



**Yukon Flats National Wildlife Refuge Report – 2010**

**Moose population survey of the western  
Yukon Flats – November 2010**

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## **ABSTRACT**

A moose population survey was conducted on the Yukon Flats National Wildlife Refuge in November 2010. The estimate for the 2,269mi<sup>2</sup> survey area in the western Yukon Flats (Game Management Unit [GMU] 25D) was 440 moose (95% confidence interval; 294-587 moose). Density of moose was 0.19/mi<sup>2</sup>. The population was comprised of 265 cows (95% CI; 170-361), 85 calves (45-125), and 93 bulls (49-137). Search time averaged 6.5 minutes/mi<sup>2</sup>. The 2010 estimate of total moose was 10% less than the November 2008 estimate of 490 (412-569). Due to fog and winds in mountainous terrain, 7 units went unsampled, 3 of which had good numbers of moose in past surveys. Accounting for the 7 unsampled units increased the estimate of total moose to approximately 460, using averages of counts in those units since 2004.

## INTRODUCTION

Moose (*Alces alces*) are an important food resource and the Refuge is legally mandated to provide the opportunity for continued subsistence use by local residents. Aerial population surveys are conducted in order to provide managers with data on moose numbers and measures of recruitment and productivity. These data are used in making harvest decisions and contribute to our understanding on the quantity and quality of an important wildlife resource.

Surveys on the Yukon Flats National Wildlife Refuge are conducted in two separate areas, one in the eastern Refuge (2,936 mi<sup>2</sup>) that includes the villages of Fort Yukon and Chalkyitsik, and the other in the western Refuge (2,269 mi<sup>2</sup>) that includes the villages of Stevens Village and Beaver (Figure 1). The western survey is conducted by the Refuge and local village residents and the eastern survey is conducted by the Alaska Department of Fish and Game (ADF&G) and the Council of Athabascan Tribal Governments (CATG). This report summarizes results of the November 2010 survey of the western Yukon Flats. Information about the eastern Yukon Flats survey area can be found in Caikoski and Thomas (2007).

## OBJECTIVES

1. Estimate numbers of calves, cows, bulls, and total moose in a 2,269mi<sup>2</sup> survey area in the western Refuge.
2. Estimate the ratio of calves/cows and bulls/cows.

## STUDY AREA

The study 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 areas and include much of the uplands south and west of Beaver and areas north of the Porcupine River.

The western Yukon Flats traditional study area extends from White Eye (near the lower mouth of Birch Creek), south to Mt. Schwatka, and west to Stevens Village (Figure 1). The survey area is 2,269 square miles.

## METHODS

Moose population estimation surveys were conducted according to methods outlined in Gasaway et al. (1986) and Ver Hoef (2001). Gasaway methods provide the foundation for geospatial methods. The publications, “GeoSpatial Population Estimator Software User’s Guide” (DeLong 2006), and “GeoSpatial Survey Operations Manual” (Kellie and DeLong 2006) provided

guidelines for sample unit design and selection, navigation, and data analysis. Two computer software programs, Moosepop (Gasaway et al. 1986) and the GeoSpatial Population Estimator (GSPE) were used to analyze data.

Sample units were stratified using previously collected data, commonly termed a desktop stratification (Kellie and DeLong 2006). This differed from past GSPE surveys (1999-2008) when stratification was done by an over flight with a 4-place aircraft. The decision to stratify using prior data instead of an over flight was based on estimates of precision from the western and eastern surveys. Whereas the western survey has been stratified each time using an over flight, the eastern survey is often stratified using prior data. Comparison of precision revealed little difference, thus the added expense of an additional aircraft was deemed unnecessary. Sample units were stratified as high using three criteria: 1)  $\geq 1$  moose observed in a unit in any year from 2004 to 2008, 2) for units where a count had never been conducted, the result of the 2008 over flight stratification was used, and 3) units surrounded on four sides by highs were classified high. The units that fell under this criterion were 59, 62, 82, 86, 109, 156, 204, 207, and 246.

Five tandem seat fixed-wing aircraft (4 Piper Super Cub, 1 Aviat Husky) were used to survey 5.3 mi<sup>2</sup> units bounded by two minutes of latitude (north to south) by five minutes of longitude (east to west). Sampling aircraft used GPS to navigate to and within assigned units. Search intensity varied with habitat. The survey protocol required high search intensity in forested habitats (8-10 minutes per square mile) and lower intensity in open habitats or areas with significant water (usually the Yukon River). Survey aircraft generally flew 12 to 15 east/west transects in each unit, about 200 to 300 meters apart, at 200 to 300 feet AGL at 70 knots. However, north to south transects were flown when adjacent north and south units were assigned for survey or because of strong westerly winds experienced on two days in 2010.

## RESULTS

### Stratification

Forty-two percent (n=175) of the survey area was stratified as high density, the remaining 246 units were low density (Table 1, Figures 2, 3).

