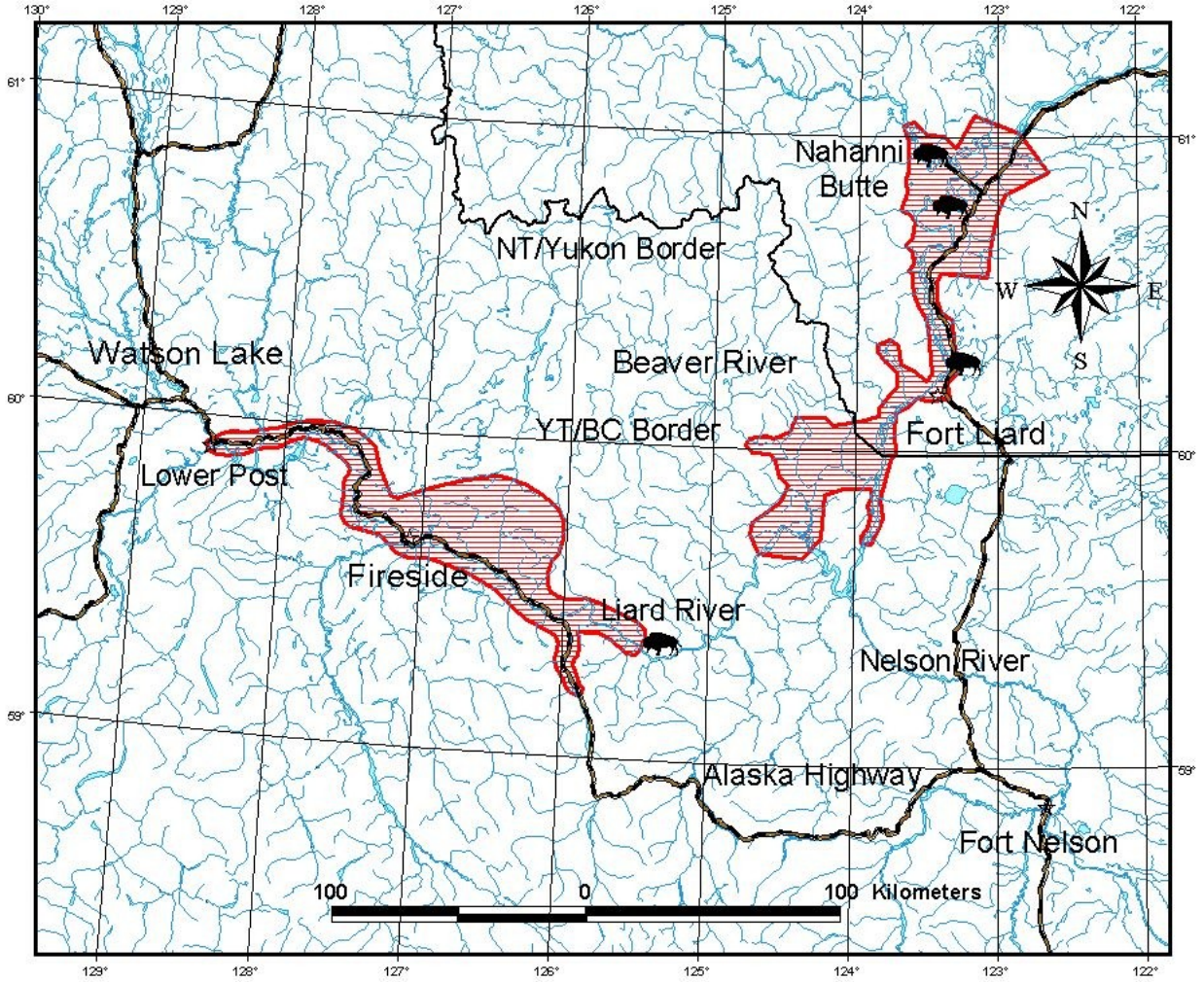

Figure 1. Winter ranges of the Nahanni and Nordquist wood bison populations. Release locations are indicated by bison icons. Nordquist range from Rowe (2007).

