Hunting & trapping
- Main page
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Hunting tips
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End of the Reign? (*Minnesota Conservation Volunteer* article)

Moose hunting

The 2013 moose season will not open.

- Learn about DNR moose management and its pioneering research in northeastern Minnesota on the **moose management page**.
- **FAQ on moose in Minnesota** PDF
- **Moose population drops dramatically; hunting season will not open**

Moose information

- **Minnesota Moose Research and Management Plan** PDF
- **Wilderness Moose Hunt** (*Minnesota Conservation Volunteer* article)
- **Minnesota Mammals - Moose**
- **Superior National Forest**
- **Superior National Forest ATV Regulations**

Reports and surveys

- **2013 aerial moose survey** PDF
- **2012 aerial moose survey** PDF
- **2011 aerial moose survey** PDF
- **2010 aerial moose survey** PDF
- **2012 Harvest report** PDF
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- **2010 Harvest report** PDF
- **Archive of moose reports and surveys**

Maps and statistics

- **Moose Harvest, 1995 - 2011** PDF
- **Moose Harvest, 1995 - 2011 Bulls Harvested** PDF
- **2011 moose harvest map** PDF
- **Archive of moose harvest maps**

2011 Minnesota Moose Harvest

Mark S. Lenarz, Forest Wildlife Populations and Research Group

Introduction

Each year, a limited number of permits are issued that allow Minnesota residents to hunt moose. The following report is intended to document the number of hunters applying for permits, the number of permits issued, a hunting party's chance of receiving a permit, hunter success rate, and a breakdown of the harvest by hunting zone. Information on permit numbers and moose harvested by members of the 1854 Treaty Authority or Fond du Lac band of Lake Superior Chippewa within the 1854 Ceded Territory is also provided.

Methods

All successful State hunters are required to register their moose at one of 9 registration stations and provide information on the location where they killed their moose and date of kill. Hunter are also requested to collect biological samples from the moose harvested and these are submitted at the registration station.

Results

In 2011, State hunters harvested 53 moose in northeastern Minnesota. No season was held in northwestern Minnesota. Of the 1,963 parties that applied for this year's moose hunt, 105 (5%) were drawn, and 103 purchased licenses (Table 1). Access to portions of hunting zones 20, 22, 23, 24, 25, 26, 61, 62, 63, 64, 77 and 80 were restricted beginning in September because of an ongoing wild fire (Pagami Creek fire) and hunters in these zones were offered the option of returning their license for a refund. Subsequently, 11 hunting parties returned their license. Table 1 also lists the number of permits offered by hunting zone, chance of being selected for a permit, and hunter success. The 1854 Treaty Authority issued 59 permits and band members killed 10 moose (10 bulls and 0 cows). The Fond du Lac band issued 67 permits and hunters harvested 18 moose. An additional 3 moose harvested by Tribal Conservation Officers for a total of 21 (16 bulls, 4 cows, 1 bull calf). The Fond du Lac season closed 12/31/2011.

Discussion

The success rate of State hunters in 2011 was 58%, an increase of 7% over 2010 (Tables 1 and 2). This was the fifth year of hunting for bulls only. The success rate for members of the 1854 Treaty Authority was 17%, down 4% from last year. The Fond du Lac band issued 67 permits and hunters harvested 18 moose (27% success). An additional 3 moose were harvested by Tribal Conservation Officers for a total of 21 (16 bulls, 4 cows, 1 bull calf). The Fond du Lac season closed 12/31/2011.

Table 1. Moose harvested, licenses offered and sold, application rate, and party success, in 2011 moose hunt by State hunters in northeastern Minnesota

Zone	Bulls	Licenses Offered	Licenses Sold*	Party Applications**	Chances for Permit	% Success‡
20	1	4	2	50	8%	50%
21	2	3	3	64	5%	67%
22	0	2	1	22	9%	0%
23	0	1	1	15	7%	0%
24	1	2	1	86	2%	100%
25	1	2	1	103	2%	100%
26	1	2	2	18	11%	50%
27	3	4	4	24	17%	75%
28	0	2	2	31	6%	0%
29	4	4	4	109	4%	100%
30	3	5	5	131	4%	60%
31	3	6	6	283	2%	50%
32	2	4	4	18	22%	50%
33	1	2	2	41	5%	50%
34	0	2	2	38	5%	0%
36	2	5	5	24	21%	40%
37	2	2	2	11	18%	100%
60	2	3	3	28	11%	67%
61	2	5	5	57	9%	40%
62	3	10	5	176	6%	60%
63	2	4	4	31	13%	50%
64	1	8	5	50	16%	20%
70	4	4	4	104	4%	100%
72	4	4	4	111	4%	100%
73	1	2	2	44	5%	50%
74	1	2	2	55	4%	50%
76	1	3	3	63	5%	33%
77	2	2	2	51	4%	100%
79	2	2	2	31	6%	100%
80	2	4	4	94	4%	50%
Total	53	105	92	1963	5%	58%

* 11 Parties returned their license prior to the hunt because of access restrictions caused by Pagami Creek fire.

