

2015 - JCR Evaluation Form

SPECIES: EIk

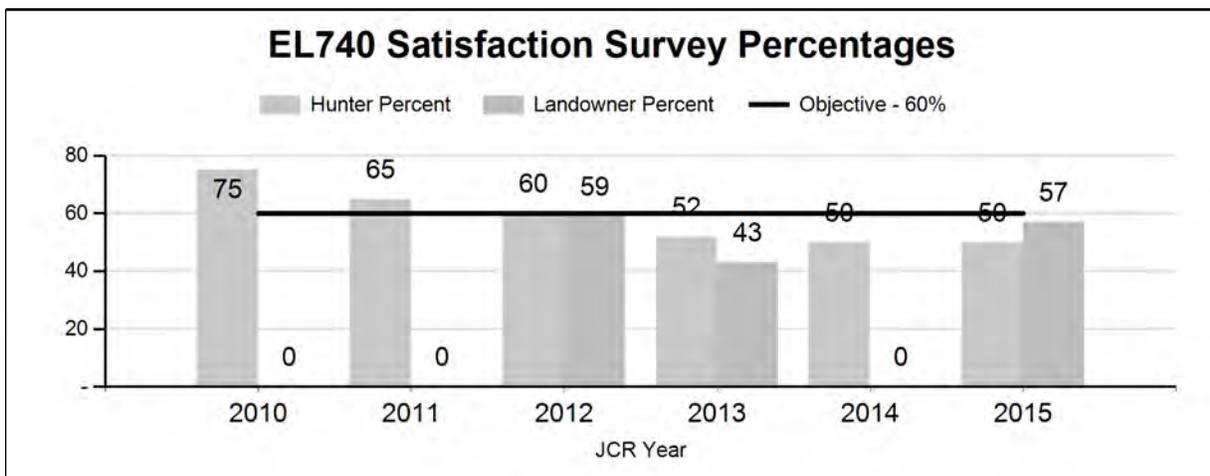
PERIOD: 6/1/2015 - 5/31/2016

HERD: EL740 - BLACK HILLS

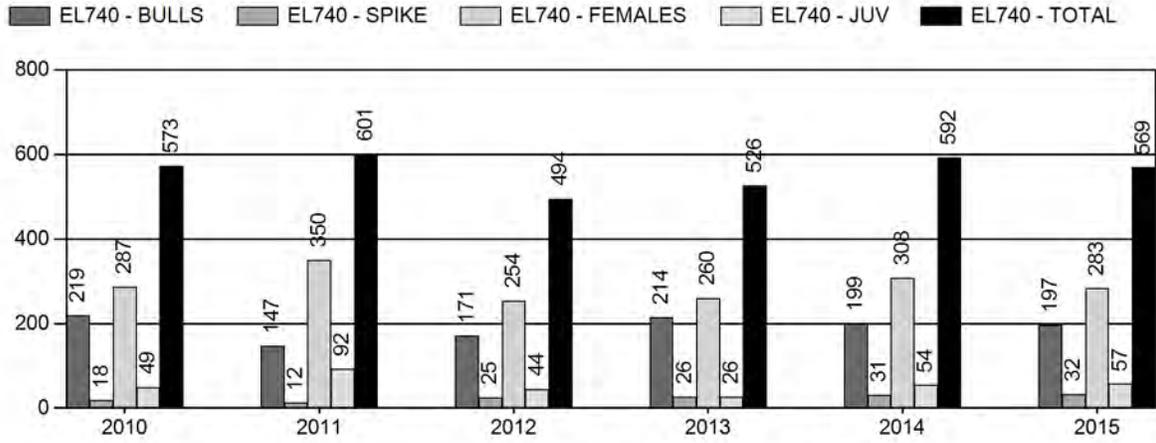
HUNT AREAS: 1, 116-117

PREPARED BY: JOE SANDRINI

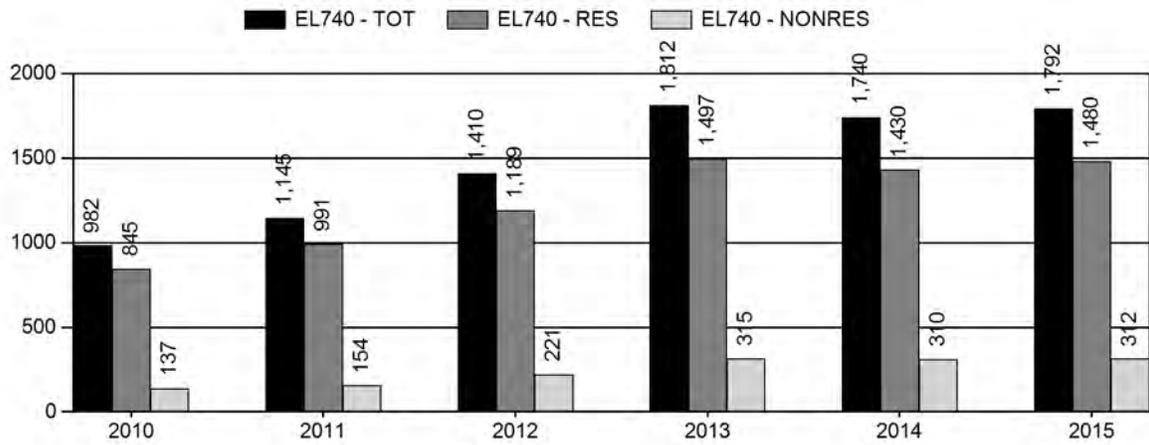
	<u>2010 - 2014 Average</u>	<u>2015</u>	<u>2016 Proposed</u>
Hunter Satisfaction Percent	58%	50%	60%
Landowner Satisfaction Percent	55%	57%	60%
Harvest:	557	569	565
Hunters:	1,418	1,792	1,775
Hunter Success:	39%	32%	32%
Active Licenses:	1,487	1,900	1,890
Active License Success:	37%	30%	30%
Recreation Days:	15,376	19,833	18,900
Days Per Animal:	27.6	34.9	33.5
Males per 100 Females:	29	0	
Juveniles per 100 Females	33	0	
Satisfaction Based Objective			60%
Management Strategy:			Private Land
Percent population is above (+) or (-) objective:			-6%
Number of years population has been + or - objective in recent trend:			3



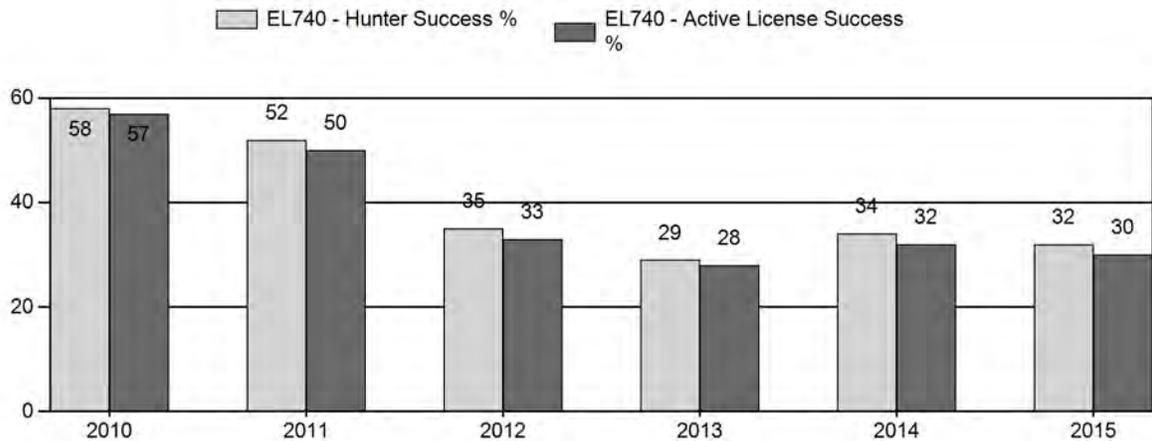
Harvest



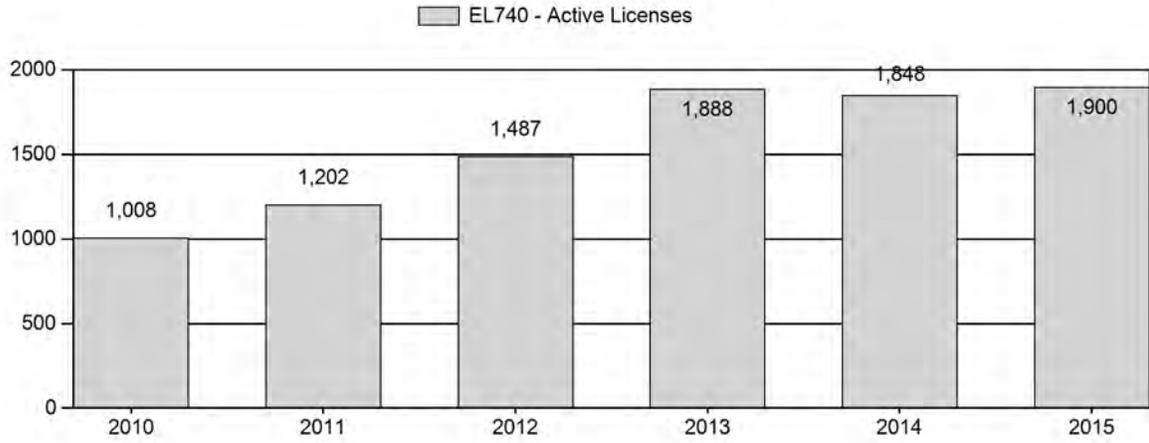
Number of Hunters



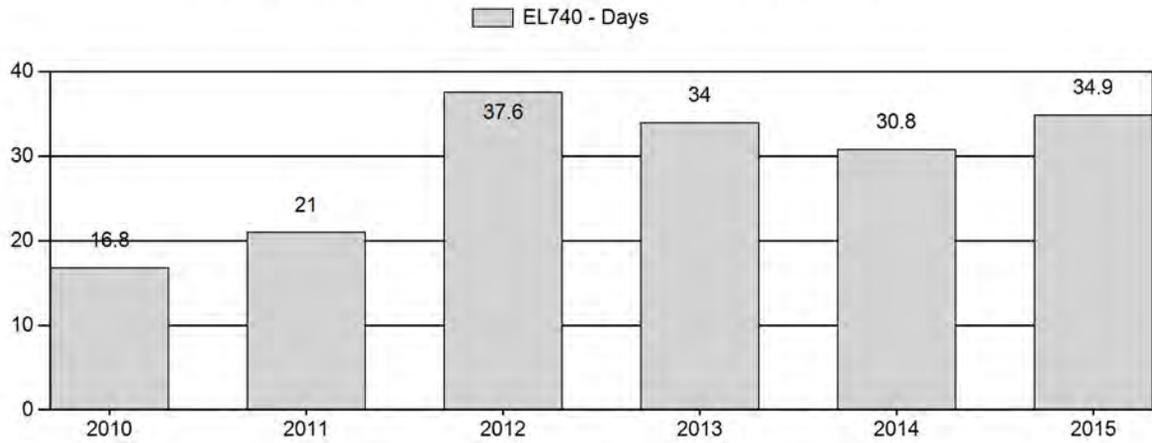
Harvest Success



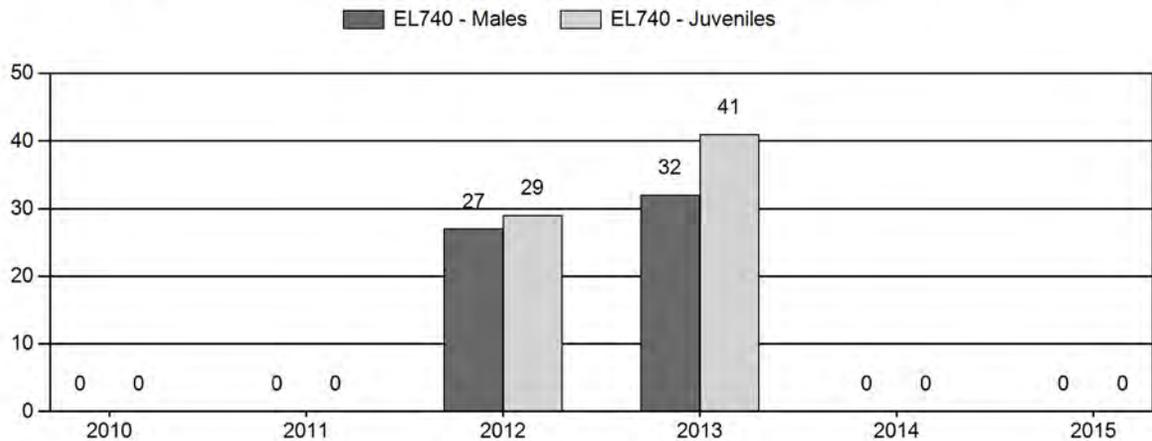
Active Licenses



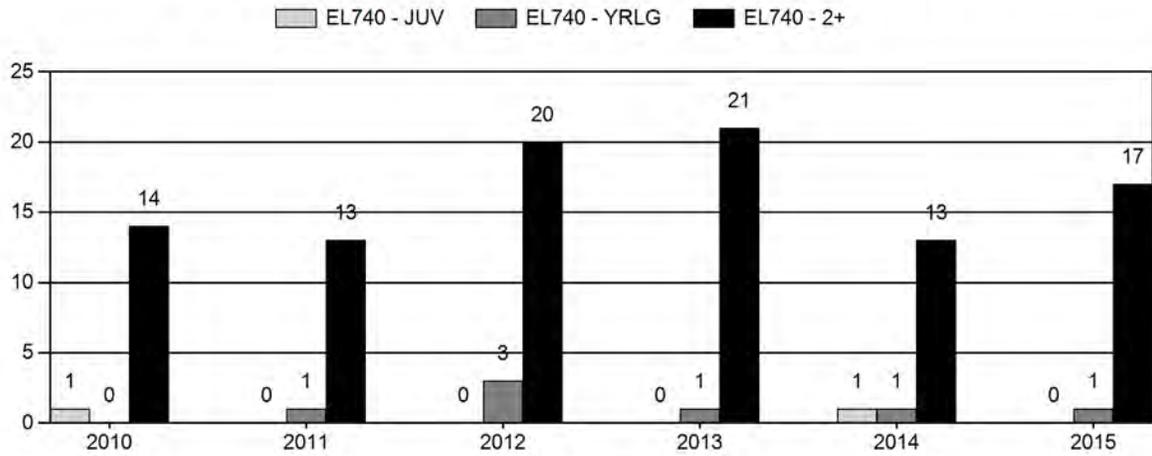
Days per Animal Harvested



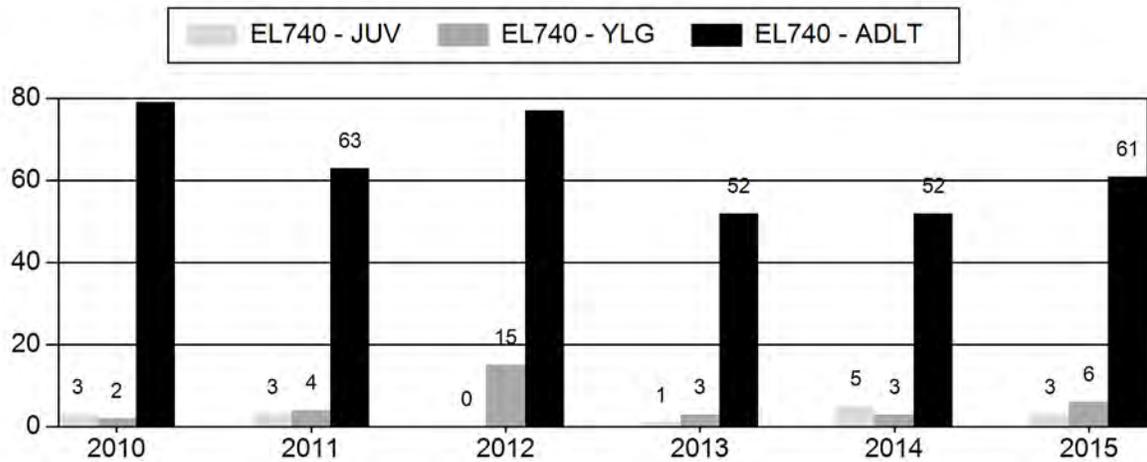
Postseason Animals per 100 Females



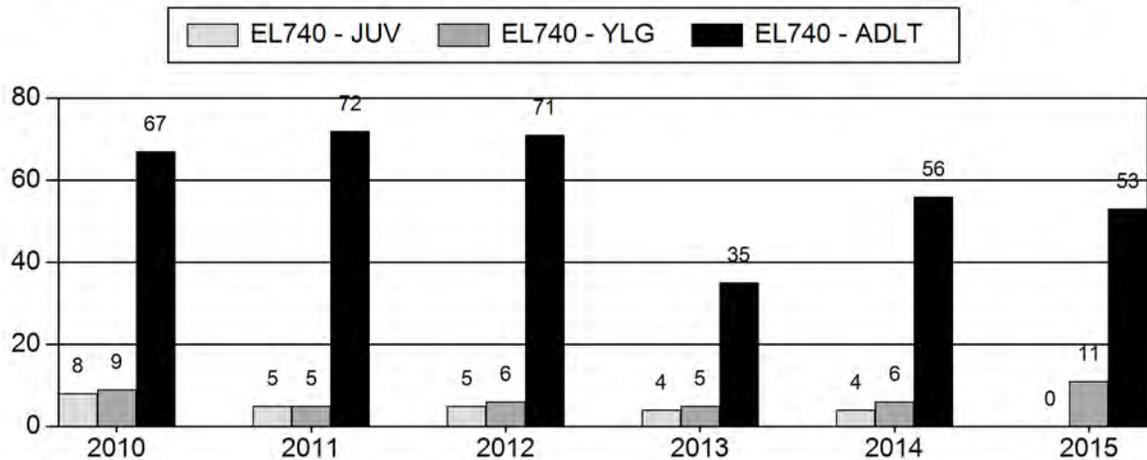
Age Structure of Field Checked Males



Age Structure Data (Field and Laboratory) - Male



Age Structure Data (Field and Laboratory) - Female



2010 - 2015 Postseason Classification Summary

for Elk Herd EL740 - BLACK HILLS

Year	Post Pop	MALES				FEMALES		JUVENILES		Tot CIs	Cls Obj	Males to 100 Females				Young to		
		Ylg	Adult	Total	%	Total	%	Total	%			Ylg	Adult	Total	Conf Int	100 Fem	Conf Int	100 Adult
2010	0	0	0	0	0%	0	0%	0	0%	0	0	0	0	0	± 0	0	± 0	0
2011	0	0	0	0	0%	0	0%	0	0%	0	0	0	0	0	± 0	0	± 0	0
2012	0	32	32	64	17%	239	64%	69	19%	372	0	13	13	27	± 0	29	± 0	23
2013	0	19	24	43	19%	133	58%	54	23%	230	0	14	18	32	± 0	41	± 0	31
2014	0	0	0	0	0%	0	0%	0	0%	0	0	0	0	0	± 0	0	± 0	0
2015	0	0	0	0	0%	0	0%	0	0%	0	0	0	0	0	± 0	0	± 0	0

