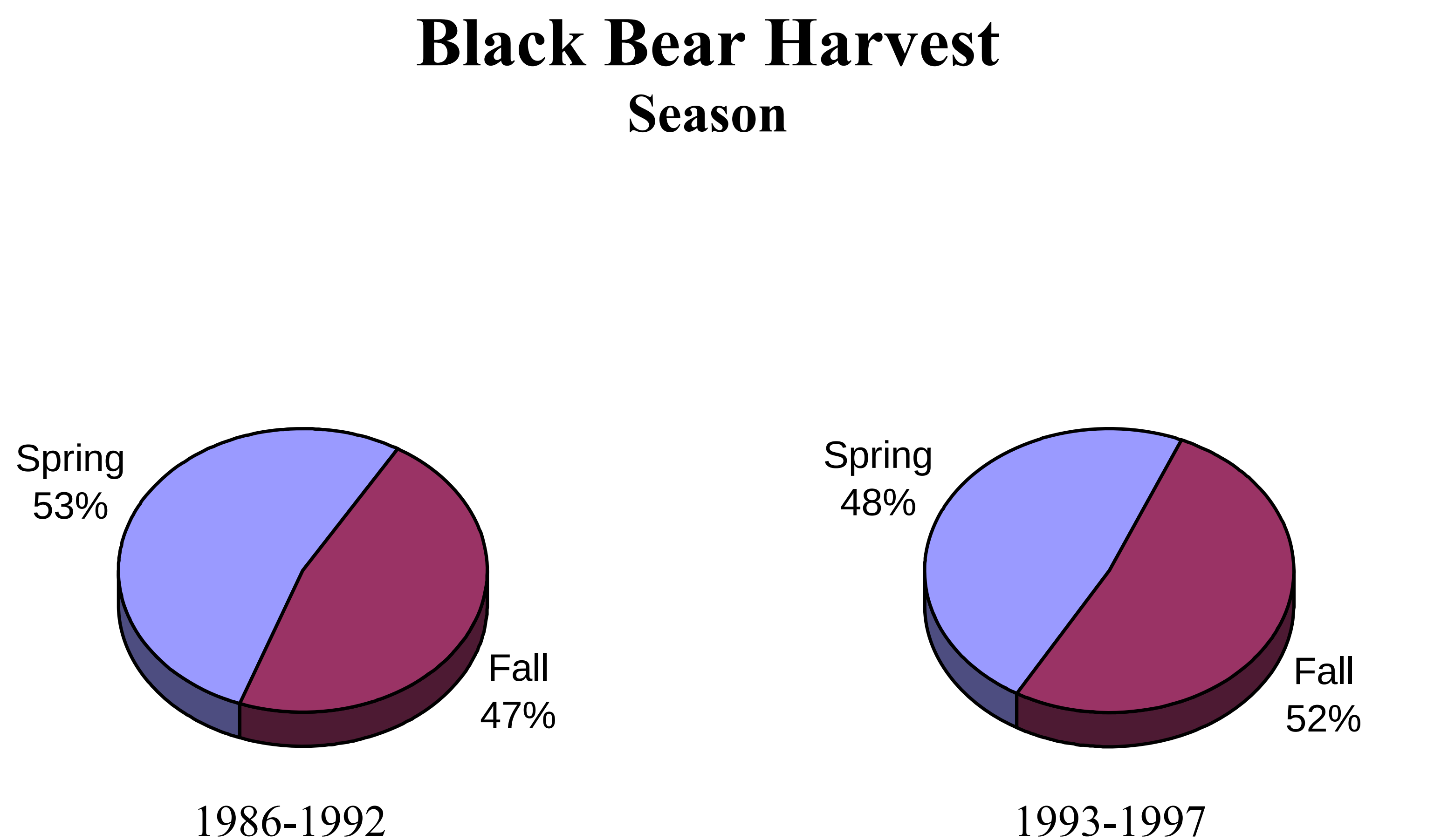


Figure 5. Comparison of black bear harvest, by season, between the 1986-1992 and 1993-1997 planning periods.

