

**2007 AERIAL MOOSE SURVEY
WRANGELL-ST. ELIAS NATIONAL PARK AND PRESERVE**

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CENTRAL ALASKA NETWORK

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Executive Summary:

We estimated the number of moose for an 8210 km² area in Wrangell-St. Elias National Park and Preserve during six days of surveys between 12-26 November. During the surveys, we counted and classified 500 moose. Using geospatial sampling and analysis, we estimated the population at 1576 $\pm$ 244 moose (90% C.I.), with a density of 0.5 moose/mi². The calf:bull:cow ratio was estimated at 19:52:100.

Key Words: moose, *Alces alces*, survey, population, geospatial, Wrangell-St. Elias National Park and Preserve, density

Introduction:

Monitoring of animal abundance and distribution was ranked 3rd among all potential vital signs evaluated by the Central Alaska Network (CAKN). The CAKN has adopted a holistic view of network ecosystems and will track the major physical drivers of ecosystem change and responses of the two major components of the biota: plants and animals. Thus, the CAKN has identified *Fauna Distribution and Abundance* as one of its top three Vital Signs. In general, the CAKN wants to know where fauna are distributed across the landscape and to track changes in both their distribution and abundance. The *Fauna Distribution and Abundance* Vital Sign comprises monitoring efforts for a suite of vertebrate species spanning the significant elevation gradient found in CAKN parks, and also including species of specific interest within each park. Moose (*Alces alces*) are one such species for the CAKN in part because moose are found in each network park. Moose are considered good indicators of long term habitat change within park ecosystems because they require large quantities of resources from their habitat year round, and populations have the potential to respond dramatically to long term changes in resource conditions. They are crucial to many subsistence communities as a primary source of food throughout most of NPS land in Alaska in addition to being harvested by the general public on NPS Preserve lands. Moose (*Alces alces*) are one of 6 keystone large mammal species in interior Alaska which are of great importance ecologically as well as from a management perspective. In short, moose are important to people, from both consumptive and non-consumptive viewpoints.

A protocol for long-term monitoring in CAKN was developed to evaluate moose populations in each unit on a three-year rotating basis (Burch et al. 2004). Denali moose were surveyed in 2005, and Yukon-Charley moose were surveyed in 2006. The overall goal of the monitoring program is to determine changes in abundance, distribution and composition of moose in CAKN. This paper describes the 2007 surveys conducted in Wrangell-St. Elias National Park and Preserve (WRST).

Study Area:

The study area is comprised of WRST from the Nabesna River, arcing southward around the Wrangell Mountains, to the Kennicott Glacier near McCarthy (Figure 1), a total of 8210 km². This area includes a large portion of the moose hunted within WRST, and contains the majority of Game Management Unit (GMU) 11. The northwestern-most segment of the study area is

