

**MONITORING AND MANAGEMENT
ACTIVITIES FOR THE AISHIHIK
BISON (*BISON BISON*) HERD,
SOUTHWESTERN YUKON**

2011-2012 ANNUAL REPORT

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MONITORING AND MANAGEMENT ACTIVITIES FOR THE AISHIHIK BISON (*Bison bison*) HERD, SOUTHWESTERN YUKON: 2011-2012 ANNUAL REPORT

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Summary

- Bison are a species at risk in Canada, and a highly sought after big game animal in Yukon. As well, they are a species of concern to local First Nations. As such, they are currently among the most closely managed wildlife species in Yukon.
- In 2011–2012, our main aims in the bison program were to conduct a population census of the Aishihik Herd and replace and replenish radio-collars in order to document distribution, habitat use, and survival. In addition, we collected biological samples for various testing, produced maps to aid hunters, and provided a variety of outreach initiatives and products.
- A population census was conducted in July 2011 and the results were communicated to senior managers in Environment Yukon, the Yukon Wood Bison Technical Team, and local media. The results were also disseminated in the Bison Banter—the newsletter of the Yukon Bison Technical Team (available at: <http://www.env.gov.yk.ca/publications-maps/brochures.php#bison>)—and in a separate technical report (available at: <http://www.env.gov.yk.ca/publications-maps/plansreports.php#bison>).
- We conducted two live-capture and collaring sessions in 2011–2012 and radio-collared 13 female and 2 male bison. As of March 31st, 2012, there were 30 radio-collared bison in the population. Of note, our emphasis for collaring in 2011–2012 was to phase out GPS collar deployments in favour of VHF collars.
- Five radio-telemetry flights were flown in 2011–2012 to relocate radio-collared bison and produce a map to aid hunters in deciding where to plan their hunts.
- One minor scientific paper on bison was published in a peer-reviewed journal in 2011–2012. The paper was published in *Northwestern Naturalist* and reports on the first accounts of wolf (*Canis lupus*) predation and scavenging on Yukon bison.

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BACKGROUND AND OBJECTIVES

Wood bison (*Bison bison athabascae*) were once abundant across much of the Yukon. They had been present in the Yukon throughout the Ice Age, and—along with caribou (*Rangifer tarandus*) and thimhorn sheep (*Ovis dalli*)—survived the extinction of most large mammals approximately 8,000–10,000 years ago. Anthropologists interviewed Teslin elders in the 1970s, who said that bison were last hunted when their grandparents were children, or mid-to-late 19th century. Interviews with First Nation elders in southeastern Yukon also indicate that bison were present in the Ross River and Liard area last century, with the last one disappearing in the early 1900s. By then, bison were gone from much of their historic range, including the Yukon. It is estimated that there are about 160,000 wood bison distributed across their range in northwestern Canada and Alaska prior to the arrival of settlers (Soper 1941). Habitat change and over-harvest are 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 reintroduce wood bison to portions of their historic range in northwestern Canada and interior Alaska. The Yukon was part of this initiative; between 1988 and 1992, 170 animals were released into the wild from a temporary enclosure near the Nisling River (Gates et al. 2001, Government of Yukon 2012). Since then, the herd

has grown and has been closely monitored in order to assess the population status of the herd, and provide current information to base an annual harvest by licensed hunters. Since the herd had few natural predators, it was steadily increasing in size. Limited hunting began in March 1998 in anticipation of the herd exceeding the target level of 500 animals. In following years more liberal harvest strategies were implemented with the goal of reducing population growth and size. The most recent census occurred in July 2014 and provided an estimate of 1470 (90% confidence intervals = 1306–1684) bison in the population (Jung and Egli 2014).

Wood bison populations are rather unique: at the same time they may be a *Threatened* species and a big game species. This is the situation in the Yukon, where reintroduced populations contribute significantly to the global recovery of the species and provide meat to local people through harvest. Furthermore, there are significant community concerns over the potential impact of reintroduced wood bison to other valued wildlife and the land. This unique juxtaposition of an apparently “overabundant endangered species” necessitates that populations are carefully managed, with a duty of care that is higher than other harvested species. The challenge is to manage populations in a manner that provides for the recovery of the species (as required by the federal *Species at Risk Act*), while addressing community concerns and allowing for local people to benefit from the resource, primarily through hunting opportunities. To do

this successfully requires cooperation, commitment and good information.

Here we report on the activities undertaken in 2011–2012 by Environment Yukon’s Bison Program. Specifically, our objectives for the fiscal year were as follows:

Monitor population trends

Population monitoring was the bulk of the work in 2011-2012. Because of the high harvest rate, inherent small population size, and conservation status of the herd, we require regular population censuses and surveys to obtain key demographic data to gauge the status of the herd. These data are crucial for setting Annual Allowable Harvests and deciding upon annual harvest regimes, under an adaptive framework. Population inventories are done every second year. In 2011-2012, the population monitoring objectives included the following:

- a. Composition count. A composition count provides information on the percent of calves in the population, which is variable from year-to-year. This data allows wildlife managers to gauge the anticipated growth of the herd and set harvest targets.
- b. Population census. Every 2-3 years the population is counted and its true size is estimated. This data is needed to assess where we are with respect to the population size prescribed in management plans for the herd. The census serves to validate where our models of population and harvest dynamics.
- c. Radio-collaring. Radio-collared bison are needed to facilitate population monitoring. Through telemetry flights and various counts (mainly composition and

census) of radio-collared bison, we collect data on productivity, recruitment, and adult survival.

Monitor the movements and spatial distribution of wood bison

Better information is needed on the distribution (including range expansion) and habitat use of populations in order to provide data to regional planning processes and meet the legal requirements for identifying critical habitat under the federal *Species at Risk Act*. We collect data from GPS-collared animals to examine seasonal distribution (range use) and habitat preferences.

Monitor bison harvest

Harvest statistics are tracked annually and used by the Yukon Wood Bison Technical Team to develop bison harvest models and make harvest recommendations for the next bison hunting season.

MONITORING AND MANAGEMENT ACTIVITIES

Radio-telemetry Flights

Radio-collared bison are used to facilitate population monitoring and provide information on the distribution and habitat use of the herd. Several times a year, radio-collared bison are located via an aerial survey. Often these aerial telemetry surveys are conducted prior to a population census or capture session in order to increase the efficiency and cost-effectiveness of those operations. Telemetry flights were flown in a Maule M7 or a Cessna 206 fixed wing aircraft at elevations between 8,000-

13,500 feet asl (above sea level). Transects that comprise a north-south grid over the core bison range, and spaced 15 km apart, are flown to ensure reasonable coverage of the area.

During 2011-2012, 5 radio-telemetry flights were flown (Table 1). On May 16th, 2011, a radio-telemetry flight was flown prior to a scheduled composition count (see Population Monitoring). The second radio-telemetry flight, done on July 22nd, 2011, was flown before a mark-resight population census took place (see Population Monitoring). Radio-telemetry flights done on September 25th, 2011 and March 19-20, 2012 were done in advance of capture and radio-collaring operations (see Live Capture and Radio-Collaring). The radio-telemetry flight conducted on

February 13th, 2012 was done before the second part of the hunting season opened, in order to facilitate the production of a map to aid hunters (see Harvest Management).

During 2011-2012, there were 31 radio-collared bison (11 VHF and 20 GPS collars). The percentage of radio-collared bison relocated during radio-telemetry surveys varied from 63% to 77% (Table 1). We attribute the mediocre success of the radio-telemetry flights to the fact that the GPS collars are difficult to locate from aerial surveys due to low signal strength. VHF collars are easily found, using our protocol.

