

MOOSE

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2018 - JCR Evaluation Form

SPECIES: Moose

PERIOD: 6/1/2018 - 5/31/2019

HERD: MO313 - BIGHORN

HUNT AREAS: 1, 34, 42

PREPARED BY: TIM THOMAS

	<u>2013 - 2017 Average</u>	<u>2018</u>	<u>2019 Proposed</u>
Trend Count:	106	169	175
Harvest:	38	19	15
Hunters:	44	20	15
Hunter Success:	86%	95%	100 %
Active Licenses:	44	20	15
Active License Success	86%	95%	100 %
Recreation Days:	355	210	150
Days Per Animal:	9.3	11.1	10
Males per 100 Females:	83	322	
Juveniles per 100 Females (Preseason)	46	89	

Trend Based Objective ($\pm 20\%$) 110 (88 - 132)

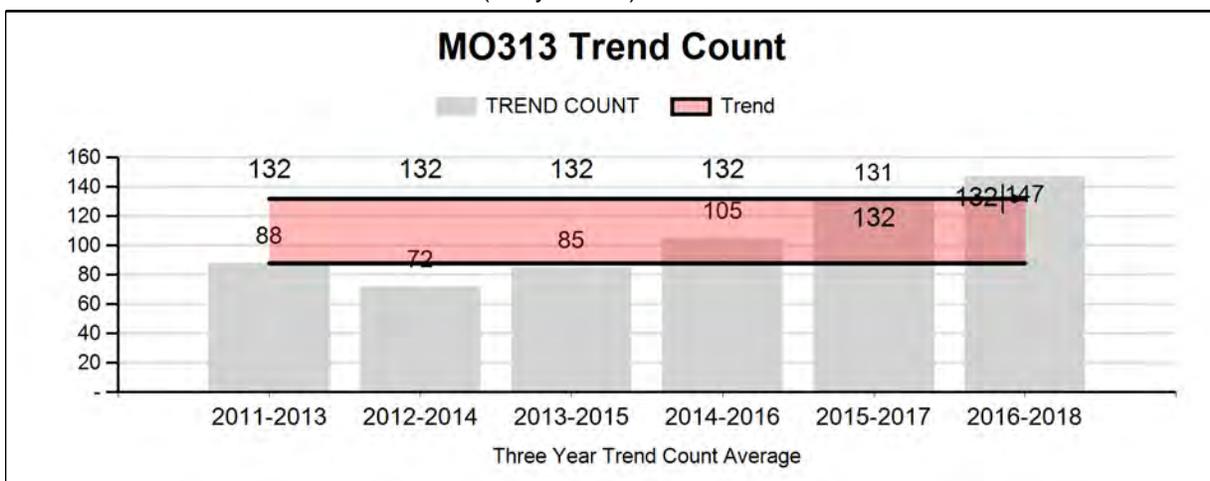
Management Strategy: Special

Percent population is above (+) or (-) objective: 54%

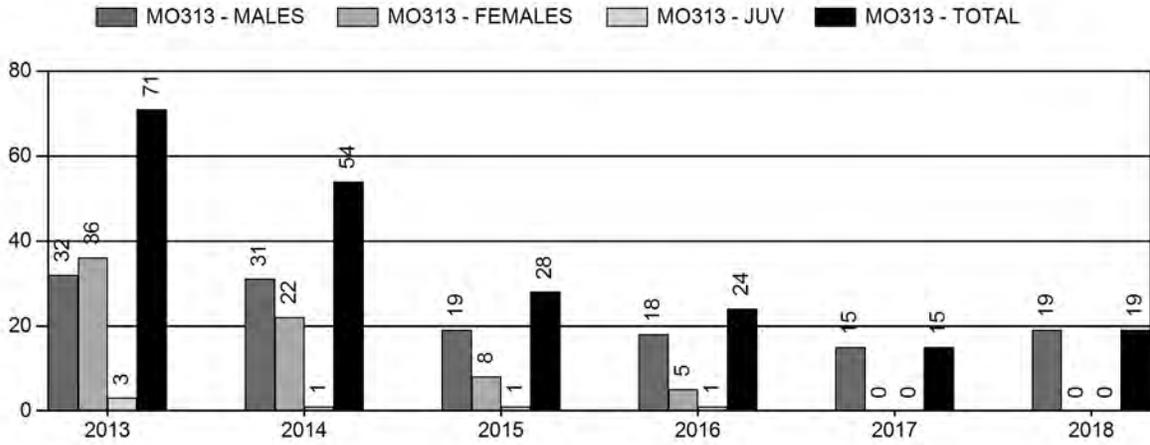
Number of years population has been + or - objective in recent trend: 2