Black Bear Harvest
Sex

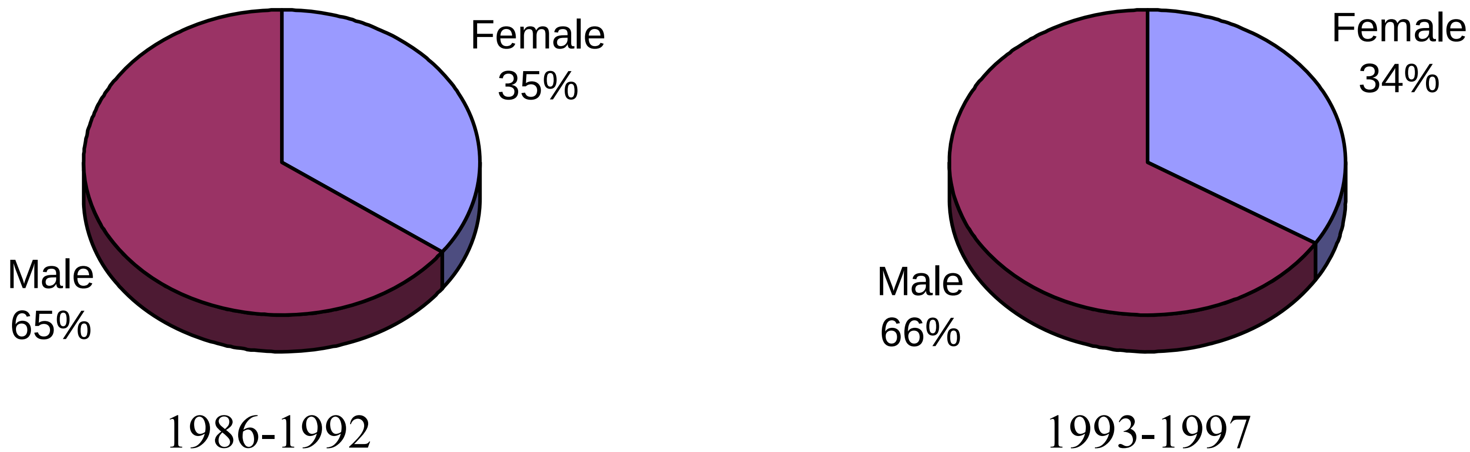


Figure 6. Comparison of black bear harvest, by sex, between the 1986-1992 and 1993-1997 planning periods.