In general, radio-collared bison were more congregated in the summer months, when they were found at higher elevations than in the fall and winter (Figures 1-5).

Table 1 Summary data for 5 wood bison telemetry flights flown in southwestern Yukon, during 2011–2012. There were 31 radio-collars active during the year (11 VHF and 20 GPS). Of these, one radio-collar stopped functioning at the end of September.

Date	Number of Collars Found (%)	Number of Hours Flown
May 16, 2011	23 (74%)	7.1
July 22, 2011	24 (77%)	6.0
September 25, 2011	23 (74%)	7.3
February 13, 2012	20 (67%)	6.5
March 19-20, 2012	19 (63%)	10.7

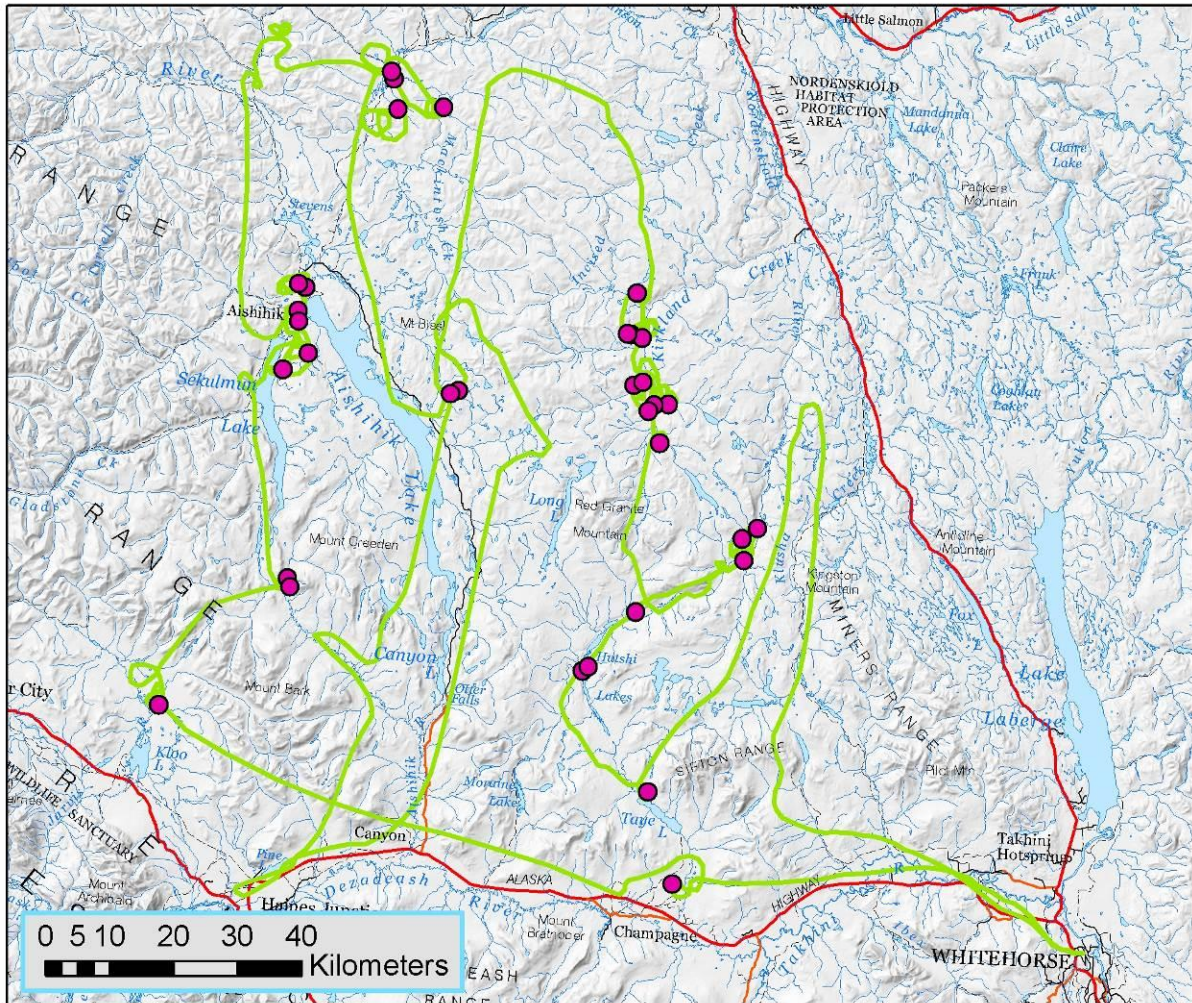


Figure 1 Bison telemetry flight flow on May 16th, 2011. Pink circles are locations where radio-collared bison were found. Green line is the flight line flow.