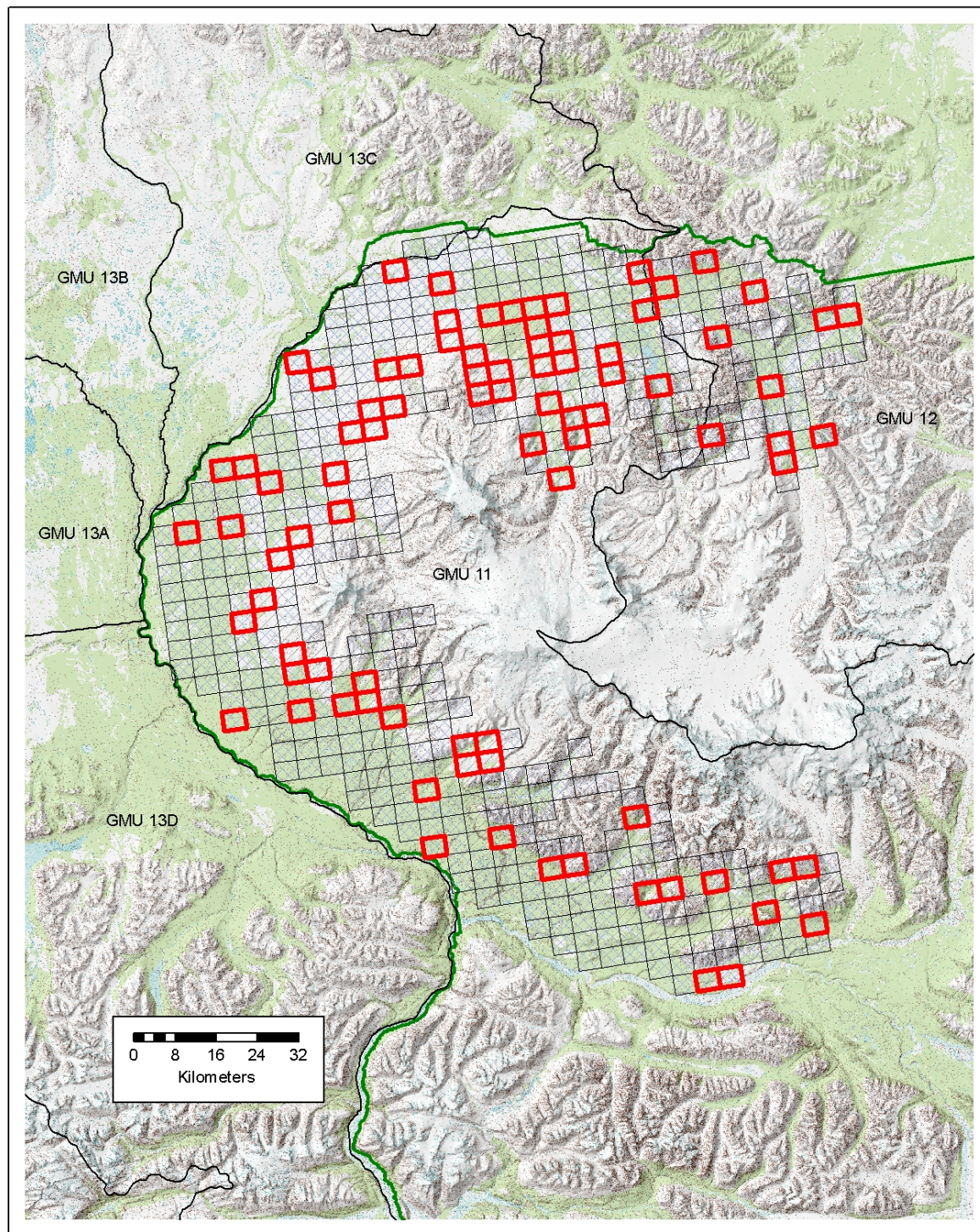


Figure 1. Study area (8210 km²) and selected survey units (in red, 1403 km²) for 2007 moose survey, Wrangell-St. Elias National Park and Preserve. Survey units are 16.16 km²

contained within GMU 12. The area was defined to sample a large portion of the hunted population within WRST, while still representing a feasible effort given available resources.

The area is dominated by low elevation (450-760m) dense to open spruce forest. From about 760m to about 1300m, the spruce forest gives way to a willow (*Salix* spp.) and birch (*Betula* spp.) dominated brush zone. Above 1300m, the habitat is primarily tundra/shrub. During this fall survey period, WRST moose mostly inhabit the open spruce/brush zone at mid elevations (800-1600m).

Methods:

Surveys were completed as outlined in the CAKN Moose Monitoring Protocol (Burch et al. 2004) and the ADFG GeoSpatial Survey Operations Manual (Kellie and Delong 2006). Survey units were delineated by 2 minutes of latitude and 5 minutes of longitude, resulting in unit sizes of 16.16 km² (downloaded from ADFG intranet site <http://intra.wc.adfg.state.ak.us/>). Using GIS, a 2 x 5 minute grid was laid out over the park, and count units were stratified (see below) and selected randomly (Figure 1). Based on recommendations from Kellie and Delong (2006) a minimum of 50 “high” and 30 “low” units were initially selected. Once those units were surveyed, additional units were added to improve the population estimate as resources and weather allowed. Surveys were continued until a coefficient of variation of $\leq 10\%$ was achieved.