Another separate population of wood bison was reintroduced in the Aline Lake area, east of Liard Hot Springs in northern BC in 1995 (Fig. 1). The Government of British Columbia released 49 wood bison (from EINP), establishing the Nordquist population about 80 km SW of the Nahanni bison herd that dispersed to the Beaver River area (Harper and Gates 2000). It was anticipated that the Nordquist and Nahanni populations would coalesce in the future (Gates et al. 2001). Instead, the Nordquist population dispersed westward towards the Alaska Highway corridor. In October 2002, a mixed group of 52 animals was observed in the community of Fireside, BC. Some of these animals were marked with numbered plastic eartags, most of which were consistent with bison that had been released into the Nordquist population. However, it could not be ruled out that some eartagged animals were not from the Nahanni population (N. Larter and K. Davidge pers. obs.). Subsequently, the Nordquist population has taken up residence along the Alaska Highway corridor (Rowe 2007). Bison are frequently seen along both the Liard and Alaska Highways and are unfortunately becoming a traffic hazard.

We conducted a wood bison survey in March 2004 in response to: 1) the continued concerns from residents in the communities of Fort Liard and Nahanni Butte about the lack of population monitoring of the Nahanni wood bison population, 2) the need for a current population estimate of the Nahanni population because the goals of the National Recovery Strategy for wood bison include the establishment of at least 4 herds of more than 400 animals each, with at least 1 herd being located in British Columbia (Harper and Gates 2000), 3) the

need to assess the appropriateness of an aerial strip transect survey for estimating the Nahanni wood bison population size, 4) the need to document winter distribution of the greater area used by the wood bison metapopulation that encompasses the southwestern Northwest Territories, northeastern British Columbia, and southeastern Yukon Territory, 5) the need to assess whether bison use of the Alaska Highway corridor was concentrated along the highway right-of-way and vicinity, and 6) the need for interjurisdictional cooperation with monitoring the shared wood bison metapopulation.

METHODS

Delineation of the Survey Area

For the Liard River Valley survey area we compiled all historical bison observations from previous bison and wildlife surveys conducted in the area, all opportunistic observations of bison made by Environment and Natural Resources staff since the summer 2002, and all information provided by harvesters and local residents of both Nahanni Butte and Fort Liard. All location data was entered into a Geographic Information System (GIS) and a preliminary survey area was delineated based on the distribution of observations. Maps of this survey area were distributed amongst biologists and to local First Nations from Nahanni Butte and Fort Liard for comment and refinement. The survey area boundaries were finalized after community meetings (Fig. 2).

For the Alaska Highway corridor survey area we chose a swath of *ca*. 5 km wide that included the Alaska Highway, its right of way, and for the most part the Liard River. To the south, the area was modified by the topography, and was generally bounded on both sides of the river at 800 m elevation (a.s.l.).

Aerial Survey Technique

For the Liard River Valley survey area, we flew line transects. Because the survey area had an unusual shape and part of it was bounded to the west by a mountain range, transect length was highly variable (range 3.35-48.00 km see Appendix 1). Line transects ran parallel to each other in an east-west direction in