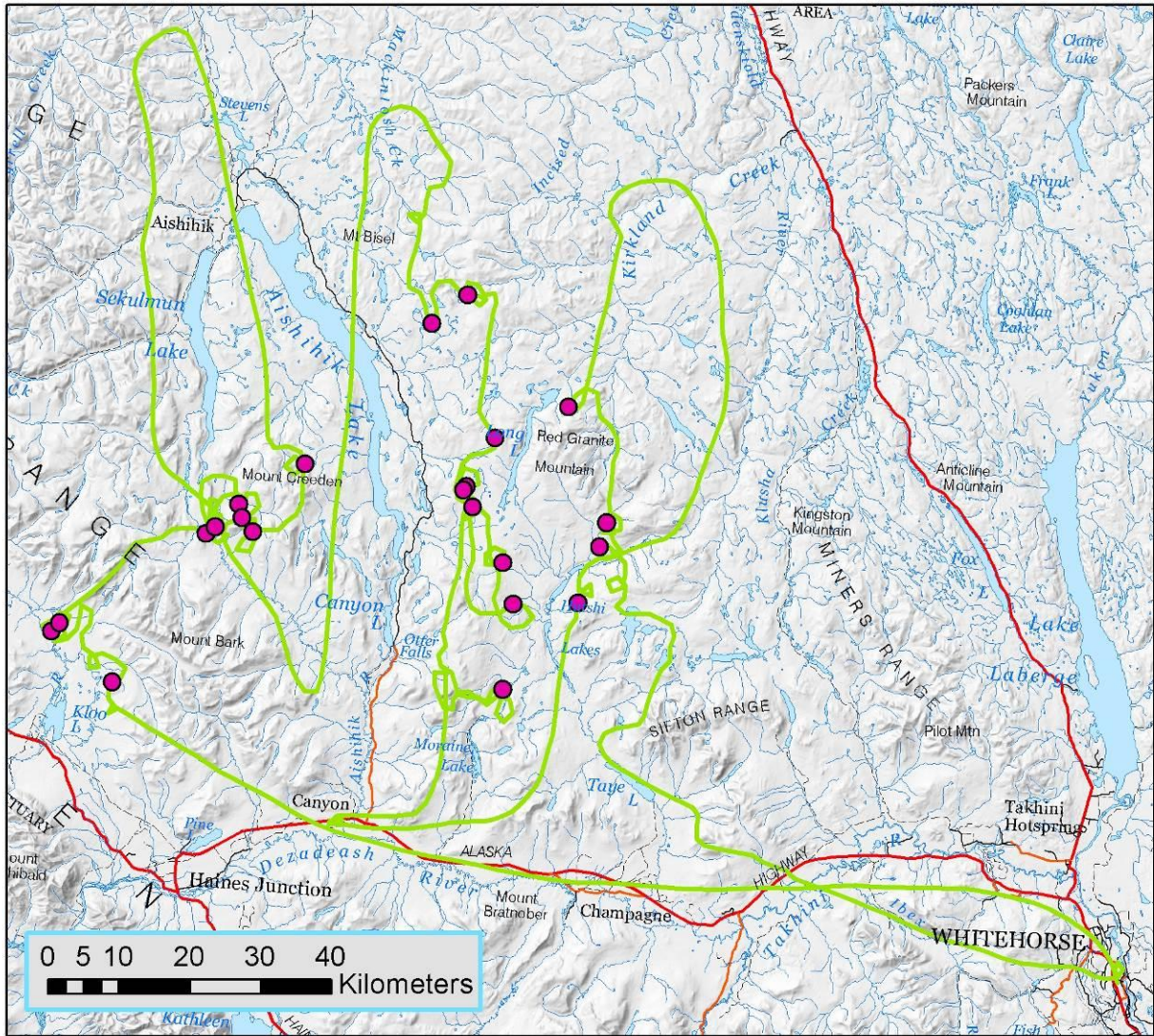


Figure 2 Bison telemetry flight flown on July 22nd, 2011. Pink circles are locations where radio-collared bison were found. Green line is the flight line flown.

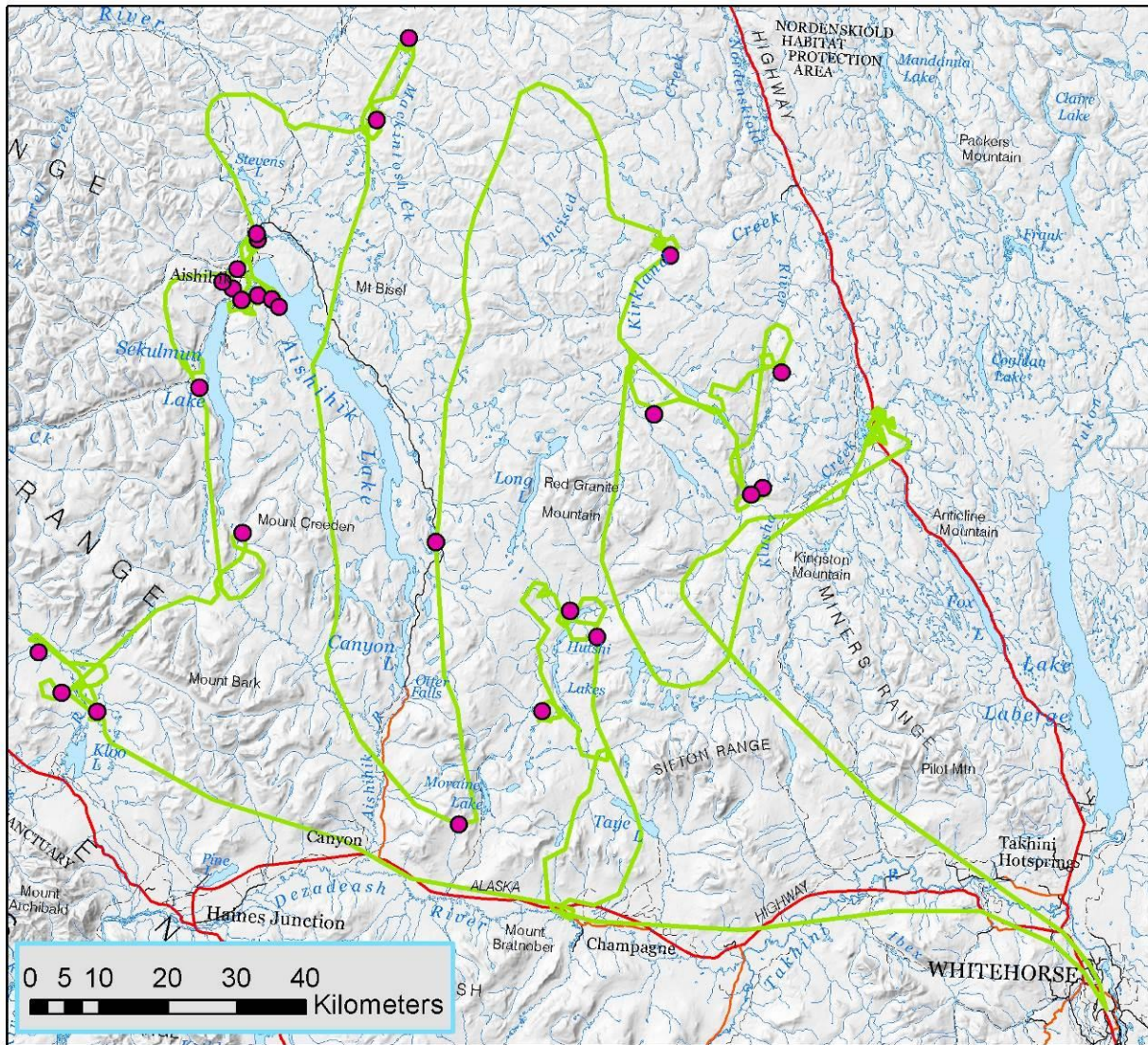


Figure 3 Bison telemetry flight flow on September 25th, 2011. Pink circles are locations where radio-collared bison were found. Green line is the flight line flow.