**2016 HUNTING SEASONS
BLACK HILLS ELK HERD (EL740)**

Hunt Area	Type	Season Dates		Quota	License	Limitations
		Opens	Closes			
1	1	Oct. 15	Nov. 30	100	Limited quota	Any elk
1	4	Oct. 15	Nov. 30	75	Limited quota	Antlerless elk
116		Oct. 15	Nov. 10		General	Any elk
116		Nov. 11	Nov. 30		General	Antlerless elk
116	6	Oct. 15	Jan. 31	250	Limited quota	Cow or calf
116	8	Aug. 15	Oct. 14	50	Limited quota	Cow or calf valid off national forest
117	1	Oct. 15	Nov. 30	275	Limited quota	Any elk
117	1	Dec. 1	Jan. 31			Antlerless elk
117	4	Oct. 15	Jan. 31	250	Limited quota	Antlerless elk
117	6	Oct. 15	Jan. 31	250	Limited quota	Cow or calf
117	8	Aug. 15	Oct. 14	50	Limited quota	Cow or calf valid off national forest

Special Archery Season Hunt Areas	Season Dates	
	Opens	Closes
1, 116, 117	Sep. 1	Sep. 30

SUMMARY OF CHANGES IN LICENSE NUMBER

Hunt Area	Type	Change from 2015
Herd Unit Totals	1	none
	4	none
	6	none
	8	none

Management Evaluation

Current Hunter/Landowner Satisfaction Management Objective: 60% landowner & hunter

Management Strategy: Private Land

Secondary Management Strategy: Age distribution of harvested bulls

2015 Hunter Satisfaction Estimate: 50%

2015 Landowner Satisfaction Estimate: 57%

Most Recent 3-year Running Average Hunter Satisfaction Estimate: 51%

Most Recent 3-year Running Average Landowner Satisfaction Estimate¹: 50%

2015 Postseason Population Estimate: ~ 2,500 (*Field Estimate*)

2016 Proposed Postseason Population Estimate: ~ 2,500 (*Field Estimate*)

HERD UNIT ISSUES: The Black Hills Elk Herd Unit is managed for 60% or greater self reported landowner and hunter satisfaction. The management strategy is private land, with a secondary management objective seeking an annual bull harvest (based upon tooth age data) comprised of 20% aged ½ to 2 years old; 60% aged 3 to 5 years old; and 20% aged 6 years old, or older ($\pm 5\%$ in all categories). These management objectives and strategies were adopted in 2013. Field personnel anecdotally estimated Wyoming's Black Hills elk population to number about 2,500 at the close of the 2015 hunting season.

It is neither possible to construct a population model, nor generate a population estimate for this herd as the Department has never been able to collect adequate classification data. Additionally, historic and more recent radio collar data show substantial numbers of elk regularly cross the Wyoming / South Dakota Stateline violating the closed population assumption of models (Simpson, 2015). Consequently, no attempts have been made to model this population since 1996. Instead, this herd was managed in an ad hoc fashion for two decades to provide ample recreational opportunity and address depredation complaints, as active elk management has been continually hampered due to constrained access to private land for hunting. As a result, the aforementioned non-numerical management objectives were adopted.

The Black Hills Elk Herd Unit is comprised of Hunt Areas (HA's) 1, 116, & 117. It is located in the northeast corner of Wyoming and encompasses approximately 3,270 mi², of which 1,920 mi² are considered occupied habitat. Elk are not ubiquitous across occupied habitat either in time or space. Rather, they move about in relation to range conditions, snow depth and human activity, with some areas seeing regular elk use and others very infrequent use. Approximately 73% of the occupied habitat is private land, with the single largest block of public land being found on the Black Hills National Forest (BHNF), which contributes 14% of the occupied habitat. HA 1 is 95% public land, and represents the largest contiguous block of public land extensively inhabited by elk. Elk do occur on other portions of the Black Hills National Forest and dispersed sections of State and other federally owned lands. However, elk use and harvest in those areas are not consistent.

¹ Includes only data for bio-years 2013 & 2015 (see notes in text regarding 2013 value).

The adopted management framework for this herd states all landowners receiving landowner elk licenses and other landowners whose property see regular elk use, or have expressed an interest in elk management will receive a mail survey with prepaid response envelopes every three years; and annual, documented one on one visits (or an annual meeting with “key” landowners) will be conducted on non-survey years.² Landowner satisfaction with elk numbers was first quantified in the early spring of 2013 with the proposal to move to a non-numerical objective. At that time, 167 Black Hills landowners were mailed a short survey to gauge their satisfaction with elk numbers and quantify support for a non-numerical objective. A total of 71 landowners responded, and slightly more than 60% of these noted they were satisfied, very satisfied, or neutral with respect to elk numbers in the Black Hills. During bio-year 2013, 30 large landowners who regularly harbor elk, allow some level of hunting and often experience conflict with elk were individually contacted. 48% of these landowners reported being satisfied or very satisfied; one landowner reported “no opinion” - neutral responses were not solicited.

The criteria used to gauge landowner satisfaction were formalized in bio-year 2014 by Wildlife Division Administration when it was deemed landowners reporting elk numbers to be “at, or about at” desired levels were to be considered satisfied, while those reporting numbers to be above or below desired levels characterized as unsatisfied. As such, survey results for bio-years 2012 and 2013 were reanalyzed using these criteria where they could be teased from the responses collected. Consequently, the recorded satisfaction values were changed to 59% and 43% for bio-years 2012 and 2013, respectively. Unfortunately, due to the timing of survey efforts and administrative direction regarding satisfaction measurement criteria, no landowner satisfaction survey data meeting the revised standards were collected in bio-year 2014.

At the beginning of 2016, a mail survey was again sent to 167 landowners. Eighteen surveys were returned “undeliverable” and 75 completed surveys were received yielding an effective response rate of 50%. Of the responding landowners, 19% reported elk numbers were below, 56% at, and 25% above desired levels. However, when specifically asked about satisfaction, 44% reported being satisfied or very satisfied, 21% neutral, and 37% dissatisfied or very dissatisfied.³ The reasons for dissatisfaction were: 44% felt elk numbers were “too low;” 22% thought elk numbers were “too high;” another 15% indicated elk causing damage (or a combination of damage and too many elk); and 11% indicated “other” reasons for dissatisfaction, such as not qualifying for landowner licenses. The majority of neutral respondents (60%) stated they had no strong feelings about elk numbers, and 33% were “happy the way things are,” while the remaining 7% were “unsure.” In summary, 64% of survey respondents were not specifically dissatisfied with elk numbers or management. Something that suggests we are closer to our management objective than the Department mandated satisfaction criteria indicate.

Landowner survey data demonstrate how difficult it is to broadly quantify landowner satisfaction in the Black Hills. Most of the properties are relatively small by typical Wyoming ranch standards, and many are not dependent on agriculture for profit. A significant portion of these of landowners enjoy having elk around and would like to see more, as would other non-traditional landowners who have purchased property for hunting. On the other hand, there are traditional

² See “Final Black Hills Herd Unit and Population Review” adopted by the Dept. and Commission in 2013.

³ Reported values rounded.

ranching landowners negatively impacted by elk and frustrated with the damage they cause. As such, these two contingents are diametrically opposed in what they desire in the way of elk numbers. The end result is conflict between the disparate positions, with both contributing to dissatisfaction.

In the normal course of duties, Department field personnel contact landowners on an almost daily basis. While these visits were not used to quantify satisfaction criteria during bio-years 2014 and 2015, consistently strong feelings relative to changing elk management have not been expressed. Occasional complaints about elk numbers were received from some landowners experiencing damage. However, no elk damage claims were made in the Moorcroft game warden district; while two claims were submitted in the Sundance district, resulting in payments totaling about \$2,100.00 for damage to growing alfalfa and wheat. In the Newcastle game warden district, a total of approximately \$7,400.00 was paid to two claimants for elk damage to growing crops. One of these was a continuation of previous, similar claims spawned in retaliation for law enforcement actions, and the other was to a landowner who also submitted one of the claims in the Sundance district. Overall, field personnel report ambivalence among the majority of landowners regarding elk management over the past two years, with some noting occasional conflicts and dissatisfaction with elk numbers, while others expressed real satisfaction with numbers or even a desire for more elk. To sum it up, the Department did not get consistent, serious complaints from landowners about the elk numbers or season structure. Given landownership patterns and cultural attitudes, annual damage claims will likely persist. However, with elk moving onto un-hunted private land adjacent to areas of depredation or into South Dakota, the situation is likely to remain unchanged no matter what is done to alter hunting season structure.

WEATHER: For the most part, winter weather and growing season conditions over most of the past decade seemed to have been neither detrimental, nor beneficial for Black Hills elk; but did result in occasional, localized depredation complaints in late December and early January some years. Severe drought did plague the Black Hills in 2012, and this resulted in very poor forage production and the led to several large wildfires. These warm and dry conditions continued through the 2012-13 winter. Spring of 2013 finally saw a break in this pattern when temperatures dropped below normal and good precipitation was again received. As the growing season progressed, temperatures were above average and precipitation well above normal. This same pattern was basically followed in 2014 and 2015, resulting in good to excellent forage growth each year. Fall and winter weather over the 2013-2015 timeframe was characterized by normal to above average temperatures, and average to below normal precipitation (<http://www.ncdc.noaa.gov/cag/>).

Based upon weather and habitat conditions observed over the past eight years, elk have likely entered most winters in good condition, except following the summer drought of 2012. Impacts of drought that year were revealed in data collected from radio collared cow elk along the Wyoming / South Dakota Stateline showing calf survival was lower in 2012 (0.65, $n = 37$, $SE = 0.04$) compared to 2013 (0.76, $n = 34$, $SE = 0.08$); and pregnancy rates of cow elk were significantly reduced in 2013 compared to 2012 [0.93 ($n=40$) in 2012 and 0.66 ($n=43$) in 2013] (Simpson, 2015). In summary, recent weather patterns have been generally favorable for elk.

However, fluctuations in weather patterns such as the 2012 drought and a few significant snow events have likely impacted herd demographics and exacerbated damage at times.

HABITAT: The Black Hills is the western most extension of many eastern plant species. These species are often found mixed with more typical western plants and provide a variety of habitats used by elk. Ponderosa pine (*Pinus ponderosa*) is the predominant overstory species. There are scattered patches of quaking aspen (*Populus tremuloides*), paper birch (*Betula papyrifera*), bur oak (*Quercus macrocarpa*), and mountain mahogany (*Cercocarpus montanus*). Many of these stands are in late successional stages. Important shrubs include Saskatoon serviceberry (*Amelanchier alnifolia*), Oregon grape (*Berberis repens*), common chokecherry (*Prunus virginiana*), and wild spiraea (*Spiraea betulifolia*). Since 2000, wildfires in both Wyoming and South Dakota have burned well over 10% of the BHNH and significant amounts of private land in this ecosystem. These fires have been beneficial for elk by creating early successional plant communities and increasing available forage. However, there are no habitat evaluation or vegetation surveys located within this herd unit related to elk forage or cover.

Elk habitat quantity and quality are thought to be good, but security areas may be impacted or lacking in areas due to high road densities. These road densities, along with vast tracts of commercially thinned ponderosa pine stands, do not provide what is usually considered classic, good elk habitat. Despite the lack of security cover in areas and numerous roads, the elk population significantly expanded through the 1990's and into the early years of the next decade. Several factors benefited this population. First, herbaceous forage is abundant, and wildfires have increased available forage. Second, despite high road densities, much of the land inhabited by elk is privately owned. This private land has lower road densities and experiences limited human activity. Many of these same private land areas provide elk refuge from hunting pressure during the fall. Also benefiting the situation, in 2010 the BHNH increased the number of road closures when they adopted a new travel management plan.

FIELD DATA: Collection of classification data was suspended in 1996, and only occasionally have limited classification data been garnered during other field activities. The limited data that have been collected over the years have generally mirrored larger samples collected in the Black Hills of South Dakota by SDGF&P. SDGF&P collects preseason classification data on elk every year, and since 2003 these data consistently yielded calf:cow ratios near 50:100, but more variable bull:cow ratios, which have averaged near 30:100 (South Dakota Department of Game, Fish and Parks, 2015). In 2015, no specific efforts were made by the WGFD to classify elk. However, the WGFD did partially fund SDGF&P's helicopter based late winter, hills-wide elk survey and population estimation efforts. This funding was used pay for SDGF&P's efforts that covered good portion of the occupied habitat south of Interstate Highway 90 (I-90) in Wyoming's HA's 1 & 117. This work detected a total of 923 elk in the portion of Wyoming surveyed. Of the elk observed, SDGF&P personnel were able to classify 516 (262 cows, 52 calves, and 202 bulls). The 407 unclassified elk were primarily large groups of cows and calves. SDGF&P also provided a population estimate of 1,091 elk with a 95% confidence interval of 988 to 1,521 in the portion of Wyoming they surveyed. It is hoped the data collected can eventually be used in future years to regularly estimate elk numbers in that portion of Wyoming south of I-90 harboring wintering elk, or at least provide good trend data.

While classification data are lacking, tooth age data have been collected from harvested elk most years since 1987.⁴ Tooth age data can estimate annual recruitment by considering the percentage of yearlings in the female segment of the harvest (Figure 1). Since 1987, this figure has averaged⁵ 16.2% (std. dev. 7.8%) suggesting annually between 8 and 24 yearling cows (and about the same number of yearling bulls) are added per 100 adult cows into this population. However, recruitment of yearling elk appears to have declined after 2000. Between 1987 and 1999, as this herd grew rapidly, older age classes of female elk were well distributed throughout the harvest and there was an increasing percentage of yearling cows represented in the harvest. This trend reversed itself beginning in 2000 (Figure 1). A Student's T-Test indicates yearling recruitment was significantly higher between 1987 and 1999 when there were an average of 20% yearlings in the female harvest, versus an average of 11% after 2000 ($p=0.0003$).⁶ Since 2000, with significantly increased license issuance and extended hunting seasons, there has been a general increase in the percentage of harvested female elk over age 5 and a decline in the percentage of young (≤ 2 years old) females taken, while the relative percentage of mid-aged cows has remained fairly stable (Figure 2). This trend by and large has continued until this past year when the percentage of yearling cows in the female harvest jumped to 19% and the relative percentage of older cows (6^+ years old) dropped. Similarly, the yearling buck:doe ratios of the deer herds in the Black Hills increased significantly in 2015 following excellent fawn production in 2014 and very high survival into 2015. Something similar might be inferred with regards to yearling recruitment into this elk population as well.

