MOOSE

For formatting purposes,
this page left blank intentionally.

2017 - JCR Evaluation Form

SPECIES: Moose
HERD: MO313 - BIGHORN
HUNT AREAS: 1, 34, 42

PERIOD: 6/1/2017 - 5/31/2018

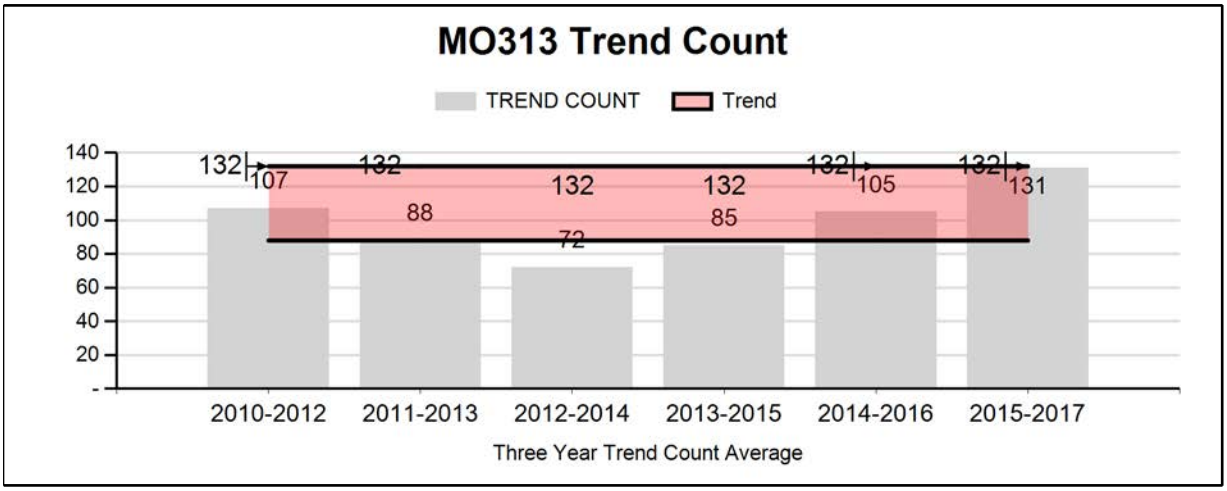
PREPARED BY: TIM THOMAS

	2012 - 2016 Average	2017	2018 Proposed
Trend Count:	92	150	110
Harvest:	49	15	18
Hunters:	56	15	20
Hunter Success:	88%	100%	90 %
Active Licenses:	56	15	20
Active License Success	88%	100%	90 %
Recreation Days:	433	133	160
Days Per Animal:	8.8	8.9	8.9
Males per 100 Females:	75	84	
Juveniles per 100 Females	37	47	

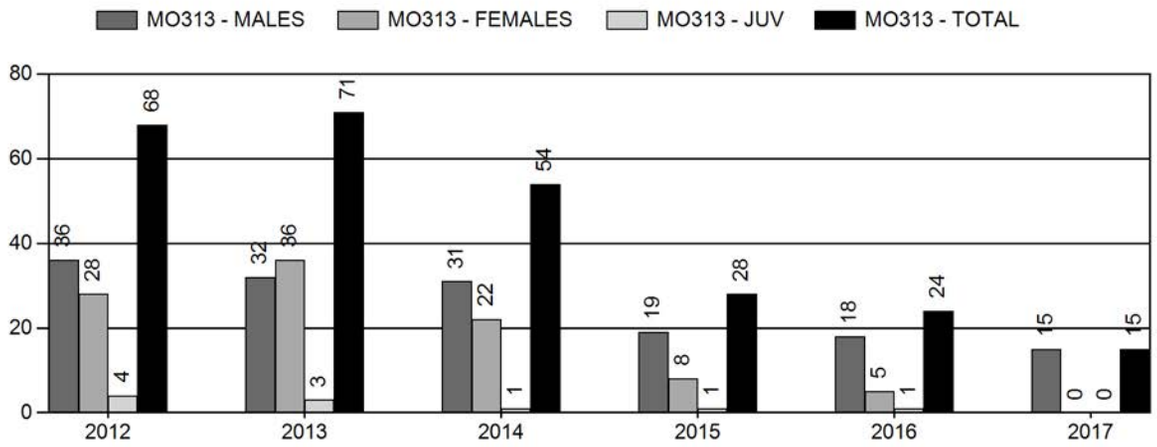
Trend Based Objective (± 20%)	110 (88 - 132)
Management Strategy:	Special
Percent population is above (+) or (-) objective:	36%
Number of years population has been + or - objective in recent trend:	0

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

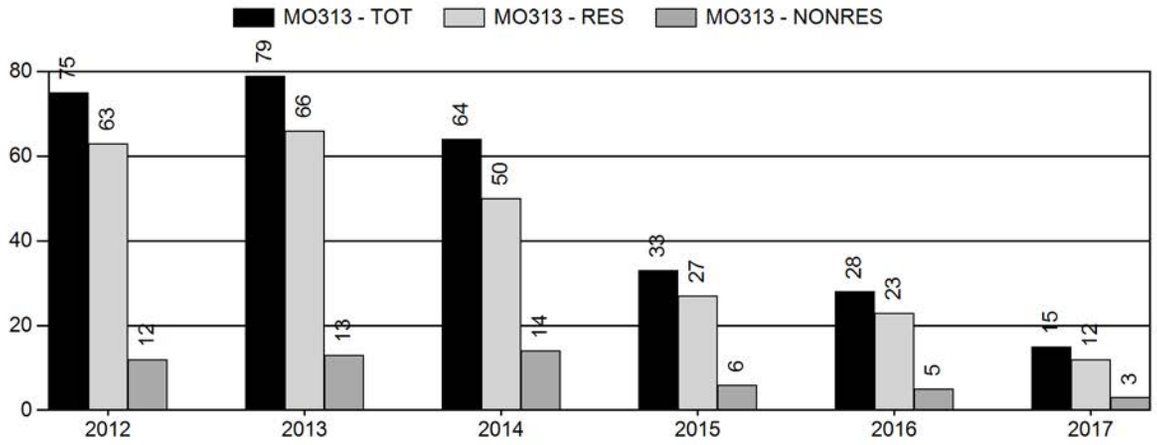
	JCR Year	Proposed
Females ≥ 1 year old:	0%	0%
Males ≥ 1 year old:	14%	12%
Juveniles (< 1 year old):	0%	0%



