

**WYOMING MOUNTAIN LION MORTALITY REPORT**

**HARVEST YEAR – 2013**

**September 1, 2013 – March 31, 2014**



Prepared by:

Justin Clapp/Large Carnivore Section

Wyoming Game and Fish Department

Lander, Wyoming

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## **INTRODUCTION**

The following report contains mountain lion mortality data and harvest composition for Wyoming's 33 Hunt Areas (HAs) and 5 Mountain Lion Management Units (MLMUs; Figure 1) for harvest data beginning 1 September 2013 through 31 March 2014 (HY 2013). HY 2013 marks the beginning of the third 3-year management cycle for mountain lions used by the Wyoming Game and Fish Department (WGFD). Because harvest limits are evaluated and revised every three years, the next revision is not scheduled until after HY 2015. This report summarizes statewide mountain lion mortality, but does not propose any recommendations for future management. For an in-depth explanation of data analysis, harvest criteria, and discussions on statewide mountain lion management, the Mountain Lion Management Plan (WGFD 2006) or the Wyoming Mountain Lion Harvest/Mortality Report: Harvest Years 2007-2009 or 2010-2012 (Thompson et al. 2010, Thompson et al. 2013) are available through the Wyoming Game and Fish Large Carnivore Section or the WGFD website:

<http://gf.state.wy.us/wildlife/MountainLionPlan/>.

The data presented in this report supersedes previous reports, as information about previous harvest data has been updated due to differing season lengths and subsequent reporting of harvested lions.



**Figure 1. Wyoming Mountain Lion Management Unit and Hunt Area map for HY 2013.**

### **RELEVANT CHANGES IN CURRENT MANAGEMENT STRATEGY**

Changes that occur in management strategies and regulations impact mountain lion management in the state. Critically assessing and quantifying impacts of harvest on mountain lion populations in addition to how mountain lion management relates to other issues relevant to wildlife management in Wyoming are essential for productive management of wildlife populations.

Evaluating and adapting management strategies (e.g. adjustment of mortality limits and/or

season length, hunt area boundaries) is the definition of adaptive harvest management. Previous changes incurred for the second management cycle (HY 2010-2012) included:

- Counting only legal and illegal kills of mountain lions toward mortality limits (HY 2010).
- Allowing unlimited harvest in HAs 15, 24, and 27 (HY 2010).
- Issuing reduced price, additional tags in several Hunt Areas (HY 2011).
- Extending season length for HA 6 (HY 2011).
- Partitioning HA 30 to create HA 32 in the northeast MLMU to direct and increase harvest pressure north of HA 1 (HY 2012)

Few notable changes for the third management cycle (HY 2013-2015) have been implemented, including:

- Extending season lengths for HAs 5, 7, 8, 9, 24, 31 (HY 2013)
- Partitioning Hunt Area 12 to create a new HA 33 within the southwest MLMU, potentially directing harvest to mule deer winter ranges (HY 2013)

Management of mountain lions in Wyoming is an adaptive management process, evaluating harvest and management as it relates to mountain lion population status and trend, while adhering to the general mission of mountain lion management in Wyoming: to sustain mountain lion populations in core habitat at varying densities depending on local management objectives (WGFD 2006).

## **STATEWIDE MOUNTAIN LION MORTALITY**

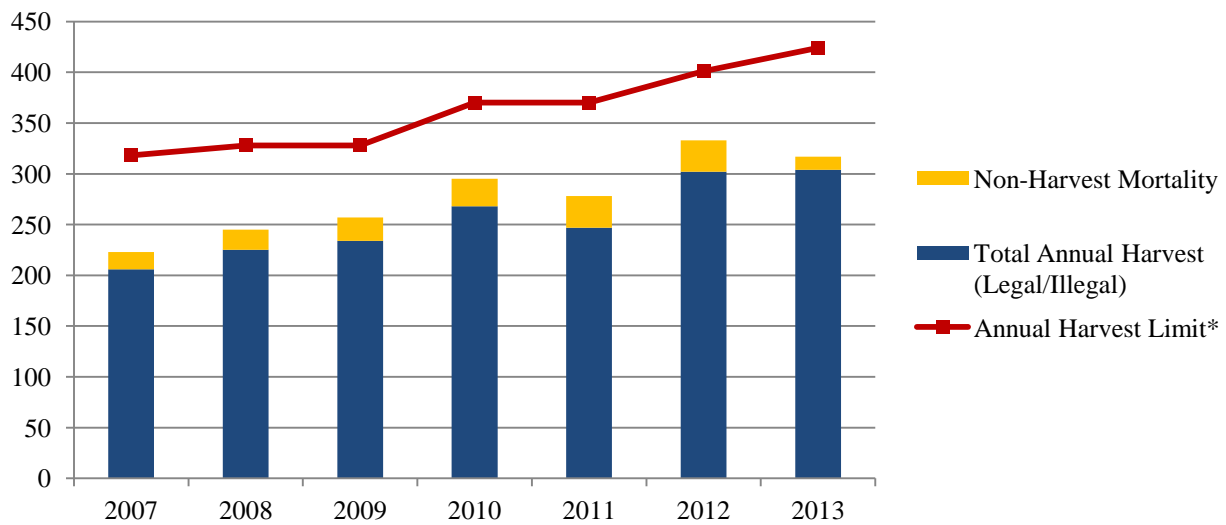
2013 resulted in the highest number of mountain lion harvests to date in Wyoming, continuing the increasing trend documented over the past several years (Figure 2). Total harvest for HY

