

**MOOSE**

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## 2016 - JCR Evaluation Form

SPECIES: Moose

PERIOD: 6/1/2016 - 5/31/2017

HERD: MO313 - BIGHORN

HUNT AREAS: 1, 34, 42

PREPARED BY: TIM THOMAS

	<u>2011 - 2015 Average</u>	<u>2016</u>	<u>2017 Proposed</u>
Trend Count:	91	123	120
Harvest:	57	24	13
Hunters:	65	28	15
Hunter Success:	88%	86%	87 %
Active Licenses:	65	28	15
Active License Success	88%	86%	87 %
Recreation Days:	469	287	130
Days Per Animal:	8.2	12.0	10
Males per 100 Females:	78	86	
Juveniles per 100 Females	47	21	

Trend Based Objective (± 20%) 110 (88 - 132)

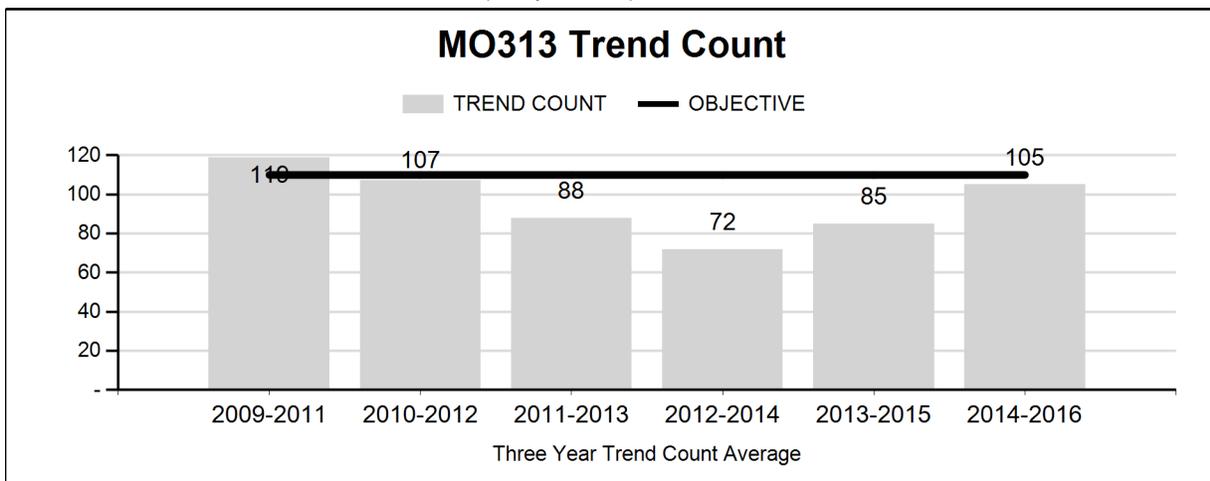
Management Strategy: Special

Percent population is above (+) or (-) objective: 12%

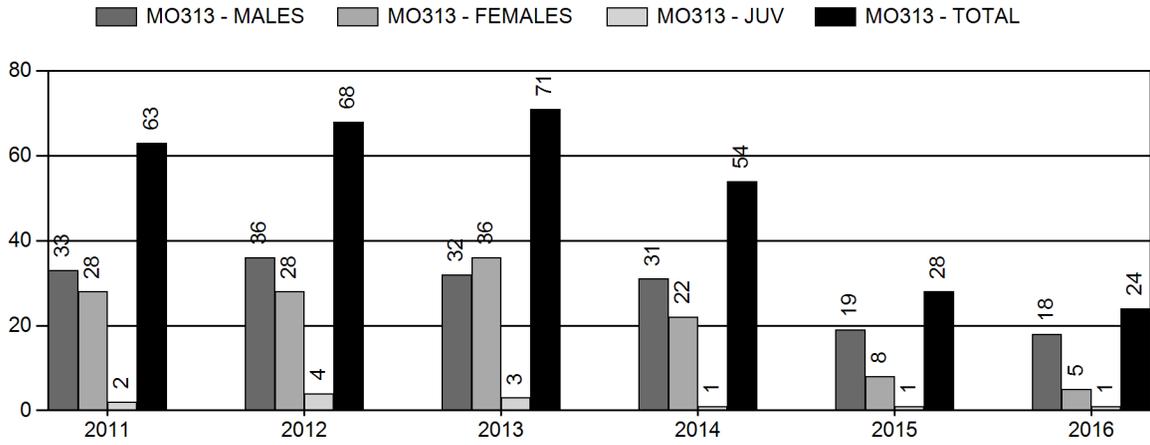
Number of years population has been + or - objective in recent trend: 1

