Yukon

SR-25-07

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July 2025

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Fish and Wildlife Branch
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Acknowledgements

We are indebted to those that kindly and aptly participated in the survey and helped us achieve our project goals; specifically, Russel Oborne, TJ Grantham, Robert Perry, Alexandra Heathcote (Government of Yukon), Annika Joe (Champagne and Aishihik First Nations), Sian Williams (Dän Keyi Renewable Resources Council), Mark Nassiopoulos (Alsek Renewable Resources), and pilots Matt O'Brian (Discovery Helicopters), Bimal Sapkota and Damon Juss (Capital Helicopters). Funding was provided by the Government of Yukon. We thank Robert Perry for editorial comments that improved this report.

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Suggested citation:

Jung TS, Drummond R, Taylor SD, and Miller HA. 2025. Results of the 2025 mark-resight survey of the Aishihik bison (*Bison bison*) population. Yukon Fish and Wildlife Branch Report SR-25-07.

Executive summary

- We report the results of the 2025 survey of the Aishihik bison population. This survey builds upon those conducted in a similar fashion in previous years. Results are intended to provide information on the current size of the population.
- During 4–10 July 2025, we conducted a mark-resight survey to estimate the size and trend of the population. We used the locations from 32 GPS-collared bison to determine our survey area. We then marked 109 bison with paintballs and subsequently conducted three independent resighting surveys.
- The 2025 estimated population size is 1,906 (95% confidence intervals [CI] = 1,588–2,339). This is very similar to the 2022 estimated population size of 1,951 (95% CI = 1,688–2,295) and amounts to an estimated 2% decrease in population size in the past three years.
- A key result from our survey is that the population has remained relatively stable since the last survey in 2022.
- Of note, our resighting rates of marked animals and our total counts during the surveys were low, and our confidence intervals higher, than previous similar surveys, indicating that our estimate may not be as accurate compared to previous years. Nevertheless, our sense from the field and earlier data is that our estimate is reasonable.
- Also of note, there is evidence from an unusually high population growth rates calculated in 2022 that the survey then may be an overestimate. If so, then the estimate from our 2025 survey may represent slight growth in the population. Whether the population is currently stable or slightly growing is currently unknown, but both possibilities are plausible.
- Total cost was approximately $67,000, exclusive of staff time.
- Three next steps are recommended: First, it would be prudent to conduct another mark-resight survey in 2028 to clarify the population trend. Second, the next mark-resight survey should be revised to provide greater coverage of the study area and higher resighting rates of marked animals. Third, we recommend using all available information on the population ecology of the herd to develop an integrated population model.

Contents

Introduction

From 1998 to 2006, bison (*Bison bison*) in southwestern Yukon were surveyed annually, using the "total count" method, where all bison found during an aerial survey were tallied. This method was used elsewhere to survey bison (Fuller 1950, Wolfe and Kimball 1989) and was practical in the Yukon when the herd was small and occupied a small range. In later years, however, total counts became difficult because the herd grew and began to use habitats where they were increasingly challenging to locate and count, such as in the forest. For bison in the Yukon, total counts failed to provide reliable information that was statistically robust and defensible; rather, they are better considered as a "minimum number known alive" (Jung et al. 2020, 2023).

Because the Aishihik Bison Herd was relatively small, legally listed as a species at risk and harvested at high rates (by design), it was crucial to closely track the size of the population (Government of Yukon 2012). Unfortunately, unlike moose (*Alces americanus*) or caribou (*Rangifer tarandus*), there is little information on methods used to count bison. Biologists in the Northwest Territories use strip transects (Bradley and Wilmshurt 2005, Larter et al. 2007) or quadrats (Larter et al. 2000) to count bison from aerial surveys, but those methods are not suitable for use in the mountainous environment bison inhabit in the Yukon.

In July 2007, we used a sample of radio-collared bison to test the use of mark-resight methods to survey the herd (Jung and Egli 2012). Mark-resight techniques simply rely on the ability to resight a marked sample of the population and allow for the estimation of population size based on the number of marked and unmarked animals seen. Statistical models are used to estimate the population size and associated confidence intervals. This technique was 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 the results may be more accessible to non-scientists.

