United States Department of the Interior

FISH AND WILDLIFE SERVICE
Yukon Flats National Wildlife Refuge
101 12th Avenue, Room 264
Fairbanks, Alaska 99701

IN REPLY REFER TO:

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March 4, 2002

Dear Reader:

Enclosed is a final report of the moose survey conducted on the western Yukon Flats, November 18-26, 2001. We estimated a total of 668 moose in the 2,269 square mile survey area which extends from Stevens Village up to White Eye and south to the White Mountains. On average there were about 3 moose every 10 square miles. This moose density is nearly equal to that estimated in the 2000 survey. We estimated lower numbers of bulls and higher numbers of cows and calves compared to the 2000 survey.

We wish to thank Steve Hjelm from Stevens Village for assisting with the survey. We also thank the Beaver Village Council for coordinating food and lodging accommodations, the Beaver Cruikshank school for providing lodging, and Beaver resident Carol Thomas for preparing meals.

Please share this report with others who may have a special interest in this report. If you have any questions regarding the results of the survey please contact our biologist Mark Bertram at 456-0446 or 1-800-531-0676.

Sincerely,

Ted Heuer
Refuge Manager

cc: Distribution list attached

Distribution List:

Chief, Beaver
Chief, Birch Creek
Chief, Canyon Village
Chief, Circle
Chief, Fort Yukon
Chief, Stevens Village
Chief, Venetie
Chief, Native Village of Venetie Tribal Government
Chief, Chalkyitsik
Village Natural Resource Specialist, Beaver
Village Natural Resource Specialist, Canyon Village
Village Natural Resource Specialist, Circle
Village Natural Resource Specialist, Fort Yukon
Village Natural Resource Specialist, Stevens Village
Village Natural Resource Specialist, Venetie
Village Natural Resource Specialist, Chalkyitsik
Natural Resource Director, CATG
Larry Williams, Chair, Yukon Flats Fish and Game Advisory Committee
Paul Williams, Sr., Beaver
Steve Hjelm, Stevens Village
Dewey Schwalenberg, Stevens Village
Craig Fleener, Fort Yukon
Calvin Tritt, Arctic Village
David James, ADFG
Patrick Valkenburg, ADFG
Bob Stephenson, ADFG
Brad Schultz, NPS
Jim Herriges, BLM
George Sherrod, USFWS
Vince Matthews, USFWS
Region 7 Librarian, USFWS
Region 7 National Wildlife Refuges
Refuge Supervisor, USFWS
Pete DeMatteo, USFWS
Patricia Heglund, USFWS
Bill Seitz, ABRC, USGS

Moose Population Survey
Western Yukon Flats

Game Management Unit 25D
Yukon Flats National Wildlife Refuge
November 18-26, 2001

For further information please contact:

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Fairbanks, Alaska 99701
(907) 456-0446
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March 4, 2002

2001 MOOSE POPULATION SURVEY -WESTERN YUKON FLATS

SUMMARY

The population estimate for the western Yukon Flats in Game Management Unit (GMU) 25D (2,269 square miles) was 668 moose with a certainty of +/- 24% at the 90% confidence level. The density estimate was 0.29 moose per square mile. Estimated bull:cow, yearling bull:cow, and calf:cow ratios for the survey area were 52:100, 9:100, and 27:100, respectively. Estimated proportions of bulls, cows, and calves were 29%, 56%, and 15%, respectively. Search times averaged 6.1 minutes per square mile.

BACKGROUND

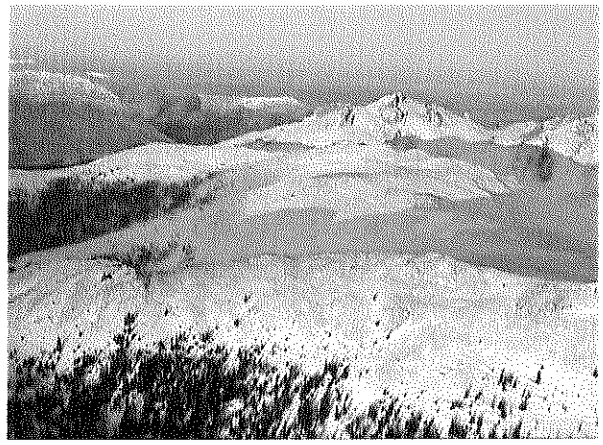
Moose are the most important game species on the western Yukon Flats and a primary source of meat for subsistence users. Moose are also important prey for black bears, grizzly bears, wolves and an important food source for scavenger species.

Bag limits, harvest quotas, and hunting seasons for moose have varied over the years in the western Yukon Flats. The combination of federal and state regulations and the checkerboard pattern of federal, state, and private lands on the western Yukon Flats leads to confusion for both local users and managers. A registration or Tier II hunt has been administered by the State of Alaska since 1983; the number of permits issued annually has ranged from 60 to 125. In 1990 the federal government assumed subsistence management on federal public lands. Current federal regulations close the federal season when the combined harvest on federal, state, and privately owned lands reaches 60 bulls. No sport harvest has been allowed in the western Yukon Flats (GMU 25D) since 1990. The Tier II season on state, federal, and privately owned lands is August 25 to February 28. The subsistence season on federal land is also August 25 to February 28.

