



To: FWP Commission

From: Mac Minard
Executive Director
Montana Outfitters and Guides Association

Re: Comments on HD 313 Elk Management Proposal

Date: December 6, 2015

The following contains an analysis and comments pertaining to an FWP management/harvest proposal for HD 313 elk. We have carefully reviewed the Department proposal, and completed a technical analysis of available survey, permit and harvest data. We have provided comments and recommendations based upon that review.

I look forward to discussing this issue with you and if you have questions concerning this report or these recommendations please direct them to:

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Evaluation of HD 313 Elk Management Proposal and
Alternative Recommendations for
Consideration by
Montana Fish Wildlife and Parks
Commission

December 10, 2015

BY:

Mac Minard
Executive Director, Montana Outfitters and Guides Association

and

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About the Authors

Robert Arnaud

Rob received a Bachelor of Science in Animal Science in 1980 from Montana State University, Bozeman. As a licensed Montana Outfitter (License #176) Rob is also licensed in two additional states and has outfitted in an additional three states (New Mexico, Colorado and Utah) where no license is required. Rob is the current President of the Montana Outfitters and Guides Association, a position he has held for the past two years; his term expires December 31, 2015. Currently Rob does not conduct any of his outfitting business in HD 313 but is familiar with the area.

In addition to owning and operating an outfitting business, Rob has worked as a wildlife manager and consultant since the early 1990's, alongside a team of wildlife professionals with the Turner Corporation. In that capacity Rob has conducted numerous wildlife assessments and currently holds a seat on the Board of Biologists that oversee all of Turners two million acres. At one time, between Colorado and Montana, Rob was responsible for managing over 10,000 elk on private property for three different landowners. Rob has worked with state agencies, Rocky Mountain Elk Foundation (RMEF) and other conservation/management professionals across several states to develop sustainable seasons and harvest management objectives. Rob has the distinction of having written the second largest conservation easement in RMEF history.

Mac Minard

Mac received his Bachelor of Science degree in Wildlife Management (Research Option) and minors in Biostatistics and Economics from the University of Alaska, Fairbanks. During a nearly 25 year career with the Alaska Department of Fish and Game Mac worked as a research biologist and management biologist. Ultimately he was appointed Regional Supervisor where he oversaw research and management activities for fisheries across 80 percent of the state of Alaska. Mac has worked for Arizona Game and Fish (Wildlife Technician) as well as Montana Fish Wildlife and Parks (Deputy Chief of Fisheries) and currently serves as Executive Director for the Montana Outfitters and Guides Association. He has held this job for nearly ten years. In addition, Mac continues to consult on conservation and regulation issues involving complex mixed stock fisheries problems in Cook Inlet and Bristol Bay.

*"Faced with the choice between changing one's mind and proving that there is no need to do so, almost everyone gets busy on the proof."
John Kenneth Galbraith*

I. Synopsis

Montana Fish Wildlife and Parks staff has proposed a 95 percent reduction in hunting opportunity by going to a 75 permit limited draw system for hunting bull elk in HD 313. This action will effectively eliminate hunting opportunity for the Northern Yellowstone herd. Critical analysis of available data shows action is both unnecessary as conservation measure and is ill-advised from an economic and social aspect.

The basis for the FWP proposal is what appear to be historically low adult bull-to-cow ratios and that this condition portends a conservation concern as it will negatively impact the recovery of the Northern Yellowstone elk herd. We found no evidence that we are on the verge of a conservation crisis warranting the extreme measures proposed by FWP.

There is credible evidence that the Northern Yellowstone elk herd is recovering from its predictable (and necessary) decline over the last decade. Indicators including winter trend counts, calf/cow ratios and bull/cow ratios and on-ground habitat assessments are trending in a positive direction. The herd is on the road to a slow and steady recovery and available data suggests that trend will continue. What appears to be problematic is the manner in which FWP is looking at survey data to draw conclusions on herd condition.

Our analysis demonstrates that single strata classification surveys for the Total Northern Range best represent evaluation parameters for assessing overall herd condition. Classification surveys limited to the Montana section are unreliable and will provide a false surrogate for evaluation of population structure. Focusing on survey results from the Montana section alone will likely lead to erroneous conclusions about overall herd condition. Documented changes in migration patterns and the uncertainty of bull elk movement year-to-year are the likely drivers for this condition.

Additionally, and perhaps most importantly; the recognition that with the re-introduction of the wolf a decade ago there has emerged a new management paradigm that must be taken into account when setting realistic management objectives. Our analysis demonstrates significant differences in bull/cow ratios coincident with a post-wolf reintroduction. Temporal stratification of TNR data into pre-wolf (1995 - 2001) and post wolf (2002 – present) reintroduction is more technically robust and yields entirely different results than the Department's approach of arbitrarily using 10 or 20 year temporal stratifications. Not taking this change into account assumes pre-wolf productivity is possible in a post wolf reality.

The FWP proposal seeks to address low adult bull/cow ratios. When developing the staff recommendation, they used 12 mature bulls/ 100 cows (21 year average) to develop an objective of at least 10 mature bulls (within 80 percent of the long-term average) per 100 cows and compared that to 2.1 mature bulls/100 cows (2009-2014 avg.) to establish the need for the proposal. As we have shown, this approach incorrectly uses Montana section data and assumes pre-wolf productivity is possible in a post- wolf reality.

We recommend a more contemporary objective be calculated using 80 percent of the 2002 – 2015 average of 15.1 adult bulls/100 cows (TNR). This will yield the objective of 12 mature bulls per 100

cows, which compares favorably with the 9.8 adult bulls/100 cows in the 2009-2014 average referenced by the Department in their comparisons. When compared to other hunting districts within Montana, we see that the total bull/cow ratio, when calculated using this methodology, has averaged 20.2 bull/100 cows (2002-2015). This by far exceeds the 10 bulls/100 cows recommended in the Elk Management Plan and is equal to or greater than 83 percent of the 54 hunting districts in Montana reporting similar information.

We examined the Commission regulatory response to decline in herd size and found the incremental tightening of regulations and opportunity consistent with sound conservation principles. We did discover that the Unlimited Permit system put in place in 2012 has never been fully utilized as a management tool. Additional permits have continued to be issued beyond the March 15 application deadline in all four years this system has been in place. This negates our ability to evaluate the efficacy of this mechanism to control hunter response to opportunistic elk availability. Additionally, there is significant anecdotal evidence that FWP enforcement may have failed to curb hunters who participate under a general license and tag with no permit.

We found that the economic impact of the Department recommendation to the Gardiner area will be significant; possibly as high as \$1.9 million dollars per year as well as a loss of substantial non-resident license revenues. Given there is no demonstrated biological threat posed by regulated hunting, the economic impact that will be resultant from elimination of the unlimited system is unnecessary and ill-advised.

We have examined the potential of a six-point restriction to improve adult bull to cow ratios and demonstrated that if it were employed in the 2016 season we would see an improvement from the 2.7 Adult bulls/100 cows reported for the Montana Section to 12.1 adult bulls per 100 cows by the end of the 2017 hunting season; this would exceed the stated objective of 10 adult bulls per 100 cows. We would see a total bull/cow ratio of 21.5 exceeding 79% of the other Hunting Districts in Montana.

As a result of these findings we offer the following recommendations:

Recommendation 1: Establish a management objective for mature bull elk based on estimates from the Total Northern Range (TNR) for the period 2002 – present (post-wolf re-introduction). Using 80 percent of the long-term average will equate to a more contemporary minimum target of 12 adult bulls per 100 cows.

Recommendation 2: Fully implement a true unlimited permit system where the application process closes on March 15. Do not permit surplus licenses and application extensions. As part of this unlimited permit system, limit successful applicants to hunting elk ONLY in HD 313.

Recommendation 3: Closure of Deckard Flats

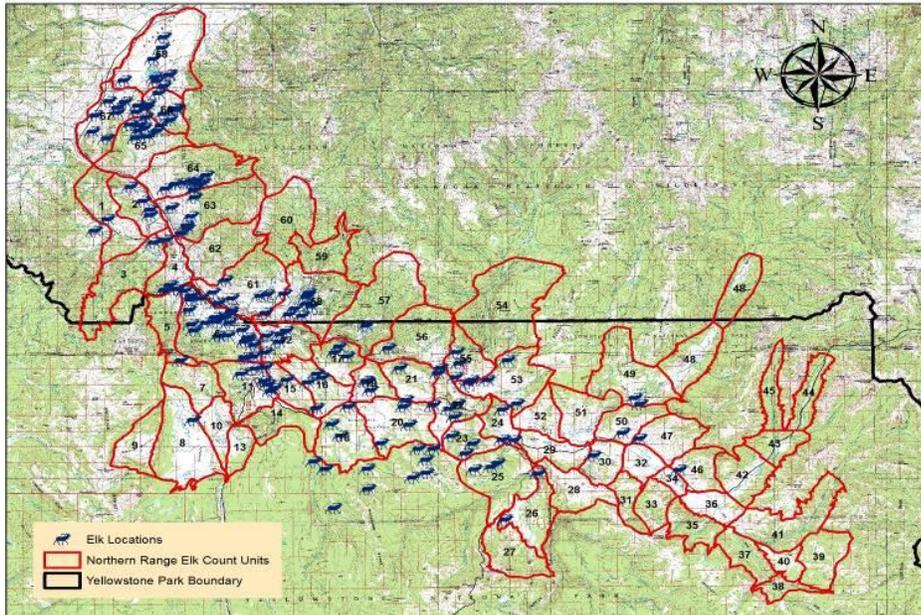
Recommendation 4: Consider implementing a six-point bull restriction in HD 313 as a means to protect younger age classes and increase the number of adult (2 and 3 year old) bulls in the population.