** Number of 2, 3, or 4 person parties minus rejected applications.

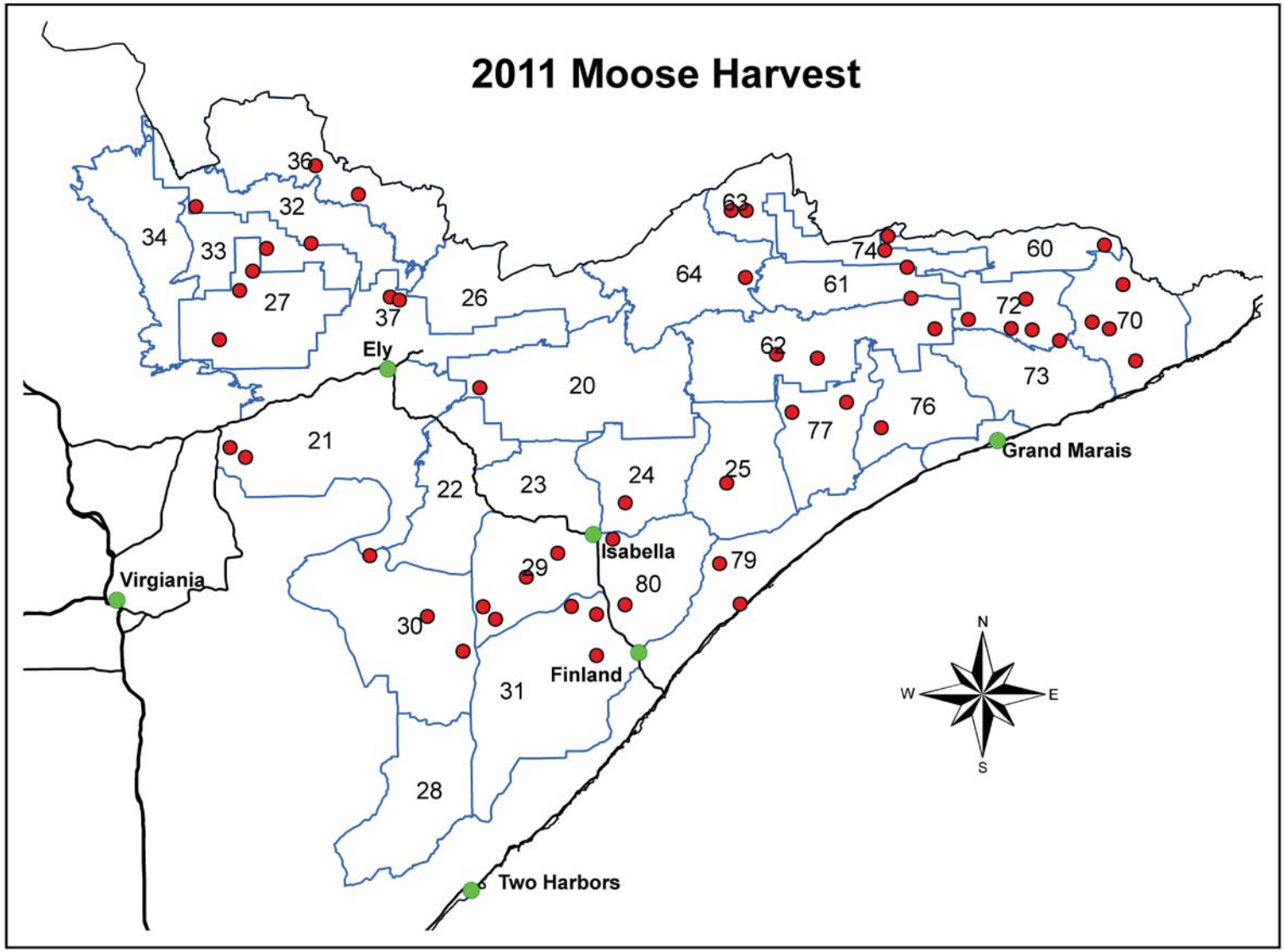
‡ Success based on licenses sold.

Table 2. Applicants, permit numbers, moose harvested, and success rates of State moose hunters in northeastern Minnesota since 1993.

Year	Party Applicants*	Permits	Licenses Purchased**	Moose Harvested	Party Success
1993	2,934	315	315	264	84%
1994	3,022	189	189	155	82%
1995	3,181	188	188	156	83%
1996	3,830	207	207	156	75%
1997	3,958	198	198	152	77%
1998	4,157	182	182	125	69%
1999	3,919	189	189	136	72%
2000			No Season		
2001	3,164	182	176	125	71%
2002	2,580	208	202	141	70%
2003	2,328	224	217	144	66%
2004	3,062	246	240	151	63%
2005	3,060	284	276	164	59%
2006	2,952	279	269	161	60%
2007	2,566	233	229	115	50%
2008	2,706	247	245	110	45%
2009	2,746	225	223	103	46%
2010	2,415	213	212	109	51%
2011	1,963	105	92	53	58%

* Number of 2, 3, or 4 person parties minus rejected applications.

