2014 - JCR Evaluation Form

SPECIES: Moose

PERIOD: 6/1/2014 - 5/31/2015

HERD: MO545 - SNOWY RANGE

HUNT AREAS: 38, 41

PREPARED BY: WILL SCHULTZ
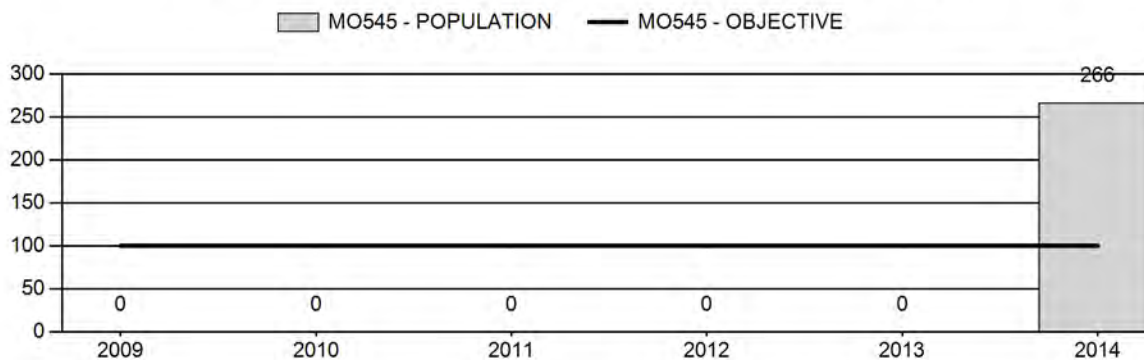
	2009 - 2013 Average	**2014**	**2015 Proposed**
Population:	0	266	N/A
Harvest:	49	46	46
Hunters:	54	48	48
Hunter Success:	91%	96%	96%
Active Licenses:	54	48	48
Active License Success:	91%	96%	96%
Recreation Days:	444	319	319
Days Per Animal:	9.1	6.9	6.9
Males per 100 Females	106	100	
Juveniles per 100 Females	51	36	

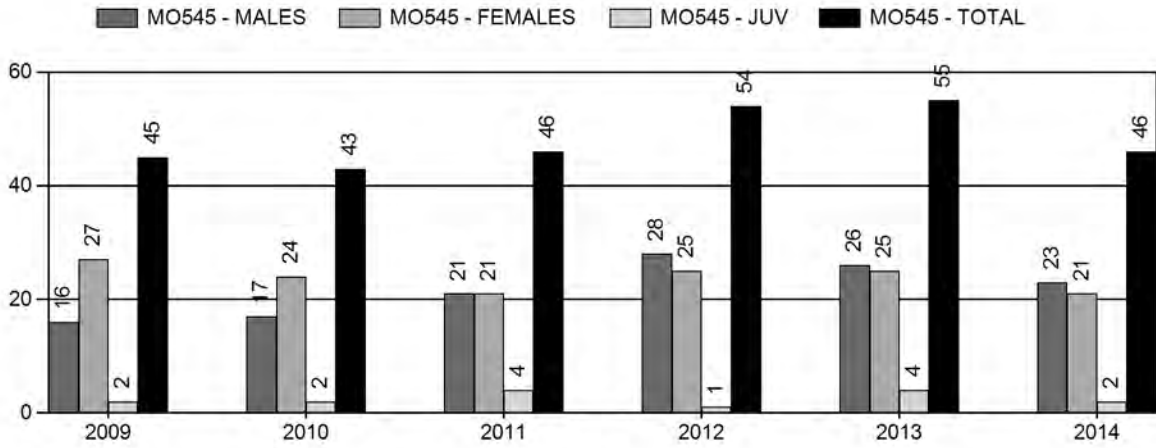|	
Population Objective (± 20%) :	100 (80 - 120)
Management Strategy:	Special
Percent population is above (+) or below (-) objective:	166%
Number of years population has been + or - objective in recent trend:	1
Model Date:	None

Proposed harvest rates (percent of pre-season estimate for each sex/age group):

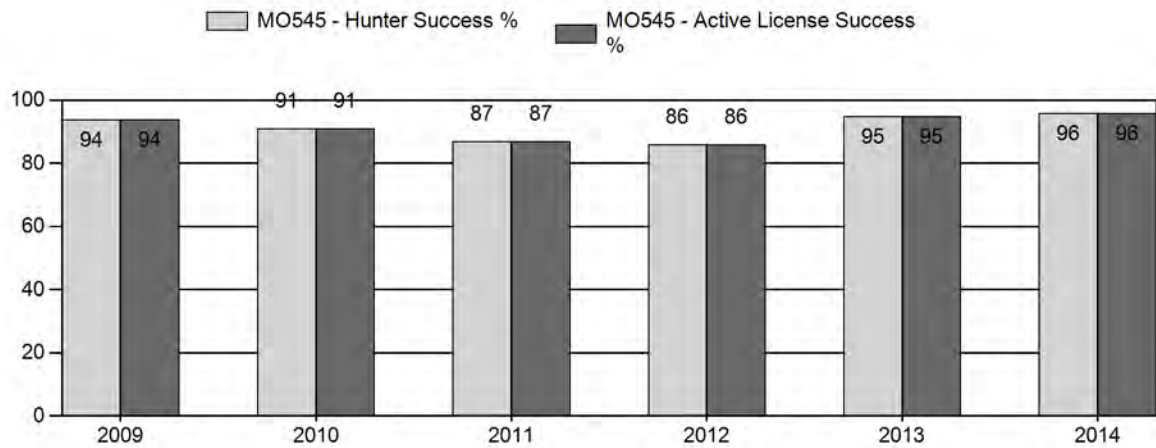|	**JCR Year**	**Proposed**
Females ≥ 1 year old:	NA%	NA%
Males ≥ 1 year old:	NA%	NA%
Juveniles (< 1 year old):	NA%	NA%
Total:	NA%	NA%
Proposed change in post-season population:	NA%	NA%

Population Size - Postseason

███ MO545 - POPULATION　　━━ MO545 - OBJECTIVE

Harvest

Legend: MO545 - MALES, MO545 - FEMALES, MO545 - JUV, MO545 - TOTAL

Year	MALES	FEMALES	JUV	TOTAL
2009	16	27	2	45
2010	17	24	2	43
2011	21	21	4	46
2012	28	25	1	54
2013	26	25	4	55
2014	23	21	2	46

Number of Hunters

Legend: MO545 - TOT, MO545 - RES, MO545 - NONRES

Year	TOT	RES	NONRES
2009	48	40	8
2010	47	39	8
2011	53	43	10
2012	63	48	15
2013	58	46	12
2014	48	37	11

Harvest Success

Legend: MO545 - Hunter Success %, MO545 - Active License Success %

Year	Hunter Success %	Active License Success %
2009	94	94
2010	91	91
2011	87	87
2012	86	86
2013	95	95
2014	96	96

Active Licenses

MO545 - Active Licenses

Year	Active Licenses
2009	48
2010	47
2011	53
2012	63
2013	58
2014	48
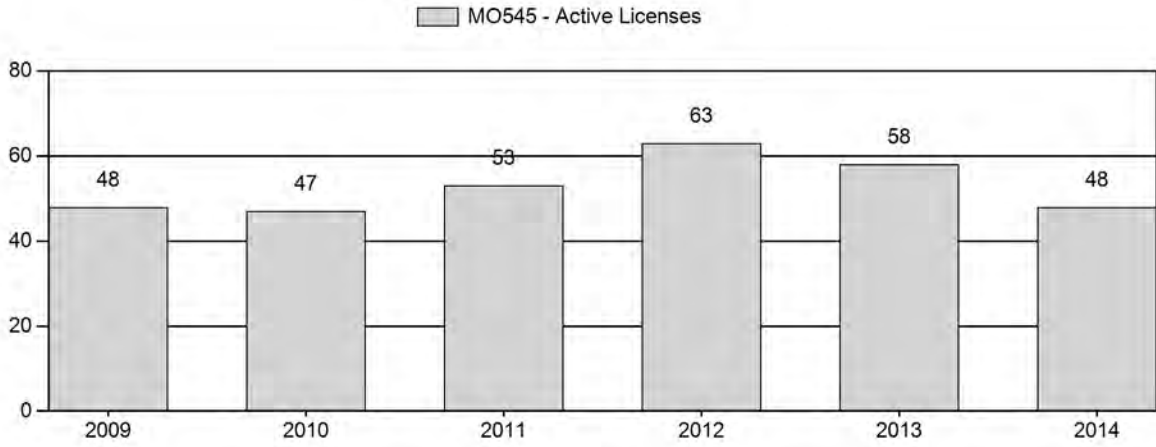
Days per Animal Harvested