The first aerial surveys to monitor moose in the western Yukon Flats were conducted in March 1962 during feasibility studies for the proposed Rampart Canyon Dam and Reservoir Site. Trend surveys were initiated in 1983 in cooperation with the Alaska Department of Fish and Game to monitor moose population trends and were conducted annually until 1994. Stratification surveys were conducted in 1983 and 1986. The first population estimation survey of the western Yukon Flats (GMU 25D, 4,544 square miles) was conducted in 1992.

In 1995 annual trend surveys were discontinued due to their inability to reliably estimate density. In 1996 a smaller scale (1,532 square miles) population estimation survey was initiated to better measure moose population trends. A new statistical analysis method, the Geo-Statistical Population Estimator (GSPE)(Ver Hoef 2001), has been used since 1999. This report summarizes findings from the November 2001 GSPE survey.

The Yukon River flows through the center of the moose survey area.



The White Mountains form the southern boundary of the moose survey area.

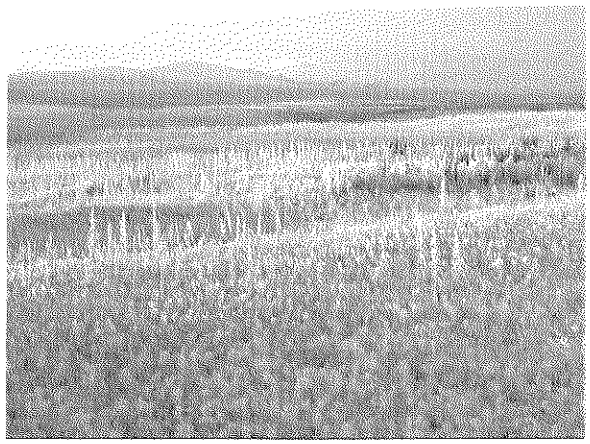
STUDY AREA

The survey area includes core hunting areas in the western Yukon Flats and is encompassed by GMU 25D and the Yukon Flats National Wildlife Refuge (Figure 1). It extends from White Eye (near the lower mouth of Birch Creek), south to Mt. Schwatka, and west to Stevens Village. The survey area includes 2,269 square miles and is divided into 421 sample units (units). Each 5.3 square mile unit is two minutes of latitude (north to south) by five minutes of longitude (east to west).

The area is characterized by mixed forests, dominated by white spruce (*Picea glauca*), black spruce (*Picea mariana*), paper birch (*Betula papyrifera*), quaking aspen (*Populus tremuloides*), and balsam poplar (*Populus balsamifera*). Forested areas comprise the majority of the survey area. Shrub communities of alder (*Alnus*) and willow (*Salix spp.)* are most common in riparian sites and surrounding lakes and meadows. Dwarf shrubs such as glandular birch (*Betula glandulosa*), Labrador tea (*Ledum decumbens*), crowberry (*Empetrum nigrum*), and blueberry (*Vaccinium uliginosum*) are common in the uplands. Burned habitats are dispersed throughout the survey area and include much of the uplands south and west of Beaver.

METHODS

A population estimation survey was conducted according to methods outlined in Gasaway et al. 1986 and the GSPE (Ver Hoef 2001). Gasaway methods were used to classify moose and analyze data. The geo-statistical technique provided guidelines for sample unit design, selection, navigation, and data analysis. All sample units were placed in random order prior to the survey. Our goal was to survey a minimum of 22% (n=93) of the 421 sample units including 60 high density units and 30 low density units.



The uplands include large burns with widely dispersed concentrations of moose.

Survey conditions were marginal across the Yukon Flats in 2001. Adequate snow was not received until November 15.

Units were stratified with a Cessna 206 by flying east/west transects through the center of each unit. The pilot and navigator used a Global Positioning System (GPS) to navigate and determine when the aircraft was entering and exiting a unit. Two rear seat observers located moose and tracks. Units which were thought to have one or more moose were stratified high density, the remaining units were stratified low density. A stratified random sample was then made to determine which units to survey.

Five two seat utility aircraft including one Aviat Husky (A-IB) and four Piper Super Cubs (PA-18) were used to survey units. Sampling aircraft used GPS to navigate to and within assigned units. Search intensity varied with habitat. This survey protocol required a high search intensity in forested habitats (8-10 minutes per square mile). Units with more open habitats or with significant water area were searched at a lower search intensity. Survey aircraft generally flew 12 to15 east/west transects in each unit, about 200 to 300 meters apart.