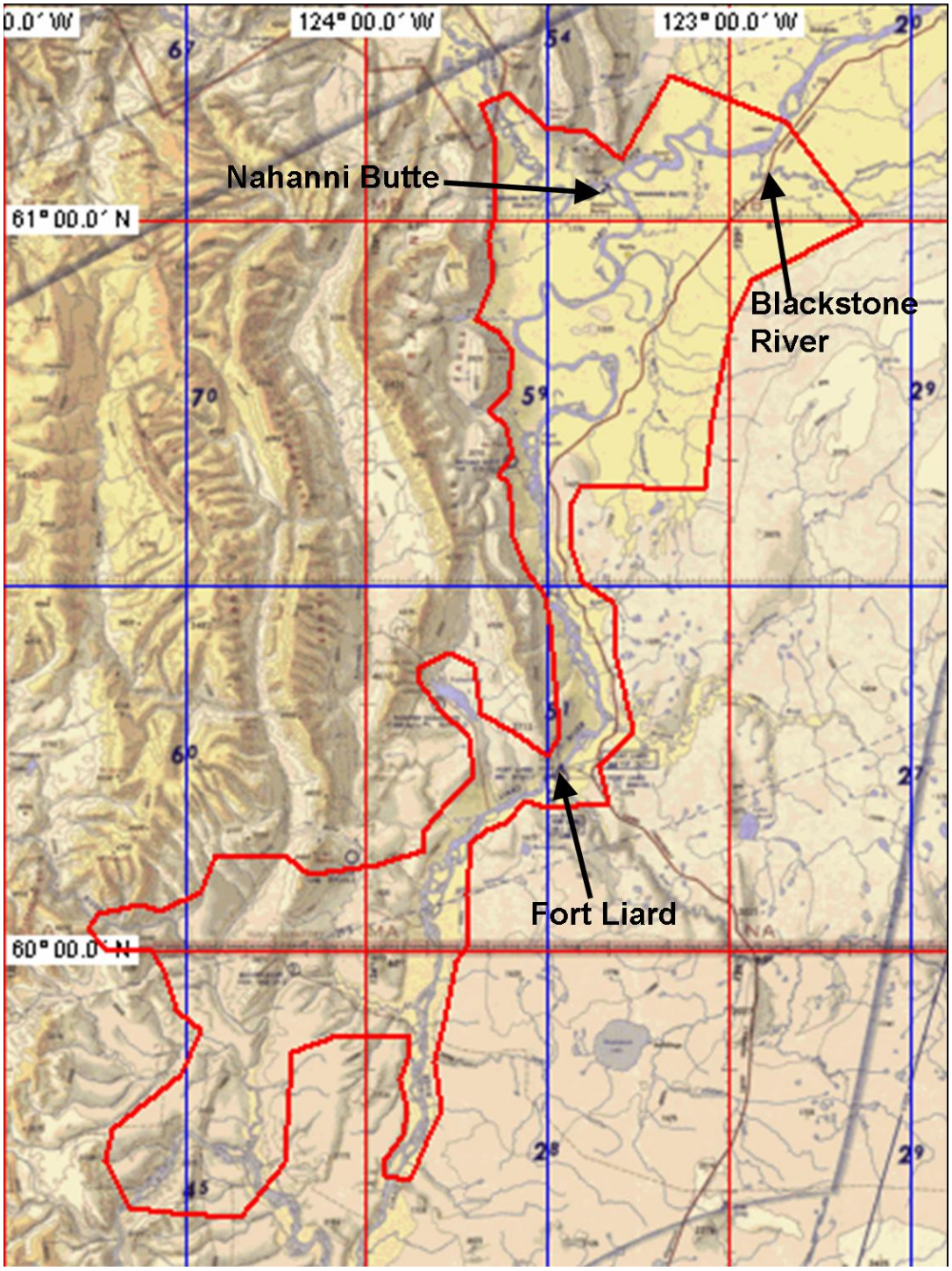

Figure 2. The survey area for the Nahanni wood bison winter range.

the southern part of the survey area, but in a southeast-northwest direction for the northern part of the survey area (Fig 3.). Transects were positioned to maximize the number of transects and minimize the range of transect lengths covering the survey area. We flew in a fixed–wing aircraft (Cessna 185) with markers on the struts, which enabled each of the two rear seat observers to view a swath of 500 m on either side of the aircraft. All bison observed both within and outside the area bounded by the strut markers were recorded by a navigator/observer sitting in the front seat. All wildlife and bison sign (tracks and feeding craters) was also recorded. The aircraft flew at a height of 122 m (400 feet) above ground level (agl) and we attempted to maintain a speed of 160 km/h.

For the Alaska Highway corridor survey area, we flew a ‘spaghetti’ transect back and forth between the northern and southern boundary of the swath again at a height of 122 m agl (Fig. 4). We recorded all bison seen within and outside the area bounded by the strut markers (500m on each side of the aircraft) and any fresh bison sign (tracks and feeding craters).

All flight lines were recorded using a handheld global positioning system (Garmin 76S) programmed for automatic recording of waypoints every 2-5 seconds.