We found that a mark-resight framework to counting bison could provide a robust and reliable estimate of the population's size 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). Application of the method inspired enough confidence in the Yukon Bison Technical Team to recommend that the population could be surveyed periodically using mark-resight methods, rather than annually by total counts.

Here, we report the results of the 2025 survey of the Aishihik bison population. This survey builds upon those conducted in a similar fashion in 2007, 2009, 2011, 2014, 2016 and 2022 (Hegel et al. 2012; Jung and Egli 2012, 2014, Jung et al. 2023). Results from the survey are intended to inform bison managers and the public on the current size of the population.

Methods

Between 4–10 July 2025, we conducted a mark-resight survey to estimate the population size and trend of the Aishihik Bison Herd. We used the locations from 32 GPS-collared bison on 3 July 2025 to ensure that our survey area aligned with the distribution of the population (**Fig. 1**).

We marked a segment of the population using a paintball gun fired from a helicopter. Paintballing is a useful way to temporarily mark animals because a large percentage of the population can be marked in a short amount of time, presumably 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 4 July 2025, we used an A-Star helicopter to locate and paintball bison from the air, using a Tippman A-5 paintball gun and blue-coloured oil-based paintballs (**Fig. 2**). We chose blue paintballs because we had conducted previous trials with captive bison at the Yukon Wildlife Preserve to determine what colours were the most visible. Additionally, we determined in our trial that blue paintballs would remain visible for up to two weeks in the summer if they were marked on the upper rear end area. When bison wallow they do not roll over completely, so the paintball marks located behind the hump are somewhat protected from being covered with dirt. We aimed to mark each individual bison with 6 to 12 paintballs to facilitate resighting. We aimed to mark at least 10% of the bison in each group.

Figure 1. Photograph of a “marked” bison.

Three independent resighting surveys were completed on 6, 7 and 10 July 2025, by a crew of three observers and a pilot in a helicopter. Each resighting crew had different members, thereby ensuring surveys were done independently. Each crew had at least one experienced member who was familiar with the local area and where to look for bison during the survey period. Crews were instructed to search areas where bison were believed to be seasonally congregated based on information (local knowledge, aerial surveys, GPS-collar data) gathered from other years during July months. To meet assumptions of our model, resighting crews did not use radio-telemetry or recent satellite collar locations to find bison.

When bison were located, crews recorded the number of marked and unmarked animals in each group as well as their geographic location using a GPS. To obtain data on the composition of the population, one crew recorded the number of adults (>1 year old), dominant bulls (~8 years or older) and calves (<1 year old) seen in each group.

