

MIDDLE NOATAK RIVER MOOSE SURVEY: NOVEMBER-DECEMBER 2001

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INTRODUCTION

The National Park Service (NPS) and the U.S. Fish and Wildlife Service (USFWS) conducted a moose survey in the western portion of the middle Noatak River moose census area in late November and early December 2001. Weather conditions were optimal for the survey with calm winds and clear skies. However, overall survey conditions were marginal due to flat light and incomplete snow cover. Detailed background information about the Noatak River moose population and previous surveys can be found in Dau et al. (1994) and Shults et al. (1995).

METHODS

We used the stratified random sampling technique developed by Gasaway et al. (1986) and modified by Ver Hoef (Unpub.) to estimate fall (i.e. post-hunt) moose abundance and composition in the western portion of the middle Noatak River moose census area (Figures 1 and 2). Sample unit boundaries were squares of approximately 5 mi², delineated by 2 degrees of latitude and 5 degrees of longitude. Due to a limited budget and decreasing daylight we did not stratify sample units in the field during 2001. Instead, we used the results of the 1994 stratification as a basis for assigning strata to the units. Since the unit boundaries used in the 1994 and 2001 surveys were different, strata were assigned based on a combination of the 1994 designation and working knowledge of the survey areas. Sample units were then randomly selected within each stratum. Sample units were surveyed using 2 PA-18 Super Cubs (1-USFWS and 1-Charter). Snow cover was incomplete, allowing low vegetation to show through and some bare ground to show under spruce forest. Snow conditions allowed moose to remain in their September rutting areas on hillsides and in side drainages. This resulted in moose being more spread out and some breakdown in our *a priori* stratification. Detailed survey methods can be found in Dau et al. (1994). Population parameters were estimated using the computer program MOOSEPOP.

RESULTS

We conducted the survey between 27 November and 3 December 2001 (Table 1). Sample units were surveyed in 12.8 flight hours. Participants in the survey were local agency biologists with prior moose survey experience.

Stratification and Sample Units

The western survey area is 1317 mi² (3412 km²) and is delineated into 264 sample units. The *a priori* stratification, using the 1994 stratification resulted in 146 low, 83 high density units, and 35 units that were eliminated due to lack of moose habitat (Table 2). We surveyed 30 of the remaining 229 units, an area of 1144 mi² (2962 km²) (13%; area = 150 mi²). The mean standard search intensity was 5.08 min/mi² (range 1.83-12.25 min, SD = 2.03 min). No sightability estimate was obtained as per Ver Hoef (Unpub.)

Population Estimation and Composition

MOOSEPOP population estimates and composition estimates are summarized in Tables 3-8. The population estimate of 1,141 moose (80% CI \pm 28%) results in a density estimate of 1.0 moose/mi² (0.4 moose/km²) (Table 3). We counted 223 moose classified as 58 bulls, 150 cows, and 15 calves. Bull, cow, and calf estimates were 316, 741, and 84 respectively (Tables 4, 5, and 6). The estimated bull:cow ratio was 43:100 (80% CI \pm 18%), and the estimated calf:cow ratio was 11:100 (80% CI \pm 37%) (Tables 7 and 8). Bull antler size classes were estimated to be 14% small, 40% medium, and 46% large. Table 9 compares the results of the complete survey conducted in 1993 with the surveys from 1994, 1995, and 2001 conducted in the western section of the census area.

DISCUSSION

The 2001 survey was less precise than the 1995 survey due to a breakdown in the *a priori* stratification and the lack of a sightability estimate. The breakdown in the stratification probably resulted from increased mobility of moose due to mild snow conditions. Large numbers of moose were observed on hillsides in fall rutting areas. Moose normally abandon these areas by late November, moving down into major river drainages. Although sightability was not quantified, poor sightability was expected due to flat light and incomplete snow cover. Increased sampling variance in 2001 is the most likely cause for the differences seen in estimates for bulls, cows, and the population between 1995 and 2001. However, the decrease seen in the 2001 calf:cow ratio is probably a real one as supported by radiocollar data collected from 1998-2001 and spring surveys conducted annually from 1999-2001. The low calf:cow ratio is most likely attributed to predation on calves by brown bears. Traditional ecological knowledge and anecdotal observations by agency personnel suggest that brown bears are increasing in numbers in GMU 23. Only one set of twins was observed during the survey.

Cost and Personnel

The cost to survey the western survey area, excluding personnel, was approximately \$4,600. For comparison, the 1995 survey cost approximately \$9,200. Agency personnel contributed 5 personnel-days of effort while the one charter pilot contributed 3. The 1995 survey required 8 agency personnel-days of effort while pilots contributed 6 personnel-days.