Population Estimation

We used the Jolly (1969) method for unequal sized sampling units (Norton-Griffiths 1978) to estimate population size and sampling variance for the

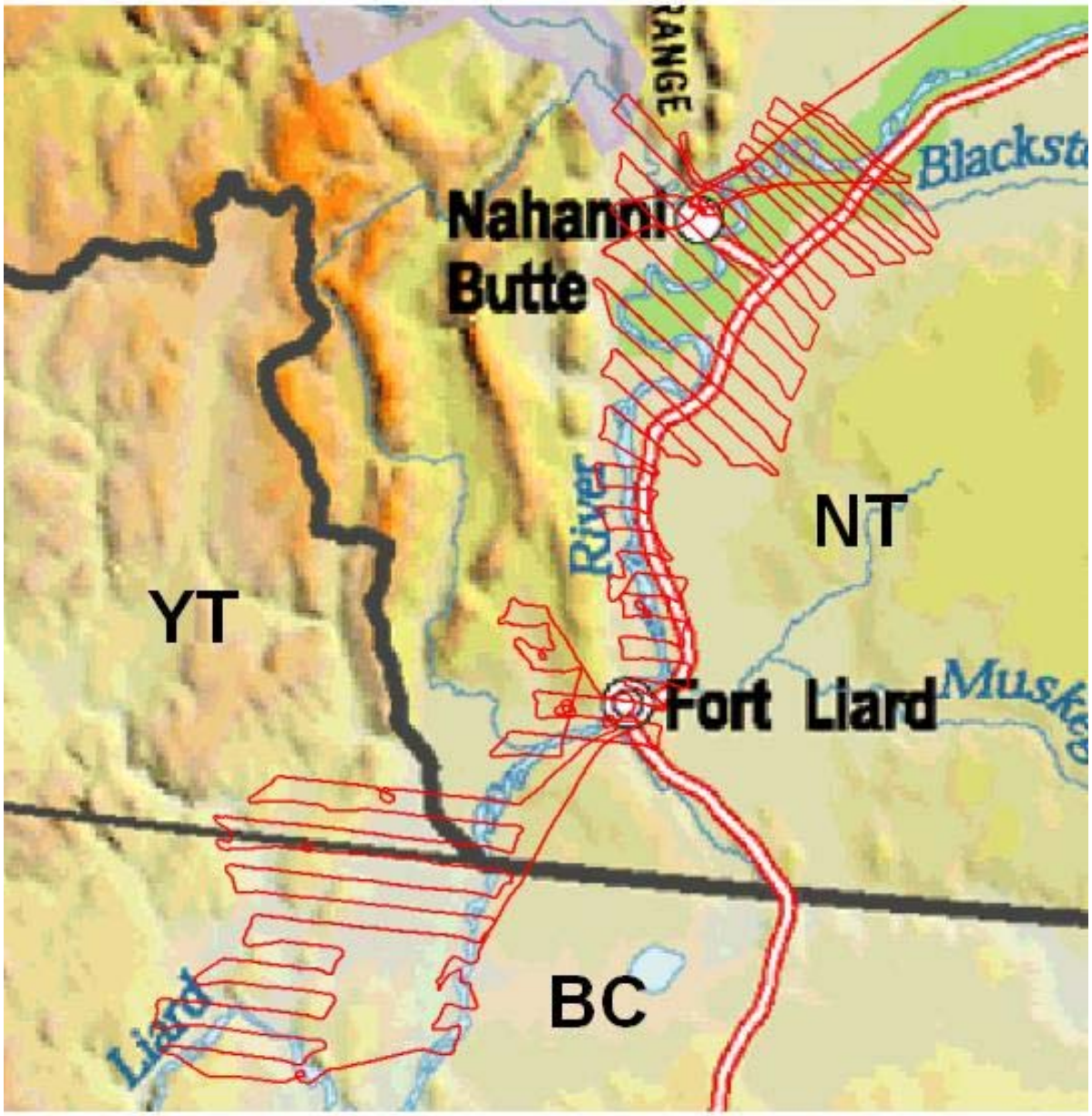

Figure 3. The flight lines indicating the line transects for the survey of the winter range of the Nahanni wood bison.