MO545 - Days

Year	Days
2009	7.4
2010	10.1
2011	8.5
2012	8.6
2013	10.9
2014	6.9
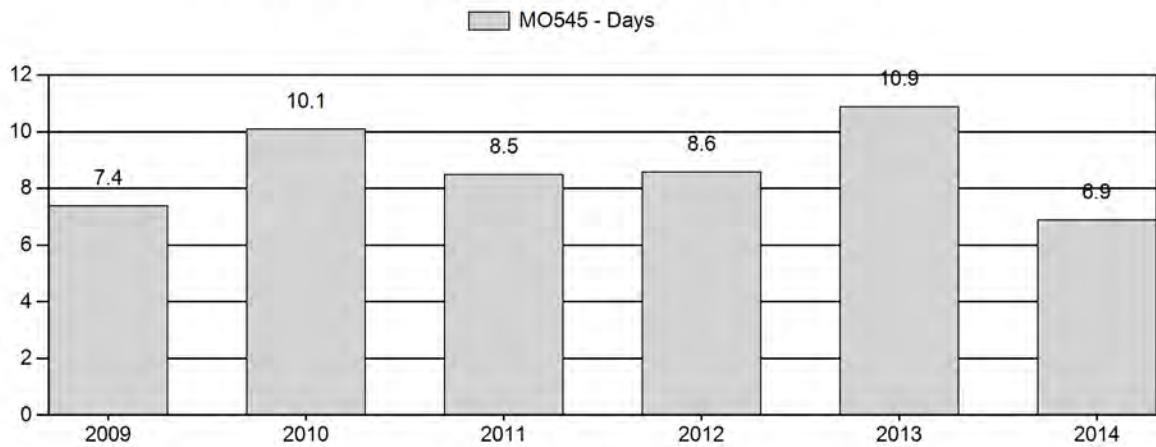
Postseason Animals per 100 Females

MO545 - Males   MO545 - Juveniles

Year	Males	Juveniles
2009	208	50
2010	67	42
2011	98	46
2012	129	64
2013	119	67
2014	100	36
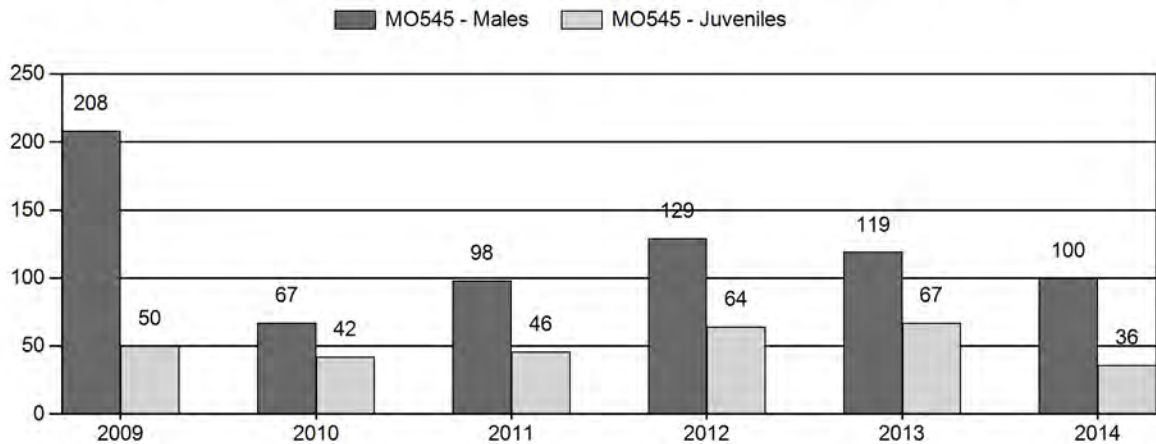
2009 - 2014 Postseason Classification Summary

for Moose Herd MO545 - SNOWY RANGE

Year	Post Pop	MALES				FEMALES		JUVENILES		Tot Cls	Cls Obj	Males to 100 Females				Young to		
		Ylg	Adult	Total	%	Total	%	Total	%			Ylng	Adult	Total	Conf Int	100 Fem	Conf Int	100 Adult
2009	0	4	21	25	58%	12	28%	6	14%	43	0	33	175	208	± 0	50	± 0	16
2010	0	7	17	24	32%	36	48%	15	20%	75	0	19	47	67	± 0	42	± 0	25
2011	0	3	46	49	40%	50	41%	23	19%	122	0	6	92	98	± 0	46	± 0	23
2012	0	4	14	18	44%	14	34%	9	22%	41	0	29	100	129	± 0	64	± 0	28
2013	0	5	27	32	42%	27	35%	18	23%	77	0	19	100	119	± 0	67	± 0	31
2014	0	2	20	22	42%	22	42%	8	15%	52	0	9	91	100	± 0	36	± 0	18

Snowy Range Moose (MO545)
Hunt Areas 38, 41
2015 Hunting Seasons

Hunt Area	Type	Dates of Seasons		Quota	License	Limitations
		Opens	Closes			
38, 41	1	Oct. 1	Nov. 14	20	Limited quota	Any moose, except cow moose with calf at side
	4	Oct. 1	Nov. 14	25	Limited quota	Antlerless moose, except cow moose with calf at side

Hunt Area	Type	Quota change from 2014
Herd Unit	1	0
Total	4	0

Management Evaluation
Current Management Objective: 100 (80 – 120)
Management Strategy: Special
2014 Postseason Population Estimate: 266
2015 Proposed Postseason Population Estimate: NA

Moose in the Snowy Range herd unit are managed toward a numeric objective of 100. A moose population model has not been developed for this herd unit. The herd is managed under a special management strategy. The objective was last reviewed in 1997.

Herd Unit Issues
The Snowy Range herd unit stretches across southern Wyoming, along the Colorado border, from Baggs to Cheyenne. Moose are found year-round in areas on Pole Mountain, Sierra Madre Mountains, and most notably, the Snowy Range Mountains. These moose descended from moose transplanted in Colorado and were not native to this area historically. Challenges for managing moose in this herd unit include a rapidly changing forest ecosystem, high infestation rates for parasites, and human conflict/safety. Limited population monitoring for moose has been an issue in this herd unit.

Weather
Weather in this herd unit was relatively normal during the past bio-year. This weather pattern most likely had a neutral to positive influence on moose. For specific meteorological information for the Snowy Range herd unit the reviewer is referred to the following links:
http://www.ncdc.noaa.gov/temp-and-precip/time-series/

Habitat

Moose habitat conditions are currently being monitored across Wyoming and in the North Park, Colorado area through a University of Wyoming project. Preliminary results published in a recent annual report for this project indicated the Snowy Range's willow habitat quality and moose fitness were relatively low when compared to the other areas (Jesmer, et. al. 2014).