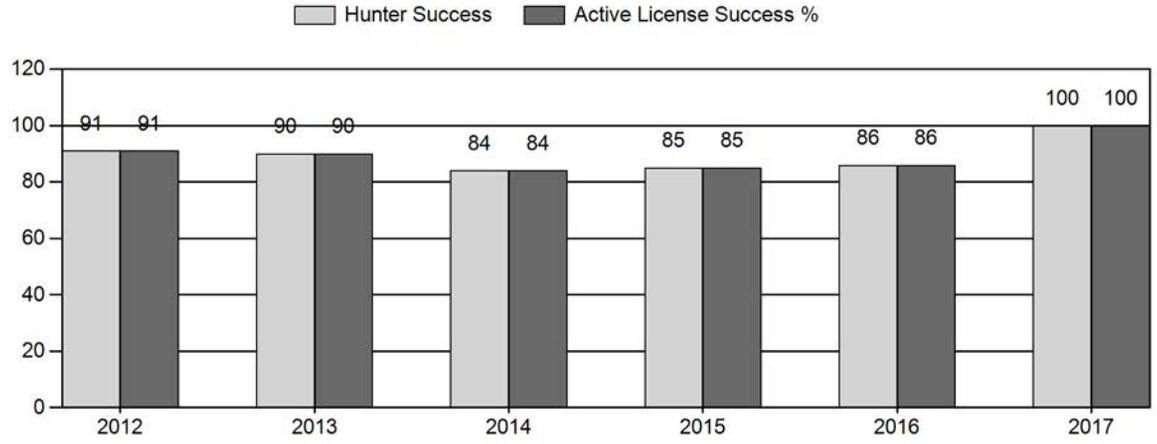
Harvest



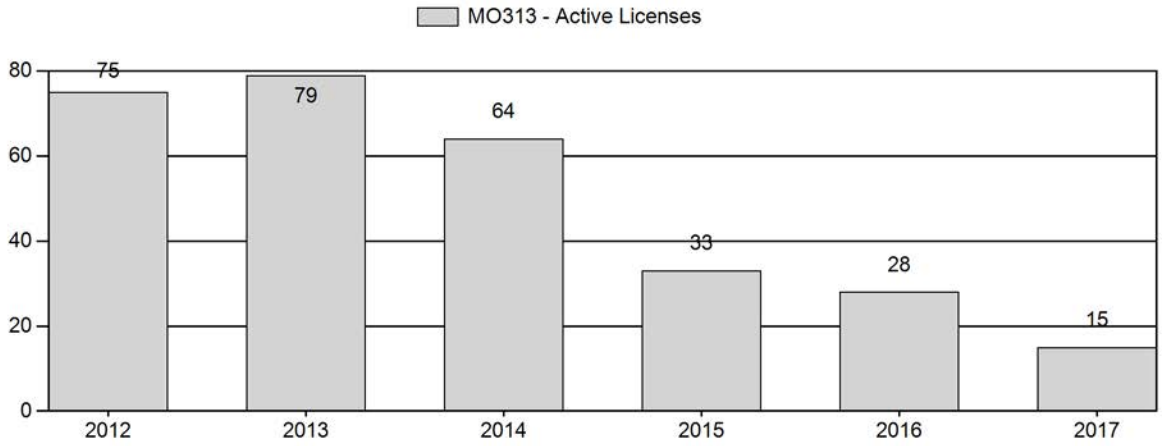
Number of Active Licenses



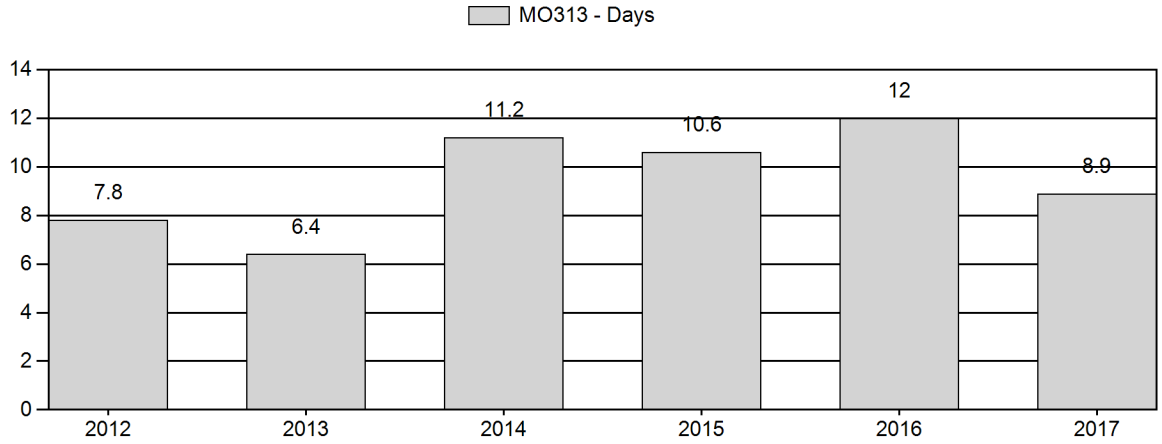
Harvest Success



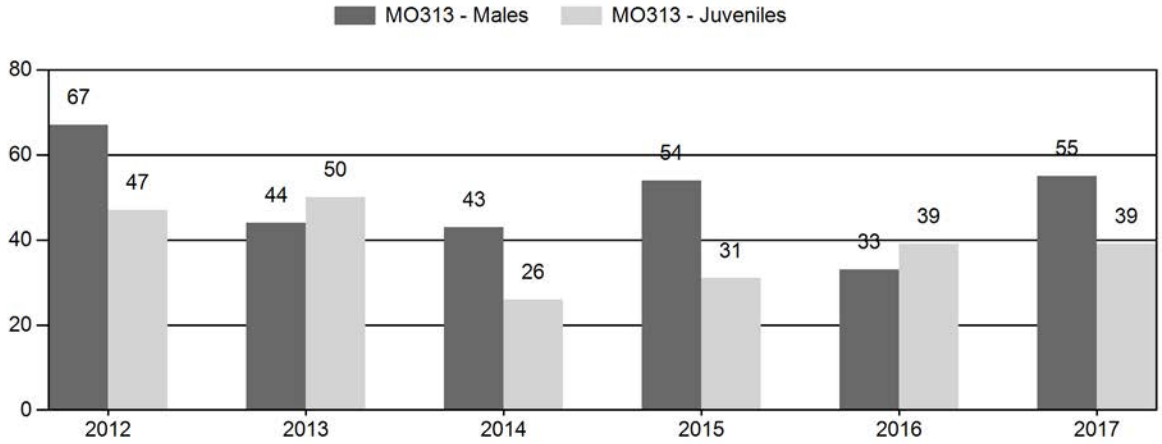
Active Licenses



Days Per Animal Harvested



Preseason Animals per 100 Females



2012 - 2017 Preseason Classification Summary

for Moose Herd MO313 - BIGHORN

		MALES				FEMALES		JUVENILES				Males to 100 Females				Young to		
Year	Pre Pop	Ylg	Adult	Total	%	Total	%	Total	%	Tot Cls	Cls Obj	Ylng	Adult	Total	Conf Int	100 Fem	Conf Int	100 Adult
2012	529	1	9	10	31%	15	47%	7	22%	32	396	7	60	67	± 0	47	± 0	28
2013	495	0	7	7	23%	16	52%	8	26%	31	326	0	44	44	± 0	50	± 0	35
2014	360	2	8	10	26%	23	59%	6	15%	39	239	9	35	43	± 0	26	± 0	18
2015	350	3	24	28	29%	52	54%	16	17%	96	248	6	46	54	± 0	31	± 0	20
2016	0	5	13	18	19%	54	58%	21	23%	93	224	9	24	33	± 0	39	± 0	29
2017	0	4	24	28	28%	51	52%	20	20%	99	235	8	47	55	± 0	39	± 0	25