2013 ( $n = 304$ ) was only two animals higher than HY 2012 ( $n = 302$ ), and the total documented mountain lion mortality for the state in 2013 ( $n = 317$ ) was less than in 2012 ( $n = 334$ ). Similar harvest numbers were to be expected, given minimal changes related to mortality limits in the third cycle of the management plan and adequate tracking conditions bolstering hunter efforts to successfully track mountain lions. It should be noted that this report includes data only through 31 March 2013, and additional harvest has the potential to occur within extended hunt area seasons (see Appendix A). With other human-caused mountain lion mortality (particularly damage related) occurring post season closure, it is assumed that additional human-caused mortality will occur prior to HY 2014; therefore, data are analyzed from September 1 of the current Harvest Year through August 31 of the following year.

Mountain lion harvest throughout Wyoming has roughly doubled since the mid-1990s, due in part to increasing mortality limits, increased mountain lion population in some areas, and increased localized interest in mountain lion hunting. Harvest limits are based on empirically tested mortality densities commensurate to sustain stable mountain lion populations and suitable habitat modeled during the implementation of the state management plan in 2006 (Anderson and Lindzey 2005). Mountain lion hunters spent an average of 4.1 days to successfully harvest a mountain lion in 2013 (Range: 1–50 days; Median: 2 days), although the majority of hunters spent only one day in the field for a successful hunt (45.9%). The primary method to successfully harvest a mountain lion was with the use of trained dogs (90.3%). Non-resident hunters accounted for 31% of all successful mountain lion hunters in HY 2013. Overall, 27% of hunters used an outfitter or guide when hunting, with 68% of non-residents using outfitters or guides for successful hunting. Non-harvest human-caused mortality accounted for 4.1% of total documented mountain lion mortality, which is lower than documented in previous years (Figure

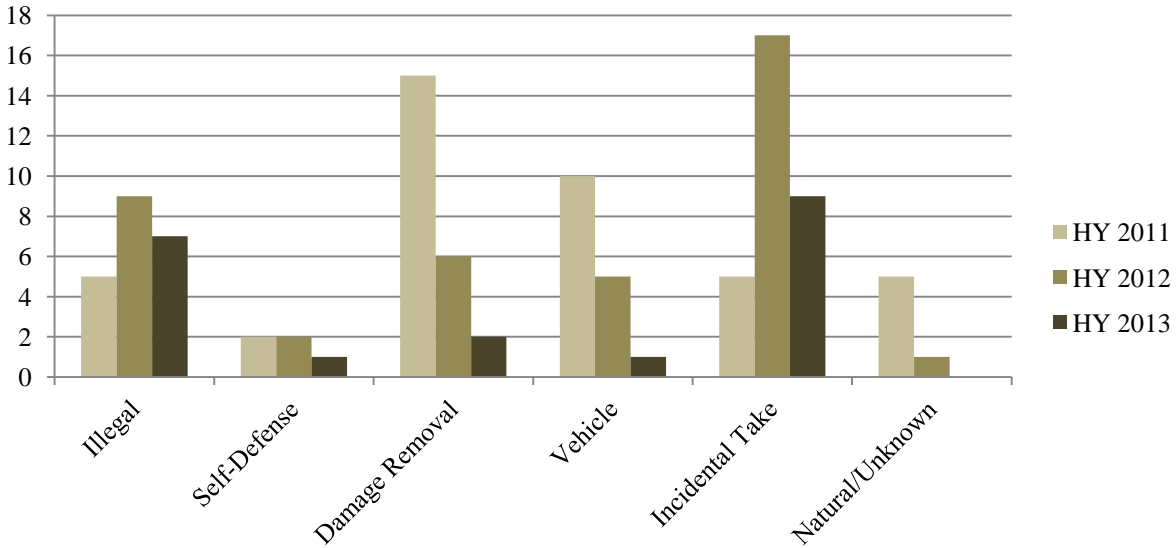
3). Vehicle collisions and damage removals show a marked decrease over the past few years, with few natural or unknown mortalities documented in HY 2013.

Mountain lion harvest occurred on a variety of land status, including: Bureau of Land Management (19.1%), Bureau of Reclamation (0.3%), private property (39.5%), US Forest Service (35.7%), and State Lands (5.4%), resulting in approximately 60% of harvested mountain lions taken on public land and 40% on private land.



\* Beginning in 2010, statewide harvest limits include hunt areas allowing unlimited harvest (i.e. HAs 15, 24, and 27), and are therefore represented by the last applicable and numerical harvest limit.