** In 2011 - 11 parties returned their licenses because access to portions of their hunting zone was restricted.


2011 Moose Harvest
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2012 Minnesota Moose Harvest

Glenn D. DelGiudice, Forest Wildlife Populations and Research Group

Introduction

Each year, a limited number of permits are issued that allow Minnesota residents to hunt moose. The following report is intended to document the number of hunters applying for permits, the number of permits issued, a hunting party's chance of receiving a permit, hunter success rate, and a breakdown of the harvest by hunting zone. Information on permit numbers and moose harvested by members of the 1854 Treaty Authority or Fond du Lac band of Lake Superior Chippewa within the 1854 Ceded Territory is also provided.

Methods

All successful State hunters are required to register their moose at 1 of 8 registration stations and provide information on the location where they killed their moose and date of kill. Hunters also are requested to collect biological samples from the moose harvested and these are submitted at the registration station.

Results

In 2012, State hunters harvested 46 moose in northeastern Minnesota (Figure 1). No season was held in northwestern Minnesota. Of the 1,460 parties that applied for this year's moose hunt, 76 (5%) were drawn and purchased a license (Table 1). Additionally, 11 hunting parties which returned permits last year (2011) prior to the hunt, because of access restrictions caused by the Pagami Creek wildfire, were offered the opportunity to hunt the same zones (20, 24, 25, 62, and 64) in 2012 and all accepted. So a total of 87 licenses were purchased this year (Table 1). Table 1 also lists the number of permits offered by hunting zone, chance of being selected for a permit, and hunter success. The 1854 Treaty Authority issued 49 permits and band members killed 16 moose (11 bulls and 5 cows). The Fond du Lac band issued 64 moose permits (bulls only) of 72 available. The final harvest was 20 bulls (18 by hunters and 2 subsistence/ceremony animals). The Fond du Lac season closed on 31 December 2012.

Discussion

The success rate of State hunters in 2012 was 53%, a decrease of 5% from 2011 (Tables 1 and 2). This was the sixth year of hunting for bulls only. The success rate for members of the 1854 Treaty Authority was 33%, up 7% from last year. The success rate for the Fond du Lac band hunters was 28%, up 3% from last year.

Table 1. Moose harvested, licenses offered and sold, application rate, and party success in 2012 moose hunt by State hunters in northeastern Minnesota.

Zone	Bulls	Licenses Offered	Licenses Sold*	Party Applications**	Chances for Permit	% Success‡
20	1	2 (2)	2 (2)	27	7%	25%
21	1	3	3	63	5%	33%
22	1	2	2	17	12%	50%
24	1	1 (1)	1 (1)	49	2%	50%
25	0	1 (1)	1 (1)	51	2%	0%
26	0	1	1	19	5%	0%
27	1	4	4	44	9%	25%
28	1	2	2	19	11%	50%
29	2	2	2	71	3%	100%
30	2	5	5	143	3%	40%
31	1	3	3	156	2%	33%
32	1	2	2	26	8%	50%
33	1	2	2	52	4%	50%
36	3	5	5	34	15%	60%
37	1	2	2	23	9%	50%
60	3	3	3	19	16%	100%
61	3	5	5	60	8%	60%
62	4	5 (5)	5 (5)	89	6%	40%
63	3	3	3	26	12%	100%
64	4	6 (2)	6 (2)	57	11%	50%
70	2	2	2	75	3%	100%
72	1	2	2	67	3%	50%
73	2	2	2	40	5%	100%
74	2	2	2	30	7%	100%
76	2	3	3	68	4%	67%
77	0	2	2	36	6%	0%
79	2	2	2	27	7%	100%
80	1	2	2	72	3%	50%
Total	46	76	76 (11)	1,460	5%	53%

* 11 Parties (in parentheses) returned their license in 2011 prior to the hunt, because of access restrictions caused by the Pagami Creek wildfire. These same 11 parties were offered the opportunity to hunt the same zones (20, 24, 25, 62, and 64) in 2012 and all accepted.

** Number of 2, 3, or 4-person parties minus rejected applications.

‡ Success based on licenses sold.

Table 2. Applicants, permit numbers, moose harvested, and success rates of State moose hunters in northeastern Minnesota since 1993.

Year	Party Applicants*	Permits	Licenses Purchased**	Moose Harvested	Party Success
1993	2,934	315	315	264	84%
1994	3,022	189	189	155	82%
1995	3,181	188	188	156	83%
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2007	2,566	233	229	115	50%
2008	2,706	247	245	110	45%
2009	2,746	225	223	103	46%
2010	2,415	213	212	109	51%
2011	1,963	105	92	53	58%
2012	1,460	76	87	46	53%

* Number of 2, 3, or 4-person parties minus rejected applications.