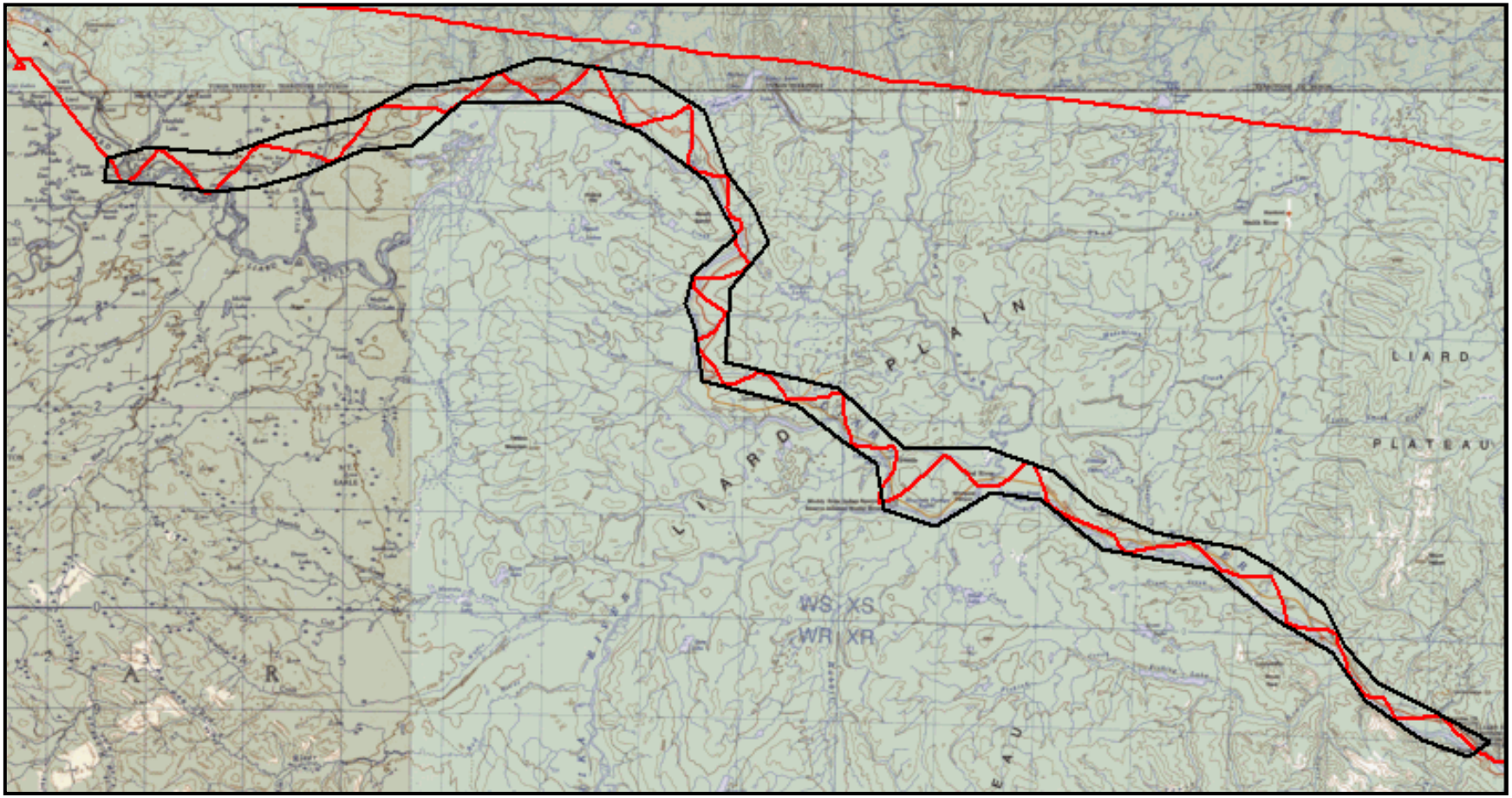

Figure 4. The flight line for the Alaska Highway corridor (red line) with the survey area outlined with the black line.

Nahanni population. Because of the shape of the survey area, the flight distance used commuting between transects was high relative to the flight distance covered on transect. Therefore, we made a second estimate of population. For this estimate we pooled the transect flight line and commute flight line and divided the total length of 1730 km into 57 segments of 30 km in length. We discarded the remaining 20 km. Each 30 km segment was 1km wide and represented a sample of 30 km^2. All animal observations on the flight line were placed with their corresponding line segment. Each 30 km^2 area represented a sample of the 195, 30 km^2 areas, in the total survey area of 5850 km^2 and was used as a sample of the total area to calculate a population estimate.

