

## 2018 - JCR Evaluation Form

SPECIES: Mule Deer

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

HERD: MD740 - CHEYENNE RIVER

HUNT AREAS: 7-14, 21

PREPARED BY: JOE SANDRINI

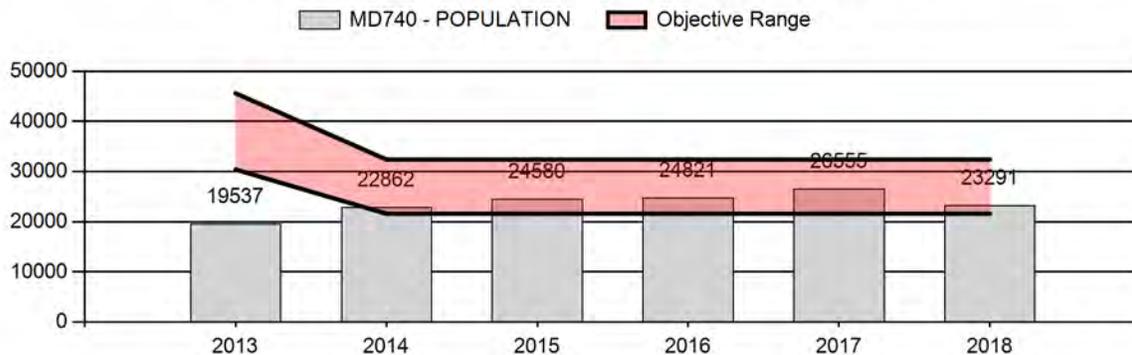
	<u>2013 - 2017 Average</u>	<u>2018</u>	<u>2019 Proposed</u>
Population:	23,671	23,291	24,391
Harvest:	1,081	1,384	1,535
Hunters:	1,912	2,247	2,425
Hunter Success:	57%	62%	63%
Active Licenses:	1,938	2,273	2,500
Active License Success:	56%	61%	61%
Recreation Days:	7,549	8,404	9,300
Days Per Animal:	7.0	6.1	6.1
Males per 100 Females	43	39	
Juveniles per 100 Females	70	58	

Population Objective (± 20%) :	27000 (21600 - 32400)
Management Strategy:	Private Land
Percent population is above (+) or below (-) objective:	-13.7%
Number of years population has been + or - objective in recent trend:	9
Model Date:	02/15/2019

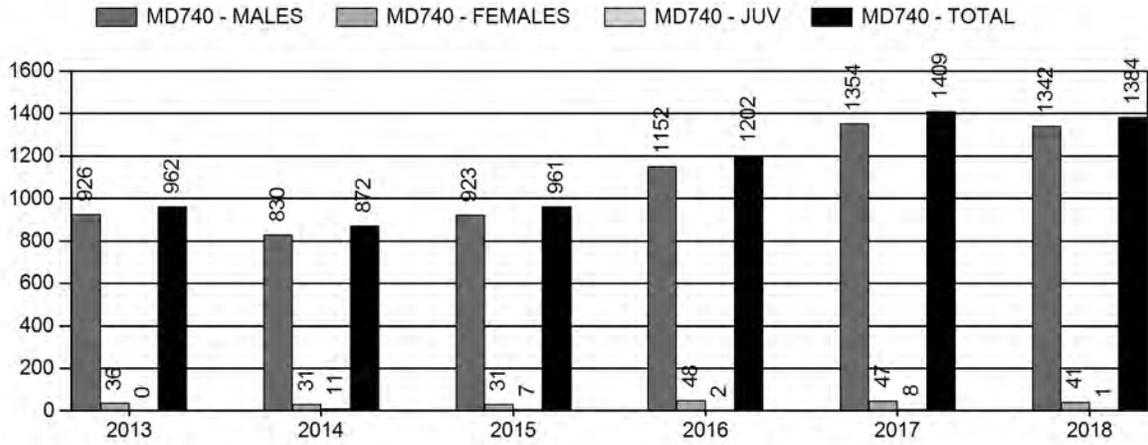
**Proposed harvest rates (percent of pre-season estimate for each sex/age group):**

	<u>JCR Year</u>	<u>Proposed</u>
Females ≥ 1 year old:	0.4%	0.4%
Males ≥ 1 year old:	23.4%	26.4%
Total:	6.1%	6.3%
Proposed change in post-season population:	+0.3%	+4.7%

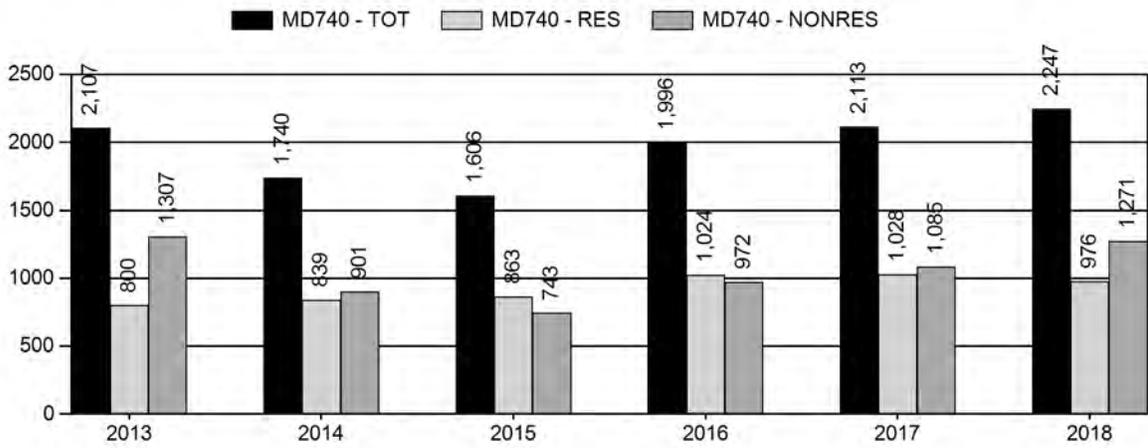
## Population Size - Postseason



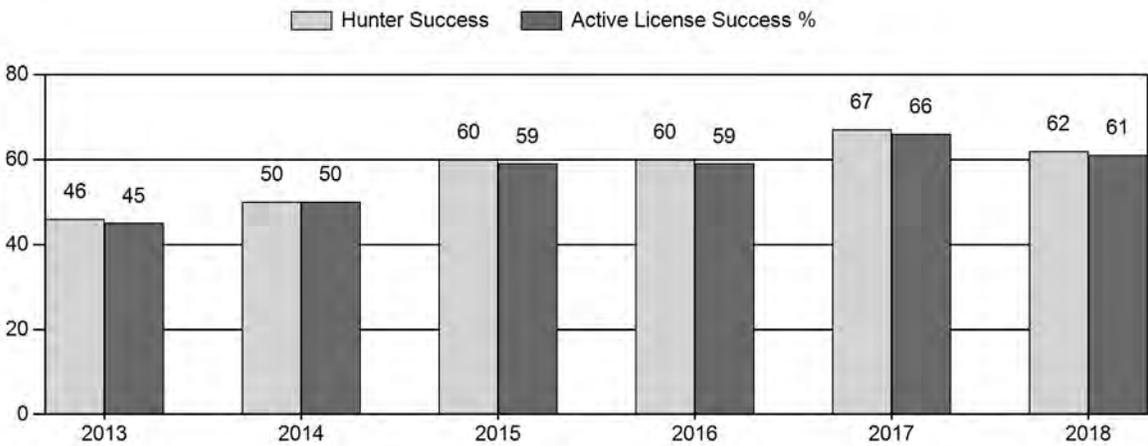
# Harvest



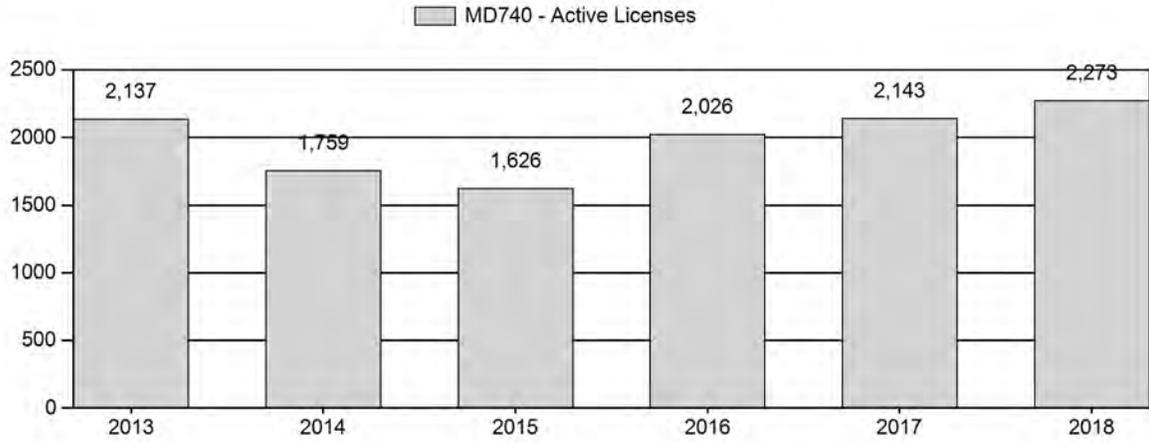
# Number of Active Licenses



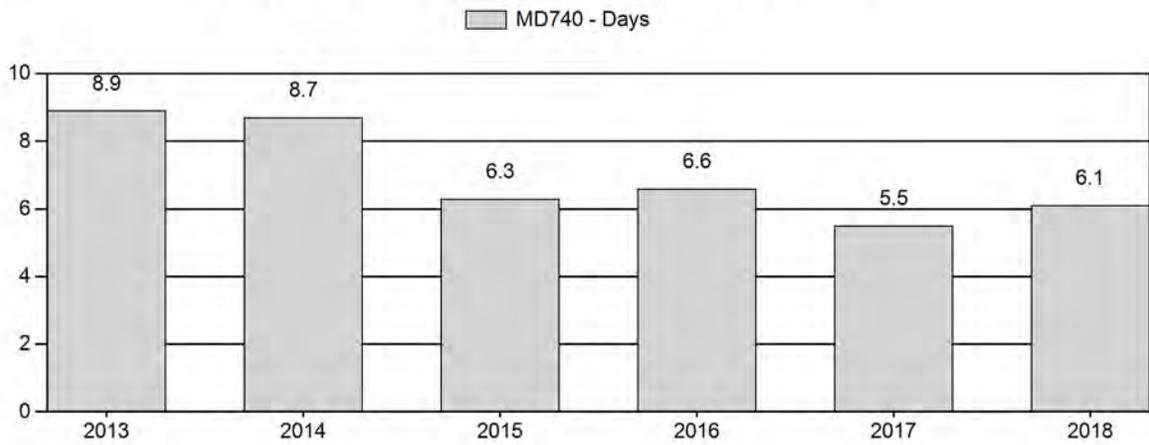
# Harvest Success



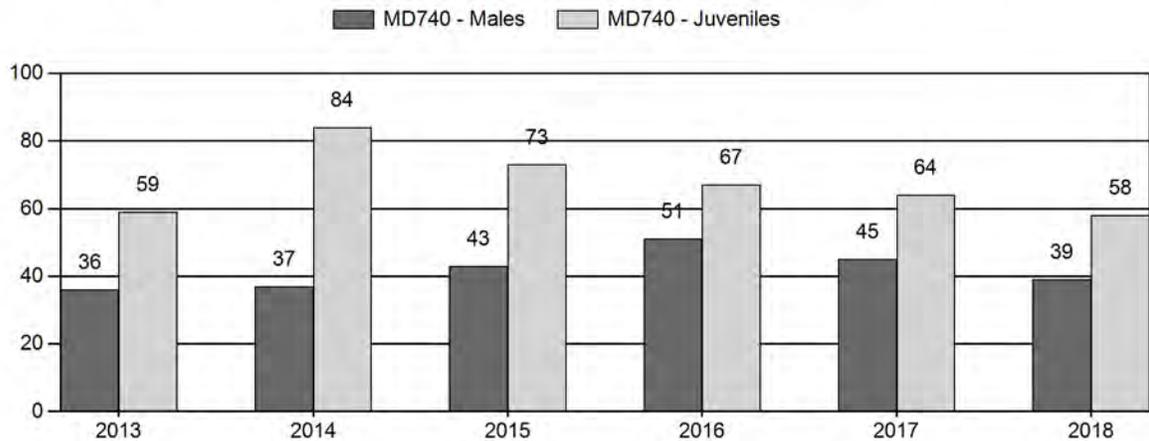
# Active Licenses



# Days per Animal Harvested



# Postseason Animals per 100 Females



## 2013 - 2018 Postseason Classification Summary

for Mule Deer Herd MD740 - CHEYENNE RIVER

Year	Post Pop	MALES							FEMALES		JUVENILES		Tot Cls	Cls Obj	Males to 100 Females			Young to			
		Ylg	2+ Cls 1	2+ Cls 2	2+ Cls 3	2+ UnCls	Total	%	Total	%	Total	%			Ylng	Adult	Total	Conf Int	100 Fem	Conf Int	100 Adult
2013	19,537	114	0	0	0	302	416	19%	1,142	51%	669	30%	2,227	1,137	10	26	36	± 3	59	± 3	43
2014	22,862	186	0	0	0	336	522	17%	1,426	45%	1,198	38%	3,146	2,044	13	24	37	± 2	84	± 4	61
2015	24,580	268	193	76	15	43	595	20%	1,373	46%	1,009	34%	2,977	1,672	20	24	43	± 3	73	± 4	51
2016	24,821	298	297	90	8	0	693	23%	1,371	46%	916	31%	2,980	1,506	22	29	51	± 3	67	± 3	44
2017	26,555	264	413	109	12	0	798	21%	1,777	48%	1,143	31%	3,718	1,371	15	30	45	± 2	64	± 3	44
2018	23,291	132	399	114	8	0	653	20%	1,669	51%	970	29%	3,292	1,133	8	31	39	± 2	58	± 3	42

**2019 HUNTING SEASONS  
CHEYENNE RIVER MULE DEER HERD (MD740)**

Hunt Area	Type	Season Dates		Quota	License	Limitations
		Opens	Closes			
7		Oct. 1	Oct. 15		General	Antlered mule deer or any white-tailed deer
8		Oct. 1	Oct. 15		General	Antlered mule deer or any white-tailed deer
9		Oct. 1	Oct. 15		General	Antlered mule deer or any white-tailed deer
10	1	Oct. 1	Oct. 15	125	Limited quota	Antlered deer
11		Oct. 1	Oct. 15		General	Antlered mule deer or any white-tailed deer
11		Oct. 16	Nov. 30		General	Any white-tailed deer
12		Oct. 1	Oct. 15		General	Antlered mule deer or any white-tailed deer
12		Oct. 16	Nov. 30		General	Any white-tailed deer
12	6	Oct. 1	Nov. 30	50	Limited quota	Doe or fawn
13		Oct. 1	Oct. 15		General	Antlered mule deer or any white-tailed deer
13		Oct. 16	Nov. 30		General	Any white-tailed deer
14		Oct. 1	Oct. 15		General	Antlered mule deer or any white-tailed deer
14		Oct. 16	Nov. 30		General	Any white-tailed deer
21		Oct. 1	Oct. 15		General	Antlered mule deer or any white-tailed deer
21	7	Oct. 1	Oct. 31	50	Limited quota	Doe or fawn valid on private land

Special Archery Season Hunt Areas	Season Dates	
	Opens	Closes
1-14, 21	Sep. 1	Sep. 30

**Region B Nonresident Quota:** 1,500

**SUMMARY OF CHANGES IN LICENSE NUMBER**

Hunt Area	License Type	Quota change from 2018
<b>Herd Unit Totals</b>	<b>Region B</b>	<b>+150</b>

## **Management Evaluation**

**Current Management Objective:** 27,000

**Management Strategy:** Private Land Management

**2018 Postseason Population Estimate:** ~ 23,300

**2019 Proposed Postseason Population Estimate:** ~ 24,400

**2018 Hunter Satisfaction:** 74% Satisfied 17% Neutral 9% Dissatisfied

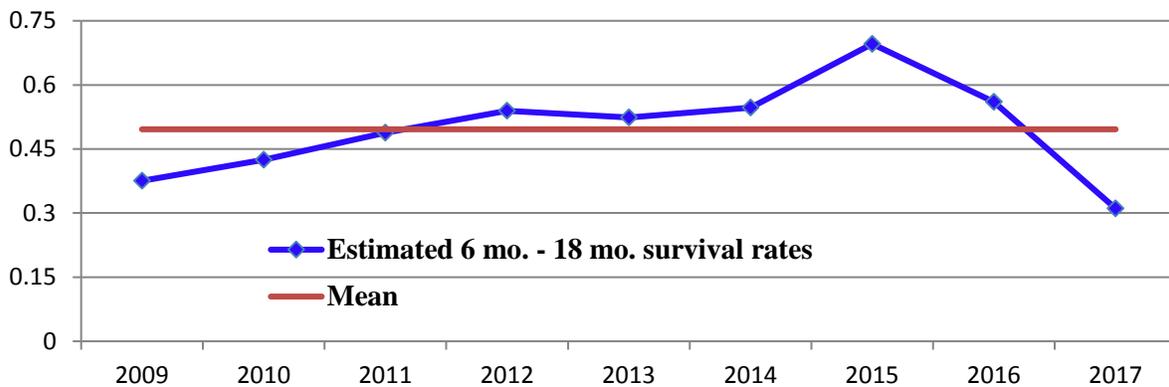
**HERD UNIT ISSUES:** The Cheyenne River mule deer herd was created in 2009 by combining the Thunder Basin and Lance Creek herds. In 2014, following an internal review and public input process, the postseason population objective was revised downward to 27,000 from 38,000 and the management strategy changed from recreational to private land. This was done to better align the post-season population objective with historic herd performance, habitat capacity, and address the consequences of limited access to private land for mule deer hunting. To date this objective seems very reasonable.

There are about 6,350 mi<sup>2</sup> in this herd unit, and 5,485 mi<sup>2</sup> (86%) are considered occupied habitat. Approximately 75% of the land within the herd unit is private. The United States Forest Service, Bureau of Land Management, or the State of Wyoming administers the remaining lands. Hunter access is largely controlled by private landowners, and access fees along with outfitted hunting are common. Consequently, hunting pressure can be heavy on lands legally accessible to the public. Historically, two-thirds or more of the hunters pursuing mule deer in this herd unit have been non-residents. In recent years, due to reductions in the Region B quota, nonresident hunter numbers have more closely approximated that of residents. Compared to residents, non-residents typically are more willing to pay trespass or access fees for hunting privileges, or hire an outfitter. Many resident hunters, but also an increasing percentage of non-residents, pursue mule deer with general licenses on accessible on public land, which significantly concentrates hunting pressure.

Primary land uses within the herd unit include livestock grazing, oil and gas production, and some crop production. By far, the dominant land use is livestock grazing. Cultivation of alfalfa, grass hay, oats, and wheat occur mostly in the southern and eastern portions of the herd unit. The majority of oil and gas development occurs in the western and north central portions of the herd unit. However, substantial new oil and gas development is occurring in northern Niobrara County (HA's 9 & 11) and near Douglas (HA 14). Horizontal oil well development over a large portion of hunt areas 10, 11, 14 and 21 has begun to increase disturbance. There are also several large surface coalmines in HA 10 and HA 21, which create a high level of disturbance and limit access to public lands for hunting.

We are maintaining this herd at the current objective and management strategy based on internal discussions and conversations with our constituents. We evaluated and considered population status and habitat data included in this document and a change is not warranted at this time. We will review this herd objective again in 2024. However, if the situation arises that a change is required, we will review and submit a proposal as needed.

**WEATHER:** Winters during bio-years 2010 and 2011 were tough to severe. They resulted in above average over-winter mortality. This is evident from observed fawn:doe and yearling buck:doe ratios (Figures 1, 2 & 3). Following these winters was severe drought in 2012. The combination of these climatic conditions led to reductions in fawn productivity and survival even though the 2012-13 winter was mild. Bio-year 2013 was a transition year when drought moderated yielding good forage conditions followed by a relatively normal winter. Favorable weather for mule deer was then experienced through 2015, with spring and summer weather conditions leading to outstanding forage production followed by mild winters. Consequently, fawn production and survival were excellent in bio-years 2014 and 2015, and resulted in substantial herd growth. During the spring and summer of 2016 and 2017 drought hit most of the herd unit. In many locations, cool season forage production was nominal and warm season production limited. Overall, range conditions were generally fair to poor going into both the 2016-17 and 2017-18 winters. The 2016-17 winter saw a return to more normal winter weather and survival, with temperatures generally close to average and precipitation slightly above normal. The 2017-18 winter was notably colder than that of the previous year, and several ranchers in the herd unit said they fed more hay to their cattle than normal and had lower than expected yearling cattle weights in the spring. It appears now that over-winter mortality of buck mule deer six to eighteen months old increased substantially in bio-year 2017 (Figure 1), while anecdotal information suggests survival of adults was closer to average. Decreased survival and fawn productivity the past two years led to reduced herd growth in 2017 followed by a slight drop in 2018. Weather summary details available are at <http://www.ncdc.noaa.gov/cag/>.



**FIGURE 1.** Estimated survival rate<sup>1</sup> of buck mule deer in the Cheyenne River herd Unit from 6 mo. to 18 mo. of age with mean (bio-years 2009 - 2017)

<sup>1</sup>  $[(\text{Yearling Buck:Doe})_{\text{Bio-Year}+1} / 0.85] / \frac{1}{2} (\text{Fawn:Doe})_{\text{Bio-Year}}$  Note - This assumes constant doe survival rate of 0.85.

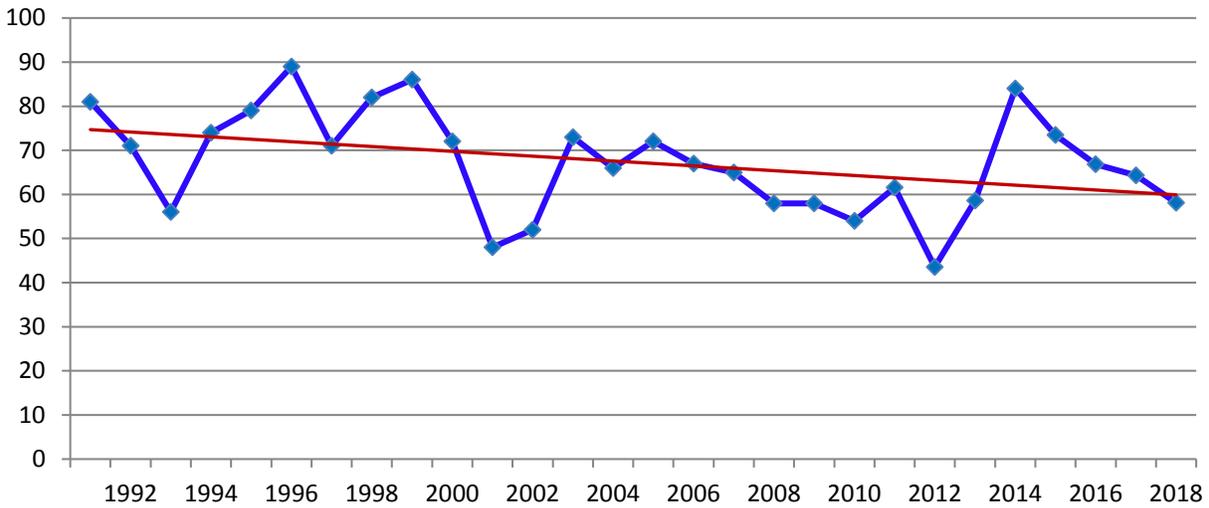
**HABITAT:** Mixed sagebrush (*Artemisia ssp.*) grasslands with scattered hills dominated by ponderosa pine (*Pinus ponderosa*) comprise most of the western, central, and northern segments of the herd unit. The easternmost lands in the herd unit are dominated more by short grass prairie punctuated with pine breaks, and there is a small area (about 30 mi<sup>2</sup>) of southern Black Hills habitat along the Stateline near Newcastle. Rolling ponderosa pine and limber pine (*Pinus flexilis*) hills and ridges dominate the southern portions of the herd unit. Major agricultural crops include grass and alfalfa hay and winter wheat. Croplands are localized and found primarily near Gillette, Moorcroft, Upton, Newcastle, Manville, and Lusk. These variations in habitat types and limited riparian areas affect deer densities and distribution. The majority of mule deer are typically found utilizing broken topography characterized by sagebrush, conifer covered hills, or cottonwood and sagebrush dominated riparian communities. Scattered mule deer are found in the open sagebrush-grassland areas.

Several major cottonwood drainages traverse the herd unit including the headwaters of the Belle Fourche River in the north and those of the Niobrara River to the south. The Cheyenne River and many of its tributaries such as Beaver Creek, Lightning Creek, Twenty-Mile Creek, Lance Creek, and Old Woman Creek make up the bulk of the herd unit. Overstory canopy along these drainages is dominated by decadent stands of plains cottonwood (*Populus deltoides*). These riparian cottonwood groves comprise one of the most important habitat types for mule deer in this herd unit. Unfortunately, many are in poor condition and lack recruitment of new cottonwoods along with the general lack of woody understory species. The health and vigor of riparian cottonwood communities and shrub stands need to be enhanced across the herd unit if mule deer are going to thrive in this part of Wyoming.

After about a decade of annually collecting Wyoming big sagebrush leader growth and utilization data in this herd unit, the Department suspended these efforts. This was done because it had been demonstrated annual leader production was proportional to the amount of spring and early summer moisture received; while over-winter browsing of shrubs could be fairly well gauged through causal observation. During 2014 and 2015, wet spring and summer conditions combined with low numbers of pronghorn and mule deer yield excellent leader growth and low levels of winter use. Observations in 2016 and 2017 indicated little in the way of cool season grass and forb production together with reduced leader growth on shrubs; and fawn production and survival dropped to levels near or slightly below long-term averages. On the heels of the 2017-18 winter and drought conditions the previous summer, fawn production dropped more significantly in 2018. This herd was thought to be near objective as habitat conditions deteriorated and deer numbers leveled off in the face of consistent harvest. This would seem to indicate the population was below carrying capacity when forage conditions were good (2014 & 2015) and was near it when they were substantially poorer (2016 - 2018). As such, the current population objective seems reasonable.

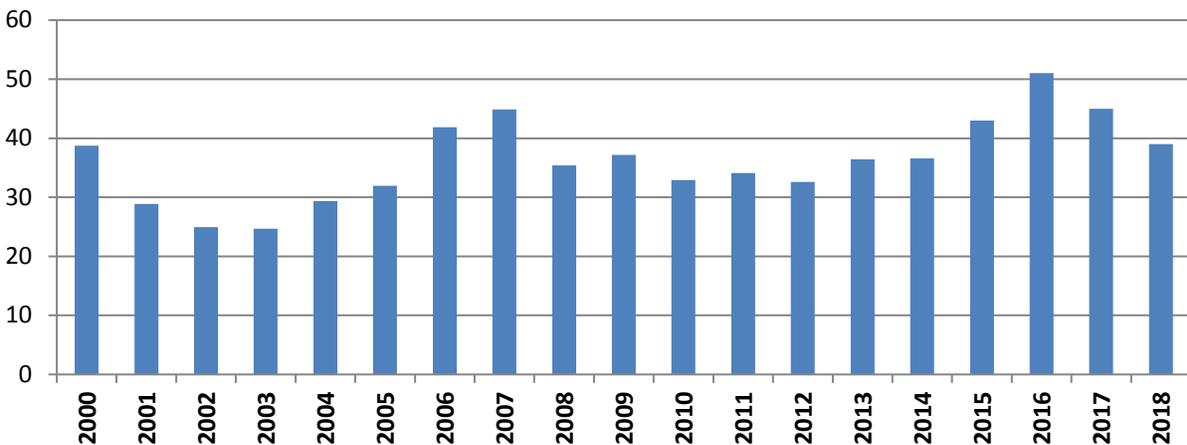
**FIELD DATA:** Postseason fawn:doe ratios have undergone cyclic fluctuations, but generally trended downward (Figure 2). In 2018, the observed, post-season fawn:doe ratio was 58:100, which was significantly below the previous 20-year average of 65:100, and represented a drop of 31% from the recent high of 84:100 observed in 2014. The latest decline in late fall fawn numbers is thought to be the result of drought two summers in a row and normal to more severe winter weather impacting the reproductive potential of does and survival of fawns. As such, this herd is likely heading into a cyclical population decline, since fawn:doe ratios have declined the past four

years, and in 2018 were equal to those observed during this herd’s last decline (2006 – 2012), when an average of 58 fawns per 100 does was observed.



**Figure 2.** Post-Season Fawn:Doe Ratios (1991 – 2017) in the Cheyenne River Mule Deer Herd with linear trendline.

Post-season buck:doe ratios in this herd have fluctuated cyclically while generally trending upward (Figure 3). Prior to 2008, moderate productivity coupled with limited access for hunters to private land yielded an increasing buck:doe ratio despite enhanced license issuance. Then, as fawn production and survival dropped, buck:doe ratios declined. Region B license issuance was lowered during this time and buck:doe ratios stabilized. Excellent fawn production and over-winter survival in 2014 and 2015 caused buck:doe ratio to jump to 43:100 in 2015 and 51:100 in 2016. As recruitment and survival declined the past two years, the observed buck:doe ratio dropped to 45:100 last year and 39:100 this year. Despite cyclical variations in productivity and survival over the past couple of decades, conservative harvest of bucks has resulted in increasing buck:doe ratios, despite generally declining fawn:doe ratios.



**Figure 3.** Post-Season Buck:Doe Ratios in the Cheyenne River Mule Deer Herd (2000 - 2018).

**HARVEST DATA:** In this herd unit, most mule deer are harvested on private land because it provides the majority of mule deer habitat. The Department is currently attempting to balance desires of many landowners and hunters to maintain or increase deer numbers, but still keep the population at levels that will reduce the chance of a large-scale die-off. This was part of the reason for reducing the post-season population objective in 2014. We are now at a point where a few landowners are expressing the desire to host more hunters and even entertain some limited doe/fawn hunting, while others are limiting harvest as they have lower than desired deer numbers. Considering the biological data and landowner sentiments, we seem to be near a number of deer where this mule deer population should be actively managed.