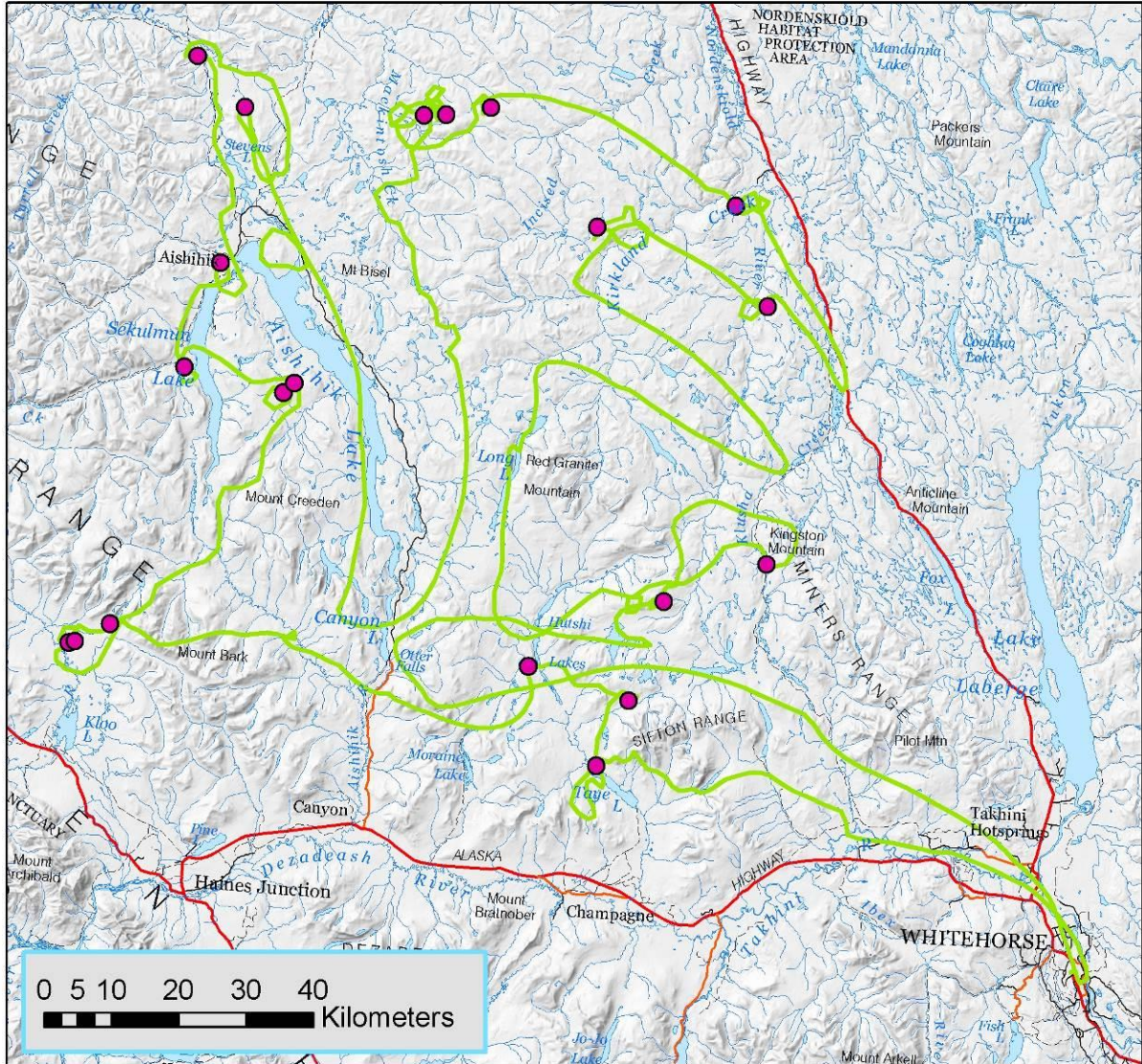


Figure 4 Bison telemetry flight flow on February 13th, 2012. Pink circles are locations where radio-collared bison were located. Green line is the flight line flow.

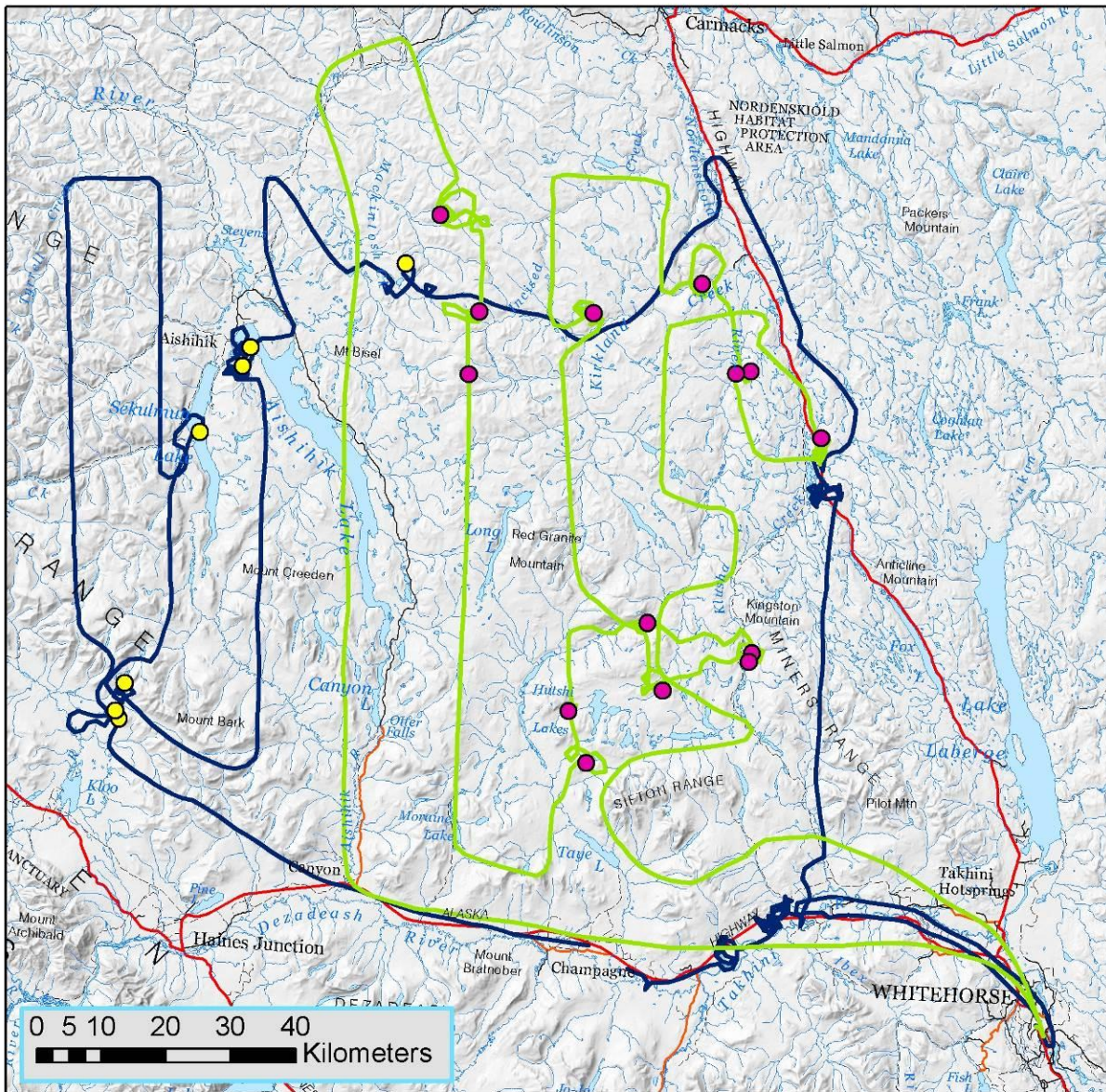


Figure 5 Bison telemetry flight flown on March 19-20, 2012. Pink circles are where radio-collared bison were located on March 19 and the green line is the flight line flown on that day. Yellow circles are where radio-collared bison were located on March 20 and the blue line is the flight line flown on that day.

Live Capture and Radio-Collaring

Radio-collared bison facilitate population surveys (e.g. composition counts and censuses) and they provide important information on the distribution and habitat use of the

population. A small number of bison are live-captured and radio-collared each year, in order to maintain working radio-collars on bison (Government of Yukon 2012). During 2011-2012, our goal for the collaring project was to begin removing GPS collars from bison and replace them

with VHF collars. The GPS collars (model 3300L; Lotek Wireless, Newmarket, Ontario) were used to collect precise locations of bison several times a day, in order to examine habitat use patterns, movements, and population distribution. This part of the project was scheduled to be completed by March 31st, 2013, however we began removing GPS collars in 2012. GPS-collared bison were instead outfitted with VHF collars (model LMRT-4; Lotek Wireless, Newmarket, Ontario). VHF collars do not provide the detailed location data of GPS collars. Relocating VHF-collared bison requires an aerial survey (see Radio-

Telemetry Flights). The advantage to VHF collars, however, is that they are much more reliable than GPS collars and their batteries last up to 7 years, compared to 2 years for a GPS collar. In 2011-2012, the objective of the radio-collaring aspect of our monitoring program shifted from providing data for habitat use and movement analyses to collecting data on bison survival and general spatial distribution. VHF collars are well suited to collecting data on survival and spatial distribution and are more cost effective because they require less frequent live-capture events due to their reliability and battery longevity.



Figure 6 An immobilized bison wearing a radio-collar with yellow fire hose to improve visibility and a yellow livestock ear tag to aid in identification of individuals.

