2008 AERIAL MOOSE SURVEY

DENALI NATIONAL PARK AND PRESERVE

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Abstract

We estimated the number of moose (Alces alces) on the north side of the Alaska Range mountains in Denali National Park and Preserve. The 10,004 km^2 (3862 mi^2) area was surveyed from 3 through 25 November 2008. We observed 830 moose during the aerial survey and estimated ($\pm$ 90% confidence interval [CI]) 1279 $\pm$ 135 moose for the entire survey area. Overall density was 0.13 moose/km^2 (.33 moose/ mi^2). The calf:bull:cow ratio was 24:54:100. We estimated that 77% of cows were without calves, 22% of cows had 1 calf, and 1% of cows had 2 calves present. Two smaller portions of the survey area (East End and Kantishna) were also analyzed.

Introduction

This project is part of the long term monitoring program at Denali National Park & Preserve. Denali is part of the larger Central Alaska Network (CAKN) monitoring program and follows protocols developed by that program. Information generated by this program is used in management decisions relative to park resource preservation, improving our understanding of taiga and tundra ecosystems in interior Alaska, and representing an intact, naturally-functioning subarctic site in broad-based monitoring networks. This report describes accomplishments made in FY2008 to aid in determining moose population status and trends in Denali. The objective of this aerial survey was to estimate the number of moose in a 10,004 km^2 (3862 mi^2) area of Denali National Park & Preserve.

Study Area

The survey was conducted on the north side of the Alaska Range Mountains within Denali National Park & Preserve. The survey area was bounded by the park boundary on the east and north, and the north slopes of the Alaska Range Mountains on the south. To the west the area was bounded by the park boundary and a line

running roughly from the confluence of the Herron and Foraker Rivers southeast to the Birch Creek Hills. The study area totaled 10,004 km^2 (3862 mi^2) .

For comparison to some past surveys, two portions of the study area were identified for separate analysis. The East analysis areas is bounded roughly by the Healy ridge (Outer Range Mountains) on the north, the Park boundary on the east, the Alaska Range on the south, and the Teklanika River on the west. The East analysis area totaled 903 km^2 (348 mi^2). The Kantishna South analysis area includes the bulk of the Kantishna Hills and is bounded roughly on the north by Otter and Marten Creeks, on the east by the Toklat River and Stony Creek, on the south by the McKinley River Bar, and on the west by Glacier Creek. The area of the Kantishna South analysis area totaled 1,729 km^2 (668 mi^2).

Methods

We used a spatial moose survey estimation method developed by Ver Hoef (2000b, 2000c) to survey for moose in the study area. Moose survey units were based on a statewide grid utilizing GIS technology to lay out the sample units. The north-south boundaries are based on even increments of latitude (2 minutes, starting at 0) and the east-west boundaries are based on even increments of longitude (5 minutes, starting at 0). Each sample unit is approximately 15.3 km^2 (5.91 mi^2). Sample units were assigned to one of two density strata (high or low) based observations of moose in the unit during stratification flights, stratification from past surveys (Owen and Meier 2005) and known habitat characteristics for the area e.g., proportion of trees, topography). Stratification flights took place before units were surveyed and were conducted by flying one flight line over each unit and recording the number of moose and/or moose tracks observed. Those units where 5 or more moose were expected were assigned to the high stratum while those with less than five were considered low. Survey data were analyzed using GeoSpatial Population Estimator Software (DeLong 2006) to generate population estimates and sex/age ratios. All estimates are reported with $\pm$ 90% confidence interval.

Results and Discussion

The survey was conducted from November 3 through 25, 2004. Snow conditions were generally good throughout the survey area. We surveyed 312 units (103 high, 209 low) which comprised 1845 km^2 (47.8%) of the study area.

We observed 830 moose during the survey and estimated 1279 $\pm$ 135 moose for the entire survey area. The calf:bull:cow ratio was 24:54:100. Calves, bulls, and cows represented 13%, 31%, and 56% of the estimated population, respectively. We estimated that 77% of cows were without calves, 22% of cows had 1 calf, and 1% of cows had 2 calves present. Overall estimated moose density was 0.13/km^2 (0.33 moose/mi^2). Observed moose density in high survey units was 0.37/km^2 (0.96 moose/mi^2) while observed moose density in low survey units was 0.03/km^2 (0.07 moose/mi^2).