Between 2006 and 2014, hunter participation and harvest declined, while harvest effort increased. The trend in effort was reversed in 2014, as the population began to increase and hunter participation continued to drop. Non-resident hunter numbers fell steadily between 2006 and 2015 as the Region B quota was successively lowered most years. In addition, likely responding to declining deer numbers, resident hunter participation dropped through 2013 to about 835 active licenses before increasing in 2016 and stabilizing at about 1,000 hunters since. With proportionately greater increases in buck numbers relative to hunter participation, complaints about the low number of deer seen and harvested have diminished significantly over the past four years.

Harvest statistics have generally reflected well changes in the population estimate. However, these statistics indicate this population dropped to its low point in 2013, versus 2012 as projected by the model. This was likely attributable to winter storm Atlas in October 2013 hindering harvest success. Additionally, with the vast majority of the harvest being adult bucks, it is likely harvest statistics reflect changes in mature buck numbers more than gross population changes. As such, we might expect an offset between harvest statistics and population estimates of a year or two as recruitment into older age classes fluctuates. In 2014, harvest statistics reversed their course from declining hunter success and increasing effort to improved success and reduced effort. This same scenario continued in 2015, with substantial increases in hunter success and reductions in effort. Hunter success and effort values then continued to improve steadily through 2017. In 2017, with very little change in license issuance, total hunter success climbed to 67% from 60% and effort decreased from 6.6 to 5.5 days per harvest from the year before. Then in 2018, as this population appeared to level off or decline, hunter success dropped to 62% and effort increased to 6.1 days per harvest. These 2018 changes suggest more of a drop in the population than indicated by the current population model.

As harvest increased the past few years, the number of field check mule deer has increased as well. In 2017, with the advent and use of the smartphone mediated check station application, field check numbers increased substantially. This trend continued in 2018 as the number of field check deer was augmented by increased Chronic Wasting Disease (CWD) testing efforts. However, the exact number of mule deer field checked in 2018 is difficult to know, as an unknown number of lab aged, CWD sampled deer were recorded using the check station application resulting in the JCR program generating duplicate counts of lab and field aged deer. At minimum, a total of 124 mule deer harvested were field checked and/or lab aged in 2018. The bulk of these, 108, were bucks age two-years or greater. Of the 113 mule deer tested for CWD, 10 were positive, yielding a prevalence rate of 9.9%. All of the infected deer coming from the 101 adult bucks tested. The

2018 detection prevalence was substantially higher than the approximately 2.2% that had been observed from this herd prior to 2018, during which time 38 of 1,740 tested positive.

**POPULATION:** After recent model revisions, this herd's 2018 post-season population estimate of about 23,300 puts it 14% below objective. Model projections suggest this herd increased almost 40% between 2012 and 2017 before essentially leveling off in 2018. The substantial rebound was a result of excellent reproduction and survival between 2014 and 2016, while hunting seasons remained extremely conservative. This population increase was also a considerable course reversal considering this herd declined appreciably between 2007 and 2012, when it fell 45%. However, placing great confidence in the accuracy of population estimates in recent years very tenuous, since the inherent constraints in the spreadsheet models used make population estimates at the extremes of the years modeled the most questionable, and harvest statistics and field observations suggest deer numbers declined more than indicated this year.

The Semi-Constant Juvenile / Semi-Constant Adult (SCJ SCA) model was again chosen to estimate this herd's population. It was selected over competing models because it had the lowest AICc and fit observed buck ratios well without being overly parameterized. Preseason population estimates of the selected model are also 86% correlated with changes in hunter success, and inversely correlated 72% with changes in hunter effort between 2006 and 2018. The competing models are not as well correlated. However, modeled changes in population size do not seem to be of the magnitude field personnel and many landowners report. There seemed to be more of a peak in deer numbers about 2006 or 2007 with a steeper increase preceding this and more abrupt decline following. More recently, in some locations it does not appear that the increase in deer numbers has been as great as the model suggests and numbers may have dropped more than indicated this year. Model projections for the coming year are based upon long-term (1995-2018) classification sample means instead of the past 5-year's average. This was done to more accurately capture herd performance, as average, observed fawn:doe and buck:doe ratios the past-five years are well above what this herd is capable of next year given demographics and weather patterns. Overall, the chosen model is considered to be of fair quality because it has 15-20 years of data; ratio data available for all years in model; the juvenile and adult survival estimates are very reasonable; it exhibits modest fit; and results are generally defensible. But, we do not have any specific survival rates or independent population estimates for this herd; and the population changes indicated are not completely congruent with field personnel's sentiments.

**MANAGEMENT SUMMARY:** The traditional hunting season dates in this herd unit are Oct. 1-15. In order to facilitate population growth commensurate with landowner and hunter desires, we are proposing to continue with very little doe/fawn harvest and antlered-only general license seasons for mule deer. Limited doe/fawn harvest will continue in HA 12, where a couple landowners are experiencing some damage and want to reduce mule deer numbers. Fifty Type 7 licenses valid on private land will again be issued in HA 21 to address localized concentrations of mule deer around cultivated and landscaped areas.

Due to heavy hunting pressure on accessible public land, there is a discrepancy in deer numbers and densities between these areas and surrounding private lands. Historically, this was most exemplified in HA 10, which contains the highest proportion of public land in the herd unit. To address low buck numbers and hunter crowding here, the season length there and Region B quota where steadily decreased for a number of years, and finally a 3-point restriction implemented in

2012. These strategies helped improve the HA 10 buck:doe ratio to the herd-wide average in 2009 and 2010, but deer densities remained depressed. With the 3-point restriction in place during 2012, the post-season buck:doe ratio improved to 42:100. Similar classification efforts in 2013 and 2014 revealed a buck:doe ratio that remained near 36:100.

Following the 2015 inaugural limited quota season in HA 10, comparable classification efforts found buck:doe ratios of 51:100 in 2015 and 57:100 in 2016. However, 30% of the bucks observed were yearlings in 2015 and 43% in 2016. In 2017, nearly 700 deer were classified in this hunt area (most from the ground) yielding a buck:doe ratio of 41:100. 2018 aerial classification efforts here obviously experienced some type of bias, as 134 bucks per 100 does were recorded. At any rate, buck numbers in HA 10 are strong and we should consider increased license issuance as cohorts of younger deer reach mature age classes. Along these lines, it is suggested the license quota for HA 10 be set at 10% of the Region B quota. This is because the average proportion of deer classified in Region B from HA 10 since 1992 has been about 10%. Harvested buck quality has also been good recently in the HA. Tooth boxes were mailed to Type 1 license holders in 2017 and 2018, and based upon harvest survey data, a return rate of 28% and 23% was garnered each year, respectively. These data revealed the median buck harvested in 2017 was a 3.5 year old deer with 4X4 antlers a bit under 20 inches in outside beam width. In 2018, the median buck harvested was a 4.5 year old deer with 4X4 antlers and an in outside beam width of about 21 inches. Since a limited quota season was established in HA 10, mean hunter success has been 77% each year without much variance (std dev = 5.5%). Finally, limited quota hunting in this hunt area has been very well received by those hunting here, with 91% of hunters reported being satisfied or very satisfied with their hunt in 2017, and 80% in 2018, but no hunters reported any measure of dissatisfaction either year. Since hunting on limited quota basis was instituted in HA 10, mean hunter satisfaction has been 83%.

Throughout Region B, some landowners continue to state they are not willing to host increased numbers of deer hunters, while others want to take more hunters. Overall, local game managers remain reluctant to significantly increase Region B license issuance due to concerns over non-resident hunters purchasing licenses without securing permission on private lands, resulting in phone calls looking for places to hunt, hunter complaints about access, and dissatisfaction from those hunters relegated to hunting isolated parcels of public land with low buck numbers. However, now that HA 10 has been limited quota for four years, Region B license demand still exceeds issuance, and the buck:doe ratio strong the past four years, a slight increase in the Region B quota is undoubtedly warranted. Therefore, Region B licenses will increase 11% to 1,500 in 2018. A number that, when this herd is near objective, should be the number of non-resident tags issued annually.

Assuming resident hunter participation remains constant, the 2019 hunting season should result in harvest of about 1,450 bucks and 50 antlerless deer. Given long-term postseason classification values and modeled survival rates, this harvest should allow the postseason population to increase about 5% to 24,400. This would put it 12% below its objective of 27,000. However, winter weather was normal to somewhat severe, at least in the northern portion of the herd unit, and considering 2016 & 2017 drought and recent declines in fawn:doe ratios, this population will more likely level off or drop in 2019.

## 2018 - JCR Evaluation Form

SPECIES: Mule Deer

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

HERD: MD751 - BLACK HILLS

HUNT AREAS: 1-6

PREPARED BY: JOE SANDRINI

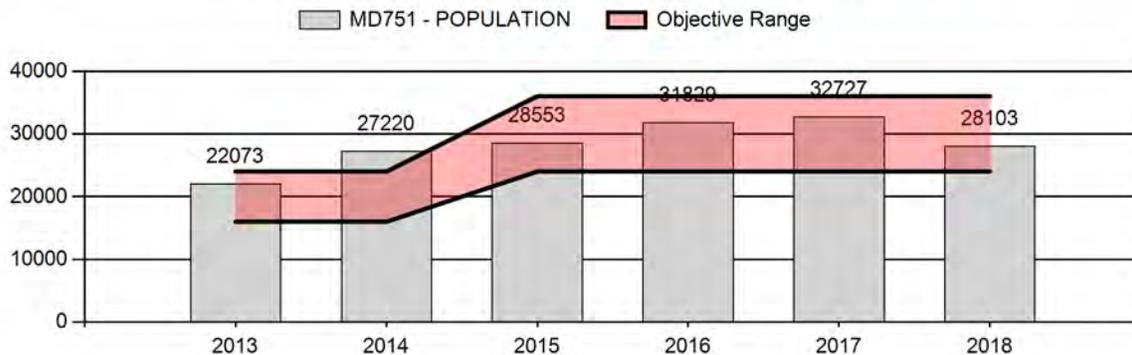
	<u>2013 - 2017 Average</u>	<u>2018</u>	<u>2019 Proposed</u>
Population:	28,480	28,103	29,581
Harvest:	2,251	2,217	2,500
Hunters:	4,728	5,325	5,400
Hunter Success:	48%	42%	46 %
Active Licenses:	4,877	5,437	5,525
Active License Success:	46%	41%	45 %
Recreation Days:	14,077	16,332	17,000
Days Per Animal:	6.3	7.4	6.8
Males per 100 Females	29	22	
Juveniles per 100 Females	77	66	

Population Objective (± 20%) :	30000 (24000 - 36000)
Management Strategy:	Recreational
Percent population is above (+) or below (-) objective:	-6.3%
Number of years population has been + or - objective in recent trend:	3
Model Date:	02/15/2019

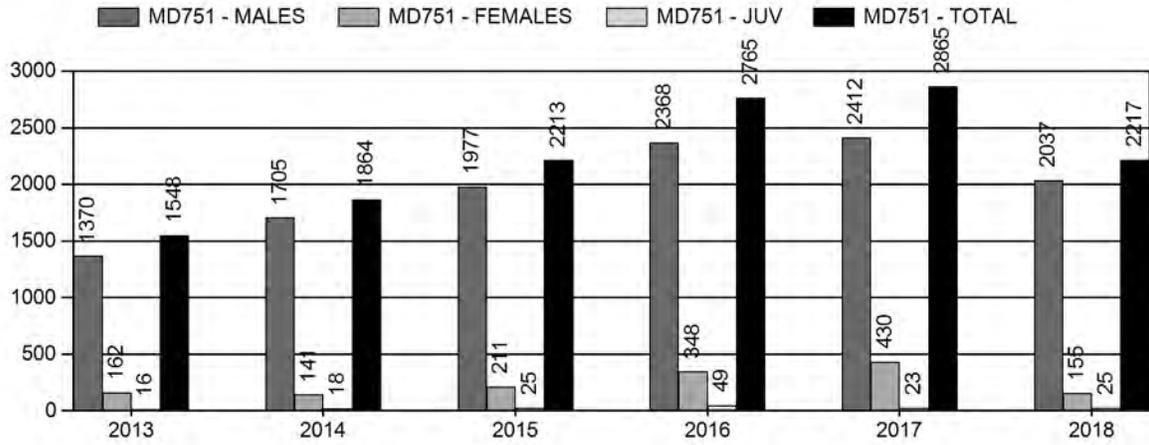
**Proposed harvest rates (percent of pre-season estimate for each sex/age group):**

	<u>JCR Year</u>	<u>Proposed</u>
Females ≥ 1 year old:	1.1%	1.8%
Males ≥ 1 year old:	38.4%	41.2%
Total:	8.0%	8.5%
Proposed change in post-season population:	- 6.2%	+ 5.3%

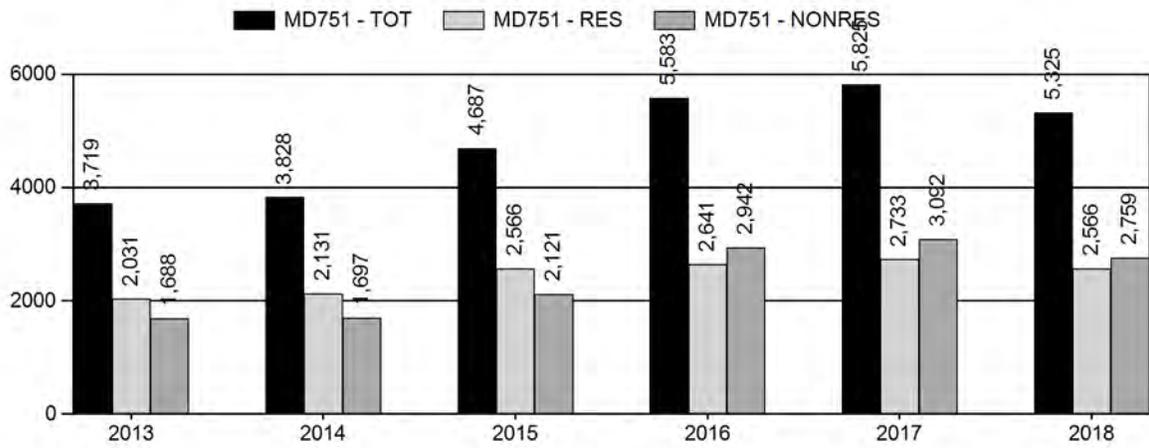
## Population Size - Postseason



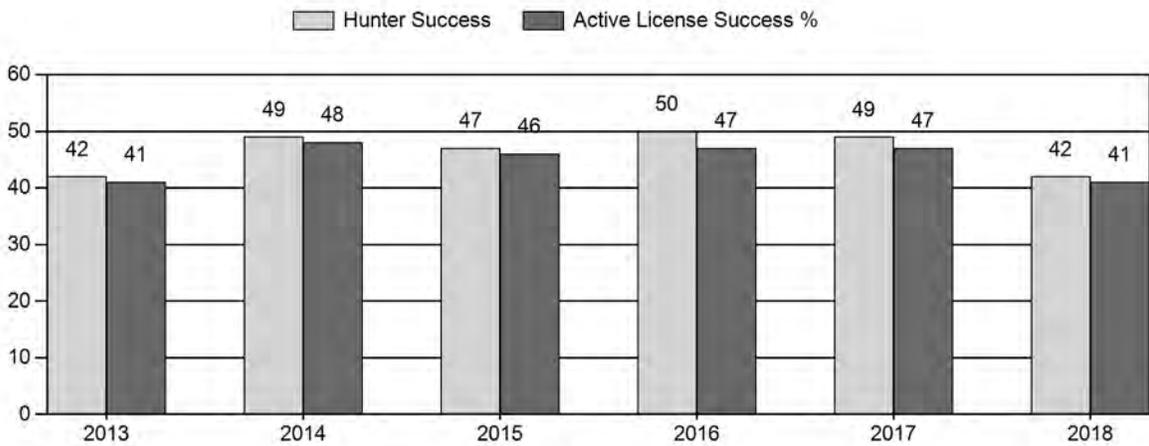
# Harvest



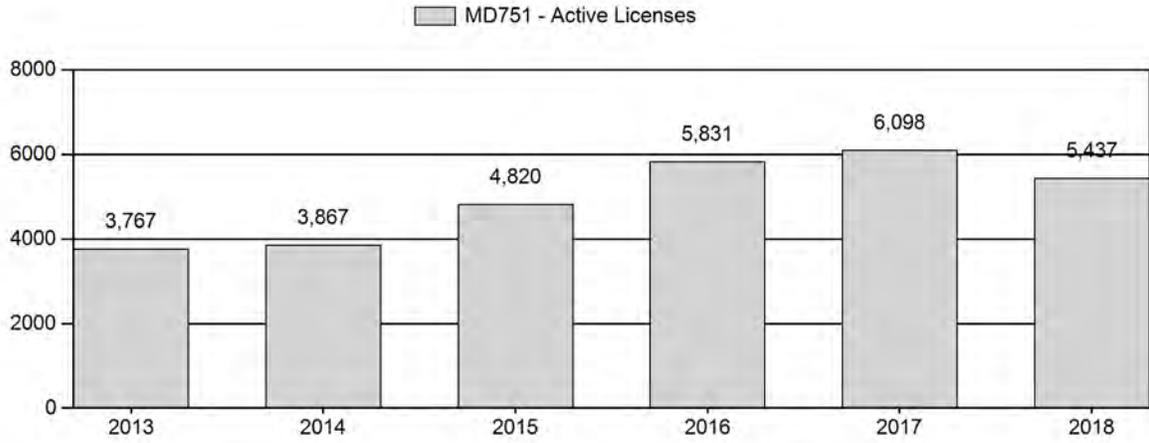
# Number of Active Licenses



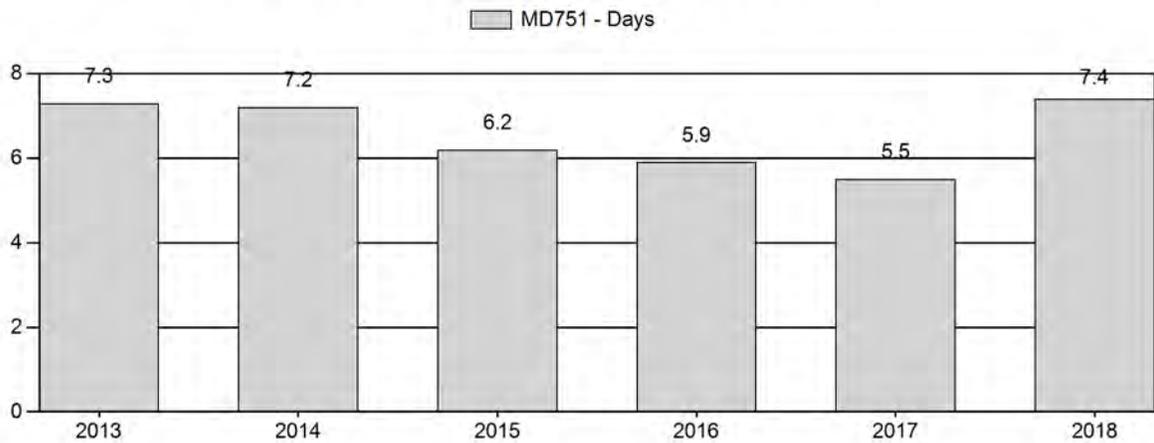
# Harvest Success



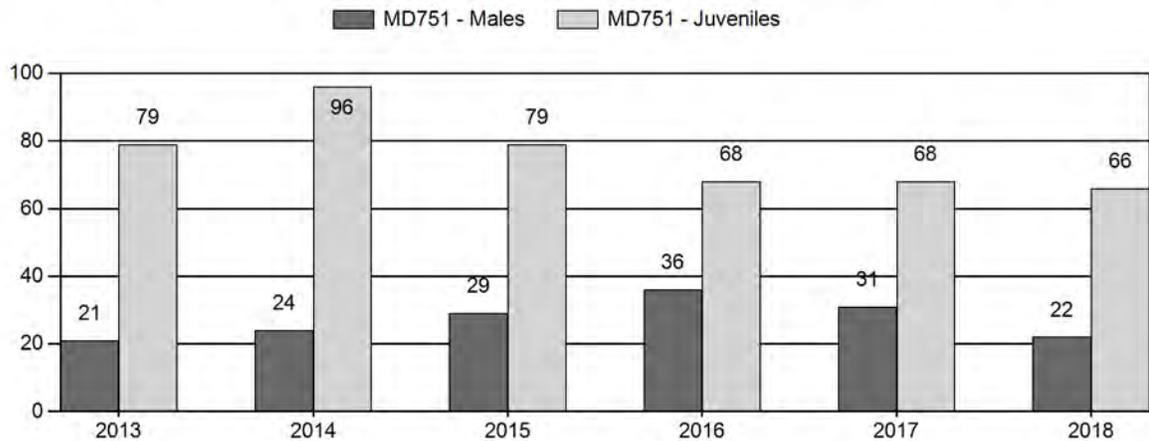
# Active Licenses



# Days per Animal Harvested



# Postseason Animals per 100 Females



## 2013 - 2018 Postseason Classification Summary

for Mule Deer Herd MD751 - BLACK HILLS

Year	Post Pop	MALES							FEMALES		JUVENILES		Tot		Males to 100 Females				Young to		
		Ylg	2+ Cls 1	2+ Cls 2	2+ Cls 3	2+ UnCls	Total	%	Total	%	Total	%	Cls	Obj	Yng	Adult	Total	Conf Int	100 Fem	Conf Int	100 Adult
2013	22,073	71	0	0	0	62	133	11%	634	50%	499	39%	1,266	1,714	11	10	21	± 2	79	± 6	65
2014	27,220	98	0	0	0	113	211	11%	880	45%	847	44%	1,938	2,466	11	13	24	± 2	96	± 6	78
2015	28,553	158	90	16	0	9	273	14%	939	48%	746	38%	1,958	1,812	17	12	29	± 2	79	± 5	62
2016	31,829	182	183	32	0	0	397	17%	1,113	49%	762	34%	2,272	1,467	16	19	36	± 3	68	± 4	50
2017	32,727	146	216	57	2	0	421	16%	1,343	50%	917	34%	2,681	1,429	11	20	31	± 2	68	± 4	52
2018	28,103	71	109	15	2	0	197	12%	884	53%	582	35%	1,663	1,297	8	14	22	± 2	66	± 4	54

**2013 - 2018 Trend Count Summary**  
for Mule Deer Herd MD751 - BLACK HILLS

<b>Year</b>	<b>Count Dates</b>	<b>Number Counted</b>
2014	OCTOBER 2014	1,093
2015	OCTOBER 2015	1,098
2016	OCTOBER 2016	1,410
2017	OCTOBER 2017	1,426
2018	OCTOBER 2018	1,453

**2019 HUNTING SEASONS  
BLACK HILLS MULE DEER HERD (MD751)**

Hunt Area	Type	Dates of Seasons		Quota	License	Limitations
		Opens	Closes			
1		Nov. 1	Nov. 20		General	Antlered deer off private land; any deer on private land
1, 2, 3	7	Nov. 1	Nov. 30	4,200	Limited quota	Doe or fawn valid on private land
2		Nov. 1	Nov. 30		General	Antlered deer off private land; any deer on private land
3		Nov. 1	Nov. 30		General	Antlered deer off private land; any deer on private land
4		Nov. 1	Nov. 20		General	Antlered deer off private land; any deer on private land except the lands of the State of Wyoming's Ranch A property shall be closed
4	7	Nov. 1	Nov. 20	300	Limited quota	Doe or fawn valid on private land
5		Nov. 1	Nov. 20		General	Antlered deer off private land; any deer on private land
5	6	Nov. 1	Nov. 20	200	Limited quota	Doe or fawn
6		Nov. 1	Nov. 20		General	Antlered deer off private land; any deer on private land
Archery		Sep. 1	Sep. 30			Refer to license type and limitations in Section 2

**Region A Nonresident Quota: 4,500**

**SUMMARY OF CHANGES IN LICENSE NUMBER**

Hunt Area	License Type	Quota change from 2018
4	6	- 300
4	7	+300
<b>Herd Unit Total</b>	<b>6</b>	<b>- 300</b>
	<b>7</b>	<b>+ 300</b>
	<b>Region A</b>	<b>None</b>

## **Management Evaluation**

**Current Postseason Population Management Objective:** 30,000

**Management Strategy:** Recreational

**2018 Postseason Population Estimate:** ~ 28,100

**2019 Proposed Postseason Population Estimate:** ~ 29,600

**2018 Hunter Satisfaction:** 79% Satisfied 12% Neutral 9% Dissatisfied

**HERD UNIT ISSUES:** In 2015, the management objective of the Black Hills Mule Deer Herd Unit was revised to a post-season population of 30,000 mule deer. Prior to this revision, an objective of 20,000 had been in place since 1986. The herd is managed under the Department's "Recreational Management Strategy," which calls for 20 to 29 bucks per 100 does post-season.

The Black Hills mule deer herd unit encompasses 3,181 mi<sup>2</sup> of occupied habitat. Approximately 76% of the land in the herd unit is private. Significant blocks of accessible public land are found on the Black Hills National Forest in Hunt Area (HA) 2 and HA 4, and on the Thunder Basin National Grassland in HA 6. A block of BLM land with a couple of access points is also present in HA 1. Because the majority of private landowners lease to outfitters or charge access fees for hunting, and given the timing of the Black Hills deer season, accessible parcels of public land receive much greater hunting pressure than private lands and are probably the most heavily hunted in the State.

Historically, management of this mule deer herd has been a derivative of managing the Black Hills White-Tailed Deer Herd, with hunting seasons primarily structured to address the white-tailed deer population. Although, this has changed to some degree in recent years. As with many of the herd units in the eastern half of Wyoming, the Game & Fish Department has tried to maintain deer numbers at levels acceptable to landowners. In the case of these two sympatric herds, landowners typically feel saturated with whitetails before mule deer become a problem.

White-tailed deer are the more numerous deer species in HA's 2 and 4, whereas more equal proportions of mule deer occupy HA's 1 and 3, and greater proportions of mule deer inhabit HA's 5 and 6. The vast majority of mule deer in the herd unit reside on private land. This results in management strongly influenced by landowner sentiments. Field personnel report mule deer numbers are near tolerance levels in most locations; but some landowners, especially those near Newcastle, desire to see more mule deer.

**WEATHER:** After a peak in 2006, this herd declined steadily through 2011, something that was exacerbated by a severe winter during bio-year 2010. Increasingly conservative harvest regimes were put in place and this herd began to rebound, but recovery was hampered by severe drought in 2012. In 2013, there was a transition with the advent of good growing season weather and an average winter. Then, in both 2014 and 2015, warm and wet growing seasons followed by mild winters set the stage for excellent fawn productivity and survival. Based upon weather, habitat conditions and deer numbers, it is likely mule deer entered the 2014-15 and 2015-16 winters in good to excellent condition. In addition, weather those years resulted in outstanding over-winter survival, as indicated by very robust post-season yearling buck ratios. More recently, drought plagued the Black Hills during the primary growing seasons of 2016 and 2017. These drought years resulted in poor forage production and led to several large wildfires. Fall weather over this same timeframe was characterized by normal to slightly above average temperatures and below

average precipitation. However, in 2016 and 2017 more normal to severe winter weather was experienced, as temperatures were close to average or below, and total precipitation received normal or above normal most months. Forage growth in 2018 was very good with above average moisture and close to normal temperatures during the growing season. However, the 2018-19 winter has been characterized by well below normal temperatures and above average snowfall. Given the previous two-year's drought and more severe winter weather, improvements in this herd's performance have come to a temporary end. As such, contrary to model predictions, the population will probably stabilize or continue to drop, as will the number of bucks available for harvest. See <http://www.ncdc.noaa.gov/cag/> for weather information.

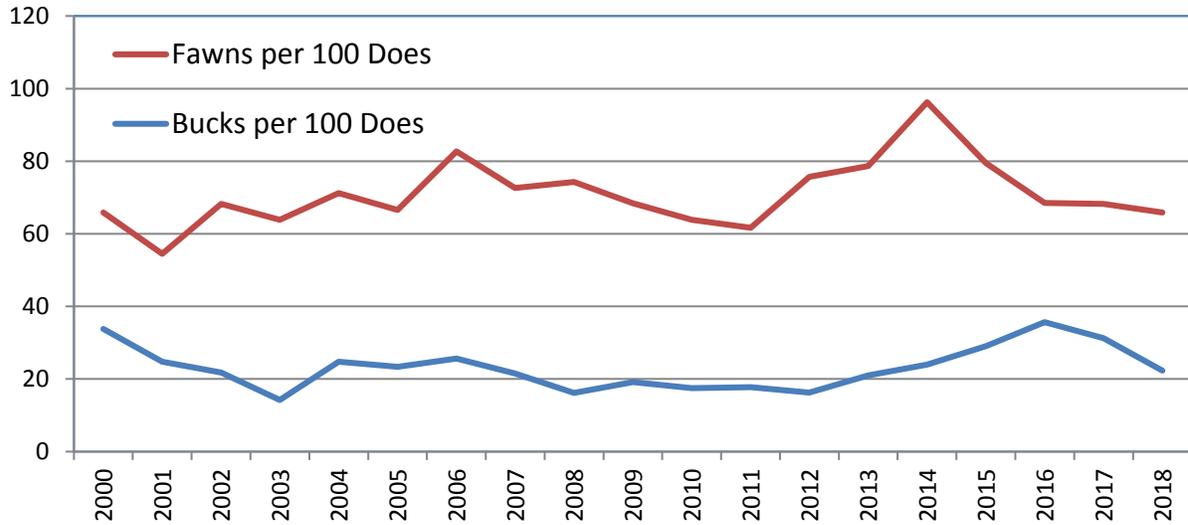
**HABITAT:** Ponderosa pine (*Pinus ponderosa*) is the dominant overstory species on forested lands. Quaking aspen (*Populus tremuloides*), paper birch (*Betula papyrifera*), and bur oak (*Quercus macrocarpa*) stands are also present. Important shrubs include big sagebrush and silver sage (*Artemisia spp.*), Saskatoon serviceberry (*Amelanchier alnifolia*), Oregon grape (*Berberis repens*), common chokecherry (*Prunus virginiana*), wild spiraea (*Spiraea betulifolia*), and true mountain mahogany (*Cercocarpus montanus*) in the southern portion of the herd unit. Non-timbered lands are dominated by sagebrush, or are used to produce agricultural crops such as winter wheat (*Triticum aestivum*), alfalfa hay (*Medicago sativa*), and grass hay.