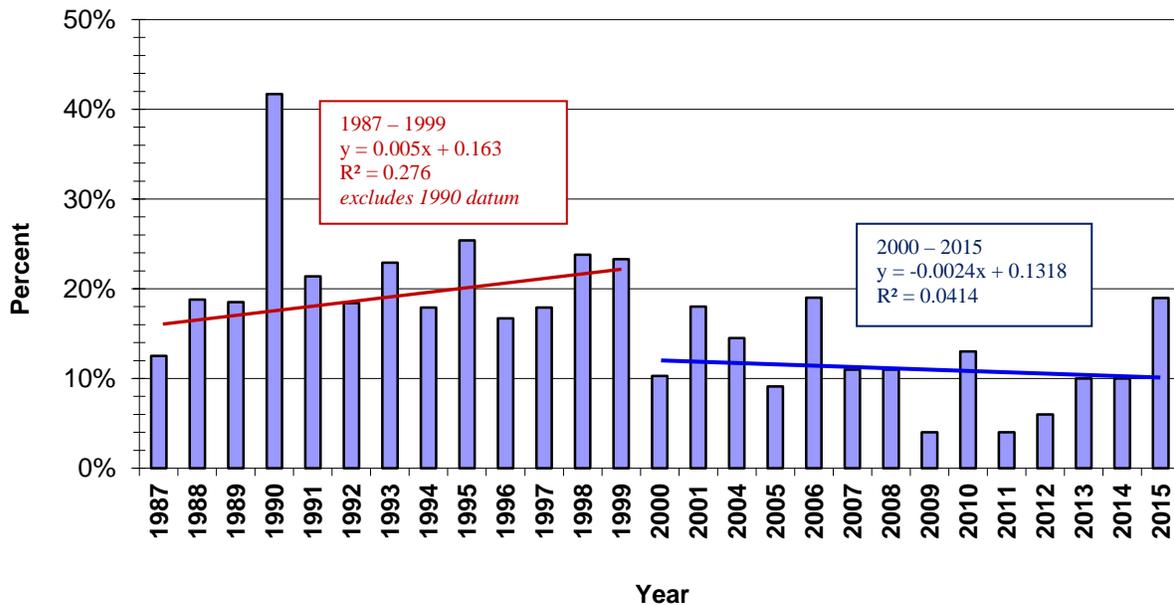


Figure 1. Percentage of yearlings in the female segment of the elk harvest (1987 – 2015).

⁴ Budgetary constraints prevented tooth age data collection in 2002 & 2003.

⁵ Omitting 1990 data reduces this average to 15.3% with a std. dev. 6.1%.

⁶ Including 1990 data in T-test yields a significant difference ($P=0.0006$) with $Mean_{(1987-1990)}$ of 22%.

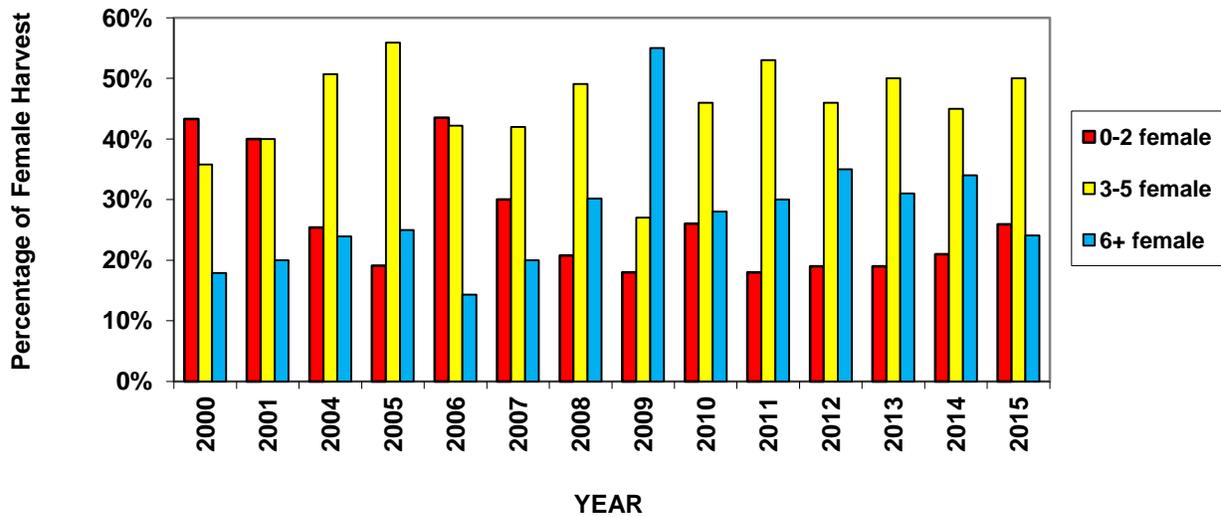


Figure 2. Relative percentages of various age classes of female elk harvested (2000 – 2015).

Of course there is greater hunter selectivity when it comes to take of bulls. Between 2000 and about 2009, tooth age data seem to suggest a bit of a decline in the relative percentages of both middle-aged (3-5 year old) and young (≤ 2 years old) males in the bull harvest, with a slight increase in the percentage of older bulls (6^+ years old) harvested (Figure 3). However, since then this trend may have reversed itself as it appears a greater proportion of younger bulls (≤ 5 years old) have been harvested more recently (Figure 3). Over the past 10 years, Type 1 license success has averaged about 60% in HA 117, where the bulk of the tooth age data are returned, while antlerless hunter success has generally increased. Taken with changes in any elk versus antlerless elk license issuance until a couple of years ago, it makes sense that we have impacted the antlerless segment of the herd more than the bull segment. Something also reflected in the increasing percentage of female elk in the total harvest. If this population has stabilized or is declining and average recruitment dropped, one would expect to see an increase in the percentage of younger aged bulls harvested, as availability of older bulls declines.

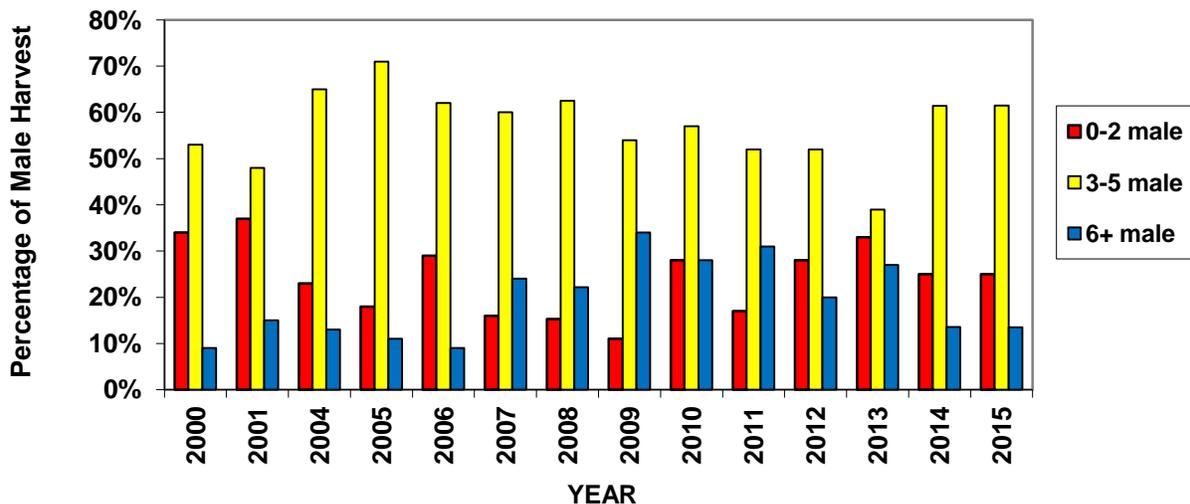


Figure 3. Relative percentages of various age classes of male elk harvested (2000 – 2015).

It does appear we may be shifting harvest pressure on to younger-aged bulls (Figure 3 & Table 1). If these recent trends continue, our ability to meet our secondary objective may become difficult without reductions in Type 1 license issuance.

Segment of Bull Harvest	Objective	2013	2014	2015
Bulls 0-2 yrs. old	20%	33%	25%	24%
		3 yr. mean		27%
Bulls 3-5 yrs. old	60%	39%	61%	63%
		3 yr. mean		55%
Bulls 6+ yrs. old	20%	27%	14%	13%
		3 yr. mean		18%

Table 1. Secondary management objective, relative distribution of ages of harvested bulls

HARVEST: The low percentage of yearling females present in the harvest between 2000 and 2014 suggests reduced recruitment, as does the fact elk have not been pioneering into unoccupied habitats as they once were. However, over the years the bulk of tooth age data have been returned from HA 1 and 117, therefore any decrease in recruitment should only be ascribed to that segment of the herd. It does seem harvest rates adequate to manage elk numbers may be achieved some years south of I-90, but poor success by hunters pursuing female elk in HA 116 is likely allowing that portion of the herd to grow. Conservative elk management at times in South Dakota and interstate elk movement further confound our ability to make herd-wide judgments relative to current harvest level’s capacity to manage elk numbers.

Elk harvest bounced back to predicted levels in 2014, as weather conditions allowed hunters easier access to elk compared to 2013 when access to elk was severely hindered by winter storm “Atlas.” We believe the approximately 25% relative increase in hunter success in 2014 compared to 2013 was due more this storm effect than any changes in elk number. Notably, in 2015 with the same hunting season structure in place as the previous two years, total harvest fell midway between that experienced in 2013 and 2014. Field personnel also reported that hunters seemed to struggle a bit more to find and harvest elk in 2015.

At the herd unit level, elk hunter success is highly correlated with reported hunter satisfaction (~84% in 2015, and over 90% in some previous years). Beginning in 2013, HA 116 moved from limited quota license hunting to a liberal general license season combined with a significant number of reduced priced cow/calf licenses, which have never sold out through the regular license draw. Due to very limited access to elk hunting on private land, this has resulted in a large number of license holders hunting the BHNF north of Sundance where few elk reside or are harvested. Consequently, since 2013 hunter success on general licenses has been low, averaging only 15% (std. dev. 1.5%); while active license success on cow/calf licenses has averaged only ~31% (std. dev. 10%) and that of total active licenses ~26% (std. dev. 12%). These poor success

rates are reflected in low hunter satisfaction in HA 116, where it has averaged 43% during this same timeframe. That figure biases the herd unit hunter satisfaction numbers low, since an average of 55% of the hunters at the herd unit level are sampled each year from HA 116. In contrast, since 2013, hunter satisfaction in HA 1 and HA 117 has averaged 65% and 58%, respectively.

Given an average annual recruitment of 30 yearling elk per 100 cows (based upon 15% yearling cows in total cow elk harvest) and assuming a pre-season herd composition of 40 bulls per 100 cows and 47 calves per 100 cows (SDGF&P long-term data), the 2015 estimated harvest of 512 adult elk would have removed the annual recruitment of yearlings from a total population of just under 3,200 elk. Alternatively, if the value of 19% cow harvest being yearlings found in 2015 is used in these same calculations, the 2015 harvest of adult elk would only have been sufficient to control the growth of a herd of about 2,500 elk. Thus, (based upon our anecdotal population estimate of 2,500) the 2015 harvest should have about kept the estimated number of elk in this herd at its current level. However, several hundred elk (perhaps nearly 1,000 head) regularly cross the Stateline and winter in South Dakota making it difficult to determine the net effect harvest is having on our post-season population.

POPULATION: Despite the lack of a population estimate, indications are elk numbers increased quite a bit between 1990 and 2010 as elk significantly expanded their distribution. Silvicultural practices and wildfires throughout the region have also created habitat favorable for elk. Although habitat changes have continued to favor elk in recent years, elk have not continued to pioneer into previously unoccupied areas. Harvest statistics and tooth age data suggest population growth may have been curbed recently, at least south of I-90. But, it is likely improved reproduction and survival since 2014 may have allowed this sub-population to grow. Given the high quality habitat in the region and limited access to hunt elk on private land, this herd will likely continue to exhibit growth in areas where access constraints thwarts efforts to obtain adequate harvest.

MANAGEMENT SUMMARY: Changes implemented to the 2013 Black Hills elk hunting season included expanding HA 116 to include all of the lands within Wyoming's Black Hills ecosystem previously enrolled in HA 129, and hunting this area under a combination of General and Type 6 and 8 cow/calf licenses. Also, because hunter success and satisfaction had dropped south of I-90, issuance of all license types in HA 1 and HA 117 were reduced as well. It is also important to note that contacts with landowners in 2014 indicated 82% of them did not want a change in license numbers, and several expressed dissatisfaction with the long hunting season. This statistic bears out the fact that while some traditional landowners complain about elk numbers, few are willing to allow hunting at the levels needed to significantly reduce this population. As a result, no changes to the hunting season structure have been implemented since 2013. This strategy seems to be reducing or holding elk numbers in check where there is adequate access for hunting, but may be allowing sub-herds to grow in areas without adequate hunter access.

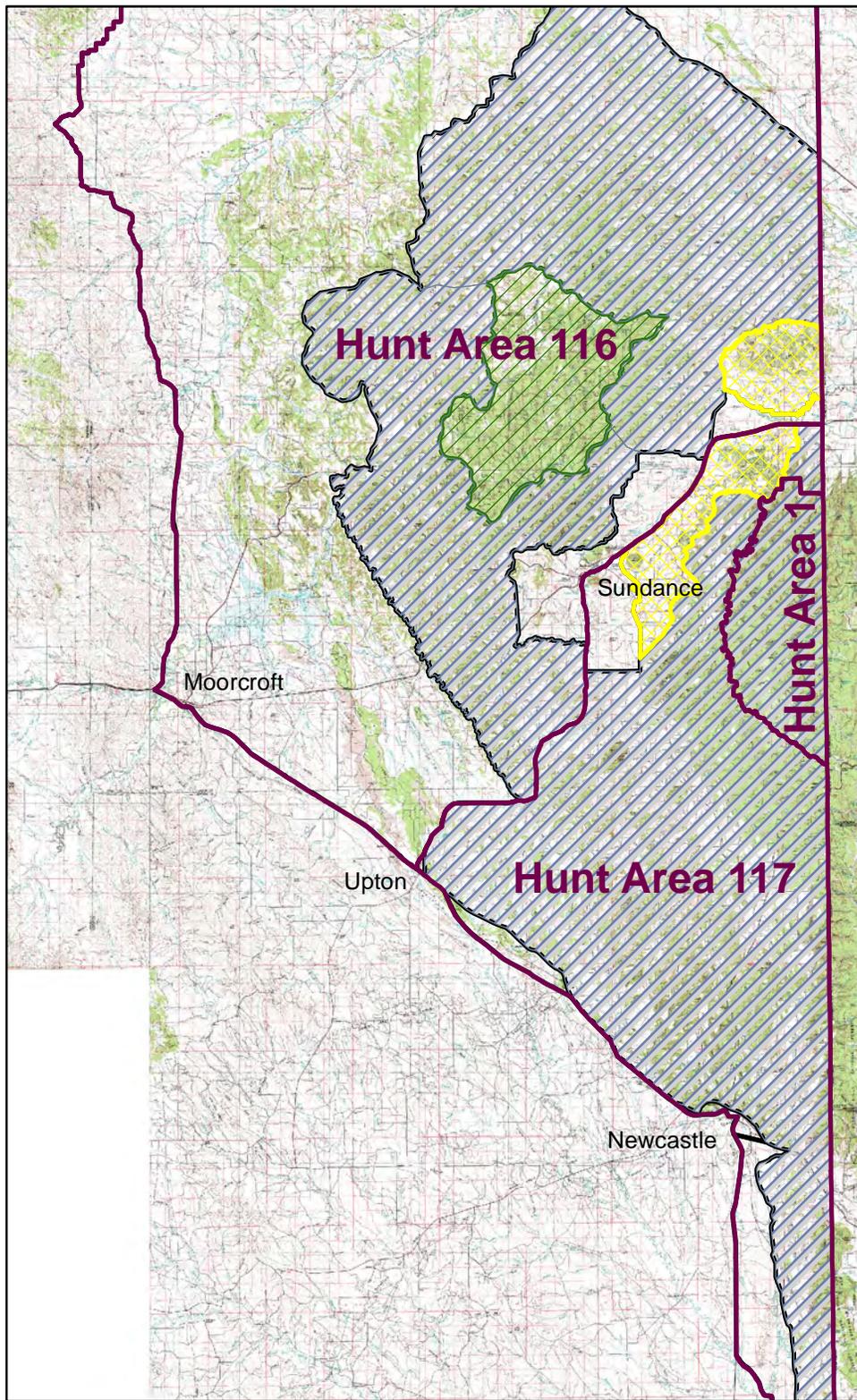
Given mean hunter participation and success rates over the past decade and a half, the 2015 harvest should result in about 565 elk. This harvest estimate is predicated on a similar number of elk being harvested from HA 116 on General Licenses and continued average success rates in other hunt areas. However, the long season for antlerless elk hunting in HA's 116 and 117 (five

and a half months) could increase antlerless harvest above predicted values if access to elk improves. If projected harvest levels are reached, elk numbers should decline slightly south of I-90, while elk numbers north of the Interstate will likely continue to increase. Based upon an estimated preseason herd composition of 47:100:40 (calf:cow:bull) and a recruitment rate of 30 yearling elk per 100 cows, a harvest of about 500 adult elk would remove the annual yearling recruitment from a herd of ~ 3,100 elk (all age classes), a number above what field personnel believe to be present at this time.

Literature Cited

Simpson, Benjamin, D. 2015. *Ecology of Rocky Mountain Elk in the Black Hills of South Dakota and Wyoming*. A Thesis Submitted in Partial Fulfillment of the Requirements for the Master of Science Major in Wildlife and Fisheries Science South Dakota State University, Brookings, SD. 169 pgs.

South Dakota Department of Game, Fish and Parks. 2015. *South Dakota Elk Management Plan 2015-2019. Completion Report 2015-01*. South Dakota Department of Game, Fish and Parks, Pierre, South Dakota, USA.