Habitat conditions improved in 2014 with an increase in timely seasonal precipitation. However, much of the transition and winter ranges were severely impacted by the drought conditions experienced in bio-year 2012. No WGFD moose habitat production/utilization data was available for this herd unit. However, annual production rates were assumed to have improved from the previous year, while utilization rates on winter ranges were assumed to have continued to be high.

Field Data

Traditionally there has been little allocation of funding in this herd unit to collect moose classification data. Moose classification data has been collected incidentally during annual mule deer and elk classification surveys. In 2014, no additional hours of helicopter flight time was allocated to collect moose classification data in the Snowy Range herd unit. A classification sample of 52 moose was collected in December of 2014 in conjunction with mule deer and elk surveys. Eleven (11) of the 52 moose observed during the 2014 survey were in Hunt Area 41, on the Sierra Madre range. The 2014 classification ratios were 100 bulls/100 cows and 36 calves/100 cows.

Harvest Data

In 2014, the weighted harvest estimates indicated 48 hunters harvested 23 bulls, 22 cows and 2 calves (lab data indicated 1 calf). A total of 2 illegally harvested moose were documented in 2014. Male lab-aged tooth samples (n=37) indicated this year's median age and percentage of the bull harvest $\geq$ 5 years of age, were within the "prime-age bull" class (Figures 1, 2 and 3) (Thomas 2008). Age class distribution from female lab-aged tooth samples (n=17) indicated 47% of the antlerless moose harvest were $\leq$ 2 years old (Figure 4).

Median age for tooth samples from harvested bulls increased in 2014 and this increase was attributed to a reduction of 5 licenses being allocated for the 2014. The 2014 median bull age increased to 5 years of age which was an improvement of 1 year in age from the 2013 season, and within the parameters for the "prime-age bull" class. The Snowy Range has a reputation for producing trophy quality bulls. An objective for managers is to sustain both quantity and quality for the bull segment of this moose population.

The reported ages for harvested antlerless moose in 2014 was similar to the 2013 results even though license numbers had been reduced by 10 licenses. Although the proportion

of antlerless harvest ≤ 2 years in age (47%) was acceptable, it was assumed this proportion would increase in 2014 with the decrease in license numbers. As stated earlier in this report, making inferences from small or incomplete data sets has hampered the ability of managers to make management decisions of significant consequence for this herd unit.

Figure 1. Median age of bulls harvested for the Snowy Range Moose herd unit, from lab aged teeth (n=20), Wyoming, 2014.
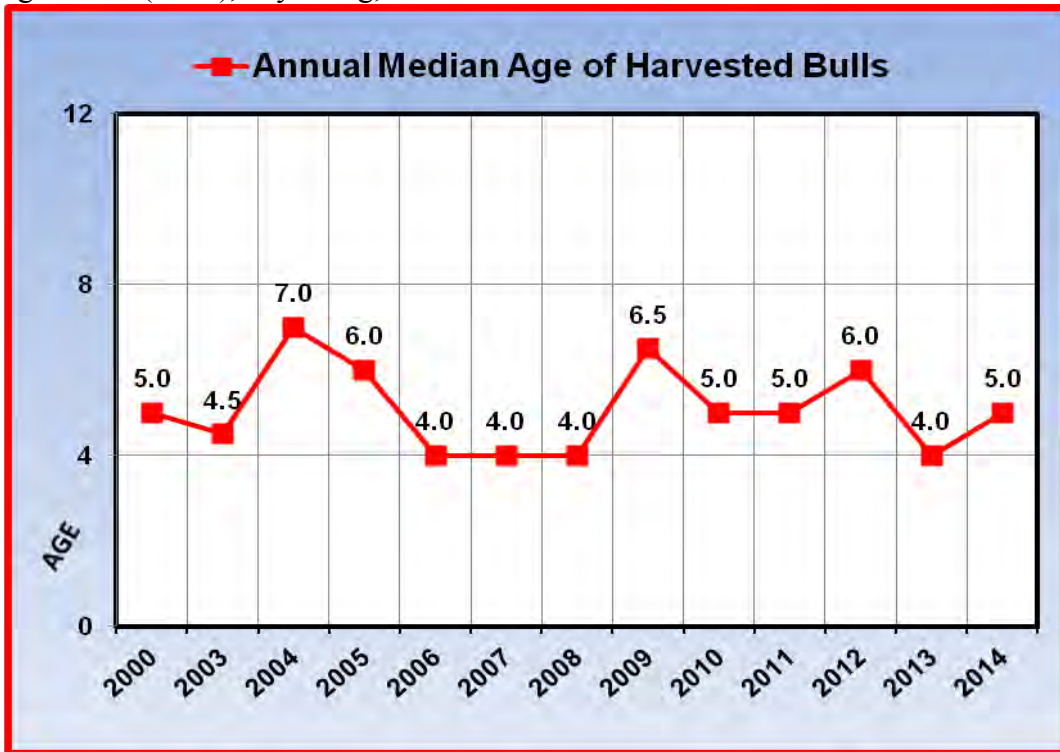
Figure 2. Average (3-year running) median age of bulls harvested for the Snowy Range Moose Herd Unit, from lab aged teeth (n=20), Wyoming, 2014.
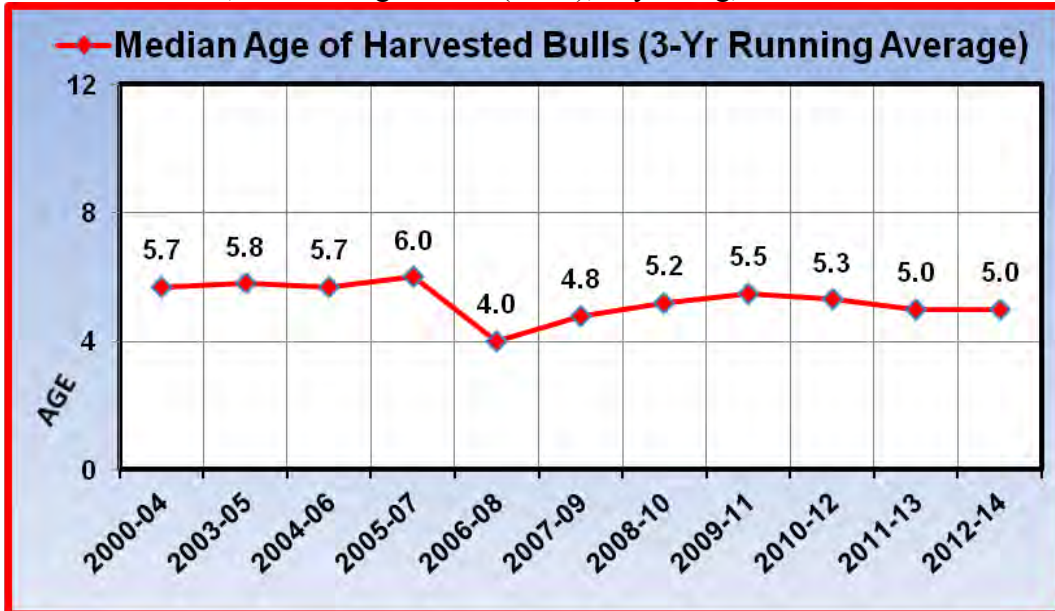
Figure 3. Annual Percentages of the bull harvest ≥ 5-years in age from Snowy Range Moose Herd Unit, from lab aged teeth (n=20), Wyoming, 2014.
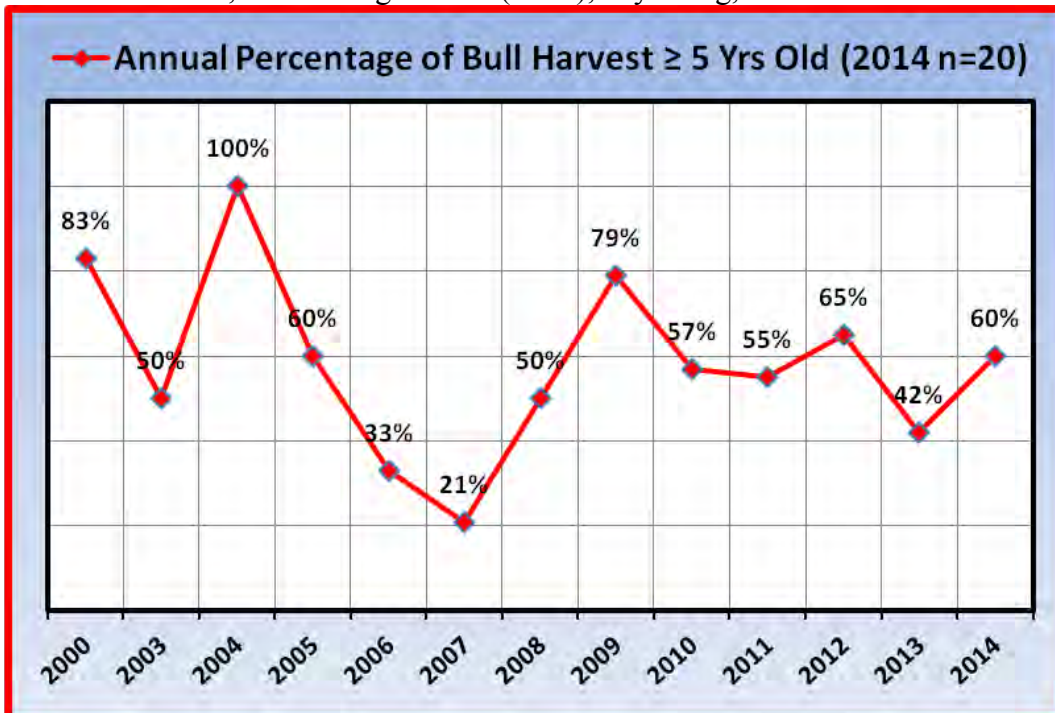
Figure 4. Age class distribution for antlerless moose harvested from Snowy Range
Moose Herd Unit, Wyoming, 2014.
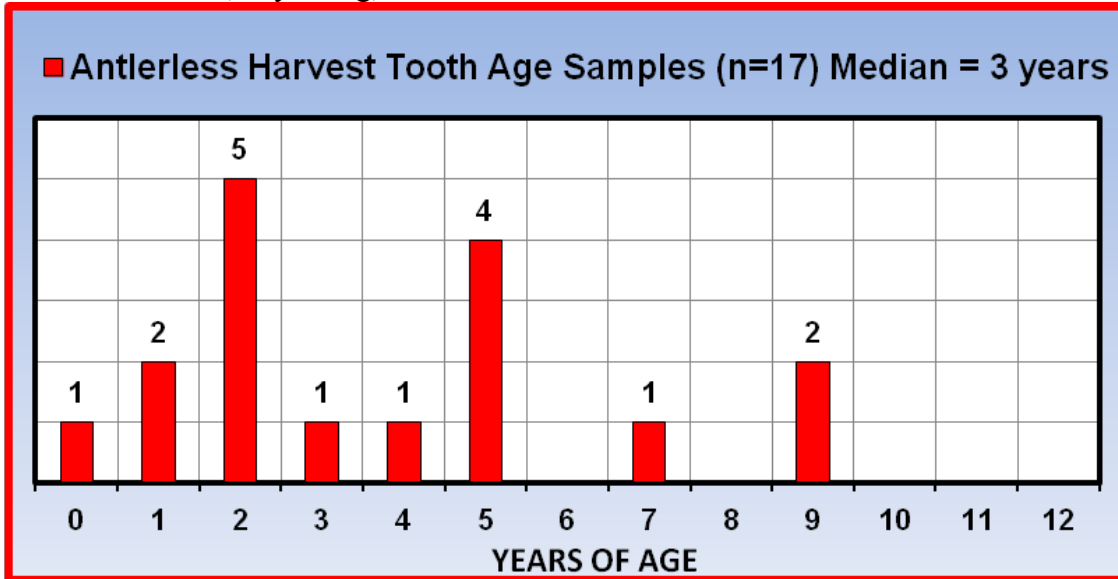
Population
A Wyoming Spreadsheet model has not been developed for this herd unit. A moose
abundance survey was completed in the Snowy Range herd unit in March 2015
(Appendix I). A total abundance estimate of 266 ± 56 (90% *CI*) (*SE* = 34) moose was
produced for this herd unit. The results of the sightability survey provided managers with
a plausible abundance estimate for moose wintering in the Snowy Range herd unit. The
abundance estimate will be useful in constructing a population model and making future
harvest recommendations for moose in this herd unit.