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

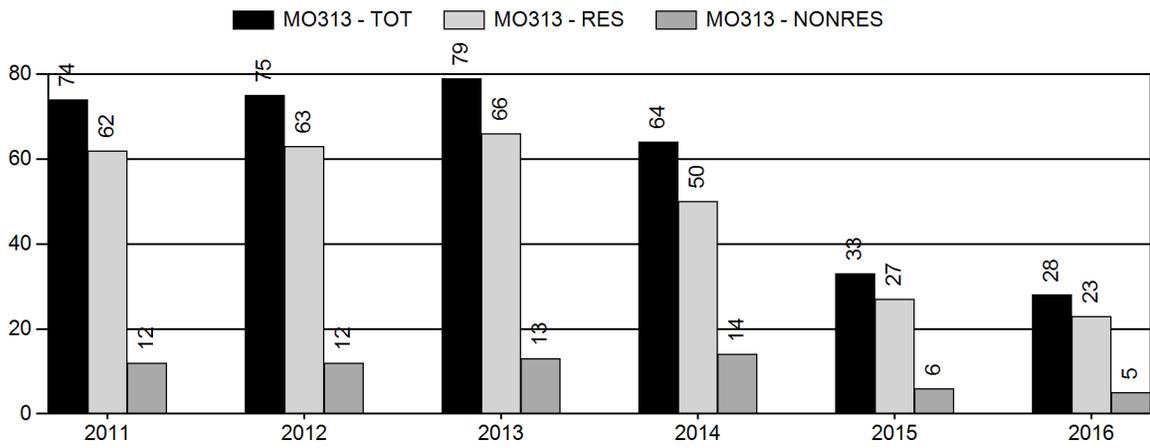
	<u>JCR Year</u>	<u>Proposed</u>
Females ≥ 1 year old:	7%	0%
Males ≥ 1 year old:	18%	14%
Juveniles (< 1 year old):	0%	0%