2018 HUNTING SEASONS
BIGHORN MOOSE HERD (MO313)

Hunt Area	Type	Season Dates Opens	Season Dates Closes	Quota	License	Limitations
1	1	Oct. 1	Oct. 31	5	Limited quota	Any moose, except cow moose with calf at side
34	1	Oct. 1	Oct. 31	10	Limited quota	Any moose, except cow moose with calf at side
42	1	Oct. 1	Oct. 31	5	Limited quota	Any moose, except cow moose with calf at side

Special Archery Season Hunt Areas	Season Dates Opens	Season Dates Closes	Limitations
1, 34, 42	Sep. 15	Sep. 30	Refer to Section 2 of this Chapter

Hunt Area	Type	Quota change from 2017
34	1	+ 5
Herd Unit Total		
	1	**+ 5**
	4	**None**

Management Evaluation
Current Trend Count Management Objective: 110 (88-132)
Management Strategy: Special
2017 Trend Count: 150
Most Recent 3-year Running Average Trend Count: 131

Herd Unit Issues

The Bighorn Moose Herd Unit is located in north central Wyoming, centered on the Bighorn Mountains. Management is shared between the Sheridan and Cody regions with the Sheridan Wildlife Biologist having herd unit reporting responsibility. This herd unit contains three hunt areas – Areas 1, 34 and 42.

The primary management objective for the Bighorn Moose Herd Unit is a trend count objective of 110 moose (±20%), with a desired distribution of approximately 50 moose observed in Hunt Area 1, 30 moose observed in Hunt Area 34, and 30 moose observed in Hunt Area 42. The secondary management objectives are to maintain a median age of harvested bulls of ≥4 years and to have at least 40% of the harvested bulls be ≥ 5 years old (Thomas 2008).

The management strategy for all moose herd units in Wyoming is special management, emphasizing trophy quality hunting opportunities. The objectives and management strategies for this herd unit were last reviewed and updated in 2015 when the objective was changed to a trend count objective from a post-season population objective based on simulation modeling.

Weather

Temperature and precipitation data referenced in this section were collect at the Burgess Junction (#481220) weather station located on the Bighorn Mountains in this herd unit. These data were reported by the Western Region Climate Center (www.wrcc.dri.edu).

Spring 2017 was cool and wet, with near normal temperatures and above normal precipitation, resulting in a good start for forage production in the Bighorn Mountains. May, June and August saw below average precipitation, with July receiving over double the normal precipitation. Temperatures through the summer were near or above normal. During the fall of 2017, precipitation was significantly above normal (September), well below normal (October) or near normal (November), with temperatures slightly (September-October) to well (November) above normal. Temperatures were above average in December and January, turning cold in February. Precipitation was near normal for December through February. Moose appear to have entered the winter in good condition, allowing them to survive the winter fairly well. Calves may have problems navigating deep snow during later winter months, requiring additional energy expenditures during a time of low body reserves.

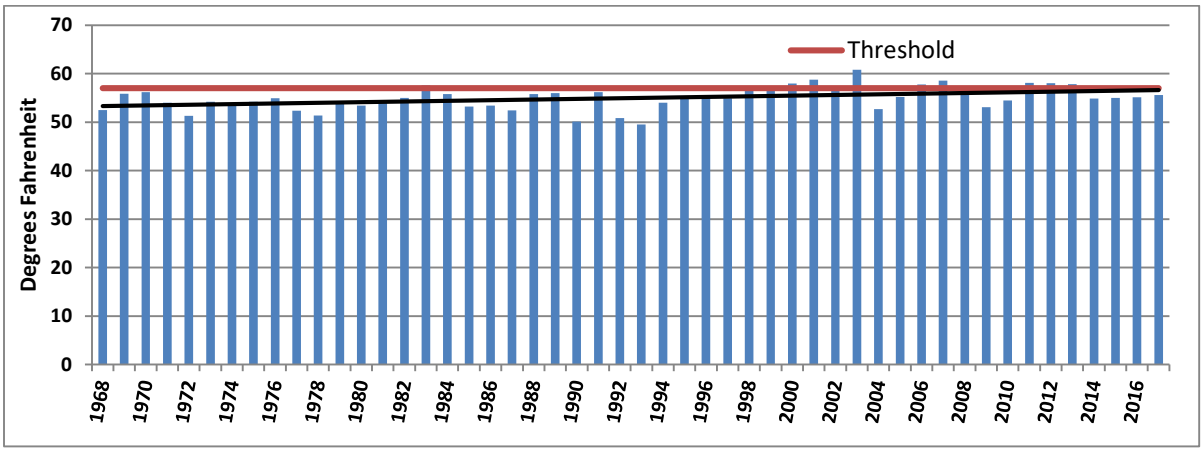


Figure 1. Average monthly summer (July-August) temperatures from 1968-2017 collected at the Burgess Junction weather station (#48122). The trend (black line) shows an increasing average summer temperature over time. Moose may be sensitive to summer temperatures above 57^0F (red line).

Moose thrive in colder climates and appear to be sensitive to warmer temperatures, showing signs of increased heat stress at about 23˚ F during winter months and 57˚ F during summer months (Renecker and Hudson 1986, Schwarz and Renecker 1997). McCann et al. (2013) suggested a summer heat threshold of ~63˚ F. Recent research conducted in Massachusetts and Minnesota suggests moose alter behavior and move to thermal cover to avoid heat stress during warm weather (Olson et al. 2014, Olson et al. 2016, Wattles and DeStefano 2013). This can potentially affect feeding and movement patterns. Long-term consequences or effects on fitness of warming climates are currently not well understood. Moose at the southern limit of moose distribution, like moose in Wyoming, may be more vulnerable to increasing temperatures as the

normal ambient temperature is generally already higher than northern latitudes, leaving a narrower margin before temperatures exceed threshold levels. The average monthly temperatures recorded at the Burgess Junction weather station have shown an upward trend over the past 50 years for both summer (July-August; Fig. 1) and winter (January-February; Fig. 2) months.