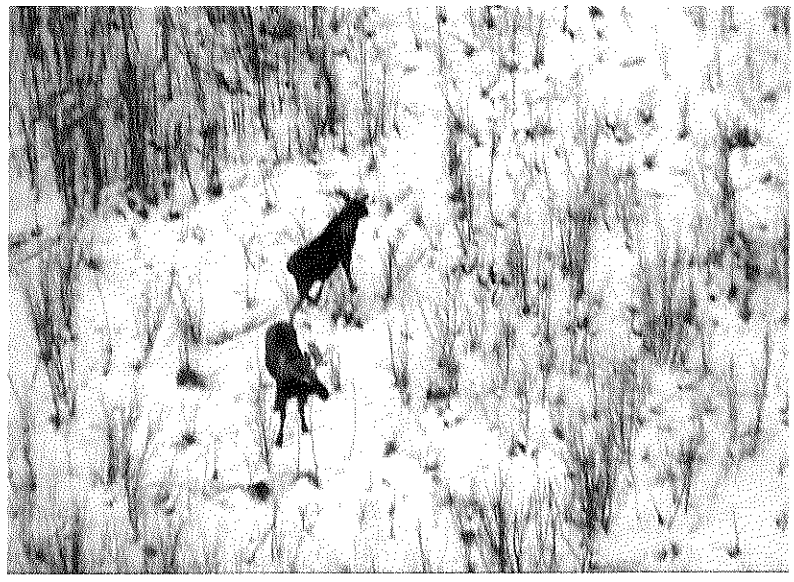
RESULTS

Stratification Minimal snowfall requirements (6 inches) were not received until after November 15. Snow cover was incomplete (some low vegetation showing) over all but the southwestern portion of the survey area. Snow depths varied from approximately 8 inches near Stevens Village to nearly 6 inches at Beaver. The stratification was conducted November 18, 19, and 20, 2001. The survey time for the stratification was 8 hours and 29 minutes. The stratification aircraft was operated at a ground speed of 130 mph and at a height of about 1,000 feet above ground level (AGL). The average rate of sampling was .23 minutes per square mile or 1.2 minutes per unit (Table 1). Over 39% (n=166) of the survey area was stratified as high density,

A total of 159 moose were observed during the 2001 moose survey stratification, nearly twice the number of moose observed in 2000.

the remaining 255 units were judged low density (Figure 1). Ten units in the White Mountains were not surveyed due to turbulence; these units were stratified high due to the tracks and moose observed in adjacent units. Moose were observed in clusters throughout the survey area with higher concentrations adjacent to the Yukon River and it's islands. Moose were more widely dispersed in the Hermit Ridge burn northwest of Beaver and the 1988 burn (Fire 043) in the foothills of the White Mountains south of Beaver. A total of 159 moose was observed by the stratification crew. The crew also observed 7 gray wolves, 2 otters, 8 fox, and thousands of muskrat pushups. Wolf tracks were common throughout the survey area but especially prevalent near the mouth of Beaver Creek.

Unit Sampling Survey aircraft sampled 98 (23%) of 421 stratified units in seven survey days between November 18 and 26 (Figure 1, Table 2). These included 61 (38%) of the 166 units stratified as high density and 37 (32%) of the 255 units stratified as low density. Crews were able to survey 5 to 8 units daily. Weather was generally favorable through the sampling period with clear to partly overcast skies and minimal ground fog. Ground temperatures ranged from 0° to -30° Fahrenheit. Survey light ranged from 5 to 6 hours.



Yearling and medium bulls comprised 43% of observed bulls.
There were an estimated 9 yearling bulls for every 100 cows.

Mean search time was 6.1 minutes per square mile for all units in all habitats. Predominant habitat types were summarized from data sheets to calculate search times by habitat type. A search intensity of 7.2 minutes/square mile was recorded in densely forested conifer and deciduous habitats (n=24). Units predominantly scrub, wetland, or riparian (n=35) (most interspersed with dense forests) recorded mean search intensities of 6.2 minutes/square mile. Search intensities for subalpine (n=16) and burned habitats (n=23) were 5.6 and 5.1 minutes/square mile, respectively.

A total of 213 moose was observed in sampled units and an additional 59 moose was observed adjacent to units. Observations in and out of units were totaled to derive observed sex and age ratios. A summary of total observations and sex and age composition is included in Table 4.

Although wolf tracks were observed throughout the survey area only 2 groups of wolves were observed. One black wolf was observed near the Beaver landfill and 2 gray wolves were about 10 miles south of Beaver. Additional observations included a kill site about 6 miles upriver from Beaver, a collared cow moose about 10 miles east of Beaver, caribou tracks near Mallard Lake, 2 fox, and 1 lynx. Muskrat pushups were numerous on most wetlands and exceeded observations in 2000.

The estimated bull/cow ratio decreased from 72:100 in 2000 to 52:100 in 2001.

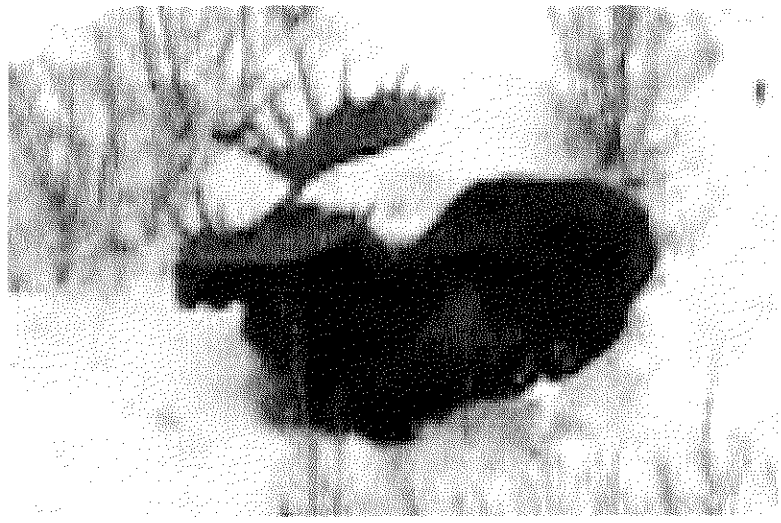
Population Status Two computer software programs, Moosepop and the GSPE, were used to analyze data. Since there was no evidence of spatial autocorrelation in the data set, the results between the two methods were nearly identical. The following results are based on GSPE.