**Figure 2. Annual mountain lion harvest and mortality data for Wyoming, HYs 2007-2013.**



**Figure 3. Non-legal harvest mortality of mountain lions in Wyoming, HYs 2011-2013.**

Eight of 33 total hunt areas in the state closed due to mortality limits being reached or exceeded, while 16 areas closed as per mountain lion season regulations (31 March 2014). Five hunt areas in the southeast MLMU (HAs 7, 8, 9, 27, and 31) and two in the north-central MLMU (HAs 15 and 22) remain open all year, while three hunt areas (HAs 5, 6, and 24) have season dates extended to accommodate late-season tracking conditions for hunters (e.g. spring snow). Additionally, hunt areas 15, 24, and 27 allow unlimited harvest to address concerns with potential domestic livestock depredation and/or proximity to residential areas or in areas with minimal mountain lion habitat.

### **HARVEST COMPOSITION AND MORTALITY DENSITY**

Three primary monitoring criteria are used to evaluate management objectives and assess mountain lion population status:

1. *Density of human-caused mountain lion mortalities/1,000 km<sup>2</sup>*
2. *Percent (%) of adult females in the harvest by HA*



3. *Average age of adult female harvest by HA.*

These criteria are based on research conducted in Wyoming (Anderson and Lindzey 2005) and are used as the foundation of the state management plan, whereby when the density of mountain lion mortalities increased above 8.0 lions/1,000km<sup>2</sup> of winter lion habitat, the resident mountain lion population decreased. To reach this level of mortality it was also noted that an increase in the proportion of adult female mortality occurred. If harvest densities were maintained to reduce populations, it was postulated that managers would see a reduction in the age of adult females harvested (WGFD 2006). Appendix C provides data relative to these monitoring criteria separated by Hunt Area. These data are quantified into trends and assessed at the end of each 3-year management cycle prior to any alterations made to current management strategies.

**Table 1. Known sex and age composition of harvested mountain lions by Mountain Lion Management Unit for HY 2013.**

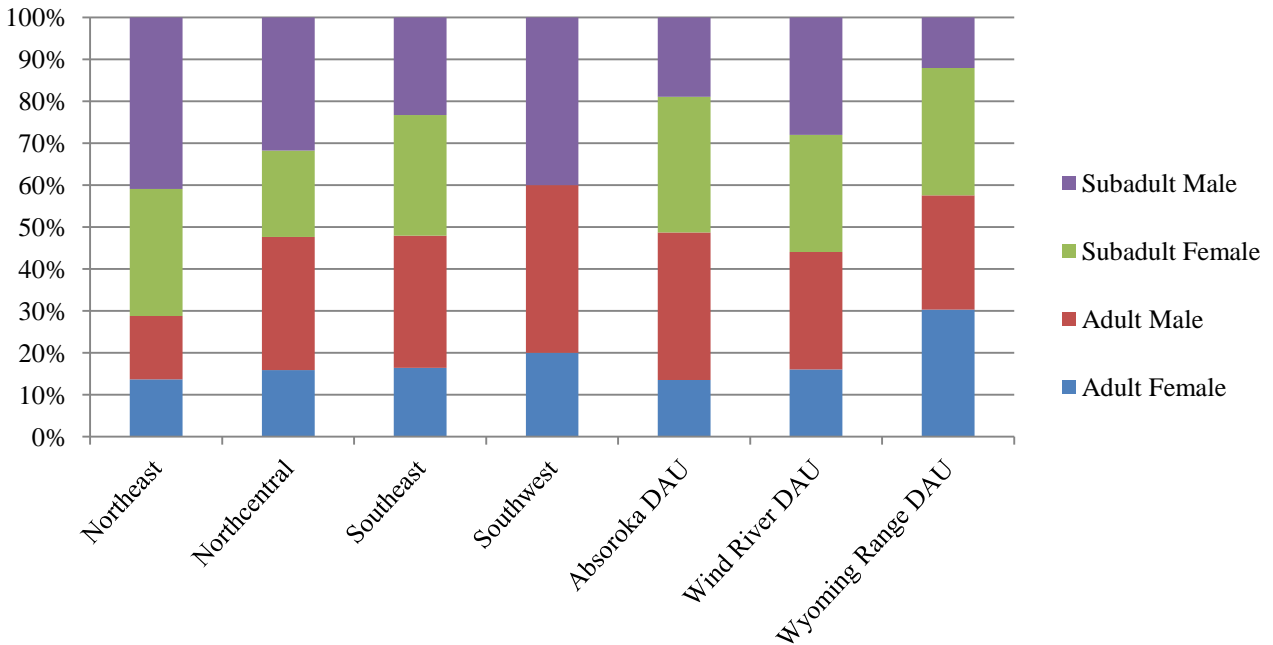
Management Unit	Adult Female	Subadult Female	Adult Male	Subadult Male	Totals
Northeast	9	20	10	27	66
Northcentral	10	13	20	20	63
Southeast	12	21	23	17	73
Southwest	1	0	2	2	5
Absaroka DAU	5	12	13	7	37
Wind River DAU	4	7	7	7	25
WY Range DAU	10	10	9	4	33
Totals	51	83	84	84	302

Table 1 provides sex and age class data for harvested mountain lions, separated by Mountain Lion Management Units. Also, harvest and sex/age class composition of harvest separated at the Hunt Area level are provided (Appendix B); note that as sample sizes decrease, interpretation of data is more difficult. Age class for females is determined by lactation status, with any female currently or previously lactating considered an adult. Male mountain lions > 3