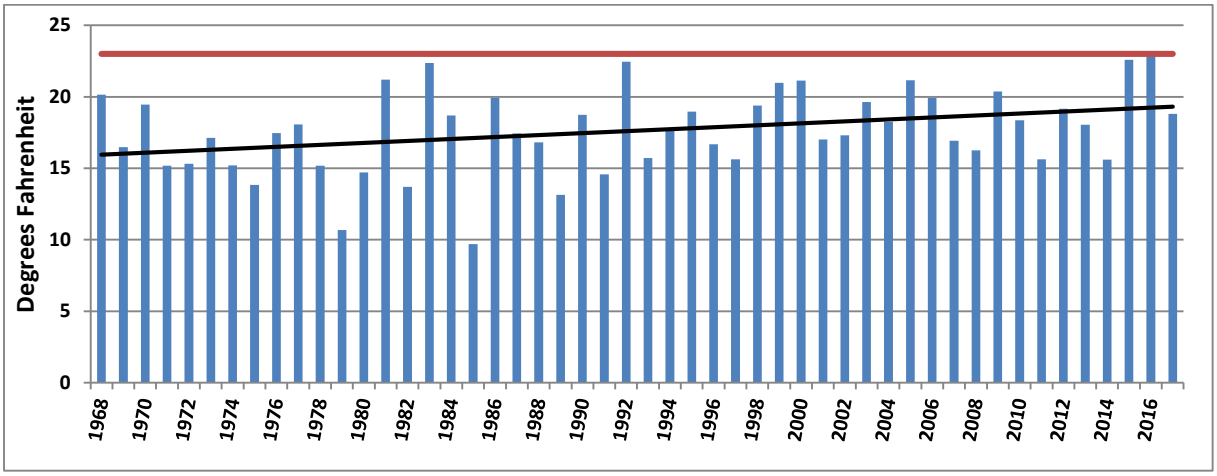


Figure 2. Average monthly winter (January-February) temperatures from 1968-2017 collected at the Burgess Junction weather station (#481220). The trend (black line) shows an increasing average winter temperature over time. Moose may be sensitive to winter temperatures above 23^0F (red line).

Habitat

The majority of moose habitat in this herd unit is located on the Bighorn Mountains, primarily on lands managed by the U.S. Forest Service Bighorn National Forest. Habitats include riparian willow, aspen, conifer, open grassland and mountain shrub communities.

We do not have an established habitat transect in this herd unit. Range personnel with the Bighorn National Forest have collected willow transect information at various locations on the Bighorn Mountains, the primary range for moose in this herd unit. Some survey sites suggest high use (> 50% twig browsing) by wildlife, which could include moose, elk or mule deer. In general, taller willow species seem to be decreasing and shorter willow species seem to be maintaining or increasing. We believe taller willow species tend to be more desired browse species for big game such as moose. Taller willows also produce more biomass than smaller willows, generally increasing the amount of forage available for browsers such as moose. As such, there appears to have been a decline in both preferred forage plant composition and forage quantity over time, reducing the carrying capacity for moose. Some willow habitat is relatively linear, such as along drainages on the west side in Hunt Area 42, limiting moose distribution.

Field Data

Field personnel classify moose in Hunt Areas 1 and 34 annually. In recent years, these surveys were conducted using aerial survey techniques from a Bell 206B JetRanger III helicopter. Hunt Area 1 is surveyed in late August, and Hunt Area 34 is surveyed during late November – mid-January, depending on survey conditions, snow cover, and aircraft availability.

Classification counts in Area 42 have been collected sporadically over the years, usually incidental to other duties during July and August. Systematically surveys were initiated in Hunt

Area 42 in 2015 using ground count routes during mid-summer. Specific survey routes were established by the Greybull Wildlife Biologist and are conducted by regional personnel.

Survey results can vary significantly between years, often without easily discernible rationale, making interpretation of data difficult at best (Fig.3). Over time, trends in survey counts can be observed and may provide insight to general population dynamics. We do obtain a known annual minimum population from these surveys.

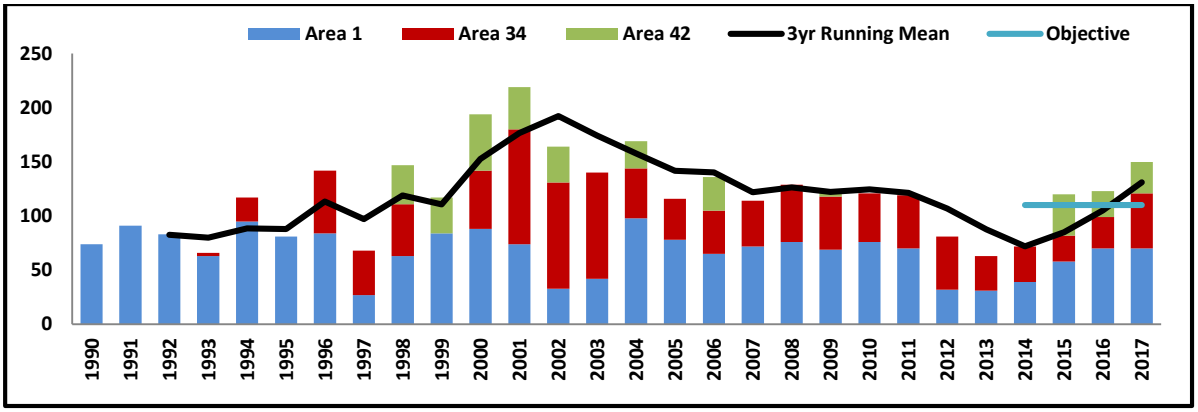


Figure 3. Moose classification/trend counts in Bighorn Herd Unit. Area 1 is surveyed in late August of each year. Area 34 is surveyed in later November – January of each year. Area 42 was periodically surveyed during mid-late summer incidental to other activities, and starting in 2015, using designated survey routes.

During 2017, we classified 70 moose in Area 1 (Fig. 4), the same as during 2016. This was slightly above the long-term (n=27 years) average count of 67 moose. We observed only 39 bulls per 100 cows, an increase from 2016 but still well below the minimum desired level of at least 50 bulls:100 cows. The apparent lack of bulls was evident during the hunting season, where several hunters commented on the inability to find bulls, especially mature bulls. We observed 17 calves during the survey, for a ratio of 45 calves per 100 cows, the same as the previous year and above the long-term (n=36 years) average of 38 calves per 100 cows.

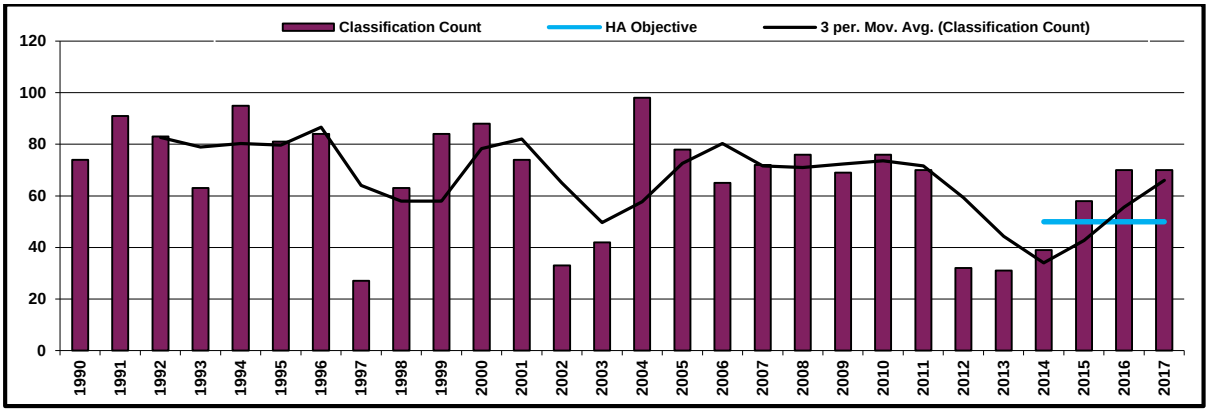


Figure 4. Moose classification/trend counts in Hunt Area 1 of the Bighorn Herd Unit. Area 1 is surveyed in late August of each year using aerial survey techniques. The sub-objective for Area 1 is 50 moose.