LITERATURE CITED

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Table 1. Chronology, aircraft, and flight times for 2001 middle Noatak drainage moose survey.

Date	Aircraft ^a	Hrs	Personnel	Activity
11/27	N788	1.6 ^b	Ayers/Stevenson	survey units
11/27	N8231E	1.3	Rood/Schnorr	survey units
11/28	N8231E	3.1 ^b	Rood/Ayers	survey units
11/29	N8231E	1.8	Rood/Schnorr	survey units
11/30	N788	1.5 ^b	Ayers/Moran	survey units
11/30	N8231E	1.6	Rood/Schnorr	survey units
12/03	N8231E	1.9	Rood/Schnorr	survey units

^a N8231E (PA-18); N788 (PA-18)

^b flight hours estimated

Table 2. Sample unit data for 2001 Western Middle Noatak River moose survey.

Unit	Stratum	Time (min)	Area (mi ²)	Bull ^a			Cow ^b			Calf	Total
				S	M	L	0	1	2		
16	1	20	4.90	0	0	0	0	0	0	0	0
58	3	22	4.91	0	0	0	1	0	0	0	1
76	1	9	4.92	0	0	0	0	0	0	0	0
83	3	17	4.92	0	0	0	0	0	0	0	0
132	1	19	4.94	0	0	0	0	0	0	0	0
175	1	18	4.95	0	0	0	0	0	0	0	0
195	1	12	4.96	0	0	0	0	0	0	0	0
228	3	24	4.97	0	4	5	11	1	0	0	22
243	1	20	4.98	1	0	2	6	0	0	0	9
247	3	11	4.98	0	0	0	0	0	0	0	0
261	1	23	4.99	0	2	0	2	1	0	0	6
273	3	22	4.99	0	0	0	0	1	0	0	2
285	3	33 ^c	5.00	3	6	4	24	2	0	0	41
286	3	21	5.00	0	0	0	6	0	0	0	6
288	3	40	5.00	0	2	3	12	1	1	0	22
304	3	33 ^c	5.01	2	7	0	23	2	0	0	36
323	3	17 ^c	5.01	0	0	1	1	1	0	0	4
343	1	17 ^c	5.02	0	0	1	1	0	0	0	2
348	3	40	5.02	0	0	1	5	0	0	0	6
365	3	33 ^c	5.03	0	0	0	1	1	0	0	3
376	3	28	5.04	1	4	5	3	0	0	0	13
378	3	33 ^c	5.04	0	0	0	0	1	0	0	2
379	3	33 ^c	5.04	0	0	0	6	1	0	0	8
407	3	33 ^c	5.05	0	0	0	2	0	0	0	2
408	3	33 ^c	5.05	0	0	2	2	1	0	0	6
434	3	62	5.06	1	1	0	15	0	0	0	17
435	3	33 ^c	5.06	0	0	0	4	0	0	0	4
457	3	32	5.08	0	0	0	4	0	0	0	4
458	3	36	5.08	0	0	0	4	0	0	0	4
471	3	22	5.09	0	0	0	3	0	0	0	3

^a Bull antler size classes: S=small (<25 in), M=medium (26-50 in), and L=large (>50 in)

^b Cow associations: 0=no calf, 1=1 calf, 2=2 calves.

^c Estimated survey time determined by mean time spent in units of same stratum

Table 3. MOOSEPOP results showing estimated population size, density, and precision for the Western Middle Noatak moose survey, November-December 2001.

2001			
PAR/STRAT	low	high	TOTAL
N	146	83	229
Tot area	726.70	417.00	1143.70
n	9	21	30
Area sur	44.67	105.42	150.09
# seen	21	202	223
Density	0.4701	1.9161	0.9973
To	341.6	799.0	1140.7
V(To)	24426.20	33307.23	57733.43
To df	8	20	26

SCFo=1.00000	V(SCFo)=0.0000000000	df(SCFo)= 9999
Te= 1140.7	V(Te)= 57733.43	df(Te)= 26
80% CI around Te = (824.7, 1456.6)	is +/- 27.70%	
90% CI around Te = (730.8, 1550.6)	is +/- 35.94%	
95% CI around Te = (646.7, 1634.7)	is +/- 43.31%	

Moose Density = 1140.7/1143.7 mi² = **1.0 moose/mi²**

Table 4. Bull moose estimates calculated by MOOSEPOP, Noatak River moose survey, November-December 2001.