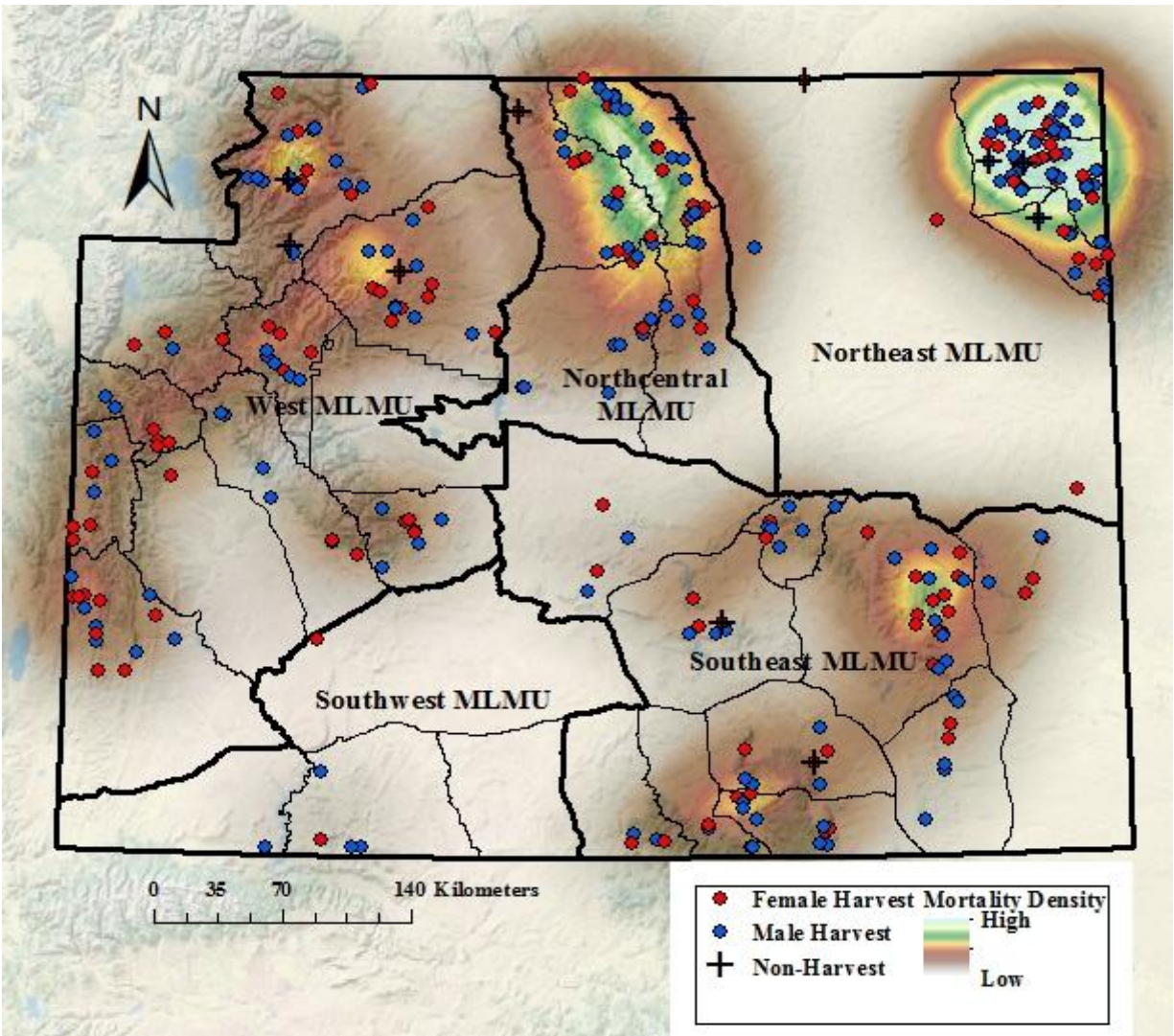
years of age are considered adults. Ages used for analyses are based on field ages and not annuli ages, as these data were not available at the time of this report.

The southeast, southwest, and west MLMUs show a relatively stable proportion of adult females in the harvest, with the exception of the Wyoming Range Data Analysis Unit (DAU, within the west MLMU), which reached over 30% adult females harvested for the first time since the adoption of the state management plan in 2007 (Figure 4). MLMUs currently under management for local reductions in the resident mountain lion population (e.g. northeast and north-central MLMUs) had previously exhibited higher proportions of adult females harvested in response to increased mortality limits, but over the past few years have shifted to a relatively low proportion due to assumed suppression in overall abundance of mature mountain lions within these units. Under high levels of harvest (resulting in high mortality densities), the elevated proportion of adult females harvested cannot be sustained for prolonged periods, and scenarios such as these convey the importance of the Department's assessment of harvest data through time to identify trends in the data, as well gathering a wide spectrum of data to best determine the status of the population.