In Area 34, we observed 51 moose during a February 2018 survey and were able to classify 44 of them. This was an increase from 2016 (n=29), the highest count since 2008 (Fig. 5) and higher

than the desired level of 30 observed moose. We observed 84 bulls and 47 calves per 100 cows. The observed bull to cow ratio usually runs high in this hunt area. This could be a true representation of the male segment of this hunt area or could be a function of bulls being disproportionally visible during the survey period. Post-season calf to cow ratios may be skewed upward due to selective harvest of barren cows due to hunting regulations (i.e. cow without calf at side). Low sample size for both areas makes it difficult to have confidence that these ratios accurately reflect the population dynamics of this herd in any one specific year but likely provide an idea of population dynamics over time.

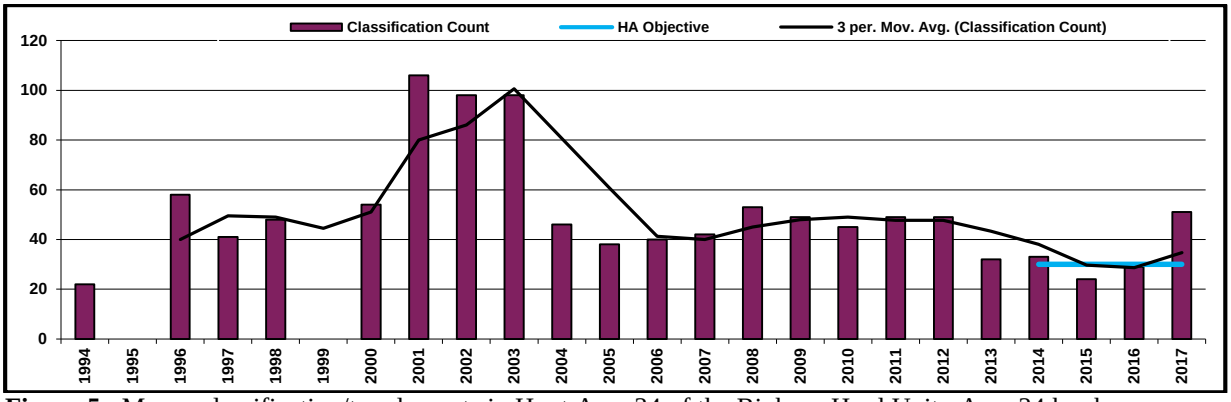


Figure 5. Moose classification/trend counts in Hunt Area 34 of the Bighorn Herd Unit. Area 34 has been surveyed during mid-November – January using aerial surveys techniques since 2001. This year's survey occurred in mid-February. The sub-objective for Area 34 is 30 moose.

During 2017, Cody Region wildlife personnel counted 29 moose during ground surveys in late June (Fig. 6). We observed 100 males per 100 females and 23 calves per 100 females. The calf to cow ratio is significantly below desired levels. This could be a function of small sample size, survey design or could be truly representative of the population. We will get a better feel as we continue to collect annual survey data in this hunt area in future years.

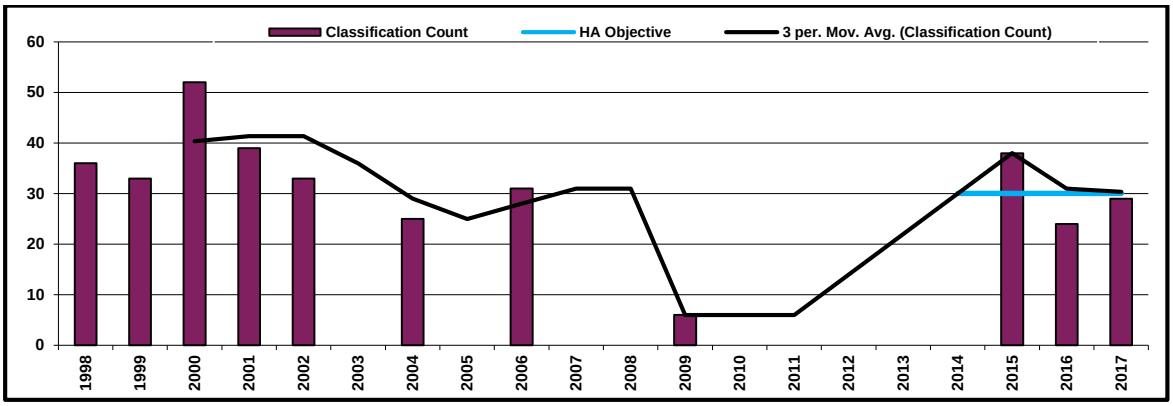


Figure 6. Moose classification/trend counts in Hunt Area 42 of the Bighorn Herd Unit. Area 42 was surveyed in mid-summer using ground survey techniques. The sub-objective for Area 42 is 30 moose.

Teeth were collected from hunter harvested moose, generally through voluntary submission by successful hunters. Median age of males harvested in 2017 was 4 years old (mean = 4.5, n = 13, range = 1-9 yrs old), down from median age of 5.5 years for moose harvested in 2016, and at the minimum desired median age threshold of ≥4 years old (Fig. 7) for the first time in four years.

Thirty-eight percent of the harvested males were ≥ 5 years old, slightly below the minimum desired level of 40% (Fig. 8), and a decrease from 2016. Hunters seemed to be less selective in 2017, with only 5 of the 13 harvested bulls ≥ 5 years old. This could have been a function of what was actually available for harvest also.

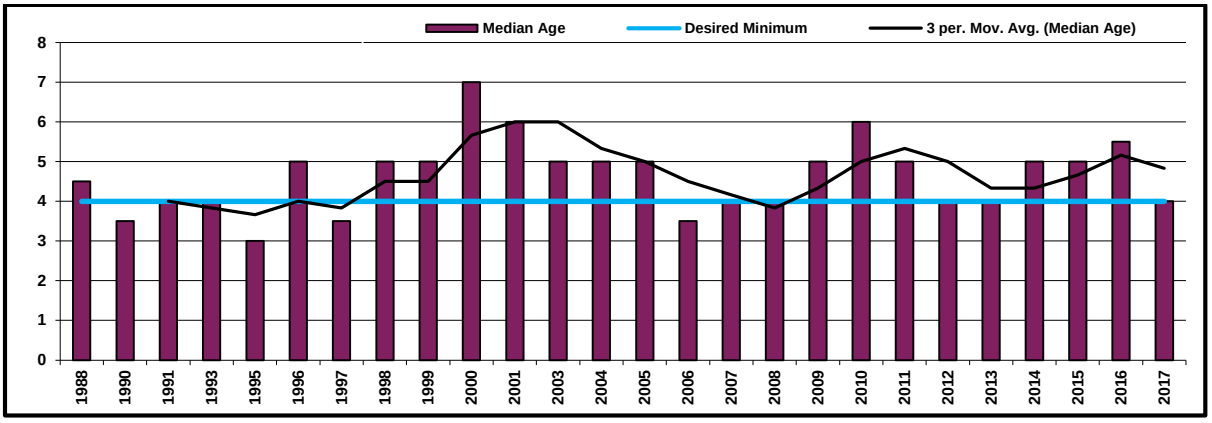


Figure 7. Median age of harvested bull moose in Bighorn Herd Unit. Teeth aged by cementum analyses. Only male moose ≥ 1 years old included in analysis.