Currently, quantification of mule deer habitat quality or quantity are not conducted within this herd unit. A single true mountain mahogany and two bur oak production and utilization transects were monitored in the past. The true mountain mahogany transect was located on mule deer transitional and winter range typical of the southern Black Hills, and the bur oak transects were in winter range more typical of white-tailed deer habitat in the northern hills. While little habitat data have been collected, it appears past drought conditions negatively affected shrub production, and peak mule deer numbers several years ago may have exceeded what the forage conditions could sustain given the lack of precipitation at the time. Bio-years 2013 through 2015 resulted in excellent forage production, and browse availability on winter and transitional ranges appeared to be generally good to excellent. However, during bio-years 2016 & 2017, forage production appeared to be fair or poor in most locations, and winter use elevated. 2018 was again wetter with good forage production. However, the 2018-19 winter to date has been colder and snowier than normal, and browsing more extensive.

**FIELD DATA:** Between 2009 and 2011, fawn productivity and survival were suppressed, with the mean observed, post-season fawn:doe ratio being 65:100 (Figure 1). In 2012, this situation reversed itself as the fawn:doe ratio improved to 76:100. Then between 2013 and 2015 it averaged 85:100, peaking at 96:100 in 2014 before falling to 68:100 in both 2016 and 2017, and then dropping to 66:100 in 2018. After 2015, annual survival of six to 18 month old deer appears to have fallen as well (Figure 2). Consequently, this population increased considerably between 2012 and 2016, and then is projected to have declined some into 2018. However, this recent decline has not been apparent in pre-season trend counts, which have remained fairly stable (Figure 3). This may be due to the fact that a single trend route in HA 5 accounts for a large percentage of the mule deer observed each fall, and numbers on this route have been consistent since 2016.

Because a post-season ratio of 66 fawns per 100 does is generally thought to be the level necessary to sustain hunted mule deer populations, the population decline experienced between 2006 and 2011 was likely due initially to increased harvest rates and a drop in over-winter survival, while increased non-hunting mortality augmented the decline after 2008 (2017 MD751 JCR). This same

period witnessed a 75% decline in preseason trend counts (Figure 3). With better fawn production and survival between 2012 and 2015, this population grew steadily until 2016, before declining in the wake of decreased recruitment and survival.



**FIGURE 1.** Post-season fawn:doe and total buck:doe ratios (per 100 does) in the Black Hills Mule Deer Herd (2000-2018).

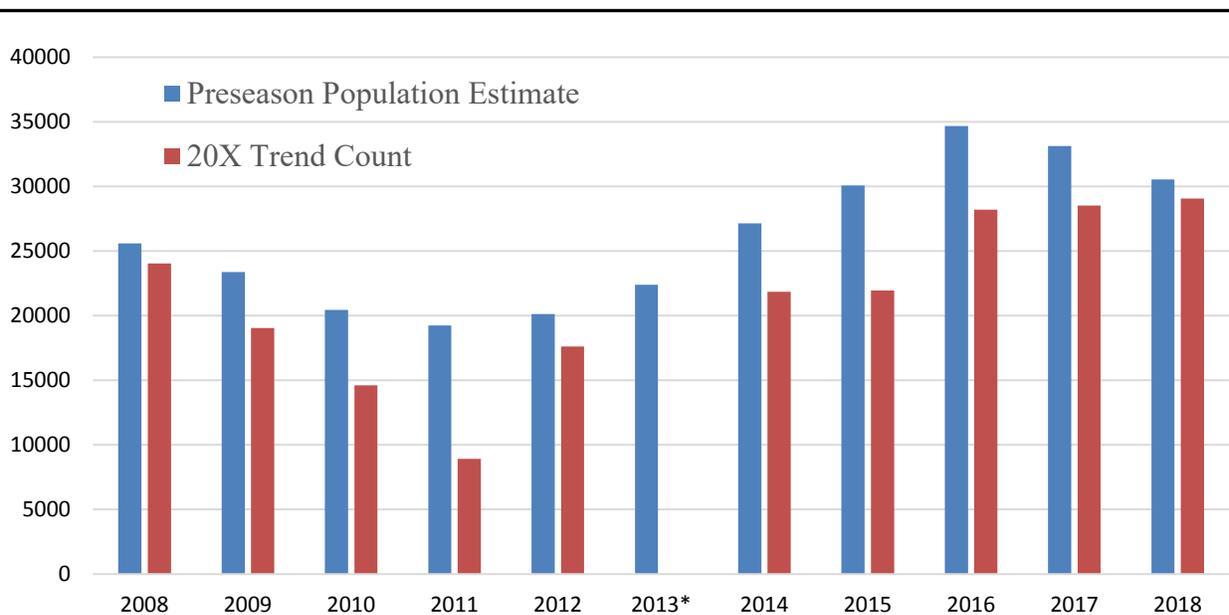


**FIGURE 2.** Estimated annual survival rate\* of buck mule deer from 6 mo. to 18 mo. of age with mean in the Black Hills Mule Deer Herd (Bio-Years 2000-2017).

\*Based upon observed fawn:doe ratios for a given bio-year and the subsequent year's observed yearling buck:doe ratio. Calculated as  $[(\text{Yearling Buck:Doer})_{\text{Bio-Year}+1} / 0.85] / \frac{1}{2} (\text{Fawn:Doer})_{\text{Bio-Year}}$

As this population declined between 2008 and 2012, so did post-season buck:doe ratios (Figure 1). With better fawn production and survival between 2012 and 2015, yearling buck numbers improved, driving an increase in the total observed buck:doe ratio from 16:100 in 2012 to 36:100 in 2016, before falling back to 31:100 in 2017 and 22:100 in 2018 (Figure 1). The recent decline

being a result of reduced fawn recruitment and survival as hunting pressure increased. However, post-season, adult buck:doe ratios observed in this herd over the last decade, and over the long-term have remained fairly consistent around 13:100, but did jump to about 20:100 in both 2016 and 2017 thanks to a strong class of two-year old bucks each year. As such, this herd improved from exhibiting buck:doe ratios below the Department’s minimum management criteria for recreational hunting to exceeding its upper end. However, as expected, increases in mortality and reductions in fawn production and survival the past two years has led to declining buck:doe ratios, and this herd is again near the bottom of management criteria for buck:doe ratios at 22:100. Given past herd performance, it is anticipated the post-season buck:doe ratio will hold steady or return to near the midrange of the Department’s recreational management criteria in 2019 if overwinter survival of deer is not overly compromised, rather than the higher value predicted by the population model.



**Figure 3.** Pre-season population estimates produced by the current TSJ CA model, and mule deer observed preseason along trend count routes (increased by a factor of 20) 2008 – 2018.

\* Trend counts not conducted in 2013 due to winter storm Atlas.

**HARVEST DATA:** Deer hunting seasons in the Black Hills have been traditionally structured to address white-tailed deer management. Consequently, harvest of mule deer bucks is managed by balancing white-tailed deer seasons and landowner tolerance for deer (both species) with recreational opportunity. Antlerless harvest is regulated primarily through doe/fawn license issuance. An analysis of historic general license harvest information shows the number of hunters in the field pursuing bucks has the greatest impact on total harvest. As such, buck harvest is regulated by altering non-resident hunter numbers via changes in the Region A quota, while resident buck hunter participation can only be limited by shortening the season. Department surveys and contacts with non-resident hunters indicate most non-residents want to harvest mule deer. This fact, combined with a hunting season that targets bucks during the rut, results in very heavy hunting pressure on buck mule deer.

With conservative hunting season structures in place between 2010 and 2014, mule deer harvest dropped about 40% from the level experienced when the population previously peaked, although reported harvest increased substantially in 2014 without concomitant increases in license issuance.<sup>1</sup> In 2015, Region A license issuance was liberalized, doe/fawn license issuance more than doubled, and HA's 2 and 3 returned to 30-day seasons. As a result, reported harvest climbed 19%. License issuance was again liberalized in 2016, and total harvest increased another 25%. During the 2017 hunting season, with an increase of 100 doe/fawn tags being the only change, about 50 more bucks and 50 more antlerless deer were taken. In contrast, 2018 saw a drop in harvest as antlerless take fell 65% and buck harvest dropped 16% even though Region A license issuance remained unchanged and d/f tag numbers increased slightly. Also in 2018, active license numbers for mule deer dropped about 10%, while hunter success fell ~15% and effort increased ~35%. These changes in harvest statistics all support a trend towards decreasing deer numbers, which is projected by the population model, but was not apparent in trend counts.

As harvest increased the between 2013 and 2017, the number of field-checked mule deer generally increased as well. In 2017, with the advent and use of the smartphone check station application, field check numbers increased proportionately more than harvest. This trend continued in 2018 as the number of field-checked deer was augmented by Chronic Wasting Disease (CWD) testing efforts while reported harvest dropped. However, the exact number of mule deer field checked in 2018 is difficult to know, as an unknown number of lab-aged CWD-sampled deer were also recorded using the check station application, resulting in the JCR program generating duplicate counts of some lab and field-aged deer. At minimum, 208 mule deer harvested were field checked and/or lab aged in 2018. The bulk of these, 184, were bucks age two-years or greater. Of the 157 mule deer tested for CWD, 9 were positive, yielding a prevalence of 5.7%. All of the infected deer came from the 131 adult bucks tested. The 2018 detection prevalence was substantially higher than the approximately 0.2% that had been observed in this herd prior to 2018 (N = 2 of 1,074). Noteworthy, in 2018, almost all of the CWD positive deer came from HA's 1 & 3 (7 of 9), and may have resulted from sampling local "hotspots."

Overall, hunting seasons between 2010 and 2014 reduced harvest of mule deer bucks about 37% from the level experienced during the immediately preceding 5-year period with the traditional 30-day November season north of I-90. Comparing these same periods, resident harvest of mule deer bucks dropped a bit more than 20%, while non-resident harvest of mule deer bucks dropped closer to 50%. During the period of conservative season structures, harvest of whitetail bucks declined less (see 2015, WD706). As a result, post-season mule deer buck:doe ratios held fairly stable and then began to improve. Meanwhile, hunter satisfaction remained basically unchanged between 2011 and 2013, with about 68% of hunters of both deer species reporting they were either satisfied or very satisfied with their Black Hills deer hunt. Satisfaction measures then improved in 2014 with 75% of both mule deer and white-tailed deer hunters reporting they were satisfied with their Black Hills deer hunt. Hunter satisfaction increased again in 2015, with just over 80% of both mule deer and white-tailed deer hunters reporting they were satisfied, and less than 7% reporting dissatisfaction. Between 2015 and 2017, hunter satisfaction climbed about a percentage point each year to a high of 83% before dropping to 79% in 2018. It can be inferred that steady increases in

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<sup>1</sup> 2014 harvest survey statistics indicate mule deer buck harvest increased about 36% in 2014, something that appears very incongruent with no significant changes in hunter number or season structure given population trends and field observations.

deer hunter success and declines in the effort required to harvest a deer between 2013 and 2017 strongly influenced changes in hunter satisfaction and influenced their decline in 2018.

**POPULATION:** Population modeling of this herd has always been difficult. The population violates the closed population assumption due to significant interstate movement of deer combined with interchange between adjacent mule deer herds in Wyoming. In addition, changes in doe harvest rates, outbreaks of EHDV, possible adenovirus mortalities, substantial predation, a high level of vehicle-deer collisions, occasional severe weather events, and inadequate classification sample sizes at times have made constructing a reliable population model questionable at best. In 2014, the spreadsheet model for this herd was reconstructed and re-initiated after correcting errors detected in the previous model. Model choice for this herd has changed several times, and did so again in 2016, when the Time Sensitive Juvenile, Constant Adult (TSJ, CA) model was chosen over competing models. This same model has been chosen each year since.

The 2018 modeled, post-season population estimate of Black Hills mule deer herd is ~28,100. A value significantly below the 33,400 projected last year. In addition, updating the model resulted in the 2017 post-season estimate declining from ~32,700 reported last year, to ~30,000. However, all recent modeled values may be somewhat inflated due to significantly increased reported harvest in 2014 without commensurate changes in season structure or perceived population size. In addition, the effects of EDHV, which caused significant mortality in some locations during 2017, are just being recognized by the model, as changes to harvest and buck:doe ratios inform the model in “hindsight.” Given the current model selection with updated data, the population is now projected to have peaked in 2006 at an estimated postseason population of around 28,500 mule deer (versus the 36,000 reported for that year in 2015). Following that peak, it declined to about 17,700 in 2011 (versus 16,500 reported in 2015). It is now estimated to have rebounded, growing 78% to about 31,600 post-season 2016, and then dropping 5% to ~30,000 in 2017.<sup>2</sup> Because the models we use to simulate populations produce the most unreliable estimates in the first and last few years of model construction, we question whether this population grew as much as indicated between 2013 and 2016. This is asserted because recent trend counts are below those found in years contained in the middle of the model at a time when this population is projected to have been at a similar level (Figure 1). At any rate, this herd definitely rebounded after a substantial decline, and then stabilized or declined a bit in 2017, before falling some in 2018.

As mentioned above, population modeling of this herd is difficult; and the Time Sensitive Juvenile / Constant Adult (TSJ CA) model was used again this year. This was done because it had the lowest AICc value and best fit. Both the SCA SCJ and TSJ CA models are well correlated with pre-season trend counts since 2008 (SCJ SCA ~90% and TSJ CA ~85%), but the TSJ CA model fits observed buck:doe ratio data substantially better. Both models indicated a slight decline in the population since 2016, something not reflected in harvest statistics until 2018. However, the chosen model does not reach the upper constraint on adult survival (0.9) that the SCJ SCA model does in all years not constrained. Instead, the TSJ CA model produces a very reasonable adult survival rate of 85% and an average juvenile survival rate of 62%. Overall, we consider the selected model to be of poor quality due to the lack of herd specific survival data, violations of the closed population assumption, below adequate classification in some years, and aerial classifications in terrain that makes classifying yearling bucks difficult.

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<sup>2</sup> All values reported in this paragraph reflect the current population model estimates and therefore do not match previous reports.

**MANAGEMENT SUMMARY:** The spreadsheet model suggests this herd was at its management objective of 30,000 mule deer in 2017, and was 6% below post-season 2018. If the herd actually numbers close to 30,000 mule deer post-season, then the current objective is near what most landowners desire north of I-90, but may be below some landowners' and hunters' wishes south of I-90. Based upon habitat conditions, the desires of hunters, and landowner sentiments, a season designed to allow this herd to stabilize or grow slightly is warranted at this time. Therefore, the 2019 hunting season is designed to maintain buck-hunting opportunity at levels commensurate with the past three years, along with consistent levels of antlerless harvest. This prescription could result in a slight lowering of buck:doe ratios, although they should remain within the range of recreational management. This prescribed management should yield a stable or slightly decreasing population (contrary to model projections) given the forage conditions and winter weather experienced this year.

Buck mule deer numbers substantially improved in this herd unit between 2012 and 2016. Based upon classification data and population estimates, typical numbers of yearling and two-year old bucks, along with cohorts older bucks, should be available for hunters in 2019.

With this population close to objective and the sympatric white-tailed deer population above objective, no significant changes have been made to the structure of doe/fawn license issuance. The exception being a change in license type designation for reduced priced doe or fawn licenses in HA 4 from Type 6 to Type 7. This is being done to be consistent with other HA's where doe/fawn tags are valid on private land only. Long-term harvest data show if doe/fawn licenses are valid for either species of deer, consistently about one-third of the antlerless deer harvested will be mule deer. We believe a few more doe/fawn licenses will sell in 2019 and active license success will increase on these tags for mule deer as hunters realize they can be used for both species. This should result in a bit of an increase in antlerless harvest from HA's 1, 2, and 3. Further, because resident general license hunter numbers will likely not change significantly in 2019, and most non-residents don't harvest antlerless deer on their Region A licenses, doe/fawn harvest on general licenses will likely not change much. Consequently, it is estimated that the 2019 season will result in the take of 250 to 300 antlerless mule deer, a value close to the average harvest over the past five years. The low level of female mule deer harvest (less than 2%), coupled with consistent data on harvest percentages by species, does not warrant complicating the regulations by segregating mule deer and white-tailed deer harvest more than already occurs on general licenses.

The 2019 hunting season as modeled will yield a postseason population of about 29,600 mule deer, which represents 5% growth in the post-season population. If this happens, which we doubt given the current weather conditions and recruitment levels, such a change would put this population essentially at objective.

## 2018 - JCR Evaluation Form

SPECIES: Mule Deer

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

HERD: MD755 - NORTH CONVERSE

HUNT AREAS: 22

PREPARED BY: WILLOW BISH

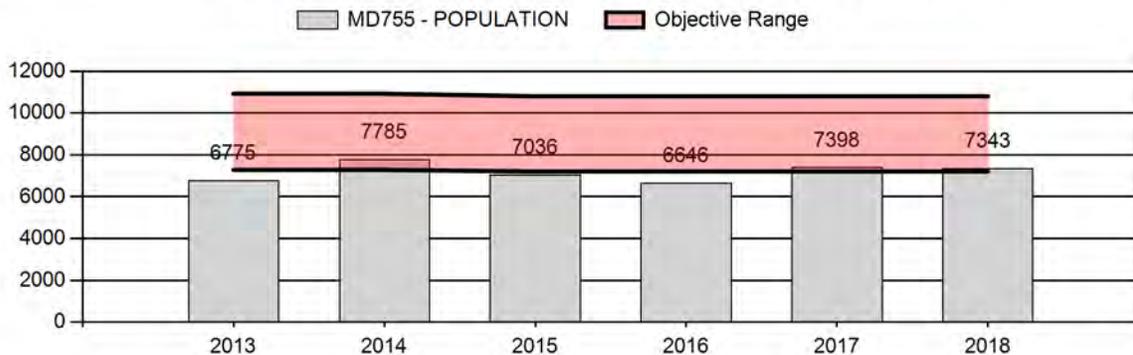
	<u>2013 - 2017 Average</u>	<u>2018</u>	<u>2019 Proposed</u>
Population:	7,128	7,343	7,767
Harvest:	235	276	400
Hunters:	317	339	450
Hunter Success:	74%	81%	89 %
Active Licenses:	323	339	450
Active License Success:	73%	81%	89 %
Recreation Days:	1,206	1,266	1,400
Days Per Animal:	5.1	4.6	3.5
Males per 100 Females	38	0	
Juveniles per 100 Females	78	0	

Population Objective (± 20%) :	9000 (7200 - 10800)
Management Strategy:	Special
Percent population is above (+) or below (-) objective:	-18.4%
Number of years population has been + or - objective in recent trend:	10
Model Date:	02/15/2019

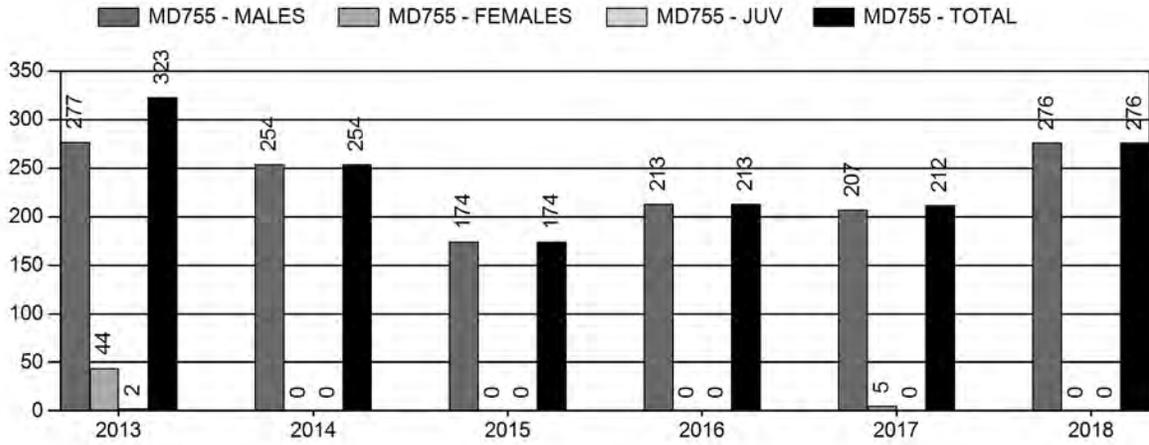
**Proposed harvest rates (percent of pre-season estimate for each sex/age group):**

	<u>JCR Year</u>	<u>Proposed</u>
Females ≥ 1 year old:	0%	0%
Males ≥ 1 year old:	16.5%	22.5%
Total:	16.5%	22.5%
Proposed change in post-season population:	-4.0%	-5.4%

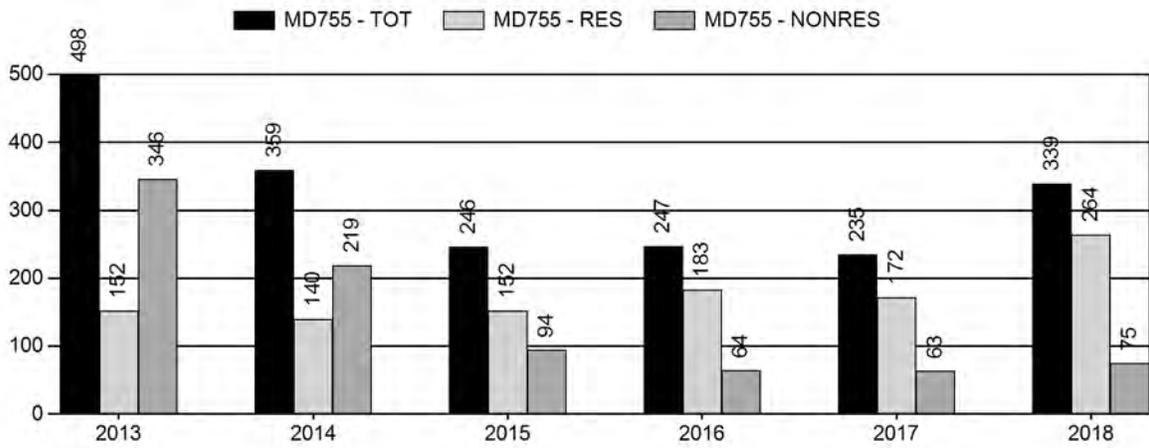
## Population Size - Postseason



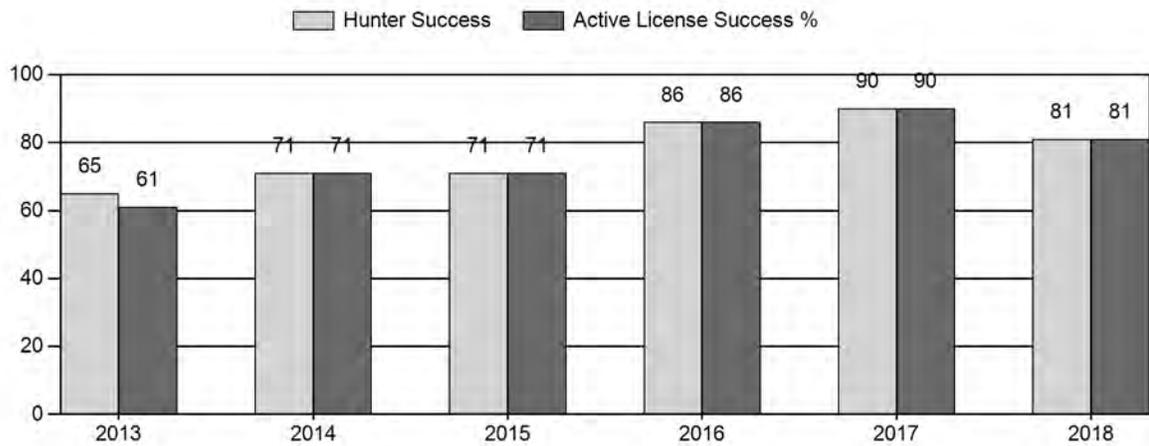
# Harvest



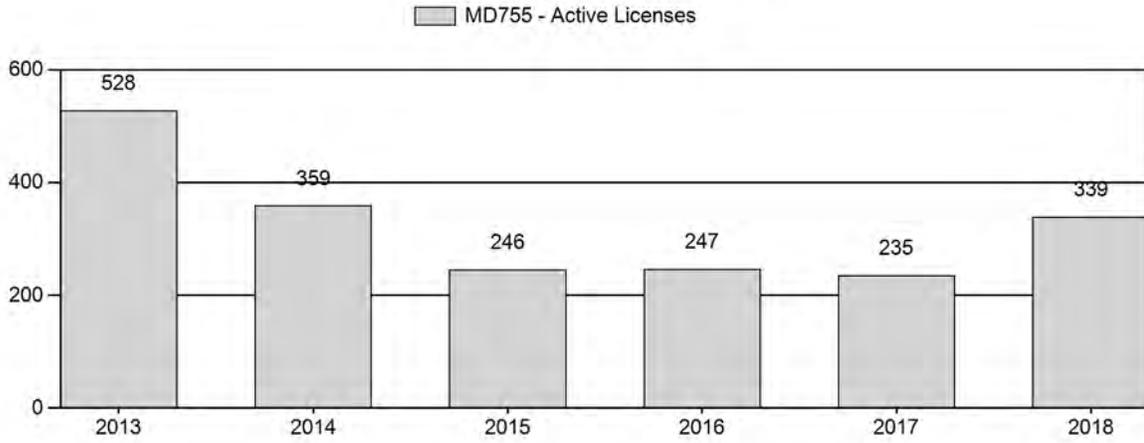
# Number of Active Licenses



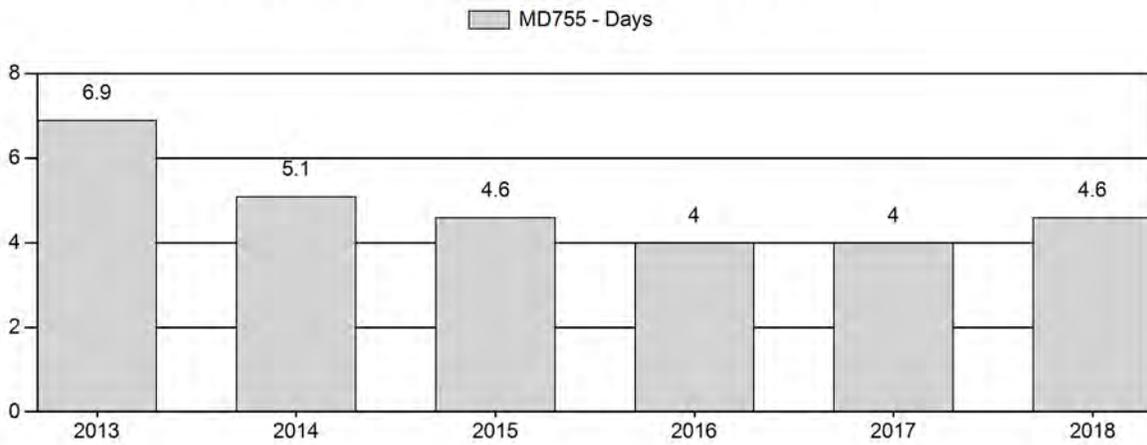
# Harvest Success



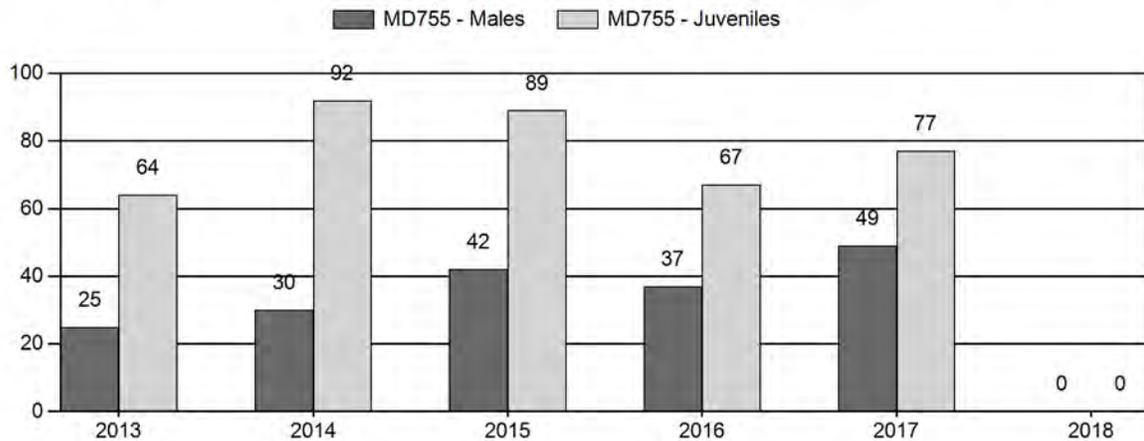
# Active Licenses



# Days per Animal Harvested



# Postseason Animals per 100 Females



## 2013 - 2018 Postseason Classification Summary

for Mule Deer Herd MD755 - NORTH CONVERSE

Year	Post Pop	MALES							FEMALES		JUVENILES		Tot Cls	Cls Obj	Males to 100 Females			Young to			
		Ylg	2+ Cls 1	2+ Cls 2	2+ Cls 3	2+ UnCls	Total	%	Total	%	Total	%			YIng	Adult	Total	Conf Int	100 Fem	Conf Int	100 Adult
2013	6,775	30	0	0	0	39	69	13%	275	53%	176	34%	520	1,095	11	14	25	± 4	64	± 8	51
2014	7,785	23	26	14	3	0	66	14%	220	45%	202	41%	488	1,936	10	20	30	± 5	92	± 11	71
2015	7,036	65	54	35	10	0	164	18%	393	43%	351	39%	908	1,858	17	25	42	± 5	89	± 8	63
2016	6,646	37	42	24	2	14	119	18%	324	49%	217	33%	660	1,224	11	25	37	± 5	67	± 7	49
2017	7,398	41	98	42	7	0	188	22%	383	44%	295	34%	866	1,588	11	38	49	± 5	77	± 7	52
2018	7,343	36	75	16	0	0	127	31%	159	39%	123	30%	409	1,825	23	57	80	± 12	77	± 12	43

**2019 HUNTING SEASONS  
NORTH CONVERSE MULE DEER HERD (MD755)**

Hunt Area	Type	Season Dates		Quota	License	Limitations
		Opens	Closes			
22	1	Oct. 1	Oct. 14	500	Limited quota	Antlered mule deer or any white-tailed deer
Archery		Sep. 1	Sep. 30			Refer to license type and limitations in Section 2

Hunt Area	Type	Quota change from 2018
22	1	+100

**Management Evaluation**

**Current Postseason Population Management Objective:** 9,000

**Management Strategy:** Special

**2018 Postseason Population Estimate:** ~7,300

**2019 Proposed Postseason Population Estimate:** ~7,800

**2018 Hunter Satisfaction:** 86% Satisfied, 8% Neutral, 6% Dissatisfied

**Herd Unit Issues**

The North Converse Mule Deer herd has a postseason population objective of 9,000 mule deer and is managed under the special management strategy, with a goal of maintaining postseason buck ratios between 30-45 bucks per 100 does. The objective and management strategy were last revised in 2015.