Estimated bull:cow, yearling bull:cow, and calf:cow ratios for the survey area were 52:100, 9:100, and 27:100, respectively (Table 3). Bull, cow, and calf composition were 29%, 56%, and 11%, respectively. Ratios and composition for moose observed in 1983 to 2001 surveys are given in Table 4.

The density estimates for the low and high strata were 0.12 and 0.57 moose per square mile, respectively, with an average of 0.29 moose per square mile +/- 0.24, 0.90 confidence level (density range: 0.23 to 0.37 moose per square mile) (Figure 2). The population estimate for the 2,269 square mile survey area was 668 moose +/- 0.24 at the 0.90 confidence level (estimate range: 507 to 827 moose) (Table 2).

DISCUSSION

Stratification We had difficulties predicting presence or absence of moose in 36% of the sample units surveyed. Since 1999 this difficulty has ranged from 28% to 36%. In 2000 we had difficulties in 28% of sample units surveyed. No moose were observed in 38% of units stratified as high density and one or more moose were observed in 32% of units stratified as low density.

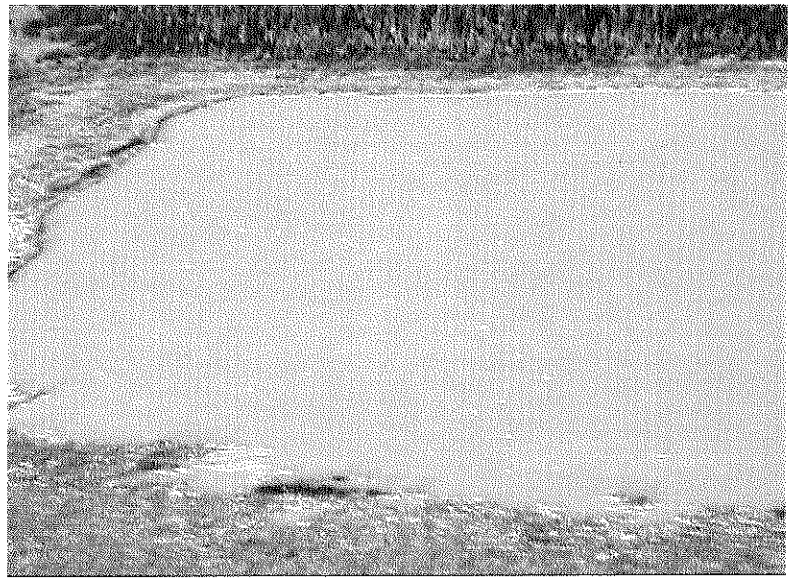


Large bulls comprised 57% of all bulls observed.

We attribute variation to the low density and scattered distribution of the moose population, the presence of predators influencing moose movement, and the small size of the survey units which increased the number and length of unit boundaries and therefore increased the likelihood that moose would cross unit boundaries. We had numerous instances of moose observed on sample unit boundaries during the survey. All these reasons for variation are common and have been experienced in all moose population surveys on the Yukon Flats.

We observed twice the number of moose during the 2001 stratification when compared with the 2000 stratification. The difference between years may be attributed to lack of consistency with observers and lower sightability due to ground fog in 2000. The number of observed moose in 2001 was comparable to 1999 (n=152). Although snow cover was not complete in parts of the survey area sightability was generally good with minimal fog and turbulence and good light intensity. The hoar frost enhanced moose sightablility in low shrub cover but hindered sightability in tall shrub and tree stands.

Two large burns, the 1991 Hermit Ridge and the 1988 Fire 043, a burn in the foothills of the White Mountains, comprise nearly 500 square miles of the 1,500 square mile survey area. Moose observed in large burns were widely dispersed and in small groups (two to seven). Many moose in the southern burn were observed traveling south. Moose trails in the 1988 burn typically ran north and south. We suspect that due to the low density and distribution of moose, and the abundance of suitable habitat, it is likely that distribution will change annually between sample units in the large burns. A comparison of moose observed by sample unit between years supports this assumption. Although cost savings make it desirable to forego the stratification in future surveys, this would likely decrease the total number of moose observed in the survey.



Muskrat activity has been increasing since 2000. Many lakes were observed with 50-100 pushups.

Unit Sampling

Mean search time was 6.1 minutes per square mile for all units in all habitats. Predominant habitat types were summarized from data sheets to calculate search times by habitat type. A search intensity of 7.2 minutes/square mile was recorded in densely forested conifer and deciduous habitats (n=24). Units predominantly scrub, wetland, or riparian (n=35) (most interspersed with dense forests) recorded mean search intensities of 6.2 minutes/square mile. Search intensities for subalpine (n=16) and burned habitats (n=23) were 5.6 and 5.1 minutes/square mile, respectively. In open terrain with high sightability, sampling time was reduced to about 20 minutes per unit.