Management Summary
In 2015, licenses numbers and hunting season lengths remained the same as they were in
2014. We decreased license numbers for the 2014 hunting season due to concerns for our
ability to maintain trophy quality in the bull harvest. This decrease was also done in part
as an effort to become more conservative with harvest rates; as a precaution in case
moose numbers were approaching our postseason management objective of 100 moose.

Current Herd Specific Studies
A new collaborative study initiated in fall 2014 by the Wyoming Cooperative Fish and
Wildlife Research Unit and the Wyoming Game and Fish Department presents an
excellent opportunity to examine the relationship between moose habitat use and seral
changes brought about by bark beetles. By making use of an existing GPS dataset
collected prior to extensive beetle damage (Baigas 2008), comparing it to new GPS data,
and examining current individual movement strategies through the lens of body
condition, this project will provide new information on the status of moose in the Snowy
Range and their response to its beetle-killed forests.

The project began its field component in March 2015. Thirty (30) female moose (29 adults and one yearling) were captured via helicopter darting on winter habitats within and surrounding the Medicine Bow National Forest. Moose were fitted with GPS store-on-board collars set to collect 90-minute fixes. The fix-rate is identical to that used in the previous study, which will allow us to compare movement strategies and space use of moose prior to and following the extensive bark beetle damage. Collars will remain deployed for a period of two years, during which study animals will be recaptured twice per year to gather longitudinal data on demography and body condition (measured via ultrasonography). Monitoring body condition in the context of pregnancy (during winter) and lactation costs (in summer) will allow the project to critically examine the habitat quality of the Snowy Range, with the goal of understanding where the herd sits relative to nutritional carrying capacity.

Bibliography of Herd Specific Studies

Baigas, P. E. 2008. Winter Habitat selection, winter diet, and seasonal distribution mapping of Shiras moose (*Alces alces shirasi*) in southeastern Wyoming. M.S. Thesis, Univ. Wyoming, Laramie, Wyoming. USA. 220 pp.

Wyoming Game and Fish Department [WGFD]. 2000. Snowy Range – Sierra Madre Moose Herd Management Plan. Wyoming Game and Fish Department, Laramie. USA. 15 pp.

Literature Cited

Jesmer, B., Jacob Goheen, Matthew Kauffman, Kevin Monteith, Aly Courtemanch. 2014. Statewide Moose Habitat Project: Linking Habitat and Nutrition with Population Performance in Wyoming Moose. Annual Report 2014. Department of Zoology and Physiology, University of Wyoming, Laramie. 11 pp.

Thomas, T. P. 2008. Moose Population Management Recommendations. Wyoming Game and Fish Department, Cheyenne. 17 pp.

ESTIMATING MOOSE ABUNDANCE FOR THE SNOWY RANGE HERD UNIT IN WYOMING
May 2015
Will Schultz and Corey Class

INTRODUCTION

Moose (*Alces americanus shirasi*) were introduced in north central Colorado during the 1970s and 1980s and subsequently migrated north into portions of adjacent Wyoming mountain ranges. The first documented sighting of a moose in the Snowy Range herd unit occurred in 1981. Since 1981, moose have continued to expand in range and numbers throughout the Snowy, Sierra Madre and Laramie Mountain ranges of south central Wyoming.