Recommendation 5: Maintain some form of limited youth hunting opportunity.

II. Introduction

HD 313 is located adjacent to Yellowstone National Park and is unique in that most of the elk population is migratory, using summer range within Yellowstone National Park and migrating to winter range within Montana. The combined Yellowstone and Montana portions of the herd are referred to as the Total Northern Range or TNR. This would equate to the aggregate population. A subset of that population is referred to as the Montana or MT portion and is the focus of HD 313 management.

Figure 1. Map of Total Northern Range outlined in red and the Yellowstone National Park boundary defined in black. The area north of the YNP boundary is referred to the Montana section.



Management direction for the Montana portion of the herd is found in the Montana Elk Management Plan; however, significant declines (80 percent decline from 1994 to 2013)) in the Northern Yellowstone herd (TNR) have rendered much of that direction outdated and in need of change (Cunningham, 2014). Hunting opportunity has been restricted by Commission action over the course of the decline and there are signs that the population is stable at low levels or slightly increasing.

The Elk Management Plan contains no objectives for the overall elk population that extends into Yellowstone National Park; however the population objective for the Montana portion of the northern Yellowstone elk herd calls for a range of 3,000-5,000 elk. The objective for this HD is presented as a range because the proportion of the herd that migrates varies with winter severity. The number of elk wintering outside Yellowstone National Park in the Montana section has remained within this objective range for most of the last ten years (Cunningham 2014).

Recent calf/cow ratios are within historically observed ranges and are resulting in the modest population increases observed. The elk plan sets a minimum calf recruitment threshold of 20 calves per 100 cows, a threshold that is being met or exceeded in recent years (Loveless, 2015).

Bull/cow ratios have declined from extraordinary levels observed in the mid 1990's, and adult bull/cow ratios are considered very low. This has prompted a series of actions by the Commission to reduce hunting mortality in response to population decline.

The Elk Management Plan recommends the standard of ten bulls per 100 cows and is silent on any specific immature or mature bull objectives. The Department has raised concerns over an apparent decline in adult bulls (branch-antlered), having estimated from classification surveys of three mature bulls per 100 cows in the Montana portion of the survey area (Loveless 2015).

Biological changes to this herd have been substantial in numbers and distribution. Whereas historically, less than 50 percent of the herd migrated out of YNP to winter, in recent years 70-80 percent have migrated out of Yellowstone National Park to winter (Cunningham 2014). This observation is buttressed by long-time residents of the area very familiar with this herd and its range. Scott Sallee, in a letter to the Commission, stated: *"This herd is extremely migratory and they all don't join until the weather drives them together. It is not sound management practice to treat the portion of the herd that has migrated across an invisible border on a certain day as a separate entity"* (Sallee 2015) .

For these reasons we need to be very careful in describing the trends for the Total Northern Range (TNR) and the Montana only section of the TNR. A review of Department literature reveals inconsistent application of TNR and MT data. Within this document we strive to keep that distinction clear as it has significant bearing on the assessment of herd status and possible management solutions.

III. Management History

A summary of key management decisions and actions in HD 313 affecting the TNR elk herd follow:

1994 to 2004

- Wolves are reintroduced to Yellowstone National Park in 1995

The TNR index of elk abundance drops from a historic high of 19,045 to 8,335

2002

Yellowstone wolves estimated to be 175 animals (record high in contemporary times)

2005

- The Commission reduces the number of antlerless permits issued for the Gardiner late elk hunt from 1,102 in 2005 to 100 per season during 2006-2010 in response to declining elk abundance.

2010

- The Commission closes the late-season hunt over concerns for declining elk abundance

2011

- Elk population is estimated to be 4,635
- Commission eliminates antlerless season.

2012

- Elk abundance estimated to be 4,174
- Commission concerned over low bull/cow ratios in MT portion of survey area
- The Commission institutes a hybrid form of unlimited permit system for antlered elk only. This was not a true unlimited permit system as additional permits were issued beyond the March 15 application deadline (2012 n= 11, 2013 n = 5, and 2014 n= 40).

2014

- Unlimited permits were restricted to first choice only. Department issues 40 permits beyond the March 15 application deadline.
- Yellowstone wolves decline to approximately 100 animals

2015

- Elk abundance in 2015 estimated to be 4,850
- Calf-to-cow ratios exceed long term averages, bull-to-cow ratios exceed the standard set out in the Elk Management Plan
- Department submits a proposal to reduce permits in HD 313 (from approximately 1500) to 75 in response to low mature bull-to-cow ratios.

IV. Department Proposal for HD 313

The Department of Fish Wildlife and Parks is proposing to move from unlimited permit issuance to a limited permit drawing system for elk hunting in HD 313. Limited permits would be capped at 75 and would be issued through special drawing and will effect a 95 percent reduction in permit issuance/hunting opportunity. They further propose to limit the harvest to antlered elk (bulls of all age classes) and establish a harvest quota of 50 – 150 bull elk. No other changes to season length or structure are being proposed (FWP, 2015 Cover Sheet).

The premise for these recommend changes is that overall herd size has declined. Adult bull/cow ratios are at very low levels having declined from 19.5 adult bulls/100 cows (1995 – 2005) to 2.2 adult bulls/100 cows (2009 – 2014) in the MT section of the survey area and from 31.8 to 9.8 adult bulls per 100 cows for the TNR; and this trend portends a conservation concern.

Evaluation criteria for the efficacy of the proposed change can be found in paragraph 3. How will the success of this proposal be measured? To evaluate the efficacy of the proposed change, FWP staff recommend management targets based on maintaining adult bulls per 100 cows at 80 percent (or greater) of the 21 year long term average for two consecutive years. It is unclear which data set, the TNR or MT section, would be used to establish the management target as FWP staff refer to both by offering two competing management targets. Using the MT section data of 12 adult bulls per 100 cows equates to a management target of at least 10 ($12 * 0.8 = 10$) adult bulls/100 cows as classified in HD 313. Using the TNR with a 21 year average of 23.2 adult bulls/100 cows, the regulation would be considered successful if for a two consecutive year period with 18.5 ($23.2 * 0.8 = 18.5$) adult bulls /100 cows were observed in the TNR. It is unclear which management objective they prefer.

V. Northern Yellowstone Elk Abundance and Population Structure

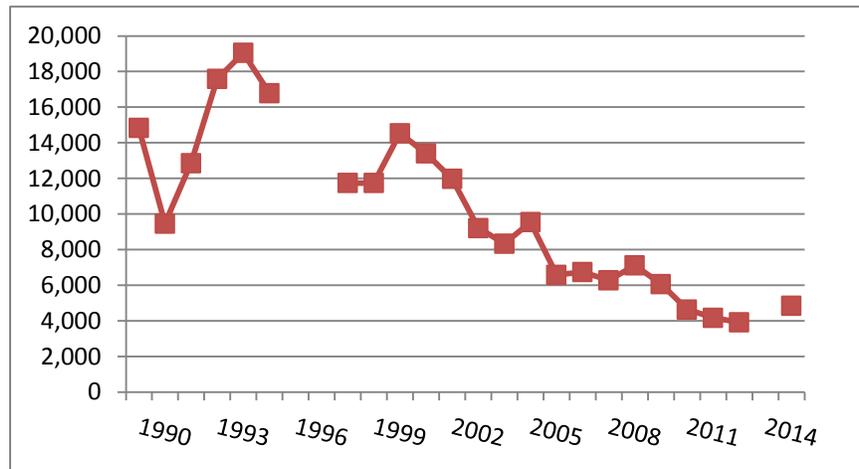
a. Elk Population Trends

Annual aerial surveys of Northern Yellowstone elk have been conducted during the winter since 1967. Survey data is collected and reported for the Total Northern Range and represent a minimum count of the northern Yellowstone elk population while they are concentrated on relatively open, non-forested, snow covered low level portions of their winter range (Wyman, 2015).

Survey results are published annually. Trends in abundance and distribution of elk are key factors in assessing the status of the population and in developing management plans and establishing hunting seasons and regulations for the portion of the population that migrates out of Yellowstone National Park.

Minimum counts for Northern Yellowstone elk peaked in 1994 at 19,045 and then declined to less than 4,000 elk in 2013 (Figure 2). Survey results in 2015 suggest a modicum of increase, but elk remain at low levels.

Figure 2. Minimum estimates of Northern Yellowstone Elk herd from aerial winter surveys 1990- 2015.



Wildlife professionals concede that surveys underestimate the actual abundance of elk and the extent of undercount could vary markedly among years depending on survey condition and detection probabilities that have likely changed following wolf recovery. Elk in Yellowstone Park are more widely distributed in small groups and timbered areas, while elk near Dome Mountain and Dailey Lake continue to congregate in relatively large groups in open areas. Research into this issue is the focus of a sightability study (being conducted from 2015 to 2017) to better estimate how many elk are missed during each annual count (Wyman, 2015).

Year-to-year counts of the Northern Yellowstone herd can fluctuate up to 30 or 40 percent, with general fluctuations of 10 to 20 percent. Other southwestern MT section counts also experience count fluctuations of 5 to 15 percent year to year (MFWP Final EIS 2003, p 48).