The use of Global Positioning Systems provides for a simple and efficient means to locate and sample survey units in flat terrain. Since the GSPE technique does not include a sightability correction factor, striving for search intensity of at least 8 minutes per square mile is necessary. Search times in our survey ranged from 3 to 9.4 minutes per square mile (16 to 50 minutes per unit) and varied by habitat type. Although we did achieve higher search intensities in low sightability habitats (7.2 minutes per square mile) there is need to increase search intensity in forested habitats. To achieve a sampling intensity of 8 minutes per square mile in forested sample units a minimum of 14 transects are required. Transects flown .15 degrees of latitude apart will achieve the desired sampling rate of about 42 - 45 minutes per unit. We flew transects of 0.2 to 0.3 degrees of latitude apart (about 8-10 transects) in areas of high sightability where there was no canopy cover (burns, alpine). We also recommend that consideration be given to making efficient turns at the end of each transect. It may be possible to both tighten and initiate turns while partially in the unit to decrease time spent outside the unit.

Paul Williams, Sr. (USFWS, Beaver) and Steve Hjelm (Stevens Village Natural Resources) assist with refueling in Beaver during the stratification.

Our survey aircraft utilized a variety of GPS units, most of which included a moving map feature (Garmin GNC 250 XL). Configuring a route in the GPS is relatively easy but it is time consuming to enter waypoints. The survey was streamlined by providing pilots who prefer the moving map with a hand held GPS (Garmin GPS III Plus) preprogramed with routes of assigned survey units. Entering a route for a unit then takes a few seconds to complete. Aircraft without a moving map GPS unit followed the changing latitude/longitude coordinates on the GPS screen to determine if observed moose were in or out of the unit and to assist in timing when making turns. Directional gyro's improved consistency in transect lines in these aircraft.

Population Status Comparisons were made between 2000 and 2001 to evaluate population status. Population statistics for the 2001 survey and previous surveys are included in Tables 2, 3, and 4. In general, we estimated slightly more calves and cows and fewer bulls in 2001 compared to 2000.

The estimated calf/cow ratio suggests the proportion of calves in the population was higher in 2001 (27 calves/100 cows) then in 2000 (21 calves/100 cows)(Table 3). The percentage composition of calves also increased to 15% from the 11% observed in 2000.

The estimate of 9 yearling bulls/100 cows was similar to the 2000 estimate of 10 yearling bulls:100 cows (Table 3).

The estimated bull/cow ratio decreased from 72:100 in 2000 to 52:100 in 2001. Although we observed 8% fewer bulls in 2001 (Table 4), this decrease was limited to mature bulls and yearling bulls observed increased by 75% (Table 5).

Figure 2 compares the population estimates for the 2,269 square mile area from 1999 to 2001. Due to the overlapping variance in annual population estimates, a statistically significant change cannot be detected between years. However, the general population trend suggests growth of the herd is stable.

COSTS

The total cost of the survey was $16,842.30. See Table 6 for a listing of itemized expenditures.

ACKNOWLEDGMENTS

We appreciate the cooperation of Russ Oates (Project Leader, Division of Migratory Birds, USFWS-Anchorage) Richard Voss, and Bob Schulz (Refuge Managers, Arctic and Kanuti National Wildlife Refuges, USFWS) for allowing staff planes and/or pilots Ed Mallek, Paul Anderson, Don Carlson to assist in the survey. We appreciate the assistance of contract pilots Marty Webb (Tundra Ltd.), and Sandy Hamilton (Arctic Air Alaska). Thanks to observers Jim Akaran (USFWS), Steve Gjelm (Natural Resources Department, Stevens Village), Barry Whitehill (USFWS), and Paul Williams, Sr. (USFWS). Thanks also to Jay Ver Hoef and Bob Stephenson (ADF&G) for providing survey maps, technical assistance, data analysis, and reviewing this report.

We also wish to thank the Beaver Village Council for coordinating food and lodging accommodations, the Beaver Cruikshank school for providing lodging, and to Beaver resident Carol Thomas for preparing meals.

REFERENCES

Gasaway, W.C., S.D. DuBois, D.J. Reed, and S.J. Harbo. 1986. Estimating moose population parameters from aerial surveys. Biol. Pap. 22 University of Alaska. 108pp.

Ver Hoef, J. M. 2001. Predicting finite populations from spatially correlated data. 2000 Proceedings of the Section on Statistics and the Environment of the American Statistical Association, pp. 93-98.

Figure 1. Moose survey area, western Yukon Flats, 2001.