**Figure 4. Wyoming mountain lion harvest composition, separated by MLMU, HY 2013.**

The distribution of statewide harvest and non-harvest mortalities, as well as male and female harvest locations are shown in Figure 5. This map also shows relative harvest density across Wyoming using a kernel density estimator applied to all harvest locations. A kernel density estimator uses a sample of data points (random variables) to estimate the distribution of the data (in this case the probability of harvest occurrence) across the landscape. Assuming that we have a census of mountain lions harvested throughout the state, we use the density estimator not to predict probability of harvest spatially, but as a simple visual aid to emphasize areas where the highest density of harvest occurs relative to the cumulative sampling area (statewide). The majority of the mountain lion harvest season occurs during the winter, and most harvest is distributed in areas where ungulate prey densities are highest (typically ungulate winter ranges). Areas within the north-central and northeast MLMUs showed the highest harvest densities compared to management units in other areas of the state.



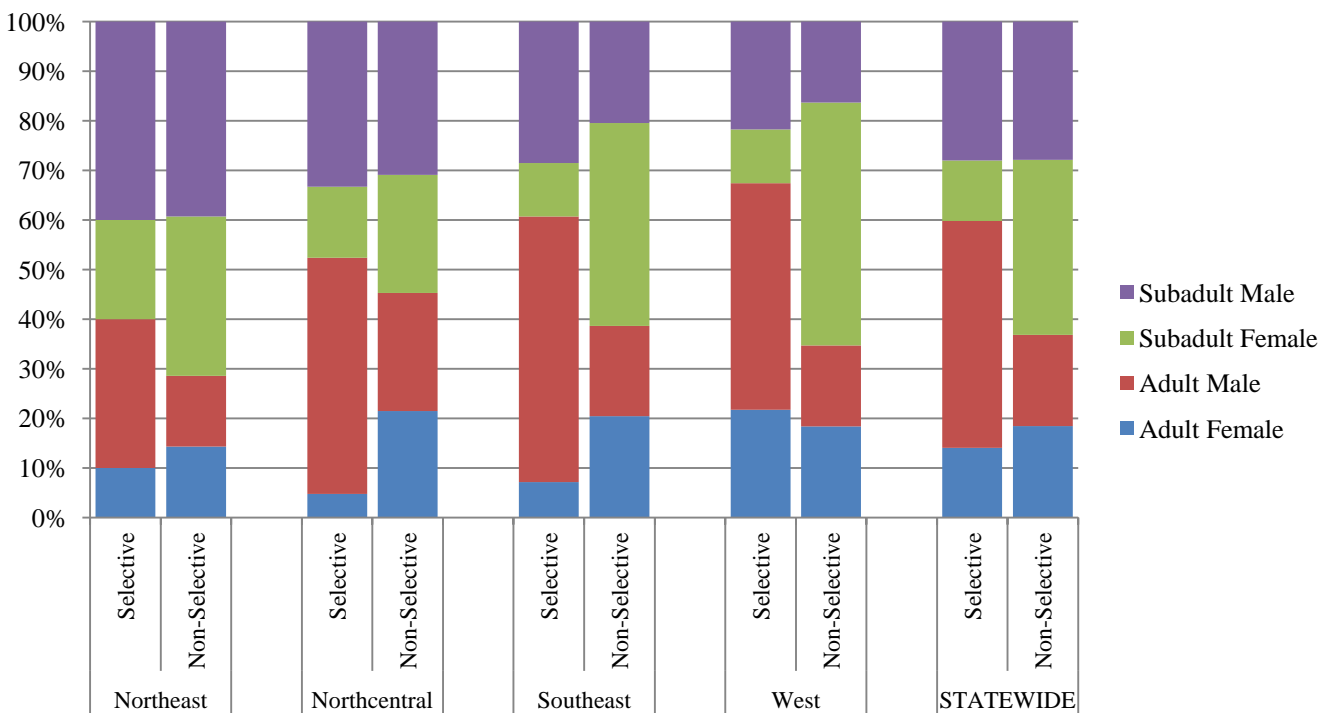
**Figure 5. Locations of mountain lion harvest and other documented mountain lion mortality, and statewide relative mortality density in Wyoming, HY 2013.**

## SELECTIVITY

WGFD requires mandatory checks for all harvested mountain lions during each Harvest Year.

Hunters report on a variety of topics regarding the harvest of mountain lions, and these data provide additional insight to the harvest season. Hunter selectivity (often for male and/or mature mountain lions) is assessed annually, and often influences the overall age/sex composition of the harvest. In HY 2013, hunters who stated they were selective while hunting (54.9% of hunters)

harvested lower proportions of both female and juvenile mountain lions, and higher proportions of mature males than non-selective hunters statewide (Figure 6). This trend is also apparent in MLMUs with high mortality densities (northeast and north-central), albeit with a lower proportion of mature animals harvested. This may be attributed to age class alterations resulting from prolonged elevated harvest, which reduce the availability of mature mountain lions for harvest and provide vacant habitat for juvenile immigration via dispersal.



**Figure 6. Comparison of mountain lion sex/age composition of harvest between selective and nonselective mountain lion hunters by MLMU in Wyoming, HY 2013.**

Forty-seven percent (47%) of non-resident hunters and 30% of resident hunters reported being selective during the 2013 hunting season, but harvest data indicated similar sex/age composition between residents and non-residents. Hunters that stated selectivity often harvested the first and only mountain lion observed during hunting (64.5 %). It may be the case (especially with experienced hunters) that selectivity may be initiated when determining which tracks to

pursue, since selective hunters that passed harvest opportunities (by releasing treed mountain lions in favor of a continued hunt) show little difference in the proportion of mature and/or males ultimately harvested. Not surprisingly, selective hunters spent an average of 2.6 days longer in the field than non-selective hunters, an average of 5.8 days on successful hunts, where non-selective hunters spent only 3.2 days.