Surveys suggest winter distribution of Northern Yellowstone elk has changed since 2008, with more than one-half of the counted elk being observed north of the Yellowstone National Park boundary (Wyman, 2015). Possible reasons for a high proportion of elk migrating to this lower elevation winter range include milder environmental conditions (e.g., less snow) and better forage availability. Wolf densities and the cessation of the late season cow elk hunt may also be factors influencing the winter distribution of elk.

In summary, herd size has declined across the range and wintering distribution of elk has changed suggesting historic comparisons within the MT section may not be valid. Survey methods are known to be imprecise but survey error is assumed to be similar between years and winter counts provide a relative index of abundance comparable between years.

b. Classification Surveys

Annual classification surveys of Northern Yellowstone elk have been conducted on their winter range since 1968 (Loveless, 2015). These surveys provide estimates of the sex and age structure of the surveyed population and are used to calculate indices of winter calf survival and recruitment as well as proportions of adult and yearling bulls in the population. Survey data is reported for Total Northern Range (Yellowstone National Park plus Montana) and for a subset of that data for just the MT section.

Classification data are presented in Table 1 along with some basic averages for parameters followed by Department managers as indicators of herd condition. These parameters include calves/100 cows, yearling bulls/100 cows, adult bulls/100 cows and total bulls/100 cows for both the Total Northern Ranges and a subset for Montana only.

Table 1. Classification data for Northern Yellowstone elk 1995 – 2015.

Year	Total Northern Range					Montana Only				
	Total Elk	Total	Total	Total Adult	Total Bull/	MT Elk	MT Caves/	Bulls/100	Bulls/100	MT Bull/
	Classified	Caves/	Yearling	Bulls/100						
1995	3613	33.4	10.9	28.7	39.7	983	62.1	20	60.1	80
1996	2921	28.5	8.7	25.8	34.5		No Survey			
1997							No Survey			
1998	2720	22.4	4.2	60.9	65.1	387	34.7	9	50.8	59.8
1999	4055	33.9	8.9	42.0	50.8	1685	46.3	13.4	28	41.3
2000	3157	22.7	6.7	16.8	23.5	1773	26.8	6.4	1.3	7.7
2001	1869	29.0	6.5	53.6	60.1	644	35.2	6.9	10.2	17
2002	4001	13.8	7.2	35.9	43.1	1200	11.4	9.5	13.3	22.8
2003	4200	12.4	3.7	18.1	21.8	1315	18	2.6	3.9	6.4
2004	3167	12.3	3.4	20.7	24.1	1075	19.8	3.9	6.3	10.2
2005	3508	13.0	4.5	15.8	20.3	1039	17.2	7.5	1.7	9.2
2006	3649	23.8	6.0	13.9	19.9	2116	26.6	7.1	7.3	14.5
2007	4828	18.6	6.1	11.7	17.8	1646	23	7.1	1	8.1
2008	3656	11.4	2.4	14.4	16.8	2578	14	2.2	9.6	11.9
2009	4269	21.5	4.0	10.7	14.7	1793	27.2	4.7	1.9	6.6
2010							No Survey			
2011							No Survey			
2012	5146	10.8	4.2	8.1	12.3	2065	11.1	4.3	0.8	5.1
2013	3507	18.4	5.4	10.5	15.8	1257	20.9	7.3	2.7	10
2014						2772	24.1	8.7	3.1	11.8
2015	3930	26.5	8.7	6.5	15.2	2507	29.6	9.4	2.7	12.1
1995 - 2005 Avg		22.1		31.8	38.3		30.2		19.5	28.3
2009 - 2014 Avg		16.9		9.8			20.8		2.1	8.4
21 Yr Avg		20.7	6.0	23.2	29.1		26.4	7.6	12.0	19.7

i. Geographic differences and implications to management

As mentioned earlier, FWP management staff divides the classification data set into TNR and MT. TNR is the aggregate of elk both inside and outside Yellowstone National Park while the MT data is a subset of elk outside the park. This raises the question of which data set is most useful for monitoring and reporting status of the Northern Yellowstone herd. Wyman (2015) points out that winter distribution of the Northern Yellowstone elk has changed since 2008. This suggests comparisons within the Montana section alone may not be valid and suggests the aggregate TNR data would be the most comprehensive and best for monitoring and reporting herd condition.

Remarkably, Department staff has elected to focus on the MT portion of the data, which is a subset of the total. Presence of elk in Yellowstone Park and outside the Park at the time of survey flights changes as a product of weather, predators and hunting pressure. The Department proposal to move to limited permits relies heavily on survey data from the MT section and not the TNR, and particularly focuses on adult bull ratios.

To evaluate the geographic stratification of classification data and help determine the appropriateness of using TNR or MT section only we conducted simple statistical tests between 21 year means to determine if the MT section data serve as a representative look at the TNR herd overall (Table 2). This

test poses a technical issue in that the means are not completely independent as the MT section is exclusive and the TNR is a combination of Yellowstone National Park and MT section. Recognizing this deficiency we moved ahead with the analysis as a means to examine the conclusions drawn from using only the MT section as the Department suggests and using the TNR concerning population parameters.

Table 2. Tests for differences between 21 year mean ratios for TNR and Montana using a paired t-test for two sample means.

Parameter	TNR	M	P value	Conclusion
Calves /100 Cows	20.7	26.4	0.067305	Not significant at .05%
Adult bulls/100 cows	23.2	12	0.006661	Highly significant at .05%
Coefficient of variation	69%	147%	(Std/mean)	

Results from a paired t-test for two sample means indicate there is no significant difference between the 21 year mean ratios for calves/100 cows for TNR (20.7) and MT (26.4); but there was a highly significant difference between the adult bull-to-cow ratios. Further inspection of the coefficient of variation (note: coefficient of variation is a standardized evaluation of how variable a mean is, in other words how much stock you place in it. A high CV indicates low reliability, a low CV greater reliability) for these two means finds they are widely different, suggesting the average ratios using MT data are highly variable and therefore uncertain.

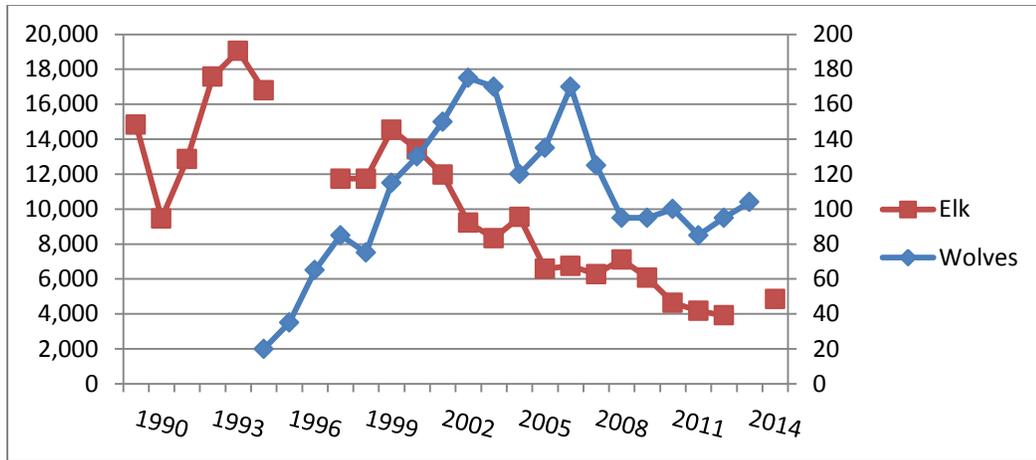
There is evidence from other areas in the Rockies, including the east side of Yellowstone Park, indicating that cow elk (and cows with calves) generally migrate farther and earlier than adult bulls, and the switch from migratory to non-migratory status seems to have resulted largely from changes in distribution of females. Thus, it is quite possible that these changed distributions have altered the sex-ratio tallies in the MT segment of the Northern Yellowstone herd. Increasingly larger numbers of cow elk remaining outside the Park would skew ratios toward lower bull:cow ratios in the MT segment. Moreover, elk may switch from migratory to non-migratory status from one year to the next, based on a study in Canada (Hebblewhite and Merrill, Proc. West. States Deer & Elk Workshop, 2015).

What this means is that TNR data best represents the overall herd condition and MT section only classification results should not be used as a surrogate for the actual population structure for adult bulls as they will likely lead to erroneous conclusions about herd condition.

ii. Reintroduction of wolves and the new management reality

Wolves were present on the landscape in and around Yellowstone National Park in low numbers for years, but increased dramatically following their reintroduction to Yellowstone National Park in the winter of 1995 and 1996 (NPS 2015). Wolf abundance within the park increased from approximately 20 wolves in 1995 to approximately 175 wolves by 2003 (Figure 3). Since then the number of wolves in Yellowstone Park has trended downward and the 2014 estimate placed the number of wolves in the park at 104 (NPS, 2015).

Figure 3. Aerial winter counts of Northern Yellowstone elk 1990- 2015 and wolf abundance in Yellowstone National Park 1995-2014.