** In 2011 - 11 parties returned their licenses, because access to portions of their hunting zone (20, 24, 25, 62, and 64) was restricted. In 2012 – these same 11 parties were offered the opportunity to hunt the same zones and all accepted.

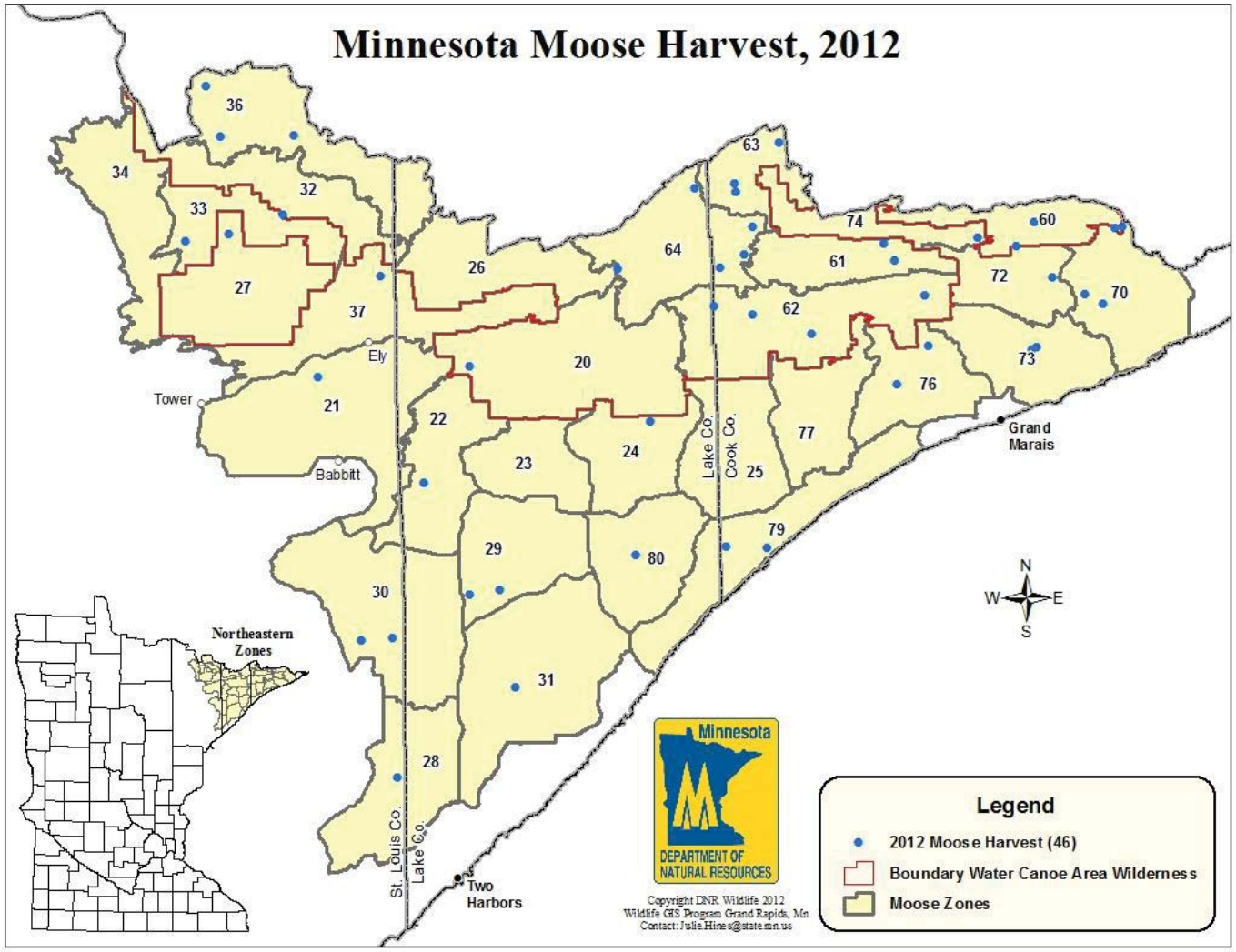


Figure 1. Moose zones and locations of harvested moose during the State's 2012 moose season.