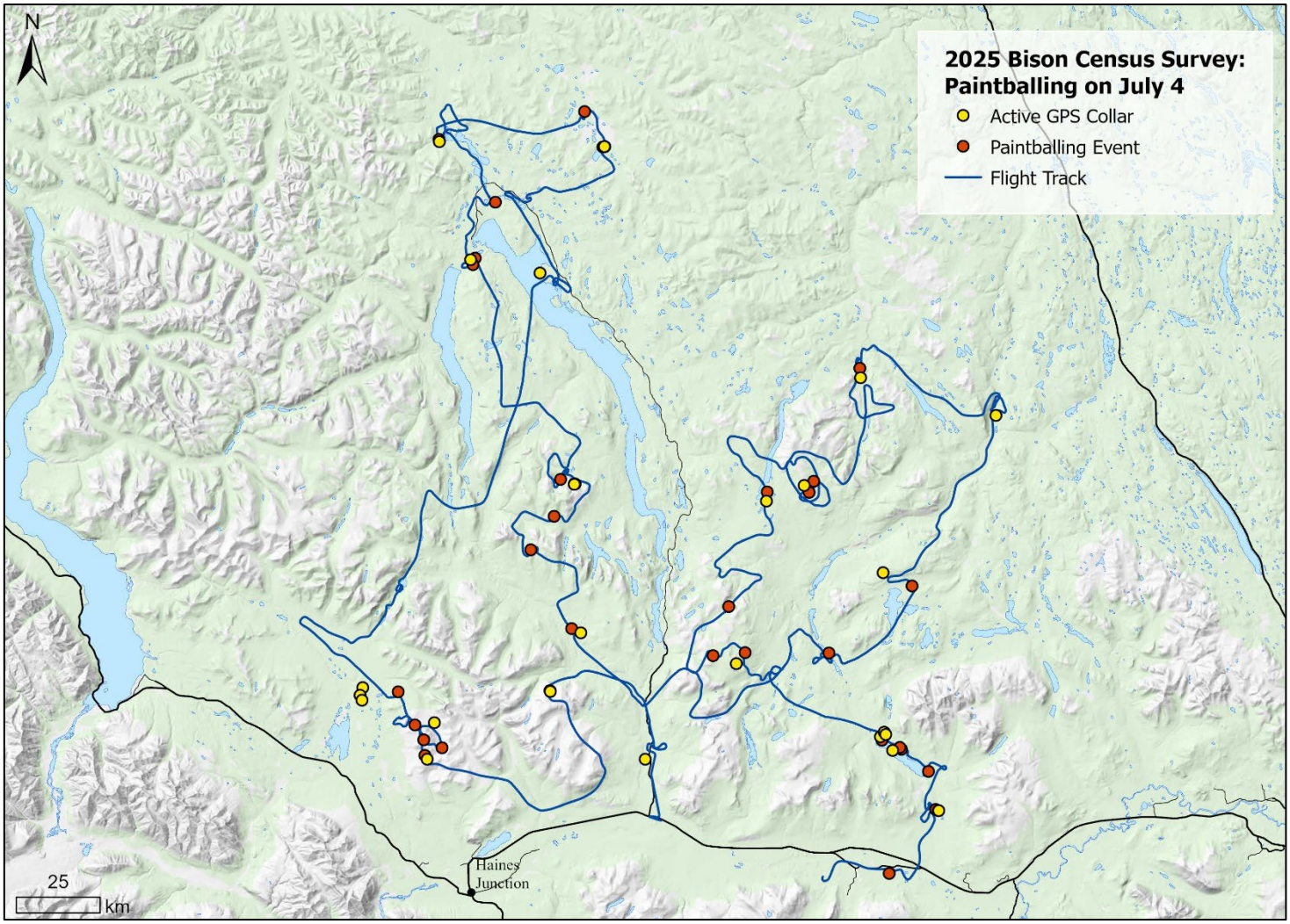

Figure 2. Locations of 32 GPS-collared bison yellow dots) and marking (paintballing) events (red dots; *n* = 109) on 4 July 2025. The blue line is the path flown during the marking flight.

A mark-resight population estimate was modeled using the Joint Hypergeometric Maximum Likelihood Estimator algorithm for closed populations. Similar to previous surveys (Jung and Egli 2011, 2014, Jung et al. 2023), we used NOREMARK software (White 1996) to model the data and compute population estimates with 95% confidence intervals (CI). 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. For comparative purposes, NOREMARK was used to derive survey-specific population estimates and 95% CI were calculated using the Lincoln-Peterson Estimator algorithm.

Results and Discussion

On 4 July 2025, 7.4 hours of helicopter time was spent marking 109 bison from 31 observed groups (**Fig. 1 and 2**). This took more time than in previous surveys (Jung and Egli 2012, 2014, Jung et al. 2023), because bison were more broadly distributed across their range than in other years. Specifically, a considerable number of bison were found in the northern part of their range, which is unusual for mid-summer. Moreover, GPS-collared bison were found at low elevations, specifically in the Nordenskiold River drainage and in the vicinity of Aishihik Village. Regardless, the 32 GPS-collared bison greatly facilitated knowing where to find bison to mark and to delineate the area for resighting surveys, similar to previous years, highlighting the value of collared animals for employing the mark-resight methodology.

Three resighting surveys were conducted with an independent survey done on each of 6, 7, and 10 July 2025, which were within 2 to 6 days since the bison were marked (**Table 1; Fig. 3-5**). Cumulatively, the resighting surveys used 23.2 hrs of helicopter time and covered 3,600 km of survey routes (**Table 1; Fig. 3-5**).