### Unit Sampling

Between 15-18 November survey aircraft sampled 96 (23%) of 421 units in the western Yukon Flats (Table 1). These included 63 (36%) of the 175 units stratified as high density and 33 (13%) of the 246 units stratified as low density (Table 1). Temperatures ranged from -20 to 20° F but were primarily about 10° F. Mean search time was 6.5 minutes per mi<sup>2</sup> (Table 2). We observed 128 moose, including 22 calves, 76 cows, and 30 bulls (Table 3).

### Population Status

There was little evidence of spatial autocorrelation in the data set, and therefore, results between the Moosepop and GSPE analysis programs were generally similar. The following population

estimates are based on estimation with the GSPE. The population estimate for the 2,269 mi<sup>2</sup> western Yukon Flats survey area was 440 moose (95% CI; 294-587 moose; Tables 4 and 5). The population was comprised of 265 cows (95% CI; 170-361), 85 calves (45-125), and 93 bulls (49-137; Table 4). Density of moose was 0.19/mi<sup>2</sup>. The ratio of calves to cows was 32 calves/100 cows (95% CI; 13-51) and bulls to cows was 35 bulls/100 cows (95% CI; 14-56). The trend in numbers of total moose was negative (Figure 4). Density in the western survey area was generally similar to the eastern survey area (Table 5).

## DISCUSSION

Numbers of total moose were reduced from 2008, but greater than 2006. Numbers remain below the goal of the moose management plan (ADF&G 2002). Densities since the inception of the survey remain low (< 0.4 moose/km<sup>2</sup>) and are consistent with the low density dynamic equilibrium described by Gasaway et al. (1992). Gasaway et al. (1992) noted that in many areas across Alaska and the Yukon, moose persist at a low density below K where both wolves and bears are present and lightly harvested. Illegal cow harvest likely also contributes to low densities across the Yukon Flats.

Ratios of calves to cows were 32:100. This value was lower than four growing populations of moose at Togiak (30-68:100 during 1998-2006, Aderman 2008), the middle Yukon River (61:100 during 2010, E. Wald, unpubl. data), lower Yukon River (69:100 in 2010, E. Wald, unpubl. data), and lower Kuskokwim River (49-73:100 during 2007-2010, E. Wald, unpubl. data). The bull to cow ratio was high, above levels desired by managers in order to maintain sufficient numbers of breeding bulls (30:100), and lower than populations in remote, inaccessible areas where harvest is minimal (60-80:100). If cows are illegally harvested, then bull to cow ratios would be elevated.

Harvest of moose is restricted to bulls only in this region. Bull densities following the fall hunting season were 0.04 per mi<sup>2</sup> overall. Where counts were conducted, densities were 0.01 per mi<sup>2</sup> in low and 0.08 per mi<sup>2</sup> in high density units. If density is related to harvest opportunity, then hunters could increase their opportunity by targeting units of high density (Figure 3), of which many are around the village of Beaver and along the Yukon River corridor where access is good. Recently, a moose management meeting was held in Beaver, and one topic discussed was aligning state and federal seasons in an attempt to make hunting regulations less confusing and to make it easier for a hunter to harvest a moose without worrying about land status. Most bulls observed during this survey are in the medium (30-50 inches wide) to large (>50 inches wide) antler class, with few yearling bulls. This result likely reflects low recruitment and greater harvest on yearling bulls, which are more naïve.

### Shortcomings and Future Improvements

The precision of this year's estimate of total moose was poorer compared to past surveys where stratification was done by an over flight of sample units. Elimination of a stratification plane saved approximately \$6,000 based on flight hours from past stratifications and aviation fuel costs. If adequate funds are available, the precision of the estimate can be improved with stratification by over flight.

We were unable to sample 7 units located in the White Mountains due to persistent high winds or fog in valleys. Numerous attempts were made and all failed. Of the 7, 3 are high density units and in past surveys (2004-present) averaged 7 moose per unit, whereas in the 4 low density units counts averaged 0. The estimate of total moose would have increased to approximately 460, using averages of counts since 2004 in the 7 unsampled units.

This survey does not estimate detection of moose and instead assumes that detection is constant across years. If this assumption is not met, interpretation of annual variation in moose numbers is more difficult. In addition, estimates of moose numbers would increase if adjusted for detection. The detectability of moose on this survey is a question that should be investigated in the future. A mark-recapture estimate of detection could be obtained with collared moose, or double sampling could be used (Kellie and DeLong 2006).