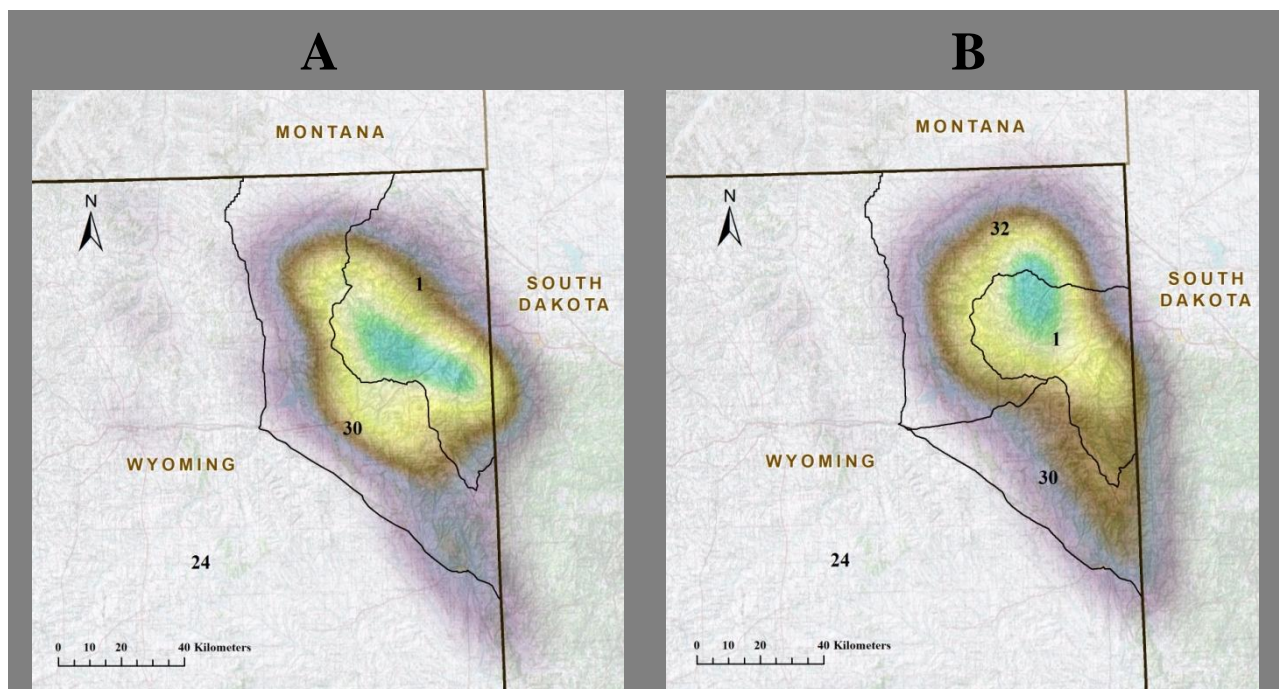
## **DISCUSSION**

We documented an average statewide mortality density of 6.71 mortalities/1,000 km<sup>2</sup>, adult female harvest of 16.8%, and an average estimated age of adult females of 5.8 years, and though areas exist where harvest densities fluctuate (the intent of the management plan), current data indicate that on a statewide level, the overall increase in harvest has rendered stabilization in mountain lion populations in Wyoming.

Harvest limits have steadily increased over the past several years in some MLMUs, reflected in the continued record harvests reported for the state. Much of these increases are associated with the management strategy to reduce local lion populations within north-central and northeast Wyoming. Increasing harvest limits have also been driven by concerns over potential impacts to local mule deer populations, primarily in the Platte Valley area in the southeast MLMU and Wyoming Range DAU in the West MLMU. However, only around 25% of hunt areas generally close due to mortality limit restrictions. Hunt area mortality limits are not necessarily objectives or goals that need to be reached, but total harvest of all hunt areas within a MLMU (with a combination of source, stable, and sink hunt areas) should result in viable and sustainable mountain lion populations and provide hunter opportunities for harvest. Therefore, regional (hunt area level) mortality limits provide a “ceiling” to predict population level impacts given the potential for harvests to reach allowable mortality limits. It is then,

generally not the expectation that mortality limits for all hunt areas must be reached in order to achieve management objectives.

The benefits of an adaptive management process include the ability to make alterations to the management strategy to meet local objectives based on available data. An example of this was recently implemented in the northeast MLMU. The Department responded to public concern regarding regional mountain lion management as well as potential conflict, primarily in the form of domestic livestock depredation, which resulted in hunt area boundary and mortality limit changes to direct mountain lion harvest onto private lands surrounding the Bear Lodge Mountains (Hunt Area 32). We used a kernel density estimator as a visual aid to compare harvest densities relative to the northeast MLMU before and after management strategies were implemented. Figure 7A shows general areas where the the highest densities of mountain lion harvest had occurred previous to the hunt area boundary alterations (HYs 2010–2011). When compared to Figure 7B (HYs 2012–2013), the restructure of the hunt areas resulted in a shift in harvest densities toward the desired area, driven by directing harvest to the newly established hunt area 32 and accompanied by an increase in overall harvest limits for the northeast MLMU.