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

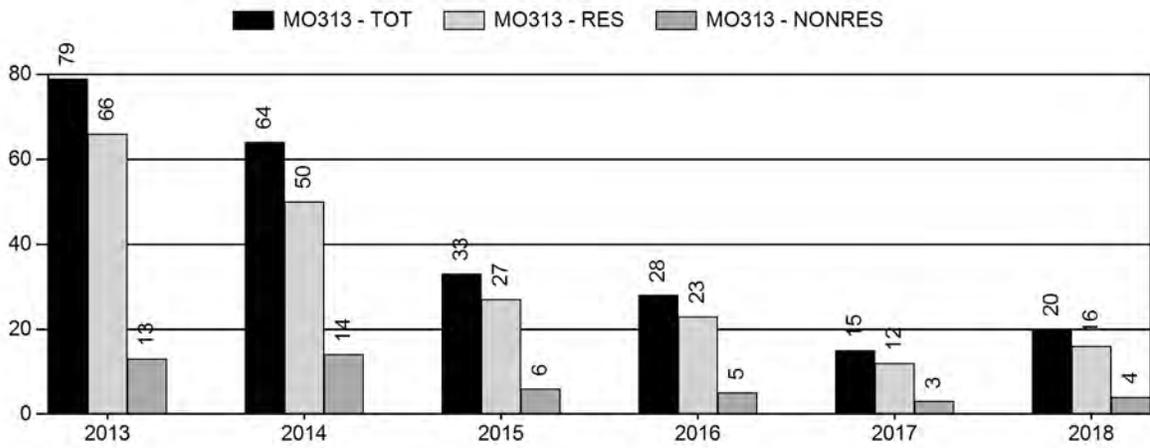
	<u>JCR Year</u>	<u>Proposed</u>
Females ≥ 1 year old:	0%	0%
Males ≥ 1 year old:	16%	14%
Juveniles (< 1 year old):	0%	0%