2013 Aerial Moose Survey Final Results

Glenn D. DelGiudice, Forest Wildlife Populations and Research Group

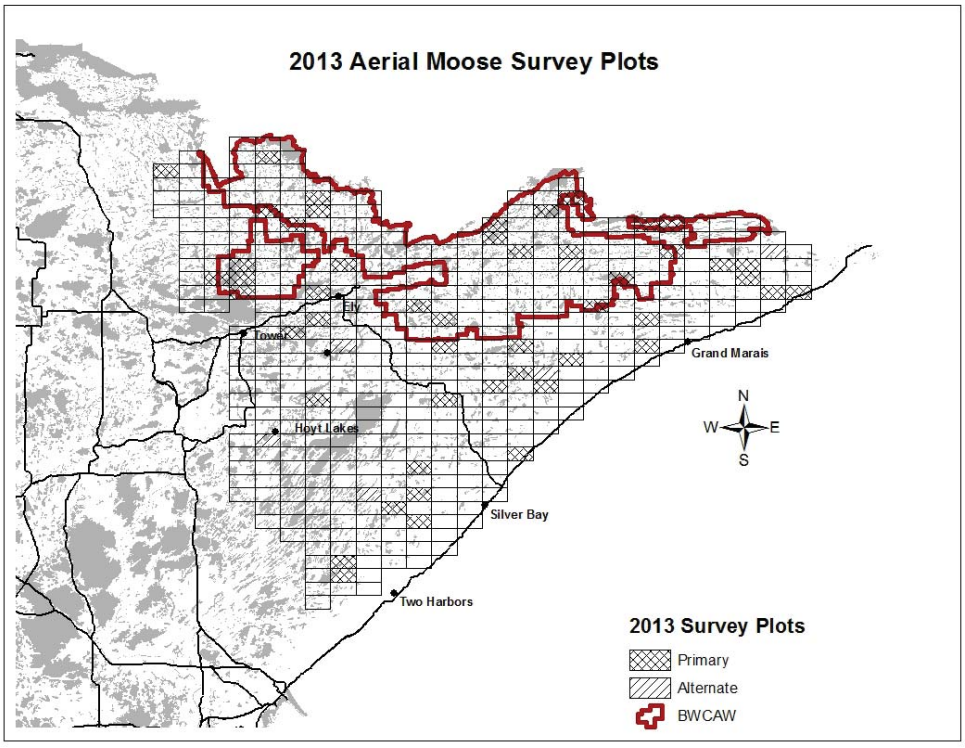
Introduction

Each year, we conduct an aerial survey in northeastern Minnesota in an effort to monitor moose (*Alces alces*) numbers and fluctuations in the status of Minnesota's largest deer species. The primary objectives of this annual survey are to estimate moose numbers, calf:cow and bull:cow ratios. We use these data to determine and examine the population's trend and composition, to contribute to our understanding of moose ecology, and to set the harvest quota for the subsequent hunting season.

Methods

We estimated moose numbers, age and sex ratios by flying transects within a stratified random sample of survey plots (Figure 1). Survey plots were last stratified as low, medium, and high moose density in 2009. As in previous years, all survey plots were rectangular (5 x 2.67 mi.) and all transects were oriented east to west. DNR Enforcement pilots flew the Bell Jet Ranger (OH-58) helicopters used to conduct the survey. We sexed moose using the presence of antlers or the presence of a vulval patch (Mitchell 1970), and identified calves on the basis of size and behavior. We used the program DNRSurvey on Toughbook® tablet style computers to record survey data. DNRSurvey allowed us to display transect lines superimposed on a background of aerial photography, observe the aircraft's flight path over this background in real time, and record data using a tablet pen with a menu-driven data entry form.

Figure 1. Northeast moose survey area and sample plots (cross hatching) flown in the 2013 aerial moose survey. The red line delineates the boundary of the Boundary Waters Canoe Area Wilderness.



In previous years, we used 3 strata based on expected moose density (low, medium, and high) in an effort to optimize precision of our survey estimates. In 2012, we added a 4th stratum to represent a series of 9 plots that have undergone disturbance by wild fire, prescribed burning, and timber harvest. Each year, these same 9 plots will be surveyed in an effort to evaluate the effect of disturbance on moose density over time.

We accounted for visibility bias by using a sightability model (Giudice et al. 2012). We developed this model between 2004 and 2007 using moose that were radiocollared as part of research on the dynamics of the northeastern moose population. Logistic regression indicated that the covariate "visual obstruction" (VO) was the most important covariate in determining whether radiocollared moose were observed. We defined VO as the proportion of vegetation within a circle (10-m radius or roughly 4 moose lengths) that would prevent you from seeing a moose when circling that spot from an oblique angle. If we observed more than one moose at a location, VO was based on the first moose sighted. We used uncorrected estimates (no visibility bias correction) of bulls, cows, and calves to calculate the bull:cow and calf:cow ratios.

Recent research indicated that variance calculations used in earlier analyses underestimated the total variance of survey estimates (Fieberg 2012). We reanalyzed survey data from 2004 to 2011 using the package Sightability Model in Program R (R Development Core Team 2011, Fieberg 2012) to recalculate confidence intervals. Based on this approach, confidence intervals are asymmetrical around the estimates. Minor corrections to our sightability model also modified population estimates slightly (0-4%) from those previously reported.