In the East subunit we surveyed 36 units (24 high, 12 low) which comprised 550.8 km^2 (61%) of the subunit area. We observed 252 moose in the subunit and estimated 304 $\pm$ 30 moose. The calf:bull:cow ratio was 13:36:100. Calves, bulls, and cows represented 9%, 24%, and 68% of the estimated population, respectively.

We estimated that 87% of cows were without calves, 12% of cows had one calf, and 1% of cows had 2 calves present. Overall estimated moose density for the East subunit was 0.34 moose/ km^2 (0.87 moose/mi^2).

In the Kantishna South subunit we surveyed 47 units (36 high, 11 low) which comprised 719.1 km^2 (42%) of the subunit area. We observed 136 moose in the subunit and estimated 228 $\pm$ 55 moose. The calf:bull:cow ratio was 38:73:100. Calves, bulls, and cows represented 18%, 35%, and 46% of the estimated population, respectively. We estimated that 65% of cows were without calves, 31% of cows had one calf, and 3% of cows had 2 calves present. Overall estimated moose density for the Kantishna South subunit was 0.13 moose/ km^2 (0.34 moose/mi^2).

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Tables and Figures

Table 1. Number of moose survey units and area (km^2) by stratum, Denali National Park and Preserve, November, 2008.

	Stratum		
Number of units:	High	Low	Combined
Available	104 (1,589)	549 (8,415)	653 (10,004)
Surveyed	103 (1,574)	209 (3,206)	312 (4,780)

Table 2. Number of moose observed by sex/age class and stratum, and estimated population (± 90% confidence interval), Denali National Park and Preserve, November, 2008.

	Stratum			
Sex/Age class	High	Low	Combined	Estimated population
Cows	346	126	472	717 ± 70
Calves	61	37	98	173 ± 27
Bulls	182	78	260	389 ± 62
Combined	589	241	830	1,279 ± 135

Table 3. Moose cohort ratios and estimated populations, and densities (± 90% confidence intervals) for North side moose surveys, Denali National Park and Preserve, 1986-2008.

Year	Calves/ 100 cows[a]	Bulls/ 100 cows[a]	Estimated population	Density Estimate moose/ km^2	Source
1986	23	75	1,650 ± 347	0.19	Meier (1987)
1991	23	81	1,564 ± 123	0.22	Meier et al. (1991)
1996	30	56	2,000 ± 402	0.13	Fox (1997)
1997	22	63	1,630 ± 204	0.23	Belant and Stahlnecker (1997)
1999	22	69	1,866 ± 244	0.24	Belant et al. (1999)
2004	39	88	1,104 ± 219	0.11	Owen and Meier (2005)
2008	24	54	1,279 ± 135	0.13	This study

[a] 1996 ratio includes the Lakes and Flats Regions (see Fox 1997).

Figure 1. 2008 Denali National Park and Preserve North side Moose Survey units.