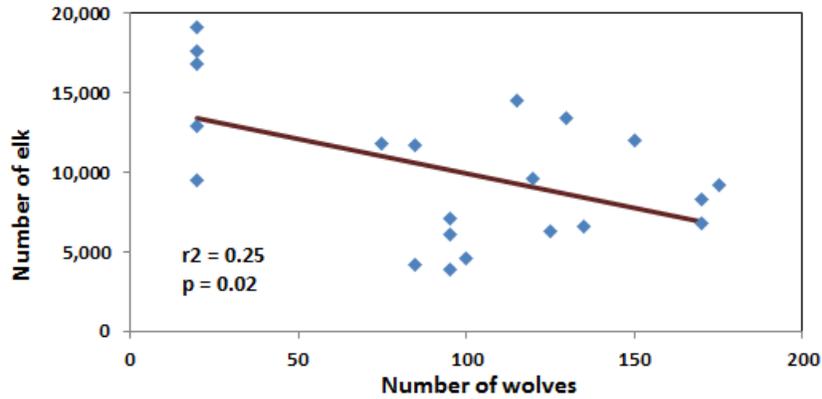


The impact of wolves on elk populations within the park and within the huntable portion of their range (HD 313) is recognized as significant. Although certainly not the only factor responsible for the decline of the Northern Yellowstone elk herd, wolves have had a role in that decline. They continue, along with other factors, to influence the seasonal distribution and recovery of elk in the area.

Shifts from the pre-wolf to post-wolf condition were reported by Creel and Winnie (2004). In a study area that included four drainages in the Gallatin Canyon, northwest of Yellowstone, which encompass much of the wintering grounds to Yellowstone National Park’s Gallatin elk herd, Creel and Winnie found that bull elk were 6.3 times more likely to be killed by wolves than were cow elk. These studies also showed that when wolves were present, elk were less likely to stray away from timbered areas and that when wolves were present, elk herd sizes halved (Creel and Winnie 2004). The reduction in herd size due to the presence of wolves was caused by cow dispersal into smaller groups and bulls leaving the herds altogether (Creel and Winnie 2004).

A simple regression analysis of elk abundance can be measured from aerial counts of the TNR (Wyman 2015) and wolf abundance within Yellowstone National Park (NPS 2015) Figure 4. Since we have more elk abundance information in the years 1990 -1993 when wolves were at background levels we were left to assume wolf abundance to be around the same level (20) as observed in 1994. When included, the regression is significant at the 95% level; $p = 0.02$, and the r^2 is 25%. This does not suggest, nor do we imply, wolves on the landscape are the only causal effect on elk population trends. It does, however, clearly show that wolves have increased while elk have declined. This result buttresses the argument for temporal stratification of the TNR data set in a manner that takes this condition into account.

Figure 4. Regression of elk abundance in the TNR as a function of wolf abundance in Yellowstone National Park.



It is incumbent on management to take into account the presence of wolves as part of the new reality when evaluating historic performance as indicated by parameters such as calf production and bull/cow ratios. To not do so will lead to establishment of unrealistic objectives and possibly ill-advised management actions.

For the purpose of comparison we stratified the classification results based on peak and post peak abundance of wolves (Figure 3) and examined the TNR classification results (see section above on geographic differences) which illustrates the point; prior to 2001 the cow to calf ratio for elk in TNR averaged 28.3 calves/100 cows. Since 2002 that number has been cut nearly in half averaging 16.6 calves/100 cows (Table 3).

Table 3. Late winter classification survey results for Northern Yellowstone elk, 1995 – 2015 for Total Northern Range (combined YNP and MT) and Montana Only (HD 313).

Year	Total Northern Range						Montana Only			
	Total Elk Classified	Total Caves/100 Cows	Total Yearling Bulls/100	Total Adult Bulls/100 Cows	Total Bull/100 Cows	MT Elk Classified	MT Caves/100 Cows	MT Yearling	MT Adult	
								Bulls/100 Cows	Bulls/100 Cows	
1995	3613	33.4	10.9	28.7	39.7	983	62.1	20	60.1	
1996	2921	28.5	8.7	25.8	34.5		No Survey			
1997							No Survey			
1998	2720	22.4	4.2	60.9	65.1	387	34.7	9	50.8	
1999	4055	33.9	8.9	42.0	50.8	1685	46.3	13.4	28	
2000	3157	22.7	6.7	16.8	23.5	1773	26.8	6.4	1.3	
2001	1869	29.0	6.5	53.6	60.1	644	35.2	6.9	10.2	
2002	4001	13.8	7.2	35.9	43.1	1200	11.4	9.5	13.3	
2003	4200	12.4	3.7	18.1	21.8	1315	18	2.6	3.9	
2004	3167	12.3	3.4	20.7	24.1	1075	19.8	3.9	6.3	
2005	3508	13.0	4.5	15.8	20.3	1039	17.2	7.5	1.7	
2006	3649	23.8	6.0	13.9	19.9	2116	26.6	7.1	7.3	
2007	4828	18.6	6.1	11.7	17.8	1646	23	7.1	1	
2008	3656	11.4	2.4	14.4	16.8	2578	14	2.2	9.6	
2009	4269	21.5	4.0	10.7	14.7	1793	27.2	4.7	1.9	
2010							No Survey			
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2012	5146	10.8	4.2	8.1	12.3	2065	11.1	4.3	0.8	
2013	3507	18.4	5.4	10.5	15.8	1257	20.9	7.3	2.7	
2014						2772	24.1	8.7	3.1	
2015	3930	26.5	8.7	6.5	15.2	2507	29.6	9.4	2.7	
1995 - 2005 Avg		22.1		31.8	38.3		30.2		19.5	
2009 - 2014 Avg		16.9		9.8			20.8		2.1	
21 Yr Avg		20.7	6.0	23.2	29.1		26.4	7.6	12.0	
Pre Wolf Avg 95 -2001		28.3		38.0	45.6		41.0		30.1	
Post wolf Avgs 2002 - 2015		16.6		15.1	20.2		20.2		4.5	

The same dramatic changes can be seen in the proportion of mature bulls in the TNR population. Prior to 2001 there was an estimated 38.0 mature bulls per 100 cows; since then that number has dropped to 15.1 mature bulls per 100 cows.

These shifts from pre-wolf to post-wolf condition were tested using a paired t-test for two sample means and were found to be significantly different for the periods 1995 – 2001 (labeled pre-wolf reintroduction) and 2002 – 2015 (labeled post-wolf reintroduction) for all population parameters tested using TNR data (Table 4).

Table 4. Tests for differences between pre (1995-2001) and post (2002- 20015) wolf reintroduction using paired t-test for two sample means.

Parameter	1995 - 2001	2002 - 2015	P value	Conclusion
Calves /100 Cows	28.3	16.6	0.000932	significant at 5%
Total bulls/100 cows	45.6	20.2	0.008111	significant at 5%
Adult bulls/100 cows	38.0	15.1	0.021533	significant at 5%

For the purpose of establishing realistic management expectations, the TNR data set should be stratified temporally into pre-wolf (1995- 2001) and post-wolf (2002 – 2015) time periods and not on simple 10 year or 21 year averages for Montana data as FWP staff have offered.

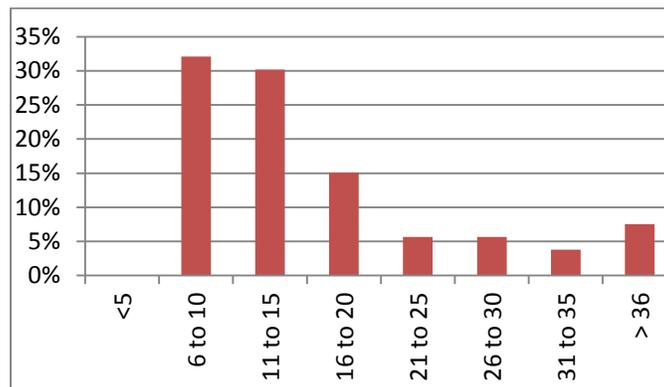
In developing the FWP staff recommendation of 80 percent of the long-term average, staff used 12 mature bulls/ 100 cows (21 year average, Table 3) to develop an objective of at least 10 mature bulls (within 80 percent of the long term average) per 100 cows. This approach is flawed as it incorrectly uses MT data and assumes pre-wolf productivity is possible in a post-wolf reality.

A more contemporary objective is calculated using 80% of the 2002 – 2015 average of 15.1 adult bulls/100 cows (TNR) for an objective of 12 mature bulls per 100 cows. This approach results in a mature bull to cow ratio that exceeds that offered in the Department proposal.

iii. Statewide comparisons

To understand how the TNR bull cow ratios compare to other areas of the state we used bull / cow ratios from 53 hunting districts across the state (Newell and Vore, 2015) which provide contemporary data (2011 – 2015) on average bulls per 100 cow ratios for Montana. Figure 5 is a histogram of total bulls/100 cows in percent frequency for bin ranges of 5. These data reflect counts of total bulls, including spike (yearling) bulls and mature bulls for 53 Montana hunting districts where this data is available. Data suggests that 62 percent of the hunting districts across the state have bull to cow ratios of 15 bulls/100 cows or less.

Figure 5. Frequency distribution (in percent) of total bulls per 100 cows for 53 Montana hunting districts for the period 2011 – 2015.



The average total number of bulls per 100 cows in the TNR for the period 2002 – 2015 (post-wolf reintroduction period) is 20.2, which compares favorably with similar data statewide.