Results and Discussion

We initiated the survey on 3 January and completed it on 15 January 2013. It consisted of 9 actual survey days. Sixty-seven percent of plots were surveyed under snow conditions classified as "good," 33% as marginal, and 0% as "poor," not dissimilar from the past 2 years' surveys. During the survey flights, observers detected 251 moose for 49 plots (653 mi^2) flown, including 109 bulls, 99 cows, 34 calves, and 9 unidentified moose. Estimates of the calf:cow and bull:cow ratios adjusted for sampling-only were 0.33 and 1.23, respectively (Table 1). In 2012, the first year 49 plots (versus 40 in the previous 5 years) were surveyed, 344 moose were observed, including 144 bulls, 140 cows, 55 calves, and 5 unidentified.

After adjusting for sampling and sightability, we estimated the population in northeastern Minnesota at 2,760 (2,120 – 3,580) moose (Table 1). Based on the log rate of change (-0.427, -0.762, -0.093 [90% confidence limits]), the 2013 population estimate was significantly lower (35%) than the 2012 estimate. Gasaway and Dubois (1987) indicated that even with relatively precise survey estimates, a change of at least 20% may be required to detect a significant change in population size. However, time series analysis of estimates since 2005 indicates a significant downward trend (Figure 2, $P = 0.0005$). This corroborates several data sets which suggest the northeastern Minnesota moose population is declining. Lenarz et al. (2010) had used simulation modeling to integrate survival and reproductive rates measured between 2002 and 2008 and found that the population was decreasing approximately 15% per year over the long-term. The 2013 estimate indicates a significant (52%) decline in the population since 2010, not inconsistent with that finding (Table 1).

Table 1. Estimated moose numbers, 90% confidence interval, and calves:cow, percent calves, percent cows with twins, and bulls:cow observed from aerial surveys in northeastern Minnesota, 2005-2013.

Survey	Estimate	90% Confidence Interval	Calves: Cow	% Calves	% Cows w/ twins	Bulls: Cow
2005	8,160	5,960 – 11,170	0.52	19	9	1.04
2006	8,840	6,670 – 11,710	0.34	13	5	1.09
2007	6,860	5,230 – 9,000	0.29	13	3	0.89
2008	7,890	5,970 – 10,420	0.36	17	2	0.77
2009	7,840	6,190 – 9,910	0.32	14	2	0.94
2010	5,700	4,480 – 7,250	0.28	13	3	0.83
2011	4,900	3,810 – 6,290	0.24	13	1	0.64
2012	4,230	3,190 – 5,600	0.36	15	6	1.08
2013	2,760	2,120 – 3,580	0.33	14	3	1.23

Figure 2. Point estimates, 90% confidence intervals, and trend line of estimated moose numbers in northeastern Minnesota, 2005-2013. (Note: The 2005 survey was the first to be flown with helicopters, and to include a sightability model and a uniform grid of east-west oriented rectangular 5 x 2.67 mi^2 plots).