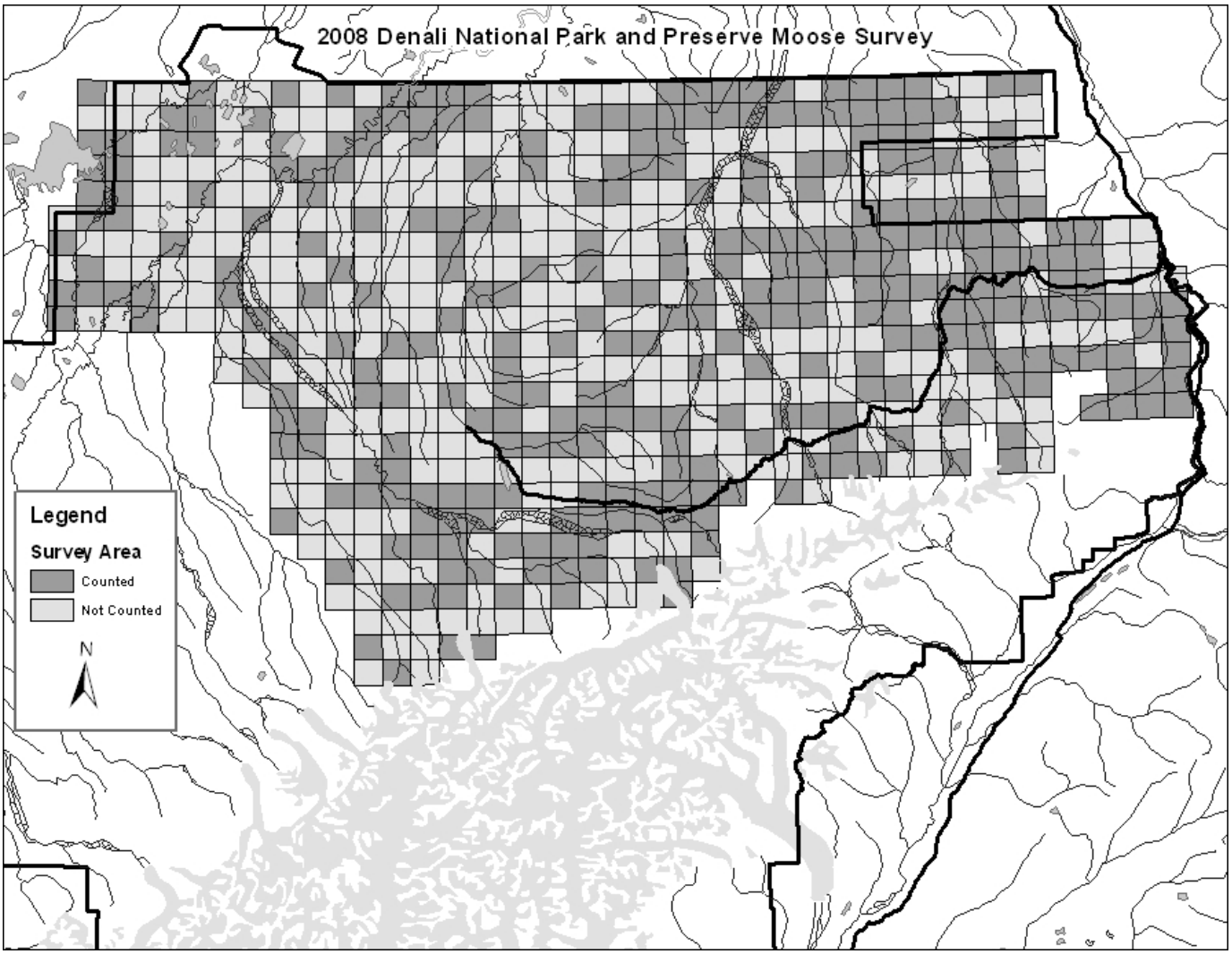


Table 4. Moose cohort ratios and estimated populations, and densities (± 90% confidence intervals) for North side East area moose surveys, Denali National Park and Preserve, 1986-2008.

Year	Calves/ 100 cows	Bulls/ 100 cows	Estimated population	Density Estimate moose/ km^2	Source
1986	18	44	416 ± 149	0.53	Meier (1987)
1987	23	37	319	0.58	Dalle-Molle (1987)
1991	14	55	272 ± 43	0.34	Meier et al. (1991)
2004	29	52	240 ± 37	0.26	Owen and Meier (2005)
2008	13	36	304 ± 30	0.34	This study

Figure 2. 2008 Denali National Park and Preserve North side East area Moose Survey units.