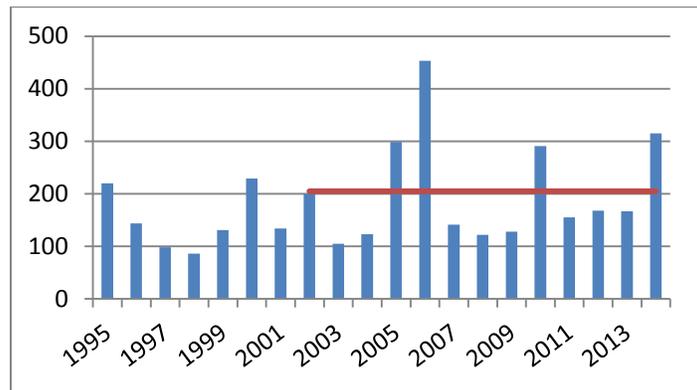
The TNR total bull cow ratio is equal to or greater than 44 (83%) of other hunting districts where such data is available in Montana.

VI. Bull Elk Harvest

Hunter harvest of bull elk in HD 313 has ranged from a low of 86 in 1998 to a high of 453 in 2006 and averaged 205 bulls per year since 2002 (Figure 5).

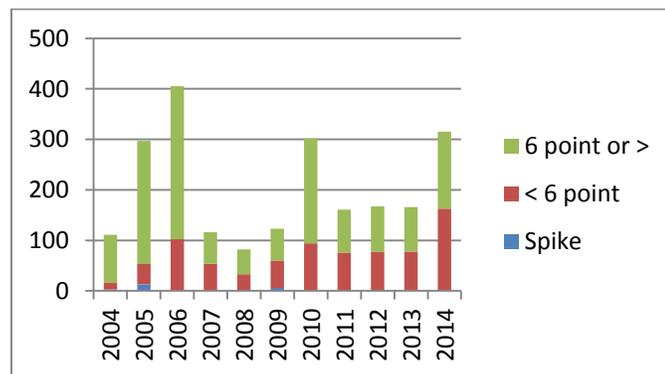
Perhaps the most striking observation from the graphic in Figure 6 is the 4-year cyclic pattern that exists between years of higher elk harvests. Cunningham (2014) Wyman 2015 and Loveless (2015) all refer to weather events that push elk from the park. We did not consult National Weather Service records to examine that premise but it is clear there is a cyclic pattern between the years of peak harvests followed by a period of moderate harvests. This pattern has persisted for the last 20 years and periodic spikes in harvest have not been sustained historically and therefore are not sufficient to warrant following year response. References in FWP staff’s proposal to institution of unlimited permits being first choice in 2014 and that harvest year being the largest since 2006 (FWP 2015) are misleading in that they imply a causal relationship. This pattern has existed for two decades and is likely a function of something other than permit system structure.

Figure 6. HD 313 harvest history for bull elk 1995 – 2014



Within the proposal the Department expresses concern over the adult bull/cow ratios and suggests that hunting harvest is playing a factor in suppressing the adult bull/cow ratio. While we have demonstrated that when the TNR classification data is examined during the contemporary time frame, bull/cow ratios are equal to or better than the vast majority of the other hunting districts, it is still important to understand the harvest history of bull elk in HD 313.

Figure 7. Bull elk harvest as a function of mature, immature and spike 2004 – 2015



Inspection of the data (Figure 7) shows nothing alarming as the cyclic nature of the harvest is present in the immature and mature components; recent harvests are within previously observed ranges for the contemporary time. Mature bulls make up about 64 percent of the bull harvest with immature bulls accounting for 35 percent and yearlings (spikes) 1 percent or less.

VII. Management Response to Population Decline

a. Antlerless season restriction

Antlerless elk season restrictions are called for when elk abundance declines to levels where conservative management is required to increase herd numbers. Following the collapse of the Northern Yellowstone herd the Commission responded appropriately by first reducing antlerless permits in 2005 from 1,102 to a limit of 100 antlerless permits per season. This limitation remained in effect until 2010 after which the Commission eliminated antlerless harvest in HD 313 altogether.

This management strategy continues to make sense as a means to increase elk abundance and it is anticipated it will remain as the herd continues to increase over time.

b. Unlimited Permit System

In 2012 the department began the issuance of unlimited permits for hunting bull elk in HD 313 (313-40) in response to declining bull elk abundance. The intent of the unlimited permit program was to reduce bull elk harvest by moderating the number of hunters coming to the area by requiring a permit to be applied for prior to a March 15 deadline. Going to unlimited permits was predicted to have two positive effects; first was a reduction in the number of hunters participating in HD 313 and second was to stop the flood of hunters that descend upon the area when elk were migrating and become opportunistically accessible.

The issuance of the unlimited permits by year is offered in Table 5 (Worsech, 2015). Since 2012 the number of unlimited permits issued has averaged 1,485 per year in an approximate 70 / 30 split between residents and non-residents. The highest year of permit issuance was 2013 when 1,774 unlimited permits were recorded.

In 2014 the FWP Commission further restricted the structure of the hunt by designating permits as "First Choice Only" for applicants; under the assumption fewer permits would be issued. The number of permits requested in 2014 dropped from 1,774 permits the prior year to 1,232 by the March 15 deadline.

Remarkably, the unlimited permit system was never fully implemented as intended. By Commission action a hybrid system was adopted that allowed permits to be issued beyond the March 15 deadline in all four years they were offered. The result was hunter participation increased by 3 to 13 percent (table 5), accounting for 354 additional permits issued beyond the March 15 cut off.

Table 5. Unlimited permit issuance by year for HD 313-40

Annual Unlimited Permit Issuance				# Beyond 15-Mar	% Beyond 15-Mar	Harvest/ Permit	Additional Bull Harvest Excess Permits
Year	Res	NR	Total				
2012	858	375	1233	82	7%	0.136253	11
2013	1304	470	1774	51	3%	0.094138	5
2014	912	497	1409	177	13%	0.223563	40
2015	1033	492	1525	44	3%		
Total	4107	1834	5941	354	6%		56
Average	1026.75	458.5	1485.25				
Percent	69%	31%					

Permitted hunter success has ranged from 9 percent (2013) to 22 percent (2014) and averages about 15 percent for permitted hunters harvesting bull elk in HD 313-40.

There are anecdotal reports that some hunters never applied for or received permits and hunted on their general tags. Why this was happening can only be speculated. Although there is no empirical evidence to quantify this statement, and the magnitude of that condition is unknown, if it occurred it would serve to further increase participation and therefore harvest potential.

What is clearly known, however, is that the continued issuance of permits beyond the March 15 deadline added as much as 13 percent to the overall harvest potential within this management unit. When seasonal hunter success is applied to permits issued beyond the March 15 deadline, an estimate of 56 bull elk are accounted for with 40 of them occurring in 2014 alone.

The combination of continued permit issuance beyond the March 15 deadline, and the likelihood that some hunters did not obtain a permit in the first place, makes it impossible to evaluate the efficacy of this regulation in managing the harvest of bull elk based on past performance.

Staff comments dismissing the unlimited permit system as a useful mechanism for controlling harvests are premature as the unlimited permit system has yet to be fully implemented and tested.

VIII. Economic and Social Impacts of FWP Proposal

a. Economic Value of Elk Hunting in HD 313

The Department proposal will reduce hunting opportunity in HD 313 by an average of 95 percent. The economic consequences must be weighed against the anticipated benefits. The Montana Department of Fish Wildlife and Parks maintain several data sources intended to address the data needs and estimates. In an effort to understand the economic impact a 95 percent reduction in hunter participation will have on state and local economies, we consulted the FWP website (MFWP b). We obtained the number of hunter days by residency and applied economic multipliers for average length of a hunting trip in HD 313 (MFWP, 2015 b), and values of a hunting day for resident and non-residents (Lewis and King, 2014). Calculations were made

for the value of resident participation by year and summed for the period 2012 – 2015 in the following manner:

(Number of resident hunters) (Avg. days hunted) (Resident avg. expenditure/day) = Resident Value

This process was repeated for non-resident permit holders as well. This data has limitations and represents hunter expenditures related to transportation, food, lodging, equipment purchased just for the trip and/or guide fees. NOT included is the cost of licenses or durable goods (e.g. rifle, boots, packs, etc.)

Table 6. Estimates of economic value of elk hunting in HD 313 for the period 2004 – 2012.

Year	Residents	Days in Field	Res. Rate	Total	Non Res.	Days in Field	Non Res. Rate	Total	Res./Non Res. Combined
2004	1,285	3	\$86.25	\$332,493.75	248	5	\$577.08	\$715,579.20	\$1,048,072.95
2005	971	5	\$86.25	\$418,743.75	498	6	\$577.08	\$1,724,315.04	\$2,143,058.79
2006	1049	5	\$86.25	\$452,381.25	995	6	\$577.08	\$3,445,167.60	\$3,897,548.85
2007	723	6	\$86.25	\$374,152.50	569	6	\$577.08	\$1,970,151.12	\$2,344,303.62
2008	920	6	\$86.25	\$476,100.00	251	6	\$577.08	\$869,082.48	\$1,345,182.48
2009	913	6	\$86.25	\$472,477.50	253	6	\$577.08	\$876,007.44	\$1,348,484.94
2010	890	6	\$86.25	\$460,575.00	407	5	\$577.08	\$1,174,357.80	\$1,634,932.80
2011	817	6	\$86.25	\$422,797.50	372	6	\$577.08	\$1,288,042.56	\$1,710,840.06
2012	517	7	\$86.25	\$312,138.75	424	6	\$577.08	\$1,468,091.52	\$1,780,230.27
Average		5.6		\$413,540.00		5.8		\$1,503,421.64	\$1,916,961.64
2016	68	5.5	\$86.25	\$32,257.50	7	5.7	\$577.08	\$23,025.49	\$55,282.99

Based on this summary, the value of elk hunting in HD 313 is estimated to average \$1.9 million per year. It is unknown what proportion remains in the local area, but clearly based upon the parameters sampled (fuel, food, lodging), a significant benefit to local businesses is realized (Table 6).