### **ACKNOWLEDGEMENTS**

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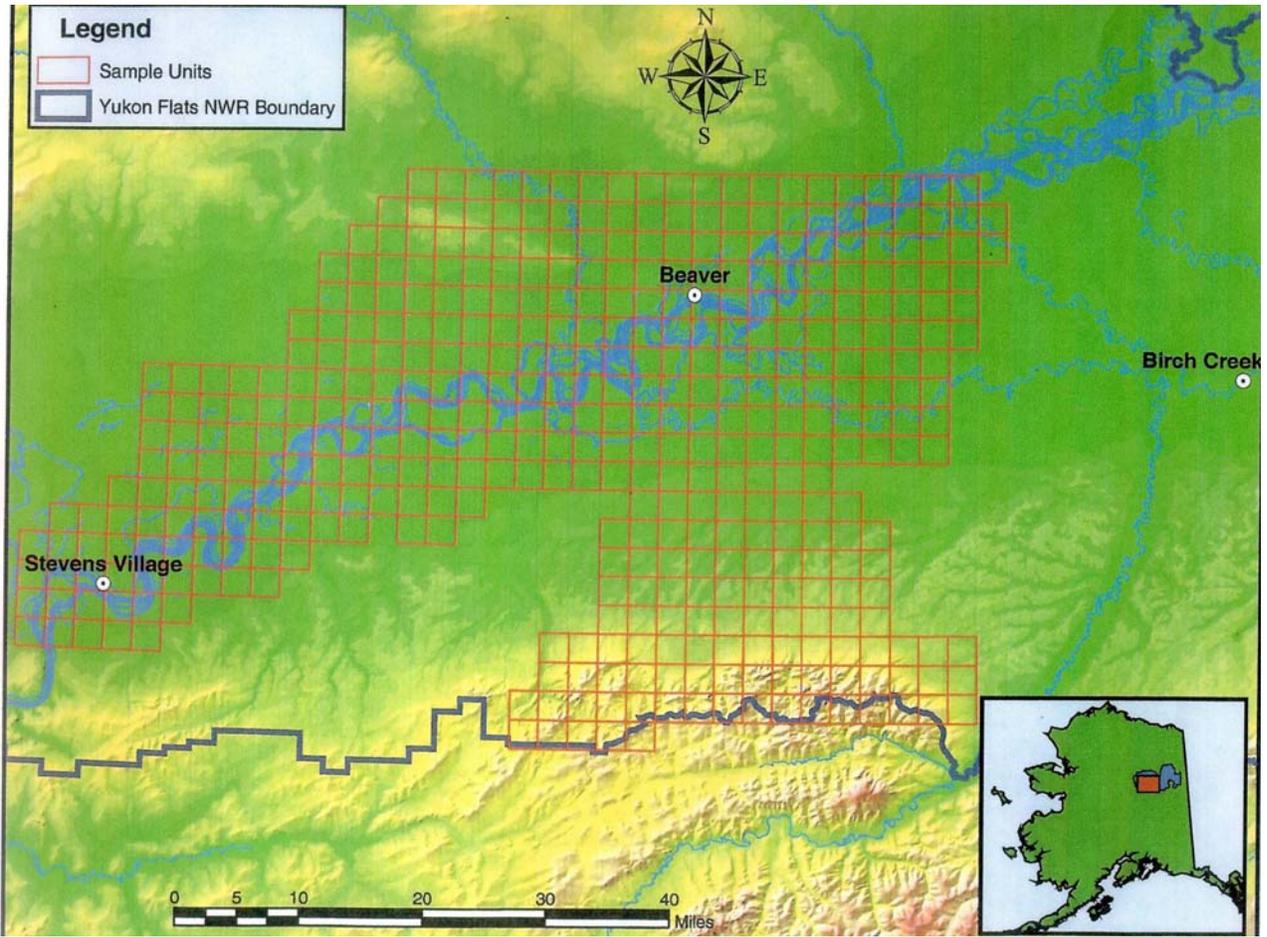


Figure 1. Location of moose survey units in the western Yukon Flats, November 2010.



