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Moose twinning rate estimates for portions of Alaska GMU 12 including Tetlin National Wildlife Refuge and adjacent lands, 2021-2025.

Brent E. Jamison and CeLee R. Terasa, Tetlin NWR, Tok, Alaska

Photo: USFWS

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Summary

We conducted surveys from fixed-wing aircraft between May 27 and June 3 each year. In 2025, the observed twining rate for the overall study area was 0.18 (*n*=33) which was similar to the preceding 4-year average of 0.16 (*n*=130).

Twinning rates for the portion of the survey area west of the Nabesna River were consistently lower than that east of the river. The multi-year estimate for the western portion was 0.12 (*n*=112), while that in the eastern portion was 0.28 (*n*=51).

Continued monitoring of the twinning rate in the western portion of the survey area is recommended to evaluate the long-term trend. Documenting habitat use by cows that calve west of the Nabesna River and gathering habitat data (e.g., overall forage availability and conducting browse surveys) in these areas may help better understand this population.

Introduction

Moose (*Alces alces gigas*) are among the most highly valued subsistence resources on Tetlin National Wildlife Refuge (NWR). Twinning rates are the most useful single index of the nutritional status of cow moose and are closely tied to habitat quality (Franzmann and Schwartz 1985, Keech et al. 2000, Boertje et al. 2007). We began annual surveys in 2021 to estimate moose twinning rates for the Tetlin NWR and adjacent lands to complement population surveys that are conducted in cooperation with the Alaska Department of Fish and Game (ADF&G).

Methods

The survey area was within Alaska Game Management Unit (GMU) 12 and encompassed 3,065 mi^2. The area was bounded by the Tok Cutoff (AK Hwy 1) on the west, Nutzotin and Mentasta Mountain ranges on the south and southwest, the Alaska Highway to the north, and the Canadian border to the east (Figure 1). Land ownership includes Alaska state lands, Wrangell-St. Elias National Preserve, Tetlin National Wildlife Refuge, Native village of Tetlin, Tetlin Native Corporation lands, Native Village of Northway, Northway Native Association, and Doyon Limited Regional Corporation.

We conducted surveys in accordance with approved protocols described by Jamison and Cobb (2025). No telemetry studies of moose were ongoing and no radio-collared cows were present within the survey area from 2021-2025. Therefore, we conducted survey flights to search suitable habitat for uncollared cows with calves. We performed surveys from fixed-wing aircraft (Piper PA-18 Super Cub) annually between May 27 and June 3. We operated aircraft at ≤500 ft above ground level and at 65-85 mph ground speed, and continued survey flights until we encountered ≥30 cows with one or more calves.

The pilot and observer both searched for moose. We categorized moose as bull, yearling cow, cow with no calf, cow with one calf, or cow with two calves. We recorded the location of each moose observation with a handheld GPS unit to avoid double counting moose during flights on subsequent days.

We calculated the twinning rate (T) as,

$$T = \frac{M_t}{M_c + M_t}$$

where M_c was the number of cows observed with one calf and M_t was the number of cows observed with twins. We calculated the Standard Error (SE) of the estimate and binomial 90% confidence intervals following Cochran (1977) and Boertje et al. (2007). The multiyear twinning rate was calculated by pooling observations across years. We calculated twinning rates separately for the eastern and western portions of the survey area (east and west of the Nabesna River) after examining preliminary results of the first three years of surveys. We did not make statistical comparisons between the eastern and western portions of the survey area due to small sample sizes and unequal search effort.

Results

We conducted 18 survey flights with two individual pilots and six unique observers over five years. Over the entire survey area, we observed 870 adult and yearling moose (Table 1). Of these, 136 were cows with one calf and 27 were cows with twins. The estimated twinning rate ranged from 0.03 (SE = 0.03) to 0.23 (SE = 0.08) across years (Figure 2). The multiyear twinning rate was 0.17 (SE = 0.03; Table 2).

Based on our field observations in earlier survey years, we suspected that the twinning rate may differ between habitats in the eastern versus western portions of the survey area. Subsequently, we compared data for moose observed east versus west of the Nabesna River.