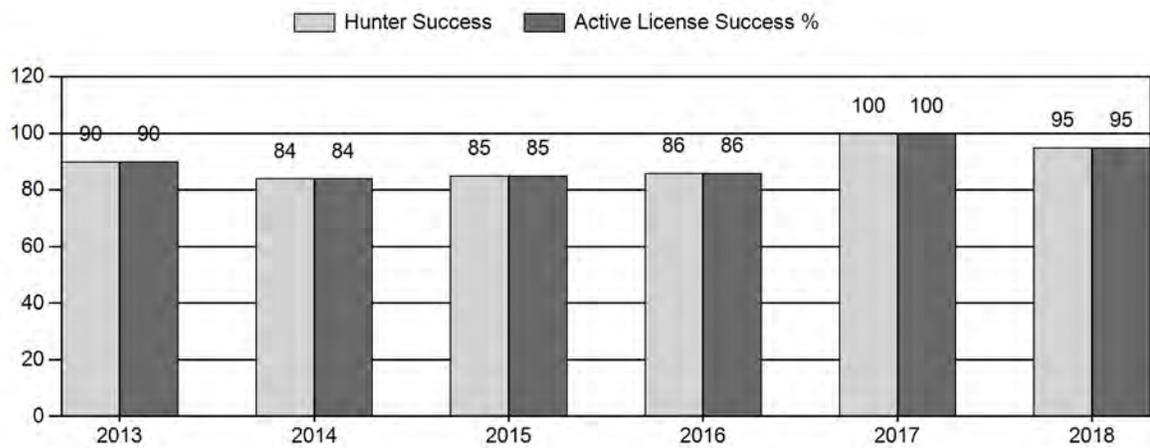
Harvest



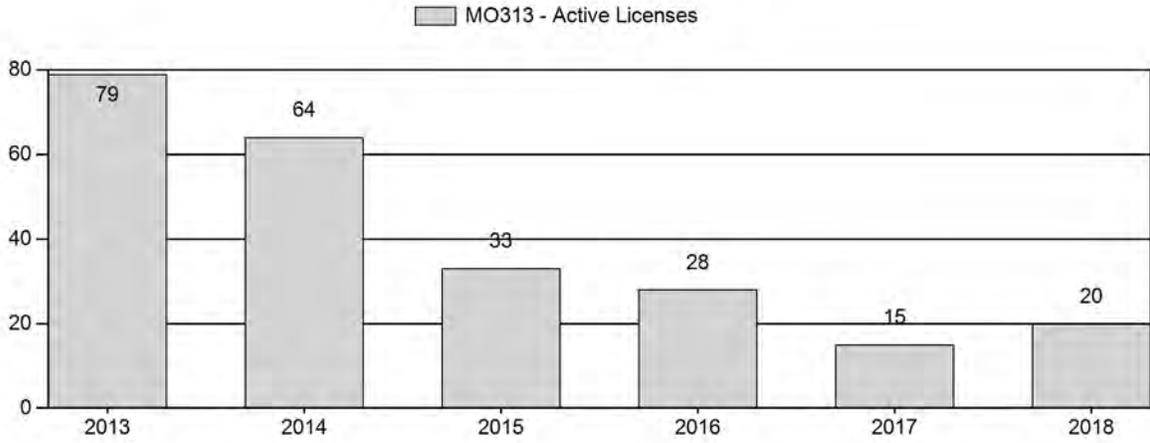
Number of Active Licenses



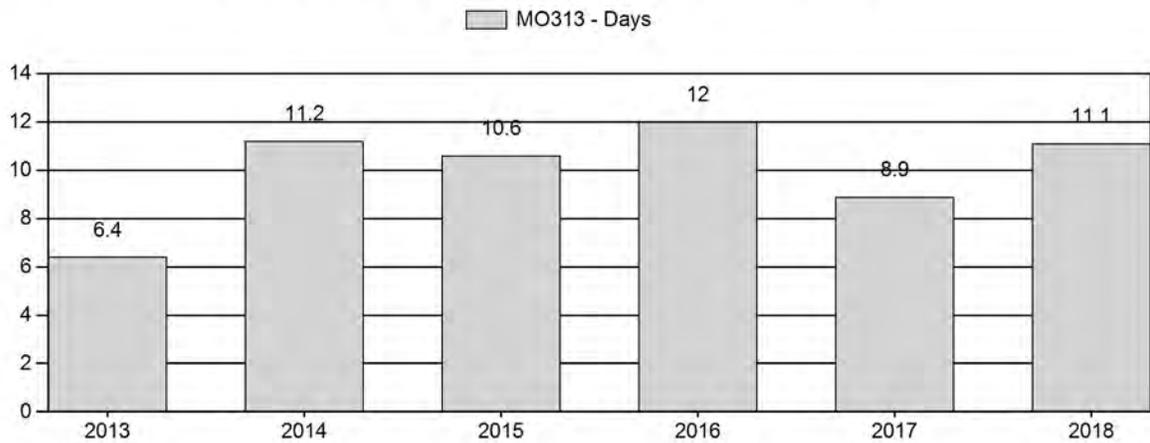
Harvest Success



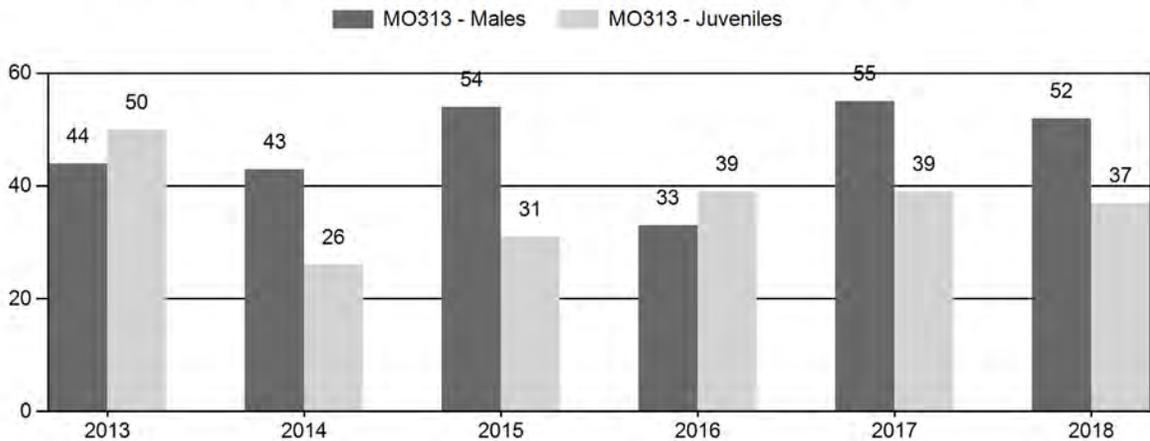
Active Licenses



Days Per Animal Harvested



Preseason Animals per 100 Females



2013 - 2018 Preseason Classification Summary																				
for Moose Herd MO313 - BIGHORN																				
Year	Pre Pop	MALES				FEMALES		JUVENILES		Tot	Cls	Males to 100 Females			Young to					
		Ylg	Adult	Total	%	Total	%	Total	%			Cls	Obj	Ying	Adult	Total	Conf Int	100 Fem	Conf Int	100 Adult
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	0	9	25	34	28%	65	53%	24	20%	123	167	14	38	52	± 0	37	± 0	24		

2013 - 2018 Postseason Classification Summary																				
for Moose Herd MO313 - BIGHORN																				
Year	Post Pop	MALES				FEMALES		JUVENILES		Tot	Cls	Males to 100 Females			Young to					
		Ylg	Adult	Total	%	Total	%	Total	%			Cls	Obj	Ying	Adult	Total	Conf Int	100 Fem	Conf Int	100 Adult
2013	425	2	8	10	31%	13	41%	9	28%	32	0	15	62	77	± 40	69	± 37	39		
2014	300	0	0	0	0%	0	0%	0	0%	0	0	0	0	0	± 0	0	± 0	0		
2015	320	0	0	0	0%	0	0%	0	0%	0	0	0	0	0	± 0	0	± 0	0		
2016	0	0	12	12	41%	14	48%	3	10%	29	0	0	86	86	± 0	21	± 0	12		
2017	0	0	16	16	36%	19	43%	9	20%	44	0	0	84	84	± 0	47	± 0	26		
2018	0	0	8	8	32%	9	36%	8	32%	25	0	0	89	89	± 0	89	± 0	47		