Black Bear Harvest
Method

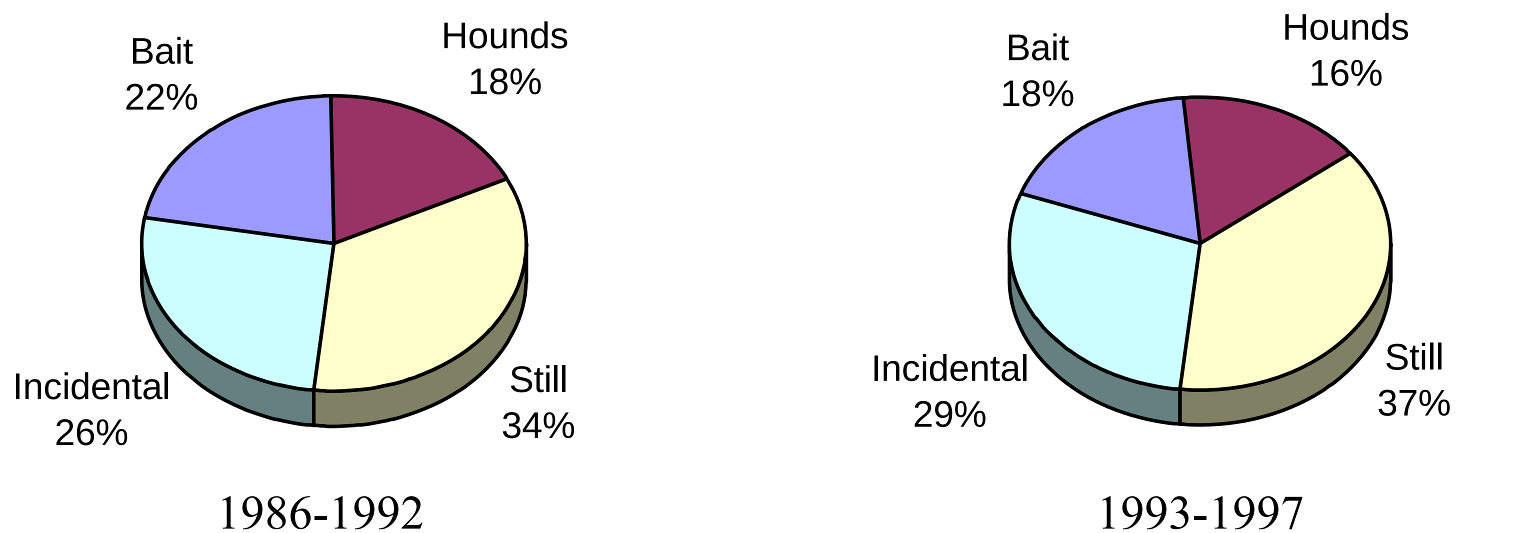


Figure 7. Comparison of black bear harvest, by method of take, between the 1986-1992 and 1993-1997 planning periods.