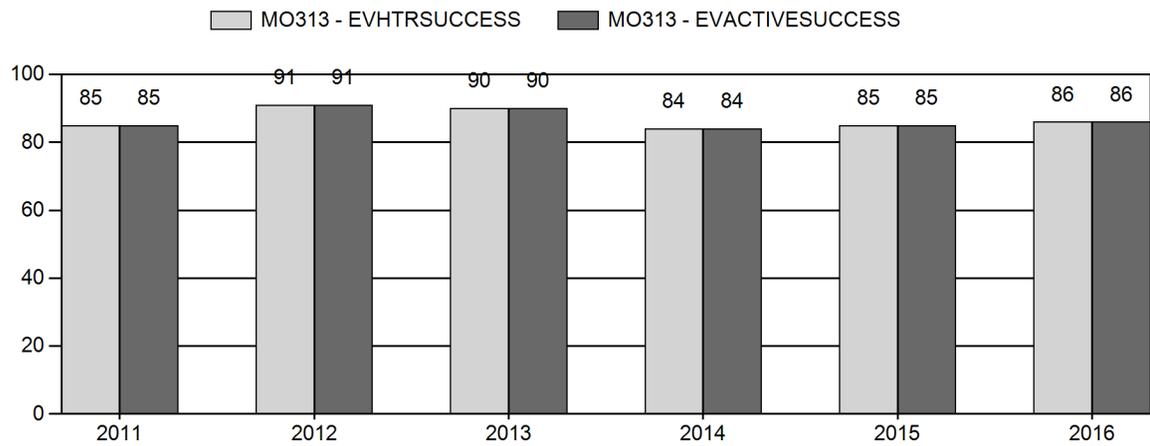
# Harvest



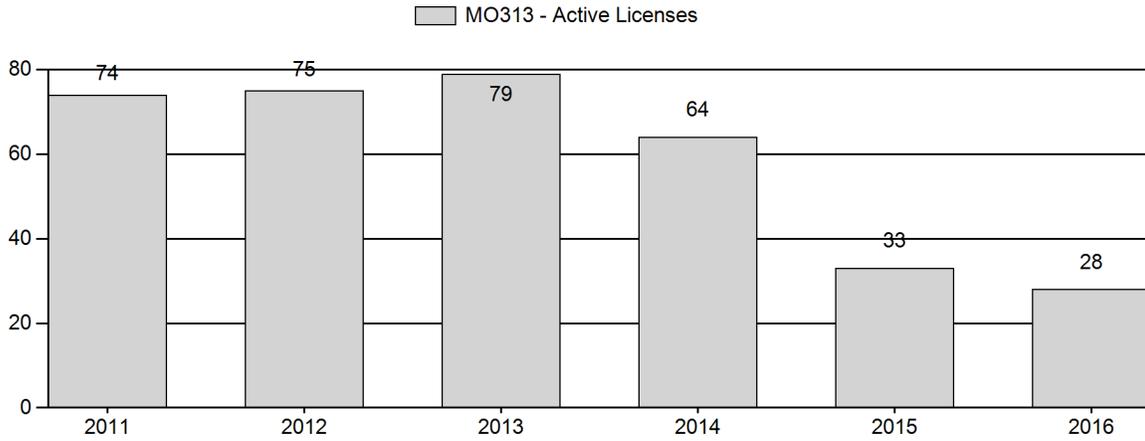
# Number of Active Licenses



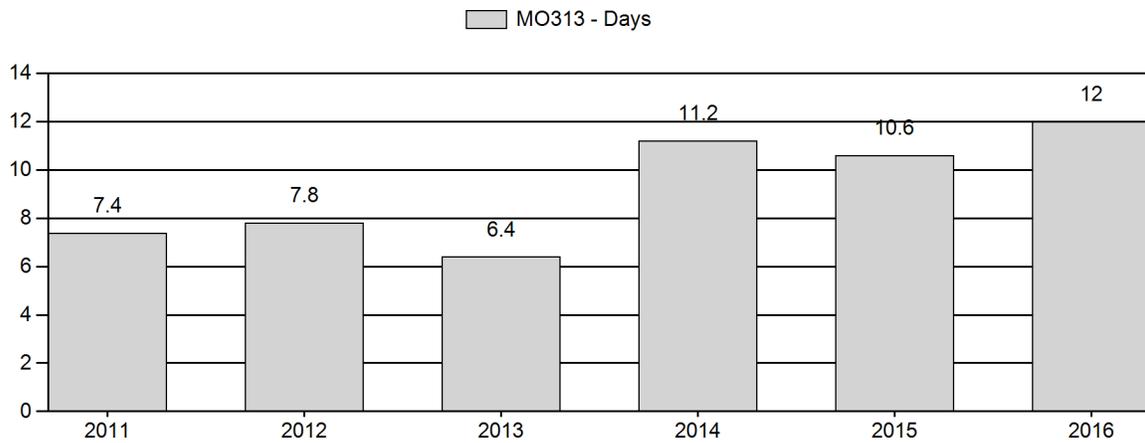
# Harvest Success



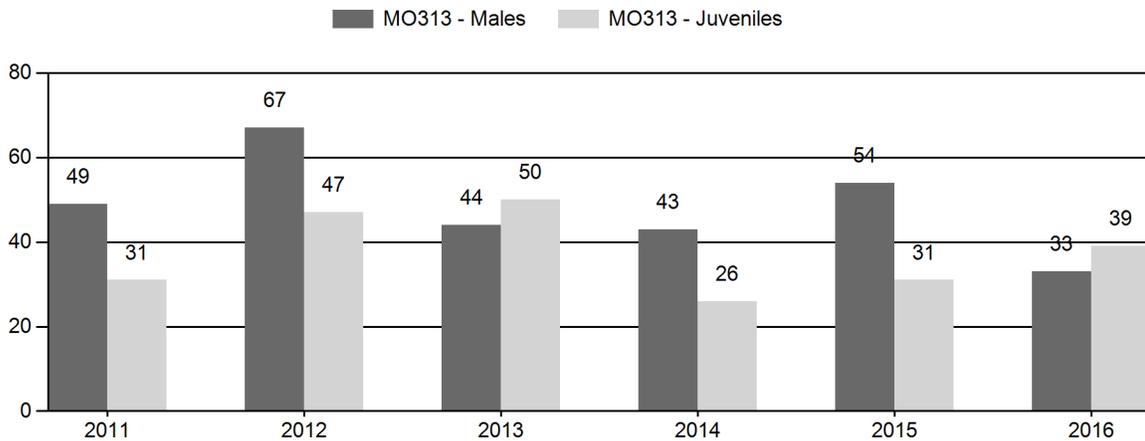
# Active Licenses



# Days Per Animal Harvested



# Preseason Animals per 100 Females



## 2011 - 2016 Preseason Classification Summary

for Moose Herd MO313 - BIGHORN

Year	Pre Pop	MALES				FEMALES		JUVENILES		Tot CIs	Cls Obj	Males to 100 Females				Young to		
		Ylg	Adult	Total	%	Total	%	Total	%			Ylg	Adult	Total	Conf Int	100 Fem	Conf Int	100 Adult
2011	538	2	17	19	27%	39	56%	12	17%	70	331	5	44	49	± 0	31	± 0	21
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 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 2015
1	1	- 5
	4	- 5
34	4	- 5
<b>Herd Unit Total</b>		
	<b>1</b>	<b>- 5</b>
	<b>4</b>	<b>- 10</b>

**Management Evaluation**

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

**Management Strategy:** Special

**2016 Trend Count:** 123

**Most Recent 3-year Running Average Trend Count:** 105\*

\*No survey in Hunt Area 42 in 2014

**Herd Unit Issues**

The Bighorn Moose Herd Unit is located in north central Wyoming. Management is shared between the Sheridan and Cody regions, with the Sheridan Wildlife Biologist having herd unit 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  $\geq 4.5$  years and to have at least 40% of the harvested bulls be  $\geq 5$  years old.