We observed 413 adult and yearling moose east of the Nabesna River and 460 west of the river over the 5 survey years. Of those in the eastern portion, 51 were cows with calves whereas we observed 112 cows with calves west of the river. The multiyear twinning rate estimates for the eastern and western portions were 0.28 (SE = 0.06) and 0.12 (SE = 0.03), respectively (Table 2, Figure 3).

Table 1. Moose observations during spring twinning surveys for a portion of Alaska GMU 12 including the Tetlin National Wildlife Refuge, 2021-2025.

		Cow moose					
Year	Bulls	Yearling	no calf	one calf	twins	triplets	Total[a]
2021	58	18	66	25	6	0	173
2022	109	18	86	29	7	0	249
2023	46	5	40	31	1	0	123
2024	58	2	35	24	7	0	126
2025	108	15	46	27	6	0	202
Totals	379	58	273	136	27	0	873

[a] Total adults and yearlings; does not include calves.

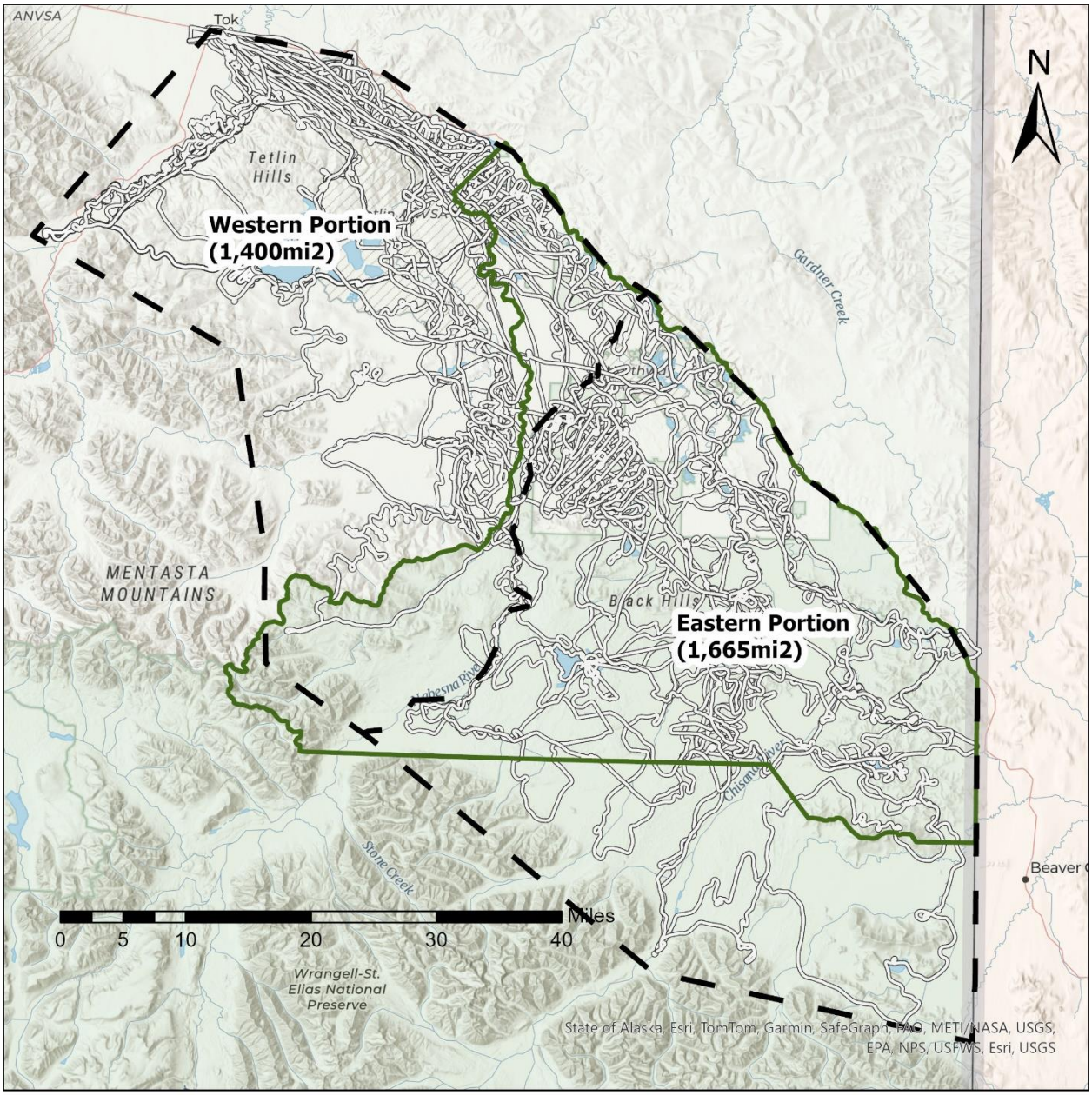

Figure 1. Survey area for moose twinning rate surveys conducted by Tetlin NWR, 2021-2025.

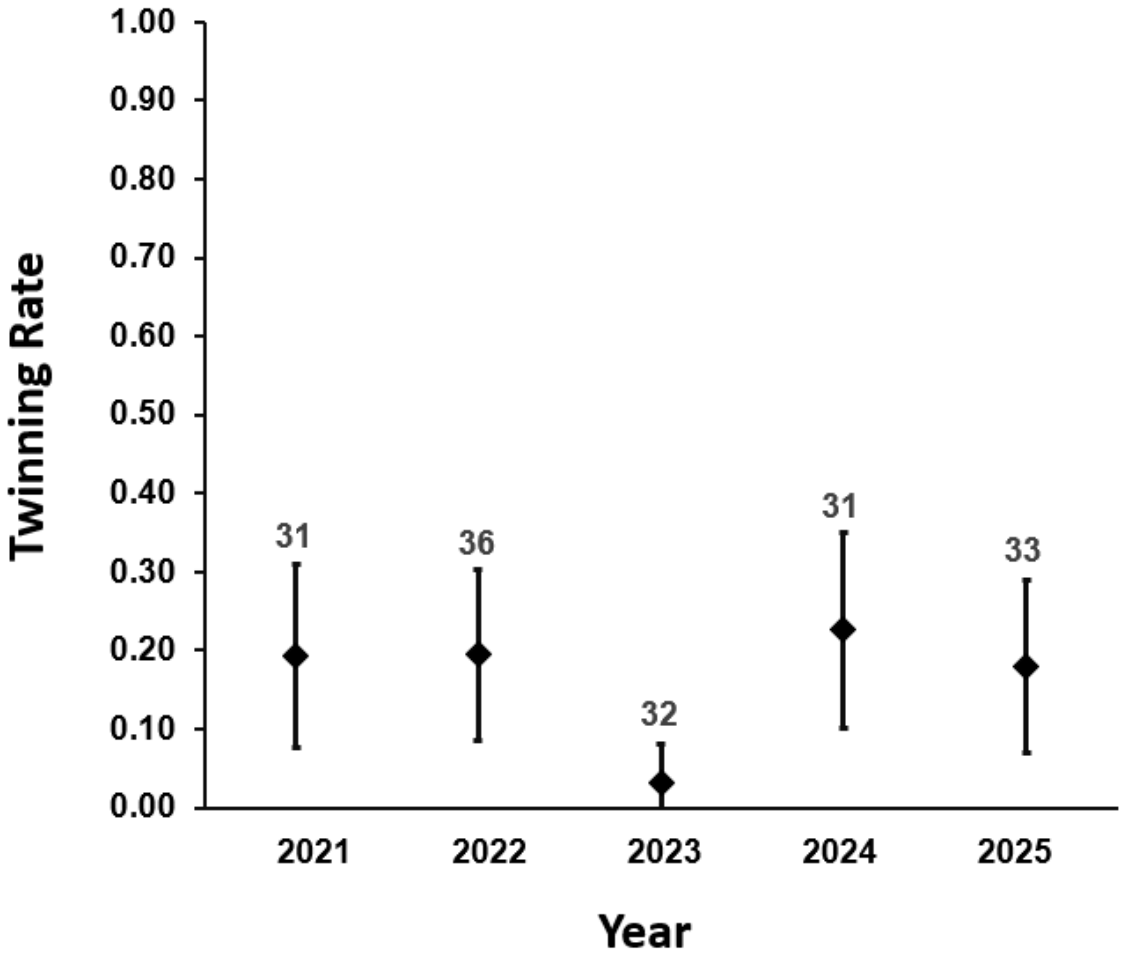

Figure 2. Twinning rates and 90% CI for a portion of GMU 12 including the Tetlin National Wildlife Refuge 2021-2025 estimated from observations of uncollared cows with calves. Data labels are the number of cows with calves observed during surveys.