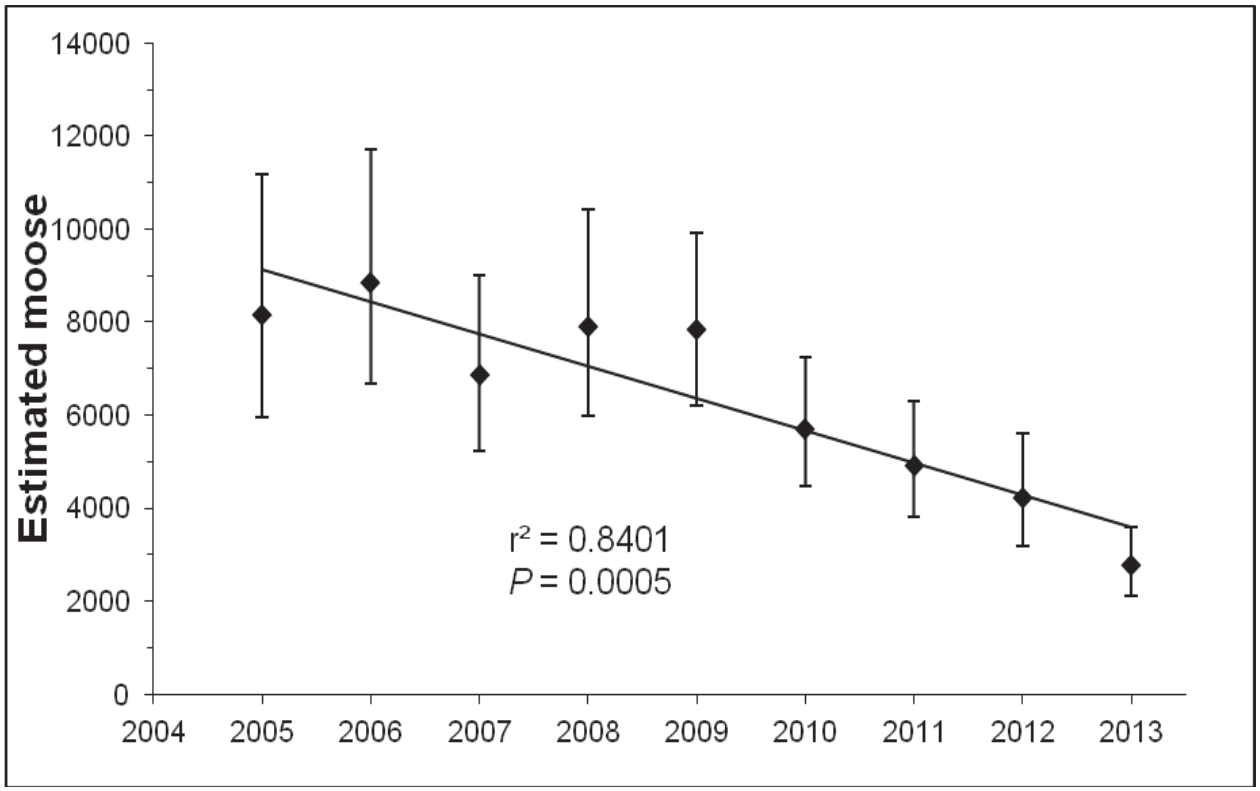
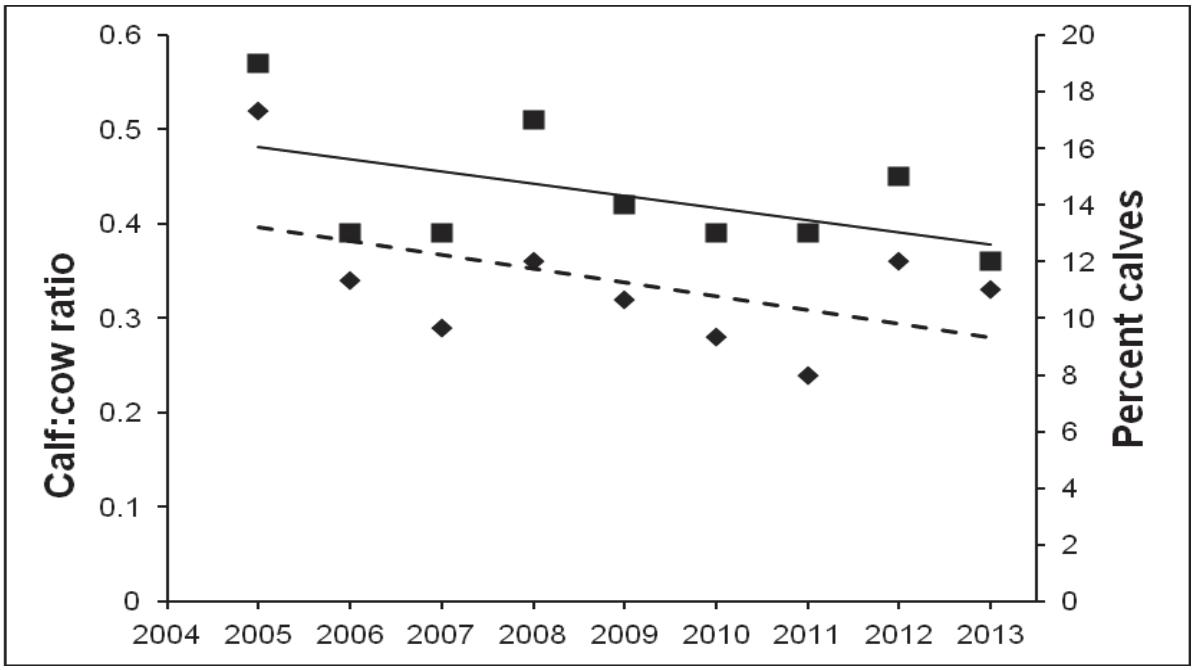