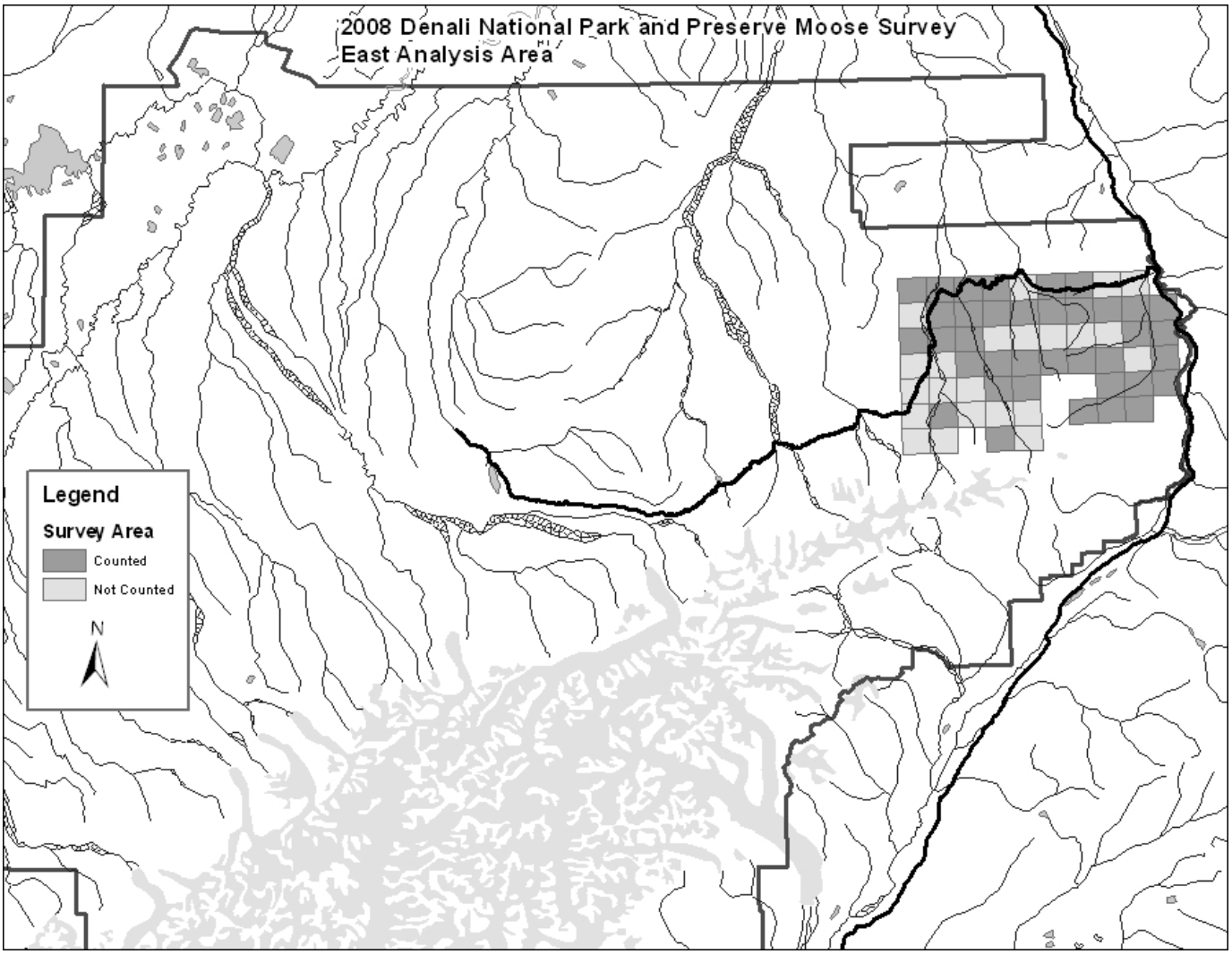
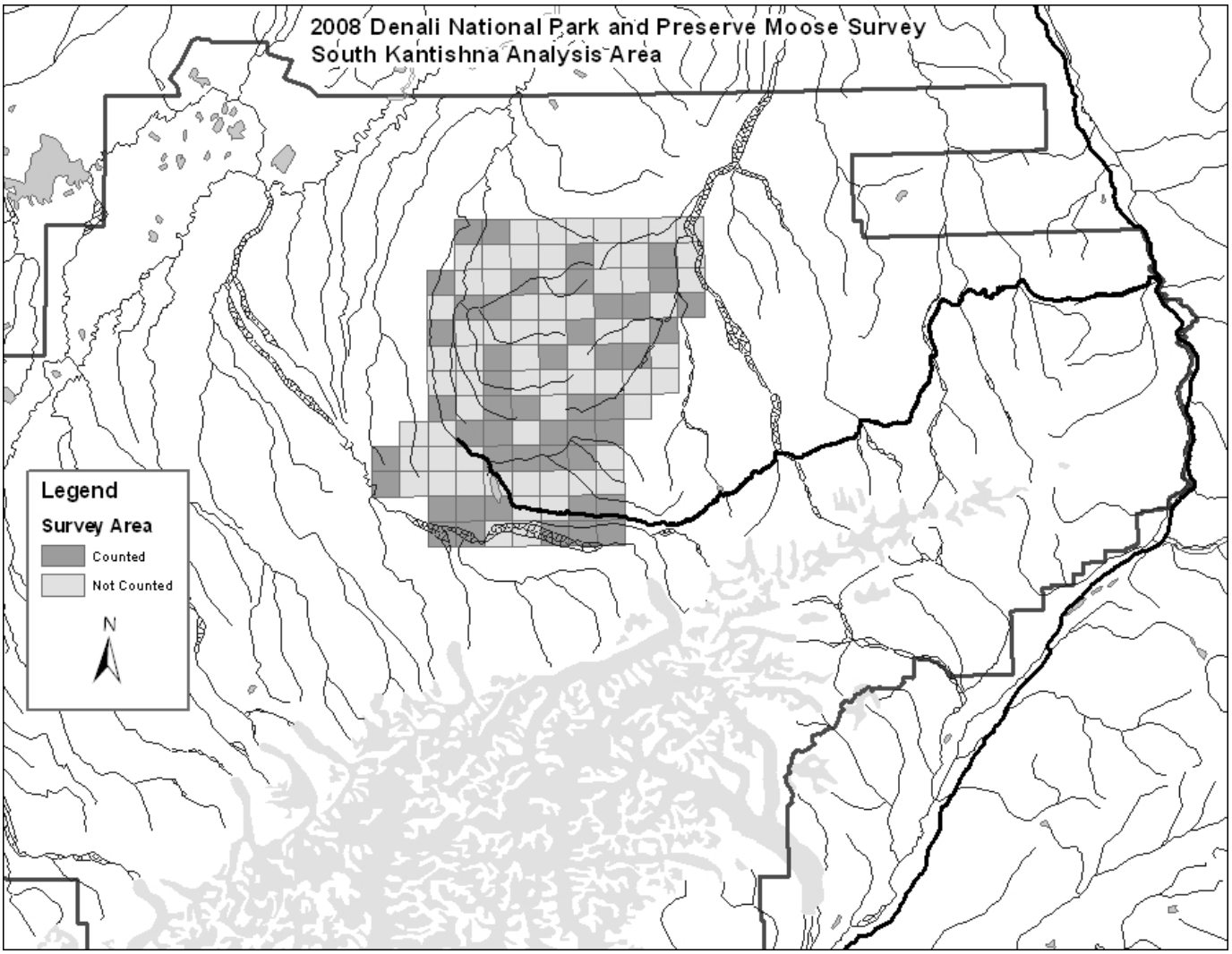


Table 5. Moose cohort ratios and estimated populations, and densities (± 90% confidence intervals) for North side Kantishna-South area moose surveys, Denali National Park and Preserve, 1986-2008.

Year	Calves/ 100 cows	Bulls/ 100 cows	Estimated population	Density Estimate moose/ km^2	Source
1986	28	91	424 ± 123	0.27	Meier (1987)
1991	11	132	395 ± 69	0.25	Meier et al. (1991)
2003	9	105	276 ± 72	0.13	Owen (2004)
2004	37	148	133 ± 64	0.08	Owen and Meier (2005)
2008	38	73	228 ± 55	0.13	This Study

Figure 3. 2008 Denali National Park and Preserve North side Kantishna-south area Moose Survey units.


2008 Denali National Park and Preserve Moose Survey
South Kantishna Analysis Area
Legend
Survey Area
Counted
Not Counted
N