**Figure 7. Spatial comparison of relative harvest densities before (A) and after directing mountain lion harvest (B) by incorporating a new Hunt Area 32 in HY 2012 within the Northeast MLMU.**

This example shows the effectiveness of adapting management strategies to target harvest to specific regions. However, areas such as these with large expanses of suitable habitat coupled with high prey densities may be capable of supporting increased densities of mountain lions, and mountain lion densities are unlikely to be uniform across the landscape. Increasing harvest limits in areas such as the Black Hills/Bearlodge Mountains has thus far resulted in an elevated proportion of adult female mountain lions harvested followed by an assumed reduction in the proportion of resident mountain lions throughout the area. The resulting vacant habitat provides opportunities for juvenile dispersal into the area, and does not necessarily translate directly into immediate population reduction, but rather an influx of juvenile animals through dispersal and recruitment. These situations become more complicated when managing populations where adjacent suitable habitat (across state boundaries) provide dispersal potential into the area. We are currently further evaluating how the increased harvest and subsequent sex/age structure relates to the overall population of mountain lions in the Black Hills ecosystem (for this particular example).

The WGFD continues to collect mountain lion mortality data on an annual basis to monitor population trends across the state. Mortality data collected in HY 2013 provide only the initial data (year 1 in cycle) required to monitor population trends and the effectiveness adaptations made for the current three year management cycle (HY2013–HY2015). Data from the past two management cycles (last 6 years) are also used to study long-term population dynamics. This is a valuable resource, especially applied toward areas where management strategies typically do not change. This information, coupled with ongoing research and



monitoring techniques, increases our knowledge and understanding of the species, resulting in better mountain lion management for the state.

## LITERATURE CITED

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**APPENDIX A. Statewide Hunt Areas, season dates, and limitations for HY 2013.**

Hunt Area	Dates of Seasons	Mortality Limit	Limitations
1	Sep. 1 - Mar. 31	24	
2	Sep. 1 - Mar. 31	5	
3	Sep. 1 - Mar. 31	12	
4	Sep. 1 - Mar. 31	10	
5	Sep. 1 - Mar. 31	12	Additional license valid
	Apr. 1 - Apr. 30*		Valid off national forest*
6	Sep. 1 - Apr. 30	21	Additional license valid
7	Sep. 1 - Aug. 31	14	Additional license valid
8	Sep. 1 - Aug. 31	10	Additional license valid
9	Sep. 1 - Aug. 31	12	Additional license valid
10	Sep. 1 - Mar. 31	7	
11	Sep. 1 - Mar. 31	2	
12	Sep. 1 - Mar. 31	8	
13	Sep. 1 - Mar. 31	5	
14	Sep. 1 - Mar. 31	15	
15	Sep. 1 - Aug. 31	Unlimited	Additional license valid
16	Sep. 1 - Mar. 31	6	Additional license valid
17	Sep. 1 - Mar. 31	9	
18	Sep. 1 - Mar. 31	12	
19	Sep. 1 - Mar. 31	20	Additional license valid
20	Sep. 1 - Mar. 31	20	
21	Sep. 1 - Mar. 31	20	
22	Sep. 1 - Aug. 31	25	
23	Sep. 1 - Mar. 31	20	
24	Sep. 1 - May 31	Unlimited	Additional license valid
25	Sep. 1 - Mar. 31	12	Additional license valid
26	Sep. 1 - Mar. 31	15	
27	Sep. 1 - Aug. 31	Unlimited	Additional license valid
28	Sep. 1 - Mar. 31	3	
29	Sep. 1 - Mar. 31	6	
30	Sep. 1 - Mar. 31	12	
31	Sep. 1 - Aug. 31	11	Additional license valid
32	Sep. 1 - Mar. 31	25	
33	Sep. 1 - Mar. 31	2	

\*Brown = year-round harvest \*Orange = extended season dates

**APPENDIX B. Table of known sex and age class composition of harvest by Hunt Area and MLMU, HY 2013. Table excludes 2 harvests of unknown classification.**

MLMU	HA	Adult Female	Subadult Female	Adult Male	Subadult Male	Other Mortalities	Total
Northeast	1	5	8	4	9	1	27
	30	0	5	2	5	1	13
	32	3	6	4	12	1	26
	24	1	1	0	1	1	4
	Total	9	20	10	27	4	70
Northcentral	15	2	2	6	5	0	15
	21	4	3	4	2	1	14
	22	1	2	8	2	0	13
	23	3	6	2	11	1	23
	Total	10	13	20	20	2	65
Southeast	5	0	2	3	1	0	6
	6	5	8	6	2	0	21
	7	2	2	2	4	0	10
	8	0	2	1	2	1	6
	9	0	1	3	0	0	4
	10	0	2	0	2	0	4
	16	1	1	1	1	0	4
	25	2	1	1	1	0	5
	27	1	1	2	4	0	8
	31	1	1	4	0	1	7
Total	12	21	23	17	2	75	
Southwest	11	0	0	0	0	0	0
	12	1	0	1	2	0	4
	13	0	0	1	0	0	1
	33	0	0	0	0	0	0
	Total	1	0	2	2	0	5
Absaroka DAU	19	2	5	9	4	3	23
	20	3	7	4	3	1	18
	Total	5	12	13	7	4	41
Wind River DAU	3	1	2	0	4	0	7
	4	2	2	4	1	0	9
	18	1	3	3	2	0	9
	28	0	0	0	0	0	0
	Total	4	7	7	7	0	25
Wyoming Range DAU	2	2	1	1	0	0	4
	14	4	4	4	3	0	15
	17	0	1	0	0	0	1
	26	2	2	2	1	1	8
	29	2	2	2	0	0	6
Total	10	10	9	4	1	34	
STATEWIDE		51	83	84	84	13	315