Bison were captured using chemical immobilization—using a dart fired from a helicopter—during 2 capture sessions: September 29th, 2011 and March 20-23, 2012. A medetomidine-telazol-ketamine combination was used to immobilize bison. The effects of this immobilizer were later reversed by administering a dose of tolazollne and atipamazole. A Bell Jet Ranger (206B) helicopter was used for the September capture session, while a Eurocopter A-Star BA helicopter was used in the March capture session. Captured bison were supplied with supplementary oxygen (~4 litres/min) and fitted with a VHF collar. To make the collars more visible to hunters, a bright yellow sleeve of fire hose was fitted over the collar (Figure 6). To make this year's collars unique when viewing them from the air, a triangular shaped orange piece of durable, UV and cold-resistant vinyl was riveted onto the yellow sleeve. This helps to reduce the possibility of recapturing a recently collared bison. To facilitate identification, immobilized bison were given an individually numbered, plastic livestock ear tag (Allflex Canada, St-Hyacinthe, Quebec) in one ear and an individually numbered aluminum ear tag (Kurl-lock #3, Ketchum, Brockville, Ontario) in the other ear. Cow bison were checked for pregnancy status via palpation. Select biological samples were collected (e.g. blood, feces, and a DNA sample).

A total of 15 bison—13 adult females and 2 adult males—were captured, or recaptured, in 2011-2012 during two separate capture sessions. In September 2011, we recaptured a single bull, retrieved his faulty GPS collar, and outfitted him with a new

VHF collar. In addition, a GPS collar that fell off of another adult male bison was located on the ground and retrieved.

We captured 14 adult bison (13 females, 1 male) during the March 20-23, 2012 capture session. VHF collars were put on the 13 females; however, the male had a wound on his neck (unrelated to the collar), so we retrieved his GPS collar but did not put another collar on him. Ten (10) of the females had been captured in previous years and were recaptured and supplied with new collars; the remaining 3 females were captured and collared for the first time. Ten of the captured female bison were pregnant, while one female bison was not pregnant and the reproductive status of the remaining 2 female bison could not be determined.

As of March 31st, 2012, there were 30 collared bison in the Aishihik population, 9 with GPS collars and 21 with VHF collars.

Population Monitoring

Two focused population monitoring initiatives took place in 2011–2012: a composition count and a population census. In addition, radio-telemetry flights provided data on the survival of radio-collared bison.

On May 18th, 2011, a composition count was completed. The aim was to determine the number of calves that survived to yearling stage. The composition count was done as an aerial survey, flown in a Bell L4 Long-ranger helicopter. Bison groups were located and the age-sex composition was determined, using the following age-sex categories: calves, mature bulls and unclassified adults.

Unfortunately, it is difficult to classify adults by sex from a moving helicopter; it is, however, possible to identify the mature bulls.

Classification counts are normally done in July. In 2011-2012, we experimented with doing them sooner to see if we could get a better measure of calf recruitment after winter. Doing so proved challenging, and after classifying 4 groups of bison, the flight was aborted because it was deemed not possible to distinguish calves born in the past year. Since many new calves had been born in early May, the bond between the mother and last year's calf was no longer visible. A total of 74 bison were counted of which 17 (23%) were newborn calves.

Between July 18-25, 2011, we conducted a census of the population. Detailed methods and results of the census are reported separately by Jung and Egli (2012). From this census, we obtained data on population size, as well as group size and composition. Based on 3 independent composition counts, involving hundreds of animals each, the calf composition was 19.9% (Figure 7); see Jung and Egli (2012) for further details.

Survival data obtained during radio-telemetry flights are recorded in a database, and may be analyzed at a later date.

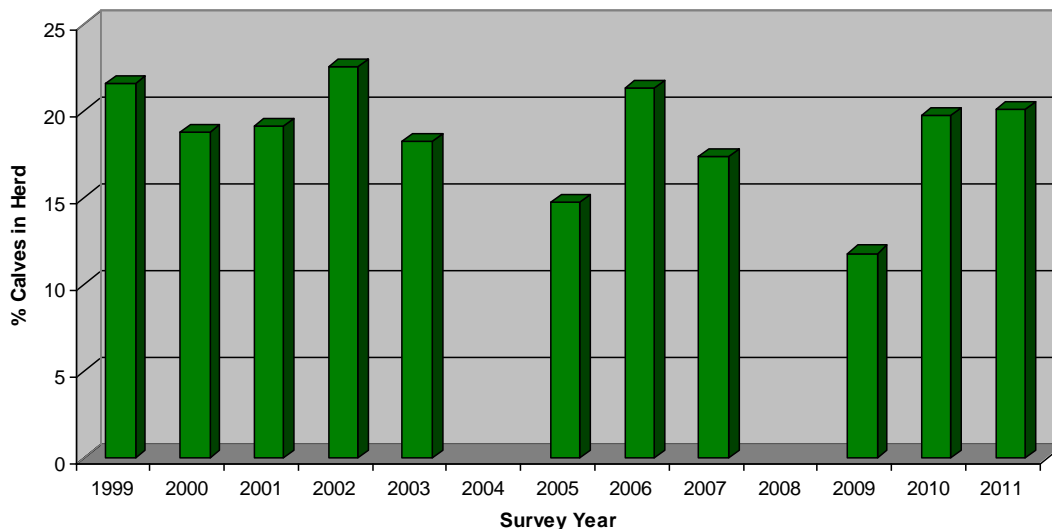


Figure 7 Percent of bison calves observed during July composition counts in southwestern Yukon, 1999-2011. There is no data for 2004 and 2008.

Biological Sample Collection

We collected biological samples from two sources: hunter submitted incisor bars, and samples collected during live-capture of individuals for the

purposes of radio-collaring (see Live Capture and Radio-Collaring).

From the hunter-submitted incisor bars we obtained an incisiform tooth, and a small piece of tissue (meat). Teeth were sectioned at the root and the animal's age was determined via cementum analysis. The tissue

provides a DNA sample that can be contributed to larger-scale studies (e.g., national) of bison genetics.

During live-capture and radio-collaring operations we collected blood, DNA, and feces from captured bison. These samples provide a basis of assessing the health status of the population, and are intended to be archived until larger-scale (e.g. national) studies seeking samples from the population are in place.

In October 2011, with help from the Yukon government’s Animal Health Unit, we performed a detailed necropsy on a bison carcass at the Yukon Wildlife Preserve. We conducted the necropsy to assess the difficulty of locating key samples required for disease testing.

Studies on the Ecological Impacts of Bison

Scat samples have been collected from all ungulate species that live in the Aishihik area: bison, moose, caribou, sheep, elk, deer, and horse samples collected in 2008–2010. We received

results from analysis of scat contents —completed by a commercial lab at the University of Washington— in early 2012. Analyses were completed during summer 2013. Results of these analyses were presented in Jung and Czetwertynski (2013).

Research on the impact of reintroduced bison on relict boreal grasslands began in the Aishihik area in summer 2011. Staff from Environment Yukon, Environment Canada, and a graduate student from the University of Alberta measured vegetation at 26 sites, of which 14 had been measured in 1981 (Vetter 2000), prior to the reintroduction of bison. In addition, Environment Canada installed two bison exclosures in October 2011, each measuring 12 m x 12 m. These are intended to exclude bison and over time it will be possible to measure changes in grasslands that are used by bison and those that are not. The current plan is to assess change in the exclosure and adjacent plots in 5 years (i.e., summer 2016).