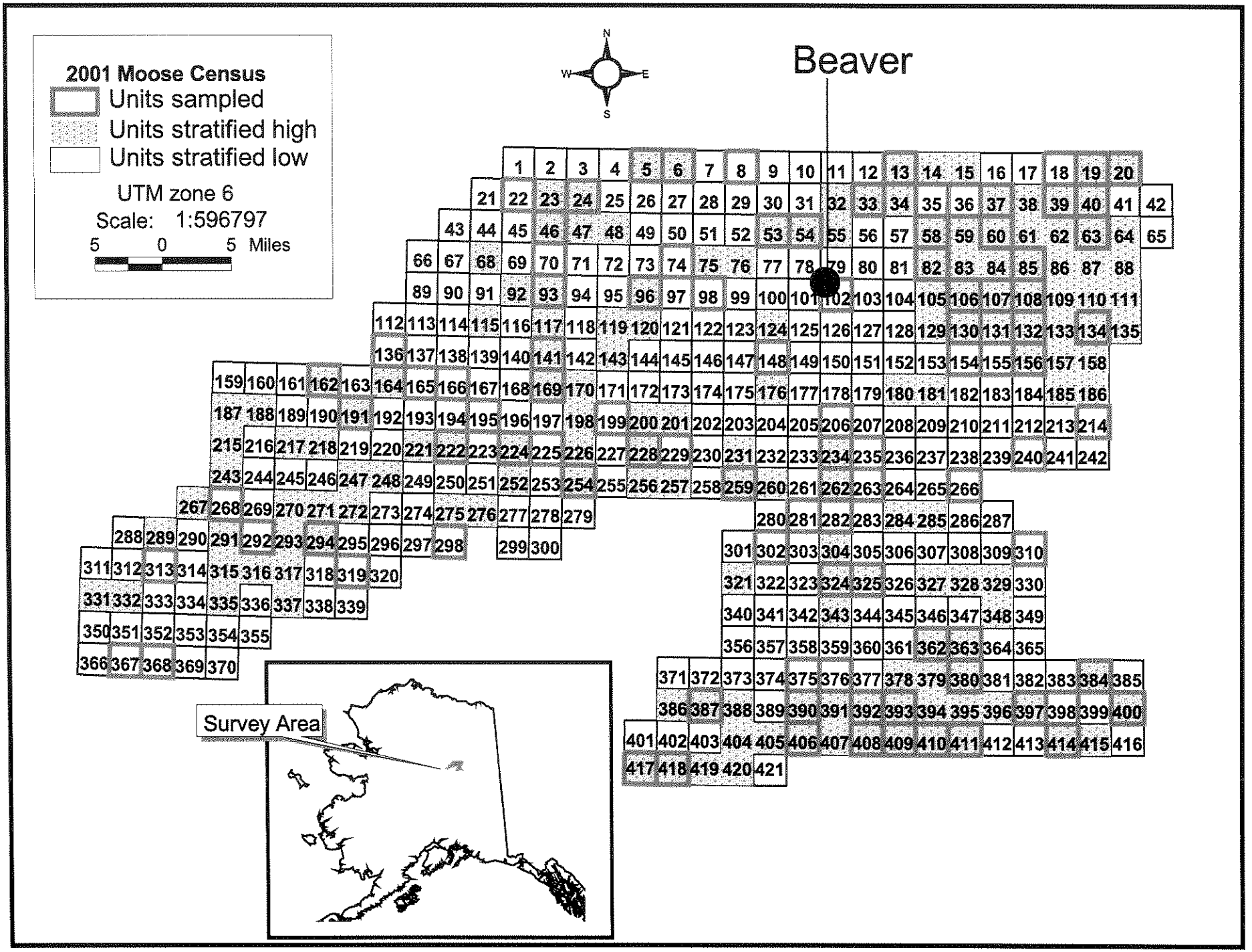


Figure 2. Estimated moose density in 2,269 square miles on the western Yukon Flats,1999 to 2001