The management strategy for all moose herd units in Wyoming is special management, emphasizing trophy quality opportunities. The objectives and management strategy 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 collected 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](http://www.wrcc.dri.edu)).

Spring 2016 was relatively warm and wet, resulting in a good start for forage production in the Bighorn Mountains. Starting in May, precipitation was below average for the summer, with temperatures near or above normal. The fall of 2016 was generally warm and wet. Precipitation was significantly above normal (September) or near normal (October – November), with temperatures slightly (September) to well (October–November) above normal. Temperatures were well below average in December and January, moderating in February. Precipitation was almost double average in December (2.67” compared to average=1.39”) and slightly below average during January and February. There were several significant snow events in later March and April. Moose appear to have entered the winter in good condition, allowing them to survive the winter fairly well. Calves may have problems, requiring additional energy expenditures to navigate deep snow.

Moose appear to be sensitive to warmer temperatures, showing signs of increased metabolic rates or heat stress at about 23° F during winter months and 57° F during summer months. Recent research conducted in Massachusetts and Minnesota suggests moose move to thermal cover to avoid heat stress during warm weather. This can alter feeding and movement patterns. Long-term consequences or effects on fitness of warming climates are not currently 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 desired levels. Monthly average temperatures were at or above normal from August 2015 – November 2016 at the Burgess Junction weather station.

## **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. 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 produce more biomass than smaller willows, generally increasing the

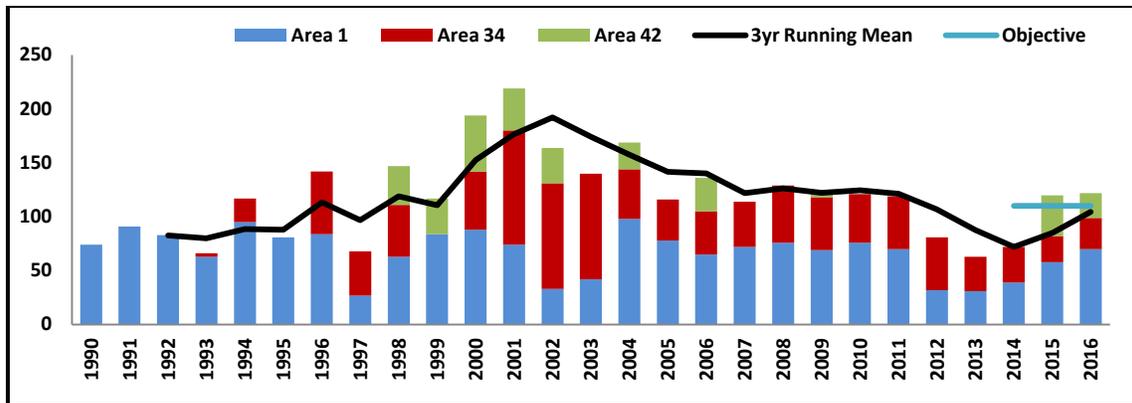
amount of forage available. As such, there has been a decline in a preferred forage plant over time, reducing the carrying capacity for moose. Some willow habitat is relatively linear, such as along drainages on the west side in Hunt Area 42, limiting moose distribution.

### 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.

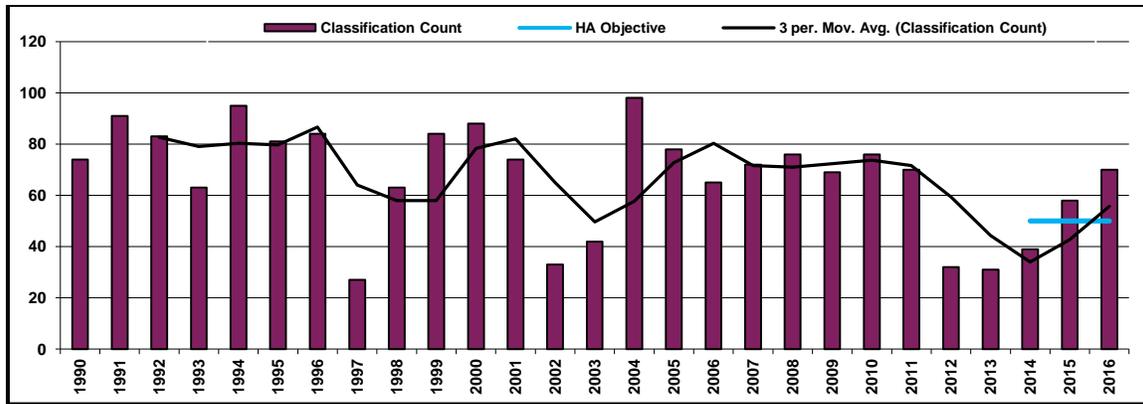
Classification counts in Area 42 have been collected sporadically over the years, usually incidental to other duties during July and August. An effort was initiated in 2015 to systematically survey Area 42 using ground count routes during mid-summer. Specific survey routes were established by the Greybull Wildlife Biologist.