During the four years the permit system has been in place, an average of 460 have been issued non-residents each year and constitutes at least \$390,000 (460 x \$846 elk combo) per year in license revenues.

The proposal proffered by the Department to move to limited permits would effectively eliminate non-resident participation and reduce resident participation to 75 permits. Assuming similar spending behaviors the economic value of the HD 313 elk hunt would be approximately \$55,000 per year.

A move to 75 limited permits in HD 313 will result in an economic loss to the local area of up to \$1,861,700 dollars per year and some unknown portion of the \$390,000 of non-resident license sale revenue to FWP.

b. Loss of Hunting Opportunity on Public Land

The Rocky Mountain Elk Foundation raised hard-earned hunter and conservation dollars to purchase both the private historic OTO dude ranch and the lower end of the Church Universal land to open it to the public for hunting and recreation. At a time when the FWP and public are working together to try to open privately owned lands in the northern portion of Park County for the hunting public, it seems counter intuitive that FWP would lobby to close over 100,000

acres of historically open and fruitful public ground? Gardiner is a legacy for hunters across the nation and Montana. With over 85% in HD 313 that is public ground, Montanans want to continue to have the opportunity to hunt the area as past generations have.

c. Precedent for Montana Elk Management

If the staff proposal is accepted in its current form, and the management objective becomes 10 mature bulls per 100 cows then a new standard will have been set. What of the other hunting districts that are materially short of this mark currently? The management precedent will be significant if the Commission seeks uniformity and applies these standards to the rest of the state.

As we have pointed out that when an objective is calculated correctly, considering geographic and temporal strata, bull to cow ratios for the TNR are equal to or exceed 83% of the other hunting districts in the state. Using the Departments approach the objective being established for HD 313 would be better than 25% of the other hunting districts.

If the justification for this action is herd health this condition presents a very difficult management decision for the Commission when considered through the lens of statewide perspective. Is the Commission prepared to move to limited permits to achieve similar objectives in 25% of the hunting districts across the state?

If this is a matter of improving trophy quality that issue becomes moot as it is not based on a biological issue but is satisfying a perceived demand by the hunting public.

IX. Six Point Season Management Option

Declining elk populations in the East Kootenay region of British Columbia, characterized by distorted bull/cow ratios and low calf recruitment led to intense public controversy in the mid-1990s. In response, the BC Ministry of Environment, Land and Parks took steps to address the biological concerns. Among those steps were included secession of the calf/cow elk harvests and the institution of a six point bull elk restriction. In a report published by Dr. Steven Wilson and Richard Morley in 2005 the authors report on the results of the six-point management strategy; quote:

“In addition, [to the antlerless restrictions] the 6-point bull season has been very successful in achieving population objectives (principally bull escapement as measured by bull-to-cow ratios) and had resulted in almost universally high hunter satisfaction. Hunters reported excellent hunting experiences, although the 6-point restriction did not guarantee success”

We examined this option using a simple cohort analysis following yearling (spikes) and two-year-old (5 point bulls) to maturity and tracking the projected changes in category of mature (2 yr. old and older) bulls per 100 cows. We forecast changes using the 2015 classification survey data as the baseline, and projected changes in adult bull to cow ratios for 2016, pre-hunting season (September), 2016, post-hunting season (Dec – Feb), 2017 pre-hunting season (September) and 2017 post hunting season (Dec – Feb).

a. Definitions:

We conducted the analysis using the following definitions:



Spike Bull = Yearling Bull
One year old bull elk



5 Point Bull = 2 Yr. Old Bull Elk
Classified as Montana Adult Bull



6 Point Bull = 3+ year old
Classified as Montana Adult Bull
(A small percentage of bulls do not
Achieve 6 points)

We examined both the TNR and Montana section data without the aforementioned stratification to keep the translation as simple and un-confounded as possible.

b. Assumptions

To complete this analysis the following analysis we made the following assumptions:

- Non stratified department survey data forms a baseline for analysis
- No natural mortality or death loss
- Static recruitment of yearling bulls
- We assumed 2.7 adult bulls/100 cows would be left in the herd based upon the previous 3 years data.

Obviously this model could be far more complex with the incorporation of survival and recruitment schedules, however, these data do not exist for this herd and neither do precise estimates of age of classification or age at harvest. For the purpose of simple trend analysis, however, and the concern expressed by management staff, this method is considered sufficiently robust.

c. Results

A graphical representation of the annual recruitment schedule is found in Appendix 2.

Although we conducted the analysis on the non-stratified FWP data set for both TNR and the MT section only we will focus the discussion of results on the MT section. Similar results occurred in the TNR analysis, but since the Department is focused on the MT section we confined this explanation to that section and results are found in Table 7.

Table 7. Results of application of a six-point restriction on bull elk harvest in Hunting District 313 for 2016 and 2017.

			Bull Elk/100 Cows - Montana Section					
Year	Condition	Assessment	1 Yr old	2 yr old	3 years +	Adult Bulls 2 yr+ 3 yr	Total Bulls 1 yr. + 2yr. +3yr	
2015	Post-hunt	Dec- Feb	9.4	?	2.7		12.1	
2016	Pre-hunt	September	9.4	9.4	2.7	12.1	21.5	
2016	Post-hunt	Dec- Feb	9.4	9.4	0	9.4	18.8	
2017	Pre-hunt	September	9.4	9.4	9.4	18.8	28.2	
2017	Post-hunt	Dec- Feb	9.4	9.4	2.7	12.1	21.5	

Prior to the 2016 hunt (September) we can expect on average to see 21.5 total bulls/100 cows, with 12.1 adult bulls/100 cows. Following the first season under a 6 point only restriction the protected yearling and 2 year-olds advance an age class, and assuming ALL six-point elk are harvested (highly unlikely but this provides for a very conservative estimate) we see 9.4 adult

bulls/100 cows and 18.8 total bulls/100 cows. Following for a second year the pre-hunt condition would be 18.8 adult bulls/100 cows with 9.4 three-year olds present and 28.2 total bulls/100 cows. Again assuming all 6 point bulls are harvested in the 2017 season we see the adult bulls/100 to be at 12.1 and total bulls at 24.2.

This is a very simplistic model, but under even the most extreme case where ALL six point elk are harvested in the season, the following protected cohort is there to be part of the breeding component. By the end of a single year we nearly meet the Department objective and by the second year we exceed it. In addition it would leave the total bull/cow ratio at 18.8 which is BETTER than 68% of all other Hunting Districts.

By the end of a second year we will exceed the stated goal in the MT section and will have 21.5 total bulls/100 cows; better than 79% of the other Hunting Districts in Montana.

The 6-Point season structure appears to have promise and even under a very conservative application virtually meets the stated Montana section goals in year one and by the second year exceeds them, providing a the total bull to cow ratio that exceeds 79% of all the other Hunting districts in the state.

X. Conclusions

- 1) There are statistically significant differences between the long-term (21-year) averages for bull-to-cow ratios between the Total Northern Range and Montana section of the survey area. This suggests that management objectives need to be based on the TNR as focusing on just the Montana section may likely lead to an erroneous assessment of herd condition.
- 2) There are statistically significant differences between the pre and post-wolf reintroduction periods (1995 – 2001 and 2002 – 2015) in the average number of calves, bulls and adult bulls per 100 cows as compared to the TNR survey data. This suggests evaluation of population parameters and development of management objectives would be best done using contemporary temporal stratification (2002- present) for TNR survey data set.
- 3) When bull cow ratios are calculated for the TNR after taking into account appropriate temporal stratification, we find that bull/cow ratios average 20.3 bulls/100 cows which is equal or better than 83 percent of the other hunting districts in Montana and exceeds by twice the guidance found in the Elk Management Plan. This suggests that although abundance of elk remains low, there is no biological threat posed by the bull/cow ratios currently being reported.
- 4) The unlimited permit system has never been fully implemented and its efficacy in controlling hunter participation and managing bull harvest is unknown. This suggests that by fully applying the unlimited permit system hunter participation can be reduced beyond what has been observed under the hybrid unlimited system that has been in place.
- 5) Going to a six-point bull restriction will improve the proportion of adult bulls in the population by reducing/eliminating harvest of immature (2 years and younger) bulls and by reducing hunter success. Benefits of this restriction would be observed for the TNR within four years.

- 6) The economic impact of the Department recommendation to the Gardiner area will be significant, possibly as high as \$1.9 million dollars per year, as well as a loss of non-resident license revenues. Given there is not a biological threat posed by regulated hunting the economic impact that will be realized through elimination of the unlimited system is unnecessary and ill-advised.

XI. Recommendations

We respectfully offer the FWP Commission the following recommendations to ensure the long-term sustainability of elk in HD 313 and, to the extent possible, the viability of elk hunting opportunity within the area.

Recommendation 1: Develop the management objective for mature bull elk based on estimates from the Total Northern Range (TNR) for the period 2002 – present (post-wolf reintroduction). Using 80 percent of the long-term average would equate to a more contemporary minimum target of 12 adult bulls per 100 cows.