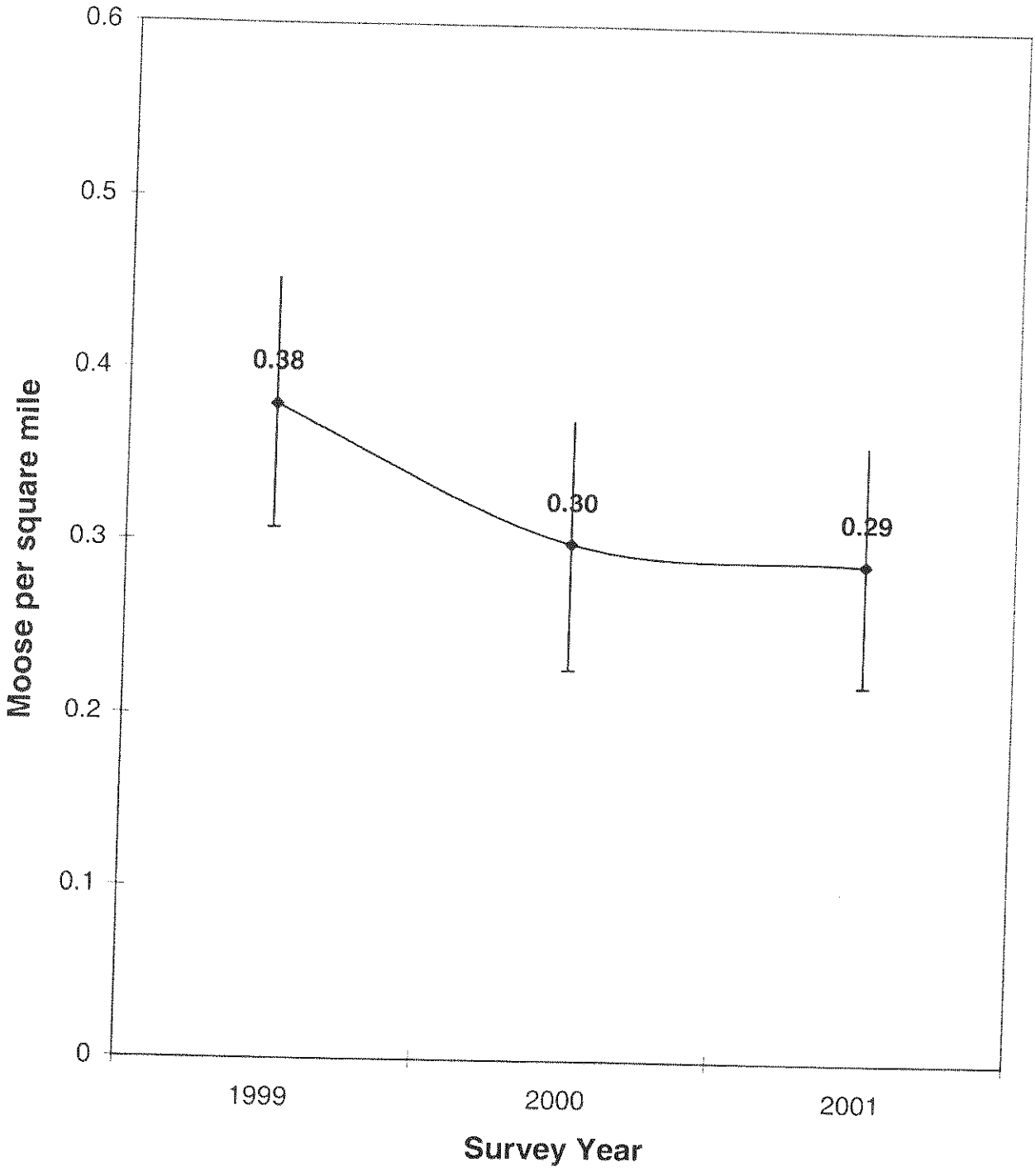


Table 1. Summary of stratifications for moose population estimation surveys on the western Yukon Flats, 1992 to 2001.

Year	Area (square miles)	Stratified Units			Sampled Units			Total Time Hours/Minutes	Minutes Per Square Mile	Minutes Per Unit
		#High	# Med	#Low	#High	#Med	#Low			
		Area (sq mi)			Area (sq mi)					
Nov 1992 Stratified Random	4544	26	42	283	26	30	20			
		348	515	3682	343	379	286			
Nov 1992 Stratified Random	1532	14	25	80	14	20	3			
		184	308	1040	184	247	46			
Nov 1996[1] Regression Analysis	1532	37	41	41	9	9	9	12' 53"	0.50	--
		539	516	476	124	122	120			
March 1999 GSPE	2269	103	--	318	49	--	47	9' 38"	0.26	1.4
		554	--	1714	264	--	253			
Oct 1999 GSPE	2269	153	--	268	64	--	29	11' 20"	0.30	1.6
		825	--	1444	345	--	156			
Oct 2000 GSPE	2269	183	--	238	69	--	25	12' 24"	0.33	1.7
		987	--	1281	371	--	124			
Nov 2001 GSPE	2269	166	--	255	61	--	37	8' 29"	0.23	1.2
		895	--	1374	334	--	199			

2001 Observers - Steve Hjelm, Paul Williams, Pilot - Ed Mallek,
Navigator - Mark Bertram.

[1] In 1996 the samples units were not stratified high, medium and low. Number in the high, medium, and low columns indicate the total area and area sampled in the Stevens, Beaver, and Schwatka survey units, respectively.

Table 2. Summary of survey statistics and population and density estimates for moose population surveys on the western Yukon Flats, 1992 to 2001.

Survey Year and Type	Unit Size (square miles) (# sample units)	Area Searched (square miles) (# sample units)	Minutes Searched per square mile	# Moose	Moose per square mile	0.90 Confidence Level	Sightability Correction Factor
Nov. 1992 Stratified Random	4544 (351)	1008 (76)		602	0.14	0.22	0.15
Nov. 1992 Stratified Random	1531 (119)	575 (43)	5.0	455	0.30	0.33	0.17
Nov. 1996 Regression Analysis	1531 (119)	366 (27)	4.7	666	0.44	0.21	0.05
March 1999[1] GSPE	2269 (421)	517 (96)	5.1	735	0.32	0.21 (0.95CI)	N/A
Oct. 1999 GSPE	2269 (421)	501 (93)	6.4	862	0.38	0.19	N/A
Oct. 2000 GSPE	2269 (421)	495 (92)	5.5	670	0.30	0.24	N/A
Nov 2001 GSPE	2269 (421)	533 (98)	6.1	667	0.29	0.24	N/A

[1] This survey was conducted in March, all other surveys were conducted in October and November. These data are included to represent late winter density on the western Yukon Flats. Because moose distribution in March and October/November are not comparable, the moose density and population estimates in the March survey will not be compared with October/November surveys to detect change over time.