2013 - 2018 Trend Count Summary

for Moose Herd MO313 - BIGHORN

Year	Count Dates	Number Counted
2013	AUGUST 2013, DECEMBER 2013	63
2014	AUGUST 2014, DECEMBER 2014	72
2015	JUNE 2015, AUGUST 2015, DECEMBER 2015	120
2016	JUNE 2016, DECEMBER 2016, AUGUST 2016	123
2017	JUNE 2017, AUGUST 2017, FEBRUARY 2018	150
2018	JUNE 2018, AUGUST 2018, JANUARY 2019	169

**2019 HUNTING SEASONS
BIGHORN MOOSE HERD (MO313)**

Hunt Area	Type	Season Dates		Quota	License	Limitations
		Opens	Closes			
1	1	Oct. 1	Oct. 31	5	Limited quota	Any moose, except cow moose with calf at side
34	1	Oct. 1	Oct. 31	5	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		Limitations
	Opens	Closes	
1, 34, 42	Sep. 15	Sep. 30	Refer to Section 2 of this Chapter

Hunt Area	Type	Quota change from 2018
34	1	- 5
Herd Unit Total		
	1	- 5
	4	None

Management Evaluation

Current Trend Count Management Objective: 110 (88-132)

Management Strategy: Special

2018 Trend Count: 169

Most Recent 3-year Running Average Trend Count: 147

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 ($\pm 20\%$), 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. We will conduct a 5-year objective evaluation in 2020.

Weather

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

Spring 2018 was generally warm and wet, with slightly above normal temperatures and above normal precipitation, resulting in a good start for forage production in the Bighorn Mountains. Precipitation during May was almost twice the long-term mean. Precipitation was near normal during the summer. Temperatures through the summer were near or slightly above normal. During the fall of 2018, precipitation was below normal (September), well above normal (October) or near normal (November), with temperatures slightly below normal. Temperatures were above average in December and January, turning cold in February. Precipitation was 50% of normal during December and well above normal for January. May was cooler than average and snow fall was twice normal. Cool temperatures and wet snow during parturition could adversely influence neonate survival.

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.

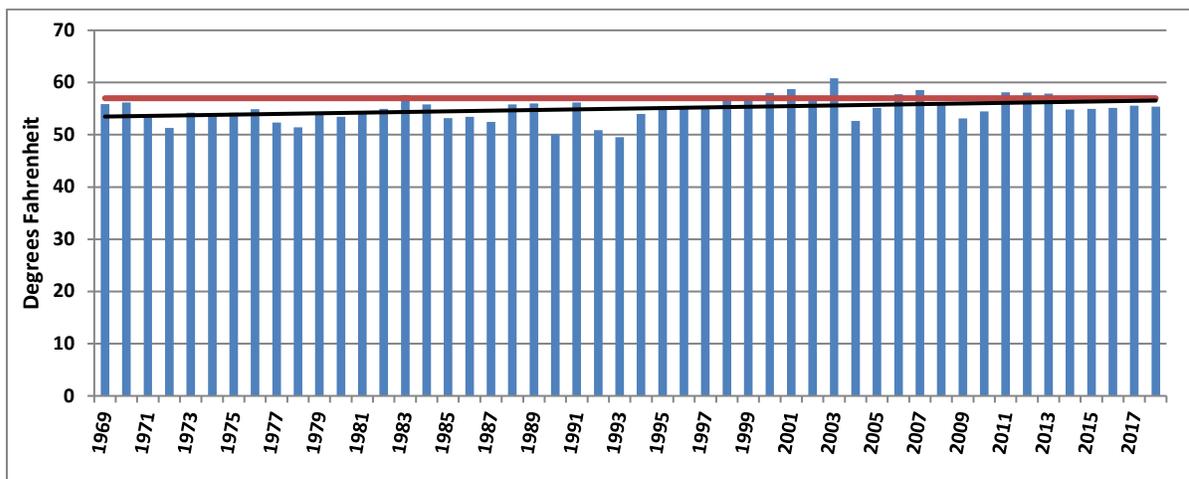


Figure 1. Average monthly summer (July-August) temperatures from 1969-2018 collected at the Burgess Junction weather station (#48122). The trend (black line) shows an increasing average summer temperature over time. Moose may be sensitive to summer temperatures above 57°F (red line).

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. We currently do not have a good understanding of long-term consequences or effects on fitness of warming climates. 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.