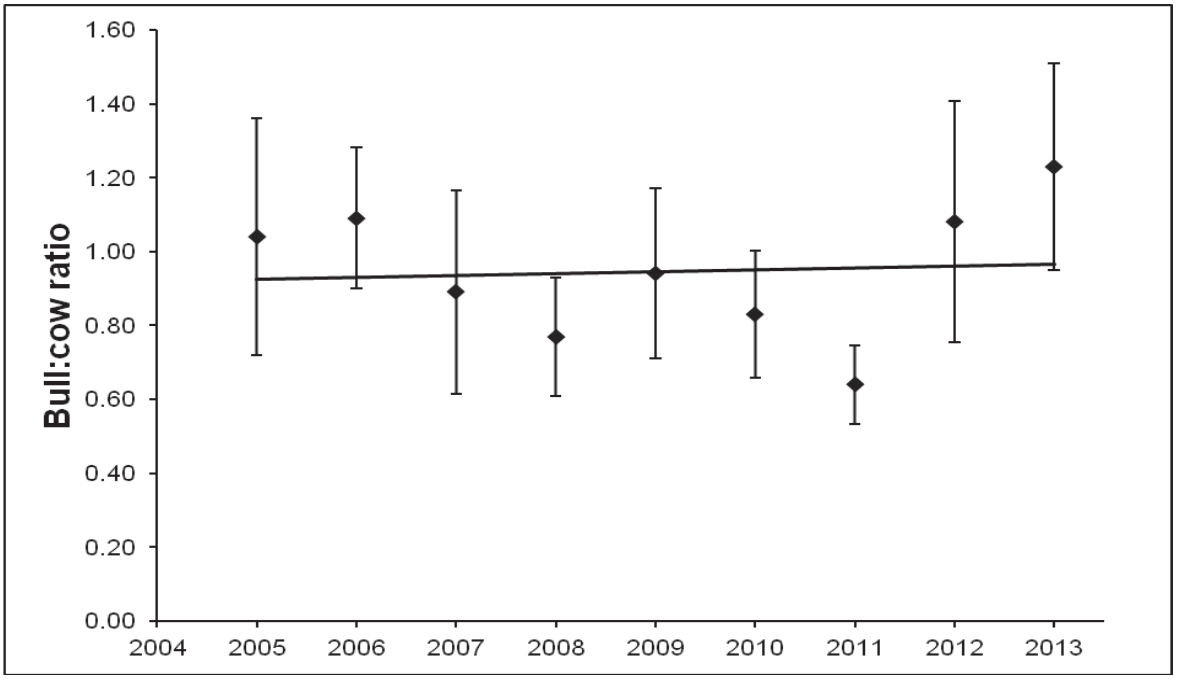
Figure 3. Estimated calf:cow ratios (solid diamonds, dashed trend line) and percent calves (solid squares, solid trend line) from aerial moose surveys in northeastern Minnesota, 2005-2013.



Estimated calf recruitment from this year's survey remained *relatively* high and similar to last year's estimate (Table 1). The calf:cow ratio in mid-January 2013 was 0.33 and calves represented 14% of the total moose observed (Table 1). Only 3% of the cow moose were accompanied by twins (Table 1), down from 6% in 2012. In 2012, the close agreement between calf:cow ratio and % calves ($r = 0.94$, $P < 0.001$) indicated that classification of adult moose to sex is accurate. Despite the apparent stability of calf survival through to the January 2013 survey compared to the 2012 survey, it is important to note that annual adult survival is more important to the population growth rate than calf survival (Lenarz et al. 2010). Further, *annual* recruitment of the calves is not actually determined until the next spring calving season when winter survey-observed calves become yearlings. At this point little is known about the survival rates of moose calves during the period between the annual winter survey and subsequent spring calving.

The estimated bull:cow ratio (Table 1; Figure 4) increased considerably since 2011 and is the highest it's ever been since 2005. Further, this year's estimated bull:cow ratio indicates that adult bulls may somewhat outnumber adult females, although there is a great deal of variability associated with these annual ratio estimates. Consequently, there is no clear upward or downward long-term trend (2005-2013) in bull:cow ratios. Despite the higher bull:cow ratios during this year's survey, the number of bulls observed over 49 survey plots surveyed decreased 24% from last year's (2012) 49 plots flown, and was considerably less (74%) than the average annual number of bulls observed (413) from 2007 to 2011.

Figure 4. Estimated bull:cow ratios, 90% confidence intervals, and trend line from aerial moose surveys in northeastern Minnesota, 2005-2013.



Acknowledgments

These surveys would not be possible without the excellent partnership between the Division of Enforcement, the Division of Fish and Wildlife, the Fond du Lac Band of Lake Superior Chippewa and the 1854 Treaty Authority. In particular, I would like to thank Thomas Pfingsten, Chief Pilot, for coordinating all of the aircraft and pilots; Tom Rusch for coordinating flights and survey crews; and Mike Schrage (Fond du Lac Band of Lake Superior Chippewa) and Andy Edwards (1854 Treaty Authority) for securing supplemental survey funding from their respective groups. Enforcement pilots, Brad Maas, John Heineman, Thomas Pfingsten, and Luke Ettl skillfully piloted the aircraft during the surveys, and Tom Rusch, Andy Edwards, Mike Schrage, and Nancy Gellerman flew as observers; their efforts are gratefully appreciated. I also want to thank John Giudice who continues to provide critical statistical consultation and analyses. I also want to acknowledge Barry Sampson for creating the process to generate the GIS survey maps and GPS coordinates for the transect lines, and Bob Wright, Brian Haroldson and Chris Pouliot for the creation of the program DNRSurvey. Bob also modifies the software as needed and provides refresher training for survey observers using DNRSurvey each year.

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