To: FWP Commission

From: Mac Minard
Executive Director
Montana Outfitters and Guides Association

Re: Comments on HD 313 Elk Management Proposal

Date: November 21, 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 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 fours 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.

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

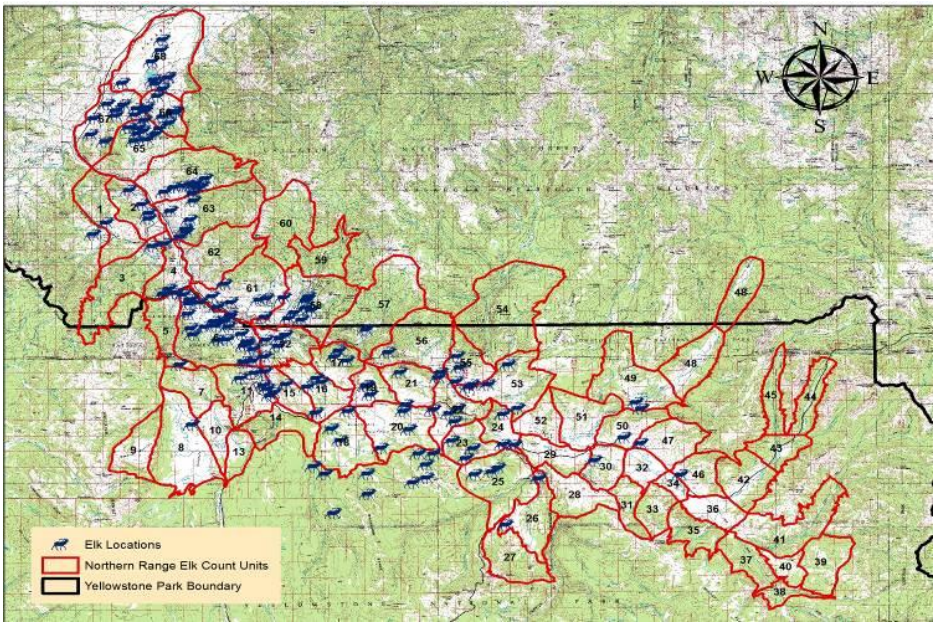
Recommendation 4: Consider implementing a six-point bull restriction in HD 313 as a means to protect younger age classes and increase the number of six-point (and better) bulls in the population.

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 oultined in red and the Yellowstone National Park boundry defined in black. The area north of the YNP boundry 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). For this reason 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

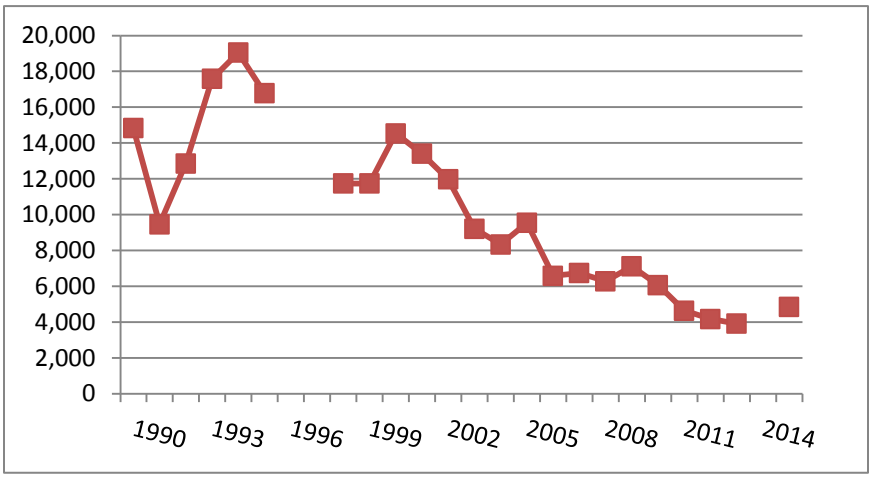
a. Elk Population Trends

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- 12015.




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.

| | | Total Northern Range | | | | | | | Montana Only | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Total | Total | Total Adult | | | | MT Yearling | MT Adult | | |
| | Total Elk | Caves/ | Yearling | Bulls/100 | Total Bull/ | | MT Elk | MT Caves/ | Bulls/100 | Bulls/100 | MT Bull/ |
| Year | Classified | 100 Cows | Bulls/100 | Cows | 100 Cows | | Classified | 100 Cows | Cows | Cows | 100 Cows |
| 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).