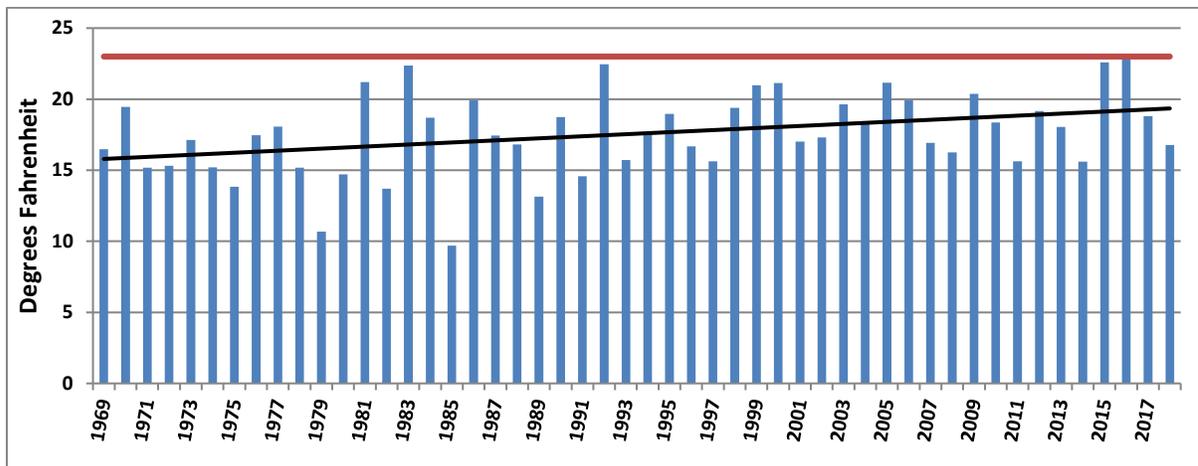


Figure 2. Average monthly winter (January-February) temperatures from 1969-2018 collected at the Burgess Junction weather station (#481220). The trend (black line) shows an increasing average winter temperature over time. Moose may be sensitive to winter temperatures above 23°F (red line).

Precipitation patterns are expected to change for Wyoming with a warming climate. We are expected to receive more moisture during late winter and less during summer months. This could negatively influence riparian systems and associated vegetation communities on which moose rely.

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, mixed 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 all hunt areas annually. In recent years, surveys in Areas 1 and 34 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 – late January, depending on survey conditions, snow cover, and aircraft availability.

Systematically ground surveys were initiated in Hunt Area 42 in 2015 using designated count routes during mid-summer. The Greybull Wildlife Biologist established specific survey routes which 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 may provide insight on general population dynamics. We do obtain a known annual minimum population from these surveys.

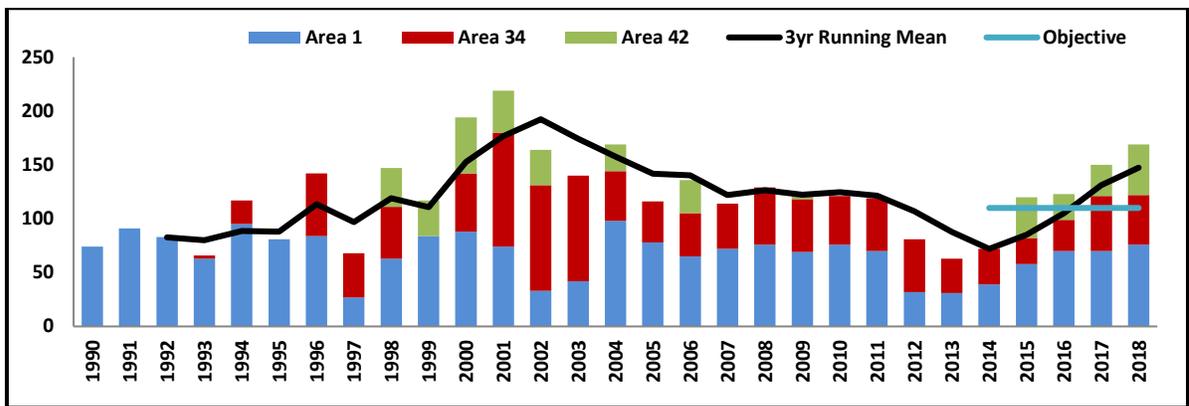


Figure 3. Moose classification/trend counts in Bighorn Herd Unit. Area 1 is surveyed in late August. Area 34 is surveyed in later November – January. Area 42 was periodically surveyed during mid-late summer incidental to other activities, and starting in 2015, using designated survey routes.

During 2018, we classified 76 moose in Area 1 (Fig. 4), an increase from 2017 and above the long-term ($n=29$ years) average count of 67 moose. We observed 38 bulls per 100 cows, similar to 2017 and well below the minimum desired level of at least 50 bulls:100 cows. The apparent lack of bulls could be a function of the survey technique or timing of survey. We observed 18 calves during the survey, for a ratio of 43 calves per 100 cows, similar as recent years and above the long-term ($n=37$ years) average of 38 calves per 100 cows. Field personnel noted at least two females with twin calves during the summer of 2018. In Alaska, twinning is considered a sign of good habitat quality.