Legend

-  E740_Revised_WINYLG
-  E740_Revised_YLG
-  E740Revised_out
-  E740 ssf ¹⁷⁶

2015 - JCR Evaluation Form

SPECIES: Elk

PERIOD: 6/1/2015 - 5/31/2016

HERD: EL741 - LARAMIE PEAK/MUDDY MOUNTAIN

HUNT AREAS: 7, 19

PREPARED BY: HEATHER O'BRIEN

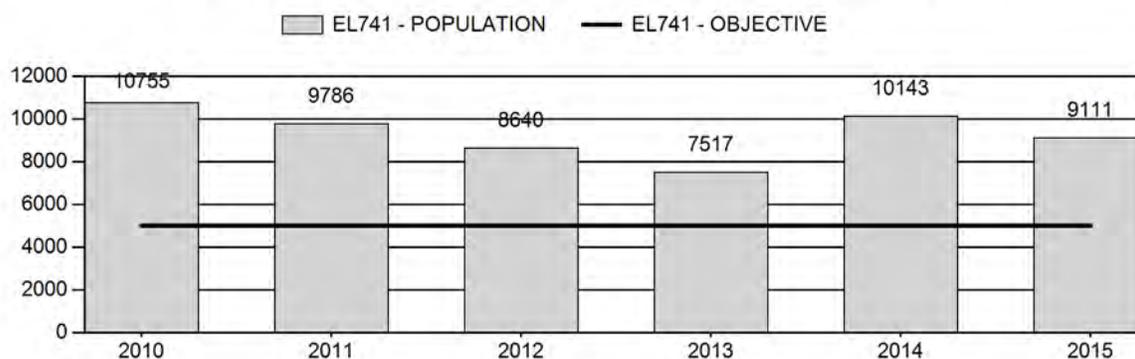
	<u>2010 - 2014 Average</u>	<u>2015</u>	<u>2016 Proposed</u>
Population:	9,368	9,111	7,899
Harvest:	2,357	2,663	2,513
Hunters:	4,608	4,864	4,700
Hunter Success:	51%	55%	53%
Active Licenses:	4,686	5,019	4,850
Active License Success:	50%	53%	52%
Recreation Days:	36,933	34,059	35,000
Days Per Animal:	15.7	12.8	13.9
Males per 100 Females	31	31	
Juveniles per 100 Females	37	39	

Population Objective (± 20%) :	5000 (4000 - 6000)
Management Strategy:	Special
Percent population is above (+) or below (-) objective:	82%
Number of years population has been + or - objective in recent trend:	15
Model Date:	5/23/2016

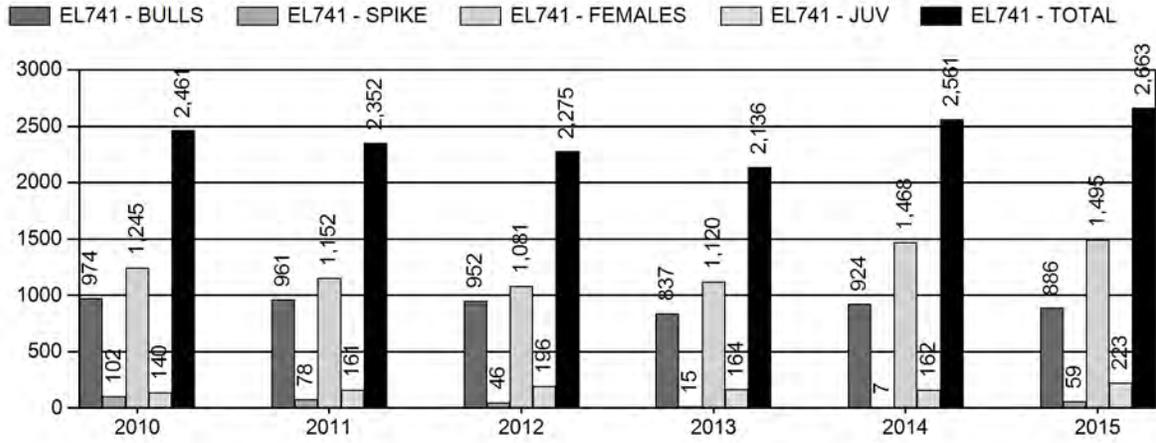
Proposed harvest rates (percent of pre-season estimate for each sex/age group):

	<u>JCR Year</u>	<u>Proposed</u>
Females ≥ 1 year old:	23.7%	24.9%
Males ≥ 1 year old:	33.7%	36.5%
Juveniles (< 1 year old):	2.5%	2.0%
Total:	28.5%	30.1%
Proposed change in post-season population:	-9.9%	-12.5%

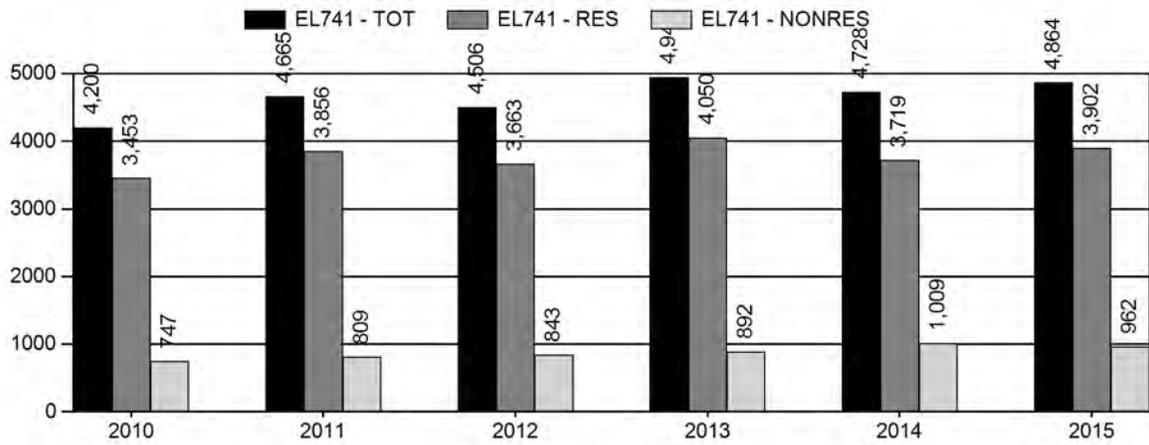
Population Size - Postseason



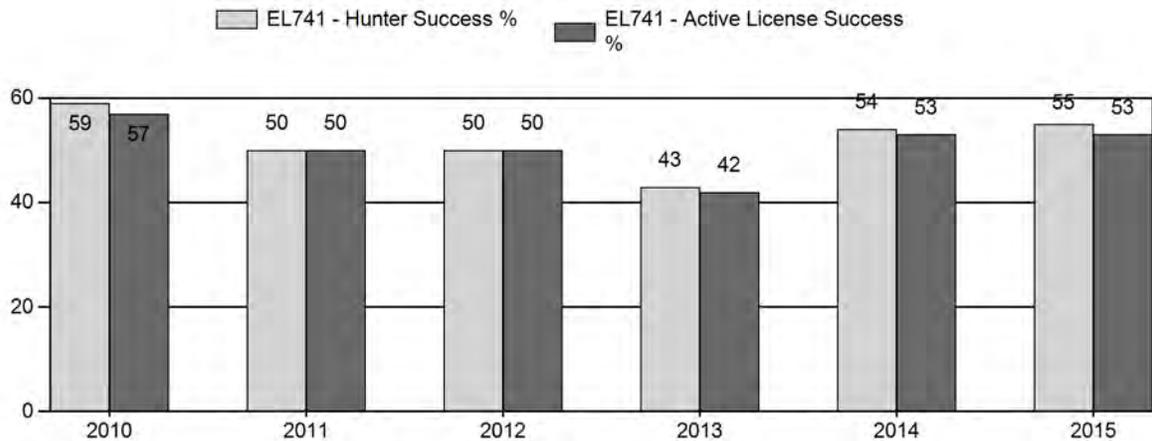
Harvest



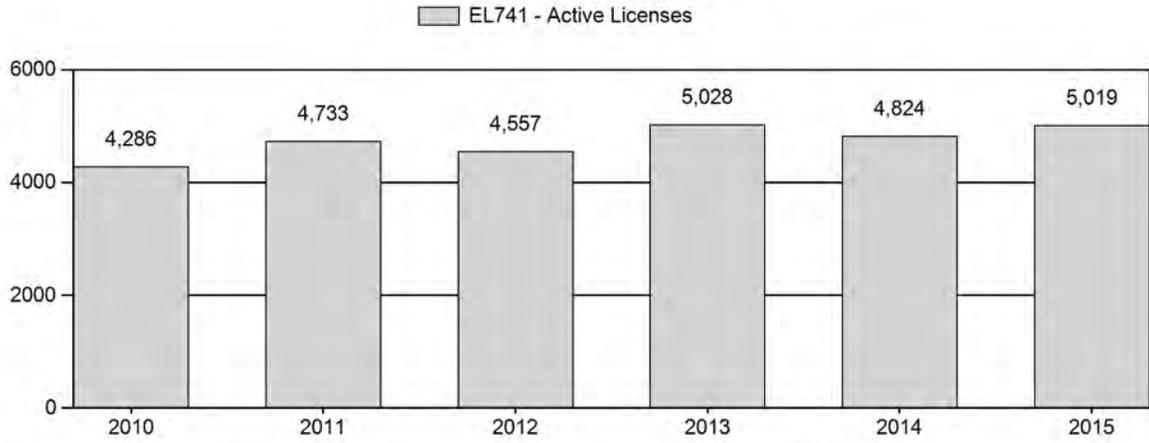
Number of Hunters



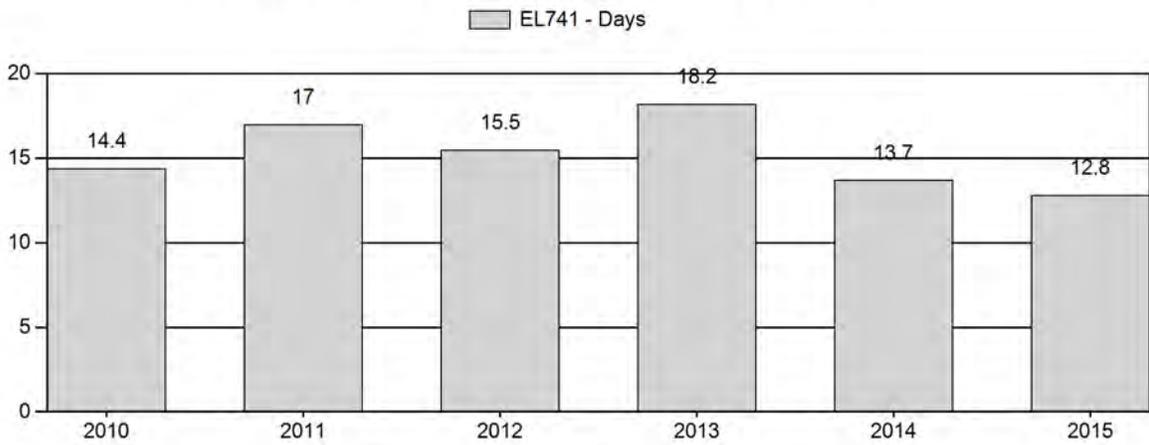
Harvest Success



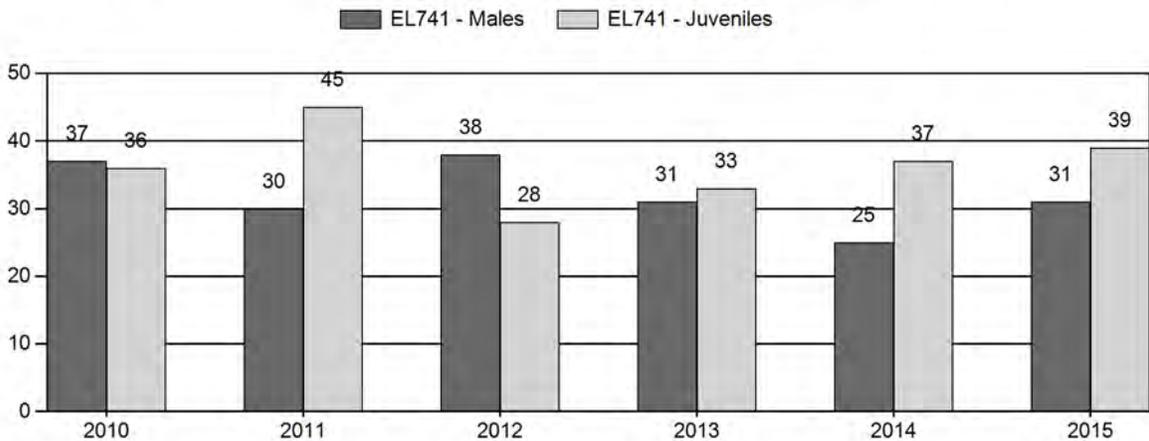
Active Licenses



Days per Animal Harvested



Postseason Animals per 100 Females



2010 - 2015 Postseason Classification Summary
for Elk Herd EL741 - LARAMIE PEAK/MUDDY MOUNTAIN

Year	Post Pop	MALES				FEMALES		JUVENILES		Tot Cls	Cls Obj	Males to 100 Females				Young to		
		Ylg	Adult	Total	%	Total	%	Total	%			Ylng	Adult	Total	Conf Int	100 Fem	Conf Int	100 Adult
2010	10,755	475	639	1,114	21%	3,020	58%	1,094	21%	5,228	545	16	21	37	± 1	36	± 1	26
2011	9,786	324	548	872	17%	2,890	57%	1,298	26%	5,060	539	11	19	30	± 1	45	± 1	35
2012	8,640	143	362	505	23%	1,334	60%	379	17%	2,218	617	11	27	38	± 2	28	± 2	21
2013	7,517	328	487	815	19%	2,605	61%	869	20%	4,289	535	13	19	31	± 1	33	± 1	25
2014	10,143	383	468	851	15%	3,454	62%	1,270	23%	5,575	592	11	14	25	± 1	37	± 1	30
2015	9,312	404	485	889	18%	2,882	59%	1,116	23%	4,887	504	14	17	31	± 1	39	± 1	30

2016 HUNTING SEASONS
LARAMIE PEAK MUDDY MOUNTAIN ELK (EL741)

Hunt Area	Type	Season Dates		Quota	License	Limitations
		Opens	Closes			
7	1	Oct. 15	Nov. 20	1,500	Limited quota	Any elk
		Nov. 21	Dec. 31			Antlerless elk
	4	Oct. 15	Dec. 31	1,200	Limited quota	Antlerless elk
		6	Aug. 15			Oct. 14
	Oct. 15		Dec. 31	Cow or calf		
	7	Jan. 1	Jan. 31	500	Limited quota	Cow or calf
	19	1	Oct. 1	Oct. 14	150	Limited quota
Nov. 21			Jan. 31	Antlerless elk		
2		Nov. 1	Nov. 20	150	Limited quota	Any elk
		Nov. 21	Jan. 31			Antlerless elk
4		Oct. 1	Oct. 14	125	Limited quota	Antlerless elk
		Nov. 21	Jan. 31			Antlerless elk
5		Nov. 1	Jan. 31	125	Limited quota	Antlerless elk
6		Oct. 1	Oct. 14	225	Limited quota	Cow or calf
		Nov. 1	Jan. 31			Cow or calf
Archery			Sep. 1	Sep. 30		

Hunt Area	Type	Quota change from 2015
7	1	0
	4	+400
	6	-400
	7	0
19	1	0
	2	0
	4	0
	5	0
	6	0
Total	1	0
	4/5	+400
	6	-400
	7	0

Management Evaluation

Current Postseason Population Management Objective: 5,000

Management Strategy: Special

2015 Postseason Population Estimate: 9,100

2016 Proposed Postseason Population Estimate: 7,900

2015 Hunter Satisfaction: 74% Satisfied, 14% Neutral, 12% Dissatisfied

The Laramie Peak / Muddy Mountain Elk Herd Unit has a postseason population management objective of 5,000 elk. The herd is managed using the special management strategy, with a goal of maintaining postseason bull ratios between 30-40 bulls per 100 cows and a high percentage of branch-antlered bulls in the male harvest segment. The objective and management strategy were last reviewed in 2013, when managers and landowners agreed to maintain both the population objective and the special management strategy for bulls.

Herd Unit Issues

Hunting access within the herd unit is variable, with a mix of national forest, state lands, and private lands. The addition of Walk-In Areas and Hunter Management Areas greatly expands hunting opportunity within the herd unit as well. Landowners offer varying levels of access to hunting. While most landowners offer some form of access – whether it be free or fee hunting – there are a few ranches that offer little access. These areas tend to harbor high numbers of elk that are inaccessible during hunting seasons. The main land use within the herd unit is traditional ranching and grazing of livestock; however several properties in the herd unit have become “non-traditional” in that they are owned by individuals who do not make a living by ranching their lands. Industrial-scale developments are minimal within this herd unit, though

there is potential for the expansion of wind energy development. Chronic Wasting Disease is present in this herd at low prevalence (typically 6-8% of hunter-harvested elk).