Table 3. Summary of estimated sex and age composition for moose population estimation surveys on the western Yukon Flats, 1992 to 2001.

Survey Year / Area Size(mi^2)	Total Bulls	Total Cows	Total Calves	Total Moose	Bulls/ 100 Cows	Yrl Bulls/ 100 Cows	Calves/ 100 Cows	% Bulls	% Cows	% Calves	Moose per square mile
1992 / 4544	224	317	78	619	71	12	25	36	51	13	0.14
1992 / 1532	134	252	69	455	53	9	28	30	55	15	0.30
1996 / 1532	184	340	142	666	54	10	42	28	51	21	0.44
1999[1] / 2269	n/a	n/a	64	735	n/a	n/a	n/a	n/a	n/a	9	0.31
1999 / 2269	165	529	168	862	31	6	31	19	61	20	0.38
2000 / 2269	247	345	74	670	72	10	21	37	52	11	0.30
2001 / 2269	194	375	101	668	52	9	27	29	56	15	0.29

[1] This survey was conducted in March. All other surveys were conducted in October/November.

Table 4. Summary of observed moose during moose surveys on the western Yukon Flats, 1983 to 2001.

Survey Year	Area Size square miles	Total Bulls	Total Cows	Total Calves	Total Moose	Bulls/ 100 Cows	Yrl Bulls/ 100 Cows	Calves/ 100 Cows	% Bulls	% Cows	% Calves	Moose per square mile
1983[a]	119	13	15	13	41	87	27	87	32	37	31	0.34
1984[a]	56	1	1	1	3	100	100	0	33	33	34	0.05
1985[a]	140	20	20	10	50	100	40	50	40	40	20	0.36
1986[a]	233	52	70	19	141	74	21	27	37	50	13	0.61
1987[a]	170	36	51	13	100	71	8	25	36	.1	13	0.59
1988[a]	174	38	45	13	96	84	18	29	40	47	13	0.55
1989	no survey in western Yukon Flats											
1990[a]	53	7	16	4	27	44	12	25	26	59	15	0.51
1991[a]	237	48	49	15	112	98	8	31	43	44	13	0.47
1992[b]	109	19	27	5	51	70	11	19	37	53	10	0.47
1992[c]	1009	154	191	48	393	81	15	25	39	49	12	0.39
1992[d]	476	117	150	39	306	78	13	26	38	49	13	0.64
1993[e]	170	29	57	17	103	51	14	30	28	55	17	0.61
1994	104	30	26	9	65	115	23	35	46	40	14	0.63

Table 4. Summary of observed moose during moose surveys on the western Yukon Flats, 1983 to 2001, continued...

Survey Year	Area Size square miles	Total Bulls	Total Cows	Total Calves	Total Moose	Bulls/ 100 Cows	Yrl Bulls/ 100 Cows	Calves/ 100 Cows	% Bulls	% Cows	% Calves	Moose per square mile
1995	no survey in western Yukon Flats											
1996[f]	366	105	168	57	330	54	11	34	32	51	17	0.90
1997	no survey in western Yukon Flats											
1998	no survey in western Yukon Flats											
1999[g]	517	unk	unk	26	248	unk	unk	unk	unk	unk	10	0.48
1999	501	52	161	56	269	32	6	35	19	60	21	0.50
2000	495	75	117	28	220	64	7	24	34	53	13	0.44
2001	533	69	154	49	272	45	9	32	25	57	18	0.51

[a] includes the Meadow Creek, Mud Lakes, and Schwatka trend units
[b] includes trend units within 4,500 mi^2 survey area
[c] data from the 1992 4,500 mi2 Gasaway survey
[d] data is a 1,500 mi2 area within the 1992 4,500 mi^2 survey area, ie, comparable to the 1996 survey area
[e] includes only the Meadow Creek and Mud Lakes trend areas
[f] data from the 1996 regression estimator survey of 1500 mi^2
[g] data from the March 1999 GSPE survey

Table 5. Observed bulls in moose population surveys, western Yukon Flats, 1996 to 2001.

Year	Yearling Bull	Medium Bull (30"-50")	Large Bull (>50")	Total Bull
1996	18	29	60	107
1999	10	22	20	52
2000	8	24	43	75
2001	14	16	39	69

Table 6. Expenditures for moose population survey, western Yukon Flats, 2001.	
Cost item	subtotal
Flight time	
Stratification	
755: 13.1 hours x $104/hr (dry)	
subtotal.....	1362.40
Survey	
20HY: 20.6 hours x $93 (dry) = 1915.80	
N13833: 16 hours x $93 (dry) = 1488.00	
74996: 20.2 x $93 (dry) = 1878.60	
N8578D: 11.2 hours x $155 (dry) = 1745.40	
N3741Z:18.16 hours x $155 (dry) = 2950.10 (total of 86 hours for light utility aircaft)	
subtotal.....	9977.90
Fuel (contract w/Evert's to fill 1,000 gal tank at Beaver used ~ 14 bbl)	3490.00
Food (purchase-$432, freight-$60, contract for food preparation-$480)	972.00
Lodging (contract w/Cruikshank school)	1040.00
Misc. gear (cots, gear bags, airfare, overtime)	0.00
TOTAL.....	**$16,842.30**