Public hunting access within the herd unit is poor, with only small tracts of accessible public land interspersed with predominantly private lands. High trespass fees and outfitting for mule deer are common on most ranches within this herd unit. Primary land uses in this area include extensive oil and gas production, large-scale industrial wind generation, In-situ uranium production, and traditional cattle and sheep grazing. In recent years, expansion of oil shale development has dramatically escalated anthropogenic disturbance throughout this herd unit.

**Weather**

Total precipitation in 2018 was slightly above average which was similar to 2017. However, the bulk of the precipitation was received throughout the summer months (May-July) with less than average precipitation through spring and fall. Due to the relatively dry spring, forage production occurred later in the season than normal but precipitation throughout the summer months supported good forage growth for the year. The 2018-2019 winter has been relatively mild to date, however, there were some cold snaps and snow accumulation in November which may have influenced animal movements and foraging capabilities. Given the relative mildness of the

rest of the winter and less than average snowfall received, mule deer have likely experienced normal over-winter survival this year.

### **Habitat**

There are no habitat transects in this herd unit due to the preponderance of private land. Habitat conditions are variable in this herd unit due to some past wildfires which have removed portions of sagebrush habitat. The past five years have produced above average to average precipitation, resulting in a general trend of good forage production. These conditions have been effective in allowing rangelands to recover from the extreme drought in 2012. Sagebrush plants are recruiting in some areas of this herd unit, which may lead to higher quality forage availability in the future.

### **Field Data**

The total number of mule deer classified has steadily decreased in this herd unit as classification sample sizes have been difficult to meet since this herd has not been a budget priority. Given the potential level of oil and gas disturbance that may be forthcoming, managers prioritized this herd unit for aerial flights beginning in 2015 in order to collect more representative baseline pre-disturbance information. The bulk of aerial survey time was spent classifying mule deer along the Pine Ridge, Salt Creek, and in the sand hills where limited road densities and difficult access preclude ground classifications. Although classification survey effort was elevated beginning in 2015, only 409 mule deer were classified in 2018 as flight budgets were somewhat reduced and observers had a more difficult time finding deer despite recent population increase. The sample size goal for 90% confidence was 1,825 mule deer, which was far above the total number of deer classified. This sample size was much lower than in recent years, with the most recent 5-year average being 688 deer classified.

Fawn production in 2018 was 77 fawns per 100 does, which is the same as the previous 5-year average. This level of fawn production is contributing to this herd's general upward trend and, if the trend continues, will likely result in this herd meeting objective within the next few years.

The 2018 postseason buck ratio (80) is higher than the previous 5-year average of 37 bucks per 100 does and far exceeds management guidelines. Yearling buck ratios in 2018 (23) were also higher than the previous 5-year average of 12 bucks per 100 does. While buck ratios are likely increasing as a result of good fawn production and recruitment, along with conservative license issuance and limited private land hunting access, it is likely that such high buck ratios are a result of low sample size. The buck ratio in 2017 was 49, and it is unlikely that such a dramatic increase in buck ratios would occur in one year. However, the data do support field manager's observations that deer hunting opportunity has increased in recent years.

### **Harvest**

Overall harvest has declined in this herd unit as license issuance has decreased to address population decline, although this trend reversed beginning in 2016. From 2011 to 2015, Type 1 quotas were reduced by 63%, buck harvest decreased by 60%, and average hunter success was 71%. The 2015 harvest of 174 bucks was by far the lowest total deer harvest ever obtained in this herd unit. License issuance between 2015 and 2017 was static, but hunting success averaged

82%. In 2018, the quota was increased by 100 licenses and hunter success was 81% resulting in a harvest of 276 bucks. Overall, 2018 harvest statistics suggest increased buck mule deer availability and improved hunting opportunity within this herd unit.

In 2018, 86% of hunters reported being either satisfied or very satisfied with their hunt, indicating a remarkably high level of satisfaction given the lack of public access and population decline. It should be noted that most hunters whom speak to Game and Fish personnel are advised to secure access on private land before purchasing a license in areas that have limited public access, or at least be aware of the limited availability of accessible public land.

## **Population**

The 2018 postseason population estimate was about 7,300 mule deer. After population decline following substantial winter mortality in bio-year 2010, this herd is beginning to trend upward toward objective due to increased fawn production.

The “Semi-Constant Juvenile & Semi-Constant Adult Survival” (SCJ-SCA) spreadsheet model was chosen for the post-season population estimate of this herd. This model had a low relative AIC (78) and most accurately depicted population trend and size based on field personnel perceptions and landowner input. Adult survival was constrained lower than normal (between 0.5 and 0.7) for 2010 as a result of high winter mortality that year. This model is considered to be of fair quality based on model fit and simulated population trend.

## **Management Summary**

The hunting season in this area has traditionally run from October 1<sup>st</sup> to October 14<sup>th</sup>. These season dates have generally been adequate to meet landowner desires while allowing a reasonable harvest. For 2019, the Department is increasing the Type 1 quota by 100 licenses, for a total of 500 licenses. The license reduction in previous years allowed buck ratios to increase back within special management criteria. Observed 2018 buck ratios far exceeded management criteria maximums, although sample sizes were far from being adequate. Doe/fawn license issuance was considerable in past years, but was eliminated in 2014 due to population concerns. Conservative hunting season structure, including relatively low Type 1 license issuance and no doe/fawn licenses, has been warranted to permit population growth while allowing for more mature bucks to become available for harvest. However, recent hunter success, buck ratios, and population trend suggest more hunting opportunity can now be provided.

In this herd unit, landowner input is given a lot of deference given the limited availability of accessible public land. The proposal to increase Type 1 licenses has proved rather contentious with landowners in recent years. A few landowners and outfitters would like even more licenses than proposed but many are not supportive of increases. The data supports an increase, but given the level of contention, only a modest increase has been proposed.

If we attain the projected harvest of 400 bucks and experience normal fawn productivity, the predicted 2019 postseason population will likely increase slightly to 7,800 mule deer, which is 13% below objective.

## 2018 - JCR Evaluation Form

SPECIES: Mule Deer

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

HERD: MD756 - SOUTH CONVERSE

HUNT AREAS: 65

PREPARED BY: WILLOW BISH

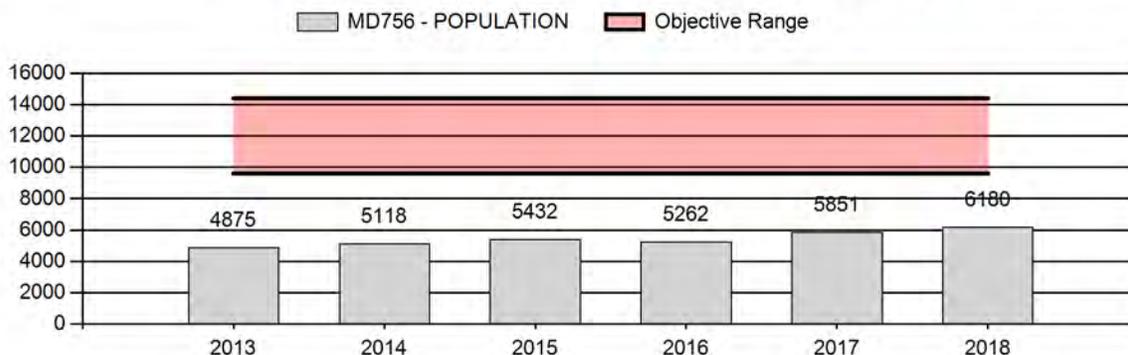
	<u>2013 - 2017 Average</u>	<u>2018</u>	<u>2019 Proposed</u>
Population:	5,308	6,180	5,396
Harvest:	258	301	266
Hunters:	691	704	700
Hunter Success:	37%	43%	38%
Active Licenses:	691	704	700
Active License Success:	37%	43%	38%
Recreation Days:	2,523	2,881	2,600
Days Per Animal:	9.8	9.6	9.8
Males per 100 Females	38	51	
Juveniles per 100 Females	60	79	

Population Objective ( $\pm 20\%$ ) :	12000 (9600 - 14400)
Management Strategy:	Private Land
Percent population is above (+) or below (-) objective:	-48.5%
Number of years population has been + or - objective in recent trend:	19
Model Date:	02/15/2019

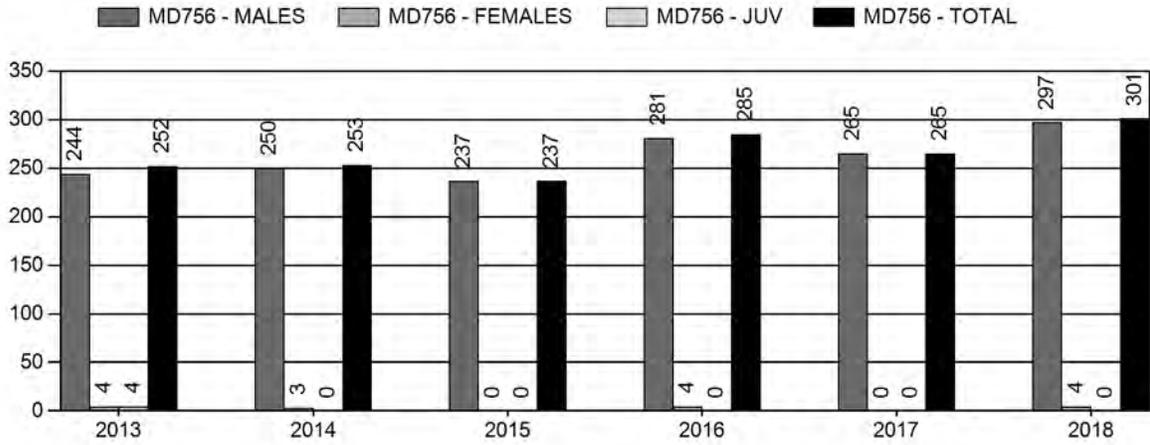
**Proposed harvest rates (percent of pre-season estimate for each sex/age group):**

	<u>JCR Year</u>	<u>Proposed</u>
Females $\geq 1$ year old:	0.2%	0%
Males $\geq 1$ year old:	20.8%	20.7%
Total:	30%	20.7%
Proposed change in post-season population:	-5.1%	-5.2%

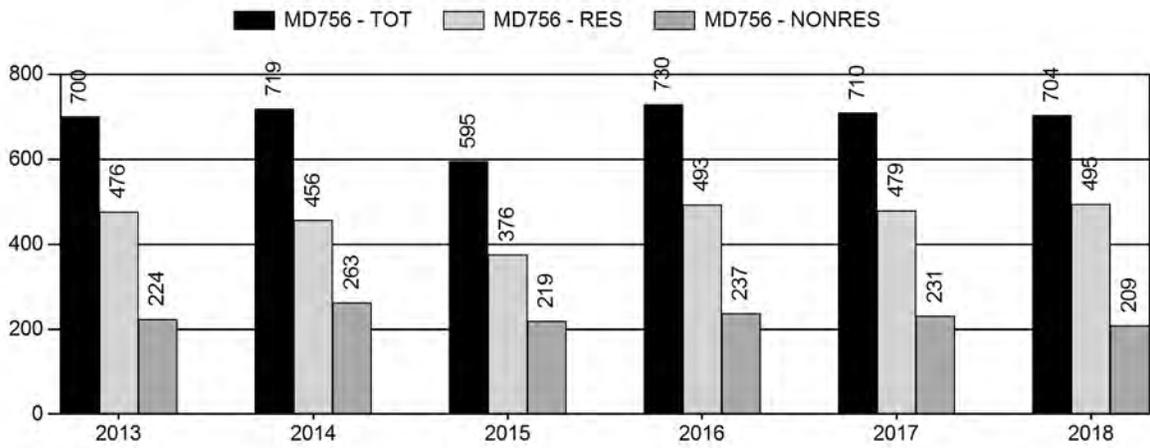
## Population Size - Postseason



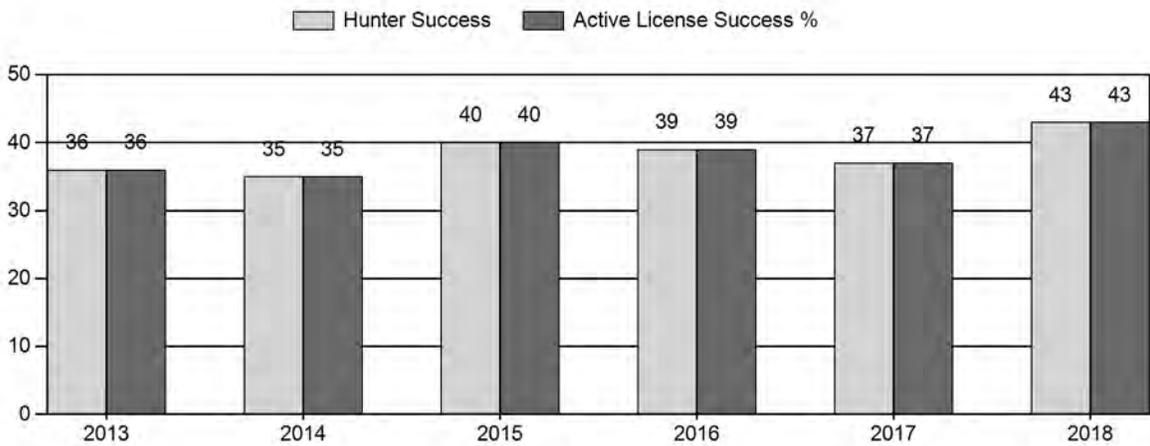
# Harvest



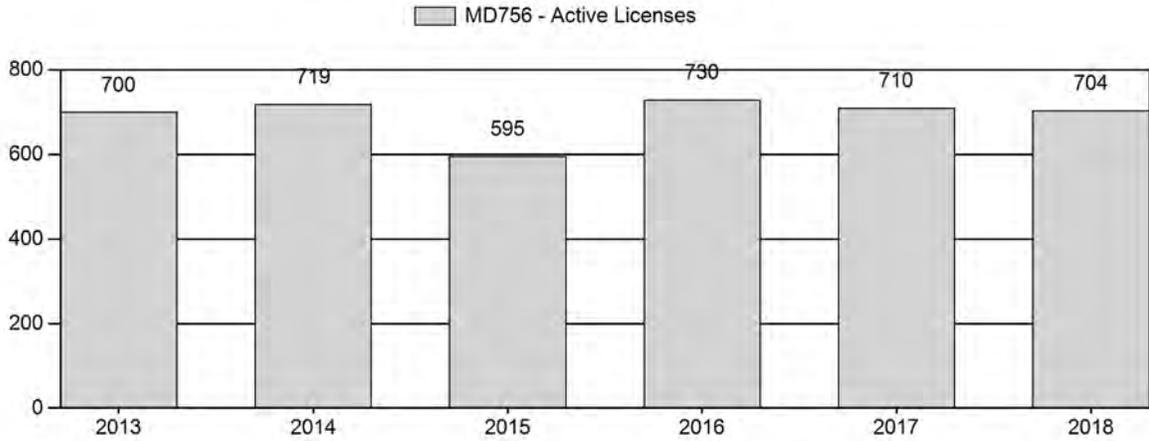
# Number of Active Licenses



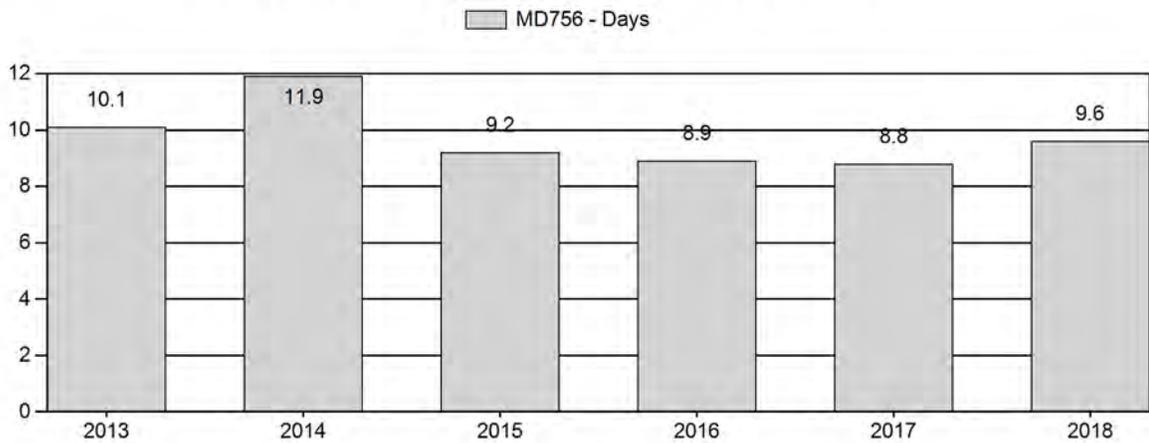
# Harvest Success



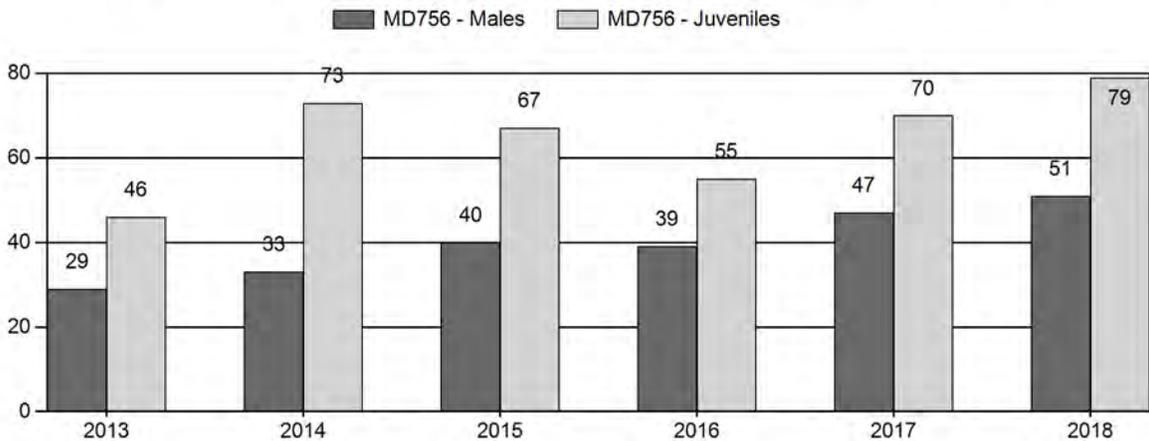
# Active Licenses



# Days per Animal Harvested



# Postseason Animals per 100 Females



## 2013 - 2018 Postseason Classification Summary

for Mule Deer Herd MD756 - SOUTH CONVERSE

Year	Post Pop	MALES								FEMALES		JUVENILES		Tot		Males to 100 Females				Young to		
		Ylg	2+ Cls 1	2+ Cls 2	2+ Cls 3	2+ UnCls	Total	%	Total	%	Total	%	Cls	Obj	YIng	Adult	Total	Conf Int	100 Fem	Conf Int	100 Adult	
2013	4,875	64	65	17	8	0	154	17%	528	57%	245	26%	927	719	12	17	29	± 3	46	± 4	36	
2014	5,118	30	56	24	19	0	129	16%	393	49%	286	35%	808	1,281	8	25	33	± 4	73	± 7	55	
2015	5,432	81	68	29	7	0	185	19%	458	48%	308	32%	951	1,164	18	23	40	± 4	67	± 6	48	
2016	5,262	137	176	70	20	0	403	20%	1,030	51%	568	28%	2,001	900	13	26	39	± 2	55	± 3	40	
2017	5,851	70	103	38	3	0	214	22%	453	46%	319	32%	986	1,315	15	32	47	± 5	70	± 6	48	
2018	6,180	41	79	23	8	0	151	22%	299	44%	237	34%	687	1,571	14	37	51	± 6	79	± 8	53	

**2019 HUNTING SEASONS  
SOUTH CONVERSE MULE DEER (MD756)**

Hunt Area	Type	Season Dates		Quota	License	Limitations
		Opens	Closes			
65		Oct. 15	Oct 31		General	Antlered mule deer three (3) points or more on either antler or any white-tailed deer
	Archery	Sep. 1	Sep. 30			Refer to license types and limitations in Section 2

**Management Evaluation**

**Current Management Objective:** 12,000

**Management Strategy:** Private Land

**2018 Postseason Population Estimate:** ~ 6,200

**2019 Proposed Postseason Population Estimate:** ~ 5,400

**2018 Hunter Satisfaction:** 65% Satisfied, 19% Neutral, 16% Dissatisfied

The South Converse Mule Deer Herd Unit has a postseason population management objective of 12,000 deer. The herd is managed using a private land management strategy, as buck ratios are difficult to influence with hunting seasons as the majority of mule deer in this herd unit occupy private lands. The objective and management strategy were last revised in 2013.

**Herd Unit Issues**

Hunting access within the herd unit is marginal, with tracts of public land and national forest interspersed with predominantly private lands. The main land use is traditional ranching and grazing of livestock, with agricultural fields that have the potential for damage issues when big game are abundant. Doe/fawn licenses have historically been issued to address damage, but are not currently necessary for mule deer. Disease issues are a concern within this herd unit in particular, as the prevalence of Chronic Wasting Disease (CWD) has been higher here than any other area in Wyoming or adjacent states in most years. Research investigating population-level effects of CWD was concluded in 2014, with a published dissertation and additional publications (Devivo, 2015). Please refer to Appendix A of this report for further information regarding CWD and recently completed research in the South Converse Herd Unit. The CWD prevalence estimate derived from hunter-harvested mule deer in 2015 and 2016 were calculated from low sample sizes. However, the Department increased CWD sampling efforts in 2017 and 2018 and was able to sample approximately 19% of harvested deer both years.

## **Weather**

Total precipitation in 2018 was slightly above average which was similar to 2017. However, the bulk of the precipitation was received throughout the summer months (May-July) with less than average precipitation through spring and fall. Due to the relatively dry spring, forage production occurred later in the season than normal but precipitation throughout the summer months supported good forage growth for the year. The 2018-2019 winter has been relatively mild to date, however, there were some cold snaps and snow accumulation in November as well as January/February which may have influenced animal movements and foraging capabilities. Given the relative mildness of the rest of the winter and less than average snowfall received, mule deer have likely experienced normal over-winter survival this year.

## **Habitat**

Given average precipitation and informal assessments of habitat conditions throughout this herd unit, forage production and quality were moderate in 2018. A significant portion of mule deer habitat in this herd unit is comprised of decadent shrubs with lower palatability and available nutrition. The poor condition of these decadent shrub stands throughout the herd unit may be one of the primary limiting factors on this deer herd. Aspen stand treatments, juniper removal from riparian areas, and mountain mahogany rejuvenation projects are currently being implemented in the herd unit to improve habitat for mule deer.

## **Field Data**

Fawn production/survival was moderate in this herd through the mid-2000's, and the population fluctuated between approximately 8,000 and 12,000 deer during this time period. The general license season during this time period was 11 days (except in 2008 when it was extended to 17 days), and issuance of doe/fawn licenses ranged from 50 to 400 licenses. From 2008-2013, fawn production/survival was extremely poor, with fawn ratios averaging 50 per 100 does. The population has declined significantly since 2008 from approximately 8,000 to 5,000 deer. In accordance, the general license season was shortened to 7 days and doe/fawn licenses were diminished and subsequently eliminated from the 2011-2017 hunting seasons. In 2014 and 2015, fawn production improved (ratios of 73 and 67, respectively). The fawn ratio decreased to 55 in 2016. This could be due to the relatively lower amount of precipitation received in 2016, or the larger proportion of yearling does not reproducing in the population as a result of higher fawn recruitment from the previous two years. Fawn production improved again in 2017 and 2018 with 70 and 79 fawns per 100 does, respectively. Since 2013, the population has been trending slightly upward, and the current model estimates a 2018 post-season population of 6,200 mule deer. The 2018 classification conditions were not ideal, resulting in only 686 deer being classified, although the sample size goal was 1,600. In 2016, just over 2,000 deer were classified in this herd unit which is the highest sample size acquired since 1992 despite similar levels of effort in other years. The previous 10-year average classification sample size was 1,175 deer. Although conditions in 2016 were ideal with high visibility, good snow cover, and calm conditions, the sample size supported field managers' perception that deer numbers have been increasing slightly in recent years. Annual survival of mule deer has likely increased over the past three years due to improved habitat conditions, which is also contributing to population increase. Adult does entering into winters with good nutritional condition, coupled with mild

winters, has likely increased survival. Several more years of improved fawn production and survival will be needed for this herd to increase to objective.

While fawn production improved in this herd over the past two years, fawn ratios remain well below adjacent mule deer herds. From 2008 – 2018, postseason fawn ratios averaged 54 (per 100 does) in the South Converse Herd Unit. Over the same time frame, fawn ratios averaged 63 in the Bates Hole / Hat Six Herd (Hunt Area 66) as well as in the Laramie Mountains Herd (Hunt Areas 59, 60, & 64). Such relatively low fawn production/survival in the South Converse Herd was thought to be partially attributed to the extraordinarily high prevalence of CWD. However, recently concluded research within this herd unit suggests neither fawn production nor recruitment were significantly affected in CWD-positive radio-marked adult females (DeVivo, 2015). Regardless, the high prevalence of CWD in this herd has the potential to reduce overall fawn production and recruitment over the long term as infected deer exhibit far lower survival rates than uninfected deer due to deaths from clinical CWD as well as increased vulnerability to predation, winter loss, vehicular strikes, etc. Although climatic and habitat conditions have the largest influence on the nutritional condition of does, and therefore fawn production and survival, long-term fawn recruitment may be impacted in areas with high prevalence of CWD. Given diminished survival rates of marked CWD-positive deer in this study and model projections stemming from recent research, endemic CWD at current prevalence levels may contribute to substantial population decline over the long term, or at minimum, may constrain the potential for this herd to grow when environmental conditions are favorable.

Buck ratios within the South Converse Herd historically average in the 30s-40s. These ratios seem counterintuitive, as CWD research references higher prevalence in males than females (Farnsworth et al, 2005). Despite the general season structure, higher buck ratios in this unit are a function of limited access to hunting on private lands where minimal harvest pressure on bucks is typical. In 2013, the buck ratio dropped to a 15-year low of 29, with a correspondingly low yearling buck ratio of 8 the following year. The buck ratio has since increased to 50 bucks per 100 does in 2018 which is higher than the previous 5-year average of 37. The yearling buck ratio was 14 in 2018, which is similar to recent years and is a 44% increase from 2014 when yearling buck ratios were at an all time low. Increased yearling buck ratios indicate improved recruitment in recent years, which may continue to result in good availability of adult bucks in the population in the coming years despite endemic CWD.

Since 2008, bucks classified in the South Converse Mule Deer Herd Unit have been further categorized based on antler size. Classification efforts in 2018 resulted in antler classifications in line with the long-term average with 72% Class I (small), 21% Class II (medium), and 7% Class III (large) bucks. This is similar to the previous 5-year average (66% Class I, 25% Class II, and 9% Class III bucks).

### **Harvest Data**

Harvest success was 43% in 2018, which was slightly improved over the previous 5-year average of 37%. Harvest success is not expected to improve much beyond the 30<sup>th</sup>-40<sup>th</sup> percentile in this herd unit until long-term fawn production/survival improves and enhances the growth rate of this herd, or access to private lands is greatly improved. In 2018, there were 704 active licenses and

297 harvested bucks, which is also comparable to the previous 5-year average of 691 active licenses and 255 harvested bucks. There were also 4 does reported in the harvest which likely came from general license youth hunters. Total harvest and hunter numbers declined dramatically from 2008 to 2013 by 64% and 44%, respectively, but have since generally stabilized. Hunters apparently began to self-regulate through the late 2000s and early 2010s. Private land access for mule deer hunting has dwindled as well. Despite improved deer numbers, hunter numbers have not increased in recent years due to restricted access.

In 2018, season length was extended to 17 days and an Antler Point Restriction (APR) was implemented. This resulted in a 2018 buck harvest that was slightly higher than the previous five-year average, but was still well below harvest levels prior to 2012. This slight increase in buck harvest is likely a function of extended season length, as buck harvest typically does not increase in conjunction with an antler point restriction. Field managers noted that hunters utilized the season extension, especially during the last weekend, and anticipate that the season extension will continue to result in slightly higher harvest in future years despite the APR.

## **Population**

The 2018 postseason population estimate was approximately 6,200 mule deer. This population is beginning to recover from a long-term downward trend which began in the late 1990s. Population decline in this herd is thought to be a combination of multiple limiting factors including poor habitat condition, lower fawn productivity/survival, and high prevalence of CWD.

