2010 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 km^2 area in Wrangell-St. Elias National Park and Preserve (WRST) during six days of surveys between 17-21 November 2010. During the surveys, we counted and classified 623 moose. Using geospatial sampling and analysis, we estimated the population at 1593 ± 225 moose (90% C.I.), with a density of 0.19 moose/km^2 (0.5 moose/mi^2) The calf:bull:cow ratio was estimated at 17:50:100.

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, Yukon-Charley moose were surveyed in 2006, and Wrangell-St. Elias moose in 2007. The overall goal of the monitoring program is to determine changes in abundance, distribution and composition of moose in CAKN. This paper describes the second CAKN moose survey in conducted in WRST in 2010.

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 km^2. 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

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 Alaska Department of Fish and Game (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 km^2 (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 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:

Surveys:

Of the 508 units within the study area, 123 were classified as high density, and 385 were classified as low density. Surveys took place over 5 days between 17-21 November. The majority of the surveys took place during ideal conditions—sunny, calm weather with good snow cover and frosted brush. Surveys totaled 57.6 hours of flight time (not including ferry time).

A total of 92 count units (53 high, 39 low) were surveyed, which comprised 18% of the count units. A total of 623 moose were observed and classified. Using geospatial statistics (Kellie and Delong 2006), the population was estimated at 1593 ± 225 (90% C.I.) moose (Table 1). Estimated density for the study area was 0.19 moose/km² (0.5 moose/mi²). The calf:bull:cow ratio was estimated at 17:50:100 for the entire survey area.

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 2003-2008. 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 (Figure 2, Table 2). Although fewer count units were surveyed in the Upper Copper analysis area in 2010, we observed 50 more moose than in 2007. The bull to cow ratio increased while the calf to cow ratio slightly decreased in this area during 2010. Significant changes were observed in the Mt. Drum analysis area. The calf to cow ratio nearly tripled while the bull to cow ratio decreased by half. The number of survey units counted in the Crystalline Hills analysis area was nearly double that of 2007. The number of moose observed more than doubled but the calf to cow ratio decreased by nearly half from 2007.

Discussion:

Moose densities found in this study (0.19 moose/km^2) 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 average densities of 0.17 moose/km² (range 0.11 – 0.24, n = 6) between 1990 and 2008 (Keller et al. 2009).

Results from the analysis areas provide some interesting comparisons. Traditionally, the Mt. Drum analysis area has had much higher bull ratios (118 bulls : 100 cows in 2007) 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. However, in 2010 the bull to cow ratio dropped from 118 to 56 bulls per 100 cows. Harvest records in the Mt. Drum are should be examined to determine if hunting pressure or success rates are increasing in this area. In contrast, the Upper Copper analysis area shows consistently lower bull and calf to cow ratios (Table 3). 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. WRST and ADFG GMU 12 biologists began a cooperative project in 2011 to determine moose movements through the use of radiocollars and to obtain a population estimate in an area centered on the Nabesna Road and including popular hunting areas having ORV access.

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.

Future Surveys:

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 2013.

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Literature Cited:

Burch, J., T. Meier, M. Reid, and J. Lawler. 2004. Moose monitoring protocol for the Central Alaska Network, Version 1.0. National Park Service. Fairbanks, Alaska.

Burch, J. 2006. 2006 aerial moose survey, Yukon-Charley Rivers National Preserve, Alaska. National Park Service. 36pp.

Gasaway, W.C., S.D. Dubois, R.D. Boertjie, D.J. Reed, and S.J. Harbo. 1986. Estimating moose population parameters from aerial surveys. Biological Paper Number 22, Univ. of Alaska, Fairbanks. 108pp.

Kellie, K.A. and R.A. Delong. 2006. Geospatial operations manual. Alaska Department of Fish and Game. Fairbanks, Alaska. 55pp.

Keller, P., H.K. Timm, and W.N. Johnson. 2009. Moose population survey in the Upper Tanana Valley, Game Management Unit 12, Alaska, 2008. Progress Report 01-09. U.S. Fish and Wildlife Service, Tetlin National Wildlife Refuge, Tok, Alaska. 14pp.

Owen, P.A. and T. J. Meier. 2005. 2004 aerial moose survey, Denali National Park and Preserve. Denali Park, Alaska. 7pp.

Owen, P.A. and T. J. Meier. 2006. 2005 aerial moose survey, Denali National Park and Preserve. Denali Park, Alaska. 6pp.

Owen, P.A. and T. J. Meier. 2009. 2008 aerial moose survey, Denali National Park and Preserve. Denali Park, Alaska. 12pp.