Stratification:

Units were stratified into “low” (0-2 moose), and “high” (3 or more). Stratification was completed by both “desktop” stratification and pre-survey stratification flights. For desktop stratification, three information sources were used. All surveys performed in the past that contained locational (latitude/longitude) information were plotted on the grid, and count units were stratified based on results (e.g. if 3 or more moose were seen in a grid in any year’s survey, then the unit was classified as “high”). Next, a landcover map gridded with the count units and observations was presented to a local wildlife pilot (Harley McMahan), who has flown a majority of local wildlife surveys (including most of the recorded moose surveys) over the last 30+ years, and units were classified based on his observations and recollections.

Information gathered from past surveys and observations was used to stratify remaining units based on similar landcover classifications thorough GIS. Stratification flights were then used to classify those units that either had questionable classifications (e.g. whether mostly non-habitat areas adjacent to High units were worth surveying), or to confirm a sample of predicted Low units (primarily lower elevation dense spruce). Stratification flights were performed using a Cessna 185 with 2-3 observers on opposite sides of the aircraft. All moose and sign observed were called out and the principle investigator (MR) classified the unit as high or low.

Surveys:

Once count units were selected, surveys were flown with one observer and an experienced pilot in a Super Cub. Flights consisted of methodical passes across the survey unit at about 150

meters and at about 110kph. Moose observed were recorded as: cows, cows with calves (either 1 or 2), lone calves, and small, medium and large bulls. GPS coordinates (NAD83, lat/long) were recorded for each group. If multiple survey units abutted each other, the units were flown as a single block for increased efficiency, with observations recorded for each unit.

Results:

Stratification:

Eighty-eight units (58 High, 30 Low) were stratified using past surveys. An additional 34 Highs were stratified based on McMahan's prior flights. One hundred seventy-four units were stratified in two days of aerial stratification flights on 5-6 November. The remaining units (296) were "desktop" stratified based on similarity of landcover to empirically-derived units. Of the 508 units within the study area, 130 were classified as High, and 378 were classified as Low. Stratification flights totaled 8.4 hours of flight time.

Surveys:

Surveys took place over 7 days between 12-27 November. Snow conditions were poor on the 12th, and flights were postponed to the 17th following new snow. The majority of the surveys took place during ideal conditions—sunny, calm weather with good snow cover and frosted brush. Surveys totaled 69.8 hours of flight time. High winds curtailed flights for several days, and with warmer temperatures, caused conditions to deteriorate for the remaining surveys. Two count units in the original set of selected units could not be surveyed due to poor snow conditions, and were replaced from the randomized pool of remaining count units.

A total of 87 count units (17.0% of the count area) were surveyed, with 500 moose classified (Table 1). Using geospatial statistics (Kellie and Delong 2006), the population was estimated at 1576 ± 224 (90% C.I.) moose. Estimated density for the study area was 0.5 moose/mi².

Table 1. Results of geospatial moose survey within Wrangell-St. Elias National Park and Preserve, November 2007.

Area	Population Estimate	90% CI	No. Obs.	Study Area (km2)	No. Units Surveyed	Density (mi2)
Total Survey	1576	± 244	500	8210	87	0.50
Analysis Areas						
Upper Copper	403	± 70	170	1356	25	0.77
Mt. Drum	232	± 65	82	904	8	0.66
Crystalline Hills	260	± 93	63	905	9	0.74

Three "analysis areas" were defined after surveys were completed to allow comparisons with prior surveys (Figure 2, Tables 1 and 2). ADFG has maintained a trend count area on the west slopes of Mt. Drum since 1969, and WRST has periodically performed counts in two additional areas, the upper Copper River/Drop Creek, and Crystalline Hills areas. Trend counts in the Copper River/Drop Creek area were performed in 1996 and from 2003-2006. A "Gasaway"

(Gasaway et al. 1986) survey was performed in the Crystalline Hills area in 1994, and a subsection (low elevation/low density areas were excluded) of that area was surveyed using the same methodology in 1997. Survey data from 1997 are not included here because small sample sizes negate a valid comparison. Geospatial count units within the boundaries of these trend count areas were selected, defined as “analysis areas”, and estimates for population size and age/sex ratios were developed. Few count areas within the Mt. Drum and Crystalline Hills areas were sampled (8 count units, 82 moose; 9 units, 63 moose, respectively), thus comparisons with prior surveys are of limited value. Increased sampling of the upper Copper River analysis area (25 count units, 170 moose) allows for a more valid comparison with previous surveys.