The “Time-Specific Juvenile & Constant Adult Survival” (TSJ,CA) spreadsheet model was chosen for the postseason population estimate of this herd. Adult female survival estimates from the aforementioned CWD research conducted from 2010 to 2013 were between 0.65 and 0.73, which were very low relative to most published mule deer survival rates. Therefore, survival values were included for those years. The overall adult survival was constrained between 0.65 and 0.84 given long-term survival estimates in Colorado and the low adult survival rate found during CWD research. Spreadsheet model conventions suggest adult survival constraints should remain between 0.7-0.95. However, the upper constraint of 0.95 may be unrealistic for this herd given the high prevalence of CWD. AIC values between all 3 models were very similar, but the TSJ,CA model produced the most plausible trend and population estimate. However, the model does estimate adult survival in years other than 2010-2013 to be higher than survival estimates from the research. Based on survival values observed during this research, and those observed during another research project in the adjacent Bates Hole / Hat Six Mule Deer Herd in 2017 (0.73), adult survival for the South Converse herd is likely lower than model estimates in many years. However, adult survival likely improved immediately following this research in 2014 as weather and habitat conditions were extremely favorable for fawn production and adult mule deer survival. This uptick in fawn production and survival enabled this population to modestly grow over the past five years. This cannot be simulated by the selected model as adult survival is ascribed a constant value over the course of the simulation. Overall, this model is considered to be of fair quality.

## **Management Summary**

Opening day for hunting the South Converse Mule Deer Herd Unit has traditionally been October 15<sup>th</sup>, with closing dates that have changed to offer greater or lesser opportunity depending on the management direction desired. In recent years, general licenses have been valid for antlered mule deer only. Many local hunters have pushed for an even more conservative hunting season to protect younger age class bucks. However, given the high prevalence of CWD in mature bucks, more conservative seasons may exacerbate the disease issue by limiting harvest as a culling mechanism. A more liberal season aimed at drastically reducing buck numbers to decrease CWD would likely be unpopular given the public's concern with this herd. In order to target older age class deer which are more likely to have CWD, while limiting harvest pressure on the overall buck population, a 3-point or better APR was implemented in 2018. The APR was also designed to protect younger age class bucks on public land, which helped garner public support for the season length extension. The season was also extended in 2018 until October 31 (previously October 21) to allow more opportunity for hunters to harvest older age class bucks. The 2018 season seemed to be viewed favorably by the public, and managers intend to implement the APR for a minimum of three years. The Department will not issue doe/fawn licenses for the foreseeable future based on recent population performance.

If we attain the projected harvest of 266 bucks and fawn production remains average, this herd will likely remain relatively stable but well below objective. The predicted 2019 postseason population size of the South Converse Herd is approximately 5,400 mule deer. This reduction in population projected by the model is likely due to using relatively low average fawn ratios from the previous 5-years to predict the future productivity despite improved fawn production over the past two years. Given that habitat conditions and high CWD prevalence may be limiting population growth, management goals for 2019 include continued emphasis on harvesting older age class bucks which are more likely to be CWD-positive while restricting harvest on younger bucks. In addition, managers are implementing prescriptive treatments in key habitats to benefit mule deer in this herd unit.

### **Citations**

DeVivo, Melia. Chronic Wasting Disease Ecology and Epidemiology of Mule Deer in Wyoming. Diss. University of Wyoming, 2015.

Farnsworth, M.L., L.L. Wolfe, N.T. Hobbs, K.P. Burnham, E.S. Williams, D.M. Theobald, M.M. Conner, & M.W. Miller. Human Land Use Influences Chronic Wasting Disease Prevalence in Mule Deer. *Ecological Applications*, 15(1): 119-126.

## **APPENDIX A**

### **Chronic Wasting Disease in the South Converse Mule Deer Herd Unit: Prevalence and Management Concerns**

High prevalence of CWD in mule deer is of particular concern to local wildlife managers, as mule deer herds statewide have declined due to a number of environmental factors. The South Converse Mule Deer Herd Unit (Deer Hunt Area 65) has traditionally had the highest prevalence of Chronic Wasting Disease (CWD) in Wyoming over the long term, although measured CWD prevalence in a few other Wyoming mule deer herds has surpassed it in recent years. Managers are concerned that CWD may be an additive factor influencing mortality rates in the South Converse Herd, as it may be degrading the health of breeding-age females, suppressing average life-span of mature bucks, and affecting overall mule deer survival. CWD adversely affects deer survival due to direct fatality in addition to altered behavior which may render infected deer more vulnerable to natural causes of mortality such as predation or exposure.

Hunter-harvested deer have been tested in this herd unit since 2001. It should be noted that hunter-harvested samples do not represent a random sample of this population. Rather, samples are biased towards younger age-class males, as hunting seasons have focused on antlered deer, and hunters who harvest larger mature bucks often decline sampling to preserve their cape. Thus, reported prevalence in hunter-harvested deer may actually be biased low given CWD prevalence generally increases in older-age mule deer. However, CWD-positive deer are also more vulnerable to harvest, which may also be influencing reported prevalence. Regardless, CWD surveillance efforts have remained relatively consistent across years, and measured trends in prevalence likely mirror actual CWD dynamics in this herd.

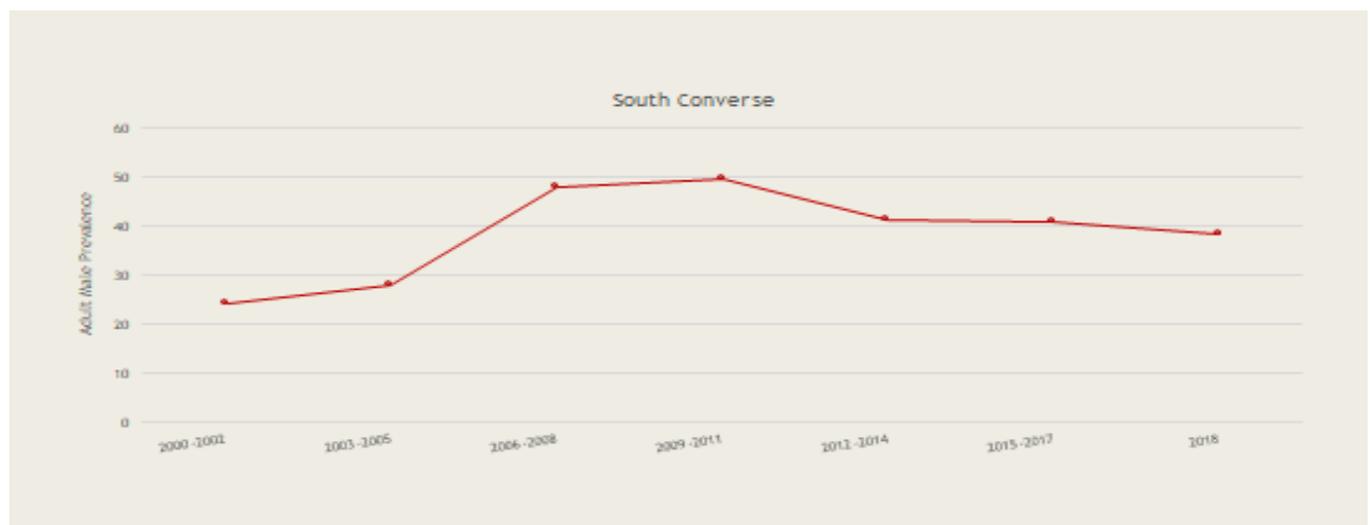
Since 2001, prevalence of CWD in hunter-harvested mule deer has increased significantly in the South Converse Mule Deer Herd (Table 1, Figure 1). Increasing CWD prevalence has coincided with concurrent overall population decrease for much of the past two decades. Considering CWD is ultimately fatal in cervids, higher prevalence is suspected of having more adverse and perhaps additive impacts at the population level - either directly or indirectly. However, it is difficult to discern or quantify the impacts of CWD on this population, and the extent to which CWD is limiting this population is speculative. Environmental conditions are still the most significant driver of this population, with annual variations in fawn recruitment and adult survival being primarily a function of weather, predation and the nutritional quality and availability of key mule deer habitats and preferred forage. Even in lieu of high CWD prevalence, this population is still capable of growth when environmental conditions are favorable, hence the modest population growth realized from 2014 – 2018. However, it is very likely that such high prevalence of CWD may be regulating this population from the standpoint that periods of population growth result in peaks that are lower than may have been

otherwise, while population nadirs may also lower. Essentially, overall population performance is likely being suppressed over the long term due to endemic CWD.

**Table 1.** CWD surveillance in hunter-harvested mule deer in the South Converse Herd Unit, 2001-2018.

Year	Total Harvest	N Tested	N Positive	CWD Prevalence
2001	885	81	12	<b>15%</b>
2002	825	98	23	<b>24%</b>
2003	733	155	46	<b>30%</b>
2004	533	52	14	<b>27%</b>
2005	461	88	29	<b>33%</b>
2006	555	81	32	<b>40%</b>
2007	729	74	30	<b>41%</b>
2008	708	44	19	<b>43%</b>
2009	425	48	20	<b>42%</b>
2010	365	42	20	<b>47%</b>
2011	303	35	20	<b>57%</b>
2012	345	30	14	<b>47%</b>
2013	252	41	18	<b>44%</b>
2014	253	38	12	<b>32%</b>
2015	237	4	3	<b>75%</b>
2016	285	14	6	<b>43%</b>
2017	265	51	18	<b>35%</b>
2018	297	57	21	<b>37%</b>

**Figure 1.** Adult buck CWD prevalence in the South Converse Herd Unit, 2000-2018.



A collaborative research project was initiated in 2010 to investigate the effects of CWD on the South Converse Mule Deer Herd. Using GPS-collared deer, a number of variables were explored to better understand the relationship between CWD and free-ranging mule deer population dynamics. This research was a cooperative effort of the United States Geological Survey, the University of Wyoming and the Wyoming Game and Fish Department, and was concluded in 2014. The research was published in a dissertation in 2015 titled “Chronic Wasting Disease Ecology and Epidemiology of Mule Deer in Wyoming”. The goal of the study was to evaluate: 1) population growth estimation and effects of CWD status, sex, age, and CWD genetics on mule deer survival; 2) CWD effects on mule deer behavior; and 3) CWD Genetic Selection.

The research confirmed that CWD is a population limiting disease, with modeled estimates of population growth ( $\lambda_1$ ) = 0.81, corresponding to a 19% annual decline in the population. Further, males had a high prevalence of CWD (43%) compared to females (18%). They found that infected males showed higher activity levels, but noted that these males may have been more active prior to infection which placed them at a higher risk of encountering infected deer and contaminated environments. Further, infected deer were more likely to be predated upon by mountain lions or harvested by hunters due to their altered behavior. Lastly, the study found reduced incidence of CWD for deer of a certain genotype and documented genetic shift within the population as a result of higher fitness associated with that genotype. Despite selection towards deer with higher fitness, the study’s population models still predicted severe decline in the next 50 years (DeVivo 2015). Some key findings of the research are listed below:

- For population growth estimation and effects of CWD status, sex, age, and genetics on mule deer survival:
  - Population  $\lambda = 0.81$ , indicating an annual 19% decline of the population with extinction in 41 years (not accounting for genetic selection, female only model)
  - Age, winter body condition, and CWD status had no effect on pregnancy or fawn recruitment
  - Survival of males was lower than females regardless of CWD status
  - Survival of CWD-positive deer was markedly lower than CWD-negative deer
  - There was no difference in survival among age classes
  - Modeling suggested mortality levels of CWD-negative deer may influence  $\lambda$
- Management recommendations from this study were:
  - Eradication of CWD is unlikely without tools such as treatment, vaccination or environmental prion cleanup
  - Management efforts are best focused on improvement of overall mule deer health – habitat management and improvement are likely the best strategies to do this
  - Harvest prescriptions should continue to emphasize male harvest only

- CWD effects on mule deer behavior were:
  - Home ranges were larger for males than females, and were larger for CWD-negative females than for CWD-positive females
  - There was no significant difference in activity between CWD-positive and CWD-negative females
  - CWD-positive males had similar activity during the breeding season as CWD-negative males, suggesting they may still participate equally in the rut, although sample sizes of marked males were small
  - Males had larger home ranges and traveled larger distances, which may explain why they have higher CWD prevalence
  - Migration behavior did not appear to be affected by CWD status in females
  
- CWD Genetic Selection findings were:
  - Researchers developed a simulation model to determine effect of genetic-specific CWD incidence and mortality on the population growth rate looking at various scenarios
  - Even with genetic selection, the population model predicted a functional extirpation of mule deer with measured CWD prevalence and associated survival
  - Male only harvest did not appear to be a significant factor contributing to decline in this population
  - Continuing male-only harvest is reasonable and will also enable continued surveillance
  - Research suggests genetic shift may be occurring in this population
    - Genotyping during the course of routine CWD surveillance from 2001 – 2003 resulted in the F allele at Codon 225 being present in 1% of the population; during the course of this study it was present in 12% of the population
    - Genotypes from 2001 – 2003 were determined from hunter-harvested deer throughout the herd unit; genotypes from DeVivo’s study from 2010 – 2014 were determined from radio-marked deer within the study area (LaPrele valley)

## **Citations**

DeVivo, Melia. Chronic Wasting Disease Ecology and Epidemiology of Mule Deer in Wyoming. Diss. University of Wyoming, 2015.

## 2018 - JCR Evaluation Form

SPECIES: Mule Deer

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

HERD: MD757 - BATES HOLE/HAT SIX

HUNT AREAS: 66-67

PREPARED BY: HEATHER O'BRIEN

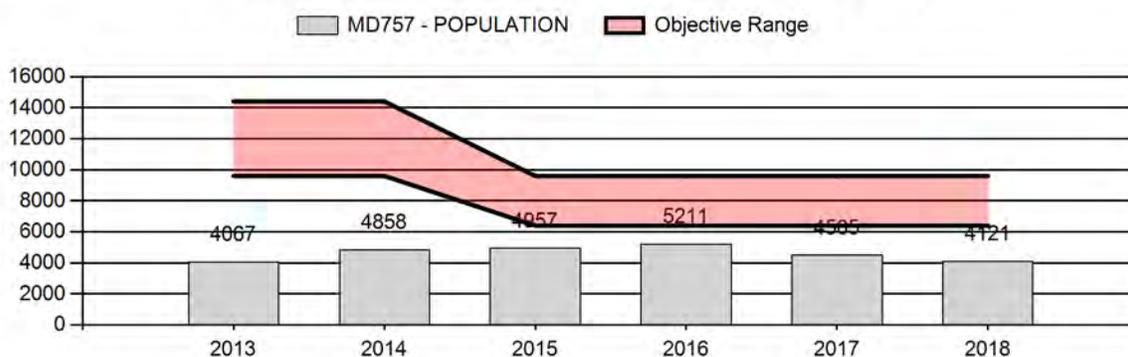
	<u>2013 - 2017 Average</u>	<u>2018</u>	<u>2019 Proposed</u>
Population:	6,316	4,121	4,496
Harvest:	302	380	225
Hunters:	830	914	600
Hunter Success:	36%	42%	38 %
Active Licenses:	830	914	600
Active License Success:	36%	42%	38 %
Recreation Days:	3,221	3,437	2,200
Days Per Animal:	10.7	9.0	9.8
Males per 100 Females	30	26	
Juveniles per 100 Females	66	66	

Population Objective (± 20%) :	8000 (6400 - 9600)
Management Strategy:	Special
Percent population is above (+) or below (-) objective:	-48.5%
Number of years population has been + or - objective in recent trend:	18
Model Date:	02/25/2019

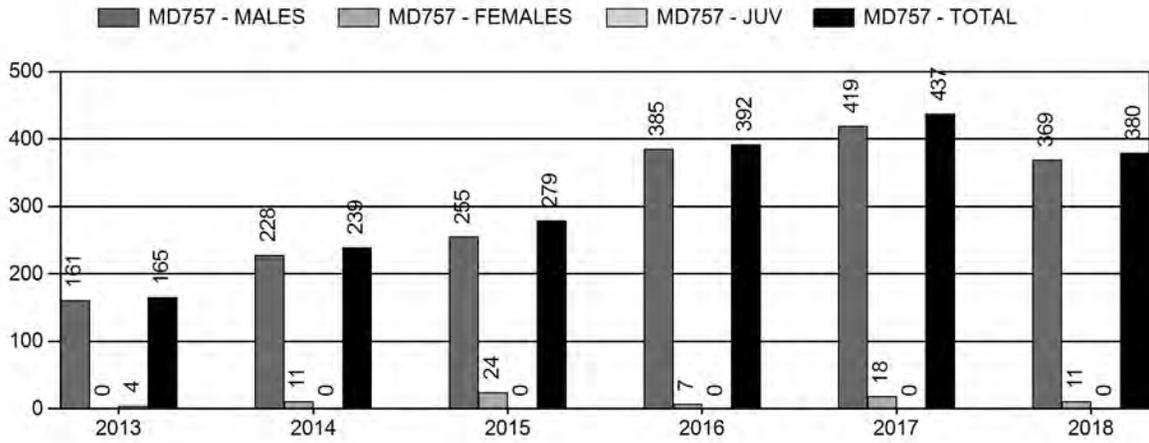
**Proposed harvest rates (percent of pre-season estimate for each sex/age group):**

	<u>JCR Year</u>	<u>Proposed</u>
Females ≥ 1 year old:	.5%	.5%
Males ≥ 1 year old:	52.3%	27.6%
Total:	8.4%	4.7%
Proposed change in post-season population:	-8.5%	+9.1%

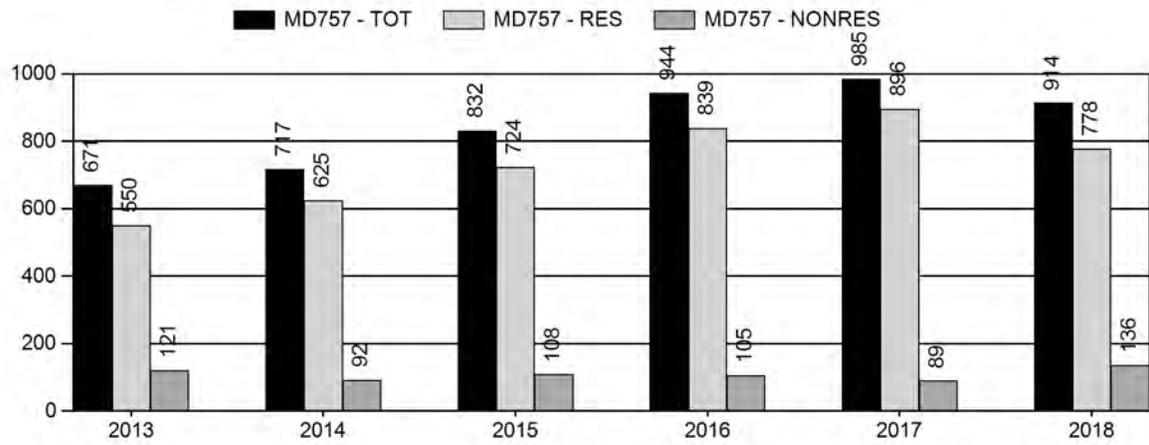
## Population Size - Postseason



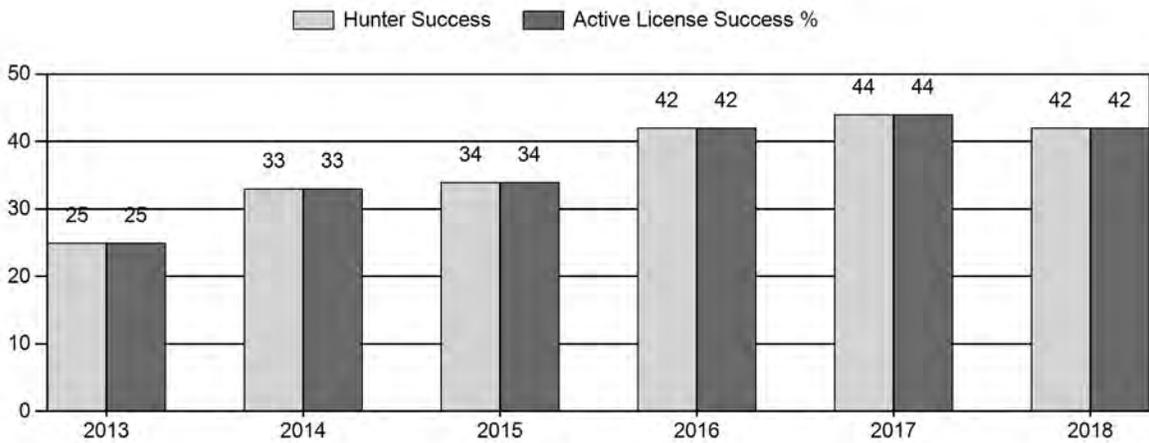
# Harvest



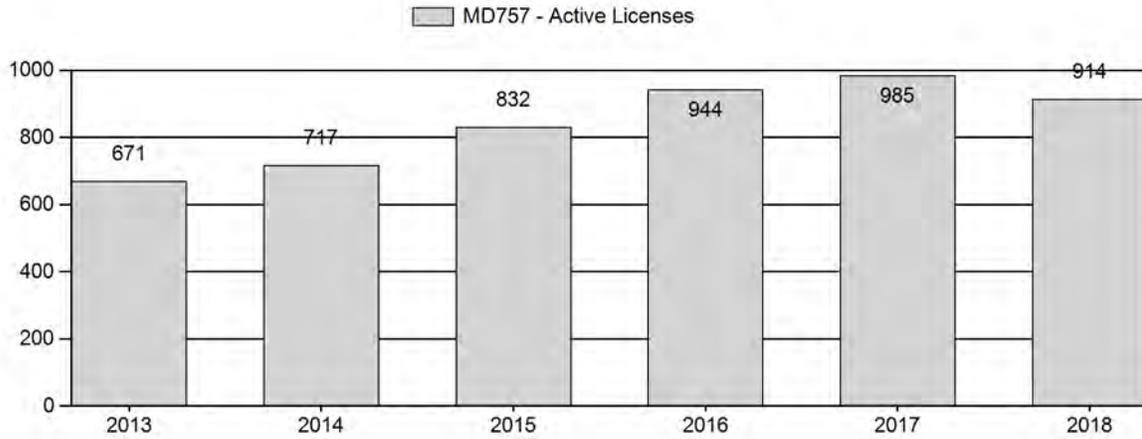
# Number of Active Licenses



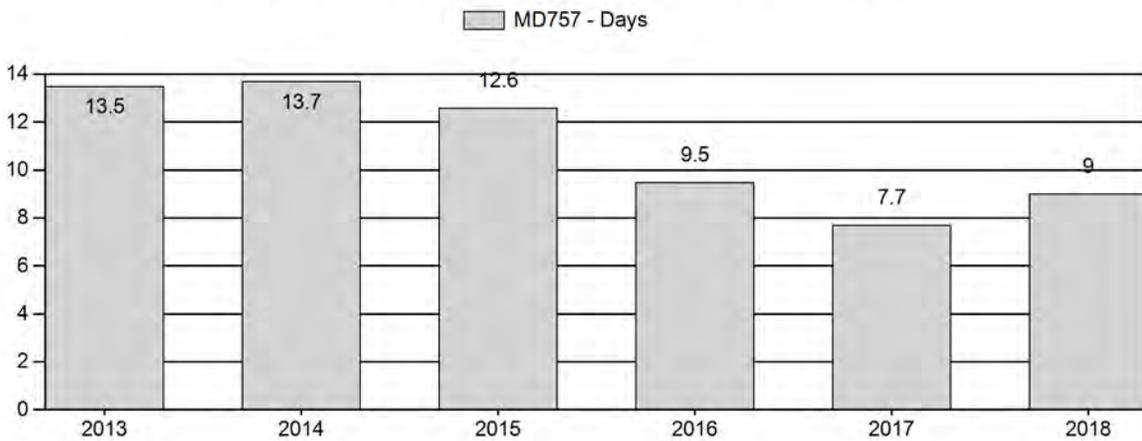
# Harvest Success



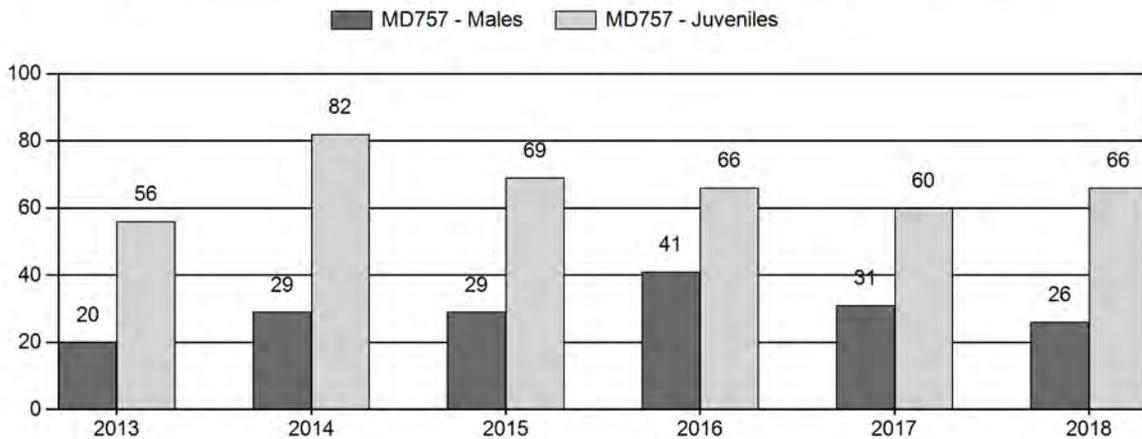
# Active Licenses



# Days per Animal Harvested



# Postseason Animals per 100 Females



**2013 - 2018 Postseason Classification Summary**

for Mule Deer Herd MD757 - BATES HOLE/HAT SIX

Year	Post Pop	MALES								FEMALES		JUVENILES		Tot CIs	CIs Obj	Males to 100 Females				Young to		
		Ylg	2+ CIs 1	2+ CIs 2	2+ CIs 3	2+ UnCIs	Total	%	Total	%	Total	%	YIng			Adult	Total	Conf Int	100 Fem	Conf Int	100 Adult	
2013	5,135	86	50	25	7	0	168	11%	845	57%	470	32%	1,483	959	10	10	20	± 2	56	± 3	46	
2014	5,578	83	79	26	7	0	195	14%	665	47%	543	39%	1,403	1,464	12	17	29	± 3	82	± 5	63	
2015	5,890	164	97	29	13	0	303	15%	1,039	50%	719	35%	2,061	1,208	16	13	29	± 2	69	± 3	54	
2016	7,190	132	198	31	4	0	365	20%	886	48%	585	32%	1,836	1,236	15	26	41	± 3	66	± 4	47	
2017	7,789	54	108	23	4	0	189	16%	611	52%	365	31%	1,165	1,216	9	22	31	± 3	60	± 5	46	
2018	4,121	32	59	7	0	0	98	13%	384	52%	252	34%	734	1,161	8	17	26	± 3	66	± 6	52	

**2019 HUNTING SEASONS  
BATES HOLE / HAT SIX MULE DEER (MD757)**

Hunt Area	Type	Season Dates		Quota	License	Limitations
		Opens	Closes			
66		Oct. 15	Oct. 21		General	Antlered mule deer three (3) points or more on either antler or any white-tailed deer
67						CLOSED
Archery		Sep. 1	Sep. 30			Refer to license type and limitations in Section 2

**Management Evaluation**

**Current Postseason Population Management Objective:** 8,000

**Management Strategy:** Special

**2018 Postseason Population Estimate:** 4,100

**2019 Proposed Postseason Population Estimate:** 4,500

**2018 Hunter Satisfaction:** 68% Satisfied, 17% Neutral, 15% Dissatisfied

The Bates Hole / Hat Six Mule Deer Herd Unit has a postseason management objective of 8,000 deer. The herd is managed using the special management strategy, with a goal of maintaining postseason buck ratios between 25-35 bucks per 100 does, as per the Mule Deer Initiative Management Plan. As part of the statewide Mule Deer Initiative, a citizen working group was formed in 2014 to discuss issues in the Bates Hole / Hat Six Mule Deer Herd Unit. The group developed a management plan and formal recommendations to Department managers in summer 2015 (MD757 2015 JCR, Appendix A). These recommendations, along with the objective and management strategy, were formally reviewed in 2015.

**Herd Unit Issues**

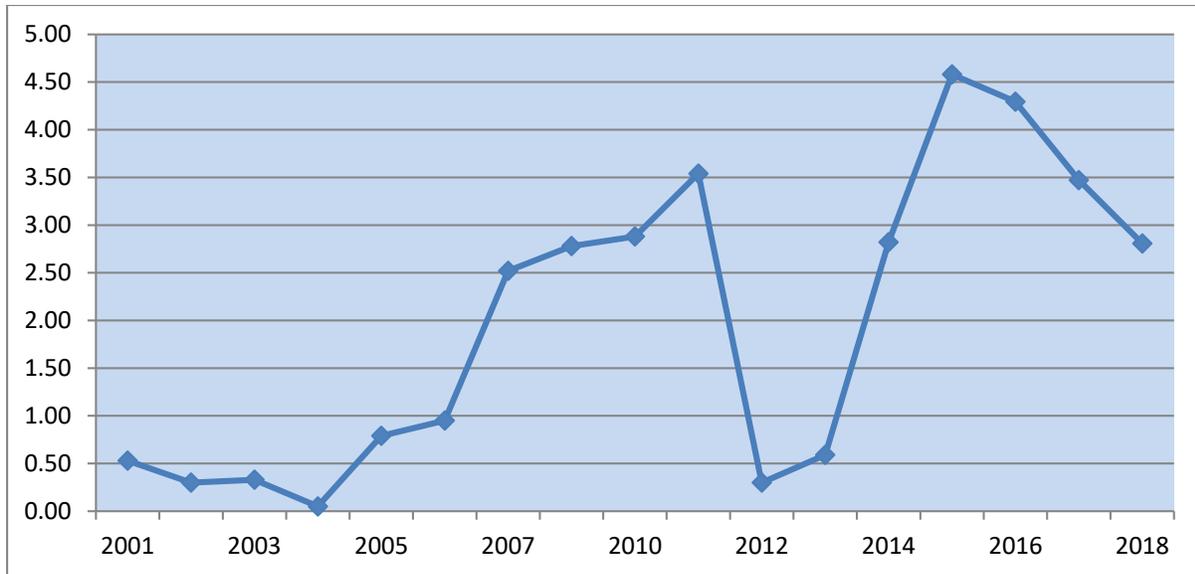
In Hunt Area 66, hunting access is good, with large tracts of public land as well as a sizeable Hunter Management Area providing access to key private lands. The main land use within the herd unit is traditional ranching and grazing of livestock. Very little industrial or energy development exists in this herd unit. Hunt Area 67, which includes the north-central portion of Casper Mountain, remains closed to hunting. Residents with small properties that dominate the hunt area are strongly opposed to hunting in their portion of the herd unit.