Survey results can vary significantly between years, often without easily discernible rationale, making interpretation of data difficult at best (Fig.1). 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.



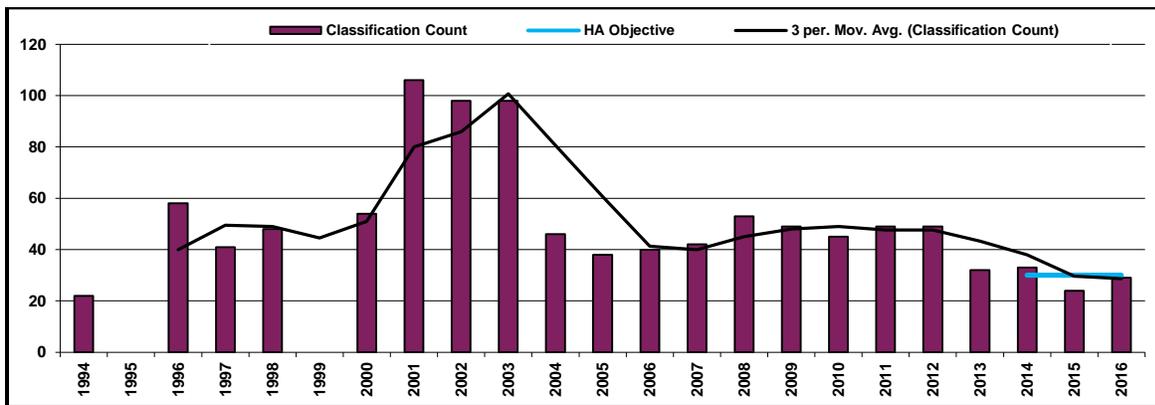
**Figure 1.** Moose classification/trend counts in Bighorn Herd Unit. Area 1 is surveyed in late August of each year. Area 34 is surveyed in later November – January of each year. Area 42 was periodically surveyed during mid-late summer incidental to other activities, and starting in 2015, using delineated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

During 2016, we classified 70 moose in Area 1 (Fig. 2), an increase from 2015 and the highest count in five years. This was slightly above the long-term (n=26 years) average count of 67 moose. We observed only 21 moose in the Goose Creek drainage the past 45 years (n=3 in 2012; n=4 in 2013; n=4 in 2014; n=4 in 2015; n=6 in 2016). This drainage used to support many more moose. We observed only 21 bulls per 100 cows, the lowest observed bull to cow ratio ever in this hunt area. 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 19 calves during the survey, for a ratio of 45 calves per 100 cows, an increase from the previous year and above the long-term average of 38 calves per 100 cows.



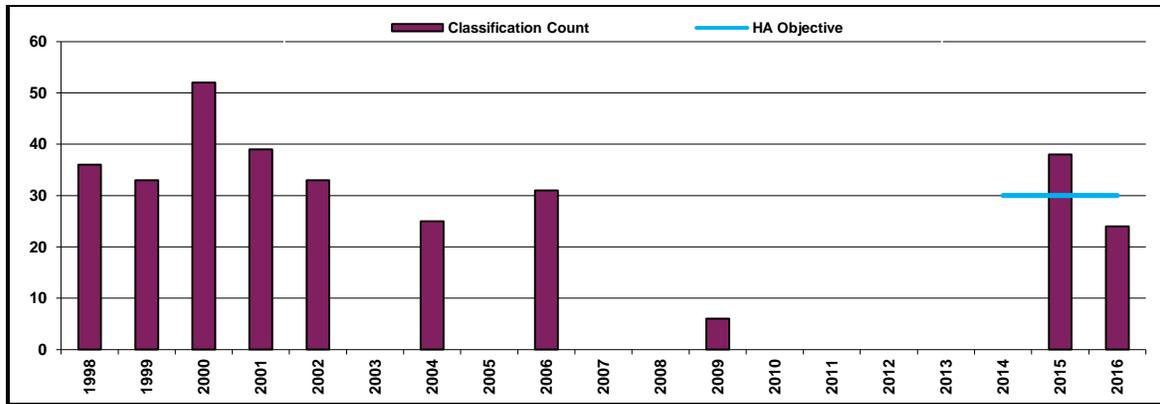
**Figure 2.** Moose classification/trend counts in Hunt Area 1 of the Bighorn Herd Unit. Area 1 is surveyed in late August of each year using aerial survey techniques. The sub-objective for Area 1 is 50 moose.

In Area 34, we classified 29 moose during 2016 (Fig. 3), an increase from 2015 (n=24), but still the second lowest classification count since 1996 (n=27). We observed 86 bulls and 21 calves per 100 cows. The observed bull to cow ratio usually runs pretty 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 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 specific year.