Table 2. Moose twinning rates (T) for a portion of Alaska GMU 12 including the Tetlin National Wildlife Refuge, 2021-2025. Estimates for the eastern and western portion of the survey area are for those areas east and west of the Nabesna River, respectively.

Year	n	T	SE	90% CI
Overall 2021	31	0.19	0.071	0.076 – 0.311
Overall 2022	36	0.19	0.066	0.086 – 0.303
Overall 2023	32	0.03	0.031	0.000 – 0.082
Overall 2024	31	0.23	0.075	0.102 – 0.350
Overall 2025	33	0.18	0.067	0.070 – 0.290
Overall multiyear	163	0.17	0.029	0.118 – 0.214
Eastern multiyear	51	0.28	0.062	0.171 – 0.378
Western multiyear	112	0.12	0.050	0.066 – 0.166

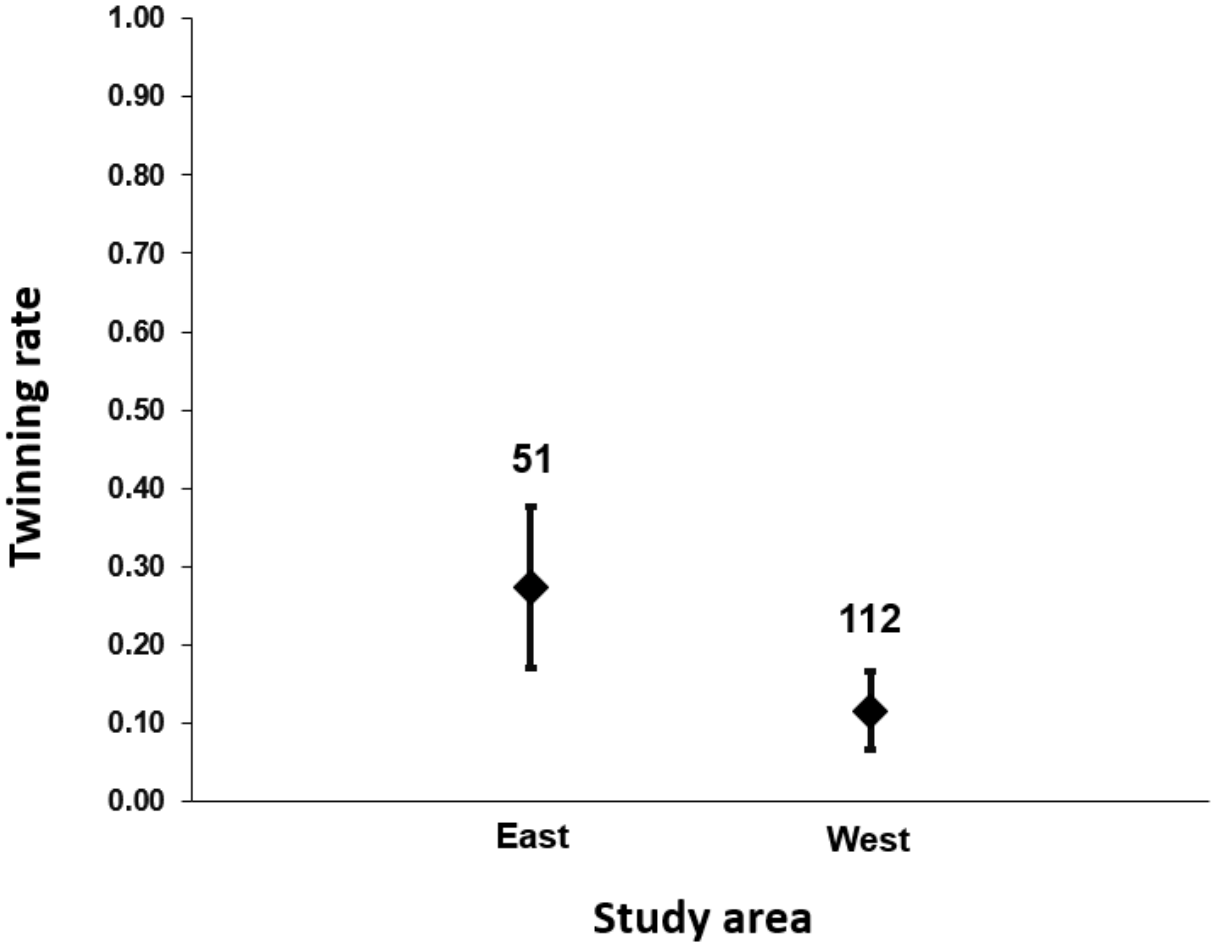

Figure 3. Multi-year twinning rates and 90% CI for areas east and west of the Nabesna River within a portion of GMU 12 including the Tetlin National Wildlife Refuge, 2021-2025.

Discussion

The multiyear twinning rate estimate for our survey area was lower than that for most populations in the state. Boertje et al. (2007) summarized twinning rate data for 15 Alaska moose populations and found that twinning rates varied from 0.07 to 0.67. The twinning rate for the southern portion of GMU 20E, the nearest population for which we have recent twinning data, was roughly 0.28 in 2025 (Hunter 2025).

Both our estimate and that for GMU 20E appeared markedly lower in 2023 than the preceding two survey years (Wells 2023). Above-average snowfall in the winter of 2021-2022 and again in 2022-2023 could have resulted in reduced fitness of individuals in these populations (Coady 1974). In 2025, the observed twinning rate for our study area was similar to the four-year average of 0.16 observed since the inception of these annual surveys.

The eastern and western portions of the twinning survey area correspond to known differences in moose density in the two population survey areas (Northwestern Unit 12 Survey Area vs. Southeastern Unit 12 Survey Area) that overlap our twinning survey area. Moose numbers in the eastern portion that includes Tetlin NWR are characteristic of a low-density population with densities of 0.28 - 0.62 moose/mi^2 between 2000 and 2022 (Gasaway et al. 1992, Wells 2022, Carmello and Jamison 2023). The density of moose is generally greater in the western portion of