Weather & Habitat

The summer of 2012 was the driest on record since 1904 in much of Wyoming. Extensive wildfires displaced and redistributed elk, especially in the east-central portion of the herd unit. The severe drought and resulting wildfires likely impacted calf survival, as post-season ratios were low at 28 calves per 100 cows. The winter of 2012 continued to be dry, with very low snow accumulation, allowing wide distribution of elk at higher elevations. April of 2013 finally saw a break in the drought, when temperatures dropped below normal for the entire month and significant precipitation was received. This cooler and wetter pattern continued through the summer of 2013 in much of the herd unit. In early October 2013, winter storm “Atlas” blanketed the area with 12-36” of wet snow, with greater depths at higher elevations. The 2013-2014 winter brought temperature and precipitation conditions near the recent 30-year average, and the growing season of 2014 brought a much-needed break in drought conditions. Grass and forb growth were excellent, making 2014 the best growing season the region had seen in years. Winter 2014-2015 was generally mild, and the 2015 growing season was just above average for the region. Fall of 2015 was relatively dry, and much of the herd unit remained accessible for hunting for the majority of the hunting season. For detailed weather data see <http://www.ncdc.noaa.gov/gac/time-series/us>.

Field Data

Calf ratios are typically in the 40s per 100 cows for the Laramie Peak / Muddy Mountain Elk Herd. While calf survival can vary from year to year, adult elk in this herd are thought to have rather high rates of survival as predation pressure is likely low and there is little mortality from disease and winter weather. Prior to 2005, antlerless license issuance was not adequate to keep up with the production of this herd. Since then, antlerless license issuance has continued to increase, and the population has stabilized or begun to decrease as harvest pressure on cows has greatly intensified. In 2012, the calf ratio reached a historic low of 28 calves per 100 cows. Since then, calf production has increased slowly and was 39 calves per 100 cows in 2015. Calf ratios over the previous 5 years (average = 36) have been much lower than the long-term average of 43 (1991-2015). This may be due to a number of factors including stress on pregnant cows from January hunting seasons, changes in habitat quality, or increased competition due to higher elk densities. Cow harvest continues to remain high, and late-season access to hunt was very good in the herd unit for 2015. While lower calf production/survival from 2012-2015 may slow population growth, continued high license issuance and harvest of cows will be necessary to reduce this herd toward objective.

Bull ratios for the Laramie Peak / Muddy Mountain Herd historically average in the mid-30s per 100 cows, though there have been years where the ratio has dropped below special management limits into the 20s. It should be noted that the accuracy of bull ratios can be questionable from year to year in this herd. While post-season classification samples are well distributed within this herd unit, changes in distribution of elk, ability to locate large cow/calf groups, and concealment of bulls in timber during January can influence results from year to year. From 2010-present, Type 1 licenses have fluctuated between 1,500 and 1,750 licenses in Area 7, depending upon hunter, landowner, and manager perceptions of bull quality. While annual tooth-age data illustrate hunters are consistently harvesting prime age-class bulls over the past three years, antler-class data show a slight decrease in the percentage of Class-II antlered bulls (see Appendix A). Hunters have more frequently communicated concern about declines in trophy quality within this herd in recent years as well. While consistent harvest pressure on trophy-class bulls may be one contributing factor, other influences including competition for key resources may also be influencing antler quality in this herd. Managers regularly observed 800-1,100 bulls during postseason helicopter surveys from 2007-2015. While a higher number of bulls implies more hunting opportunity, it also signifies a higher potential for competition for forage and other resources. It should also be noted that expectations of hunters for increasingly larger bulls in a prized hunt area may also be influencing perceptions of bull quality. Regardless, hunters, landowners, and managers seem to be satisfied with current bull ratios and the opportunity is still readily available for a quality hunt in this herd unit. Consequently, any-elk license issuance will be maintained in Areas 7 and 19 at 1,800 licenses, which is considered conservative for this herd unit.

Harvest Data

License success in this herd unit is typically in the 50th percentile. It should also be noted that days per animal can be high in this herd unit compared to others, as hunters have high expectations regarding bull quality and will exert more effort in finding a mature bull. Archery hunting has also become more popular in the herd unit, as hunters want to maximize their time in the field to harvest a mature bull. Despite this, days per animal was 12.8 in 2015, which is low compared to the 10-year average of 14.3 days. Weather and access conditions were both excellent during much of the 2015 hunting season. Overall harvest success in 2015 (53%) was on par with the ten-year average (54%). Total harvest improved in 2015, with the highest cow harvest (1,495) and overall harvest (2,663) on record for the herd unit. Total harvest of cows and calves was exceptional in both hunt areas for 2015. In Area 19, an estimated 211 cows and calves were harvested, while in Area 7 over 1,500 were harvested. Both totals represent the highest cow/calf harvests on record for each hunt area, and may be attributed to good weather, improved access, and increased availability of elk on public lands in 2015.

Population

The 2015 postseason population estimate was approximately 9,100 and is either stable or slowly trending downward. No sightability or other population estimate data are currently available to further align the model. Between 2,000 and 2,500 elk have been harvested annually since 2007, with harvest success remaining above 50% in all but one year (when weather conditions greatly restricted hunting access). Though the model illustrates a declining population, the ability of this herd to support a consistently high level of harvest without declines in harvest success suggests this herd is more likely stable than declining. Observations from managers, landowners, and hunters are also not consistent with a growing population. Total elk observed during postseason classification surveys has consistently ranged between 4,000 and 6,300 elk since 2007.

The “Time-Specific Juvenile Survival, Constant Adult Survival, Male Survival Coefficient” (TSJ,CA,MSC) spreadsheet model was selected to represent the Laramie Peak / Muddy Mountain Herd Unit for 2015. In previous years the TSJ,CA and CJ,CA models were both used. Shifting to a new model in 2015 will result in inconsistent data between previous years and 2015. However, the TSJ,CA,MSC model is currently the only model that seems representative of the herd without unwarranted manipulation. The three remaining models predict precipitous declines and/or population crashes that are improbable. All three remaining models also predict unrealistically high harvest segments for bulls that range from 45 to 60% and for cows that range from 30 to 50%. Ultimately, all three of the remaining models produce population estimates that are unrealistically low based on observed numbers of elk. The TSJ,CA,MSC model seems more representative of herd trends, though it selects the upper constraint for adult cow survival and frequently hits the lower constraint for calf survival. While the Laramie Peak / Muddy Mountain Herd does not have a high level of natural predation, a lower survival rate for bulls seems reasonable. Bulls in the herd unit are aggressively pursued by hunters during both archery and rifle seasons, in addition to suffering increased stress during the rut. The TSJ,CA,MSC model also scores the lowest AIC, though it is by less than a power of one compared to the other models. The TSJ,CA,MSC model is currently the best representation of the herd, and follows trends with license issuance and harvest success. Additional population estimate and/or survival data would help to better align this model. Variations in classification survey methodology might also help strengthen the model for this herd. A stratified quadrat sampling method is being evaluated in 2016, with the goal of refining survey methods and acquiring age and sex ratios that are more accurate for this herd. Without more accurate bull ratio data or other population estimates to anchor the model, it is considered of poor quality.

Management Summary

Season dates for this herd have changed from year to year, and in general have been liberalized over time to maximize harvest and reduce damage on agricultural fields. Meetings with landowners were held to discuss ideas to maximize female harvest and maintain bull quality. Season dates and limitations will be similar for the 2016 season, with two minor changes. Since hunters can now purchase full price antlerless licenses as an additional license, Type 4 and Type 6 licenses in Area 7 will be shifted back to reflect traditional license allocation. A total of 400 Type 6 licenses will be converted back to Type 4 licenses in Area 7. In addition, language in the limitations for unused licenses valid for antlerless or cow/calf elk will be simplified for added clarity in the regulation. Area 19 unused licenses will continue to be valid for antlerless elk through January in 2016 to extend hunter opportunity and maximize cow harvest. All other license types will be maintained with the same season dates and quotas as in 2015. Currently, access is predicted to be similar in 2016 compared to previous years. If additional access is secured in Area 19, increased license issuance will be considered by managers for future seasons. Goals for 2016 are to continue reduction of the herd toward objective, maintain bull ratios within special management limits, maintain good harvest success, and reduce elk damage to agricultural fields. Since managers and the public remain satisfied with current bull ratios and numbers in the herd, any-elk 1 license issuance will not change in either Area 7 or 19.

If we attain the projected harvest of 2,500 elk with average calf ratios, this herd will decline further toward objective. The predicted 2016 postseason population size of the Laramie Peak / Muddy Mountain Elk Herd is approximately 7,900 animals, which is 82% above objective.

APPENDIX A:

Tooth-Age and Antler Class Data for Laramie Peak / Muddy Mountain Elk

The Laramie Peak / Muddy Mountain Elk Herd Unit (Wyoming Hunt Areas 7 & 19) has historically built a reputation for superior hunting in terms of high bull ratios, bull quality, and good hunter success. Bull ratios are managed under the special management criteria, with the goal of maintaining 30-40 per 100 cows. Bull quality is monitored annually using cementum annuli tooth aging from a sample of hunter-harvested elk and categorical postseason classifications based on antler size.

Tooth age data from the Laramie Peak / Muddy Mountain herd have been collected in nearly all years from 1997-2015. Tooth samples are solicited from both bull and cow elk hunters, as female age data is more representative of a random sample across age classes, while bull age data is potentially biased towards hunter preferences for more mature age classes. Sample size has varied from year to year depending upon hunter response rates. In 2015, a total of 800 “any-elk” hunters and 975 antlerless elk hunters in the herd unit were solicited for tooth samples. Of those solicited, 139 returned teeth from bulls and 102 returned teeth from cows. Samples received from calf elk were removed from resulting totals so as not to skew statistics on adult age classes.

Average tooth age of harvested adult males slowly increased from 1999-2015, while average tooth age of harvested female elk has been more variable over time (Tables 1 & 2). Since 2012, average tooth age of both bulls and cows has gradually increased. Median age of males increased from 5.5 to 6.5 years old in 2015, while median age of females dropped from 5.5 to 4.5 years old. This slight divergence between harvested bull and cow ages suggests that hunter selectivity is for larger, older age class bulls; while the younger age class of harvested cows is likely to represent the most abundant age class in this herd.

The percentage of harvested bulls aged 6-10 gradually increased from 2001-2015, indicating that older age-class bulls were increasingly available for harvest. This contradicts some years of observed antler class data during the same time period that shows a decline of Class II (6 points on a side or better) bulls in the herd (Table 3). This disparity may be due to increased selectivity of hunters for older age-class bulls, compared to the more random sample of bulls surveyed during postseason classification flights. In addition, hunters submitting teeth may be biased towards older age class bulls, as hunters who are pleased with the quality of their animals may be more likely to submit samples.

The increasingly high percentage of older age-class bull elk is a surprising trend, considering that managers believe this herd has been stable or decreasing since 2009. License issuance has

remained high, and one would expect it to become increasingly difficult to find and harvest older age-class bulls. At the same time, average age of sampled cows has slowly increased, while license issuance and season length have been liberalized, and this herd has either stabilized or begun to decrease. These data are somewhat confounding as they suggest that females are increasingly reaching older age classes in the herd before they are harvested and/or that there are relatively fewer younger age class cows available for harvest. However, calf ratios have also declined in recent years, meaning lower calf recruitment may have suppressed the distribution of elk in younger age classes.

Trends in antler class of classified bull elk are more difficult to interpret on their own. Class I bulls are mature bulls that have < 6 points on both antlers, while Class II bulls have ≥ 6 points on either antler. The percentage of Class II bulls declined from 2008-2011, but then increased and seemed to stabilize from 2012-2015. During the same time period, average tooth-age of harvested bulls increased steadily from 5.01 to 6.40. The divergence between the two data sets in 2012-2013 suggests antler quality is not always correlated positively with bull age for this herd. Factors such as nutrition, genetics, or classification biases may also be contributing to antler quality. In 2014 & 2015, percentage of Class II bulls observed declined slightly, while average tooth-age of harvested bulls increased. Harvest success and hunter days for any-elk licenses remained similar to 5-year averages over both years, indicating hunters did not have difficulty finding mature bulls. Studies of the tooth-age dataset certainly temper any assumptions made regarding changes in the antler class dataset and aid in making sound management decisions for this herd. Collectively, these data indicate this herd can continue to support the current number of any-elk licenses for the 2016 season without compromising bull ratios or bull quality. Managers must continue to scrutinize harvest data and hunter feedback, and perhaps begin to reduce issuance of any-elk licenses if the percentage of Class II bulls observed during classification surveys continues to decline.

Table 1. Tooth-age data analysis for adult bull elk harvested within the Laramie Peak/Muddy Mountain Herd Unit, 1997 - 2015.

Year	Number of Adult Males per Age Class (Tooth Sampling)																					
	1+	2+	3+	4+	5+	6+	7+	8+	9+	10+	11+	12+	13+	14+	15+	16+	17+	18+	19+	20+	21+	22+
1997	7	13	5	5	6	2	2	3	0	2	1	0	0	0	0	0	0	0	0	0	0	0
1998	1	16	19	10	10	4	3	2	1	2	1	0	0	0	0	0	0	0	0	0	0	0
1999	20	26	39	24	16	9	8	1	2	0	0	1	0	0	0	0	0	0	0	0	0	0
2000	22	36	41	28	24	13	6	1	3	1	1	0	0	0	1	0	0	0	0	0	0	0
2001	15	22	27	29	14	10	3	3	1	0	2	2	0	0	0	0	0	0	0	0	0	0
2004	7	8	16	19	6	10	5	3	1	0	1	0	0	0	0	0	0	0	0	0	0	0
2005	6	3	27	16	10	11	6	0	3	0	1	0	0	0	0	0	0	0	0	0	0	0
2007	1	11	24	18	12	12	8	3	0	0	1	1	0	0	1	0	0	0	0	0	0	0
2008	4	2	19	24	22	17	12	3	2	1	1	0	0	0	0	0	0	0	0	0	0	0
2010	4	3	16	27	32	27	13	2	1	2	5	1	0	0	0	0	0	0	0	0	0	0
2011	7	9	11	19	25	24	7	4	6	3	3	0	0	0	0	0	0	0	0	0	0	0
2012	2	9	9	22	22	20	9	3	4	0	1	0	0	0	0	0	0	0	0	0	0	0
2013	3	3	11	33	22	40	11	9	7	4	1	0	2	0	0	0	0	0	0	0	0	0
2014	3	4	19	27	35	31	17	13	7	5	2	0	0	1	0	0	0	0	0	0	0	0
2015	4	6	10	17	18	29	27	11	9	5	2	0	1	0	0	0	0	0	0	0	0	0

Year	Percentages										
	1	2-5	6-10	11-12	13+						
1997	15%	63%	20%	2%	0%						
1998	1%	80%	17%	1%	0%						
1999	14%	72%	14%	1%	0%						
2000	12%	73%	14%	1%	1%						
2001	12%	72%	13%	3%	0%						
2004	9%	64%	25%	1%	0%						
2005	7%	67%	24%	1%	0%						
2007	1%	71%	25%	2%	1%						
2008	4%	63%	33%	1%	0%						
2010	3%	59%	34%	5%	0%						
2011	6%	54%	37%	3%	0%						
2012	2%	61%	36%	1%	0%						
2013	2%	47%	49%	0%	1%						
2014	2%	52%	45%	1%	1%						
2015	3%	37%	58%	1%	1%						

Year	1	2-5	6-10	11-12	13+	N	Avg Age
1997	7	29	9	1	0	46	4.41
1998	1	55	12	1	0	69	4.12
1999	20	105	20	1	0	146	3.91
2000	22	129	24	1	1	177	3.99
2001	15	92	17	4	0	128	4.17
2004	7	49	19	1	0	76	4.48
2005	6	56	20	1	0	83	4.51
2007	1	65	23	2	1	92	4.58
2008	4	67	35	1	0	107	5.01
2010	4	78	45	6	0	133	5.33
2011	7	64	44	3	0	118	5.35
2012	2	62	36	1	0	101	5.44
2013	3	69	71	1	2	146	6.07
2014	3	85	73	2	1	164	6.02
2015	4	51	81	2	1	139	6.40

Table 2. Tooth-age data analysis for adult female elk harvested within the Laramie Peak/Muddy Mountain Herd Unit, 1997 - 2015.