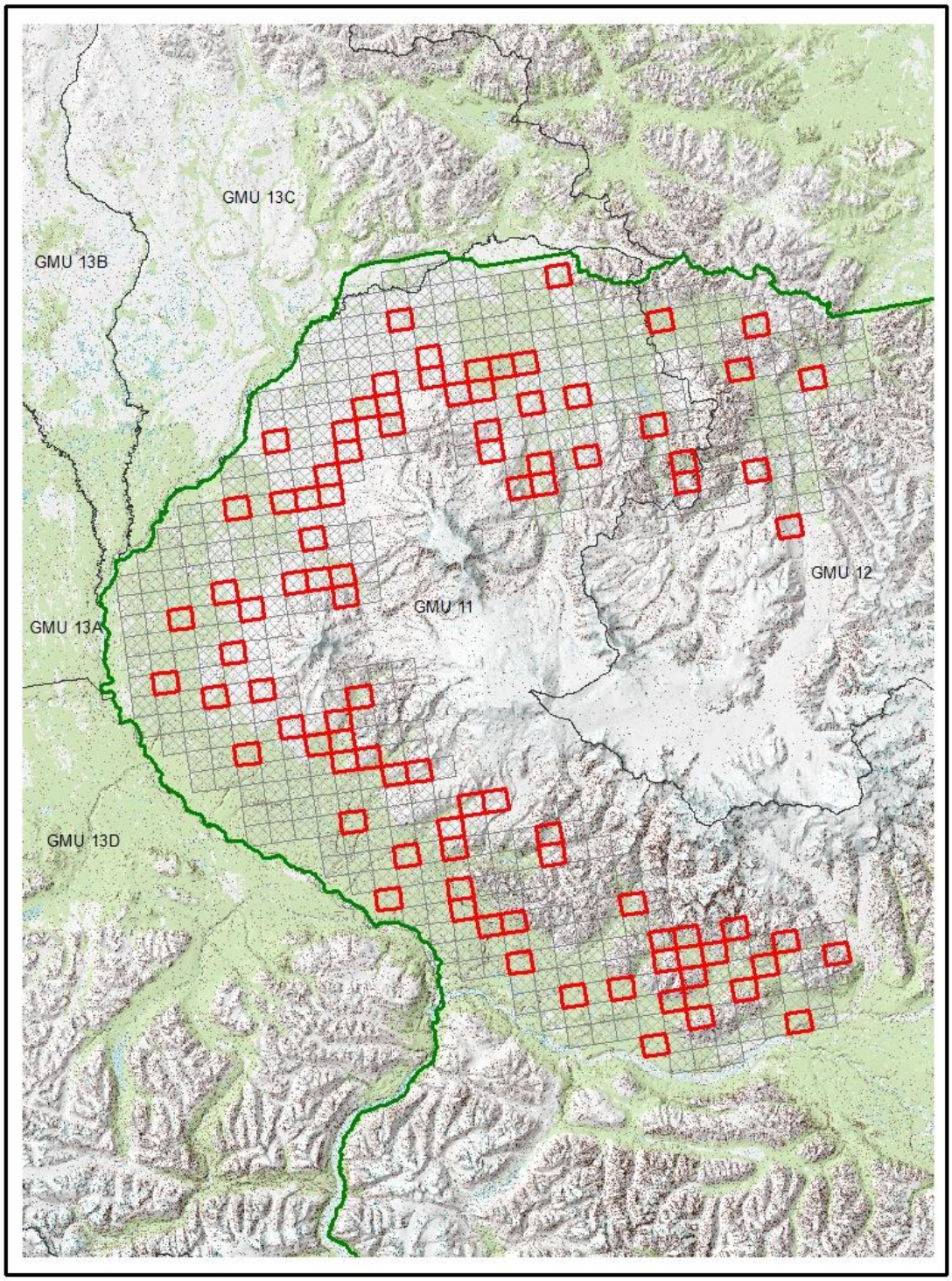

Figure 1. Study area (8210 km^2) and selected survey units (in red, 1487 km^2) for 2010 moose survey, Wrangell-St. Elias National Park and Preserve. Survey units are 16.16 km^2 in size.

Table 1. Estimated moose population (± 90% C.I.), cohort ratios, and density in the 8210 km² survey area, Wrangell-St. Elias National Park and Preserve, November 2007 and 2010.

Year	Population Estimate	Moose Observed	Calves: 100 Cows	Bulls: 100 Cows	No. Units Surveyed	Density (km²)
2007	1576 ± 244	500	19	52	87	0.19
2010	1593 ± 225	623	17	50	94	0.19

Table 2. Estimated moose population (± 90% C.I.), cohort ratios, and density for analysis areas, Wrangell-St. Elias National Park and Preserve, November 2007 and 2010.

Analysis Area	Year	Population Estimate	Moose Observed	Calves: 100 Cows	Bulls: 100 Cows	No. Units Surveyed	Density (km²)
Upper Copper 1357 km²	2007	403 ± 70	170	16	38	25	0.30
	2010	539 ± 106	220	14	49	19	0.40
Mt. Drum 903 km²	2007	232 ± 65	82	11	118	8	0.26
	2010	176 ± 51	66	31	56	10	0.20
Crystalline Hills 903 km²	2007	260 ± 93	63	29	42	9	0.29
	2010	259 ± 59	134	17	49	16	0.29