RESULTS

Nahanni Population

The winter range survey area mapped was 5082 km^2 in total with 3350 km^2 of the range falling within the Northwest Territories, 1253 km^2 of the range falling within British Columbia, and the remaining 479 km^2 of the range falling within Yukon (see Figs 1 and 2). We flew 60 line transects covering 1288 km of transect lines over the Nahanni bison winter range, 887 km of transect lines in the Northwest Territories (Fig. 3), 312 km of transect lines in British Columbia, and 89 km of transect lines in Yukon. This translated into percent coverage of 26.5, 24.9 and 18.7 for each area respectively. We counted 101 non-calf bison and 1 calf bison, all within the Northwest Territories part of the winter range. This count resulted in a population estimate of 399 non-calf bison (CV = 0.32) using the Jolly (1969) method following Norton-Griffiths (1978). Using the equal area samples of the survey flight line we made a population estimate of 346 (CV = 0.42).

Bison sign (new and older feeding craters and tracks) was distributed throughout the survey area north of the LaBiche River, except for the northeastern portion found east of the Liard Highway. Bison sign was noticeably absent south and west of the LaBiche River, although large groups of bison are known to use these areas during summer. This area has a high density of forest cutblocks of various shapes and sizes.

Nordquist Population

We counted 6 non-calf bison on the Alaska Highway corridor. We flew 222 km of flight line with a line width of 1km. Although we saw few bison in the corridor, signs of trails and feeding craters were seen distributed along most of the highway corridor. Given reports from motorists, we know that our limited aerial survey missed the large group of bison that constitute the bulk of this population. We observed signs of relatively heavy winter use in the pine regeneration areas to the north and west of Fireside. Animals are using the old Alaska Highway route as a travel corridor to the area. This area was part of an extensive fire in the early 1980s.

DISCUSSION

Nahanni Population

Aerial population surveys have been conducted in March to estimate the population size of the Mackenzie wood bison population on a number of occasions since the 1980s (Larter *et al.* 2000). These surveys generally employed flying systematic flight lines over a portion of the survey area (generally the more heavily forested areas) and flying total count surveys over the large open sedge-dominated meadows associated with the shallow lakebeds in the area. Later surveys also employed a sightability correction factor for the forested areas, which was derived from observing, or not, radio collared animals during the survey.

Bison distribution during most of the year tends to be dispersed throughout the landscape and highly clumped, with large mixed sex-age groups and small male-only groups, which are often solitary animals (Larter 1988; Gates and Larter 1990). Conducting surveys in the winter provides an added advantage of observing tracks recently left by bison. The landscape inhabited by the Nahanni and Nordquist populations is quite different from that inhabited by the Mackenzie population. The majority of the Nahanni and Nordquist winter range is forested, with major river drainages, mountains and deep valleys bisecting the winter range. There are an abundance of smaller oxbow meadows associated with rivers, but large open sedge-dominated meadows are absent. There were no bison with collars in either population.

The aerial survey was designed to be repeatable, to provide baseline information on the winter distribution of wood bison in the Nahanni metapopulation, and to provide a population estimate for the Nahanni population given the constraints of topography and lack of information from radio collared bison.

Based upon the number of animals observed on annual sex-age classification surveys conducted in July 2002 and 2003, we expected the population estimate to be greater than the 200 considered to be the population size in the late 1990s (J. Nishi pers. comm.). We also expected the estimate of this survey to have a high coefficient of variation (CV) because of the clumped distribution and the huge variation in transect lengths (range 3.35 – 48.00 km). We anticipated that dividing the entire survey flightline into 57 segments of equal length would reduce the CV. However this was not the case. The survey estimate was *ca.* 10% lower, but the CV was *ca.* 30% greater. This indicates that the clumped animal distribution, which cannot be changed, has a major influence on the CV of the population estimate. By using the entire flightline, the survey areas increased slightly because it had to include a 500 m buffer around the perimeter of the flightline.

Radio collared bison would likely aid in better defining future survey areas and sightability correction factors, leading to more precise population estimates and decreased survey effort. Techniques used in the Yukon to survey the Aishihik population have achieved reasonable population estimates with low effort and low coefficient of variation (Jung and Workman unpubl. data). Bison

aggregate into larger groups during both the summer and the winter. Winter surveys have the advantage of being able to detect fresh tracking sign and the lack of leaves on deciduous trees, and have been the norm for Northwest Territories wood bison populations. However, with the recent deployment of satellite collars on bison, the option of conducting a population survey during late-July may warrant consideration.