Wyoming Game and Fish Department (WGFD) established a postseason management objective of 100 moose for the Snowy Range herd unit in 1987. By 2000, WGFD assumed the moose population had increased beyond the management objective and established the first hunting season for moose in this herd unit. Annual moose hunting seasons have been offered continuously in this herd unit since 2002. Harvest recommendations for a big game population such as the Snowy Range moose are difficult to formulate without the appropriate population data. Uninformed recommendations may result in over harvest or extirpation if too many moose are harvested annually, or it may result in reduced sustainability for moose browse if too few moose are harvested annually.

Past moose population monitoring in the Snowy Range herd unit consisted of collecting moose sex and age composition data incidentally while completing elk and mule deer postseason composition surveys. WGFD had not developed an abundance estimate for moose in the Snowy Range herd unit, either from abundance surveys or from a population model. In recent years, this herd unit has become the premier moose hunting and viewing destination in Wyoming. Insuring moose in this herd unit are managed sustainably has become a priority for WGFD. These factors cumulatively resulted in WGFD conducting an abundance survey in March 2015 to determine the current population status for moose in the Snowy Range herd unit.

SURVEY AREA

The Snowy Range herd unit is comprised of moose Hunt Areas 38 and 41 in southern Wyoming (Figure 1).

METHODS

Survey Area Selection
Moose abundance surveys had not been previously conducted in this herd unit and therefore some extrapolation of where moose might potentially be located in late winter was required.

WGFD managers associated with this herd unit mapped out locations known to be occupied by moose during winter using data from the WGFD Wildlife Observation System. Additionally, resource selection model results from Baigas (2008) were used to identify areas assumed to

Figure 1. Snowy Range moose herd unit, Hunt Areas 38 and 41, Wyoming.
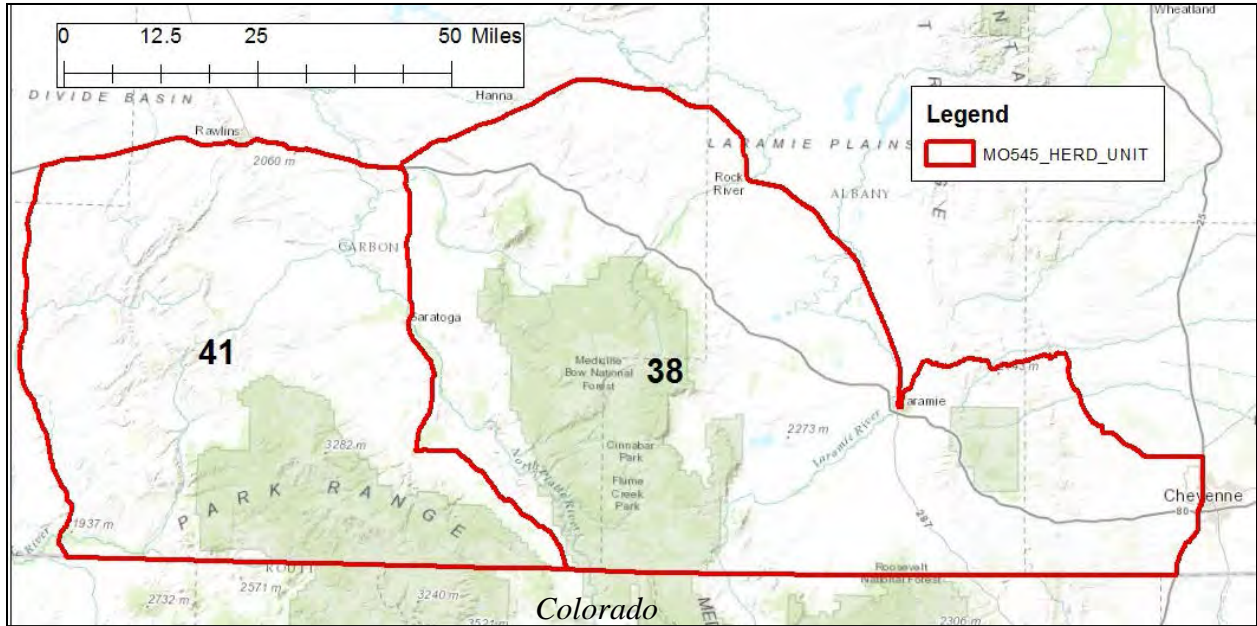
contain suitable winter moose habitat. Data from these two sources were incorporated to delineate an area assumed to be potentially occupied by moose in late winter.

A stratified random sample survey of the potentially occupied area was selected due to time and budgetary restraints. The potentially occupied area was divided geographically into survey search units (subunits) (n = 42) using features distinguishable from the air such as roads and waterways. Subunits were stratified by WGFD managers as either low or high strata with respect to assumed relative moose numbers (Figure 2). A random sample (n = 9) of the 31 low strata subunits were selected to be included in the survey. All (n = 11) high strata subunits were also included the survey.

Figure 2. Subunits for areas potentially occupied by moose in the Snowy Range herd unit, Wyoming.
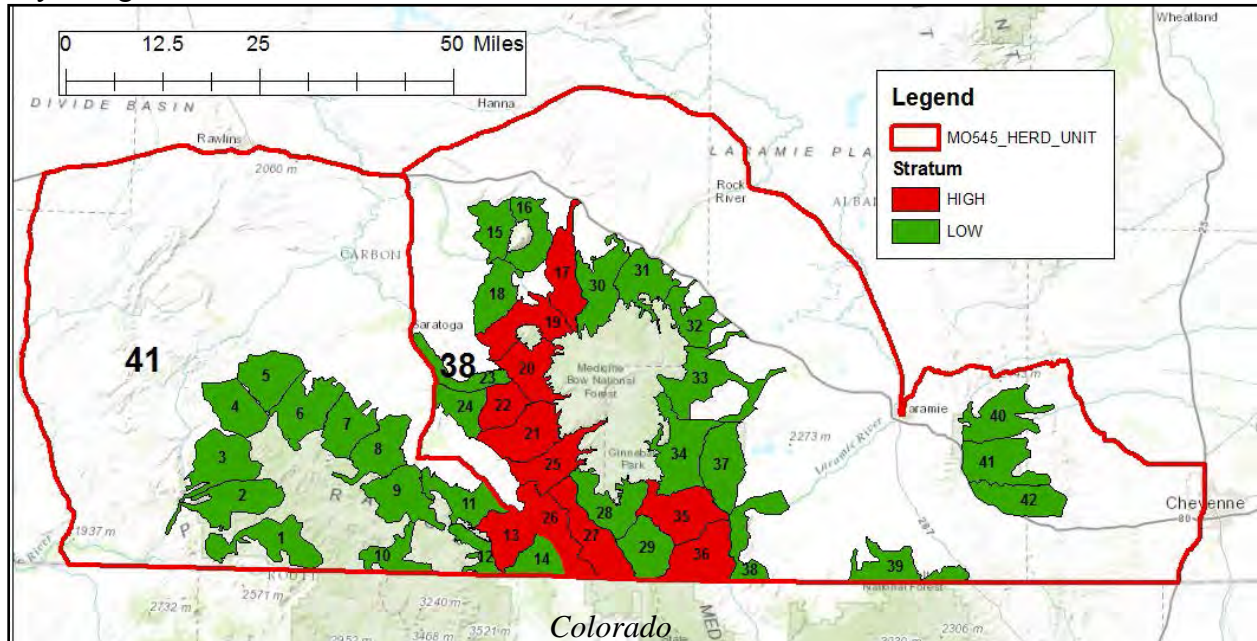
Survey

A sightability survey technique (Anderson 1994, Anderson and Lindzey 1996) was selected to determine moose abundance in the Snowy Range herd unit. The survey was conducted using a Bell® Jet Ranger helicopter (Bell Helicopter Textron Inc, Fort Worth, Texas, USA) supplied by Northern Skies Aviation (Laurel, Montana, USA). The survey was conducted 14 March - 22 March 2015. Helicopter speed was maintained at 40-50 knots, at an altitude of 100-200 ft. above ground during survey flights. Survey flight lines were flown in a manner to provide for the possibility to detect all moose groups in between the survey lines. All habitat in the subunits assumed to be occupied by moose was surveyed. Areas occupied by humans and confined livestock (e.g. houses and ranch yards) were excluded because of safety considerations. Seventy-three (73) hours of flight time were used to complete the survey.