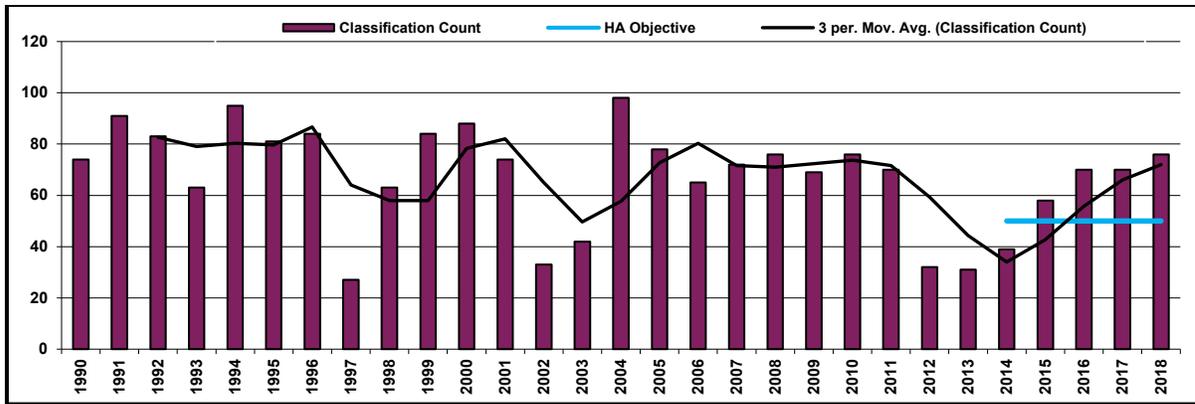


Figure 4. Moose classification/trend counts in Hunt Area 1 of the Bighorn Herd Unit. Area 1 is surveyed in late August of each year using aerial survey techniques. The sub-objective for Area 1 is 50 moose.

In Area 34, we observed 46 moose during a January 2019 survey, but were able to only classify 25 due to antler loss. This was a slight decrease from 2017 (n=51), but still higher than the desired level of 30 observed moose. We classified 89 bulls and 89 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 disproportionately 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 all hunt areas makes it difficult to have confidence that ratios accurately reflect the population dynamics of this herd in any one specific year but likely provide an idea of population dynamics over time.

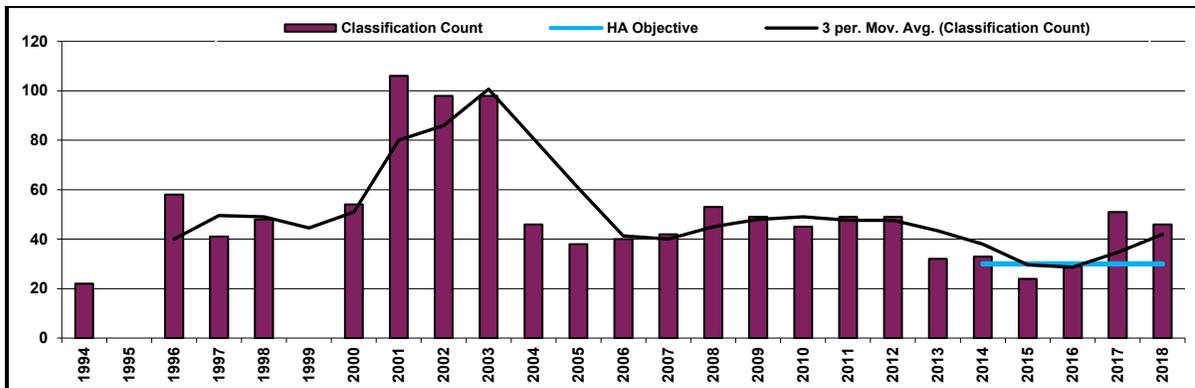


Figure 5. Moose classification/trend counts in Hunt Area 34 of the Bighorn Herd Unit. Area 34 has been surveyed during mid-November – January using aerial surveys techniques since 2001. This year’s survey occurred in late January. The sub-objective for Area 34 is 30 moose.

During 2018, Cody Region wildlife personnel counted 47 moose during ground surveys in late June (Fig. 6), substantially higher than 29 moose observed in 2017 and the highest count since 2000. We observed 78 males per 100 females and 26 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, survey timing or could be truly representative of the sub-population. We will get a better feel as we continue to collect annual survey data in this hunt area in future years.

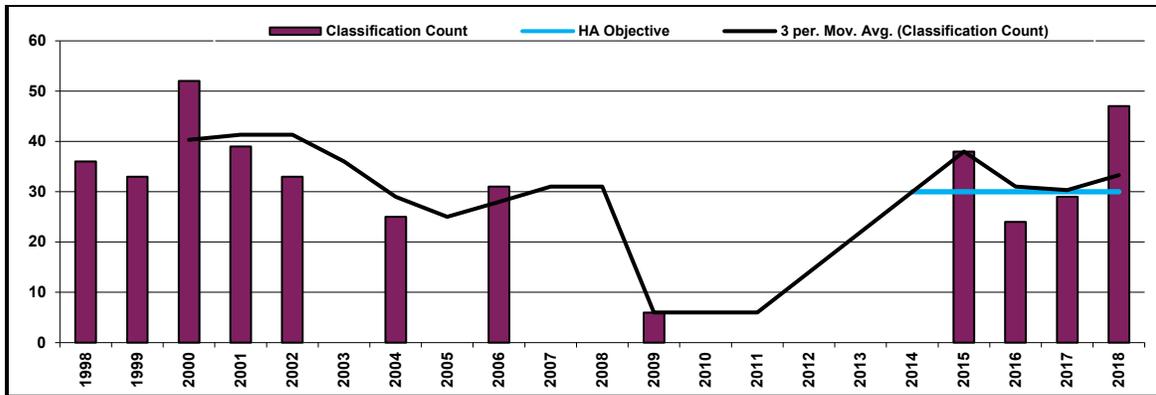


Figure 6. Moose classification/trend counts in Hunt Area 42 of the Bighorn Herd Unit. Area 42 was surveyed in mid-summer using ground survey techniques. The sub-objective for Area 42 is 30 moose.