the survey area with densities averaging just over 1.0 moose/mi^2 over the same period (Wells 2022). Though we did not make statistical comparisons, it appears that the twinning rate for the moderate-density population in the western portion of the survey area is likely lower than that for the low-density population in the eastern portion. The large number of observations in the western portion are largely driving the multiyear twinning rate for the survey area as a whole.

Twinning rates below 0.10 are clear indicators of nutritional stress and, when considered with other indices, may show that a given population has reached or exceeded carrying capacity (Boertje et al. 2007). Continued monitoring of the twinning rate in the western portion of the survey area is recommended to evaluate the long-term trend. Though the multi-year estimate has not dropped below 0.10 for this area, gathering habitat data (e.g., overall forage availability and conducting browse surveys) could provide insight into the health of the moose population.

Because we searched habitat for unmarked (vs. radio-collared) moose, our ability to detect cows with calves was biased toward more open areas such as lake shores, riverbeds, and wet meadows, areas of low shrubs, and recent burns. Consequently, sightability of cows with calves likely varies throughout the survey area. To increase efficiency in reaching the minimum sample size, we searched habitats where observers expected to encounter cows with calves based on previous years' surveys and, though total numbers of moose observed were similar between the eastern and western portions, 69% of our observations of cows with calves occurred in the western half of the survey area. In all years except 2025, we observed more cows with calves in the western half than the eastern half; likely owing to greater search effort east of the Nabesna in the current year.

Adding radio-marked cows to our sampling strategy would reduce any bias resulting from differences in sightability of moose across the survey area. Increasing the minimum sample size of cows with calves to 40 would also narrow confidence intervals and align our protocols with those used by the ADF&G.

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