The calf:bull:cow ratio was estimated at 19:52:100 for the entire survey area (Table 2). Although sampling within the analysis areas was limited, results show distinct differences in demography which are supported by prior surveys. In general, the Mt. Drum area contains much higher bull ratios than other areas. ADFG results, 1990-2006, from the same area showed an average calf:bull:cow ratio of 18:100:100 (data provided by ADFG, Glennallen).

Table 2. Age and sex ratios for surveyed areas, Wrangell-St. Elias National Park and Preserve, 2007. Only surveys providing statistically-based estimates are included here.

Area	No/100 Cows		Observed	Density (mi ²)	Source
	calves	bulls			
WRST 2007	19	52	500	0.50	This study
WRST 2007 Upper Copper	16	38	170	0.77	This study
WRST 2007 Mt. Drum	11	118	82	0.66	This study
WRST 2007 Crystalline Hills	29	42	63	0.74	This study
WRST 1993 NW Wrangells (Gasaway)	21	66	488	0.58	Route and Dale 1994

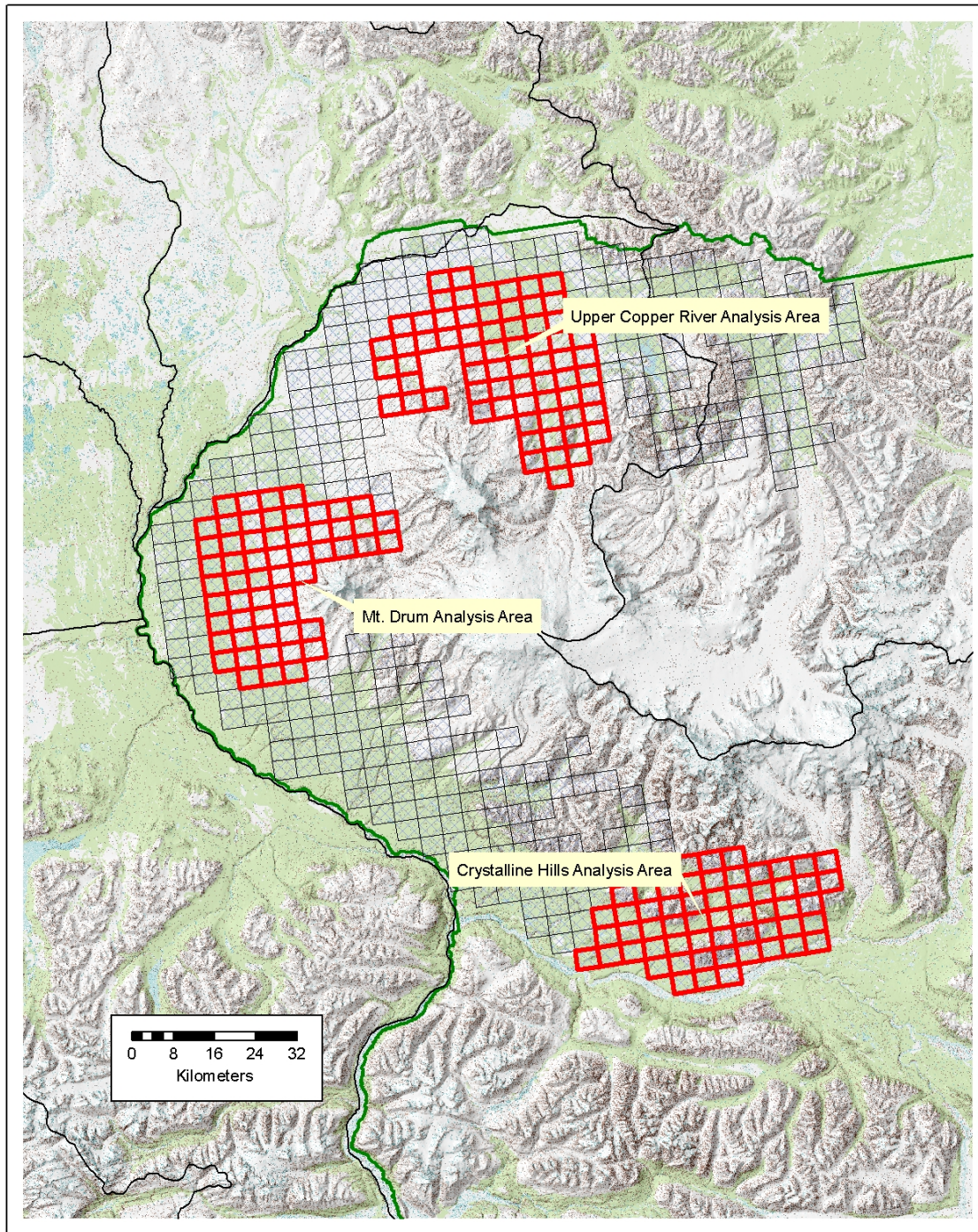


Figure 2. Analysis areas within the count area. These areas were selected to allow comparisons with historical survey areas.

Table 3. Comparisons of the Upper Copper River trend/analysis areas. Trend counts were performed prior to 2007, and represent the number of moose observed. Entries for 2007, noted with an asterisk, are estimates using geospatial techniques.

Count Area	Year	Calves : 100 Cows	Bulls : 100 Cows	Total	Source
Upper Copper	1991	15.4	40.3	232	WRST
Upper Copper	1992	19.7	36.8	119	WRST
Upper Copper	1996	13.2	48.5	367	WRST
Upper Copper	2003	9.8	45.1	331	WRST
Upper Copper	2004	17.6	54.9	245	WRST
Upper Copper	2005	6.0	53.2	286	WRST
Upper Copper	2006	14.2	39.4	336	WRST
Upper Copper	2007	16.1*	38.5*	420*	This study

Discussion:

Moose densities found in this study (0.5 moose/mi²) are similar to those found throughout the Central Alaska Network (Table 4), and are typical of many of the low density populations across Alaska. Tetlin National Wildlife Refuge, adjacent to WRST north boundary, found similar densities of 0.43 moose/mi² (Collins et al. 2005).