Year	Number of Adult Females per Age Class (Tooth Sampling)																					
	1+	2+	3+	4+	5+	6+	7+	8+	9+	10+	11+	12+	13+	14+	15+	16+	17+	18+	19+	20+	21+	22+
1997	8	3	5	9	5	1	1	2	1	1	3	0	0	0	0	0	0	0	0	0	0	0
1998	3	14	6	10	6	7	5	2	1	2	1	1	1	0	0	0	1	0	0	0	0	0
1999	14	22	16	20	8	8	6	7	3	1	8	3	3	1	0	0	0	0	0	0	0	1
2000	19	26	21	17	13	11	6	4	6	0	4	3	0	1	2	1	0	0	0	0	0	0
2001	11	15	24	11	15	9	10	5	4	4	3	3	0	0	0	1	0	0	0	0	0	0
2004	8	4	13	8	8	6	3	2	3	0	0	1	0	0	0	0	0	0	0	0	0	0
2005	26	14	39	34	21	14	16	15	4	6	5	0	4	4	0	0	0	1	0	0	0	0
2007	4	7	19	24	7	6	8	5	11	4	5	2	2	1	0	2	1	0	0	0	0	0
2008	8	11	14	14	17	8	11	5	3	2	1	2	3	1	0	2	1	1	0	1	0	0
2010	5	7	14	9	13	9	3	5	3	5	1	1	2	0	1	1	0	0	0	0	0	0
2011	4	4	11	10	14	6	7	6	2	1	0	0	0	0	1	2	0	0	0	0	0	0
2012	10	9	15	8	7	5	4	6	2	1	4	1	1	0	0	0	0	0	0	0	0	0
2013	5	1	11	20	14	8	4	3	3	2	1	4	0	0	0	0	0	0	0	0	0	0
2014	9	11	19	25	18	11	13	11	6	4	2	3	0	3	1	1	0	0	0	0	0	0
2015	16	9	12	16	10	3	9	7	3	1	5	4	3	1	2	0	1	0	0	0	0	0

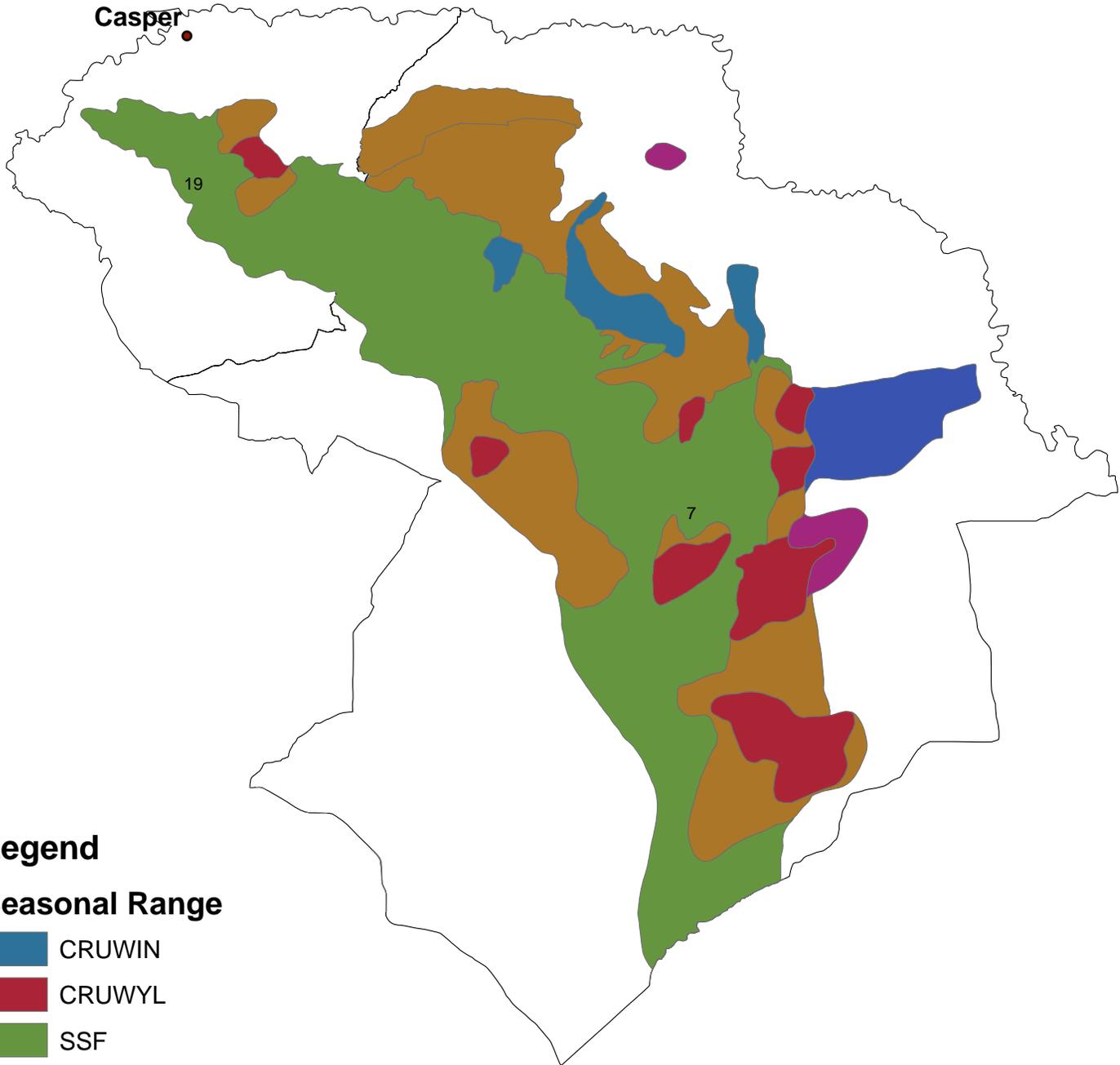
Year	Percentages						
	1	2-5	6-10	11-12	13+		
1997	21%	56%	15%	8%	0%		
1998	5%	60%	28%	3%	3%		
1999	12%	55%	21%	9%	4%		
2000	14%	57%	20%	5%	4%		
2001	10%	57%	28%	5%	1%		
2004	14%	59%	25%	2%	0%		
2005	13%	52%	26%	5%	4%		
2007	4%	53%	31%	6%	6%		
2008	8%	53%	28%	3%	9%		
2010	6%	54%	32%	3%	5%		
2011	6%	57%	32%	0%	4%		
2012	14%	53%	25%	7%	1%		
2013	7%	61%	26%	7%	0%		
2014	7%	53%	33%	4%	4%		
2015	16%	46%	23%	9%	7%		

Year	1	2-5	6-10	11-12	13+	N	Avg Age
1997	8	22	6	3	0	39	4.38
1998	3	36	17	2	2	60	4.90
1999	14	66	25	11	5	121	5.02
2000	19	77	27	7	5	135	4.61
2001	11	65	32	6	1	115	4.84
2004	8	33	14	1	0	56	4.27
2005	26	108	55	10	9	208	5.16
2007	4	57	34	7	6	108	5.97
2008	8	56	29	3	9	105	5.71
2010	5	43	25	2	4	79	5.49
2011	4	39	22	0	3	68	5.34
2012	10	39	18	5	1	73	5.20
2013	5	46	20	5	0	76	5.70
2014	9	73	45	5	5	137	5.88
2015	16	47	23	9	7	102	6.05

Table 3. Antler classification of bull elk from the Laramie Peak/Muddy Mountain Herd Unit, 2008-2015.

Mature Bull Antler Classification									
Bio- Year	Area 7 (N / %)			Area 19 (N / %)			EL 741 (N / %)		
	Class I	Class II	Total	Class I	Class II	Total	Class I	Class II	Total
2008	82 (23%)	270 (77%)	352	41 (26%)	119 (74%)	160	123 (24%)	389 (76%)	512
2009	211 (49%)	219 (51%)	430	58 (41%)	84 (59%)	142	269 (47%)	303 (53%)	572
2010	246 (47%)	280 (53%)	526	61 (54%)	52 (46%)	113	307 (48%)	332 (52%)	639
2011	278 (69%)	128 (31%)	406	104 (73%)	38 (27%)	142	382 (70%)	166 (30%)	548
2012	76 (56%)	60 (44%)	136	160 (71%)	66 (29%)	226	236 (65%)	126 (35%)	362
2013	213 (56%)	169 (44%)	382	57 (54%)	48 (46%)	105	270 (55%)	217 (45%)	487
2014	165 (64%)	93 (36%)	258	106 (57%)	79 (43%)	185	271 (61%)	172 (39%)	443
2015	212 (74%)	74 (26%)	286	93 (47%)	106 (53%)	199	305 (63%)	180 (37%)	485

**Laramie Peak/Muddy Mountain Elk Herd Unit
(EL741)
Revised May 18, 2010
Hunt Areas 7 & 19**



Legend

Seasonal Range

-  CRUWIN
-  CRUWYL
-  SSF
-  WIN
-  WYL
-  YRL

2015 - JCR Evaluation Form

SPECIES: Elk

PERIOD: 6/1/2015 - 5/31/2016

HERD: EL742 - RATTLESNAKE

HUNT AREAS: 23

PREPARED BY: HEATHER O'BRIEN

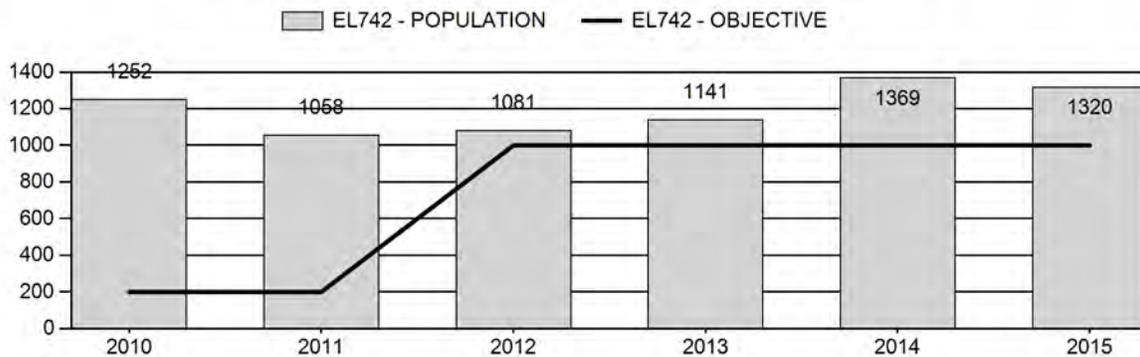
	<u>2010 - 2014 Average</u>	<u>2015</u>	<u>2016 Proposed</u>
Population:	1,180	1,320	1,182
Harvest:	169	196	195
Hunters:	370	395	400
Hunter Success:	46%	50%	49%
Active Licenses:	393	413	450
Active License Success:	43%	47%	43%
Recreation Days:	3,350	3,058	3,200
Days Per Animal:	19.8	15.6	16.4
Males per 100 Females	50	200	
Juveniles per 100 Females	37	48	

Population Objective (± 20%) :	1000 (800 - 1200)
Management Strategy:	Recreational
Percent population is above (+) or below (-) objective:	32%
Number of years population has been + or - objective in recent trend:	24
Model Date:	5/24/2016

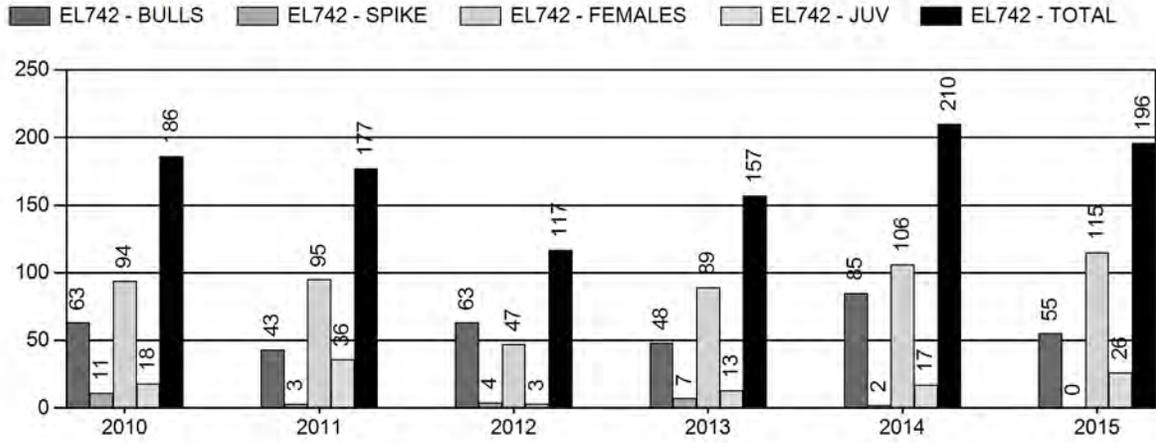
Proposed harvest rates (percent of pre-season estimate for each sex/age group):

	<u>JCR Year</u>	<u>Proposed</u>
Females ≥ 1 year old:	15.2%	16.2%
Males ≥ 1 year old:	15.5%	18.5%
Juveniles (< 1 year old):	1.7%	1.4%
Total:	12.9%	14.0%
Proposed change in post-season population:	-8.6%	-10.6%