Weather conditions for the resighting surveys were generally good; however, localized rain and thunderstorms resulted in crews having difficulties accessing some areas. Moreover, survey crews experienced challenges locating and counting bison this year for several reasons, including: First, many groups were found in low-elevation, forested environments (**Fig. 1-4**). When bison feel threatened, they seek safety in the trees where they can be exceedingly difficult to locate and count, even from a helicopter. This is evident by the relatively low number of marked bison seen on each resighting flight (18–26 of 109 marked bison; **Table 1**). Additionally, the flight tracks clearly show that we flew quite close to the location of some GPS collared bison, but surveyors did not see them (**Fig. 2-4**). Second, the week of the surveys was particularly rainy, and the persistent rain made it challenging to ensure that observed bison were marked or not, as the paint appeared to fade quite a bit by the third resighting flight. Third, bison were distributed widely across a large study area, and this is different than during similar surveys prior to 2022 (e.g., Jung and Egli 2012, 2014). Some bison do not appear to be migrating and forming distinct post-calving aggregations as they once did. The result is that they were spread across a large survey area and the time available to spend in any one area searching for them was limited.

Table 1. Summary of results from three resighting surveys for bison in southwestern Yukon, summer 2025. 109 bison were marked and they were available to be observed in each survey.

Survey date	Survey effort	Number of bison groups seen	Total number of adult bison seen	Number of marked adult bison seen	Lincoln-Peterson Population Estimate (Adults + 95% CI)	Number of calves seen	Number of calves per 100 adults
6 July	8.3 hrs 1,144 km	27	484	28	1,945 (1,365–2,525)	90	18.6
7 July	7.8 hrs 1,280 km	28	418	28	1,695 (1,191–2,198)	87	20.8
10 July	7.1 hrs 1,176 km	24	319	18	1,956 (1,198–2,714)	64	20.1

The total number of adult animals observed on each independent survey varied from 319 to 484, with the number of marked animals also varying, accordingly (Table 1). Between 64 and 90 calves were seen. The number of groups observed during each survey ranged from 24 and 28 bison. The largest group seen was 62 animals, although most groups were small, as seen in previous years (Jung 2020). The number of groups and the total number of animals seen was lower than in previous mark-resight or MNKA (minimum number known alive) surveys, reflecting our difficulty in locating and counting bison during this survey.

Estimated population sizes from each individual survey varied from 1,695 to 1,956, using the Lincoln-Peterson algorithm (Table 1). This reflects differences in proportion of marked and total adult bison seen and is similar to previous surveys for this population (Hegel et al. 2012, Jung and Egli 2012, 2014, Jung et al. 2023). We conduct multiple resighting surveys so we can model the variation in several independent surveys and provide a more accurate population estimate with improved (smaller) confidence intervals.

When considering the data from all three independent surveys, the minimum number known alive (MNKA) was 593 adult bison. This is lower than the MNKA for most previous surveys (Jung et al. 2020, 2023, Miller et al. 2024), which is indicative of the percent of bison that were at low elevations in the forest and difficult to find.

Based on our model, the estimated size of the population for the herd in 2025 was 1,906 adult bison, with 95% confidence intervals (CI) spanning 1,588 to 2,339. This is the key result from our survey.

The 2025 estimated population size (1,906; 95% CI = 1,588–2,339) is slightly less than the 2022 estimated population size (1,951; 95% CI = 1,688–2,295), using the same survey methodology. This represents an estimated decrease in 45 adult bison since 2022, which amounts to an estimated 2% decrease in population size over the past three years (**Fig. 6**). This relative stability in the population over the past three years is despite a substantial number of bison being harvested by hunters in the same interval; specifically, there was on average about 250 bison harvested in each of the past three hunting seasons. Of note is that the CI were slightly wider for the 2025 survey results than that for previous years (**Table 2**), raising a minor concern about the accuracy of our estimate.

Assuming equal growth among years in the 3-year interval between this survey and that in 2016, annual population growth (lambda) was 0.99. This lambda value represents a relatively stable population, with a lambda of 1.0 being perfectly stable. That said, the lambda calculated for this survey is the first to indicate a population that has not been growing each year (**Table 2**).