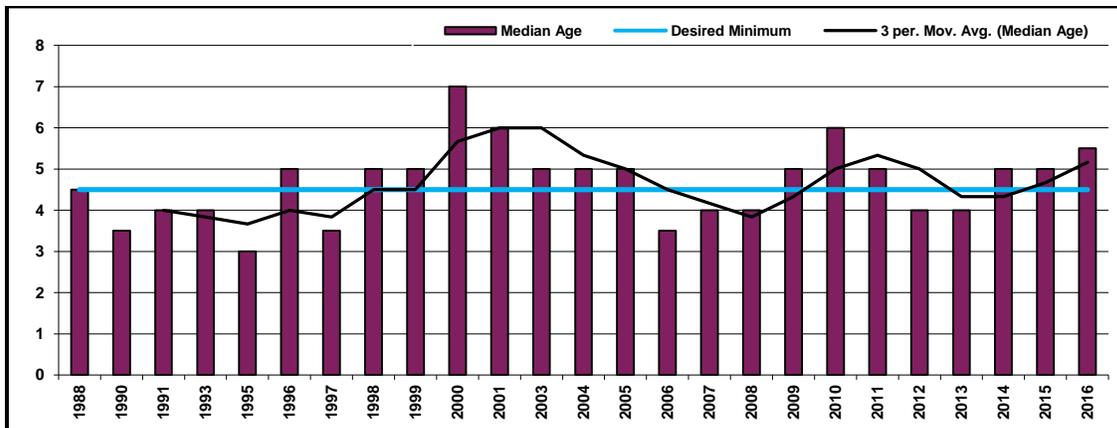
**Figure 3.** Moose classification/trend counts in Hunt Area 34 of the Bighorn Herd Unit. Area 34 has been surveyed during mid-November – January using aerial surveys techniques since 2001. The sub-objective for Area 34 is 30 moose.

An effort was initiated in 2015 to systematically conduct a classification survey in Area 42 for the first time since 2006. During 2016, Cody Region personnel counted 24 moose during ground surveys in late June (Fig. 4). We observed 75 males per 100 females and 17 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.

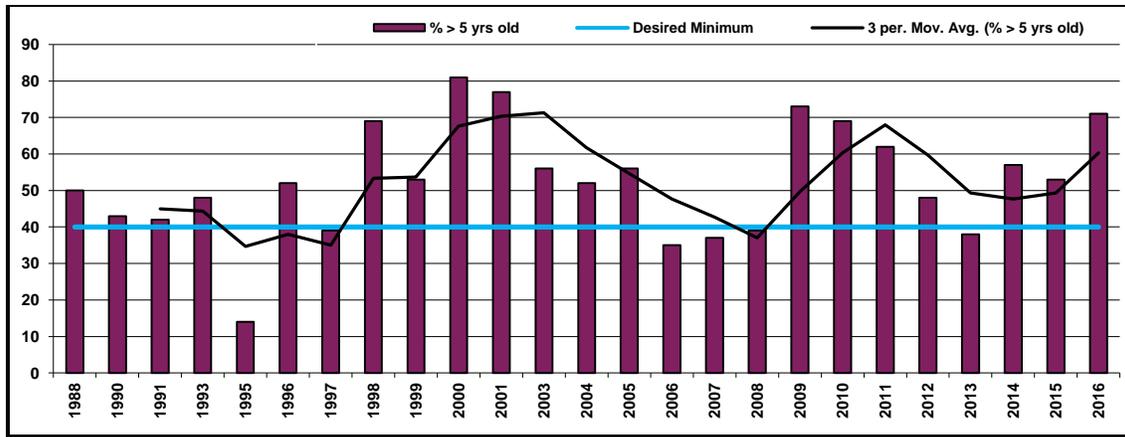


**Figure 4.** Moose classification/trend counts in Hunt Area 42 of the Bighorn Herd Unit. Area 42 has generally been surveyed in mid-summer using ground survey techniques. The sub-objective for Area 42 is 30 moose.