Two (2) observers occupied the helicopter on all survey flights. Observers were Bill Brinegar, Biff Burton, Corey Class, Rick King, Lee Knox, and Will Schultz. The primary observer was seated in the left front seat of the helicopter and was responsible for observing the ground in front of and to the left of the helicopter. The secondary observer was seated in the right rear passenger seat and was responsible for observing the ground to the right the helicopter. The secondary observers also recorded observation data on paper survey forms and collected waypoints and flight tracks using a Garmin® (Garmin International Inc., Olathe, Kansas, USA) handheld GPS unit. Sightability variables recorded for each moose group observed included: waypoint number, moose group size, activity of the most active moose in the group, percent of snow cover, vegetation class, and percent of vegetative screening cover. Observations of other wildlife were also recorded incidentally.

RESULTS

A total 134 moose were observed in 86 groups (Attachment A). Moose group observation and sightability variable data were analyzed using the Wyoming Hiller-Soloy moose model in the Aerial Survey computer program (Unsworth, et. al. 1999). A total abundance estimate of 266 ± 56 (90% *CI*) (*SE* = 34) moose was produced for this herd unit (Attachment B). Sex and age ratios from the survey yielded 38 calves, 16 yearling bulls, and 53 adult bulls /100 cows.

DISCUSSION

The abundance estimate of 266 ± 56 moose was considered a minimum estimate based on an antidotal comparison between unmarked moose and marked (radio-collared) moose observed during the survey. During the 7 days prior to the sightability survey, 30 moose in this herd unit were chemically immobilized using a dart gun fired from a helicopter, handled for sampling, and fitted with radio-collars. Twenty-seven (27) of the 30 radio-collared moose were located within subunits which were surveyed during the time of the survey. Four (4) of the 27 radio-collared moose in the surveyed subunits were observed during the survey. Several of the radio-collared moose not observed during the survey were relocated using radio telemetry immediately after the respective subunit survey was completed. These relocated radio-collared moose appeared to be actively evading the helicopter by moving into dense cover types. The inability of observers to locate the radio-collared moose during the initial survey flight indicated sightability correction rates from the Wyoming Hiller-Soloy moose model may under estimate abundance for moose group observations in dense cover.

Sex and age ratios from the sightability survey were similar to the results of the postseason classification survey completed in December of 2014 (Table 1) with the exception of the adult bull ratio. Adult bull ratios from the sightability survey were lower than the ratio from the postseason classification survey. The lower adult bull ratios from the sightability survey may have been due to bulls which had lost their antlers being classified as unknowns during the sightability survey.

Table 1. Moose sex and age ratios from a postseason classification survey completed December 2014, and a sightability survey completed March 2015, in the Snowy Range herd unit, Wyoming.

Survey	Sample	Unknown	Ad. Bulls	Yr. Bulls	Calves	Cows	Ad. Bulls /100 Cows	Yr. Bulls /100 Cows	Calves /100 Cows
Class.	52	0	20	2	8	22	91	9	36
Sight.	134	18	29	8	23	56	53	16	38

The results of the sightability survey provided managers with a plausible abundance estimate for moose wintering in the Snowy Range herd unit. The abundance estimate will be useful in constructing a population model and making future harvest recommendations for moose in this herd unit.

LITERATURE CITED

Anderson, C.R. 1994. A sightability model for moose developed from helicopter surveys in western Wyoming. M.S. Thesis. Univ. of Wyoming. 69 pp.

Anderson, C.R., Jr. and F.G. Lindzey. 1996. Moose sightability model developed from helicopter surveys. Wildlife Society Bulletin 24(2):247-259.

Baigas, P. E. 2008. Winter Habitat selection, winter diet, and seasonal distribution mapping of Shiras moose (*Alces alces shirasi*) in southeastern Wyoming. M.S. Thesis, Univ. Wyoming, Laramie, Wyoming. USA. 220 pp.

Unsworth, J. W., F. A. Leban, E. O. Garton, D. J. Leptich, and P. Zager. 1999. Aerial Survey: User's Manual. Electronic Edition. Idaho Department of Fish & Game, Boise, Idaho, USA.

Attachment A. Snowy Range herd unit moose group observation and sightability data.

H A	Subunit	Strat	Total	Cows	Calves	YR Bulls	AD Bulls	Unkn	Act	% Snow	% Veg	Veg Class	East	North
38	13	L	0	0	0	0	0	0	0	0	0	0		
38	15	L	0	0	0	0	0	0	0	0	0	0		
38	17	H	1	0	0	0	1	0	2	5	70	2	382060	4612515
38	17	H	1	1	0	0	0	0	2	10	40	2	381675	4609230
38	17	H	1	1	0	0	0	0	2	10	20	2	381783	4604586
38	17	H	2	1	1	0	0	0	2	100	40	4	381620	4595478
38	17	H	2	1	1	0	0	0	2	100	40	4	379740	4597395
38	17	H	2	1	1	0	0	0	2	5	35	2	381922	4612804
38	17	H	2	1	1	0	0	0	2	10	20	2	381809	4607597
38	17	H	2	1	0	0	0	1	2	10	40	2	381356	4609797
38	18	L	2	1	1	0	0	0	2	90	25	3	369248	4603980
38	19	H	1	0	0	0	0	1	3	100	55	4	369171	4590620
38	19	H	1	0	0	0	1	0	3	85	50	4	365830	4591991
38	19	H	1	0	0	0	0	1	3	100	25	4	376345	4595934
38	19	H	1	1	0	0	0	0	3	100	20	4	377219	4594032
38	19	H	1	1	0	0	0	0	3	100	50	4	378290	4590393
38	19	H	2	1	1	0	0	0	2	100	20	4	377890	4594088
38	19	H	3	0	0	0	3	0	3	100	25	4	375976	4593995
38	20	H	1	0	0	0	1	0	3	80	10	3	372777	4579083
38	20	H	1	0	0	0	1	0	3	100	5	4	373165	4579252
38	20	H	1	0	0	0	1	0	3	60	50	4	371619	4581231
38	20	H	1	1	0	0	0	0	3	50	25	3	369818	4584078
38	20	H	1	1	0	0	0	0	3	100	60	4	370946	4585394
38	20	H	1	1	0	0	0	0	3	90	35	4	370446	4587865
38	20	H	2	1	1	0	0	0	2	60	15	3	373335	4580294
38	20	H	2	1	0	0	1	0	3	100	35	4	373306	4580695
38	20	H	2	0	0	0	2	0	3	90	35	4	370315	4587271
38	21	H	1	0	0	0	0	1	1	100	10	2	373085	4567067
38	21	H	1	1	0	0	0	0	3	100	15	3	373345	4567457
38	21	H	1	1	0	0	0	0	3	100	40	4	373239	4572590
38	21	H	1	0	0	0	0	1	1	100	40	4	378101	4567462
38	21	H	2	1	0	0	1	0	3	80	30	3	374208	4567281
38	21	H	2	2	0	0	0	0	1	100	10	2	372668	4569585
38	21	H	2	1	1	0	0	0	3	100	40	4	372574	4570197
38	21	H	3	0	0	0	3	0	1	100	25	4	373832	4573450
38	22	H	1	0	0	0	0	1	2	100	40	4	371710	4577398
38	25	H	1	0	0	0	1	0	2	100	20	4	377757	4564535
38	25	H	1	0	0	1	0	0	1	100	40	4	376450	4563867
38	25	H	1	1	0	0	0	0	1	100	10	3	376071	4562421
38	25	H	1	0	0	0	0	1	2	0	0	1	376945	4562087
38	25	H	1	0	0	0	1	0	2	80	0	1	378773	4562542
38	25	H	1	0	0	0	0	1	3	100	30	4	376386	4560938
38	25	H	2	2	0	0	0	0	2	100	25	3	377621	4562738
38	25	H	2	1	1	0	0	0	3	0	0	1	380822	4562566
38	25	H	3	1	2	0	0	0	2	5	25	4	378994	4563346
38	25	H	3	0	0	0	1	2	3	100	30	3	381196	4560826
38	26	H	2	0	0	1	1	0	2	100	35	3	385465	4541706
38	26	H	4	0	0	1	1	2	3	100	50	4	379617	4551990
38	27	H	1	1	0	0	0	0	3	95	25	4	384765	4551903
38	27	H	1	1	0	0	0	0	1	50	35	4	386241	4551867
38	27	H	1	0	0	0	0	1	3	100	40	4	380677	4556517
38	27	H	1	1	0	0	0	0	3	100	25	3	379469	4556641
38	27	H	1	1	0	0	0	0	3	100	45	3	381393	4558770