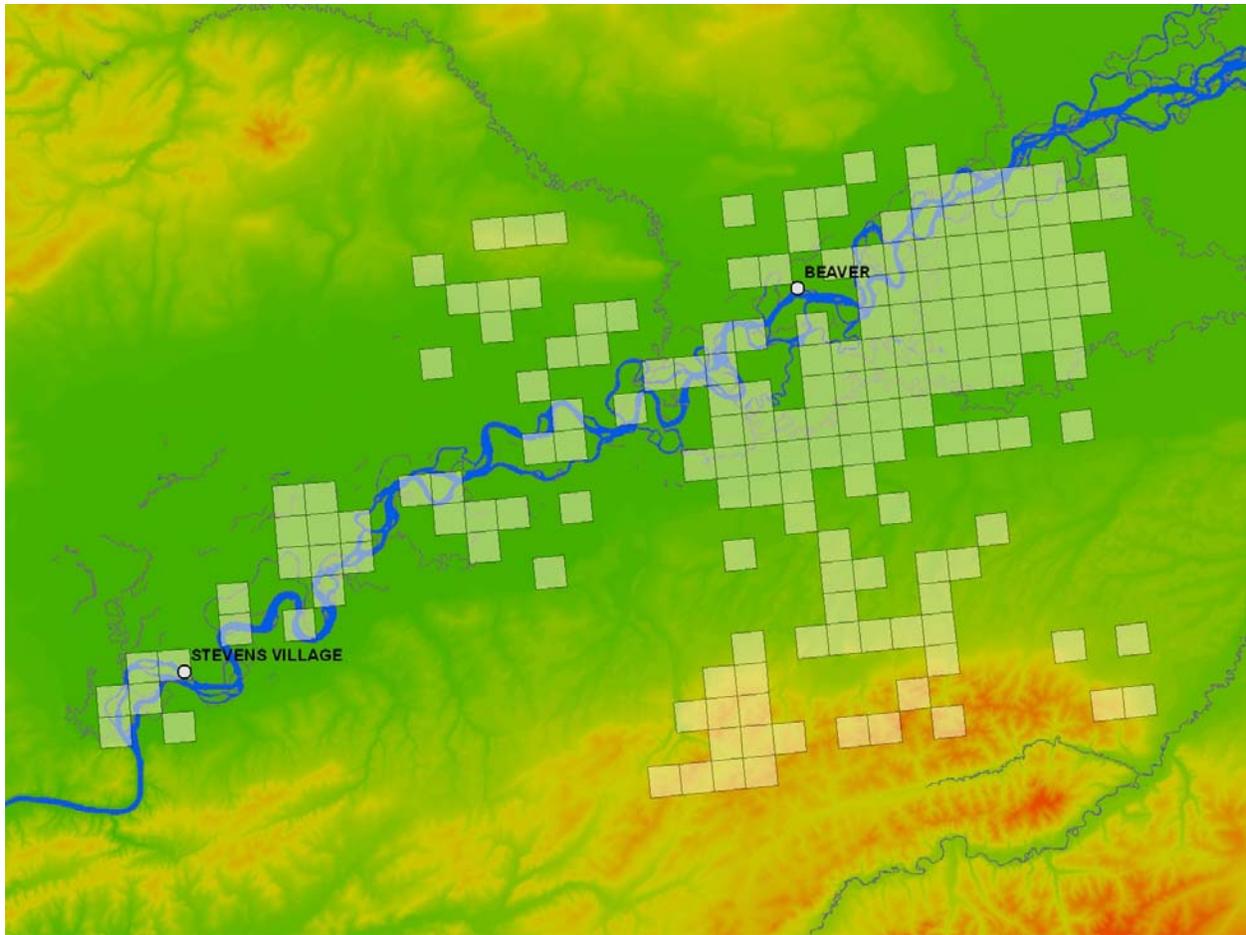


Figure 3. Moose survey units stratified as high density.