## **Weather**

From 2013 to the present, weather trends have been generally favorable, and mule deer numbers have slowly increased. Range conditions were particularly good from 2013 to 2015, when spring and summer moisture improved and winters were mild. The winter of 2015 was fairly average, though some areas experienced prolonged periods of persistent snow. The spring of 2016 had above average precipitation but summer was extremely dry, causing rangeland habitats to cure early. Fortunately, precipitation in October resulted in a late surge of plant growth, which may have provided big game with a boost in nutrition going into the winter months. While there were several notable snow storms and cold snaps during the winter of 2016-2017, there were also periods of warm weather and high winds that melted and drifted snow to expose forage. The 2017 growing season was very similar to the previous year, with ample spring moisture followed by a dry summer with little precipitation. Moisture improved during the fall, though there was below average snowfall over the winter of 2017-2018. Precipitation was below average for the 2018 growing season as well, and although moisture was good in late spring, many reservoirs became dry by late summer. Sparse rain events provided some moisture during the fall months, but the 2018-2019 winter has been above average in severity, with good snow pack at higher elevations in the herd unit. While snow is deep in these areas, most low-elevation snows have melted or drifted over the course of the winter, opening habitats for mule deer to move freely on winter ranges and access forage. For detailed weather data see <http://www.ncdc.noaa.gov/gac/time-series/us>.

## **Habitat**

This herd unit has eight established transects that measure production and utilization on True Mountain Mahogany (*Cercocarpus montanus*). Average leader growth on mahogany in 2018 was 2.81 inches (Figure 1). While this represents a decrease in production from the previous three years, average leader growth in 2018 was still higher than the long-term average. Above-average herbaceous plant production in recent years is attributed to good moisture during growing seasons. Average utilization on transects decreased compared to the past five years, and was 16.23% in 2018 (Table 1). While the herd generally grew from 2012-2016, observations by managers, landowners, and from surveys and harvest data indicate the herd declined in 2018. Habitat conditions were also poor by late summer 2018, as precipitation dropped below average and forage cured or was damaged by localized infestations of grasshoppers. Decreased average utilization on shrubs seems to correlate to a decreasing mule deer population in the past year.



**Figure 1.** Mean annual growth of true mountain mahogany (*Cercocarpus montanus*) in the Bates Hole / Hat Six Mule Deer Herd Unit, 2001-2018.

Year	02-03	05-06	06-07	07-08	08-09	09-10	10-11	11-12	12-13	15-16	16-17	17-18
<b>Mean Utilization</b>	30.65	23.75	12.27	26.73	15.33	23.33	28.00	13.67	20.29	25.90	26.40	16.23

**Table 1.** Mean utilization of true mountain mahogany (*Cercocarpus montanus*) in the Bates Hole / Hat Six Mule Deer Herd Unit, 2001-2018. Note data were not collected or reported in some years.

### Field Data

For much of the past 15 years, fawn ratios in this herd have been moderate to poor. Fawn ratios reached a 25-year low in 2010, with 45 fawns per 100 does postseason. Despite the elimination of doe/fawn hunting and restrictions placed on buck harvest, the population was still slow to recover from 2011-2013. Fawn ratios finally improved in 2014 to 82 per 100 does as a result of favorable weather and range conditions. Winter conditions from 2014-2016 were relatively mild, and spring weather and range conditions were favorable for pregnant and lactating does. As a result, overwinter survival of fawns improved. Fawn ratios were marginal from 2015-present, with 66 fawns per 100 does observed during 2018 postseason classification surveys. Yearling buck ratios have also been low the last two years, indicating poor overwinter survival of fawns. While low yearling ratios can in part be attributed to harvest during the last two hunting seasons, field checks did not indicate a disproportionate percentage of yearling bucks were

harvested. Prior to first implementing Antler Point Restrictions (APRs) in 2013, a high percentage of field-checked bucks were yearlings in some years.

Buck ratios for the Bates Hole / Hat Six Herd historically average in the mid-20s per 100 does, though they have occasionally exceeded recreational limits and risen into the low to mid 30's. In an attempt to improve yearling buck recruitment and a record-low buck ratio, an APR was added in 2013, requiring harvested bucks to have three (3) points or more on either antler. In 2015, the Area 66 Mule Deer Initiative (MDI) Management Plan recommended maintaining an APR in this herd unit if the buck ratio dropped below 25 per 100 does. This recommendation stemmed from a public desire to improve hunting quality and overall buck numbers while maintaining a general license season structure. In 2016, the observed postseason buck ratio was 41 as a result of high fawn production and survival in 2014 and 2015, but also owing to the protection of yearling bucks under the antler point restriction. In 2017 and 2018 the point restriction was removed to provide more liberal hunting opportunity, as buck ratios remained above MDI Management Plan and recreational management thresholds. Following the 2018 hunting season, the observed buck ratio declined to 26 per 100 does, and a sightability survey indicated this herd had a much lower population size than previously modeled. Consequently, the limitation of three (3) points or more on either antler will be reinstated for the 2019 hunting season.

Since 2008, bucks classified in Area 66 have been categorized based on antler size (see Table 2). The best distribution of mature buck classes was observed in 2008, with 50% Class I (small), 36% Class II (medium), and 14% Class III (large) bucks. Bucks classified from 2010-2016 showed a decrease in antler size, as the percentage of Class I bucks increased and percentage of Class II bucks decreased. It should come as no surprise that the percentage of Class I bucks increased from 2012 to 2016 with improved fawn production and the addition of antler-point restrictions, as more young bucks were present in the population. The proportion of Class III bucks has consistently remained under 10% in all years. A very high proportion of Class I bucks were observed in 2018, with a low number of Class II bucks observed. No Class III bucks were observed during 2018 postseason classifications. It should be noted however that survey effort was very light and overall sample sizes were low, as budgetary focus shifted to the year's sightability survey. Improved distribution of Class II bucks may be due in part to more even harvest pressure across antler classes with the removal of antler point restrictions. Still, the trend towards smaller antlered, younger bucks observed in the herd is concerning. Disease prevalence, low productivity, and harvest pressure may all be contributing factors if these results cannot be attributed to low sample size.

Bio-Year	Total Class N for HA	# Bucks Classified					Buck Ratios per 100 Females					
		Ylng	Class I	Class II	Class III	Total	Ylng	Class I	Class II	Class III	All Adult	Total
2008	1,254	75	57 (50%)	41 (36%)	16 (14%)	189	12	9	6	2	18	29
2009	1,320	59	61 (54%)	41 (37%)	10 (9%)	171	8	8	6	1	15	23
2010	1,479	82	49 (49%)	42 (42%)	9 (9%)	182	9	5	5	1	11	20
2011	1,248	47	52 (56%)	33 (36%)	7 (8%)	139	7	8	5	1	14	21
2012	1,272	28	55 (59%)	30 (32%)	9 (9%)	122	4	8	4	1	13	17
2013	1,483	86	50 (61%)	25 (30%)	7 (9%)	168	10	6	3	1	10	20
2014	1,403	83	79 (71%)	26 (23%)	7 (6%)	195	12	12	4	1	17	29
2015	2,061	164	97 (70%)	29 (21%)	13 (9%)	303	16	9	3	1	13	29
2016	1,836	132	198 (85%)	31 (13%)	4 (2%)	365	15	22	3	1	26	41
2017	1,165	54	108 (80%)	23 (17%)	4 (3%)	189	9	18	4	1	22	31
2018	734	32	59 (89%)	7 (11%)	0 (0%)	98	8	15	2	0	17	26

**Table 2.** Antler classification analysis for **Area 66** within the Bates Hole/Hat Six Mule Deer Herd Unit, 2008 – 2018.

During the 2018 hunting season, tooth age data were collected from harvested bucks in the herd unit in conjunction with Chronic Wasting Disease (CWD) samples (Table 3). While there are no data sets from previous years for comparison, these results can still provide valuable information to managers. While most hunters that harvested yearlings did not submit teeth for aging, two branch-antlered deer were tooth-aged as yearlings. Managers have long suspected this is somewhat common, and have discussed ways to research frequency across herd units for comparison. Many hunters that had their mule deer CWD-tested were able to find and harvest deer in mature age classes, with an average age of 3.88 for all CWD-sampled harvested bucks. Tooth ages from harvested deer ranged from 1.5 to 6.5, with a median age of 3.5. These data help illustrate the type of bucks that are most available for harvest in a general license hunt area, while also indicating the presence of older age class bucks, though they may be less common.

	<b>2018</b>
<b>Average Age</b>	3.88
<b>Median Age</b>	3.5
<b>Average Antler Spread</b>	18.4
<b>Sample Size (N) =</b>	47

**Table 3.** Lab tooth age and antler spread data from Hunt Area 66 harvested mule deer, 2018.

### **Harvest Data**

Hunter success in this herd fluctuates as a function of population size, season length, and season limitations. From 2013-2016, an antler point restriction was prescribed to the 7-day hunting season. At the same time, Region D non-resident license issuance was reduced significantly to only 400 licenses in 2014. Overall hunter participation and success were low in the first year of the antler point restriction, but gradually both participation and harvest success increased as the herd began to recover and grow. Harvest success improved further to 44% with the removal of the antler point restriction in 2017, but declined slightly to 41% in 2018. Hunter participation and buck harvest remained relatively static from 2016-2018, despite liberalized seasons in 2017 and 2018.

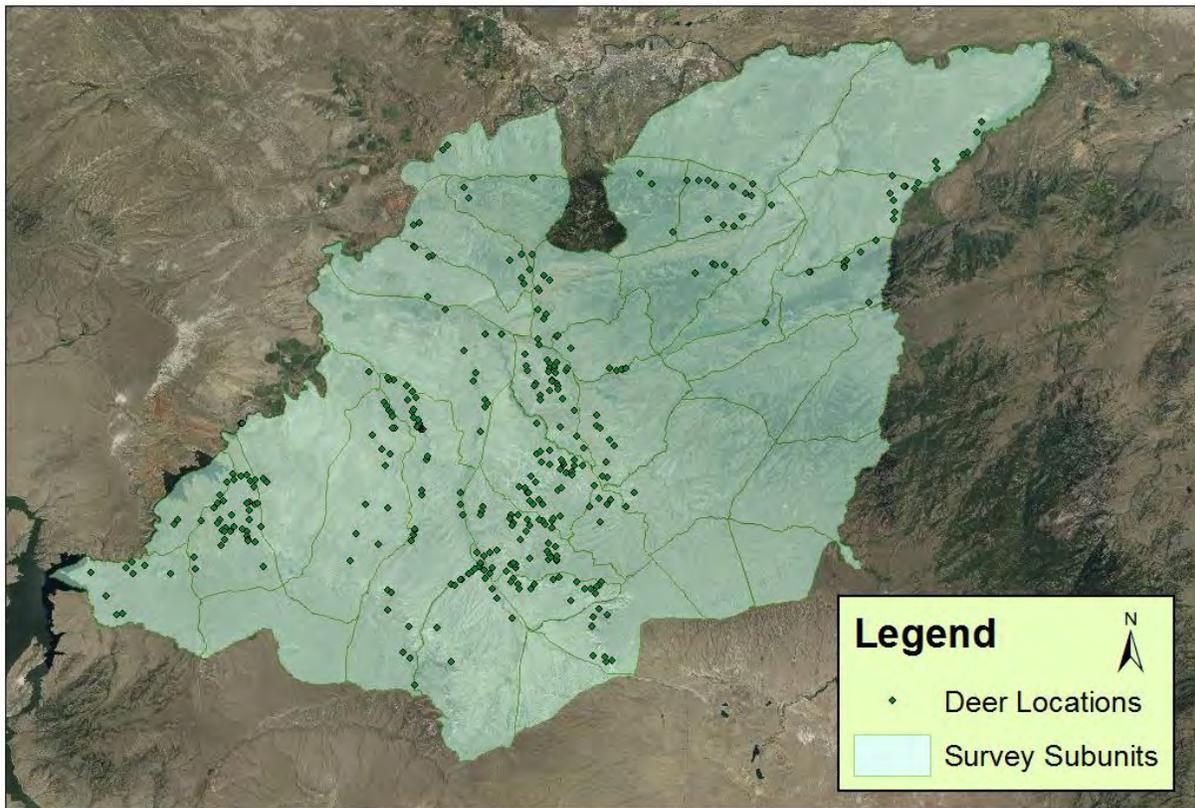
Hunter field checks were significantly increased in the Bates Hole / Hat Six Herd Unit during the 2017 and 2018 hunting seasons. Field personnel increased hunter contacts to better gauge the prevalence of Chronic Wasting Disease (CWD) in the herd unit. A total of 85 harvested mule deer were field checked and sampled during the 2018 season. The resulting prevalence of CWD for the herd unit was 27%, which was unchanged from the previous year. Managers will continue disease testing in 2019, as CWD remains a human health concern for hunters, and a management concern for the population overall.

### **Population**

In February 2017, 45 doe mule deer were captured within the herd unit and fitted with satellite GPS radio collars. A second collaring effort took place in November 2017 to re-deploy collars from previous deer mortalities. Location, disease, and mortality data are being collected and analyzed from these deer, in a collaborative effort with the Bureau of Land Management. Information gleaned from this study will be used to update seasonal range delineation, identify important habitats, identify causes and rates of mortality, and monitor disease prevalence within the herd. Data collection from collared deer was completed in December 2018 due to

widespread collar failure as a result of mis-programming by the manufacturer. Data are currently being analyzed, and final reports will be submitted by Fall 2019.

In January 2019 a sightability survey was conducted for the herd unit, with the intent of adding an abundance estimate to align the current population model (Appendix A). A total of 2,789 deer were recorded during intensive flights of the hunt area, with an additional 45 deer counted from the ground (Figure 2). Analysis of survey counts as well as vegetation, snow cover, and behavioral data yielded an abundance estimate of 3,512 deer with a confidence interval of  $\pm 275$  for the entire herd. These results modified the population model drastically, as it previously estimated herd size at approximately 7,500 deer. Such a drastic change in population estimates illustrates the importance of abundance surveys and other external data to align and improve the population model. With the newly adjusted model, managers plan to reconvene meetings with the Mule Deer Initiative group and the public to discuss the future management of this herd.



**Figure 2.** Deer locations and survey subunits from the sightability survey of the Bates Hole / Hat Six Mule Deer Herd Unit, January 2019.

The 2018 postseason population estimate for the Bates Hole / Hat Six Herd Unit was 4,100. This estimate changed drastically following adjustment of the model utilizing an abundance estimate from the aforementioned sightability survey. It should be noted that previous, higher estimates derived from the model were likely incorrect and did not accurately represent the herd. Trends of population growth and decline were likely accurate over time, although overall population totals were inflated. A separate estimate of adult survival derived from GPS-collared adult does in 2017 is also included to further align the model.

The “Time-Specific Juvenile, Semi-Constant Adult” (TSJ,CA) spreadsheet model was chosen for the postseason population estimate of this herd. All three models assume harvest is proportional across age and sex classes, and rely heavily on observed male ratios and harvest. Thus, harvest regimes that are specific to one sex or age class (as they have been in Area 66) make it difficult for the model to simulate true population dynamics. Managers are more confident in the current model, given the addition of survival data in 2017 and the abundance estimate for 2018. The model estimates a herd size above that of the abundance estimate, as it still incorporates long-term classification and harvest data and attempts to align closely to observed buck ratios. The TSJ, CA model seems the most representative of the herd in terms of recent and historic trends and aligns well to survival and abundance data, although simulated adult survival rates may be inflated based on the value measured in 2017 from collared mule deer. The CJ,CA model was rejected, as it does not align as well with survival and abundance estimates. The SCJ,SCA model predicts a similar population size and trend as the TSJ,CA model for the more recent years, but earlier years in the model are not consistent with historic estimates from those eras. The TSJ,CA model ultimately appears to be the best representation relative to the perceptions of managers and field personnel, is of good quality, and follows trends with harvest success.

## **Management Summary**

Opening day for hunting in Area 66 has traditionally been October 15<sup>th</sup>, with closing dates that have changed to offer greater or lesser opportunity depending on the management direction desired. General licenses have been valid only for antlered mule deer since 2000. Doe/fawn licenses have been offered in years when winter range shrub utilization has been excessive, although no meaningful doe harvest has been prescribed since 2007. A short, seven-day season with no doe/fawn licenses will be maintained for 2019. The 2019 season will reinstate an antler point restriction of three (3) or better on one antler, as buck ratios are currently near the threshold defined by the Mule Deer Initiative Management Plan and the abundance estimate obtained from the sightability survey indicate this population is far smaller than previously estimated. In future years, if the observed buck ratio improves beyond 25 bucks per 100 does, the antler point restriction may be removed.

If we attain the projected harvest of 225 deer with fawn ratios similar to the last five years, this herd will grow slightly. If fawn production and adult survival improve in 2019, the herd should show more rapid growth. The predicted 2019 postseason estimate for the Bates Hole / Hat Six Herd is approximately 4,500 animals, which is 48% below objective.

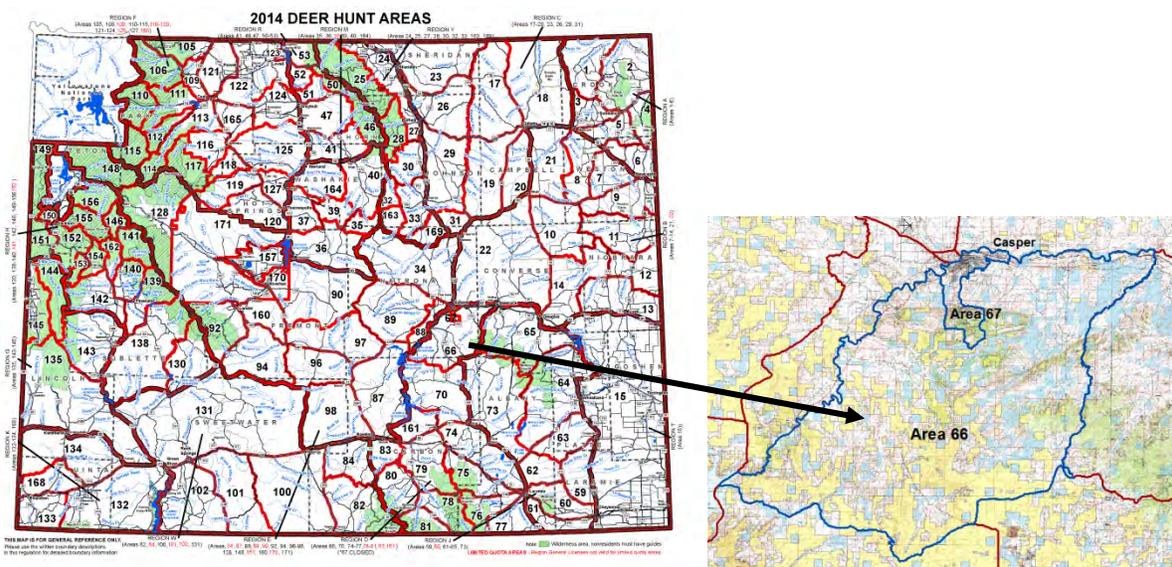
# APPENDIX A

## Bates Hole Hat Six Mule Deer Sightability Survey 2019 Summary

Heather O'Brien – Casper Wildlife Biologist

### INTRODUCTION

The Bates Hole / Hat Six Mule Deer Herd Unit (MD 757) contains hunt areas 66 and 67 and is located in Central Wyoming (Figure 1). The herd unit encompasses approximately 1,396 square miles from the City of Casper, east to Deer Creek, south to the Shirley Rim, west to Pathfinder Reservoir, and northeast along the North Platte River back to the City of Casper. The main land use is traditional ranching and grazing of livestock, with very little other development. Area 67 within the herd unit consists of the City of Casper, adjoining suburban communities, and cabin sites on Casper Mountain. This area has remained closed to deer hunting due to the desire of property owners to maintain human safety and preserve deer around their homes and cabin sites (Wyoming Game and Fish Department, 1992). Land status within the herd is a mosaic of public (Bureau of Land Management, United States Forest Service, and State of Wyoming lands) and private lands, with about 44% public lands accessible to the hunting public. The Muddy Mountain Hunter Management Area was established in 2000 and provides additional access to large blocks of interspersed public and private lands.



**Figure 1.** Map of mule deer hunt areas in Wyoming, with the Bates Hole – Hat Six Herd Unit (Hunt Areas 66 & 67) enlarged.

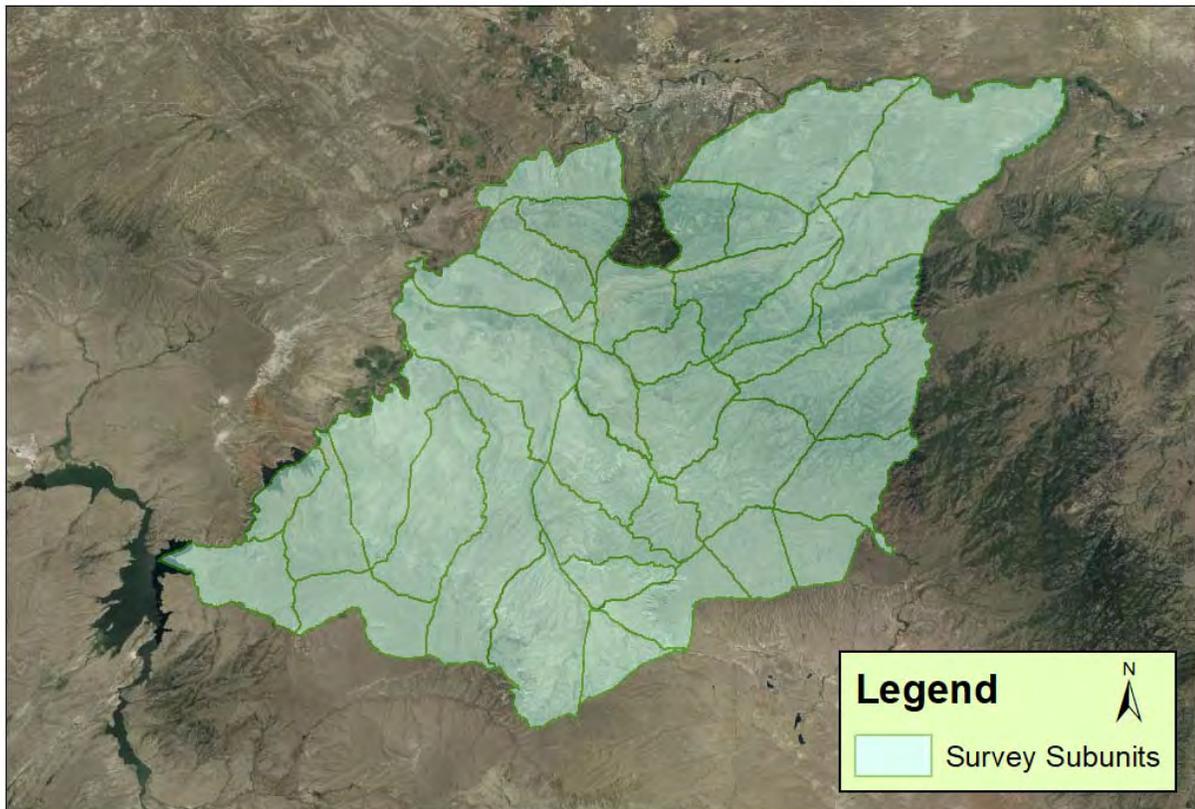
Due to its general license season structure and popularity with resident hunters, the Bates Hole Hat Six Herd Unit was selected as part of the statewide Mule Deer Initiative (MDI) in 2014. As a result, the herd has a public working group and has received supplementary funding for habitat improvements and population research. A GPS-collar study tracking forty-five doe mule deer was initiated in 2017. Goals of this study included attaining a better understanding of mule deer habitat use and seasonal distribution, gauging annual rates and causes of mortality, and documenting effects of Chronic Wasting Disease (CWD).

Population modeling of the Bates Hole Hat Six Mule Deer Herd has been persistently difficult using only classification and harvest data. In typical years, classification surveys are conducted on a limited budget. Thus, directed surveys are cover a limited portion of the herd unit with the goal of maximizing sample size. Specialized season structures allowing antlered-only harvest or those that also include antler point restrictions create variations in harvest data that violate spreadsheet model assumptions of even harvest distribution. Mortality rates from GPS collar data helped further refine the population model for this herd in 2018. However, managers still were not confident that model estimates were accurate in representing the herd. Landowners and members of the public also conveyed skepticism in the population estimate from the model, having anecdotally observed declining mule deer numbers over the past 1-2 years. With increased interest from the MDI, growing concern regarding effects of Chronic Wasting Disease (CWD) on this population, and emerging information from collar data, managers received additional funding for a more intensive abundance survey.

## METHODS

In 2018 & 2019, a sightability survey was designed and conducted within the Bates Hole Hat Six Mule Deer Herd Unit. Defined management goals were to analyze survey data as a stand-alone abundance estimate, and to combine results with recent mortality estimates to further improve the population model.

To initiate study design, a mapping exercise was conducted among field managers to divide the herd unit into manageable subunits. Objectives for each subunit were to use boundaries that were visible from the helicopter when possible such as roads, drainages, and divides. Each subunit was drawn with the target of being flown in approximately one hour, following flight speed and line spacing guidelines for sightability surveys (Unsworth et. al, 1994). Local field managers collaborated to discuss and draw subunit boundaries on a large aerial photo map of the herd unit prior to digitizing using ArcMap (ESRI, 2011) (Figure 2). Subunits in the central portion of the herd unit were already delineated for stratified random surveys of elk in the Laramie Peak Muddy Mountain Herd; in these areas elk subunits were maintained to survey mule deer as well. Each subunit was assigned a unique number for the purpose of recording and tracking data during aerial surveys, and for comparison between this and future surveys.



**Figure 2.** Survey subunits for the Bates Hole Hat Six Mule Deer Herd Unit sightability survey, winter 2019.

Prior to initiating flights, all potential observers were trained in proper data collection following the protocol for WGFD sightability surveys and safety standards outlined by WGFD flight policy (Wyoming Game and Fish Department 2017, Wyoming Game and Fish Commission, 2011). PowerPoint training presentations are available within the Department for both sightability surveys and approved flight policy. Flights were conducted from 29 January through 7 February 2019 on days when weather conditions were suitable for flights. All surveys were flown in a Bell Jet Ranger piloted by Kent Potter of Helicopter Solutions MT, Inc. from Laurel, Montana. Two observers were aboard every survey flight, and pilot observations were also included during data collection. The back-seat observer was positioned to view out the opposite side of the helicopter compared to the front-seat observer to visually survey the greatest area per transect line. Observers were replaced mid-day whenever possible to avoid eye fatigue and maximize survey performance. However, this was not always feasible due to scheduling conflicts for some observers. In these instances, 30-45 minute breaks were taken approximately every three hours during helicopter refueling to provide some rest for all-day observers.

Winter habitat conditions during 2019 flights were considered average to above average in terms of snow accumulation and daily temperatures. Higher elevation portions of the herd unit had deep and persistent snow cover, with little to no sagebrush or other vegetation visible. Lower elevation

portions of the herd unit were more open or broken in terms of snow cover. Snow in these areas was not as deep, with exposed shrubs and ground in most areas and deeper drifted snow along drainages and hillsides. Wind conditions were severe enough on several days within the survey period to cancel flights. Conversely, there were low-wind days during the survey where fog persisted in low-lying areas. Managers either cancelled flights on days when high winds or poor visibility compromised survey conditions and safety, or surveyed subunits in the herd unit where conditions were favorable and scheduled the remaining subunits later.