Table 2 Summary of the number and percent of wood bison harvested in southwestern Yukon during the 2011–2012 season.

Month	Bull	Cow	Total
September 2011	0	0	0 (0%)
October 2011	2	1	3 (2%)
November 2011	9	11	20 (15%)
December 2011	4	1	5 (4%)
January 2012	1	0	1 (1%)
February 2012	8	12	20 (15%)
March 2012	40	43	83 (63%)
Totals	64 (48%)	68 (52%)	132 (100%)

Harvest Monitoring

A total of 670 bison hunting permits were sold for the 2011–2012 bison

hunting season. The harvest for the 2011–2012 hunting season was 132 bison, 65 bulls (49%) and 67 (51%) cows (Table 2). This is the second year

in the brief history of bison harvest in the Yukon that more females were harvested than males. This also occurred in 2001.

This year more bison were taken in March than any other year since bison harvest began. A record of 63% or 83 bison were harvested in the month of March. March is generally the preferred month for hunting bison due to the warm weather and the long daylight hours.

Bison were harvested from 21 different game management subzones (Figure 8). During the 2011–2012 season, bison were most frequently harvested in game management subzones 5-42 and 5-48. This year is the first time that a bison was harvested in subzone 7-15, in the Takhini River Valley, south of the Alaska Highway.

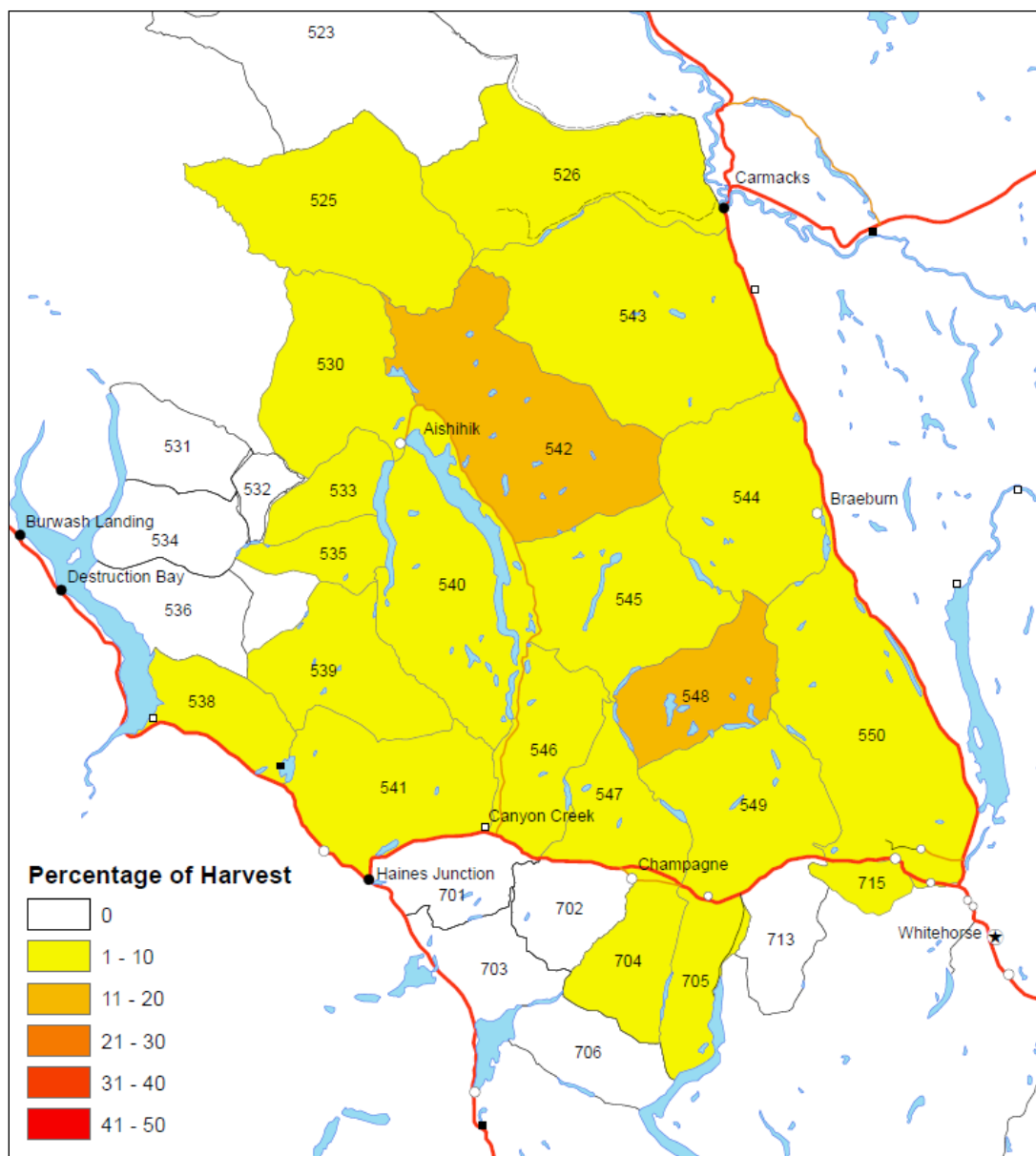


Figure 8 Distribution by game management subzone of bison harvest during the 2011–2012 bison hunting season.

OUTREACH AND DELIVERABLES

The Bison Banter, newsletter of the Yukon Wood Bison Technical Team, was posted on the Environment Yukon website and 500 hard copies were distributed to select agencies and organizations in November/December 2011. It can be found at:

http://www.env.gov.yk.ca/publications-maps/documents/bison_banter_11-12.pdf

A *Hunt Wisely* brochure for bison was reviewed and reproduced by the Conservation Officers Services Branch in preparation for the 2011–2012 bison hunting season, and a Hunter Education and Ethics Development (HEED) course on bison hunting was delivered on November 1st, 2011 in Whitehorse. The current version of the *Hunt Wisely* brochure can be found online at:

http://www.env.gov.yk.ca/publications-maps/documents/HuntWiselyBison_2014-15_web.pdf

A map showing areas of potential bison concentrations, based on aerial

telemetry surveys, was posted on the Environment Yukon website on February 15th, 2012. It was announced via a media release. The intent of the map was to provide a tool to hunters to better plan their bison hunt.

Media interviews were given with Yukon media outlets (e.g. CBC radio, CKRW radio, Yukon News, and Whitehorse Star) throughout the year on various bison topics, including: a review of the 2010-2011 harvest, the 2011 population census, the 2011-2012 'highway hunt', and the release of the February 2012 map of bison locations for hunters.

A public bison interpretation event was held in July 2011 at the Yukon Wildlife Preserve to increase public knowledge of bison. About 20 people attended.

There were no presentations on Yukon bison made at scientific conferences in 2011-2012; however, a minor paper was published on the first accounts of wolf (*Canis lupus*) predation and scavenging on Yukon bison (Jung 2011; Appendix 1).

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APPENDIX 1 2011 PEER-REVIEWED PUBLICATION

This is a pre-print version of a paper published in the scientific journal
Northwestern Naturalist.

The definitive version can be found online at:

<http://www.bioone.org/doi/abs/10.1898/10-07.1>

The citation is:

Jung, T.S. 2011. Gray wolf (*Canis lupus*) predation and scavenging on reintroduced American bison (*Bison bison*) in southwestern Yukon. *Northwestern Naturalist* 92(2): 126–130.