Population stability indicates that the number of births equals the number of deaths. Calf composition of the population has typically been ~20%, although it was lower (~15%) in the 2022 survey, and now again about 20% in 2025 (**Table 1**). However, calf survival to recruitment (i.e., 1 year old) is unknown, and typically low for other species of northern ungulates. Adult female survival and longevity appear to be good, based on data from GPS-collared animals and the age-at-harvest data (Jung 2021). Our survey, in combination with MNKA values achieved in previous years (Jung et al. 2020, 2022) provides evidence that the Aishihik bison population is so far resilient to a high percent of the population being harvested each year.

The estimate of 1,906 adult bison is in line with what we would have anticipated prior to the survey, based on average annual population growth rates observed since 2007. While the estimated population size we obtained in 2022 is plausible for a growing bison population, there was concern that it may be overestimated by our model (Jung et al. 2023). The increase in the annual population growth (lambda) we observed in the interval between the 2022 and the 2016 survey suggested that our 2022 estimate may be higher than the true population size was at that time. If we forecast from the estimated population size in 2016, using an average lambda of

1.043 (Table 2), the estimated population size in 2022 would have more likely been 1,701 animals, which was within the lower limit of our 95% confidence interval from that year's survey. In this light, our 2025 population estimate may indicate a slightly growing population if, indeed, the 2022 population estimate was too high as suggested earlier (Jung et al. 2023). Considering our initial population estimate of 899 adults in 2007 (Table 2) with 1,906 in 2025, we calculate a lambda of 1.041 over 18 years, providing some credence to the notion that the population estimate in 2022 may have been too high and that our 2025 population estimate is reasonable.

Table 2. Summary of results from periodic mark-resight surveys of the Aishihik bison population. All surveys used similar methods and the results do not include calves.

Survey year	Number of years since the last survey	Estimated population size	95% Confidence Intervals	Minimum number known alive	Estimated annual population growth (Lambda)
2007	--	899	891–1,128	726	--
2009	2	1,004	850–1,220	501	1.06
2011	2	1,053	749–1,266	585	1.02
2014	3	1,192	1,039–1,404	704	1.04
2016	2	1,325	1,157–1,552	734	1.05
2022	6	1,951	1,688–2,295	857	1.08
2025	3	1,906	1,588–2,339	593	0.99

At this time, it is unknown if the Aishihik population had been stable in the past three years or is growing slightly. Based on the concerns above about the 2022 survey, high calf production observed each year, high survival of collared adult females and projecting forward using the average rate of annual population growth (lambda), it may be the latter. Regardless, a repeated survey in the next few years will be necessary to continue to monitor the population size and track trends.

Total cost of the survey was approximately $67,000, exclusive of staff time.