DATA ANALYSIS UNITS

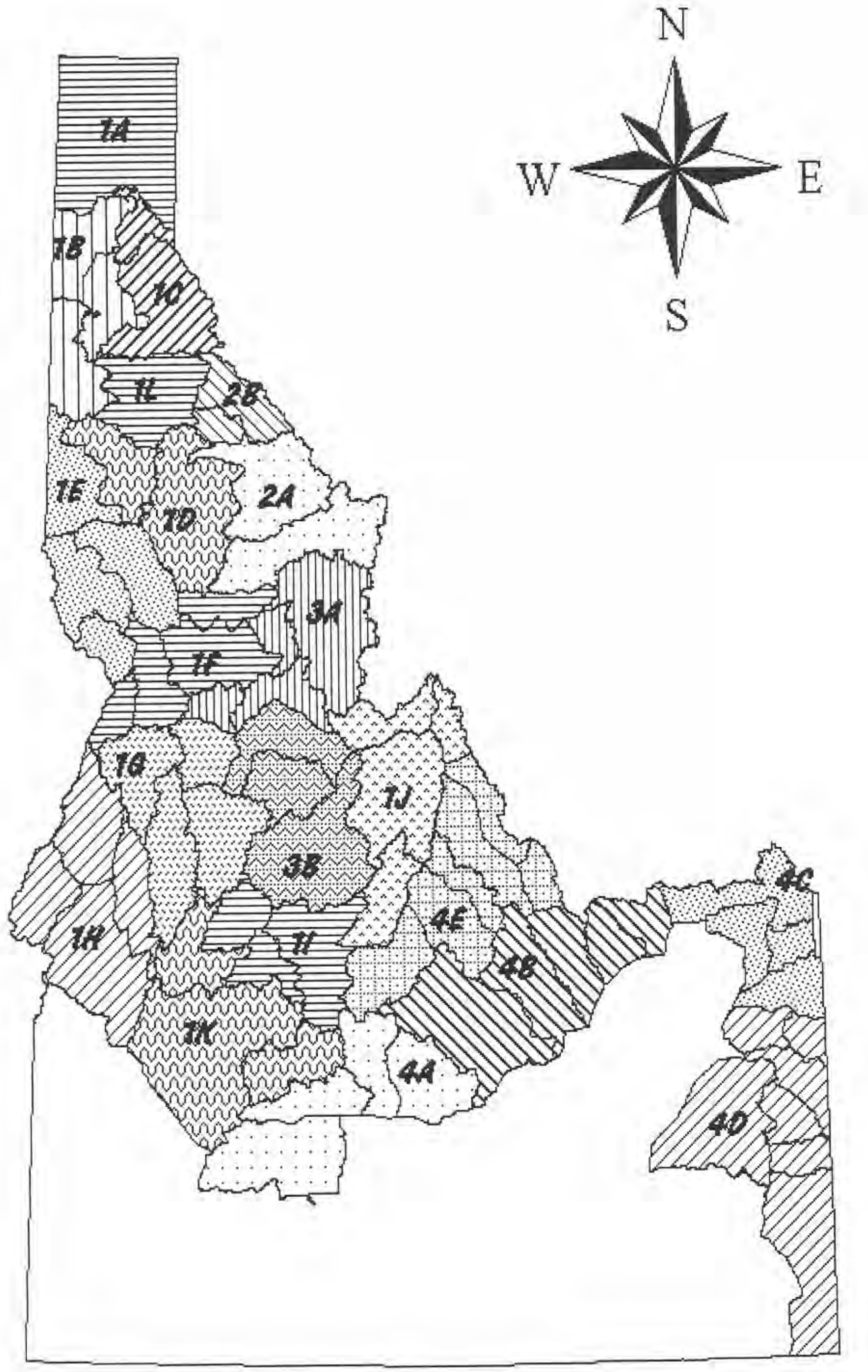


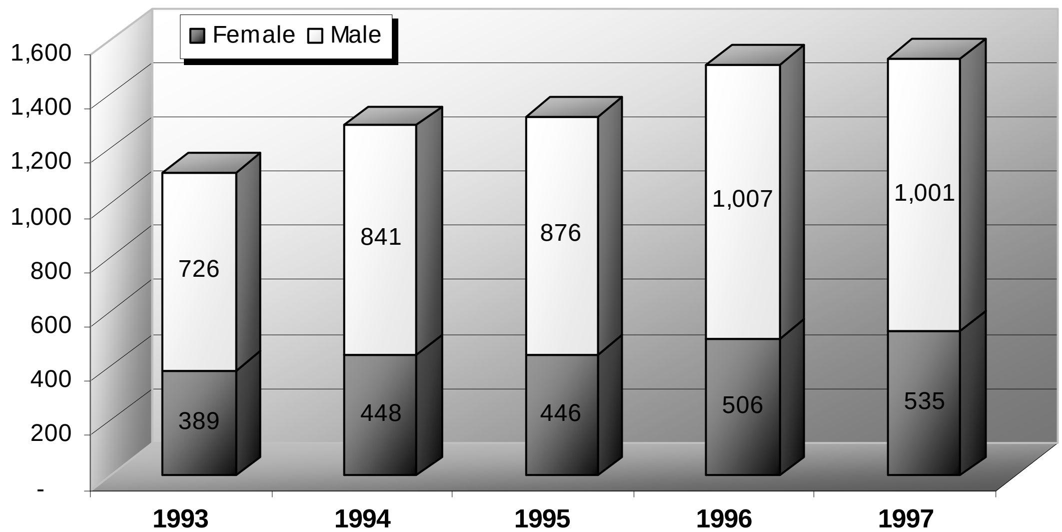
Figure 8. Twenty-one (21) data analysis units (DAUs) for black bear management in Idaho.

ALL DAUs

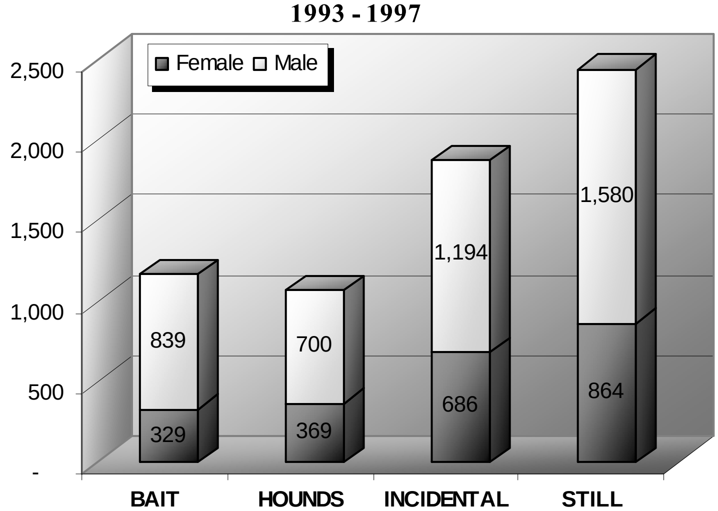
Harvest Statistics

All DAUs	Total Harvest	Percent Female	Percent Males ≥5	3-Year Average Males ≥5
1993	1,126	35	39	
1994	1,304	34	34	
1995	1,331	34	34	35%
1996	1,522	33	32	33%
1997	1,552	34	29	32%
Total	**6,835**	**34**	**33**	