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

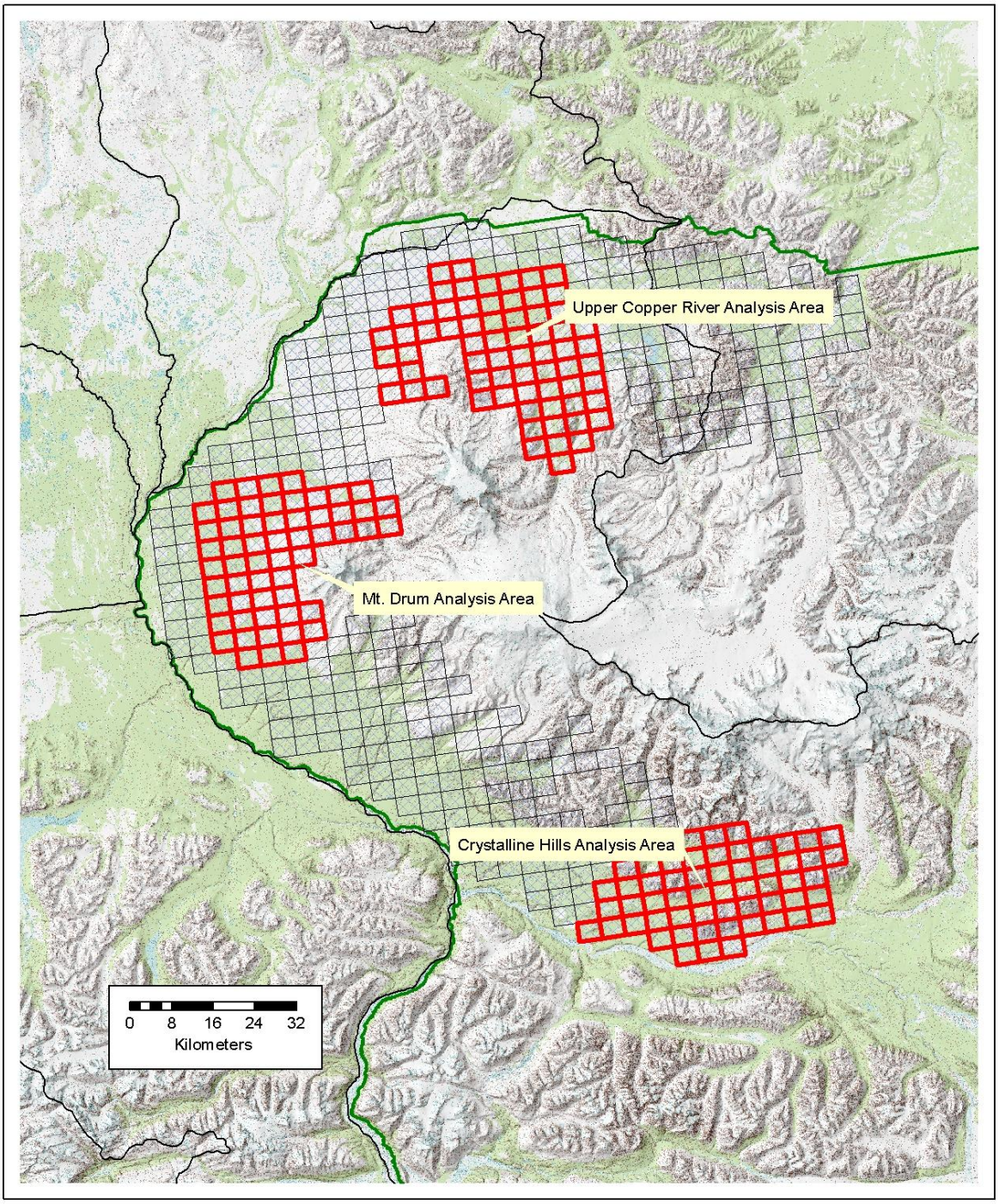

Table 3. Comparison of the number of moose observed, population estimates, and cohort ratios for the Upper Copper River trend count and GSPE analysis area, Wrangell-St. Elias National Park & Preserve, Alaska.

Year	Calves : 100 Cows	Bulls : 100 Cows	Moose Observed	Population Estimate	Survey Type
1991	15.4	40.3	232	-	Trend
1992	19.7	36.8	119	-	Trend
1996	13.2	48.5	367	-	Trend
2003	9.8	45.1	331	-	Trend
2004	17.6	54.9	245	-	Trend
2005	6.0	53.2	286	-	Trend
2006	14.2	39.4	336	-	Trend
2007	16.1	38.5	170	403 ± 70	GSPE
2008	11.8	41.4	285	-	Trend
2010	14.0	48.8	220	539 ± 106	GSPE

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

Area	Population Estimate	Calves: 100 Cows	Bulls: 100 Cows	Study Area (km^2)	Density (km^2)	Source
DENA 2004	1104 ± 219	39	88	9676	0.11	Owen and Meier 2005
DENA 2008	1279 ± 135	24	54	10,004	0.13	Owen and Meier 2009
YUCH 2006	726 ± 139	33	73	8019	0.09	Burch 2006
WRST 2007	1576 ± 244	19	52	8210	0.19	Reid 2007
WRST 2010	1593 ± 225	17	50	8210	0.19	This study