Rationale:

We have shown that there is no biological justification to establish a minimum adult bull/cow ratio other than to improve harvest quality. As pointed out, there is great uncertainty in estimating bull-to-cow population parameters when using only the MT survey data and using these survey results may lead to erroneous conclusions. Additionally, we have shown changes in herd productivity can be positively correlated temporally to the presence of the wolf on the landscape. The new reality is that wolves are here to stay and they will continue to influence what we see on the ground and measure in terms of herd abundance and productivity. Therefore it is incumbent on management to consider this new condition as the norm and temporally stratify survey data accordingly. Contemporary estimates of adult bulls/100 cows for the TNR place this number at an average of 15.1 adult bulls/100 cows making these bull cow ratios equal to or greater than 44 (83 percent) of the other hunting districts where such data is available in Montana.

Recommendation 2: Fully implement a true Unlimited Permit system where the application process closes on March 15 and surplus licenses and application extensions are not permitted. As part of this unlimited permit system, limit successful applicants to hunting elk ONLY in HD 313.

Rationale: Unlimited permits serve as a reasonable means to limit participation and avoid opportunistic hunter overload when animals become easily accessible and vulnerable. By limiting applicants to a single hunting district (HD 313) the pool of interested hunters will necessarily decline and only those willing to trade off hunting opportunity in other districts will apply, thereby reducing the number of unlimited permit applications.

Recommendation 3: Closure of Deckard Flats

Rationale: Deckard Flats is part of an important migratory corridor for this elk population. When elk move through this area they are highly vulnerable to harvest due to open terrain and easy access, particularly during periods of heavy snowfall. Closing this area will help moderate elk harvest and provide additional security during their migration. Once management objectives are realized the Commission could consider lifting this closure.

Recommendation 4: Staff the FWP Check Station near the Ringler Access

Rationale: There is a fine permanent FWP check station set up near the Rigler access just before the canyon that was manned daily when we still had a late elk hunt in Gardiner. That station has sat vacant for years, and staffing this access point will provide timely and precise estimates of elk harvested and hunter participation.

Recommendation 5: Implement a six-point bull restriction in HD 313

Rationale: Limiting directed harvest of elk in HD 313 to six-point bulls or better affords full protection to younger-aged bulls and will reduce overall hunter harvest. While this may be initially counter-intuitive, as we would be directing the bull harvest to the segment in low abundance, we are also affording significant protection to younger age-class males who will then repopulate the herd as older mature bulls. This approach, although new to Montana, has been successfully implemented in British Columbia for elk and in Alaska for moose (See Appendix 2 for summary)

Based on success in other areas with this management strategy, we believe the population response to a six-point restriction will be positive. I would add something about this recommendation guaranteeing access for resident and non-resident hunters in an area that has been the bastion of Montana elk hunting since our grandfather's time...or something to address the fact FWP is attempting to gain hunter access nearly everywhere else in the state yet proposing to close it in the district that is iconic to Montana elk hunting.

Recommendation 5: Maintain some measure of youth opportunity in HD 313.

Rationale: The absence of a biological crisis warrants consideration of a modicum of dedicated youth opportunity. We support the Departments recommendation of the creation of a Youth Antlerless B license with a harvest range of 15 to 50 cows. At this level the benefits measured in youth participation exceed the biological cost of the limited cow harvest.

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Appendix 1

Results of Comparison of Means for Classification Data for Total Northern Range and Montana for 21 year means for three parameters; calves/100 cows, total bulls/100 cows and adult bulls/100 cows.

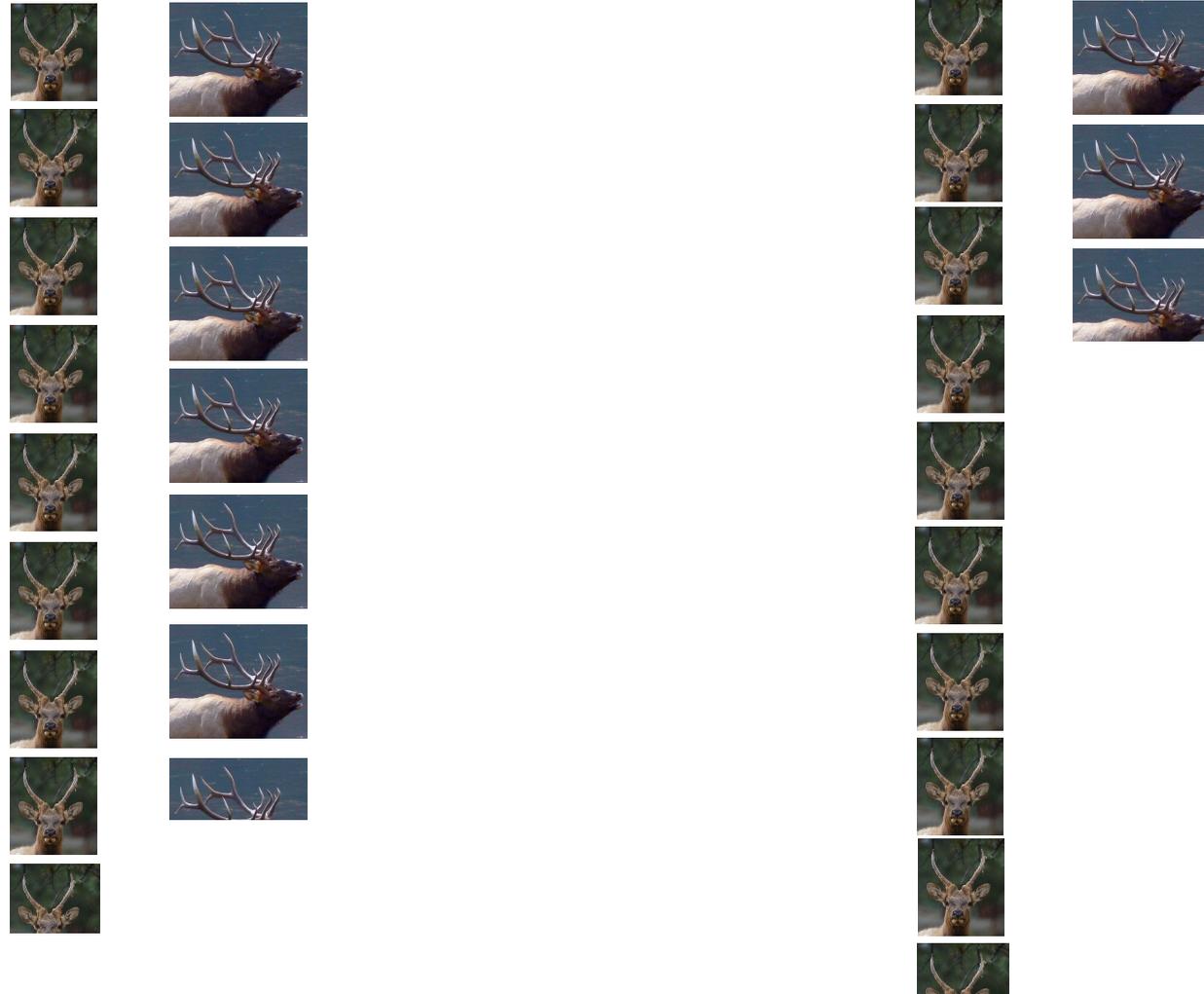
21 yr mean, TNR v. MT, calves		
t-Test: Paired Two Sample for Means		
	Variable 1	Variable 2
Mean	20.72941	26.35294
Variance	59.78596	167.9114
Observations	17	17
Pearson Correlation	0.911921	
Hypothesized Mean	0	
df	16	
t Stat	-1.96274	
P(T<=t) one-tail	0.033653	
t Critical one-tail	1.745884	
P(T<=t) two-tail	0.067305	not significant at 5%
t Critical two-tail	2.119905	
21 year, TNR v. MT, total bulls		
t-Test: Paired Two Sample for Means		
	Variable 1	Variable 2
Mean	29.14706	19.67647
Variance	279.7364	441.9007
Observations	17	17
Pearson Correlation	0.674	
Hypothesized Mean	0	
df	16	
t Stat	2.224972	
P(T<=t) one-tail	0.020409	
t Critical one-tail	1.745884	
P(T<=t) two-tail	0.040817	significant at 5%
t Critical two-tail	2.119905	
21 year, TNR v. MT, adult bulls		
t-Test: Paired Two Sample for Means		
	Variable 1	Variable 2
Mean	23.18235	12.04118
Variance	259.1115	314.1951
Observations	17	17
Pearson Correlation	0.652737	
Hypothesized Mean	0	
df	16	
t Stat	3.115413	
P(T<=t) one-tail	0.003331	
t Critical one-tail	1.745884	
P(T<=t) two-tail	0.006661	significant at 5%
t Critical two-tail	2.119905	

2015 Classifications December - February

After MT Brow Tined Hunting Season

Total Northern Range					Montana Only				
Total Elk Classified	Total Calves: 100 cows	Total Yearling bulls: 100	Total Adult Bulls: 100 cows	Total Bulls: 100 cows	MT Elk Classified	MT Calves: 100 Cows	MT Yearling bulls: 100 cows	MT Adult Bulls: 100 cows	MT Bulls: 100 Cows
3930	26.5	8.7	6.5	15.2	2,507	29.6	9.4	2.7	12.1