Results from the analysis areas provide some interesting comparisons. The Mt. Drum analysis area showed much higher bull ratios (118 bulls : 100 cows) than other areas, and is consistent with ADFG historical trend counts where ratios around parity (mean 99.8 : 100, 1980-2006) were commonly observed. This suggests that subpopulation does not receive the degree of hunting pressure (only bull harvest is legal) that other areas receive. In contrast, the Upper Copper analysis area shows consistently lower bull ratios (mean 44.5 :100, 1991-2007). The Upper Copper trend count/analysis area was defined to target animals using the Nabesna Road area, where hunting pressure is relatively high due to road access. However, there have been no studies to corroborate this position.

Table 4. Results from moose surveys performed through the Central Alaska Network.

Area	Population Estimate	No/100 Cows		Study Area (km ²)	Density (mi ²)	Source
		calves	bulls			
DENA 2004	1104	39	88	9676	0.29	Owen and Meier 2005
DENA 2005 Yentna	42	11	40	1790	0.06	Owen and Meier 2006
DENA 2005 Cantwell	na	19	47	1023	0.65	Owen and Meier 2006
YUCH 2006	726	33	73	8019	0.23	Burch 2006
WRST 2007	1576	19	52	8210	0.50	This study
WRST Analysis Areas:						
WRST 2007 Upper Copper	403	16	38	1356	0.77	This study
WRST 2007 Mt. Drum	232	11	118	904	0.66	This study
WRST 2007 Crystalline Hills	260	29	42	905	0.74	This study

In addition to differences in bull ratios, moose densities within the analysis areas were higher than the overall survey area. This is partially explained by the selection of these areas to sample known congregations to increase the observed sample, biasing the sampling to higher density areas.

The current effort represents the most comprehensive moose survey performed in WRST to date, and addresses most of the high-harvest areas of the park. This makes the information obtained particularly useful in evaluating Federal and State harvest proposals, and in overall management of moose populations in a road-accessible hunt area.

Plans for Coming Year:

The protocol for monitoring moose in CAKN calls for surveys to be completed in each unit every three years. The WRST surveys will be repeated in 2010.

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