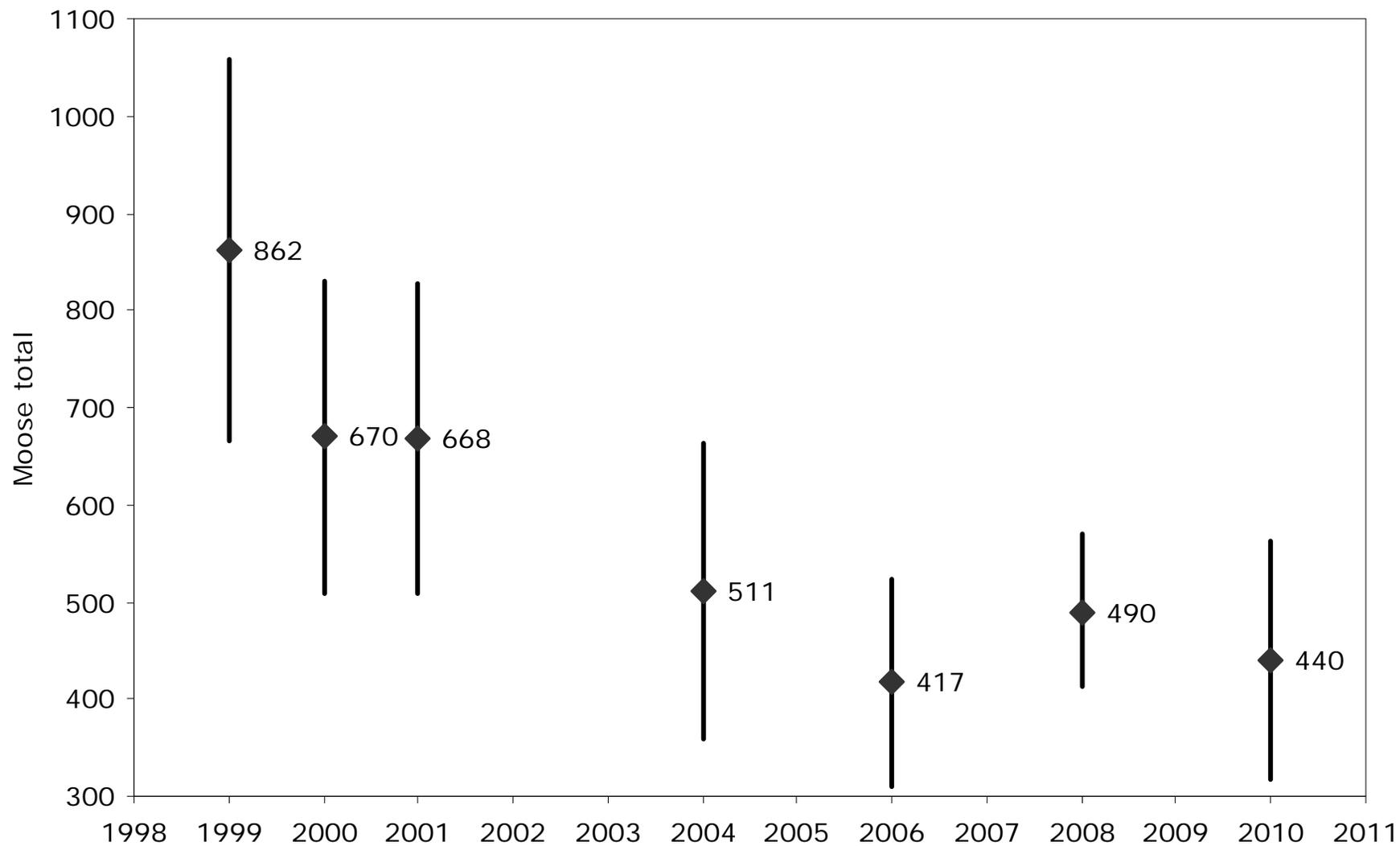


Figure 4. Estimated fall moose total (with 90% confidence interval) for the western Yukon Flats.

Table 1. Summary of stratification and sampled units for moose population estimation surveys in the western Yukon Flats, 1992 to 2010.

Survey Year and Type	Area (mi <sup>2</sup> )	Stratified Units (mi <sup>2</sup> )			Sampled Units (mi <sup>2</sup> )			Total Time Hours/Minutes	Minutes Per Square Mile	Minutes Per Unit
		#High	# Med	#Low	#High	#Med	#Low			
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 <sup>1</sup> Regression Analysis	1532	37	41	41	9	9	9	12' 53"	0.50	--
		539	516	476	124	122	120			
Mar 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			
Mar 2003 GSPE	2269	109	--	312	63	--	38	12' 11"	0.32	1.7
		587	--	1682	340	--	206			
Mar 2004 GSPE	2269	102	--	319	51	--	40	9' 52"	0.26	1.4
		548	--	1720	274	--	216			
Nov 2004 GSPE	2269	130	--	291	65	--	28	9' 29"	0.25	1.4
		700	--	1569	350	--	151			
Mar 2006 GSPE Exchange Lands	578	37	--	70	22	--	20	2'41"	0.27	1.5
		200	--	378	119	--	108			
Nov 2006 GSPE	2269	122	--	299	65	--	32	12' 41"	0.23	1.2
		656	--	1612	349	--	172			
Nov 2006 GSPE Exchange Lands	1,108	70	--	136	29	--	29	Included in above	Included in above	Included in above
		374	--	735	155	--	157			
Mar 2008 GSPE	2269	118	-	303	73	-	38	9'15"	0.24	1.3
		635	-	1634	393	-	205			
Nov 2008 GSPE <sup>2</sup>	2420	156	--	303	101	--	73	10'44"	0.26	1.4
		839	--	1630	544	--	393			

Table 1. Summary of stratification and sampled units for moose population estimation surveys in the western Yukon Flats, 1992 to 2010, continued.

Survey Year and Type	Area (mi <sup>2</sup> )	Stratified Units (mi <sup>2</sup> )			Sampled Units (mi <sup>2</sup> )			Total Time Hours/Minutes	Minutes Per Square Mile	Minutes Per Unit
		#High	# Med	#Low	#High	#Med	#Low			
Nov 2010 GSPE <sup>3</sup>	2269	175	--	246	63	--	33	N/A	N/A	N/A
		943	--	1326	339	--	178			

<sup>1</sup> 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

<sup>2</sup>Includes 38 units stratified for ADF&G BIMMA. These units are outside the survey area and data from these units are not included as part of the 2008 survey. Information from these units was not included in the sampled units column

<sup>3</sup>From desktop stratification of prior data. See methods for detailed description.