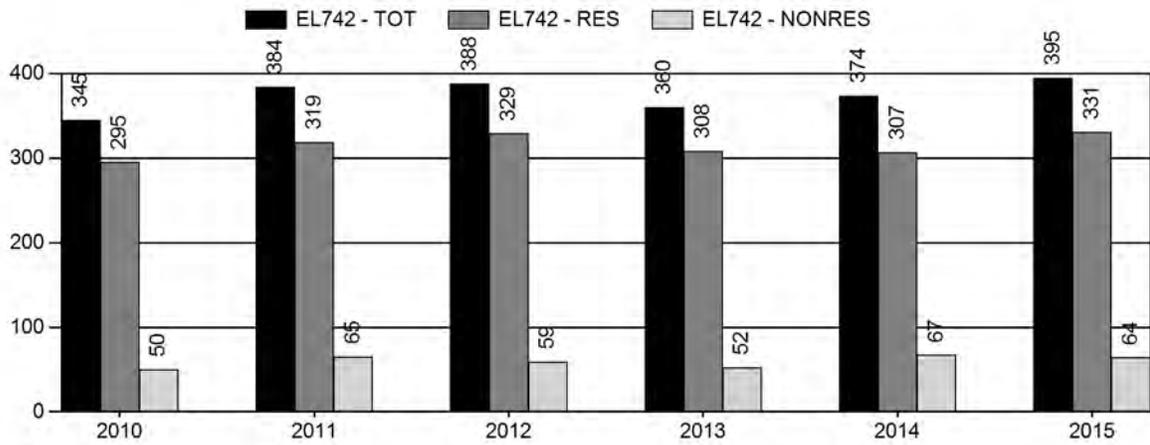
Population Size - Postseason



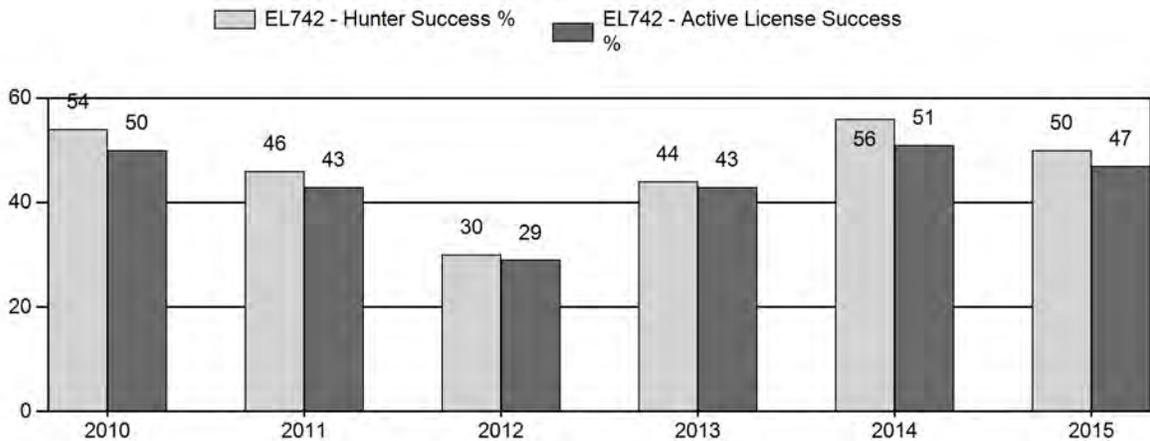
Harvest



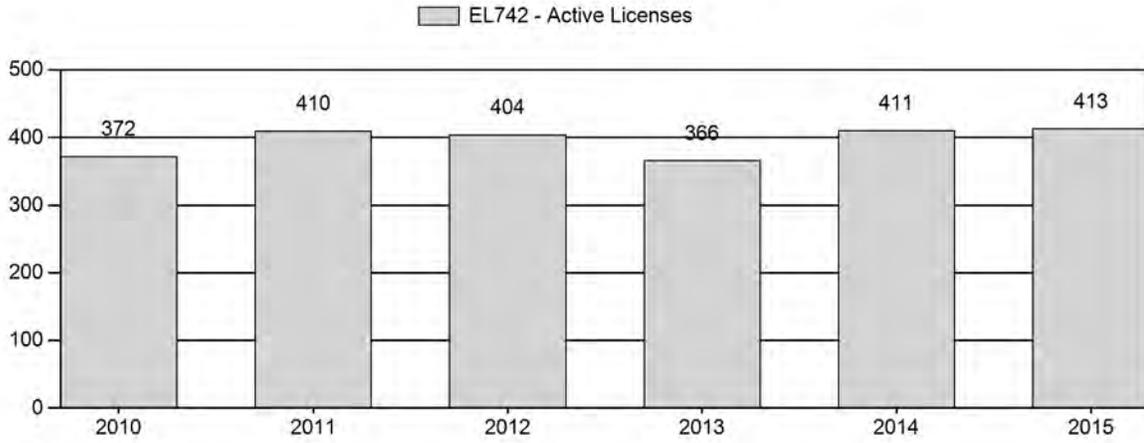
Number of Hunters



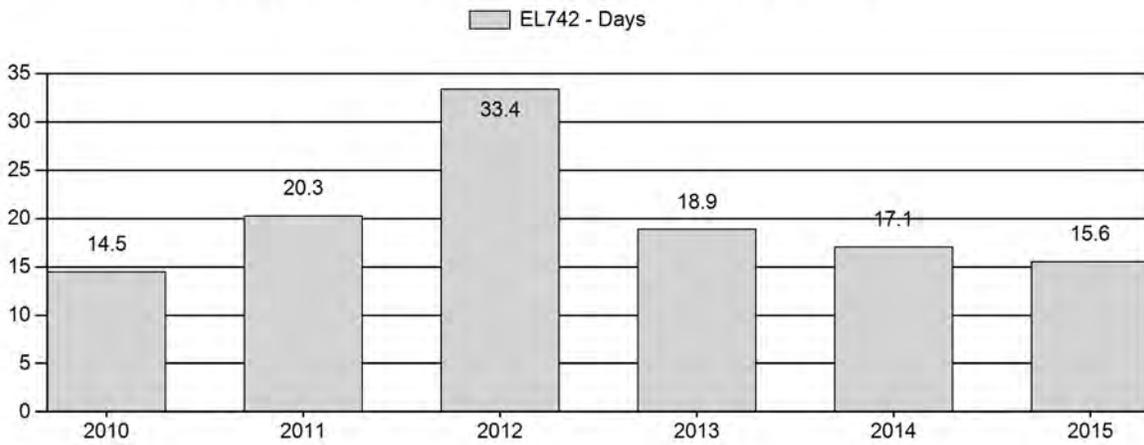
Harvest Success



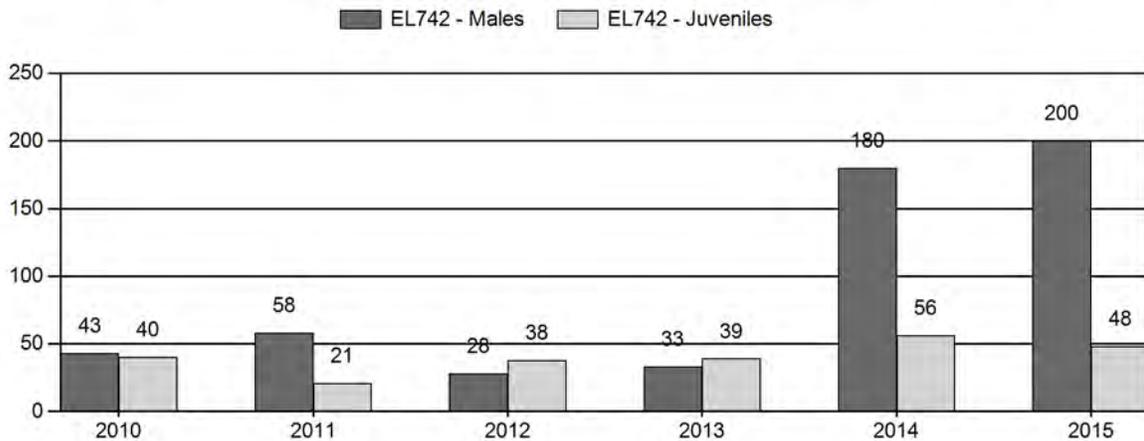
Active Licenses



Days per Animal Harvested



Postseason Animals per 100 Females



2010 - 2015 Postseason Classification Summary

for Elk Herd EL742 - RATTLESNAKE

Year	Post Pop	MALES				FEMALES		JUVENILES		Tot Cls	Cls Obj	Males to 100 Females				Young to		
		Ylg	Adult	Total	%	Total	%	Total	%			Ylng	Adult	Total	Conf Int	100 Fem	Conf Int	100 Adult
2010	1,252	24	47	71	23%	166	55%	66	22%	303	415	14	28	43	± 7	40	± 6	28
2011	1,058	17	90	107	32%	185	56%	38	12%	330	443	9	49	58	± 7	21	± 4	13
2012	1,081	26	32	58	17%	204	60%	77	23%	339	384	13	16	28	± 4	38	± 5	29
2013	1,141	26	102	128	19%	390	58%	153	23%	671	479	7	26	33	± 3	39	± 3	30
2014	1,369	35	113	148	54%	82	30%	46	17%	276	406	43	138	180	± 28	56	± 12	20
2015	1,315	10	86	96	57%	48	29%	23	14%	167	390	21	179	200	± 42	48	± 15	16

**2016 HUNTING SEASONS
RATTLESNAKE ELK (EL742)**

Hunt Area	Type	Season Dates		Quota	License	Limitations
		Opens	Closes			
23	1	Oct. 1	Oct. 31	125	Limited quota	Any elk
		Nov. 15	Dec. 15			Any elk
	4	Oct. 1	Oct. 31	125	Limited quota	Antlerless elk
		Nov. 15	Dec. 15			Antlerless elk, also valid in Area 128
6	Oct. 1	Oct. 31	175	Limited quota	Cow or calf	
	Nov. 15	Dec. 15			Cow or calf, also valid in Area 128	
	7	Nov. 15	Dec. 15	50	Limited quota	Cow or calf, also valid in Area 128
Archery						Refer to license type and limitations in Section 2

Hunt Area	Type	Quota change from 2015
23	1	No changes
	4	No changes
	6	-25
	7	+25

Management Evaluation

Current Postseason Population Management Objective: 1,000

Management Strategy: Recreational

2015 Postseason Population Estimate: 1,300

2016 Proposed Postseason Population Estimate: 1,200

2015 Hunter Satisfaction: 59% Satisfied, 27% Neutral, 15% Dissatisfied

The Rattlesnake Elk Herd Unit has a postseason population management objective of 1,000 elk. The herd is managed using the recreational management strategy, with a goal of maintaining

postseason bull ratios of 15-29 bulls per 100 cows. The objective and management strategy were revised in 2012.

Herd Unit Issues

Hunting access within the herd unit is variable. The majority of occupied elk habitat is accessible for hunting via public land and Hunter Management Area access. However, there is one ranch within the central part of occupied habitat that does not allow any access for hunting and harbors the vast majority of elk within the herd unit. Hunters have expressed frustration when elk take refuge in this area, as they tend to remain there due to low hunter pressure and good forage conditions. The main land use within the herd unit is traditional ranching and grazing of livestock, with isolated areas of oil and gas development. There is the potential for future mining of precious metals and rare earth minerals in the hunt area, but current levels of activity are low. Disease outbreaks are not a current concern in this herd unit.

Weather

The winter of 2010-2011 was severe throughout the herd unit, although no significant elk mortality was detected. Drought conditions persisted until spring 2013, which was cool with significant precipitation. Rainfall was average over the summer of 2013, but habitat conditions appeared to be poor for much of the growing season. Heavy precipitation during the fall of 2013 caused a favorable late green-up that was a benefit to big game species going into winter. The 2013-2014 winter brought temperature and precipitation conditions near the recent 30-year average, and the growing season of 2014 brought a much-needed break in drought conditions. The spring and summer of 2014 undeniably produced improved range conditions that benefitted elk. The winter of 2014-2015 was relatively mild, while the spring and summer of 2015 were slightly above average in terms of precipitation and range condition. For detailed weather data see <http://www.ncdc.noaa.gov/gac/time-series/us>.

Habitat

This herd unit has no established habitat transects that measure production and/or utilization on vegetation that are preferred by elk. Anecdotal observations and discussions with landowners in the region indicate that summer and winter forage availability for elk was good in 2015. Herbaceous forage species were observed to be in good condition in both 2014 & 2015 compared to previous years, and elk appeared to be in excellent body condition by winter 2015.

Field Data

Observed calf ratios are highly erratic in this herd unit due to varying survey conditions and levels of effort across years. Thus it is difficult to correlate changes in population size or make decisions regarding license issuance based on observed calf ratios. Instead managers continue to focus on maximizing cow harvest without over-saturating Hunt Area 23 with hunter pressure. Increases in cow license issuance are not warranted unless access improves and there are no large areas where elk can take refuge from harvest pressure.

Observed bull ratios are also highly erratic as a result of variable survey conditions and levels of effort from year to year. Since 2001, observed bull ratios have ranged from as low as 13 to as high as 58 per 100 cows. Years with low observed bull ratios were followed by years with much higher observed ratios; indicating bulls were likely missed during classification surveys in some years, and/or elk are immigrating/emigrating to and from adjacent hunt areas. 2015 classification results were highly skewed in favor of bulls, as one large cow/calf group could not be classified from video taken during survey flights. Again, license issuance and season structure changes in this herd are not typically made based on observed classification ratios. Instead, seasons are designed to maximize cow harvest and maintain relatively good license success without overcrowding hunters.

Harvest Data

License success in this herd unit is typically in the 40th percentile and is fairly consistent given license issuance and hunter opportunity has remained relatively similar across years. Hunter days per animal fluctuate from year to year, but this may be a function of changes in access due to weather and road conditions. The persistence of unattainable elk in the aforementioned private land refugia most certainly contributes to increased hunter days and reduced harvest success in most years. In 2014 & 2015, weather conditions were mostly favorable and access to elk was good. Overall harvest success improved to 56% and 49% respectively, compared to the 25-year average of 48%. The longer, split season in 2013-2015 also facilitated movement of elk off of private refugia. Elk have moved onto accessible hunting areas during the closure in all three years. Late-season licenses were also valid for use in the adjacent Hunt Area 128, where portions of the herd sometimes migrate during the fall and winter months. Field personnel continue to receive positive comments from hunters and landowners who are pleased with both of these changes to the hunting season. In 2015, a late two-week cow season was added in an attempt to maximize female harvest. Success on these appears to have been low however, and some hunters commented that the season was not long enough. Overall however, harvest has increased significantly in the past three years compared to previous years, and cow harvest was the highest on record in 2015.

Population

The 2015 postseason population estimate was approximately 1,300 elk, with a stable to modestly decreasing trend. No sightability or other population estimate data are currently available to further align the model in conjunction with classification and harvest data. There have been no complaints from landowners in recent years with regard to elk numbers or damage. Total number of elk surveyed during aerial classifications has not increased significantly in recent years. Harvest pressure and success have increased with longer seasons since 2013, but have otherwise remained consistent. Elk may emigrate from the herd unit into adjacent areas, but managers believe this herd to be stable or declining slightly.

The “Constant Juvenile Survival – Constant Adult Survival” (CJ,CA) spreadsheet model was selected for the postseason population estimate of this herd. This population is difficult to model as it is small in size and appears to have consistent interchange with an adjacent herd, thus violating the closed population assumption of the model. High variability in observed bull and calf ratios also render this herd challenging to model. Long-term classification averages are used in years when adequate sample sizes are not reached during postseason surveys, to avoid inaccuracies from high variability in the model. Trend count data are also included in the model to document higher numbers of elk that in some years have been seen but could not be classified. The TSJ,CA model was discarded, as it predicts population sizes that are lower than actual observed survey totals. When juvenile survival was increased in years known to have mild winter conditions, the SCJ,CA model also predicted a population size lower than actual numbers of elk observed. The TSJ,CA,MSC model was not used as it does not seem applicable or necessary for this herd, which does not have elevated predation rates from large carnivores. While the CJ,CA model appears to be the best choice to represent the herd, it should be noted that this model selected for the lowest juvenile and the highest adult constraints, indicating that it is of poor quality. If the model continues to be troublesome and inaccurate in reflecting trends and known numbers of elk, managers may consider changing to trend-count based management for this herd.

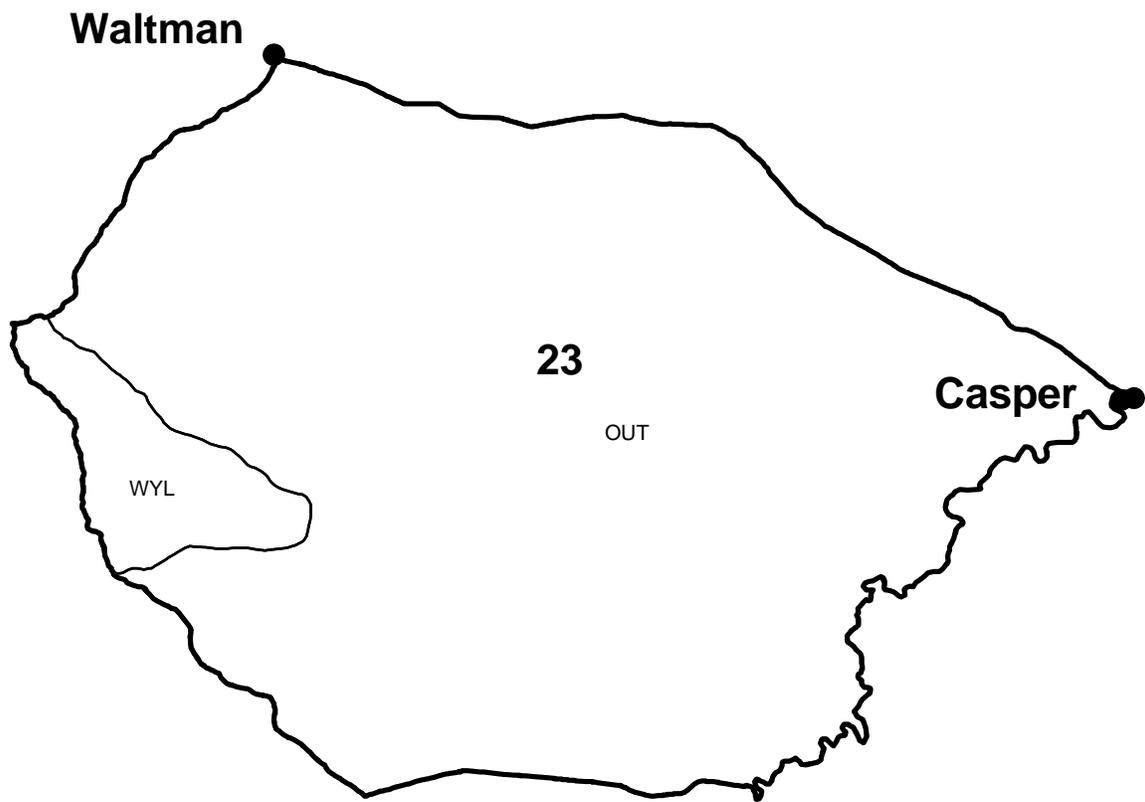
Management Summary

Opening day of hunting season in this herd is traditionally October 1st, and closing dates have differed with changing harvest prescriptions from year to year. Season structure has also changed to include a split season in recent years, in an attempt to maximize cow harvest. Longer split season dates with a closure from November 1 – 14 have been well-received the last three years by hunters, and have resulted in record high harvest success and harvest totals. Since this has worked well, the same season is being implemented for 2016. The additional December cow season added in 2015 will be lengthened to four weeks to provide more opportunity for those

license holders. Goals for 2016 are to continue high harvest pressure on cows, maintain extended opportunity to hunt bulls, and maintain/improve overall harvest success.

If we attain the projected harvest of approximately 195 elk and assuming average calf production/survival, this herd will decrease to slightly above objective. The predicted 2015 postseason population estimate for the Rattlesnake Elk Herd is approximately 1,200 animals, or 32% above objective.