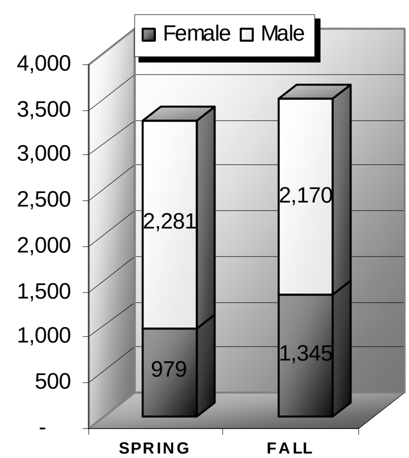
TOTAL HARVEST

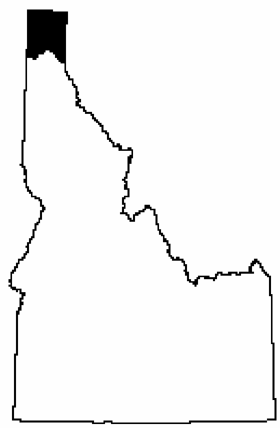


METHOD OF TAKE
1993 - 1997



SEASON
1993 -1997





DAU 1A

Game Management Unit 1

DESCRIPTION

Black bear management is heavily influenced by grizzly bear management needs in this DAU as it includes parts of the Selkirk and Cabinet-Yaak Grizzly Bear Recovery areas. Consequently, this DAU has been closed to use of bait since 1984 and to the use of hounds since 1988. Since 1991, a small controlled hunt allowing use of hounds has been allowed in a portion of DAU 1A outside of these recovery areas. During 1993 the season was shortened from 108 to 80 days and has since been increased to the current 96 days.

In general, this DAU is characterized by dense conifer habitat types. Portions of the Selkirk, Cabinet, and Purcell mountain ranges are included in this DAU, with the broad Kootenai River Valley providing the only substantial agriculture area. Overall, DAU 1A contains some of the highest quality black bear habitat in Idaho.

Total harvest in DAU 1A has averaged 173 bears from 1993 to 1997. Mature males (≥5 years old) make up over 35% of the harvest. Harvest has increased significantly in the past 2 years. However, the percent of mature males and percent of females in the harvest has not changed and indicate a moderately harvested population.

MANAGEMENT OBJECTIVES

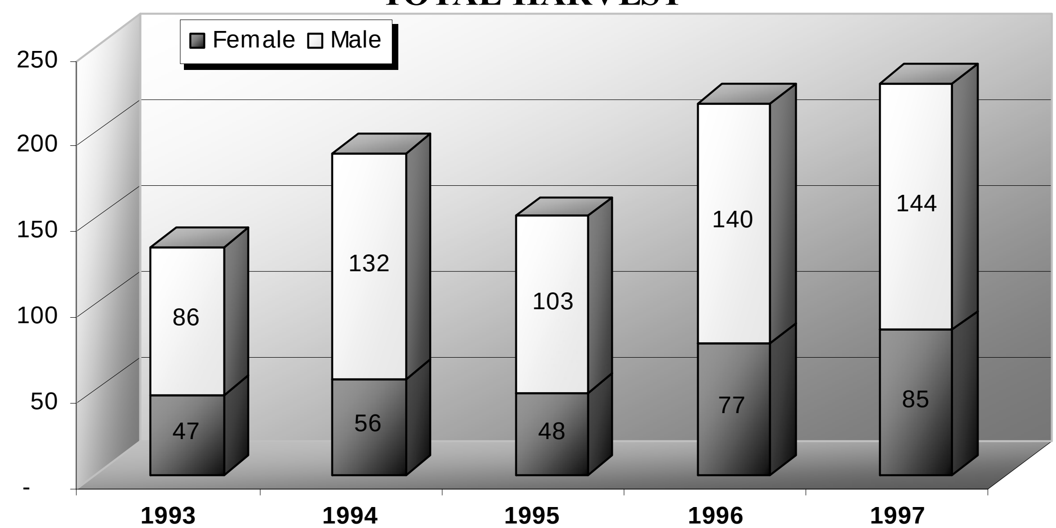
DAU 1A will be managed to maintain the light harvest targets of >35% age 5+ bears in the male harvest and <30% females in the total harvest.