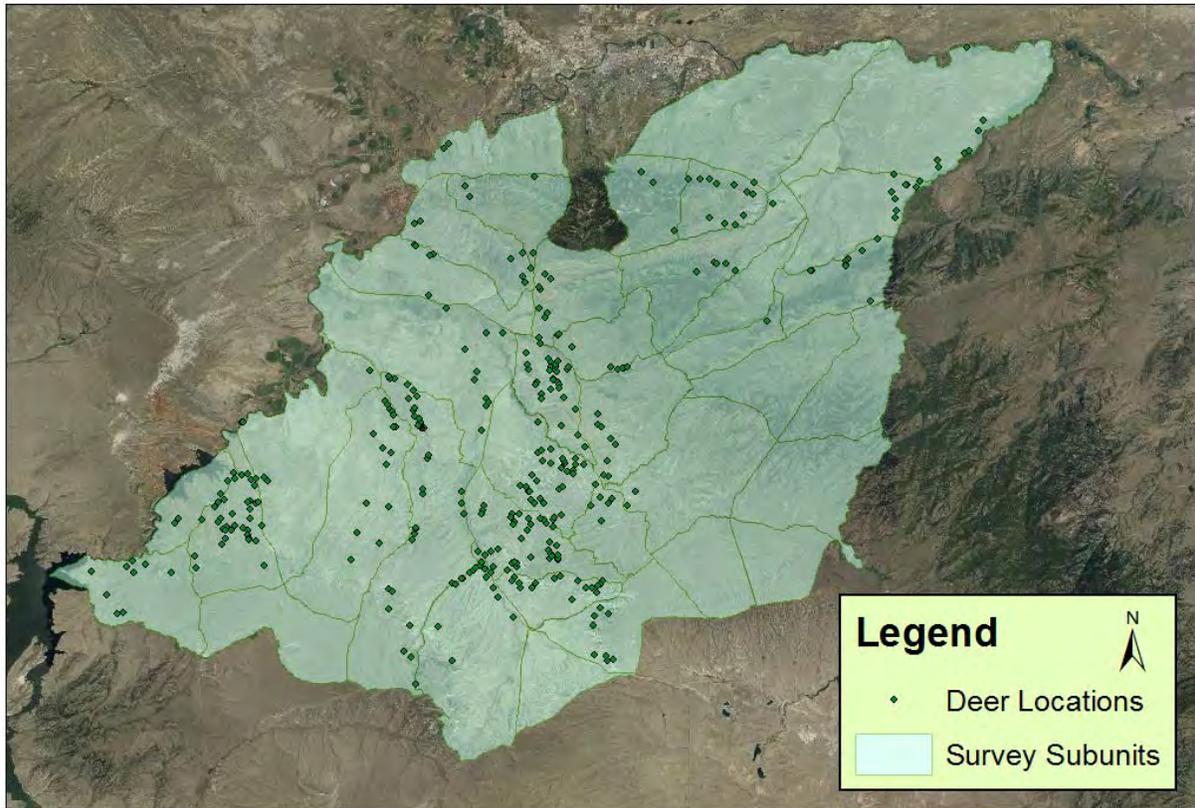
Data collection was performed by the back-seat observer in most instances using a hand-held GPS and standardized data sheet for sightability surveys (Appendix A). Location, number of individual deer in a group, activity of animals upon first sighting, percent snow cover, percent vegetative cover, and vegetative type were recorded for every survey observation. Mule deer were not classified by age or sex; though elk observed concurrently were classified as part of a separate survey. Other notable species (coyotes, winter sage-grouse flocks, congregations of pronghorn, etc.) were also recorded during flights as a means to maximize survey time and collect other useful wildlife data. Flight time to complete each subunit was recorded for evaluation purposes, so managers could modify subunit sizes for future surveys as needed.

Following the completion of all survey flights, data were compiled into a Microsoft Excel spreadsheet and standardized for import into the software program Aerial Survey for Windows (Unsworth et. al 1999). The pilot and all observers were debriefed and offered the opportunity to provide feedback on survey methods to consider for improvement of future surveys.

## RESULTS

A total of 2,789 mule deer were surveyed within 349 recorded observations. Out of 38 total subunits, 36 were flown completely. Two subunits (SU46 and SU57) contained deep persistent snow and were not flown completely. Instead, the perimeter of these subunits were flown looking for deer or elk tracks. With no sign found and to complete the survey efficiently, the remainder of these two units were not flown. To be less disruptive in developed areas closer to the City of Casper, deer were surveyed from the ground rather than from the air.

Distribution of mule deer across the herd unit was uneven, with higher densities of deer at lower elevations, along drainages, and habitats containing shrubs that are utilized for both forage and cover (Figure 3). Deer were also found in some higher-elevation habitats, where snow did not persist and where winter forage was readily available. Some low-elevation habitats were seemingly devoid of deer. These areas tended to be more open habitats with less cover and presumably less palatable or available winter forage.



**Figure 3.** Mule deer group locations and subunits for the Bates Hole Hat Six sightability survey, 28 January - 1 February 2019.

Sightability data analysis using Aerial Survey for Windows yielded a population estimate of 3,512 mule deer  $\pm 275$  using a 95% confidence interval, with a resulting standard error of 140 around the correction (Appendix B). The increase of 723 deer compared to the total observed accounts for deer presumably missed by observers due to variations in vegetation and snow cover. Observers agreed that this was a reasonable number to have missed, given many of the habitats surveyed contained dense juniper stands, tall mature sagebrush, or conifers. Observers also frequently noted that deer that remained bedded during surveys were difficult to see, as they did not move as they were flown over. Bedded deer were observed on several survey days, particularly when the temperature was low and/or winds were strong.

The abundance estimate and standard error from the sightability survey were incorporated into the spreadsheet model for the Bates Hole Hat Six Mule Deer Herd. This combined with the previous year's adult survival estimate served as data points beyond harvest and classification surveys to better anchor the model. Incorporating the abundance estimate from this sightability survey resulted in a lower population estimate for the herd unit. Without the sightability estimate, the spreadsheet model predicted a post-season population of 6,607 deer in 2018. Including the sightability estimate in the spreadsheet model yielded a post-season population estimate of 4,121 deer.

## DISCUSSION

Sightability surveys seek to estimate absolute animal abundance, and provide some of the strongest data available to wildlife managers (Steinhorst and Samual 1989). Sightability models may have their own limitations in terms of cost, and can be biased if groups of animals are undercounted. Despite these limitations, sightability surveys are a powerful source of information for managers compared to traditional classification surveys. Currently, classification surveys do not incorporate a pre-defined survey route or a sampling design. Such directed surveys introduce bias and are not conducted with consistency from one management district to the next, or from one year to the next. Directed surveys also lack true variance estimates (e.g. confidence intervals or standard error), and can still be inefficient and expensive in terms of survey effort.

The abundance estimate and resulting adjustment to the spreadsheet model for the Bates Hole Hat Six Mule Deer Herd Unit are strikingly low compared to previous population estimates. The difference of over 2,000 deer illustrates a need to incorporate abundance and survival data to help inform the Department's deer population models and resulting management. Without these anchor points, the spreadsheet model relies on harvest and classification data and assumptions regarding evenly distributed harvest pressure. These assumptions are violated in the Bates Hole Hat Six Herd Unit, as antlered-only and antler point restricted seasons allow for male-only harvest. An alternative model may be necessary to accurately represent this herd; one which does not rely on these harvest assumptions and may not rely as heavily on annual classification data.

Distribution of mule deer during the survey dates in late January and early February were different than those observed during the typical classification survey period of late November and early December. Some areas had relatively high densities of deer during both survey periods, such as along the larger drainages of Bolton Creek, Stinking Creek, and Bates Creek. Other areas had a shift of deer from low to high density (i.e. Flat Top) or from high to low density (Lone Tree Creek area). Some of this shift may have been attributed to an above-average amount of snow accumulation by late January 2019, or this shift may happen seasonally and with more frequency than was realized by managers.

Though an abundance estimate for Bates Hole Hat Six Mule Deer Herd was the main objective for this sightability survey, the resulting data can be used in other ways to improve and inform wildlife management. Mule deer location data have been used in combination with GPS collar data to recommend updates to seasonal habitats within this herd. Location data collected for observed sage-grouse flocks has been added to the Wildlife Observation System to improve knowledge of winter habitat use and distribution. Observations of large pronghorn herds can be used to demonstrate migration of pronghorn from adjacent hunt areas, and help justify further research regarding suspected migration routes.

Overall, managers felt very good about the design and implementation of this sightability survey. Minor improvements could be made to the current design to enhance future surveys in this herd

unit. Subunits that were too large or too small can be redrawn to so they can each be completed in about an hour. This would help divide effort equitably for future surveys, should subunits require random sampling for a partial survey. Location data could also be used to stratify subunits based on deer density, so that the survey can be stratified in years when funding does not allow for complete coverage. Methods that were refined designing the survey for this herd unit can now be applied to design sightability surveys in other herd units. The continued application of abundance surveys should help managers improve their knowledge of population dynamics and trend, and inform better management decisions in this and other big game herds.

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**APPENDIX B**  
**Sightability Data Analysis from Aerial Survey for Windows**  
**Bates Hole Hat Six Mule Deer Herd Unit, Winter 2019**

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

Wednesday, February 20, 2019 07:13 AM

Model: Mule Deer, Hiller 12-E, Idaho (Spring)

2018\_MD757\_v1

**Section 1: Summary of Raw Counts**

```

-----
                Units
Stratum Sampled  Total
-----
      1         36    2789
-----
Total         36    2789
=====
  
```

**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
Strat Popn Sample Total
-----
      1     36     36    2789
-----
Total     36     36    2789
=====
  
```

**Section 3: Estimates for Total Number**

Total