Gray Wolf (*CANIS LUPUS*) predation and scavenging of Reintroduced American
Bison (*BISON BISON*) in southwestern Yukon

THOMAS S JUNG

Key words: American Bison, *Bison bison*, *Canis lupus*, ecological restoration, Gray Wolf, predation, reintroduction, scavenging, Yukon

With some particularly large bulls weighing ≥ 1000 kg, American Bison (*Bison bison*, hereafter Bison) are the largest land mammal in North America. Given the potential quantity of biomass a Bison represents, preying or scavenging on Bison is seemingly profitable. Their physical size, social organization, and temperament, however, make Bison formidable prey (Fuller 1953; Smith and others 2000). Gray Wolves (*Canis lupus*; hereafter Wolves) and Grizzly Bears (*Ursus arctos*; hereafter Bears) are the only known predators of Bison, and they most often focus on calves and other young animals (Carbyn

and Trottier 1988; Larter and others 1994; Smith and others 2000, 2001; MacNulty and others 2001; Varley and Gunther 2002; Wyman 2002).

In some areas, local Wolf packs are relatively adept at killing Bison (Carbyn and Trottier 1987, 1988; Larter and others 1994). This may be related, in part, to the length of time that Bison and Wolves have been sympatric, with Wolves longer accustomed to Bison on the landscape more readily viewing them as potential prey, and having sufficient time to learn how to hunt Bison, through trial and error. In Europe, for instance, Wolves are known to prey and scavenge on European Bison (*Bison bonasus*) in the Białowieża Forest, Poland, where both species have co-existed since the 1920s (Jedrzejewski and others 2002; Selva and others 2003). In North America, there are similar observations from long-established (>55 y) Bison populations in Wood Buffalo National Park and the Mackenzie Bison Sanctuary, Canada (Carbyn and Trottier 1987, 1988; Larter and others 2000), and Yellowstone National Park, USA (Smith and others 2000). However, there are no similar records from Bison populations that have been on the landscape for shorter periods of time (for example, <25 y).

After an absence of about 350 y, 170 Bison were reintroduced to southwestern Yukon, Canada, in 1988 as part of a national recovery program to reestablish viable populations on their native range. The area hosts a full complement of native ungulates and large carnivores, including Bison, Moose (*Alces americanus*), Caribou (*Rangifer tarandus*), Dall's Sheep (*Ovis dalli*), Mule Deer (*Odocoileus hemionus*), Grizzly Bear, Black Bear (*Ursus americanus*), and Wolves. Unregulated by natural predators, the Bison population grew rapidly and is currently estimated at 1150 animals, based on aerial survey data (TS Jung, unpubl. data). As well, following a period of low densities of Caribou and Moose and non-lethal Wolf control (for example, sterilization; Hayes and others 2003), local knowledge indicates that the Wolf population has been recently increasing, with some observed packs containing ≥ 18 Wolves (TS Jung, pers. obs.). In recent years, evidence of Wolverine (*Gulo gulo*) and Common Raven

(*Corvus corax*) scavenging Bison gut piles left by human hunters has been observed (TS Jung, pers. obs.). There has been no evidence, however, of Wolves preying or scavenging on Bison, despite the recent increase in both local Bison and Wolf populations. According to the prey density hypothesis, kill rates by Wolves should increase as prey densities increase (Vucetich and others 2002). Here, I report the 1st observations of Wolves killing and scavenging Bison reintroduced to the Yukon.

On 18 November 2007, a local First Nation hunter reported 3 Wolves following and harassing a small group of Bison on a frozen pond near the north end of Aishihik Lake, about 105 km NE of Haines Junction, Yukon (UTM: Zone 08V, 363212E, 6737829N, WGS84; Fig. 1). The Wolves were observed to be paying particular attention to a small yearling. On 19 November 2007, the site was investigated and a yearling Bison was found dead. No other Bison or Wolves were observed in the area. Tracks in the snow indicated that the Wolves had chased and harassed the Bison for about 250 m along the shoreline of the frozen pond, with blood and Bison fur found scattered among the Bison and Wolf tracks in the snow (S Oakley, Yukon Department of Environment, pers. comm.). It appeared from the tracks in the snow that the Bison had lain down at least 3 times before coming to rest at the kill site. At the time the remains were found, less than one-third of the viscera had been consumed. Given the proximity in time and location, and the abundant evidence near the remains, it is believed that the yearling Bison was killed by Wolves and that it was the same Bison and Wolves that the hunter observed the day before.

On 13 December 2007, wildlife enforcement officers found the carcass of a female Bison calf that appeared to have been killed by Wolves. The remains were found approximately 100 m from the shore of the Nordenskiöld River, about 90 km NW of Whitehorse, Yukon (UTM: Zone 08V, 497140E, 6731566N, WGS84; Fig. 1). Wildlife conservation officers were alerted to the area by Raven activity and found the remains of a Bison calf in a patch of wet meadow vegetated with tall willows (*Salix* spp.; D Bakica and L Bill, Yukon Department of Environment, pers. comm.). Wolf tracks, along with patches of blood and

Bison fur on the willows and snow within 150 m of the calf, indicated that the calf was killed by Wolves. No Wolves were seen in the area, but there were abundant Wolf tracks around the remains of the calf and bite marks were observed on the neck, back, flank, and hind legs. Only about 50% of the viscera and 5% of the body had been consumed and it was believed that the calf had been killed within the previous 24 h because it was not yet eaten by the Wolves. The calf was found about 700 m from where an adult cow Bison had been shot by human hunters. There was no evidence of feeding by Wolves on the remains of the adult. It is believed that the calf killed was that of the adult cow killed by a human hunter, and that the calf remained near the remains of the mother. Although this cannot be confirmed, studies suggest a strong mother-calf relationship in Bison (for example, Green 1992).

On 24 February 2009, an adult cow Bison was found dead by a local First Nation resident along the shore of Duck Lake, a small frozen lake 90 km NE of Haines Junction (Fig. 1). Again, the presence of Ravens drew attention to the carcass. The Bison had been fatally wounded by a human hunter a day earlier, but lost and reported to wildlife enforcement officers (R Obourne, Yukon Department of Environment, pers. comm.). On 28 February 2009, wildlife enforcement officers investigated the carcass and no feeding by Wolves was observed. On the evening of 1 March 2009, it appeared that Wolves had found and begun to feed on the carcass. The next day, 7 Wolves were observed feeding on the Bison (R Obourne, Yukon Department of Environment, pers. comm.). Wolves were heard howling nearby for the next 3 nights by a school group camping about 350 m away from the carcass. Sporadic observations over the next 7 days suggested that the Wolves fed on and stayed near the carcass. By 5 March 2009, about 60% of the carcass had been consumed, and by 9 March 2010, the Bison was completely consumed; only the rumen remained and the Wolves had left the area.

While no Wolves were directly observed preying on Bison, the evidence is compelling that the yearling and calf had been killed by Wolves and the adult was scavenged. Thus, these are the 1st observations of Wolves preying and

scavenging on reintroduced Bison in southwestern Yukon. It is possible that some Wolf predation and scavenging had occurred before these observations, but if so it likely was rare. For example, since 1998 there have been 55 Bison monitored with radio-collars and none were observed killed or scavenged by Wolves or Bears (TS Jung, unpubl. data). In addition, >200 estimated days of aerial surveys to monitor or capture wildlife had been flown in the area since the reintroduction of Bison. None of these surveys yielded observations of Bison killed or scavenged by Wolves or Bears, although there were occasional observations of Moose and Caribou killed or scavenged (Yukon Department of Environment, unpubl. data). Finally, numerous area residents, outdoor recreationalists (including Bison hunters), and wildlife conservation officers traveling through the area (likely >2000 estimated person-days each year) also had not reported any observations of predation or scavenging of Bison. Thus, there had been reasonable opportunity for such observations, yet none had been reported.