H A	Subunit	Strat	Total	Cows	Calves	YR Bulls	AD Bulls	Unkn	Act	% Snow	% Veg	Veg Class	East	North
38	27	H	1	0	0	0	1	0	3	100	15	4	385951	4546151
38	27	H	1	0	0	1	0	0	2	65	15	2	387981	4539905
38	27	H	1	1	0	0	0	0	2	85	10	3	387339	4549877
38	27	H	2	1	1	0	0	0	3	100	30	4	380443	4558926
38	27	H	2	1	1	0	0	0	3	100	30	4	384124	4548167
38	27	H	2	1	1	0	0	0	2	100	30	4	383682	4547487
38	27	H	2	1	1	0	0	0	2	100	30	4	386115	4546597
38	27	H	2	1	1	0	0	0	3	85	10	3	389261	4539565
38	27	H	2	1	1	0	0	0	2	90	20	4	389568	4541806
38	27	H	2	1	1	0	0	0	3	100	20	2	390492	4541315
38	27	H	2	1	0	1	0	0	2	100	10	2	392011	4540184
38	27	H	3	1	0	1	1	0	1	50	10	3	388763	4542253
38	27	H	4	3	0	0	1	0	3	100	50	4	387337	4549879
38	29	L	0	0	0	0	0	0	0	0	0	0		
38	30	H	1	0	0	0	0	1	1	100	40	3	412982	4548198
38	30	H	1	1	0	0	0	0	2	100	65	4	410780	4539249
38	30	H	2	1	1	0	0	0	1	100	65	4	411828	4548823
38	30	H	2	1	1	0	0	0	3	100	25	4	407862	4540466
38	30	H	2	1	1	0	0	0	1	100	45	4	412149	4592986
38	31	H	2	1	0	0	0	1	2	75	15	3	409585	4550567
38	31	H	2	1	0	0	1	0	2	15	0	1	409145	4556049
38	31	H	2	1	1	0	0	0	2	80	15	3	408234	4555453
38	31	H	2	1	0	0	0	1	3	60	35	1	405787	4552152
38	35	L	0	0	0	0	0	0	0	0	0	0		
38	38	L	2	0	0	1	1	0	2	95	20	3	467062	4557887
38	38	L	3	0	0	0	0	3	2	85	35	2	468968	4557921
38	42	L	1	0	0	0	1	0	3	65	35	4	408209	4588658
38	42	L	1	0	0	0	1	0	3	5	20	4	409025	4593952
38	42	L	2	1	0	1	0	0	3	45	20	3	408364	4591926
41	1	L	1	0	0	0	1	0	2	0	0	1	375729	4541003
41	1	L	2	2	0	0	0	0	3	5	10	4	369890	4542158
41	2	H	2	1	1	0	0	0	3	60	5	2	369695	4546878
41	5	L	0	0	0	0	0	0	0	0	0	0		

Aerial Survey for Windows, Version 1.00 Beta 6.1.4 (12-Feb-2000)

Monday, May 18, 2015   03:44 PM

Model: Moose, Hiller-Siloy, Wyoming

[Files]
Title   = C:\Users\comclass\Desktop\Aerial Survey 6.1\Aerial Survey\Beta6.1.3\2015
Snowy Range Moose SAB.ttl
Summary = C:\Users\comclass\Desktop\Aerial Survey 6.1\Aerial Survey\Beta6.1.3\2015
Snowy Range Moose SAB.sum

....

2015 Snowy Range Moose SAB

Section 1:   Summary of Raw Counts

| | Units | | --------- Number of Each Class Counted --------- | | | | | |
Stratum	Sampled	Total	Cows	Bulls	Calves	YrBull	AdBull	Unclas
1	9	14	4	6	1	2	4	3
2	11	120	52	31	22	6	25	15
Total	20	134	56	37	23	8	29	18
=======	=======	======	======	======	======	======	======	======

Section 2:   Summary of Raw Counts for Perfect Visibility Model
----
This table projects the number of animals that would have been counted if
every unit had been flown and visibility had been perfect (no animals obscured
by vegetation, etc.)

| | No of Units | | --------- Number of Each Class Counted --------- | | | | | |
Strat	Popn	Sample	Total	Cows	Bulls	Calves	YrBull	AdBull	Unclas
1	31	9	48	14	21	3	7	14	10
2	11	11	120	52	31	22	6	25	15
Total	42	20	168	66	52	25	13	39	25
=====	====	======	=====	======	======	======	======	======	======

Section 3:   Estimates for Total Number

Total

| | Number of Units | | | ---------- Variance ----------- | | | Bound |
Stratum	Popn.	Sample	Estimate	Sampling	Sightability	Model	90%
1	31	9	56	431	21	0	35
2	11	11	210	0	636	90	44
Total	**42**	**20**	**266**	**431**	**657**	**90**	**56**
=======	======	======	========	========	===========	========	=======

Cows

```
          Number of Units            ---------- Variance -----------   Bound
Stratum  Popn.  Sample  Estimate Sampling Sightability     Model      90%
-------  ------  ------  -------- -------- ------------ --------- -------
   1       31       9        15      47            2          0       12
   2       11      11        93       0          218         33       26
-------  ------  ------  -------- -------- ------------ --------- -------
 Total     42      20       108      47          220         33       28
=======  ======  ======  ======== ======== ============ ========= =======
```

Bulls

```
          Number of Units            ---------- Variance -----------   Bound
Stratum  Popn.  Sample  Estimate Sampling Sightability     Model      90%
-------  ------  ------  -------- -------- ------------ --------- -------
   1       31       9        24     137            6          0       20
   2       11      11        50       0           87         11       16
-------  ------  ------  -------- -------- ------------ --------- -------
 Total     42      20        74     137           93         11       26
=======  ======  ======  ======== ======== ============ ========= =======
```

Calves

```
          Number of Units            ---------- Variance -----------   Bound
Stratum  Popn.  Sample  Estimate Sampling Sightability     Model      90%
-------  ------  ------  -------- -------- ------------ --------- -------
   1       31       9         4      12            1          0        6
   2       11      11        37       0           68         11       15
-------  ------  ------  -------- -------- ------------ --------- -------
 Total     42      20        41      12           69         11       16
=======  ======  ======  ======== ======== ============ ========= =======
```

Yearling bulls

```
          Number of Units            ---------- Variance -----------   Bound
Stratum  Popn.  Sample  Estimate Sampling Sightability     Model      90%
-------  ------  ------  -------- -------- ------------ --------- -------
   1       31       9         8      22            2          0        8
   2       11      11         9       0            6          0        4
-------  ------  ------  -------- -------- ------------ --------- -------
 Total     42      20        17      22            8          0        9
=======  ======  ======  ======== ======== ============ ========= =======
```