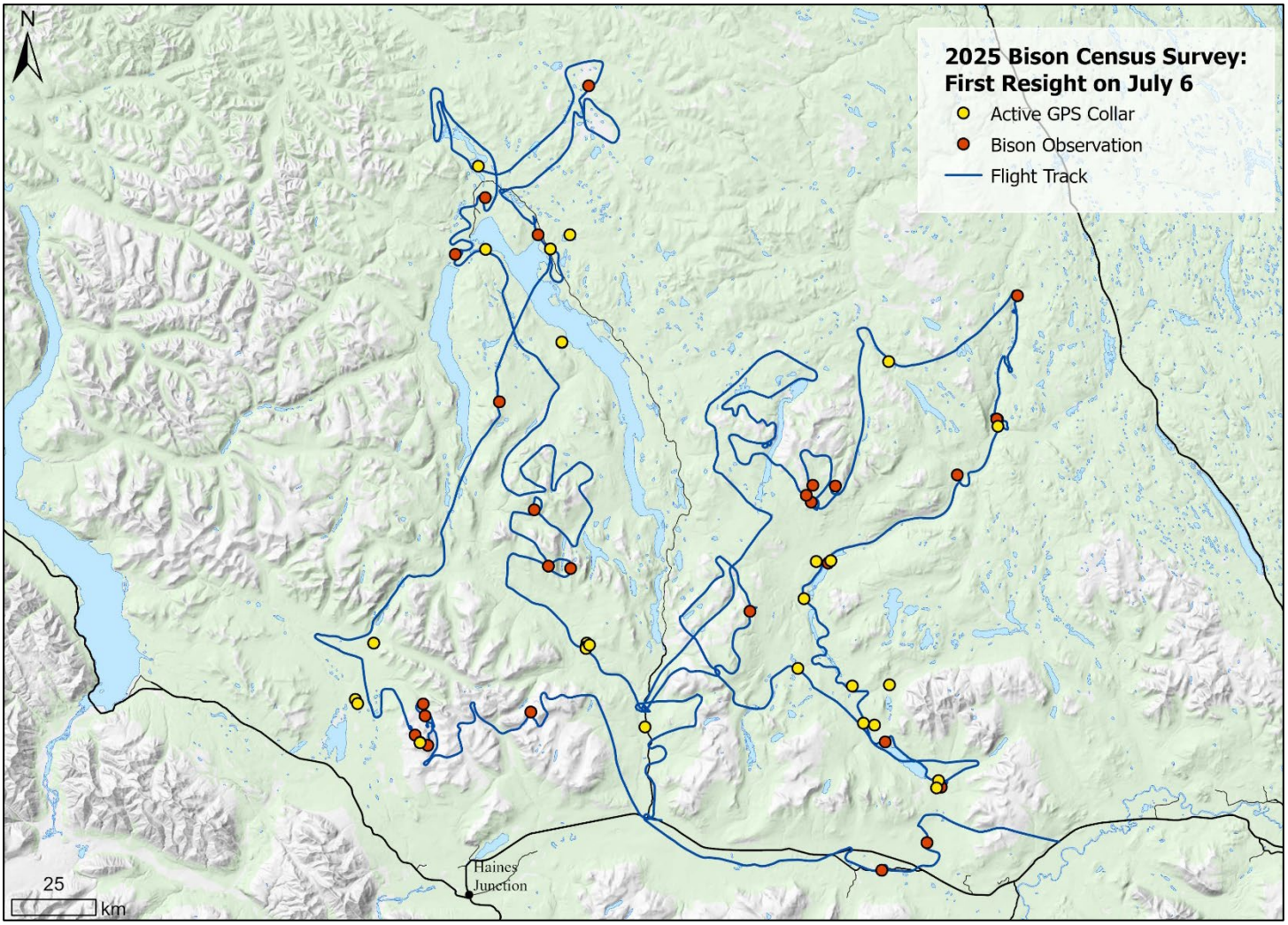

Figure 3. Locations of 32 GPS-collared bison (yellow dots) and bison observed (red dots) during the first resighting survey on 6 July 2025. The blue line is the path flown during the resighting flight