Nordquist Population

Immediately subsequent to the March 2004 reconnaissance flight along the Alaska Highway, a total of 76 wood bison were observed along the highway in six groups (T. Jung pers. obs.). More recently Rowe (2007) counted 97 bison along the Alaska Highway corridor including one large group of 83 bison that was on both sides of the highway. The area he surveyed was mainly the highway corridor, but it did include areas north of Fireside and the Aline Lake area. Possibly the habitat and travel corridors along the Alaska Highway right-of-way are providing more attractive wintering habitat than the even-aged stands of regenerating pine.

We found little bison sign between the winter ranges of the Nahanni and Nordquist populations. In fact, there was little bison sign south of the 60$^{o\ th}$ parallel, even along the major river drainages. A substantial amount of this area has been logged with numerous cutblocks of various shapes and sizes (range 0.1-2.5 km^2). Previously, it was believed that these two populations would coalesce. There may be movement between the animals from the Nahanni and

the Nordquist along the river drainages during summer. We could find no signs to support such movements during winter 2004, however we did not spend a lot of flight time between the two wintering areas. With the recent deployment of satellite and satellite GPS collars on bison in July 2007 we may find evidence to support movement of animals between the two wintering areas.

ACKNOWLEDGEMENTS

We thank all of the harvesters, local residents, and researchers that provided historical and current observations of Nahanni bison. John Nishi and Jan Adamczewski assisted with the survey design. Aaron Close of Wolverine Air provided skillful piloting in some very windy conditions. Raymond and Steve Vital provided logistical assistance in Nahanni Butte and assisted with aerial observing. Nahanni Butte Dene Band and Acho Dene Koe Band are acknowledged for their support of this survey and their continuing support of the Nahanni wood bison program.

RECOMMENDATIONS

1) Because the Nahanni wood bison population is part of a metapopulation of wood bison whose distribution covers southwestern Northwest Territories, southeastern Yukon Territory, and northeastern British Columbia there is a need for continued multijurisdictional cooperation and coordination in wood bison population management.
2) Satellite and/or GPS collars should be deployed on bison in the Nahanni population to provide better information on animal movements and distribution to more clearly define survey areas. These collars would also provide information on the sightability of animals during winter aerial surveys. Such information would help with the design and accuracy of future population estimates.
3) Another aerial survey to generate a population estimate for the Nahanni wood bison population should be conducted in 2008 or 2009. Depending upon the data acquisition from satellite collared bison consideration of a summer, rather than a winter aerial survey, may be warranted.
4) Annual sex and age classification surveys should continue to monitor demographic parameters between surveys and to estimate population trajectory.

PERSONAL COMMUNICATIONS

John Nishi, Bison Ecologist, Environment and Natural Resources, Government of the Northwest Territories, Fort Smith.

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APPENDIX 1.

List of transect lines, their length, and number of animals observed on transect.

Transect Number	Length (km)	Number bison	Number moose
1	17.30		
2	26.30		1
3	31.42		
4	32.16		
5	31.82		1
6	31.13		
7	29.65		1
8	27.97	21	1
9	25.12	12	
10	25.31		
11	47.46		1
12	48.00	5	
13	42.36		
14	41.63		
15	39.62		
16	38.80		
17	37.07		1
18	34.97		
19	26.75		1
20	19.49		2
21	12.30		
22	7.82		
23	7.88		
24	8.33		
25	7.30		
26	6.41		
27	6.57		
28	8.14		
29	8.37		1
30	8.68	24	
31	5.92		
32	8.84		
33	5.92	3	1
34	8.92	1	
35	4.65	24	
36	8.70		
37	6.30	1	
38	18.93		
39	17.97		
40	22.43		

Transect Number	Length (km)	Number bison	Number moose
41	8.81		1
42	37.45	11 (incl 1 calf)	
43	40.59		
44	44.56		2
45	44.00		
46	42.46		1
47	39.47		
48	35.25		
49	3.35		
50	13.01		
51	4.34		
52	15.45		
53	3.82		
54	18.37		
55	3.59		
56	23.42		
57	5.66		3
58	23.90		1
59	20.64		
60	15.31		1