Adult bulls

```
          Number of Units            ---------- Variance -----------   Bound
Stratum  Popn.  Sample  Estimate Sampling Sightability     Model      90%
-------  ------  ------  -------- -------- ------------ --------- -------
   1       31       9        16      56            3          0       13
   2       11      11        41       0           75         11       15
-------  ------  ------  -------- -------- ------------ --------- -------
 Total     42      20        57      56           78         11       20
=======  ======  ======  ======== ======== ============ ========= =======
```

Unclassified

```
          Number of Units         ---------- Variance -----------   Bound
Stratum  Popn.  Sample  Estimate Sampling Sightability     Model     90%
-------  ------  ------  -------- -------- ------------ --------- -------
   1       31      9        12      111            8          0       18
   2       11     11        31        0           78         11       16
-------  ------  ------  -------- -------- ------------ --------- -------
 Total     42     20        43      111           86         11       24
=======  ======  ======  ======== ======== ============ ========= =======
```

Section 4: Estimates for Proportions

Cows

```
          Number of Units         ---------- Variance -----------   Bound
Stratum  Popn.  Sample  Estimate Sampling Sightability     Model     90%
-------  ------  ------  -------- -------- ------------ --------- -------
   1       31      9    0.27333  0.01344      0.00049   0.00002 0.19433
   2       11     11    0.44264  0.00000      0.00179   0.00115 0.08912
-------  ------  ------  -------- -------- ------------ --------- -------
 Total     42     20    0.40696  0.00061      0.00113   0.00072 0.08147
=======  ======  ======  ======== ======== ============ ========= =======
```

Bulls

```
          Number of Units         ---------- Variance -----------   Bound
Stratum  Popn.  Sample  Estimate Sampling Sightability     Model     90%
-------  ------  ------  -------- -------- ------------ --------- -------
   1       31      9    0.43167  0.01066      0.00123   0.00007 0.17989
   2       11     11    0.23768  0.00000      0.00160   0.00038 0.07305
-------  ------  ------  -------- -------- ------------ --------- -------
 Total     42     20    0.27900  0.00048      0.00105   0.00024 0.06910
=======  ======  ======  ======== ======== ============ ========= =======
```

Calves

```
          Number of Units         ---------- Variance -----------   Bound
Stratum  Popn.  Sample  Estimate Sampling Sightability     Model     90%
-------  ------  ------  -------- -------- ------------ --------- -------
   1       31      9    0.07375  0.00428      0.00023   0.00001 0.11050
   2       11     11    0.17417  0.00000      0.00091   0.00031 0.05748
-------  ------  ------  -------- -------- ------------ --------- -------
 Total     42     20    0.15296  0.00019      0.00058   0.00019 0.05103
=======  ======  ======  ======== ======== ============ ========= =======
```

Yearling bulls

```
          Number of Units         ---------- Variance -----------   Bound
Stratum  Popn.  Sample  Estimate Sampling Sightability     Model     90%
-------  ------  ------  -------- -------- ------------ --------- -------
   1       31      9    0.14750  0.00203      0.00036   0.00001 0.08066
   2       11     11    0.04206  0.00000      0.00013   0.00001 0.01972
-------  ------  ------  -------- -------- ------------ --------- -------
 Total     42     20    0.06446  0.00009      0.00010   0.00001 0.02313
=======  ======  ======  ======== ======== ============ ========= =======
```

Adult bulls

```
        Number of Units         ---------- Variance -----------    Bound
Stratum  Popn.  Sample  Estimate Sampling Sightability    Model     90%
-------  ------  ------  -------- -------- ------------ --------- -------
      1      31       9   0.28417  0.00548      0.00073   0.00003 0.12994
      2      11      11   0.19562  0.00000      0.00140   0.00033 0.06831
-------  ------  ------  -------- -------- ------------ --------- -------
 Total      42      20   0.21453  0.00025      0.00090   0.00020 0.06050
=======  ======  ======  ======== ======== ============ ========= =======
```

Unclassified

```
        Number of Units         ---------- Variance -----------    Bound
Stratum  Popn.  Sample  Estimate Sampling Sightability    Model     90%
-------  ------  ------  -------- -------- ------------ --------- -------
      1      31       9   0.22125  0.02122      0.00169   0.00006 0.24925
      2      11      11   0.14551  0.00000      0.00148   0.00030 0.06943
-------  ------  ------  -------- -------- ------------ --------- -------
 Total      42      20   0.16167  0.00096      0.00100   0.00019 0.07613
=======  ======  ======  ======== ======== ============ ========= =======
```

Section 5: Estimates for Ratios

Calves per 100 Cows

```
        Number of Units         ---------- Variance -----------    Bound
Stratum  Popn.  Sample  Estimate Sampling Sightability    Model     90%
-------  ------  ------  -------- -------- ------------ --------- -------
      1      31       9      27.0    640.5         12.5       0.9    42.1
      2      11      11      39.3      0.0        118.7      18.4    19.3
-------  ------  ------  -------- -------- ------------ --------- -------
 Total      42      20      37.7     13.1         87.9      13.6    17.6
=======  ======  ======  ======== ======== ============ ========= =======
```

Yearling bulls per 100 Cows

```
        Number of Units         ---------- Variance -----------    Bound
Stratum  Popn.  Sample  Estimate Sampling Sightability    Model     90%
-------  ------  ------  -------- -------- ------------ --------- -------
      1      31       9      54.0   1465.5         29.0       2.0    63.6
      2      11      11       9.5      0.0          9.3       0.6     5.2
-------  ------  ------  -------- -------- ------------ --------- -------
 Total      42      20      15.9     29.9          7.5       0.5    10.1
=======  ======  ======  ======== ======== ============ ========= =======
```

Adult bulls per 100 Cows

```
        Number of Units         ---------- Variance -----------    Bound
Stratum  Popn.  Sample  Estimate Sampling Sightability    Model     90%
-------  ------  ------  -------- -------- ------------ --------- -------
      1      31       9     104.0   4258.6         62.0       4.2   108.2
      2      11      11      44.2      0.0        136.1      20.2    20.6
-------  ------  ------  -------- -------- ------------ --------- -------
 Total      42      20      52.8     87.0        101.8      15.0    23.5
=======  ======  ======  ======== ======== ============ ========= =======
```

Section 6: Summary Statistics

Percent correction from perfect visibility model

| | Units | | | | | | | |
Stratum	Sampled	Total	Cows	Bulls	Calves	YrBull	AdBull	Unclas
1	9	17.1	12.0	17.9	20.9	20.9	16.5	20.9
2	11	74.7	78.5	60.8	66.0	47.0	64.1	103.4
Total	20	58.1	64.2	43.2	61.1	31.9	47.0	69.7
======	======	=====	=====	=====	======	======	======	======

[Total variances (i.e., standard error squared) are in parenthesis]

Total estimates...

```
      266 (     1178) Total
      108 (      300) Cows
       74 (      241) Bulls
       41 (       92) Calves
       17 (       30) Yearling bulls
       57 (      145) Adult bulls
       43 (      208) Unclassified
```

Proportions...

```
    0.4070 (0.002453) Cows
    0.2790 (0.001765) Bulls
    0.1530 (0.000962) Calves
    0.0645 (0.000198) Yearling bulls
    0.2145 (0.001353) Adult bulls
    0.1617 (0.002142) Unclassified
```

Ratios...

```
      38 (      115) Calves per 100 Cows
      16 (       38) Yearling bulls per 100 Cows
      53 (      204) Adult bulls per 100 Cows
```
==

Moose (M545) -- Snowy Range/Sierra Madre
HA 38, 41
Revised 6/2004

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