The fact that the 2 Bison preyed upon by Wolves were young animals is consistent with most other observations (for example, Carbyn and Trottier 1988; Smith and others 2000). Clearly, calves and yearlings are safer and easier to kill than adults because they are smaller, and presumably less dangerous and less experienced with predators, than adults.

Given the distances involved (Fig. 1), it is likely that the Wolves involved in the observations made on 18 November 2007 and 24 February 2009, involved the same Wolf pack. The Wolves involved in the observation made on 13 December 2007, however, were most likely from a different pack. Subsequently, on 30 March 2010, I and others observed where possibly yet a different pack from the previous observations had appeared to attack an adult female Bison (based on tracks and blood in the snow), but left the area leaving the individual wounded but alive (TS Jung, pers. obs.; Fig. 1). Similarly, on 3 April 2010, 5 Wolves from presumably the same pack as the observations made on 18 November 2007 and 28 February 2009 were viewed from a helicopter closely following and apparently hunting a group of 4 Bison (K Egli, Yukon

Department of Environment, pers. comm.; Fig. 1). Thus, at least 2 or 3 different packs of Wolves appear to be hunting reintroduced Bison in southwestern Yukon.

Whether Wolf predation and scavenging of Bison is a functional response to increased Bison density, possible increases in Wolf densities, or changes in the ratio of predator and prey (*sensu* Vucetich and others 2002), is unknown. Alternatively, predator or prey densities may have little to do with the onset of Wolf predation of Bison. Perhaps after 20 y of being sympatric with Bison, Wolves have had sufficient time to recognize Bison as potential prey and learn how to hunt them. This may be a density-independent process. Moreover, since 1998, human hunters have harvested close to 1000 Bison (Yukon Department of Environment, unpubl. data). The role that human hunting may have had in facilitating Wolf predation and scavenging on Bison, vis-à-vis provisioning of Bison gut piles and wounded animals that are either weakened or die later, is an important consideration. In particular, wounded Bison that die later may provide substantial quantities of food to Wolves prepared to scavenge carcasses. Forbes and Theberge (1992) provide data that suggests that scavenging by Wolves occurs more frequently than is recognized.

Regardless of the mechanism or trigger, Wolf predation on Bison may have substantial implications for the population dynamics of both species, as well as alternate prey species such as Moose and Caribou. For example, Wolves may respond numerically as a result of increasing Bison populations (Joly and Messier 2000). If kill rates increase, Wolves may limit Bison population growth rates (*sensu* Gasaway and others 1992; Messier 1994). Increased vigilance and the alteration of movement patterns, habitat use, and other behaviors, may manifest as Bison learn to fear Wolves (Laundré and others 2001). In addition, Wolf predation of Bison may facilitate increased Wolf densities and subsequent declines of alternate prey such as Moose (Larter and others 1994) and Caribou.

While the apparent onset of Wolf predation and scavenging of reintroduced Bison may, in time, have substantial impact on the population dynamics of Wolves, Bison, and other local ungulate populations, predation

and scavenging are important ecological processes. The goal of reintroducing Bison to their native range should have ecological restoration as the ultimate goal, not simply numerical recovery (Sanderson and others 2008; Jung and others 2010). Predation and scavenging of Bison is an indication that this reintroduced population is fulfilling some of the ecological functions that Bison likely once did prior to local extirpation.

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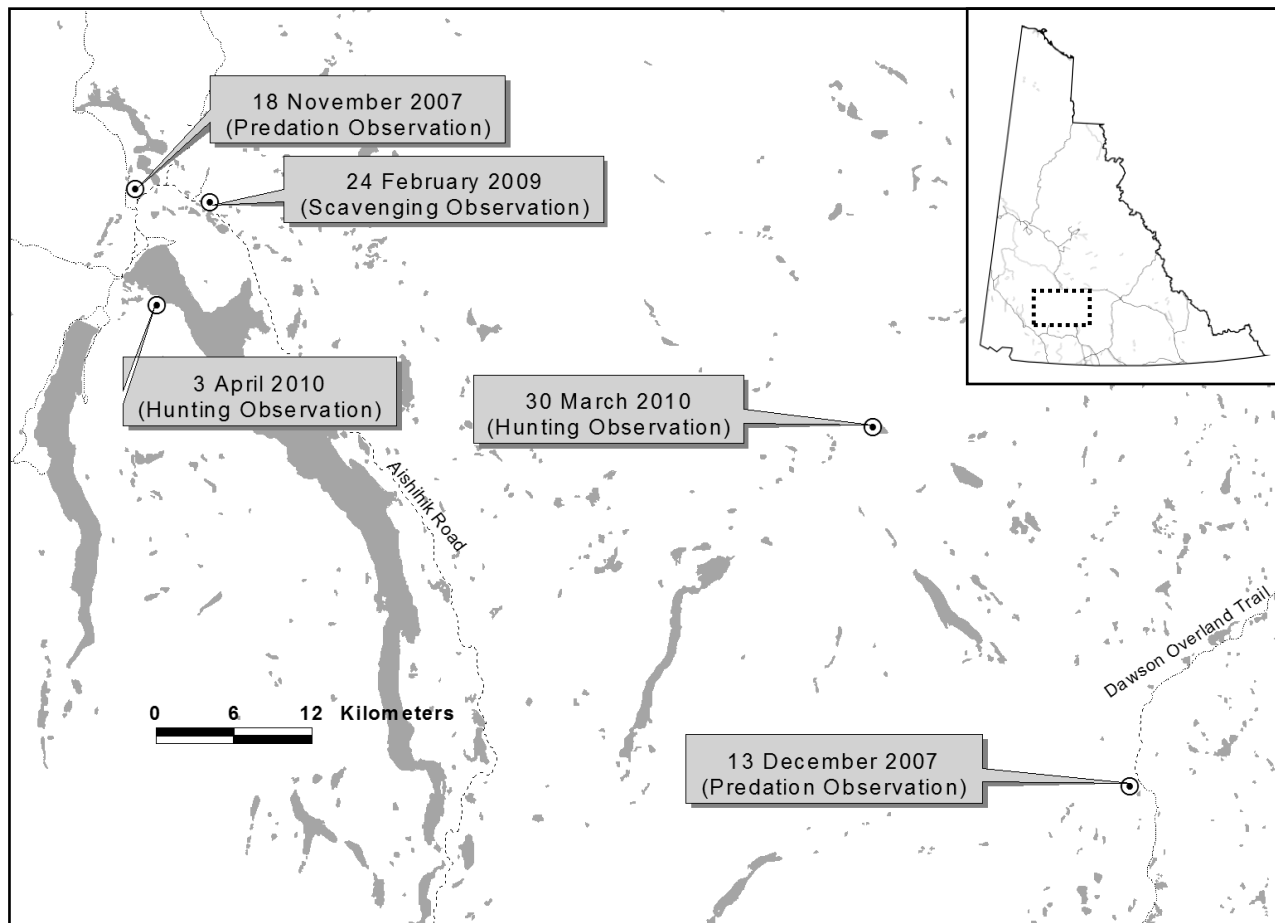


Figure 1. Location and date of Wolf (*Canis lupus*) – Bison (*Bison bison*) interactions noted in the text. Dashed box within the inset map shows the approximate location of these observations within the Yukon Territory.