```

-----
                Number of Units
Stratum  Popn.  Sample  Estimate  Variance  Bound
                Sampling Sightability  Model  95%
-----
      1     36     36     3512      0     17910     1758     275
-----
Total     36     36     3512      0     17910     1758     275
=====
  
```

## 2018 - JCR Evaluation Form

SPECIES: Mule Deer

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

HERD: MD758 - RATTLESNAKE

HUNT AREAS: 88-89

PREPARED BY: HEATHER O'BRIEN

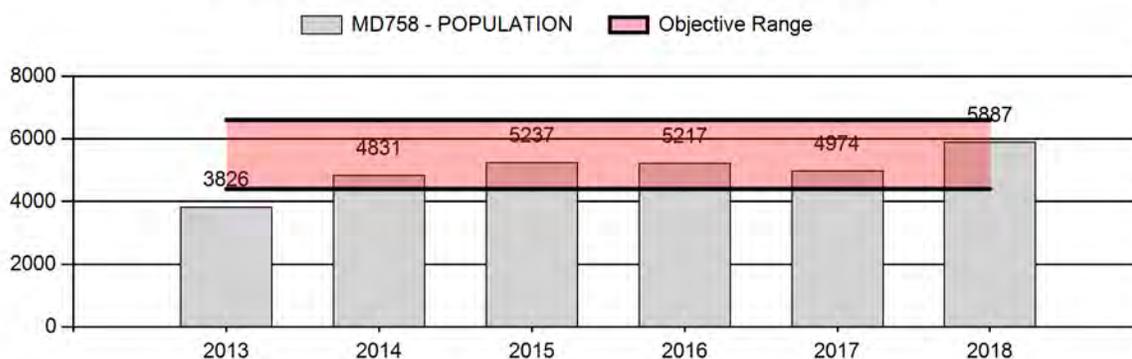
	<u>2013 - 2017 Average</u>	<u>2018</u>	<u>2019 Proposed</u>
Population:	4,817	5,887	6,092
Harvest:	146	301	330
Hunters:	311	480	600
Hunter Success:	47%	63%	55 %
Active Licenses:	314	480	600
Active License Success:	46%	63%	55 %
Recreation Days:	1,205	1,631	1,900
Days Per Animal:	8.3	5.4	5.8
Males per 100 Females	42	53	
Juveniles per 100 Females	73	70	

Population Objective (± 20%) :	5500 (4400 - 6600)
Management Strategy:	Special
Percent population is above (+) or below (-) objective:	7%
Number of years population has been + or - objective in recent trend:	1
Model Date:	02/25/2019

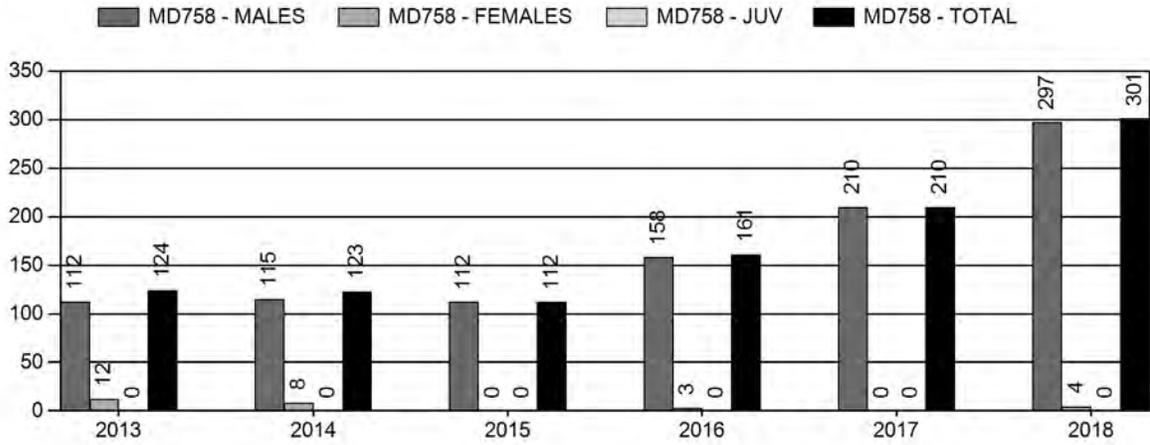
**Proposed harvest rates (percent of pre-season estimate for each sex/age group):**

	<u>JCR Year</u>	<u>Proposed</u>
Females ≥ 1 year old:	0.2%	0.0%
Males ≥ 1 year old:	19.1%	21.6%
Total:	4.8%	5.1%
Proposed change in post-season population:	+16.6%	+3.5%

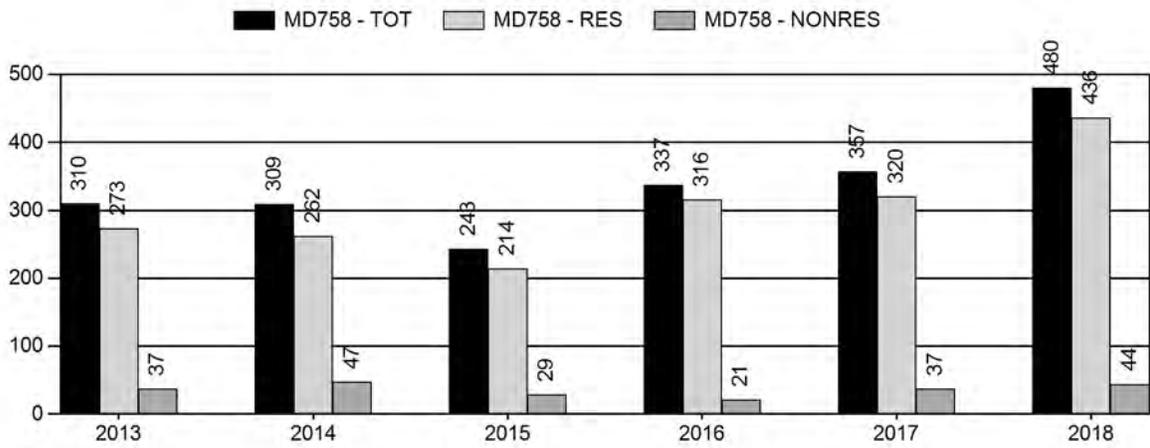
## Population Size - Postseason



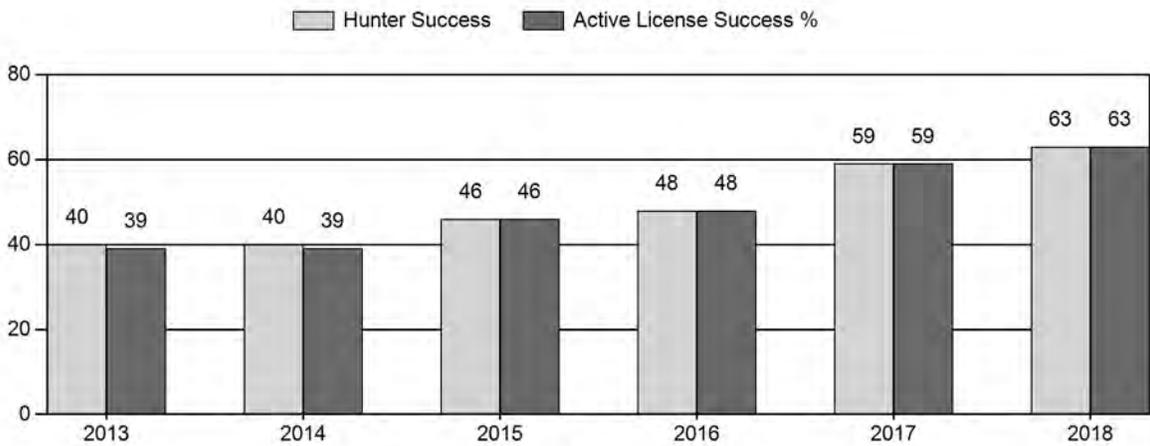
# Harvest



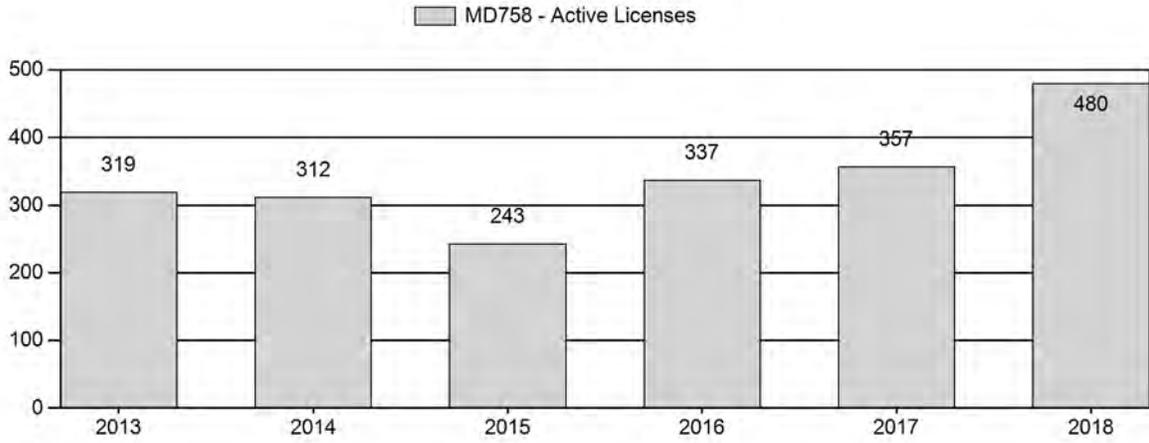
# Number of Active Licenses



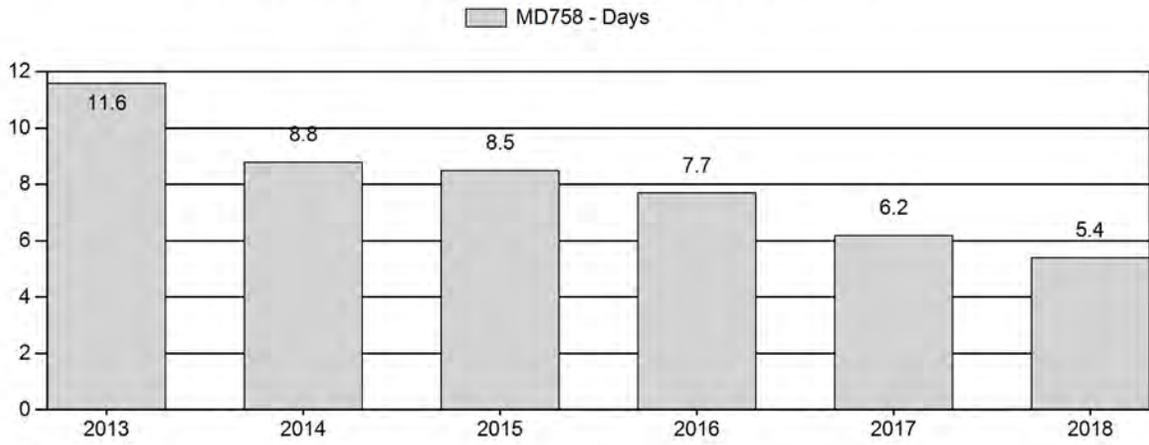
# Harvest Success



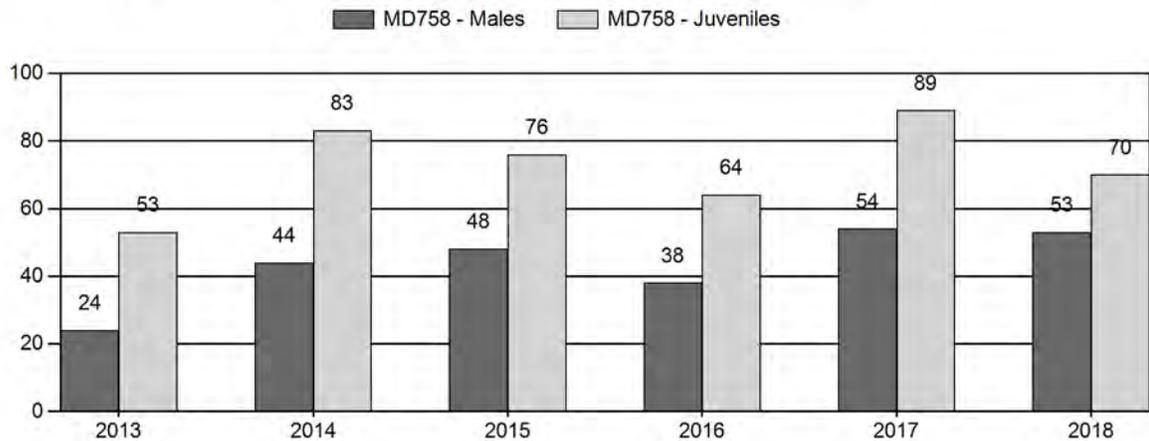
# Active Licenses



# Days per Animal Harvested



# Postseason Animals per 100 Females



**2013 - 2018 Postseason Classification Summary**

for Mule Deer Herd MD758 - RATTLESNAKE

Year	Post Pop	MALES								FEMALES		JUVENILES		Tot CIs	CIs Obj	Males to 100 Females				Young to		
		Ylg	2+ CIs	2+ CIs 1	2+ CIs 2	2+ CIs 3	UnCIs	Total	%	Total	%	Total	%			Ylg	Adult	Total	Conf Int	100 Fem	Conf Int	100 Adult
2013	3,826	14	61	20	1	0	91	14%	376	57%	198	30%	665	671	4	20	24	± 3	53	± 5	42	
2014	4,831	47	84	36	6	0	161	19%	368	44%	304	36%	833	1,446	13	31	44	± 5	83	± 7	57	
2015	5,237	96	97	41	3	0	237	22%	491	45%	371	34%	1,099	1,209	20	29	48	± 4	76	± 6	51	
2016	5,217	58	96	30	3	0	187	19%	487	49%	314	32%	988	1,288	12	26	38	± 4	64	± 5	47	
2017	4,974	50	89	95	5	0	239	22%	442	41%	392	37%	1,073	1,132	11	43	54	± 5	89	± 7	58	
2018	5,887	79	109	27	2	0	217	24%	407	45%	286	31%	910	1,270	19	34	53	± 5	70	± 6	46	

**2019 HUNTING SEASONS  
RATTLESNAKE MULE DEER (MD758)**

Hunt Area	Type	Season Dates		Quota	License	Limitations
		Opens	Closes			
88		Oct. 15	Oct. 21		General	Antlered mule deer or any white-tailed deer
89	1	Oct. 15	Oct. 31	200	Limited quota	Antlered deer
Archery		Sep. 1	Sep. 30			Refer to license type and limitations in Section 2

Hunt Area	Type	Quota change from 2018
88		No Change
89	1	+25
Total	1	+25

**Management Evaluation**

**Current Postseason Population Management Objective: 5,500**

**Management Strategy: Special**

**2018 Postseason Population Estimate: 5,900**

**2019 Proposed Postseason Population Estimate: 6,100**

**2019 Hunter Satisfaction: 72% Satisfied, 17% Neutral, 11% Dissatisfied**

The Rattlesnake Mule Deer Herd Unit has a postseason population objective of 5,500 deer. The herd is managed using the special management strategy, with the goal of maintaining postseason buck ratios between 30-45 bucks per 100 does. Management of this herd unit and interpretation of harvest data can be perplexing, with different management strategies for Hunt Area 88 versus Hunt Area 89. The objective and management strategy were last revised in 2015.

**Herd Unit Issues**

Hunting access within the herd unit is moderate. While there are large tracts of public lands and several large Walk-In Areas, there are also many parcels of private land with restricted access. Hunt Area 88 is dominated by private lands with several small public land parcels. Harvest pressure on females was previously maintained in Area 88 to address potential damage issues on

irrigated agricultural fields, but has not been necessary in recent years. General license hunting pressure can be disproportionately high on public lands within Area 88, and harvest success in the hunt area is typically low as a result. Traditional ranching and grazing are the primary land use over the whole unit, with scattered areas of oil and gas development and bentonite mining. Periodic disease outbreaks (i.e. hemorrhagic diseases) are possible in this herd and can contribute to population declines when environmental conditions are suitable.

## **Weather**

From 2013 to the present, weather trends have been generally favorable, and mule deer have fared well within the herd. Range conditions were particularly good from 2013 to 2015, when spring and summer moisture improved and winters were mild. The winter of 2015 was fairly average, though some areas experienced prolonged periods of persistent snow. The spring of 2016 had above average precipitation but summer was extremely dry, causing rangeland habitats to cure early. Fortunately, precipitation in October resulted in a late surge of plant growth, which may have provided big game with a boost in nutrition going into the winter months. While there were several notable snow storms and cold snaps during the winter of 2016-2017, there were also periods of warm weather and high winds that melted and drifted snow to expose forage. The 2017 growing season was very similar to the previous year, with ample spring moisture followed by a dry summer with little precipitation. Moisture improved during the fall, though there was little snow to speak of over the winter of 2017-2018. Precipitation was below average for the 2018 growing season, and many reservoirs became dry by late summer. Sparse rain events provided some moisture during the fall months, but the 2018-2019 winter has been mild to average in the herd unit. Thus far, the region has received average snowfall combined with many windy days. Snow has melted or drifted, opening habitats for mule deer to move freely on winter ranges and access forage. For detailed weather data see <http://www.ncdc.noaa.gov/gac/time-series/us>.

## **Habitat**

This herd unit has no established habitat transects to measure production and/or utilization on shrub species that are preferred browse for mule deer. Anecdotal observations and discussions with landowners in the region indicate growth and moisture during the spring of 2018 were average, but summer and early fall of 2018 were dry. Fall precipitation resulted in a mild fall green-up of forage that likely benefitted mule deer nutritionally prior to the winter of 2018-2019.

## Field Data

The Rattlesnake Mule Deer Herd typically has moderate fawn production, with a long-term average of 66 fawns per 100 does. Harsh winter conditions in 2011 followed by severe drought in 2012 produced the lowest fawn ratios (in the mid-40s) in over 15 years for the herd unit. Doe/fawn licenses in Area 88 were reduced in the years to follow before being eliminated in 2015. Fawn recruitment recovered significantly in 2014-2015 with improved overwinter survival. Fawn ratios were lower in 2016, with 64 fawns per 100 does, but improved to 89 fawns per 100 does in 2017. Observed fawn ratios were close to the long-term average (68) in 2018, with 70 fawns per 100 does. While the population may be slightly above objective at this time, doe/fawn licenses for Area 88 are not yet warranted as there are no complaints of damage to agriculture from any landowners within the herd unit.

Buck ratios for the Rattlesnake Mule Deer Herd have been maintained consistently within special management parameters since 1999. As a result, hunters have developed high expectations for buck numbers and trophy quality within this herd unit. It can be difficult to maintain buck ratios over the entire herd unit, as Area 88 is managed for a low number of deer and Area 89 is managed for high mature buck ratios. Even in years when the population is below objective, higher buck ratios have been maintained by adjusting Area 89 license issuance accordingly. Postseason classification surveys yielded a buck ratio of 54 per 100 does in 2017, and consequently license issuance was increased. During 2018 surveys the buck ratio was still very high, with 53 bucks per 100 does observed. Given the continued high proportion of mature bucks surveyed in a growing population, an increase in Area 89 licenses is again warranted. An increase of 25 licenses will provide additional hunting opportunity while reducing the buck ratio within special management parameters.

Since 2008, bucks classified in Area 89 have been categorized based on antler size (Table 1). The distribution of bucks in larger antler classes (Class II & III) was very good from 2009-2011. Following the severe winter of 2010-2011, the proportion of bucks in larger antler classes dropped significantly. Since then, distribution of bucks across antler classes has fluctuated, dependent upon fawn survival and harvest pressure. In 2016, there was a higher proportion of Class I bucks. This was likely due to higher fawn survival and recruitment of a large number of young males the previous two years. Despite a buck ratio on the upper end of special management criteria, overall distribution of bucks was weighted toward smaller antler classes. In 2017, a large cohort was recruited into mature age classes, and the distribution shifted towards Class II bucks. At the same time, population size increased, the overall buck ratio exceeded special management thresholds, and accordingly license numbers were increased. In 2018 there was a higher proportion of Class I bucks observed again, similar to 2016. This shift may have been influenced more by increased harvest pressure, as the ratio of yearlings recruited from 2017 should not have been particularly high. Still, the availability of prime-age bucks should be good

over the next two to three years, and a modest increase in Type 1 licenses for the 2019 hunting season is warranted. The increase in harvest pressure should reduce buck ratios within special management criteria, provide additional hunting opportunity, and maintain a high proportion of mature bucks over the next few years.

Bio-Year	Total Class N for HA	# Bucks Classified					Buck Ratios per 100 Females					
		Ylng	Class I	Class II	Class III	Total	Ylng	Class I	Class II	Class III	All Adult	Total
2008	1,220	71	126 (74%)	40 (23%)	5 (3%)	242	11	20	6	1	27	38
2009	848	31	74 (53%)	54 (39%)	12 (9%)	171	7	17	13	3	33	40
2010	778	38	59 (54%)	45 (41%)	6 (5%)	148	9	14	11	1	26	35
2011	1,009	48	114 (62%)	61 (33%)	9 (5%)	232	9	21	11	2	34	43
2012	503	17	61 (84%)	10 (14%)	2 (3%)	90	6	22	4	1	26	32
2013	548	11	53 (74%)	18 (25%)	1 (1%)	83	4	17	6	0	24	27
2014	684	37	66 (65%)	30 (29%)	6 (6%)	139	12	22	10	2	34	46
2015	896	80	90 (69%)	38 (29%)	3 (2%)	211	20	22	9	1	28	48
2016	717	45	78 (74%)	25 (24%)	3 (2%)	151	13	22	7	1	30	42
2017	762	31	53 (39%)	78 (58%)	4 (3%)	166	10	16	24	1	42	51
2018	620	46	64 (73%)	22 (25%)	2 (2%)	134	21	29	10	1	40	61

**Table 1.** Antler classification analysis for Area 89 within the Rattlesnake Mule Deer Herd Unit, 2008-2018.

### Harvest Data

License success in this herd unit is confusing to consider at the herd unit level given the season structure and access differences between Areas 88 & 89. Harvest success in Area 88 was 47% in 2018, with 139 bucks harvested. While better than the 5-year average, this success rate is low but considered typical for a general license area with little public land access. Harvest success in Area 89 was 89% in 2018 with 158 bucks harvested, and represents the highest success rate for the hunt area since 2009. Total deer harvested also increased in both hunt areas compared to 2017, indicating availability of deer was improved in both hunt areas. This increase in harvest success and higher total deer harvested coincides with an increasing population trend. Hunter days also decreased in Area 89 from 8.5 days in 2017 to 5.8 in 2018. However, it can be difficult

to use days per animal as a reference to population trends as hunters tend to be more selective of bucks and take more time to harvest a deer. It can also be difficult to interpret hunter satisfaction at the herd unit level, as hunters in Area 89 are typically more satisfied due to low hunter crowding and better access, while Area 88 hunters are less satisfied due to higher crowding and less hunting access. Hunter satisfaction at the herd unit level did increase slightly to 72% in 2018, compared to 71% in 2017 and 66% in 2016. Despite increased license issuance, good hunter satisfaction was maintained - coinciding with an increase in population size and a high buck ratio. Managers feel this further justifies an increase in license issuance to provide additional hunting opportunity while reducing high buck ratios in the herd unit.

Tooth boxes were mailed to all hunters who successfully drew an Area 89 license in 2009, 2012, and from 2014-2018 with the goal of collecting additional demographic information from harvested deer (Table 2). Hunter participation and submission of samples was poor from 2014-2016, but improved in 2017 and 2018. Despite low participation in some years, average tooth age within the hunt area appears to be fairly steady across years, with no major declines in average or median tooth age. Average measurements for antler spread have also remained fairly constant across years, indicating consistent availability of mature bucks. Slight declines in tooth age and antler spread for 2018 indicate a larger proportion of younger bucks present in the herd. These data are corroborated by postseason classification results, which also indicated a higher proportion of Class I bucks.

	2009	2012	2014	2015	2016	2017	2018
<b>Average Tooth Age</b>	5.6	5.07	5.83	5.88	5.67	5.4	5.09
<b>Median Tooth Age</b>	5.5	4.5	6.5	5.5	5.5	5.5	4.5
<b>Average Antler Spread</b>	22	20	23	23	23	23	20
<b>Total Sample Size (N)</b>	59	37	13	8	12	20	54

**Table 2.** Hunter-submitted tooth age and antler measurement data from Area 89 deer, 2009-2018.

## Population

The 2018 postseason population estimate was approximately 5,900 mule deer and trending upward from an estimated low of 3,000 deer in 2013. The “Time-Specific Juvenile, Constant Adult Survival (TSJ,CA) spreadsheet model was selected for the postseason population estimate of this herd. Both the CJ,CA and SCJ,CA models are believed to overestimate population size. Lower constraints on juvenile survival were applied to the SCJ,CA model from 2010-2012 to match observed trends of low fawn production/survival. While the resulting population trend is more plausible than the CJ,CA model, the SCJ,CA still predicts a population that is well above objective. It is suspected the (TSJ,CA) model may also be overestimating herd size. A recent sightability survey in an adjacent mule deer herd indicates current population models have been

overestimating mule deer numbers. Managers recommend a similar abundance survey be conducted in this herd to align the model and better estimate herd size. In the mean time, managers believe the trends depicted in the TSJ,CA model are the most accurate, and harvest is conservative enough to maintain good mule deer numbers. While the AIC for the TSJ,CA model is the higher than the CJ,CA model, it is still well within one level of power compared to the both remaining models. The TSJ,CA model appears to be the best representation relative to the perceptions of managers on the ground and follows trends with license issuance and harvest success. However, because there are no additional survival or abundance data to augment the model, it is only considered to be fair in quality.

### **Management Summary**

Traditional season dates in this herd run from October 15 through October 31 for limited quota licenses in Area 89, and October 15 through October 21 for general licenses in Area 88. The same season dates will be applied to the 2019 hunting season. There will be an addition of 25 Type 1 licenses to Area 89 to provide additional hunting opportunity, as a high proportion of bucks are present in the herd. Area 88-Type 6 licenses remain unnecessary, as there are currently no concerns regarding damage and few access opportunities on private lands. The 2019 season thus includes a total of 200 Type 1 licenses in Area 89, and a general season in Area 88 for antlered mule deer or any white-tailed deer. Goals for 2019 are to manage buck ratios within special management, and increase hunter opportunity, success, and satisfaction.

If we attain the projected harvest of 330 deer with fawn production similar to the five-year average, this herd will increase slightly. The predicted 2019 postseason population size for the Rattlesnake Mule Deer Herd Unit is approximately 6,100 deer, which is 7 percent above objective.

## 2018 - JCR Evaluation Form

SPECIES: Mule Deer

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

HERD: MD759 - NORTH NATRONA

HUNT AREAS: 34

PREPARED BY: HEATHER O'BRIEN

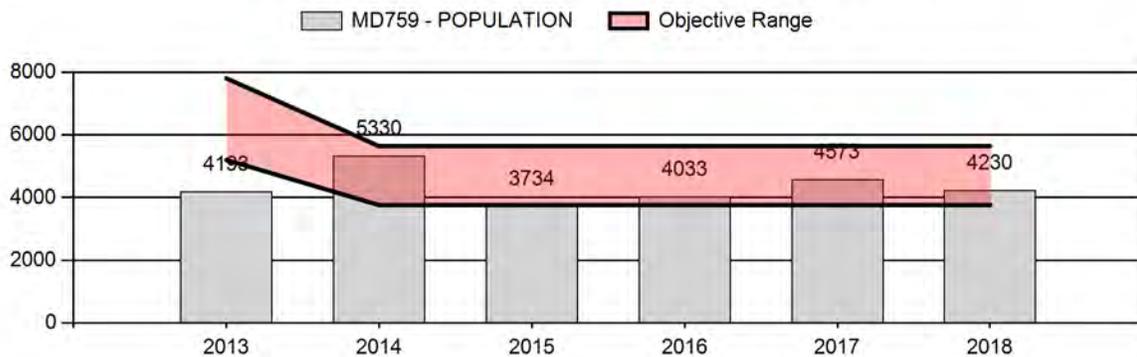
	<u>2013 - 2017 Average</u>	<u>2018</u>	<u>2019 Proposed</u>
Population:	4,373	4,230	4,492
Harvest:	149	244	275
Hunters:	185	304	340
Hunter Success:	81%	80%	81%
Active Licenses:	188	313	350
Active License Success:	79%	78%	79%
Recreation Days:	914	1,504	1,700
Days Per Animal:	6.1	6.2	6.2
Males per 100 Females	41	53	
Juveniles per 100 Females	80	54	

Population Objective (± 20%) : 4700 (3760 - 5640)  
 Management Strategy: Special  
 Percent population is above (+) or below (-) objective: -10%  
 Number of years population has been + or - objective in recent trend: 4  
 Model Date: 02/25/2019

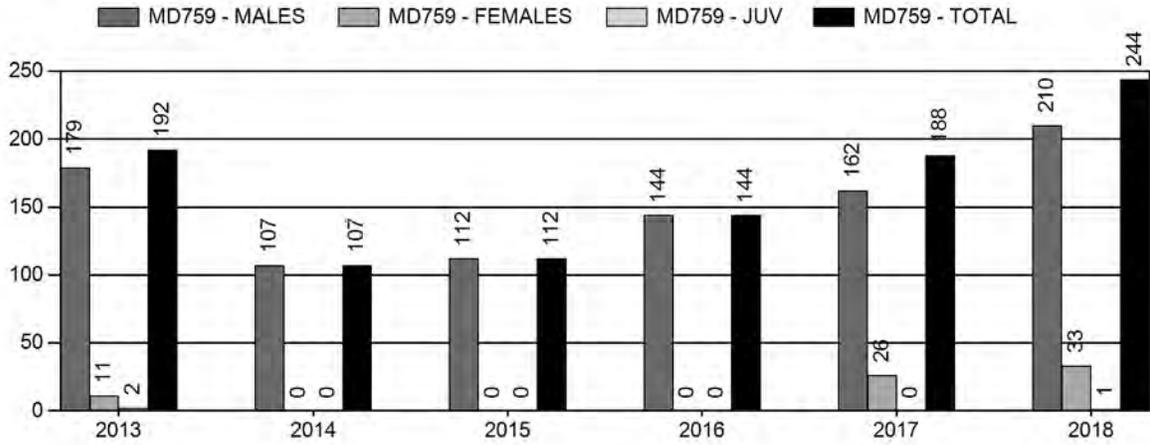
**Proposed harvest rates (percent of pre-season estimate for each sex/age group):**

	<u>JCR Year</u>	<u>Proposed</u>
Females ≥ 1 year old:	1.7%	1.9%
Males ≥ 1 year old:	17.6%	20.7%
Total:	5.4%	6.1%
Proposed change in post-season population:	-7.7%	+6.2%

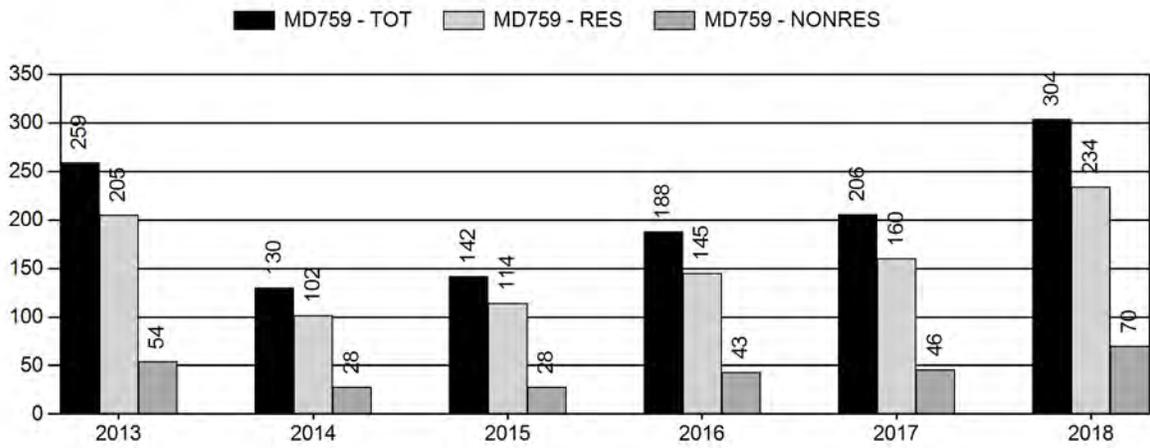
### Population Size - Postseason



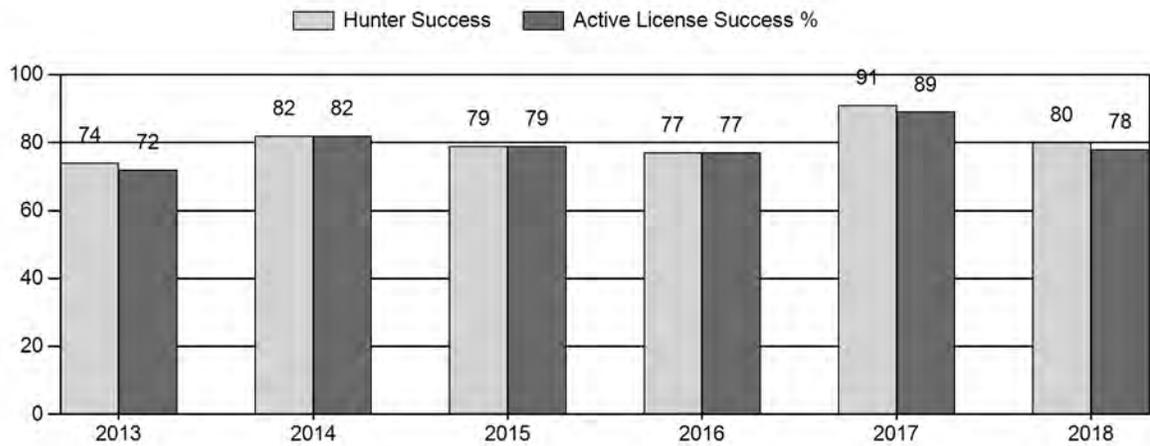
# Harvest



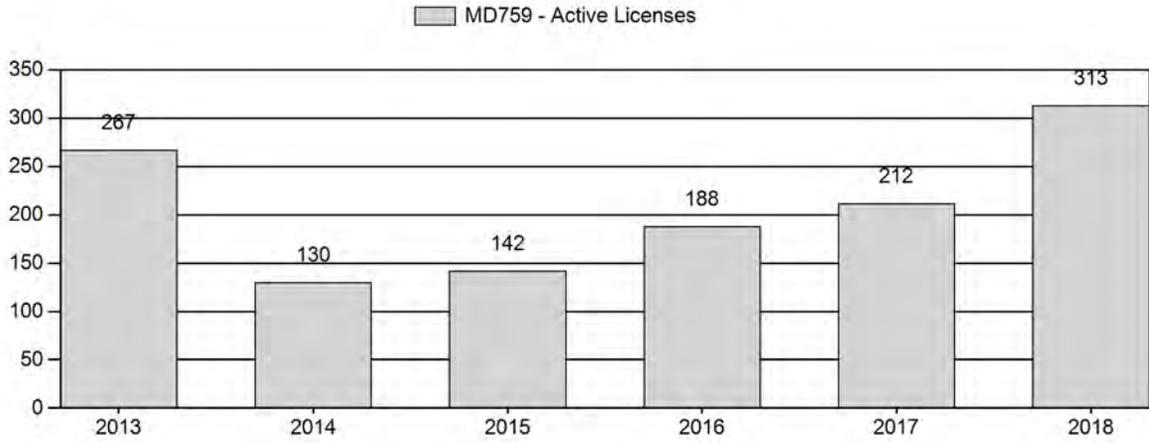
# Number of Active Licenses



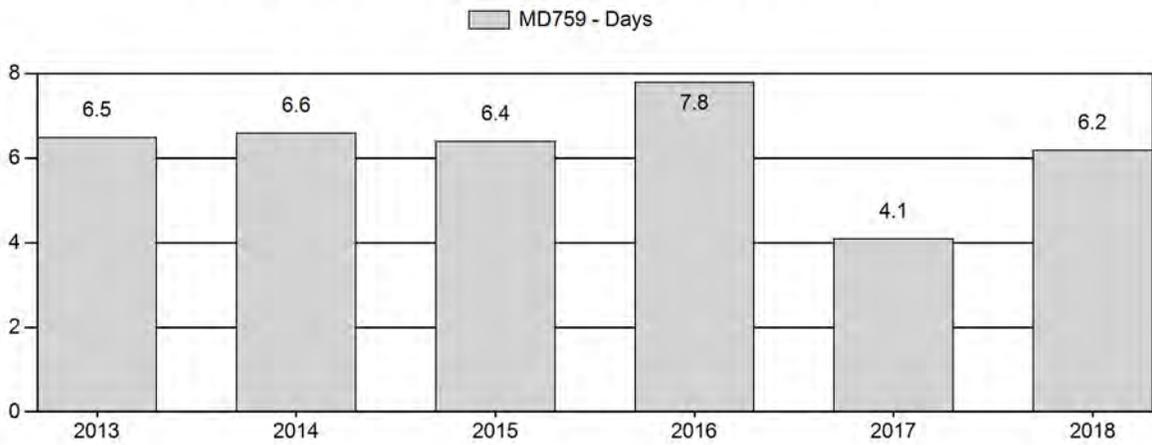
# Harvest Success



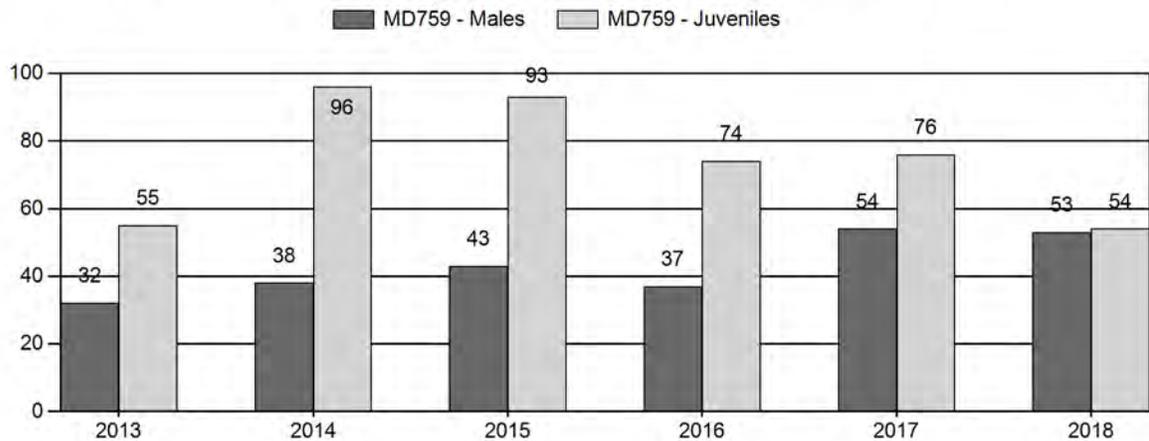
# Active Licenses



# Days per Animal Harvested



# Postseason Animals per 100 Females



### 2013 - 2018 Postseason Classification Summary

for Mule Deer Herd MD759 - NORTH NATRONA

Year	Post Pop	MALES								FEMALES		JUVENILES		Tot CIs	CIs Obj	Males to 100 Females				Young to		
		Ylg	2+ CIs	2+ CIs 1	2+ CIs 2	2+ CIs 3	UnCIs	Total	%	Total	%	Total	%			YIng	Adult	Total	Conf Int	100 Fem	Conf Int	100 Adult
2013	4,193	28	60	19	1	0	108	17%	342	54%	187	29%	637	580	8	23	32	± 4	55	± 6	42	
2014	5,330	51	84	30	2	0	167	16%	441	43%	425	41%	1,033	1,713	12	26	38	± 4	96	± 8	70	
2015	3,734	78	93	22	1	0	194	18%	452	42%	419	39%	1,065	1,236	17	26	43	± 4	93	± 7	65	
2016	4,033	68	105	36	3	0	212	18%	571	47%	425	35%	1,208	1,336	12	25	37	± 3	74	± 5	54	
2017	4,573	57	124	34	2	0	217	23%	402	44%	305	33%	924	1,113	14	40	54	± 5	76	± 7	49	
2018	4,230	56	116	17	2	0	191	26%	360	48%	194	26%	745	1,223	16	38	53	± 6	54	± 6	35	

**2019 HUNTING SEASONS  
NORTH NATRONA MULE DEER HERD (MD759)**

Hunt Area	Type	Season Dates		Quota	License	Limitations
		Opens	Closes			
34	1	Oct. 15	Oct. 31	350	Limited quota	Antlered deer
	7	Oct. 15	Dec. 15	100	Limited quota	Doe or fawn deer valid on or within one (1) mile of irrigated land
Archery		Sep. 1	Sep. 30			Refer to license type and limitations in Section 2

Hunt Area	Type	Quota change from 2018
34	1	+50
	7	+25

**Management Evaluation**

**Current Postseason Population Management Objective:** 4,700

**Management Strategy:** Special

**2018 Postseason Population Estimate:** 4,200

**2019 Proposed Postseason Population Estimate:** 4,500

**2018 Hunter Satisfaction:** 74% Satisfied, 13% Neutral, 13% Dissatisfied

The North Natrona Mule Deer Herd Unit has a postseason population management objective of 4,700 mule deer. The herd is managed using the special management strategy, with the goal of maintaining postseason buck ratios between 30-45 bucks per 100 does.

**Herd Unit Issues**

Hunting access within the herd unit is very good, with large tracts of public land as well as Walk-In Areas available for hunting. The southeastern corner of the herd unit is the only area dominated by private lands. In this area, specific doe/fawn licenses are added to address damage issues on irrigated agricultural fields in years when landowners agree to allow hunting access. The main land use within the herd unit is traditional ranching and grazing of livestock.

Industrial-scale developments, including oil and gas development, are limited and isolated within this herd unit.

The objective and management strategy were formerly reviewed in 2014. At that time, the population objective was revised from 6,500 to 4,700. For the 2019 review, we are maintaining the herd at the current objective and management strategy based on internal discussions and conversations with constituents. Population status and limited habitat data included in this document were evaluated, and a change is not warranted at this time. The herd objective will be reviewed again in 2024. If the situation arises and a change is warranted a review and proposal will be submitted as needed.

## **Weather**

From 2013 to the present, weather trends have been generally favorable, and mule deer have fared well within the herd. Range conditions were particularly good from 2013 to 2015, when spring and summer moisture improved and winters were mild. The winter of 2015 was fairly average, though some areas experienced prolonged periods of persistent snow. The spring of 2016 had above average precipitation but summer was extremely dry, causing rangeland habitats to cure early. Fortunately, precipitation in October resulted in a late surge of plant growth, which may have provided big game with a boost in nutrition going into the winter months. While there were several notable snow storms and cold snaps during the winter of 2016-2017, there were also periods of warm weather and high winds that melted and drifted snow to expose forage. The 2017 growing season was very similar to the previous year, with ample spring moisture followed by a dry summer with little precipitation. Moisture improved during the fall, though there was little snow to speak of over the winter of 2017-2018. Precipitation was below average for the 2018 growing season, and many reservoirs became dry by late summer. Sparse rain events provided some moisture during the fall months, but the 2018-2019 winter has been mild to average in the herd unit. Thus far, the region has received average snowfall combined with many windy days. Snow has melted or drifted in this region, opening habitats for mule deer to move freely on winter ranges and access forage. For detailed weather data see <http://www.ncdc.noaa.gov/gac/time-series/us>.

## **Habitat**

This herd unit has no established habitat transects to measure production and/or utilization on shrub species that are preferred browse for mule deer. Anecdotal observations during the 2018 growing season suggest range conditions were average during the spring, but became very dry by mid to late summer. Herbaceous forage species were observed to be in good condition in spring and early summer, but had cured by mid to late summer. There were no major wild land fires in the herd unit during the 2018 summer. Several precipitation events in October created a mild

green-up that likely benefitted mule deer going into winter, and mule deer appeared to be in good body condition during aerial classification surveys during late November 2018.

## **Field Data**

Following a harsh winter and severe drought in 2012, fawn survival was at a 15-year low for the herd unit. Fawn production reached a historic high of 96 per 100 does in 2014, and remained above average from 2015-2017. Fawn production was poor in 2018 by comparison, with 54 per 100 does observed during postseason surveys. Body condition of pregnant does emerging from the 2017-2018 winter may have been worse than originally thought, or summer range conditions may have been poor enough to impact lactating does and their fawns.

Buck ratios for the North Natrona Herd historically average in the mid 30s per 100 does. However, buck ratios declined in 2012-2013 to the lower cusp of special management. Yearling buck ratios were extremely poor during the same period, indicating poor recruitment and slowing the recovery of mature buck ratios. Buck ratios rebounded with a combination of reduced license issuance and improved fawn survival, and were near the upper threshold of special management by postseason 2015. From 2015-2018 the population increased and buck ratios held steady, even as license issuance was liberalized. Both harvest success and hunter satisfaction increased over the same period. By 2018 the observed buck ratio increased to 53 per 100 does, which is above special management thresholds. Although fawn ratios were poor in 2018, opportunity to harvest mature bucks is still ample. Management goals for 2019 are to reduce buck ratios within the range of special management by increasing current license opportunity.

Since 2008, classified bucks have been further categorized based on antler size (Table 1). The best distribution of mature buck classes was observed in 2010, with 46% Class I (small), 37% Class II (medium), and 18% Class III (large) bucks. Bucks classified from 2012-2018 showed a marked shift towards Class I bucks compared to previous years. It is unclear to managers why this trend has persisted, as harvest regimes have remained conservative compared to estimated herd size and buck ratios over this time period. Expectation for trophy-size bucks may be a contributing factor, as hunters apply more effort to find and harvest larger bucks while sparing smaller ones. A higher proportion of yearlings recruited to Class I may also be a contributor, though it would be more prominent in years following high observed yearling ratios. Regardless of antler class distribution, a large proportion of mature bucks are currently present in the population. With buck ratios that exceed special management parameters, managers feel an increase of Type 1 licenses is justified for the 2019 hunting season.

Bio-Year	Total Class N for HA	# Bucks Classified					Buck Ratios per 100 Females					
		Ylng	Class I	Class II	Class III	Total	Ylng	Class I	Class II	Class III	All Adult	Total
2008	1,023	59	111 (73%)	36 (24%)	5 (3%)	211	11	20	7	1	28	39
2009	1,009	51	87 (60%)	44 (31%)	13 (9%)	195	9	16	8	2	26	35
2010	905	47	55 (46%)	44 (37%)	21 (18%)	167	10	12	9	4	25	35
2011	760	52	64 (63%)	34 (33%)	4 (4%)	154	13	16	8	1	25	38
2012	868	36	91 (78%)	20 (17%)	6 (5%)	153	7	18	4	1	23	30
2013	637	28	60 (75%)	19 (24%)	1 (1%)	108	8	18	6	0	23	32
2014	1,033	51	84 (72%)	30 (26%)	2 (2%)	167	12	19	7	1	26	38
2015	1,065	78	93 (80%)	22 (19%)	1 (1%)	194	17	21	5	0	26	43
2016	1,208	68	105 (73%)	36 (25%)	3 (2%)	144	12	18	6	1	26	37
2017	924	57	124 (78%)	34 (21%)	2 (1%)	217	14	31	8	1	40	54
2018	745	56	116 (86%)	17 (13%)	2 (1%)	191	16	32	4	1	38	53

**Table 1.** Antler classification analysis for the North Natrona Mule Deer Herd Unit, 2008-2018.

### Harvest Data

Hunter success in the North Natrona Mule Deer Herd Unit is typically in the 70-80<sup>th</sup> percentile, and was 78% in 2018. A total of 244 deer were harvested, which is the highest harvest since 2011. Harvest success on doe/fawn licenses on private land in 2018 was 77%, which is down from the previous year. This suggests access on private lands may have been difficult for some, or hunter effort may have been low. Hunter days (6.8) was similar to the ten-year average (6.1). Survey totals, comments from hunters and landowners, and population modeling all indicate growth in this herd has slowed or stabilized in the past few years. Managers suspect higher license issuance in 2017 & 2018 combined with lower fawn recruitment should maintain this herd near its objective. This herd has traditionally been fairly unproductive given most mule deer occupy low elevation desert habitats, and female harvest has not been necessary to manage this herd near its objective.

Tooth age data were collected from harvested bucks in the North Natrona Mule Deer Herd Unit in 2010 and 2013-2018 (Table 2). It should be noted that changes in overall sample size between years are in part due to reductions in license issuance between sample years. Comparing data between years shows a consistency of hunter selection for mature bucks, with the average and

median age remaining within prime age classes for mule deer. Average antler spread reported by hunters has also remained quite consistent across sample years. Relatively static results for average and median age of harvested bucks suggests availability of mature bucks has remained constant due to adjustments in license issuance. These tooth-age data indicate past and current management prescription has resulted in most hunters harvesting prime-age bucks, which is consistent with management strategy.

	2010	2013	2014	2015	2016	2017	2018
<b>Average Age</b>	4.44	5.4	5.27	5.27	4.85	4.6	4.7
<b>Median Age</b>	4.5	5.5	4.5	4.5	5.5	4.5	4.5
<b>Average Antler Spread</b>	21.2	21.2	20	20.9	21.5	20.7	19.9
<b>Sample Size (N) =</b>	68	52	44	32	40	51	49

**Table 2.** Lab tooth age and antler spread data from Hunt Area 34 harvested mule deer, 2010, 2013-2018.

## Population

The 2018 postseason population estimate was approximately 4,200, which represents a decrease of approximately 300 deer since postseason 2017. No sightability or other abundance estimate data are currently available to further align the model in conjunction with postseason classification and harvest data. In the past, this herd has not typically exhibited abrupt changes in population size, as fawn production is usually moderate and habitat conditions are often fair. However, this herd appears to have grown steadily from 2012-2017, due mainly to improved fawn production and good overwinter survival. Despite significantly reduced survey effort due to time and budget constraints in 2016 -2018, managers classified high numbers of mule deer during postseason classifications. Higher densities of mule deer have also become a damage issue on irrigated farmlands in the southeast corner of the herd unit for the first time since 2011.

The “Time-Specific Juvenile – Constant Adult Survival” (TSJ,CA) spreadsheet model was chosen for the postseason population estimate of this herd. This model appears to be most representative of trends within the herd, especially during more recent years represented in the model. Modeling this herd can be difficult, as harvest regimes are biased toward bucks and the model assumes unbiased harvest across age and gender as well as consistent hunter effort. The CJ,CA and SCJ,SCA models appear to overestimate population growth the last six years, which coincides with years when doe harvest was eliminated in the herd. The TSJ,CA model selects an adult survival rate that is very reasonable for this herd, and selects low fawn survival rates in years known to have had severe winter conditions. All three models have AICs that are low and well within one magnitude of power of each other. Thus, AIC has little bearing on model

selection for this herd. The TSJ,CA model is considered to be of fair quality in representing observed population trends and estimates for this herd based on established model criteria.

### **Management Summary**

Traditional season dates in this herd run for two weeks from October 15<sup>th</sup> through October 31<sup>st</sup>. The 2019 season will offer an increase from 300 to 350 Type 1 licenses as this population appears to be near objective and buck ratios, harvest success, and hunter satisfaction were all high in 2017. Type 7 licenses were made available in 2017 and 2018 to address growing numbers of mule deer on irrigated agricultural lands in the southeast portion of the herd unit. For 2019, managers will increase these licenses to provide further opportunity for hunters and landowners to manage deer numbers. These licenses will be valid within one mile of irrigated lands to help curb potential damage issues, while conserving doe mule deer on native habitats.

If we attain the projected harvest of 275 mule deer with fawn ratios similar to a 5-year average, this herd will remain just below objective. The predicted 2019 postseason population size of the North Natrona Mule Deer Herd is approximately 4,500 animals, or 4% below objective.