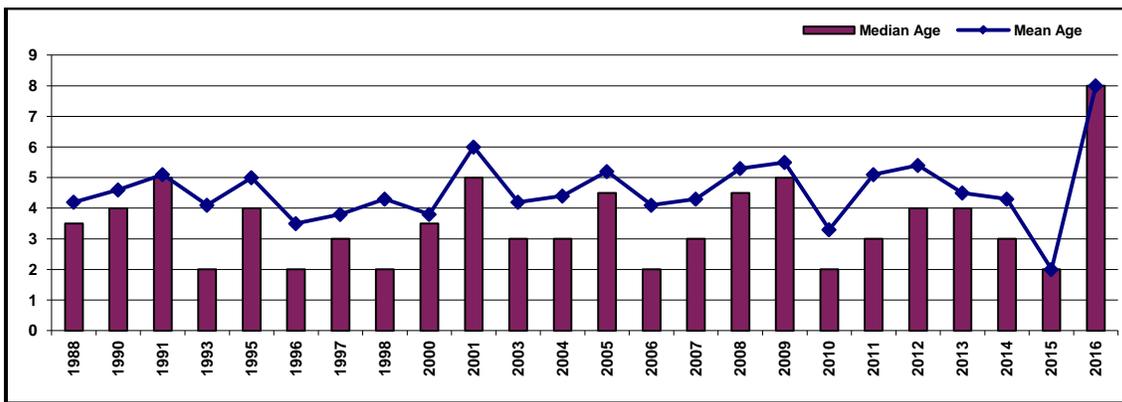
Teeth were collected from hunter harvested moose, generally through voluntary submission by successful hunters. Median age of males harvested in 2016 was 5.5 years old (mean = 5.2, n = 14, range = 2-8 yrs old), up slightly from 2015 harvested moose, and above the minimum desired median age threshold of  $\geq 4.5$  years old (Fig. 5). Seventy one percent of the harvested males were  $\geq 5$  years old, above the minimum desired level of 40% (Fig. 6), and an increase from 2015. Hunters seemed to be selective in 2016, with 10 of the 14 harvested bulls being mature (i.e.  $\geq 5$  years old). Access during most of October was good as weather conditions were relatively mild and open, allowing hunters more opportunity to pursue moose.



**Figure 5.** Median age of harvested bull moose in Bighorn Herd Unit. Teeth aged by cementum analyses. Only male moose  $\geq 1$  year old included in analysis.



**Figure 6.** Percentage of harvested bull moose  $\geq 5$  years old by year. Teeth aged by cementum analyses. Only male moose  $\geq 1$  year old included in analysis.



**Figure 7.** Median and mean age of harvested cow moose in Bighorn Herd Unit. Teeth aged by cementum analyses. Only female moose  $\geq 1$  year old included in analysis. There is no desired minimum threshold established for female moose age data.

## Harvest Data

Hunters harvested an estimated 24 moose in 2016, an 18% decrease in harvest over 2015 and the lowest harvest since 1999. Harvest declined as a direct result of decreased license availability. We reduced Type 4 (antlerless moose) licenses by 5 for the 2016 season.

Hunter success was 86% and effort, as measured by days hunted per moose harvested, was 12.0 days/harvest. Success was similar to 2015, but still at the lower limit of the desired level (i.e. 85%+). Hunter success was lowest in Area 1 this year, with only 73% of hunters successful. Type 1 (any moose) license holders were more successful in Area 1 (90% success) compared to Type 4 (antlerless moose) license holders (40% success). Effort increased in 2016 to 12 days hunted per harvested moose. Effort has increased over the past three years, suggesting we have lowered this population as desired through increased harvest.

These parameters suggest moose were somewhat difficult to find during the 2016 season. This could be a function of population declines as well as warm and dry hunting conditions. We have

reduced this population through harvest over the past decade. Moose along major roads, where they are readily visible and relatively easy to hunt, have been reduced the most. Willows lost their leaves in early September in 2016, just prior to the archery hunting season. Once willow leaves turn color and begin to drop, they become unpalatable to moose and moose move to other habitat types, where they are often harder to locate and are less vulnerable to harvest.

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 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 most visible. The sub-objective for this hunt area is 50 moose ( $\pm 10$ ). In 2016, we observed 70 moose, the highest count in 4 years. The 3-year running average is 56 moose.

In Hunt Area 34, we have survey counts going back into 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 ( $\pm 6$ ). In 2016, we observed only 29 moose, the second lowest count since 1994. The 3-year running average is 29 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.

Moose surveys have been sporadic in Hunt Area 42 over the years, with the last significant effort conducted in 2006. Efforts were initiated in 2015 to establish designated mid-summer ground survey routes in this hunt area. The sub-objective for this hunt area is 30 moose ( $\pm 6$ ). The 2016 survey resulted in 24 moose observed. We observed 38 moose in 2015. There is no 3-year running average due to lack of survey data from 2014.

Overall, we observed 123 moose during 2016 classification / trend count surveys, compared to our management objective of 110 moose ( $\pm 22$ ). The 3-year running average is 105 moose, but doesn't have any count data from Hunt Area 42 for 2014.

## **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, Leader of the University of Wyoming Fish and Wildlife Cooperative Research Unit, will be the lead investigator. The project proposal is attached as Appendix A.

To date, 19 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). 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 when possible. The telemetry collar and an ear tag were placed on the moose. One additional moose was captured by WGFD personnel by ground darting on April 7.

WGFD will attempt to capture moose via ground darting in late summer to place collars. We will likely attempt another aerial capture during early winter 2017.