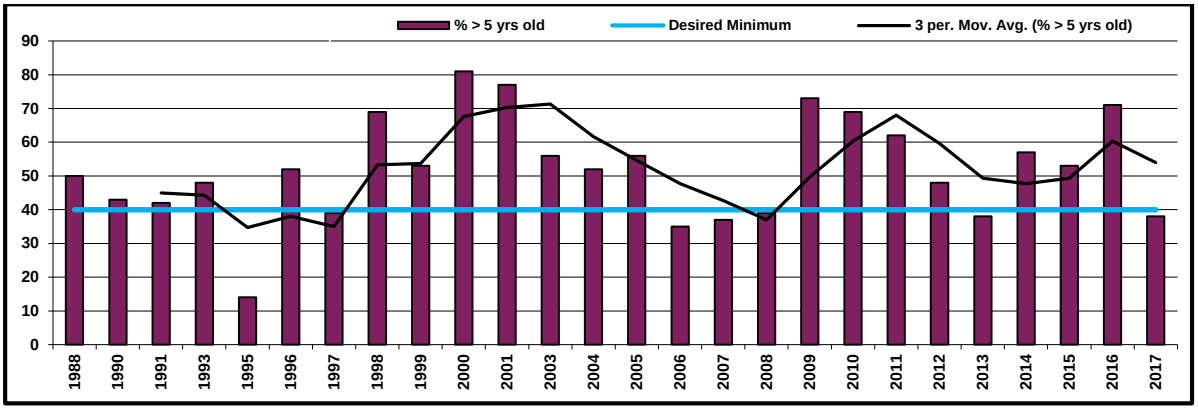


Figure 8. Percentage of harvested bull moose ≥ 5 years old by year. Teeth aged by cementum analyses. Only male moose ≥ 1 years old included in analysis.

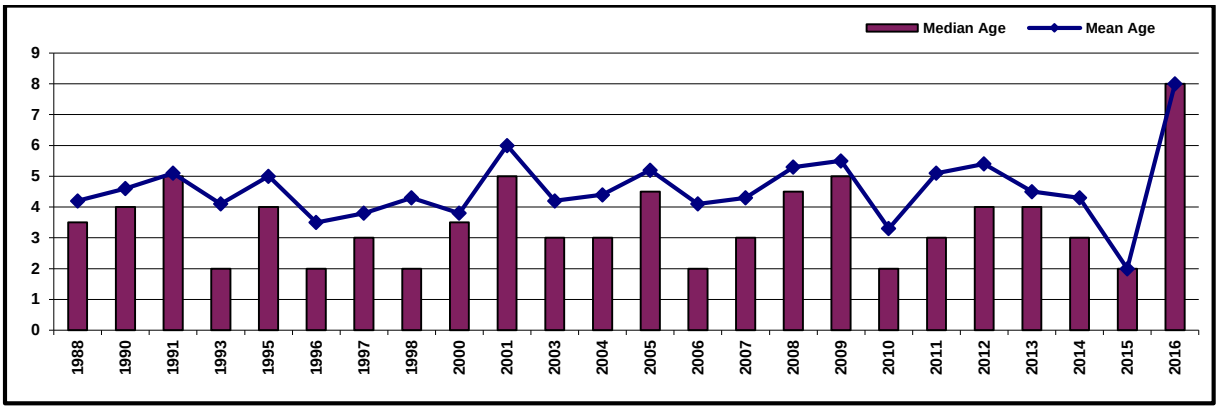


Figure 9. Median and mean age of harvested cow moose in Bighorn Herd Unit. Teeth aged by cementum analyses. Only female moose ≥ 1 years old included in analysis. There is no desired minimum threshold established for female moose age data. There was no female harvest in 2017.

Harvest Data

Hunters harvested 15 moose in 2017, a 37% decrease in harvest over 2016 and the lowest harvest since 1984. Harvest declined as a direct result of decreased license availability. We reduced Type 1 (any moose) licenses to five in each hunt area (15 total in herd unit) and eliminated Type 4 (antlerless moose) licenses for the 2017 season. We initiated a moose study in 2017 with collared females. With the investment of time and money to capture and collar cow moose, we don't want these moose harvested during the course of the study.

Hunter success was 100% and hunter effort, as measured by days hunted per moose harvested, was 8.9 days/harvest. Hunter success was the highest since 2004, the last time all hunters harvested a moose. Effort decreased in 2017 to 8.9 days hunted per harvested moose. This was the lowest effort rate in four years and is almost one day less than the 5-year average of 9.8 days/harvest.

These parameters suggest moose were relatively easy to find during the 2017 season. For some reason, moose seemed highly visible during the summer and fall months in 2017, with numerous individuals commenting on the number of moose they saw.

Since moose licenses are often a once-in-a-lifetime opportunity, especially in this herd unit, we try to balance license allocation with moose numbers to assure high (i.e. 85%+) success rates for license holders.

Most hunters checked in the field seemed generally satisfied with their hunting experience in this herd unit although we heard several comments about the difficulty finding mature bulls. Comments submitted with the harvest survey were highly variable and suggested some hunters were satisfied while others were disappointed with their hunting experience.

Population

Due to difficulty obtaining meaningful vital rate data and limitations of population estimation for moose herds at this time, we have moved away from a post-season population management objective and have adopted a trend count as the primary management objective, with bull harvest demographics as a secondary harvest objective. Trend counts do provide a known minimum population at a specific point in time.

In Hunt Area 1, we have classification / trend counts going back to the 1970s. Aerial helicopter surveys were initiated in 1992 and have been flown every year since 1994. Surveys are conducted preseason in this hunt area in habitats where moose are generally visible. The sub-objective for this hunt area is 50 moose (± 10). In 2017, we observed 70 moose, the same as during the previous year. The 3-year running average is 60 moose, at the upper end of the management objective.