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 signifcant at .05% |
| | | | | |
| Adult bulls/100 cows | 23.2 | 12 | 0.006661 | Higly significant at .05% |
| Coefficient of variation | 69% | 147% | (Std/mean) | |

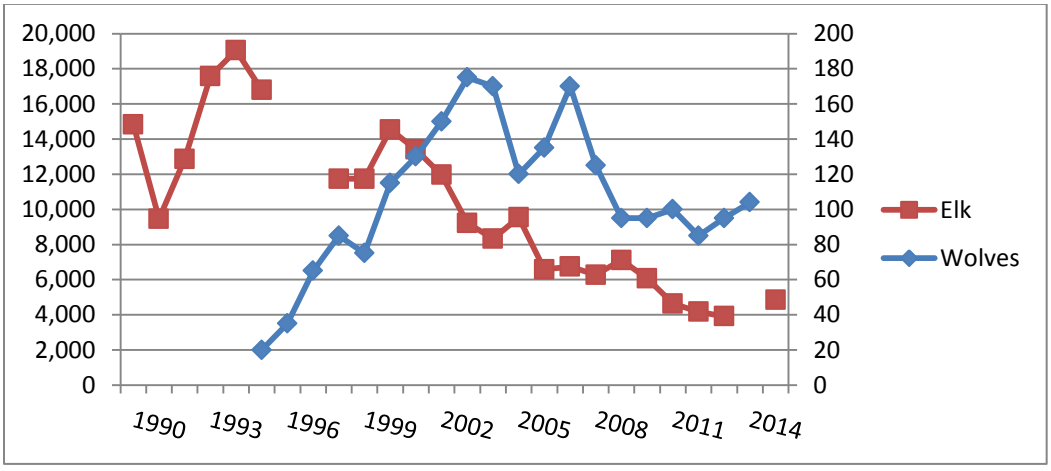
Results from a paired t-test for two sample means indicate there is no significant difference between the 21 year mean ratios for calves/100 cows for TNR (20.7) and MT (26.4); but there was a highly significant difference between the adult bull-to-cow ratios. Further inspection of the coefficient of 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.

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.

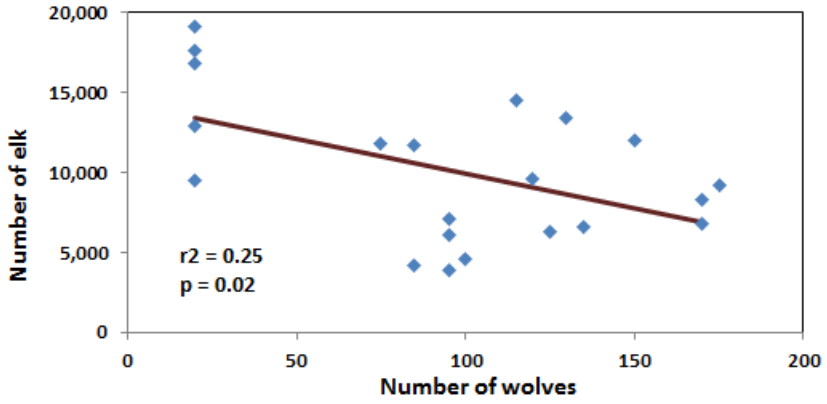


The impact of wolves on elk populations within the park and within the huntable portion of their range (HD 313) is recognized as significant. Although certainly not the only factor responsible for the decline of the Northern Yellowstone elk herd, wolves have had a role in that decline. They continue,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

The TNR classification results (see section above on geographic differences) illustrate this 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).

| | | Total Northern Range | | | | | | Montana Only | |
|---|---|---|---|---|---|---|---|---|---|
| | | Total | Total | Total Adult | | | | MT Yearling | MT Adult |
| | Total Elk | Caves/ | Yearling | Bulls/100 | Total Bull/ | | MT Elk | MT Caves/ | Bulls/100 | Bulls/100 |
| Year | Classified | 100 Cows | Bulls/100 | Cows | 100 Cows | | Classified | 100 Cows | Cows | 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 | | |
| 2011 | | | | | | | | No Survey | | |
| 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 |
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| 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 | signficant 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.