Table 2. Summary of survey statistics and population and density estimates for moose population surveys in the western Yukon Flats, 1992 to 2010

Survey Year and Type	Unit Size (mi <sup>2</sup> ) (# sample units)	Square miles searched (# sample units)	Minutes Searched per square mile	# Moose	0.90 Confidence Level (#Moose)	Density (moose/mi <sup>2</sup> )	Sightability Correction Factor
Nov 1992 Stratified Random	4544 (351)	1008 (76)		602	0.22	0.14	0.15
Nov 1992 Stratified Random	1531 (119)	575 (43)	5.0	455	0.33	0.30	0.17
Nov 1996 Regression Analysis	1531 (119)	366 (27)	4.7	666	0.21	0.44	0.05
Mar 1999 <sup>1</sup> GSPE	2269 (421)	517 (96)	5.1	735	0.21 (0.95CI)	0.32	N/A
Oct 1999 GSPE	2269 (421)	501 (93)	6.4	862	0.19	0.38	N/A
Oct 2000 GSPE	2269 (421)	495 (92)	5.5	670	0.24	0.30	N/A
Nov 2001 GSPE	2269 (421)	533 (98)	6.1	667	0.24	0.29	N/A
Mar 2003 <sup>1</sup> GSPE	2269 (421)	546 (101)	6.2	509	0.29	0.23	N/A
Mar 2004 <sup>1</sup> GSPE	2269 (421)	490 (91)	6.2	632	0.20	0.28	N/A
Nov 2004 GSPE	2269 (421)	500 (93)	7.3	511	0.25	0.23	N/A
Mar 2006 <sup>1</sup> GSPE Exchange Lands	578 (107)	227 (42)	4.8	65	0.33	0.11	N/A
Nov 2006 GSPE	2269 (421)	522 (97)	5.7	418	0.21	0.18	N/A
Nov 2006 GSPE Exchange Lands	1108 (206)	312 (58)	5.7	249	0.31	0.22	N/A
Mar 2008 GSPE <sup>1</sup>	2269 (421)	597 (111)	6.5	300	0.20	0.13	N/A
Nov 2008 GSPE	2269 (421)	936 (174)	6.3	490	0.13	0.22	N/A
Nov 2010 GSPE	2269 (421)	517 (96)	6.5	440	0.28	0.19	N/A

<sup>1</sup>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 observed moose during surveys in the western Yukon Flats, 1983 to 2010.

Survey Year	Area Size (mi <sup>2</sup> )	Total Bulls	Total Cows	Total Calves	Total Moose	Bulls/ 100 Cows	Yrl Bulls/ 100 Cows	Calves/ 100 Cows	% Bulls	% Cows	% Calves	Moose per mi <sup>2</sup>
1983 <sup>a</sup>	119	13	15	13	41	87	27	87	32	37	31	0.34
1984 <sup>a</sup>	56	1	1	1	3	100	100	0	33	33	34	0.05
1985 <sup>a</sup>	140	20	20	10	50	100	40	50	40	40	20	0.36
1986 <sup>a</sup>	233	52	70	19	141	74	21	27	37	50	13	0.61
1987 <sup>a</sup>	170	36	51	13	100	71	8	25	36	.1	13	0.59
1988 <sup>a</sup>	174	38	45	13	96	84	18	29	40	47	13	0.55
1989	no survey in western Yukon Flats											
1990 <sup>a</sup>	53	7	16	4	27	44	12	25	26	59	15	0.51
1991 <sup>a</sup>	237	48	49	15	112	98	8	31	43	44	13	0.47
1992 <sup>b</sup>	109	19	27	5	51	70	11	19	37	53	10	0.47
1992 <sup>c</sup>	1009	154	191	48	393	81	15	25	39	49	12	0.39
1992 <sup>d</sup>	476	117	150	39	306	78	13	26	38	49	13	0.64
1993 <sup>e</sup>	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
1995	no survey in western Yukon Flats											
1996 <sup>f</sup>	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 <sup>g</sup>	517	n/a	n/a	26	248	n/a	n/a	n/a	n/a	n/a	10	0.48

Table 3. Summary of observed moose during surveys in the western Yukon Flats, 1983 to 2010, continued...

Survey Year	Area (mi <sup>2</sup> )	Total Bulls	Total Cows	Total Calves	Total Moose	Bulls/100 Cows	Yrl Bulls/100 Cows	Calves/100 Cows	% Bulls	% Cows	% Calves	Moose (mi <sup>2</sup> )
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
2002	no survey in western Yukon Flats											
2003 <sup>g</sup>	546	-	-	33	201	-	-	-	-	-	16	0.37
2004 <sup>g</sup>	572 <sup>h</sup>	-	-	34	243	-	-	-	-	-	14	0.43
2004	500	59	80	29	168	74	8	36	35	48	17	0.34
2005	Survey initiated but cancelled due to inadequate snow cover											
2006 <sup>gi</sup>	227	-	-	2	31	-	-	-	-	-	1	0.14
2006	522	64	90	21	175	71	12	23	37	51	12	0.36
2006 <sup>i</sup>	312	38	55	8	101	69	13	15	38	54	8	0.32
2008 <sup>g</sup>	597	-	-	16	145						11	0.24
2008	936	71	136	54	261	52	2	40	27	52	21	0.28
2010	517	30	76	22	128	39	4	29	24	59	17	0.25