DAU 1A

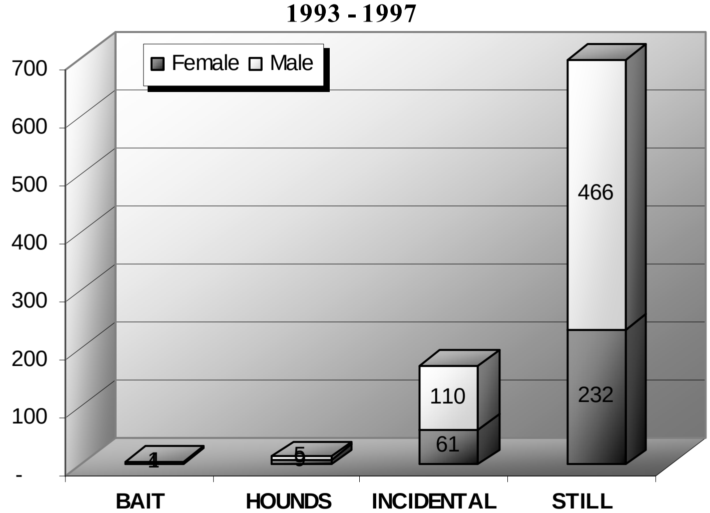
Harvest Statistics

DAU 1A	Total Harvest	Percent Female	Percent Males ≥5	3-Year Average Males ≥5
1993	134	35	46	
1994	190	29	29	
1995	151	32	41	37%
1996	220	35	39	36%
1997	229	37	37	39%
Total	**924**	**34**	**38**	

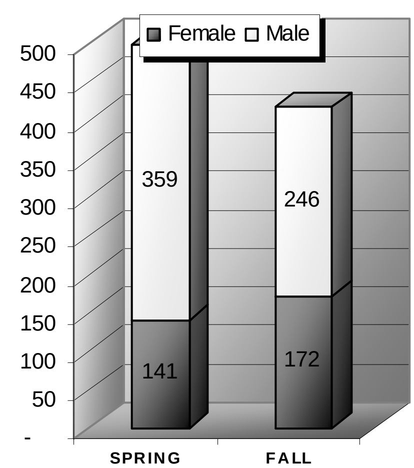
TOTAL HARVEST

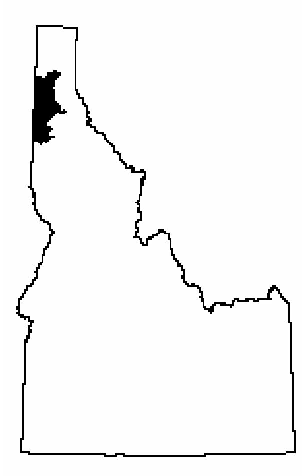


METHOD OF TAKE
1993 - 1997



SEASON
1993 -1997





DAU 1B

Game Management Units
2, 3, and 5

DESCRIPTION

DAU 1B consists largely of developed and highly accessible areas. Mountains in this DAU are not particularly high or rugged. Depredations have been a substantial problem in this DAU, particularly in Unit 2, which consists largely of second-growth coniferous forest under private ownership. Unit 3 is typified by publicly owned coniferous forest with high road densities in close proximity to Coeur d'Alene. Unit 5 is similar to Unit 2 in the northern third, but the remainder consists largely of open agricultural land with stringers of coniferous forest. Much of Unit 5 is within the boundaries of the Coeur d'Alene Indian Reservation.