In Hunt Area 34, we have survey counts going back to the mid-1990s. We initiated aerial surveys in 2001. This area is surveyed post season each year in habitats where moose are most visible. The sub-objective for this hunt area is 30 moose (±6). In 2017, we observed 51 moose, the highest count since 2008 and significantly higher than 2015 (n=24) or 2016 (n=29). The 3-year running average is 35 moose. Management the past several years was designed to reduce this

segment of the population due to moose numbers being higher than the population sub-objective. Willow and aspen habitats are generally in poor condition with heavy browsing in this hunt area.

In 2015, mid-summer survey routes, utilizing ground survey techniques, were initiated in this hunt area. The sub-objective for this hunt area is 30 moose (±6). The 2017 survey resulted in 29 moose observed. We observed 38 moose in 2015 and 24 moose in 2016. The 3-year running average is 29 moose, which is at the management objective.

Overall, we observed 150 moose during 2017 classification / trend count surveys, compared to our management objective of 110 moose (±22). The 3-year running average is 131 moose, at the upper end of our management objective.

Special Studies

The Wyoming Game and Fish Commission provided funding for a research project in the Bighorn Mountains starting in March 2017. Dr. Matt Kauffman, University of Wyoming Fish and Wildlife Cooperative Research Unit, will be the lead investigator. Additional funding was provided by the Moose Committee of the Wyoming Governor's Big Game License Coalition. The project proposal is attached as Appendix A of the 2016 Bighorn Moose JCR.

To date, 51 adult female moose have been captured and fitted with Lotek Litetrack B420 iridium based collars. Eighteen moose were captured between March 22-25, 2017, by KiwiAir using net gun (n=17) or immobilization dart (n=1). Native Range Capture Service captured and collared two moose with net gun on February 7, 2108 during elk capture operations. Baker Aircraft captures and collared 15 moose during March 1-3, 2018. One moose was captured by ground darting on April 7, 2107. Fifteen moose were darted by WGFD personnel from the ground during July 2017 – February 2018. Two moose have died, resulting in 49 active collars.

Once captured, the moose was secured by hobbling the legs and placing a blindfold over the eyes. Crew members collected body metrics, blood, fecal and hair samples. A tick survey was conducted. Rump fat and pregnancy were measured using ultrasound if Dr. Kevin Monteith was present. The telemetry collar and an ear tag were placed on the moose.

Additional ground darting will be attempted during August-September, 2018, to deploy the 11 remaining collars. A graduate student is expected to start on this project this summer.

Management Summary

Moose licenses are limited quota in all hunt areas in Wyoming. The Bighorn Herd Unit is very popular based on the number of applications for licenses available. For all moose hunt areas in this herd unit, the regular hunting season runs October 1-31, with an archery pre-season from September 15-30. Archers often harvest up to 50% of the bulls in any given year. Most moose hunting in this herd unit is on the Bighorn National Forest with good access for hunters. Snow can limit access into some areas as the season progresses.

Some managers and certain publics are concerned we may have lowered this population more than desired. Moose no longer use some areas where they were common just 5-10 years ago. Reports of fewer moose, from both hunters and general wildlife viewers, have increased in recent years. The exception was the summer of 2017, when moose were much more visible and we

received numerous comments on the number of moose observed. Classification counts in 2017 improved in both Areas 1 and 34, while remaining relatively stable in Area 42. We were below desired male harvest indices in 2107, despite a reduction in available licenses. This could be a function of variation due to small sample size (n=13 aged bulls). We observed only 55 males per 100 females during preseason surveys, which could also influence pregnancy rates if there are not sufficient males (60+ males:100 cows) to breed receptive females.

We estimate a harvest of 18 moose in 2018, an increase compared to the 2017 harvest. We maintained Type 1 (any moose) licenses at five for Hunt Areas 1 and 42, and increased Type 1 licenses in Hunt Area 34 from five to 10. Managers observed 51 moose in Area 34 during this year's survey, with an observed ratio of 84 bulls:100 cows. While the sample size is small, managers have consistently observed high bull to cow ratios in this hunter area. This area has also maintained a good age structure of bulls, with bulls over 5 years old still consistently being harvested. Managers are confident this area can sustain the additional harvest.

We eliminated Type 4 (antlerless moose) licenses in all hunt areas starting with the 2017 season to reduce the likelihood of a hunter harvesting a collared cow. We have substantial time, effort and money invested in each collared female and would prefer they are not susceptible to harvest during the study.

Wyoming Governor's Complimentary moose licenses are only valid in hunt areas with >10 any or antlered moose (i.e. Type 1) licenses. As such, they are not currently valid in any hunt area in this herd unit.

This herd unit provides quality wildlife viewing opportunities, with moose visible from U.S. Highways 14, 14A and 16, as well as main forest service roads, throughout the spring and summer.

Moose habitats, especially riparian and aspen communities, remain a concern on the Bighorn Mountains due to their relatively poor condition and heavy browsing pressure. We will continue to work with the Bighorn National Forest to address these concerns.

Literature Cited

McCann, N. P., R. A. Moen, and T. R. Harris. 2013. Warm-season heat stress in moose (*Alces alces*). Canadian Journal of Zoology 91:893-898.

Olson, B. T., S. K. Windels, M. Fulton and R. A. Moen. 2014. Fine-scale temperature patterns in the southern boreal forest: implications for the cold-adapted moose. Alces 50:105-120.