Elk - Rattlesnake
Hunt Area 23
Casper Region
Revised 8/94



2015 - JCR Evaluation Form

SPECIES: Elk

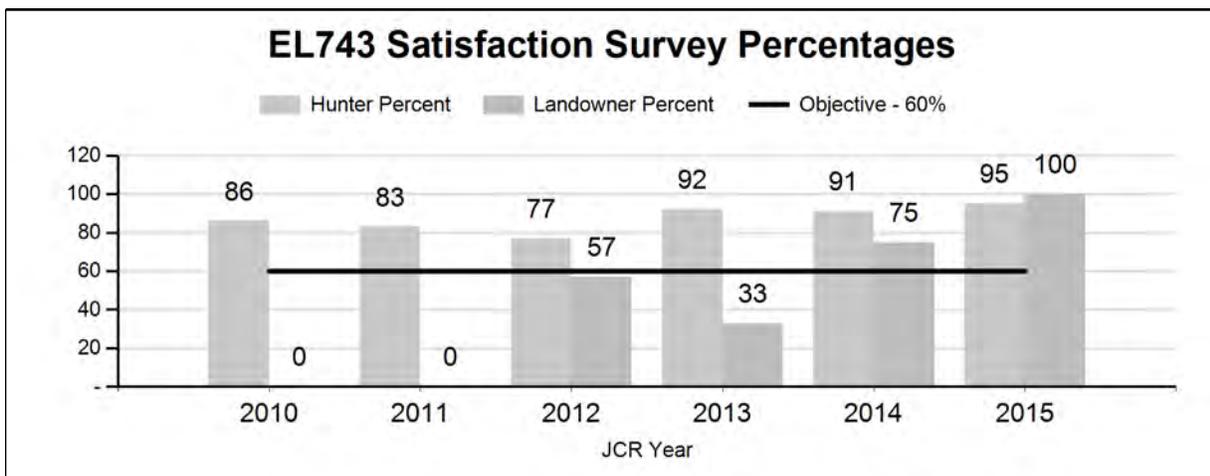
PERIOD: 6/1/2015 - 5/31/2016

HERD: EL743 - PINE RIDGE

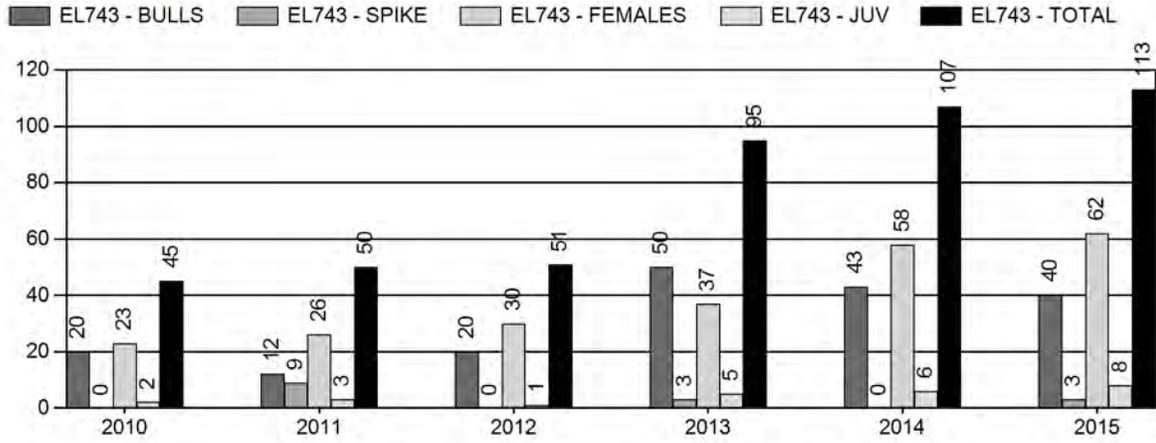
HUNT AREAS: 122

PREPARED BY: WILLOW STEEN

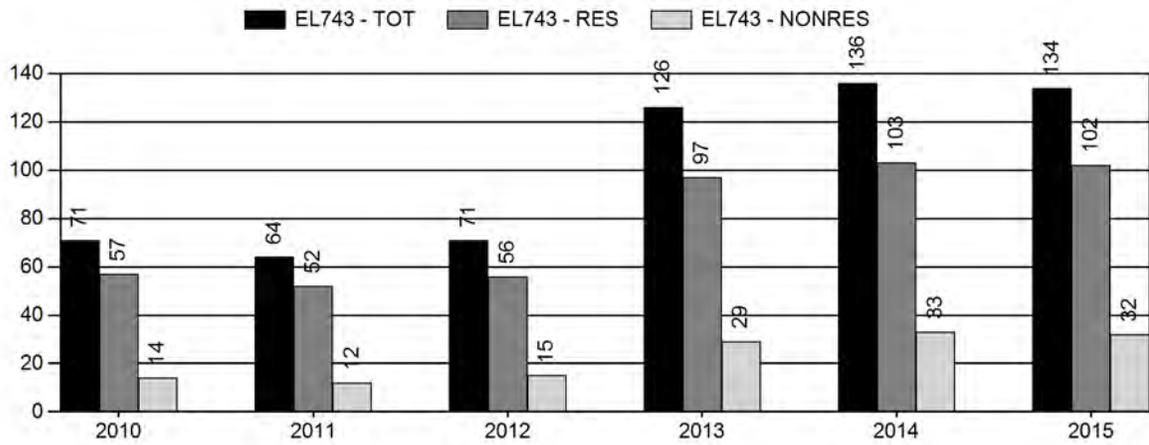
	<u>2010 - 2014 Average</u>	<u>2015</u>	<u>2016 Proposed</u>
Hunter Satisfaction Percent	87%	95%	90%
Landowner Satisfaction Percent	53%	100%	90%
Harvest:	70	113	130
Hunters:	94	134	150
Hunter Success:	74%	84%	87%
Active Licenses:	100	138	160
Active License Success:	70%	82%	81%
Recreation Days:	456	495	520
Days Per Animal:	6.5	4.4	4
Males per 100 Females:	0	0	
Juveniles per 100 Females	0	0	
Satisfaction Based Objective			60%
Management Strategy:			Private Land
Percent population is above (+) or (-) objective:			38%
Number of years population has been + or - objective in recent trend:			2



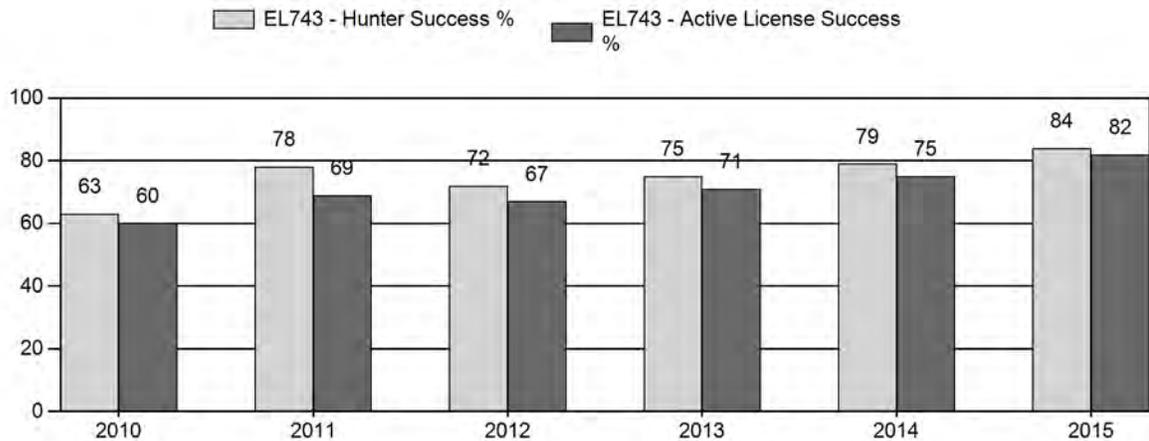
Harvest



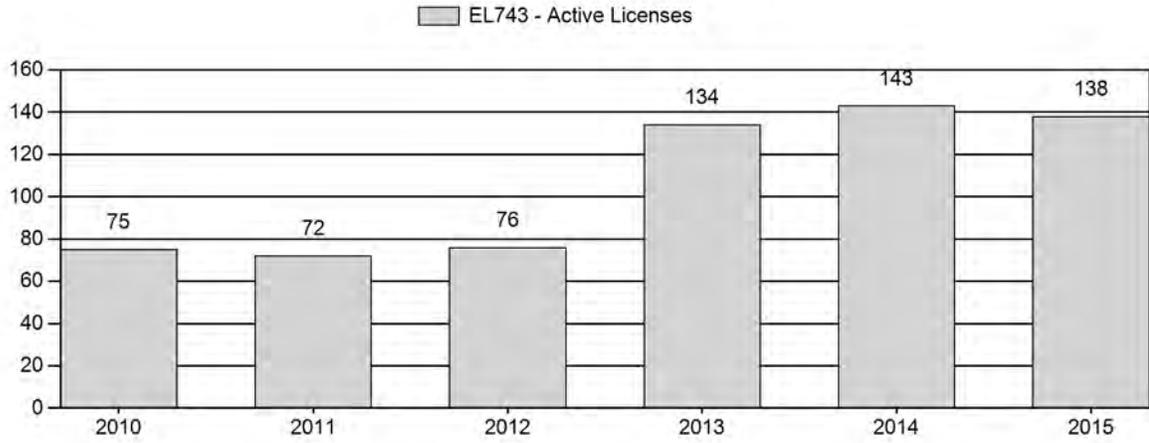
Number of Hunters



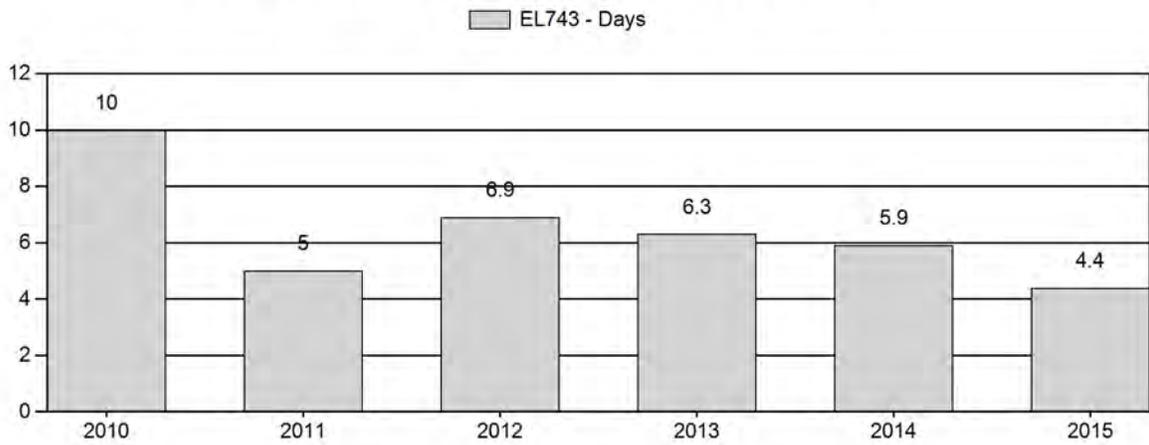
Harvest Success



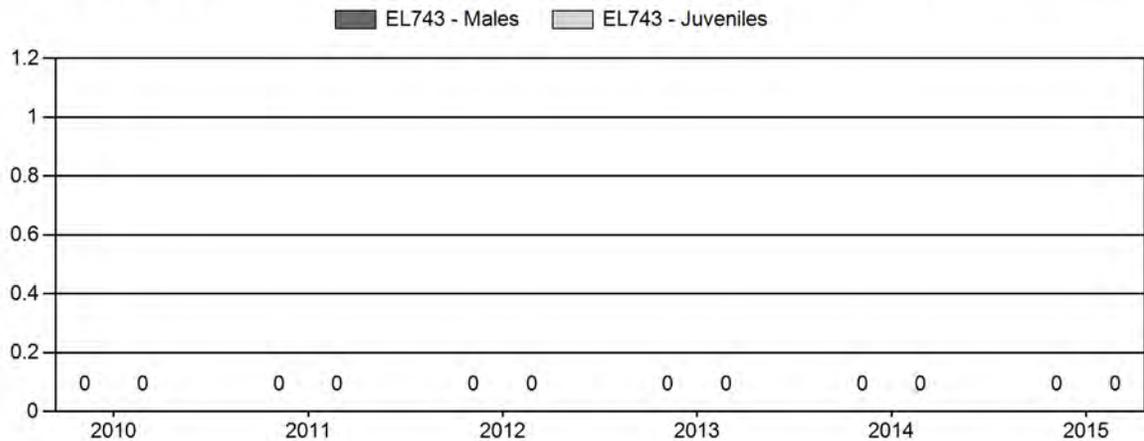
Active Licenses



Days per Animal Harvested



Postseason Animals per 100 Females



**2016 HUNTING SEASONS
PINE RIDGE ELK HERD (EL743)**

Hunt Area	Type	Season Dates		Quota	License	Limitations
		Opens	Closes			
122	1	Oct. 15	Nov. 30	75	Limited quota	Any elk
		Dec. 1	Dec. 31			Antlerless elk
Archery	6	Oct. 15	Dec. 31	150	Limited quota	Cow or calf
		Sep. 1	Sep. 30			Refer to license and type limitations in Section 2

Hunt Area	Type	Quota change from 2015
122	6	+25

Management Evaluation

Current Hunter/Landowner Satisfaction Management Objective: 60% hunter/landowner satisfaction; bull quality

Management Strategy: Private Land

2015 Hunter Satisfaction Estimate: 94%

2015 Landowner Satisfaction Estimate: 100%

Most Recent 3-year Running Average Hunter Satisfaction Estimate: 92%

Most Recent 3-year Running Average Landowner Satisfaction Estimate: 69%

The Pine Ridge Elk Herd Unit has a management objective based on 60% or higher landowner and hunter satisfaction. As a secondary objective, managers strive to maintain a bull harvest consisting of 60% mature, branch-antlered bulls. This objective was revised in 2012. An objective based upon postseason population estimates was not feasible for this herd unit.

Herd Unit Issues

Nearly all elk in this herd reside in and along the timbered Pine Ridge escarpment in the north central portion of the herd unit. Land use consists of traditional ranching and livestock grazing mixed with areas of intensive oil and gas, wind, and uranium development. Access to hunting is tightly controlled by private landowners, and achieving adequate harvest to manage growth of

this herd is very difficult. Given the private-land nature of this elk herd, the Department gives serious deference to landowner desires. In recent years, landowners have expressed dissatisfaction with growing elk numbers. A meeting in February of 2015 that was well-attended by the affected landowners resulted in increased quotas as well as a greater commitment to achieve cow harvest. In lieu of a satisfaction survey which often produces conflicting responses, another meeting was held in February of 2016 to discuss Pine Ridge Elk management. While some landowners still have relatively low tolerances for elk, the majority felt it was desirable to maintain elk numbers at their current levels and that continued harvest pressure, including a slight increase in cow harvest, would be necessary to achieve this objective.

Weather & Habitat

The Pine Ridge Elk Herd resides in relatively low-elevation habitat, and weather typically has minimal influence on elk productivity, survival and movements. In addition, there are no habitat or classification data collected in this herd unit given the Department's minimal management influence and budgetary constraints. Thus no meaningful analysis of weather and habitat data will be presented.

Field Data

Fixed-wing winter trend counts are conducted in the herd unit as budget and weather conditions allow. Past trend counts of this herd typically found between 150 and 350 elk. In 2013, a winter trend count conducted under optimum conditions found a total of 840 elk, indicating this herd was larger than previously believed. A trend count conducted in February 2014 found a total of 454 elk; however snow conditions were not ideal and elk were difficult to see bedded amongst exposed rocks and shrubs. In February 2015, a trend count yielded only 276 elk despite good survey conditions and thorough coverage. In November of 2015, field personnel attempted to conduct the trend count during deer helicopter classification flights, but were only able to locate 49 elk. Under both of these recent scenarios, it is assumed that the elk had moved away from Pine Ridge. Based on past observations and landowner input, managers still estimate this herd likely numbers 900-1,000 elk.

Landowner and hunter satisfaction surveys are used to gauge management of the Pine Ridge Elk Herd. Annual survey results must show that at least 60% of hunters were either "satisfied" or "very satisfied" with the previous year's hunting season. In addition, landowner surveys must show that at least 60% or more respondents are satisfied with elk numbers in their area. Should these satisfaction thresholds not be met, changes in management should be prescribed to address reasons for dissatisfaction. A secondary objective is also used in the Pine Ridge Elk Herd Unit to anchor the results of satisfaction surveys to a population parameter. In this case, age class targets are determined from the harvest survey and used as a measure of bull quality. The

percentage of mature branch-antlered bulls in the male portion of the annual harvest is used, with a 3-year trend average of 60% minimum being the threshold for management action.

In 2015, 100% of landowners (N=8) believed the elk herd to be “at or about at desired levels”, while 94% of hunters who returned surveys were “satisfied” or “very satisfied” with their hunting experience in the Pine Ridge Elk Herd Unit. Landowner satisfaction was based on an in-person meeting with the landowners and a “show of hands” regarding satisfaction. These particular landowners have expressed their preference for the Department to hold an in-person meeting every year as opposed to conducting a mailer survey. For the secondary objective, the three-year average for mature bulls in the harvest was 96%. Landowner satisfaction, hunter satisfaction, and the percentage of mature bulls in the harvest all exceeded the 60% threshold for bio-year 2015.

Harvest Data

Hunter success has remained high for the last 5 years (63-84%). In the past, for most of the past, antlerless elk licenses were undersubscribed as landowners have been unwilling to allow access for cow hunters. However, landowners have recently become more willing to allow hunting access and harvest more elk. While a majority of Type 6 licenses were available as leftovers in 2015, only 11 remained unsold. There were 113 elk harvested in 2015, 62% of which were cows or calves which is the most ever recorded. Harvest in 2013 and 2014 were comparable at 95 and 107 total elk, but in years past, harvest was typically somewhere between 40 and 50 elk.

Perceived loss of bull quality was also a concern amongst certain landowners in the past. However, landowners attending the 2016 meeting agreed that bull quality was still high and that a quota of 75 was desirable. Landowner’s perceptions of bull availability are reflected in the harvest results as license success was 79.3% on the Type 1 license with 87% of those being branch-antlered bulls.

Management Summary

The hunting season in this herd unit opens on October 15th following the close of deer seasons. In recent years, closing dates have been extended as landowners agreed to liberalize access for cow elk hunting later in the season. Type 1 license issuance will remain at 75 with similar season dates for bull harvest. Landowners requested the season length be extended to the end of December for antlerless elk to provide hunting opportunity for youth through the Christmas break. Since there will be more opportunity for harvest, they also requested an additional 25 Type 6 licenses, therefore, Type 6 license issuance was increased by 25 and the season length will extend through December 31st for all antlerless elk licenses.

Elk - Pine Ridge
Hunt Area 122
Casper Region
Revised 5/88

Midwest

YRL

122

OUT

Casper

Glenrock