**APPENDIX C. Table of HY 2013 mountain lion harvest data relative to WGFD mountain lion management plan monitoring criteria.**

MLMU	HA	Mortality Density Mortalities/1,000 km <sup>2</sup>	Adult Female Take % of Harvest	Mean Age of Adult Females** Years (sample size in parentheses)
Northeast	1	17.82	19.2	5.3 (5)
	30	13.47	0.0	NA
	32	17.87	12.0	4.0 (3)
	24	4.12	33.3	4.0 (1)
	Total	14.27	13.6	4.7 (9)
Northcentral	15	12.25	13.3	7.3 (2)
	21	10.80	30.8	5.5 (4)
	22	5.99	7.7	4.0 (1)
	23	16.68	13.6	5.3 (3)
	Total	10.71	15.9	5.6 (10)
Southeast	5	2.41	0.0	NA
	6	7.63	23.8	6.4 (5)
	7	9.03	20.0	4.5 (2)
	8	4.06	0.0	NA
	9	6.29	0.0	NA
	10	7.95	0.0	NA
	16	4.89	25.0	5.0 (1)
	25	*	40.0	5.0 (2)
	27	8.14	12.5	3.5 (1)
	31	6.45	16.7	NA
Total	6.20	16.2	5.4 (12)	
Southwest	11	*	NA	NA
	12	4.71	25.0	5.0 (1)
	13	1.54	0.0	NA
	33	*	NA	NA
Total	3.33	20.0	5.0 (1)	
Absaroka DAU	19	6.26	10.0	6.0 (2)
	20	6.22	16.7	7.3 (3)
	Total	6.24	13.2	6.8 (5)
Wind River DAU	3	3.14	14.3	4.0 (1)
	4	7.51	22.2	7.3 (2)
	18	7.14	11.1	5.0 (1)
	28	0.00	NA	NA
Total	3.87	16.0	5.9 (4)	
WY Range DAU	2	1.82	50.0	4.5 (2)
	14	6.90	26.7	4.1 (4)
	17	0.53	0.0	NA
	26	4.43	28.6	4.5 (2)
	29	4.73	33.3	4.0 (2)
Total	3.64	30.3	4.2 (10)	
STATEWIDE		6.71	16.8	5.3 (51)

\*Represents a Hunt Area with minimal mountain lion habitat and not managed by WGFD for long term population viability.

\*\*Mean ages are based on estimated field ages, not from annuli data.

**APPENDIX D. Table showing mean age of harvested male and female mountain lions separated by Hunt Area and MLMU, HY 2013.**

MLMU	Hunt Area	Mean Age (years)**	
		Male	Female
Northeast	1	3.1	2.9
	30	2.8	2.1
	32	3.1	2.8
	24	3.5	3.0
	<b>NE MLMU</b>	<b>3.1</b>	<b>2.7</b>
Northcentral	15	3.5	4.4
	21	4.6	4.9
	22	4.1	3.0
	23	2.8	3.5
	<b>NC MLMU</b>	<b>3.6</b>	<b>4.0</b>
Southeast	5	4.3	2.5
	6	4.6	3.7
	7	3.1	3.6
	8	2.8	2.8
	9	4.3	2.0
	10	2.0	2.0
	16	5.0	4.0
	25	2.5	4.0
	27	3.3	3.5
	31	4.5	4.0
<b>SE MLMU</b>	<b>3.8</b>	<b>3.4</b>	
Southwest	11	NA	NA
	12	3.2	5.0
	13	6	NA
	33	NA	NA
	<b>SW MLMU</b>	<b>3.9</b>	<b>5.0</b>
Absaroka DAU	19	3.8	3.8
	20	3.6	4.0
	<b>ABS DAU</b>	<b>3.8</b>	<b>3.9</b>
Wind River DAU	3	2.9	3.3
	4	4.7	4.9
	18	5.6	2.8
	28	NA	NA
	<b>WR DAU</b>	<b>4.5</b>	<b>3.7</b>
Wyoming Range DAU	2	5	3.3
	14	4.0	3.3
	17	NA	2.0
	26	4.0	3.4
	29	4.5	3.1
<b>WY Range DAU</b>	<b>4.2</b>	<b>3.2</b>	
<b>STATEWIDE</b>	<b>3.7</b>	<b>3.4</b>	

\*\*Mean ages are based on estimated field ages, not from annuli data.