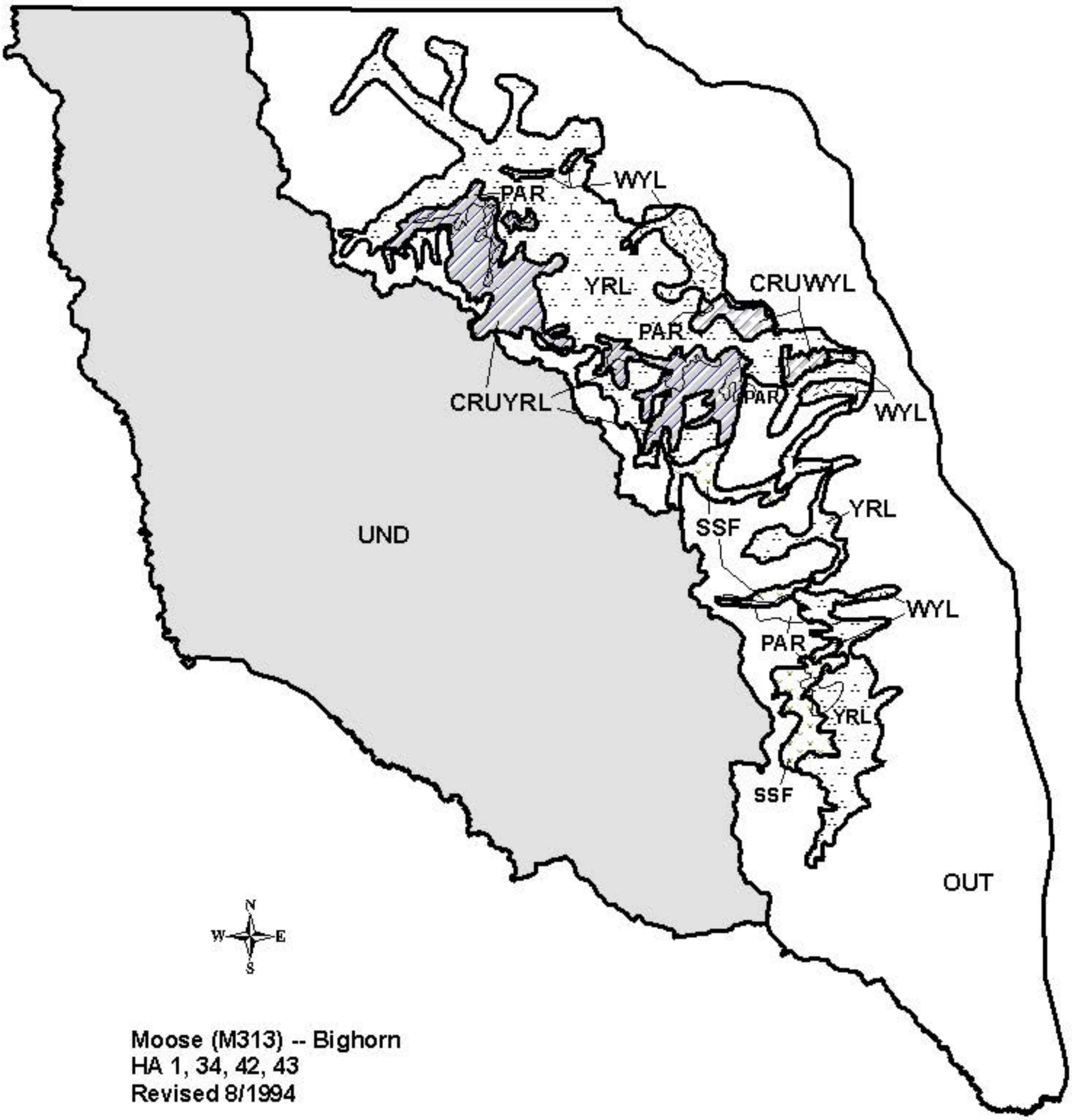
Olson, B. T., S. K. Windels, R. A. Moen, and N. P. McCann. 2016. Moose modify bed sites in response to high temperatures. Alces 52:153-160.

Renecker, L. A. and R. J. Hudson. 1986. Seasonal energy expenditure and thermoregulatory response of moose. Canadian Journal of Zoology 64:322.327.

Schwarz, C. C and L. A. Renecker. 1997. Nutrition and energetics. Pages 441–478 *in* A. W. Franzmann, and C. C. Schwartz, editors. Ecology and management of the North American moose. Smithsonian Institution, Washington, D.C., USA.

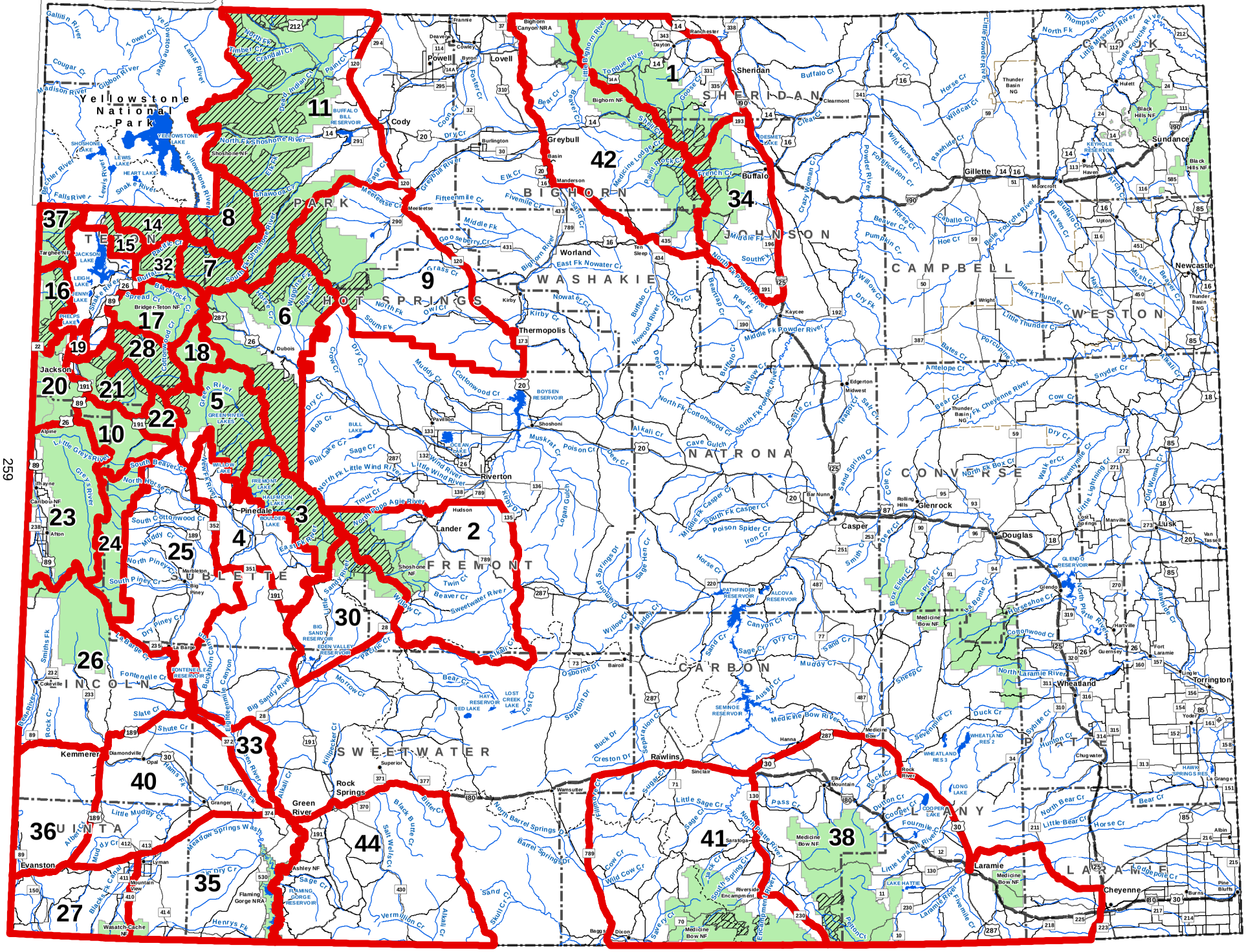
Thomas, T. P. 2008. Moose Population Management Recommendations. Wyoming Game and Fish Department. Moose Working Group. 18 pp.

Wattles, D. W. and S. DeStefano. 2013. Moose habitat in Massachusetts: assessing use at the southern edge of the range. Alces 49:133-147.



Moose (M313) -- Bighorn
HA 1, 34, 42, 43
Revised 8/1994

2017 MOOSE HUNT AREAS



THIS MAP IS FOR GENERAL REFERENCE ONLY. Please use the written boundary descriptions in this regulation for detailed boundary information.

Note: Wilderness area, nonresidents must have guides