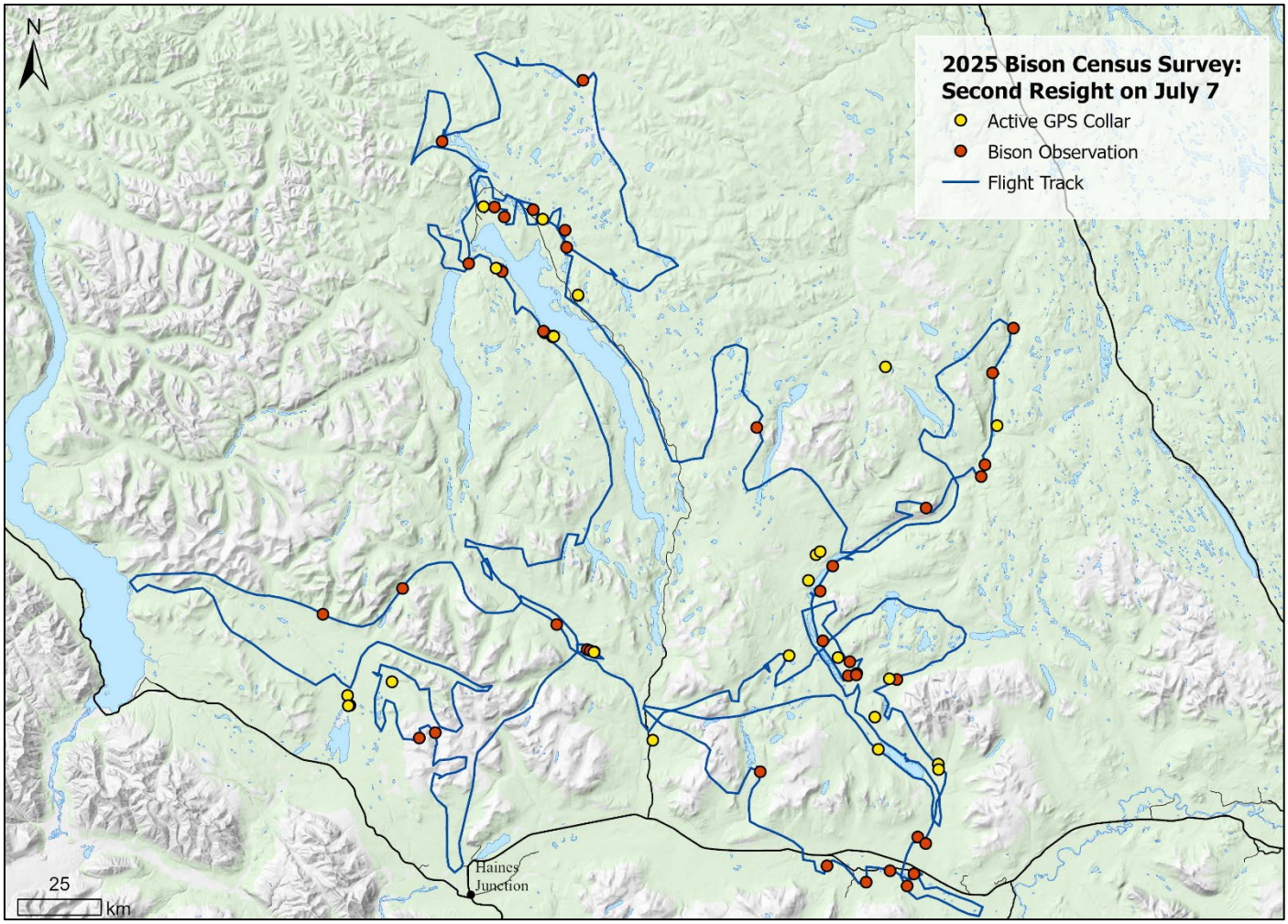

Figure 4. Locations of 32 GPS-collared bison (yellow dots) and bison observed (red dots) during the second resighting survey on 7 July 2025. The blue line is the path flown during the resighting flight.