Teeth were collected from hunter harvested moose, generally through voluntary submission by successful hunters. Teeth were aged at our Wildlife Forensic Laboratory in Laramie using standard cementum annuli analysis techniques. Median age of males harvested in 2018 was 4 years (mean = 5, n = 18, range = 1-12 yrs), the same as for moose harvested in 2017, and at the minimum desired median age threshold of ≥ 4 years (Fig. 7). One bull was aged at 12 years, the oldest male harvested from this herd unit since 2008. Forty percent of the harvested males were ≥ 5 years, at the minimum desired level (Fig. 8). Moose aged at 4 years represented the largest age class with six moose. This isn't surprising as moose tend to develop larger antlers starting at age 4.

Fourteen hunters reported antler width for harvested moose. Antler width averaged 39" and ranged from 21" – 49.5". Based on conversations with hunters and responses provided in the harvest survey, most hunters seemed happy with the moose they harvested. We do not correlate tooth age with antler width since we rely on hunter reported antler measurements, which aren't standardized or uniformly reported.

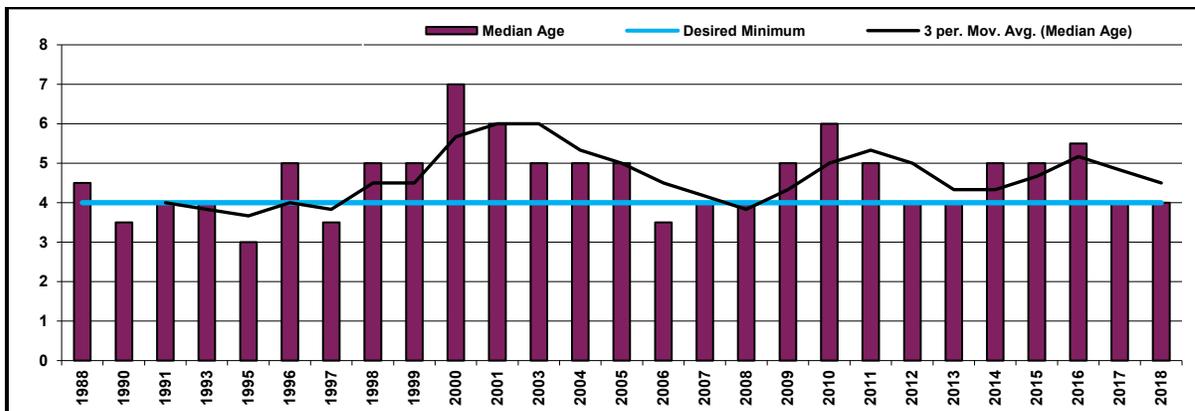


Figure 7. Median age of harvested bull moose in Bighorn Herd Unit. Teeth aged by cementum annuli analyses. Only male moose ≥ 1 years old included in analysis.

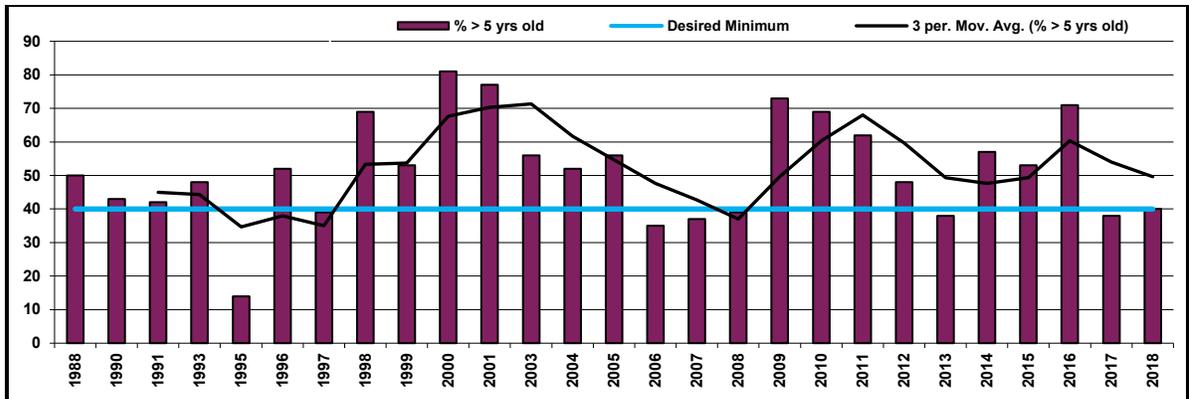


Figure 8. Percentage of harvested bull moose ≥ 5 years old by year. Teeth aged by cementum annuli analyses. Only male moose ≥ 1 years old included in analysis.