- FWP wants to increase adult bull ratio's to 80% of 21 year average
- TNR 21 year average 23.2 adult bulls per 100 cows --- $23.2 \times 80\% = 18.6$ adult bulls/100 cows = successful recovery
 Current number = 6.5 adult bulls/ 100 cows
- MT Only—21 year average adult bull = 12 adult bulls/100 cows --- $12 \times 80\% = 9.6$ adult bulls to 100 cows = successful recovery
 Current number = 2.7 adult bulls/ 100 cows



After a 6 Pt Only Hunting Season Based off of 2015 Flight Surveys

Total Northern Range							Montana Only						
Total Elk Classified	Total Calves: 100 cows	Total Yearling bulls: 100	MT Adult Bulls (5pts– 2yrs old): 100 cows	MT Adult Bulls (6 pts or better): 100 cows	Adult Bulls: 100 cows	Total Bulls: 100 cows	MT Elk Classified	MT Calves: 100 Cows	MT Yearling bulls: 100 cows	MT Adult Bulls (5 pts—2 yrs old) :100 cows	MT Adult Bulls (6 pts or better):100 cows	MT Adult Bulls:100 cows	MT Bulls: 100 Cows
3,930	26.5	8.7	8.7	6.5	15.2	23.9	2,507	29.6	9.4	9.4	2.7	12.1	21.5



- This is the results of the first year of a 6 pt season being implemented pre-hunting season 2016
- We assume no mortality or death loss in this model.
- We assume static recruitment of yearling bulls.
- We assume there will be 2.7 adult bulls/100 cows left in herd annually based off previous 3 years data.



After the **FIRST** 6 Pt Only Hunting Season Based off of 2015 Flight Surveys

Total Northern Range							Montana Only						
Total Elk Classified	Total Calves: 100 cows	Total Yearling bulls: 100	MT Adult Bulls (5pts– 2yrs old): 100 cows	MT Adult Bulls (6 pts or better): 100	Total Adult Bulls = 5 pt & 6 pt Bulls	Total Bulls: 100 cows	MT Elk Classified	MT Calves: 100 Cows	MT Yearling bulls: 100 cows	MT Adult Bulls (5 pts) :100 cows	MT Adult Bulls (6 pts or better):100 cows	Total Adult Bulls = 5pt & 6pt bulls	MT Bulls: 100 Cows
3930	26.5	8.7	8.7	2.7	11.4	20.1	2,507	29.6	9.4	9.4	0	9.4	18.8



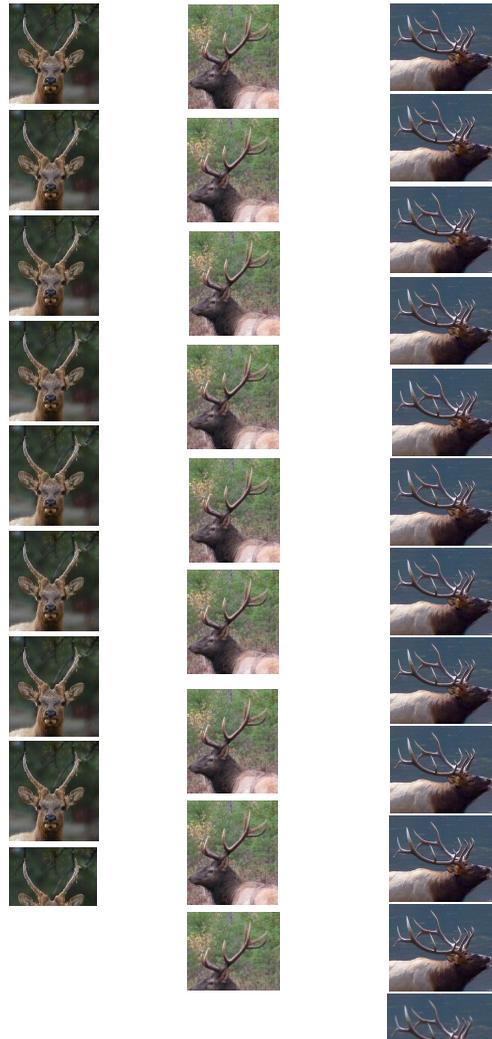
- Goal is 80% of 21 year average of adult bulls — $23.2 \times 80\% = 18.6$ adult bulls/100 cows = success
- TNR post 6 pt season leaves 11.4 adult bulls/100 cows vs. 6.5 adult bulls/100 cows in 2015.
- 40% of recovery goal met first year



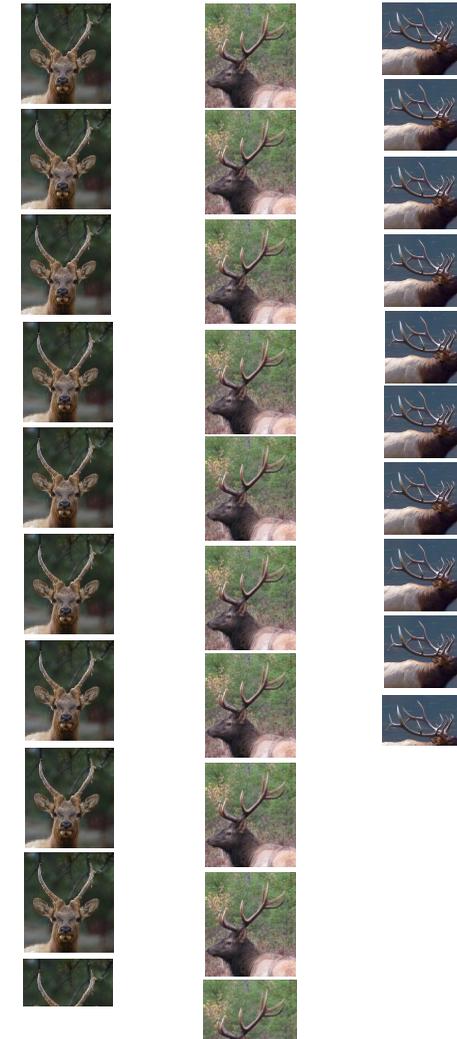
- Goal is 80% of 21 year average of adult bulls — $12 \times 80\% = 9.6$ bulls/100 cows = success
- MT post 6 pt season leaves 9.4 adult bulls/100 cows vs. 2.7 adult bulls/100 cows in 2015. This assumes 100% harvest of all older age class bulls (3+ years of age)
- Results of 1 year of 6 pt season we NEARLY MEET FWP goal WITH 9.4.
- 18.8 total bull/100 cows post season better than 68% of all MTFWP districts.

After the **FIRST** 6 Pt Only Hunting Season in 2016 and before the 2017 hunting season

Total Northern Range							Montana Only						
Total Elk Classified	Total Calves: 100 cows	Total Yearling bulls: 100	MT Adult Bulls (5pts– 2yrs old): 100 cows	Total Adult Bulls (6 pts or better): 100 cows	Total Adult Bulls = 5 pt & 6 pt Bulls	Total Bulls: 100 cows	MT Elk Classified	MT Calves: 100 Cows	MT Yearling bulls: 100 cows	MT Adult Bulls (5 pts) :100 cows	MT Adult Bulls (6 pts or better):100 cows	Total Adult Bulls = 5pt & 6pt bulls	MT Bulls: 100 Cows
3,930	26.5	8.7	8.7	11.4	20.1	28.8	2,507	29.6	9.4	9.4	9.4	18.8	28.2



- During 2017 breeding season TNR will have 20.1 adult bulls/100 cows and the MT segment will have 18.8 adult bulls/100 cows.
This ensures enough bulls to complete successful breeding of cows.
- By the 2nd year after ths first 6 pt season there will be 28.2 bulls/100cows in MT subsection.



After the **SECOND** 6 Pt Only Hunting Season Based off of 2015 Flight Surveys

Total Northern Range							Montana Only						
Total Elk Classified	Total Calves: 100 cows	Total Yearling bulls: 100	MT Adult Bulls (5pts- 2yrs old): 100 cows	MT Adult Bulls (6 pts or better): 100	Total Adult Bulls = 5 pt & 6 pt Bulls	Total Bulls: 100 cows	MT Elk Classified	MT Calves: 100 Cows	MT Yearling bulls: 100 cows	MT Adult Bulls (5 pts) :100 cows	MT Adult Bulls (6 pts or better):100 cows	Total Adult Bulls = 5pt & 6pt bulls	MT Bulls: 100 Cows
3930	26.5	8.7	8.7	4.7	13.4	22.1	2,507	29.6	9.4	9.4	2.7	12.1	21.5



- Goal is 80% of 21 year average of adult bulls — $23.2 \times 80\% = 18.6$ adult bulls/100 cows = success
- TNR post SECOND 6 pt season leaves 13.4 adult bulls/100 cows vs. 6.5 adult bulls/100 cows in 2015.



- Goal is 80% of 21 year average of adult bulls — $12 \times 80\% = 9.6$ bulls/100 cows = success
- MT post SECOND 6 pt season leaves 12.1 adult bulls/100 cows vs. 2.7 adult bulls/100 cows in 2015.
- Results of 2ND year of 6 pt season we exceed FWP goal BY 2.5 adult bulls/100 cows.
- 21.5 total bull/100 cows post season better than 79% of all MTFWP districts.
- Older age class (3+ years) being added back to herd.

Key



Spike Bull = Yearling Bull
One year old bull elk



5 Point Bull = 2 Year Old Bull Elk
Classified as Montana Adult Bull



6 Point Bull = 3+ year old
Classified as Montana Adult Bull

*** A very small percentage of bulls
will never achieve 6 pts**