<sup>a</sup> includes the Meadow Creek, Mud Lakes, and Schwatka trend units

<sup>b</sup> includes trend units within 4,500 mi<sup>2</sup> survey area

<sup>c</sup> data from the 1992 4,500 mi<sup>2</sup> Gasaway survey

<sup>d</sup> data is a 1,500 mi<sup>2</sup> area within the 1992 4,500 mi<sup>2</sup> survey area, ie, comparable to the 1996 survey area

<sup>e</sup> includes only the Meadow Creek and Mud Lakes trend areas

<sup>f</sup> data from the 1996 regression estimator survey of 1500 mi<sup>2</sup>

<sup>g</sup> data from Spring GSPE survey

<sup>h</sup> note that we dropped 17 plots from calculations for the estimate because they were biased but they are included here for observed moose

<sup>i</sup> includes proposed land exchange areas

Table 4. Summary of estimated sex and age composition for moose population estimation surveys in the western Yukon Flats, 1992 to 2010. Numbers in parentheses represent 95% confidence intervals.

Survey Year Area Size(mi <sup>2</sup> )	Total Bulls	Total Cows	Total Calves	Total Moose	Bulls/ 100 Cows	Yr/ Bulls/ 100 Cows	Calves/ 100 Cows	% Bulls	% Cows	% Calves	Moose per square mile
Nov 1992 4544	224	317	78	619	71	12	25	36	51	13	0.14
Nov 1992 1532	134	252	69	455	53	9	28	30	55	15	0.30
Nov 1996 1532	184	340	142	666	54	10	42	28	51	21	0.44
Mar 1999 <sup>1</sup> 2269	--	--	64	735	--	--	--	--	--	9	0.31
Oct 1999 2269	165	529	168	862	31	6	31	19	61	20	0.38
Nov 2000 2269	247	345	74	670	72	10	21	37	52	11	0.30
Nov 2001 2269	194	375	101	668	52	9	27	29	56	15	0.29
Mar 2003 <sup>1</sup> 2269	--	--	71	528	--	--	--	--	--	13	0.23
Mar 2004 <sup>1</sup> 2269	--	--	94	632	--	--	--	--	--	15	0.28
Nov 2004 2269	179	247	85	511	72	5	35	35	48	17	0.23
Mar 2006 <sup>1</sup> Exchange Lands 578	--	--	3	65	--	--	--	--	--	5	0.11
Nov 2006 2269	147	230	51	418	65	18	22	34	54	12	0.18
Nov 2006 Exchange Lands 1108	89	138	25	249	65	12	18	35	55	10	0.22
Mar 2008 <sup>1</sup> 2269	--	--	34	300	--	--	--	--	--	11	0.13
Nov 2008 2269	127 (100- 155)	251 (203- 298)	110 (83- 137)	490 (412-569)	51 (38-64)	3 (-0.15 - 5)	44 (31-57)	26	51	22	0.22
Nov 2010 2269	93 (49- 137)	265 (170- 361)	85 (45- 125)	440 (294-587)	35 (14-56)	5 (0-9)	32 (13-51)	21	60	19	0.19

<sup>1</sup>Survey was conducted in March. All other surveys were conducted in October/November.

Table 5 Estimated moose population composition from surveys of eastern and western Yukon Flats (GMU 25D), in addition to Venetie and Birch Creek.

Survey period and area (mi <sup>2</sup> )	Total bulls	Total cows	Total calves	Total adults	Total moose (90% CI)	Bulls: 100 Cows	Yrig Bulls: 100 Cows	Calves: 100 Cows	% Bulls	% Cows	% Calves	Moose per mi <sup>2</sup>
<b>Eastern 25D</b>												
Fall 1995 (1534)	199	369	136	568	704±33%	54	8	37	28	52	19	0.46
Fall 1997 (1534)	208	372	45	580	625±36%	56	16	12	33	60	7	0.40
Fall 1999 (2936)	218	381	223	599	829±20%	57	24	59	26	46	27	0.28
Fall 2000 (2936)	252	319	156	571	726±25%	79	19	49	35	44	21	0.25
Fall 2001 (2936)	208	217	93	425	514±27%	95	17	43	40	42	18	0.18
March 2004 (2936)			66	316	382±20%						21	0.13
Fall 2004 (2936)	170	394	203	564	773±17%	43	10	51	22	51	26	0.26
Fall 2005 (2936)	337	419	243	761	1008±20%	80	22	58	34	42	24	0.34
Fall 2006 (2936)	243	407	151	650	799±17%	60	12	37	30	51	19	0.27
Fall 2007 (2936)	189	286	111	477	585±23%	64	15	39	32	50	19	0.20
<b>Venetie Survey</b>												
Fall 2004 (2858)	192	257	105	449	551±60%	75	24	41	37	46	19	0.19
Fall 2005 (2858)	94	213	123	293	423±32%	44	4	58	22	49	29	0.15
<b>Birch Ck., Survey</b>												
Fall 2006 (3630)	219	401	117	620	732±33%	55	8	29	30	55	16	0.20
<b>Western 25D</b>												
Fall 1992 (4544)	224	317	78	541	619±21	71	12	25	36	51	13	0.14
Fall 1992 (1531)	134	252	69	386	455±33%	53	9	28	30	55	15	0.30
Fall 1996 (1531)	184	340	142	524	666±21%	54	10	42	28	51	21	0.44
March 1999 (2296)	--	--	64	671	735±17%	--	--	--	--	--	9	0.31
Fall 1999 (2269)	165	529	168	694	862±19%	31	6	31	19	61	20	0.38
Fall 2000 (2269)	247	346	75	593	670±24%	71	12	22	37	52	11	0.30
Fall 2001 (2269)	193	375	100	568	668±24%	52		27	29	56	15	0.29
March 2003 (2269)	--	--	78	430	508± 29%	--	--	--	--	--	15	0.22
March 2004 (2269)			94	538	632±20%						15	0.28
Fall 2004 (2269)	179	247	85	426	511±25%	72	5	34	35	48	17	0.23
Fall 2006 (2269)	147	230	51	381	417±21%	65	18	22	35	55	12	0.18
March 2008 (2269)			34	266	300±20%	--	--	--	--	--	11	0.13
Fall 2008 (2269)	127	251	110	379	490±13%	51	3	44	26	51	22	0.22
Fall 2010 (2269)	93	265	85	356	440±28%	35	5	32	21	60	19	0.19