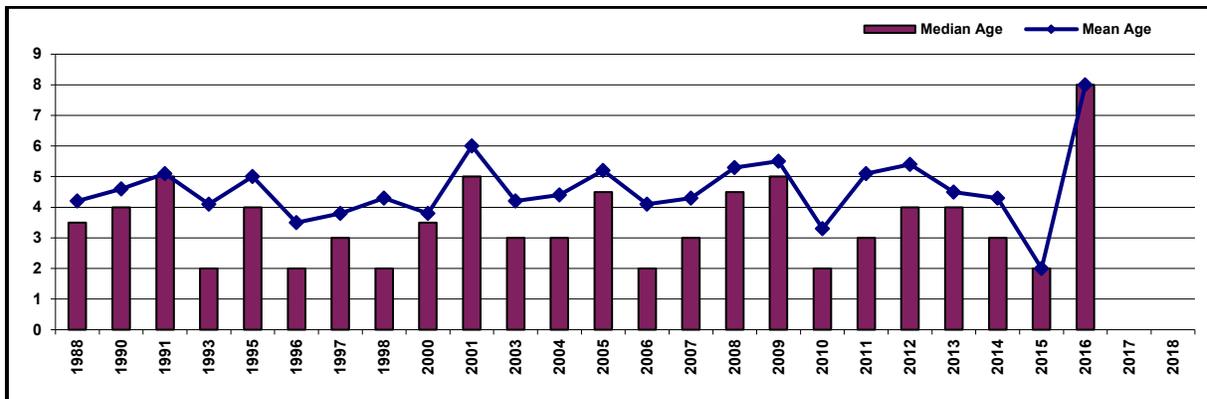


Figure 9. Median and mean age of harvested cow moose in Bighorn Herd Unit. Teeth aged by cementum analyses. Only female moose ≥ 1 years old included in analysis. There is no desired minimum threshold established for female moose age data. There was no female harvest during 2017-2018.

Harvest Data

Hunters harvested 19 moose in 2018, a 26% increase in harvest over 2017, but still well below the long-term (36 years) average harvest of 46 moose. Harvest increased as a direct result of increased license availability. We increased Type 1 (any moose) licenses in Area 34, to a total of 20 license in the herd unit. No Type 4 (antlerless moose) licenses were issued for 2017 or 2018 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 did not want these moose harvested during the course of the study.

Hunter success was 95%, with all but one hunter harvesting a moose. Hunter success was the second highest since 2004. Hunter effort increased in 2018 to 11.1 days hunted per harvested moose. This was the highest effort rate in four years and is higher than the 5-year average of 10.7 days/harvest. The increase was due to the Area 34 hunter effort of 13.6 days per animal.

These parameters suggest moose were relatively easy to find during the 2018 season. For some reason, moose seemed highly visible during the summer, 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 some comments about the difficulty finding mature bulls. Comments submitted with the harvest survey were somewhat variable and suggested most hunters were satisfied while a few 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 management 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 pre-season in this hunt area in habitats where moose are generally visible. The sub-objective for this hunt area is 50 moose (± 10). In 2018, we observed 76 moose, an increase from the previous two years. The 3-year running average is 72 moose, above the upper range 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 2018, we observed 46 moose, the second highest count since 2012, and significantly higher than 2015 (n=24) or 2016 (n=29). The 3-year running average is 42 moose, above the upper management objective limit. Management over the past decade 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 Hunt Area 42. The sub-objective for this hunt area is 30 moose (± 6). The 2018 survey resulted in 47 moose observed. We observed 24 moose in 2016 and 29 moose in 2017. The 3-year running average is 33 moose, within the desired management objective range.

Overall, we observed 169 moose during 2017 classification / trend count surveys, compared to our management objective of 110 moose (± 22). The 3-year running average is 147 moose, above the upper range of our management objective. We won't add antlerless tags to stabilize or reduce this population until the 2020 season so as not to bias current research with collared females. Harvest of antlered moose will continue.

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 the Wyoming Fish and Wildlife Cooperative Research Unit, is 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.

As of February 1, 2019, 59 collars were deployed on adult female moose across all hunt areas. One collared moose died as a result of a vehicle collision in fall of 2018. That collar will be redeployed. Several collars (~8-10) are not functioning. We are working with the manufacturer to solve this problem. A graduate student has been hired to conduct this research over the next 2-3 years.

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 available licenses. 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 taken in any given year. Most moose hunting 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 past two summers, when moose were much more visible and we received numerous comments on the number of moose observed. Classification counts generally increased in all areas over past couple years.

We estimate a harvest of 15 moose in 2019, a decrease compared to the 2018 harvest. We maintained Type 1 (any moose) licenses at five for Hunt Areas 1 and 42, and decreased Type 1 licenses in Hunt Area 34 from 10 to five. Licenses in Area 34 had been increased for the 2018 season. One two harvested bulls were aged over 5 years old. Reducing harvest should allow additional bulls to reach the 5+ age classes.

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. We will not issue Type 4 licenses until at least the 2020 season.

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 months.

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

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