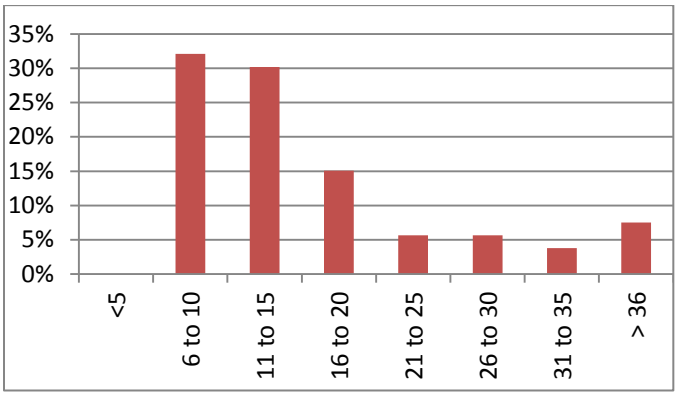
In developing the FWP staff recommendation of 80 percent of the long-term average, staff used 12 mature bulls/ 100 cows (21 year average, Table 3) to develop an objective of at least 10 mature bulls (within 80 percent of the long term average) per 100 cows. This approach is flawed as it incorrectly uses 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.

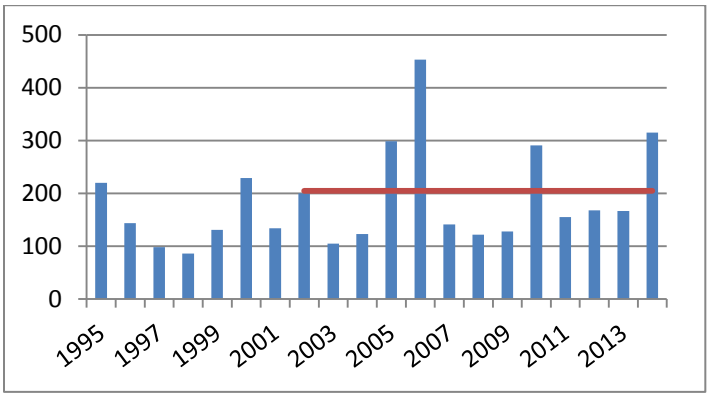
The TNR total bull cow ratio is equal to or greater than 44 (83%) of other hunting districts where such data is available in Montana.

## 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).

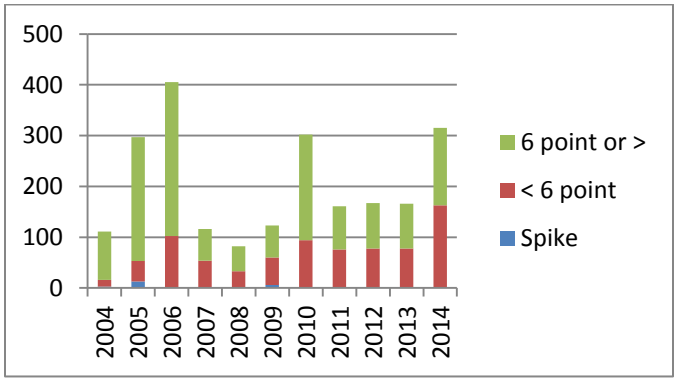
Perhaps the most striking observation from the graphic in Figure 6 is the 4-year cyclic pattern that exists between years of higher elk harvests. Cunningham (2014) Wyman 2015 and Loveless (2015) all refer to weather events that push elk from the park. We did not consult National Weather Service records 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

| | | | | # Beyond | % Beyond | | Additional | |
|---|---|---|---|---|---|---|---|---|
| Annual Unlimited Permit Issuance | | | | 15-Mar | 15-Mar | Harvest/ | Bull Harvest | |
| Year | Res | NR | Total | | | Permit | Excess Permits | |
| 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 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.

## IX. Six Point Season Management Option

Analysis Not Completed yet, however, results appear promising.

## 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: 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 | | |

Appendix 2
Efficacy of six-point bull restriction observed in
the Kootenai Elk Management Area

Ray Demarchi , a biologist from Cranbrook, implemented the 6 point or better elk season in British Columbia, Canada. At a a wildlife society meeting in Bozeman, Ray went to great lengths in a private setting to explain to Mac how it worked and why they implemented it. This was around 1993 or 1994. They (the Canadian FWP or whom?) had just implemented in 1992 and fully in 1998. Mac has been following this proposal and its components for years. It DOES work. Most of us are afraid of change or afraid of doing something differently. That is the situation with 6pt rule. No one in MT has any experience and they have not done their due diligence. (I would expand this paragraph, but not accuse anyone of being afraid or not doing due diligence. Perhaps someone in Montana does have experience with this idea. This paragraph is confrontational and anecdotal. If you want to add it I think you need a graph or some scientific data. This is too vague to end a highly organized informational document.