Appendix 1. Reported harvest of moose, wolves, and bears in the Yukon Flats (all villages), 2002 to 2008<sup>a</sup>

Year	Bull moose	Cow moose	Unk sex moose	Total moose	Proportion cow harvest	Wolf	Black bear	Grizzly bear	Unk sex bear	Total bear
2002/2003 <sup>b</sup>	121	33	2	156	21 to 22%	24	32	5	27	64
2004/2005 <sup>c</sup>	97	15	14	126	12 to 23%	50	73	23	24	120
2005/2006 <sup>d</sup>	188	17	23	228	7 to 18%	41	149	37	41	227
2006/2007 <sup>e</sup>	76	2	16	94	2 to 19%	38	78	17	0	95
2007/2008 <sup>e</sup>	75	2	0	77	3%	30	68	22	0	90
2008/2009 <sup>f</sup>	Unk	Unk	Unk	104		45	26	2		28

<sup>a</sup> data from Council of Athabascan Tribal Governments 2003, 2005, 2006, 2007, 2008

<sup>b</sup> 88% of Yukon Flats households surveyed, Chalkyitsik not surveyed

<sup>c</sup> 42% of Yukon Flats households surveyed

<sup>d</sup> 50% of Yukon Flats households surveyed

<sup>e</sup> all Yukon Flats households surveyed except only a subsample taken from Fort Yukon

<sup>f</sup> Alaska Department of Fish and Game Subsistence Division 2010

Appendix 2. Reported harvest of moose, wolves, and bears in the western Yukon Flats (Beaver, Stevens Village, and Birch Creek)<sup>a</sup>, 2002 to 2008<sup>b</sup>

Year	Bull moose	Cow moose	Unk sex moose	Total moose	Proportion cow harvest	Wolf	Black bear	Grizzly bear	Unk sex bear	Total bear
2002/2003 <sup>b</sup>	31	11	0	42	26%	5	6	0	27	33
2004/2005 <sup>c</sup>	35	7	3	45	16 to 22%	12	27	8	4	39
2005/2006 <sup>d</sup>	26	6	0	32	19%	14	17	0	0	17
2006/2007 <sup>e</sup>	11	1	5	17	6 to 35%	3	8	3	0	11
2007/2008 <sup>e</sup>	9	0	0	9	0%	10	13	2	0	15

<sup>a</sup> includes Beaver, Stevens Village and Birch Creek

<sup>b</sup> data from Council of Athabaskan Tribal Governments 2003, 2005, 2006, 2007

<sup>c</sup> 42% of Yukon Flats households surveyed

<sup>d</sup> 50% of Yukon Flats households surveyed

<sup>e</sup> all Yukon Flats households surveyed except only a subsample taken from Fort Yukon

Appendix 3. Expenditures for moose population surveys in the western Yukon Flats, November 2010.

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Survey: 41Z: 21.84 hours x \$209	4,564.56
04D: 20.01 hours x \$195	3,958.48
87S: 14.1 hours x \$135	1,903.50
996: 17.9 hours x \$135	2,416.50
792: 23.5 hours x \$135	3,172.50
Fuel charges for contract pilots during transit	257.43
Survey Fuel 97.35 hours x 9 gal/hr x \$12/gal	10,513.80
Food	773.40
Lodging (School: 950.00, Village Council: 750.00)	1,700.00
Salary, Travel, Hotel, and Per Diem for Chuck Moore (estimated)	3,000
Travel and Per Diem for Kevin VanHatten (estimated)	1,500
Total	33,760.17

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