## **Management Summary**

Moose licenses are limited quota in all hunt areas. The Bighorn Herd Unit is very popular based on the number of applications for licenses available. The regular hunting season runs October 1 – 31 in all hunt areas, 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. Classification counts in 2016 improved in Area 1 but were about stable in Area 34. We are at or near desired male harvest indices, suggesting we may be close to harvesting more males than is desired. This could result in a decrease in bull quality over time, contrary to the special management objective of providing trophy quality opportunities. This could also influence pregnancy rates if there are not sufficient males (60+ males:100 cows) to breed receptive females.

We estimate a harvest of 13 moose in 2017, a decrease from recent years. We have eliminated Type 4 (antlerless moose) licenses in all hunt areas. We will have substantial time, effort and money invested in each collared female and would prefer they are not susceptible to harvest during the three years of the study.

We also reduced Type 1 licenses in Area 1 from 10 to 5. There is some concern about the quality of bulls available for harvest based on tooth age data we collect from hunter harvested moose. We have not harvested a bull over 9 years old in this hunt area since 2006. We have only harvested 4 bulls over 6 years old during the past 4 hunting seasons. While we are just meeting the secondary age objectives, we are not seeing old aged (6+ yrs old) in the harvest. This is supported by field observation of hunters as well as wildlife managers.

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 no longer 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.

## APPENDIX A

### PROPOSED MOOSE STUDY IN THE BIGHORNS - REVISION APRIL 13, 2017

#### PROJECT TITLE

Evaluating Moose Demography and Habitat Use in the Bighorn Mountains, Wyoming

Wyoming Cooperative Fish and Wildlife Research Unit  
Dr. Matthew Kauffman, Unit Leader

Wyoming Game and Fish Department  
Lynn Janke, Sheridan Wildlife Management Coordinator  
Tim Wooley, Cody Wildlife Management Coordinator  
Tim Thomas, Sheridan Wildlife Biologist  
Leslie Schreiber, Greybull Wildlife Biologist  
Dan Thiele, Buffalo Wildlife Biologist

#### PROBLEM STATEMENT

There has never been a detailed study of moose in the Bighorns. Consequently, seasonal ranges and migration corridors have not been mapped using current methods. Moose in the Bighorns use forested, aspen and willow habitat. However, during winter moose in Area 1 move from willow to heavily forested habitats making them difficult to count using traditional winter trend count methods. This type of movement is less common in Areas 34 and 42. To manage moose into the future, managers need a robust means to evaluate whether the herd is stable, increasing or decreasing. Additionally, moose are not native to the Bighorns.

This proposed project has the following objectives.

**1. Evaluate the population performance of moose in the Bighorns.** This will be done by collecting new information from collared moose on adult survival, pregnancy at initial capture, body fat at initial capture, and calf recruitment over the study period, and combining this herd-level information with average demographic rates from previous studies across the state (i.e., Jackson, Sublette and Snowy Range herds).

**2. Evaluate seasonal range use.** Moose will be captured and fitted with GPS collars. The resulting spatial data will be used to identify seasonal ranges including parturition range and, if possible, migration corridors. Additionally, seasonal habitat selection and migration patterns of Bighorn moose will be compared to that of other herds in Wyoming.

#### Study Design

We seek to GPS collar 60 moose distributed throughout the Bighorns. Collars would be on for 3 years and collect a location at 2-hour intervals. An MS student would be recruited to conduct the field work in collaboration with WGFD.

#### Partners

This project is proposed as a collaboration among the Wyoming Coop Unit and the WGFD.

**BUDGET**

DESCRIPTION	FY2017	FY2018	FY2019
<b>Radiocollars</b>			
30 GPS Globalstar collars (\$1350 per)	\$39,750	-	-
30 GPS Iridium collars (\$1825 per)	\$54,750		
Annual Collar Data Charges (\$200 per moose)		\$12,000	\$12,000
<b>Helicopter Capture</b>			
Helicopter capture (60 moose @ 1400 per)	\$84,000	\$7,000	\$7,000
<b>Monitoring</b>			
Fixed-wing support at \$300/hr to locate mort collars		\$3,000	\$3,000
<b>Personnel, Travel, Supplies</b>			
MSc student	\$25,200	\$25,200	\$25,200
Travel expenses and field techs	\$16,119	\$20,000	\$3,000
Lab analyses (PSPB, tooth sectioning)	\$3,000	\$2,000	\$2,000
Field equipment (GPS units, weather stations, cameras)	\$6,000	\$6,000	-
Integrated Population Model (contract)	-	\$10,000	\$10,000
Accounting and tech support	\$11,441	\$4,260	\$3,110
<b>Subtotal</b>	<b>\$240,260</b>	<b>\$89,460</b>	<b>\$65,310</b>
<b>WGFD Allocation</b>	<b>\$240,260</b>	<b>\$76,860</b>	<b>\$52,710</b>
<b>Total</b>	<b>\$395,030</b>		