2001			
PAR/STRAT	low	high	TOTAL
N	146	83	229
Tot area	726.70	417.00	1143.70
n	9	21	30
Area sur	44.67	105.42	150.09
# seen	7	51	58
Density	0.1567	0.4838	0.2760
Wen	113.9	201.7	315.6
V(Wen)	2651.64	4193.42	6845.06
df	8	20	27

SCFo=1.00000	V(SCFo)=0.0000000000	df(SCFo)= 9999
Wen= 315.6	V(Wen)= 6845.06	df(Wen)= 27
80% CI around Wen = (206.9, 424.3)	is +/- 34.45%	
90% CI around Wen = (174.7, 456.5)	is +/- 44.64%	
95% CI around Wen = (145.8, 485.4)	is +/- 53.79%	

Table 5. Cow moose estimates calculated by MOOSEPOP, Noatak River moose survey, November-December 2001.

2001			
PAR/STRAT	low	high	TOTAL
N	146	83	229
Tot area	726.70	417.00	1143.70
n	9	21	30
Area sur	44.67	105.42	150.09
# seen	12	138	150
Density	0.2686	1.3090	0.6480
Wen	195.2	545.9	741.1
V(Wen)	9449.72	14179.59	23629.31
df	8	20	26
SCFo=1.00000	V(SCFo)=0.0000000000		df(SCFo)= 9999
Wen= 741.1	V(Wen)= 23629.31		df(Wen)= 26
80% CI around Wen = (	539.0,	943.2)	is +/- 27.28%
90% CI around Wen = (	478.8,	1003.3)	is +/- 35.39%
95% CI around Wen = (	425.0,	1057.1)	is +/- 42.65%

Table 6. Calf moose estimates calculated by MOOSEPOP, Noatak River moose survey, November-December 2001.

2001			
PAR/STRAT	low	high	TOTAL
N	146	83	229
Tot area	726.70	417.00	1143.70
n	9	21	30
Area sur	44.67	105.42	150.09
# seen	2	13	15
Density	0.0448	0.1233	0.0734
Wen	32.5	51.4	84.0
V(Wen)	432.77	183.87	616.64
df	8	20	15
SCFo=1.00000	V(SCFo)=0.0000000000		df(SCFo)= 9999
Wen= 84.0	V(Wen)= 616.64		df(Wen)= 15
80% CI around Wen = (	50.7,	117.3)	is +/- 39.66%
90% CI around Wen = (	40.4,	127.5)	is +/- 51.85%
95% CI around Wen = (	31.0,	136.9)	is +/- 63.03%

Table 7. Bull: Cow ratios calculated by MOOSEPOP, Noatak River moose survey, November-December 2001.

2001				
p=	0.4259	V(p)=	0.00356716	df (p)= 26
80% CI around	p = (	0.3473,	0.5044)	is +/- 18.44%
90% CI around	p = (	0.3240,	0.5278)	is +/- 23.93%
95% CI around	p = (	0.3031,	0.5487)	is +/- 28.83%

Table 8. Calf: Cow ratios calculated by MOOSEPOP, Noatak River moose survey, November-December 2001.

2001				
p=	0.1133	V(p)=	0.00098092	df (p)= 15
80% CI around	p = (	0.0713,	0.1553)	is +/- 37.07%
90% CI around	p = (	0.0584,	0.1682)	is +/- 48.46%
95% CI around	p = (	0.0465,	0.1800)	is +/- 58.91%

Table 9. MOOSEPOP results comparing the 1994, 1995, and 2001 western survey area surveys with the complete 1993 survey.

	2001	1995	1994	1993
Population Estimate (80% CI)	1141 (825-1,457)	1,141 (880-1,402)	1,000 (882-1,117)	1,125 (989-1,261)
Moose Counted	223	544	688	688
Area (mi ²)	1143.7	857.5	857.5	1627.9
Density	1.0	1.3	1.2	0.7
Bull Estimate (80% CI)	316 (207-424)	252 (172-331)	253 (184-322)	288 (235-341)
Cow Estimate (80% CI)	741 (539-943)	735 (562-907)	643 (558-728)	668 (583-753)
Calf Estimate (80% CI)	84 (51-117)	154 (125-184)	103 (76-131)	169 (142-196)
Bull:Cow Ratio (80% CI)	43 (35-50)	34 (30-39)	39 (28-51)	43 (36-50)
Calf:Cow Ratio (80% CI)	11 (7-16)	21 (16-26)	16 (12-20)	25 (22-29)
% Of Units Counted	30/229=13%	26/68=38%	17/68=25%	40/130=31%