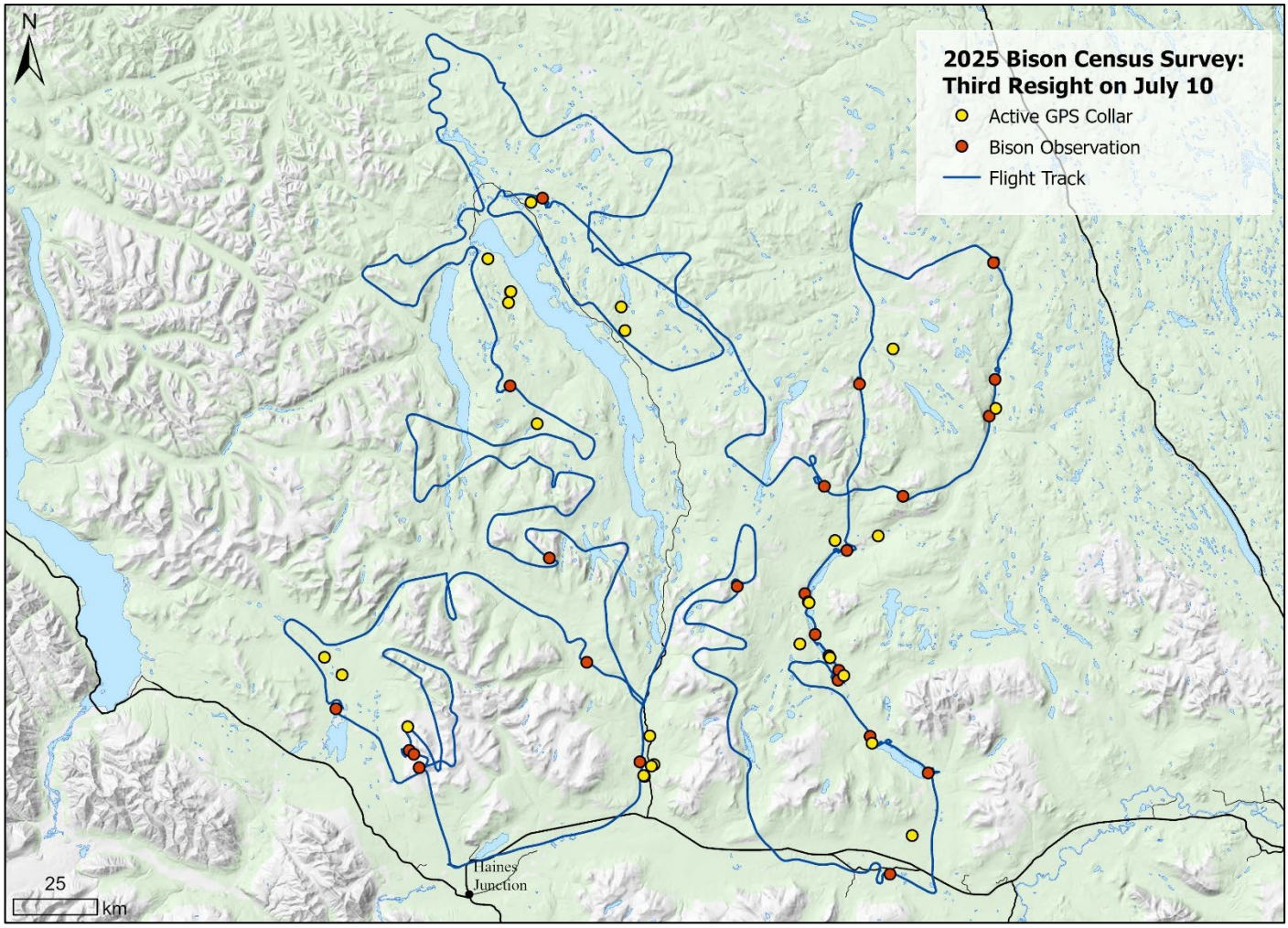

Figure 5. Locations of 32 GPS-collared bison (yellow dots) and bison observed (red dots) during the third resighting survey on 10 July 2025. The blue line is the path flown during the resighting flight.

Recommended next steps

Three steps are recommended to provide further resolution to estimated population size and trend of the Aishihik population:

First, it would be prudent to conduct another mark-resight survey in three years (2028) to update the estimated population size and better understand the population trend. This is necessary because of some uncertainty on the population trend as a result of our survey. Knowing the population trend is important given this is a small population with no connectivity to other bison populations. It is also hunted at a high harvest rate and is legally classified as Threatened under the federal *Species at Risk Act*. Accordingly, the conservation and action plan for this population (Government of Yukon 2024) calls for annual aerial surveys to track the population's status, which includes a mix of minimum number known alive (MNKA) surveys (e.g., Miller et al. 2024) and periodic mark-resight surveys such as this one.

Second, it is becoming clear that large portions of the population are no longer migrating and congregating in a few alpine blocks during June and July. This has implications for the effectiveness of our survey methodology, which is becoming less satisfactory than in previous years in terms of the area we can effectively survey in one day and our resighting rates. We recommend exploring revisions to our survey methodology that can increase our coverage of the survey, shorten the survey period (so marks remain highly visible), and increase our resighting rate.

Third, we recommend using all available information on the population ecology of the herd (e.g., adult survival, calf composition, harvest numbers, and age-at-harvest) to develop an integrated population model (e.g., Arnold et al. 2018, Riecke et al. 2019, Severud et al. 2022). An integrated population model would better estimate long-term trends in population size and demography, including forecasts into the future under different hypothetical scenarios.

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