Use of baiting and hounds is substantial in DAU 1B. Thirty-five percent of the black bears harvested in this DAU are taken with one of these aids. Still hunting and incidental harvest accounted for 32% and 29% of the harvest, respectively.

Harvest in DAU 1B has averaged 83 bears from 1993 to 1997. The lower harvest associated with new season restrictions that began in 1993 has since returned to previous highs. Harvest increased significantly in 1996 and 1997, but the percent of mature males and mature females in the harvest has remained constant. Harvest statistics indicate a moderate to highly harvested population.

MANAGEMENT OBJECTIVES

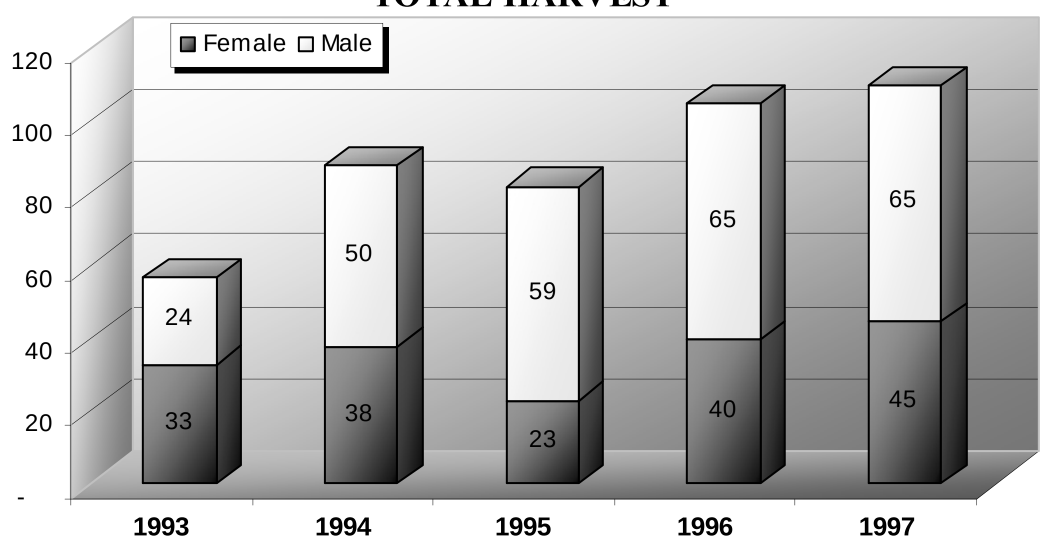
To address depredation concerns, DAU 1B will be managed to maintain the heavy harvest targets of <25% age 5+ bears in the male harvest and >40% females in the total harvest.

DAU 1B

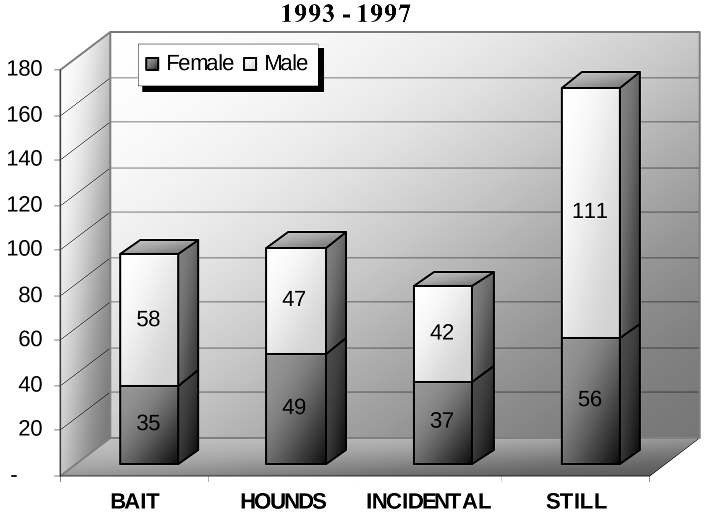
Harvest Statistics

DAU 1B	Total Harvest	Percent Female	Percent Males ≥5	3-Year Average Males ≥5
1993	57	58	25	
1994	88	43	29	
1995	85	27	25	27%
1996	107	37	25	26%
1997	112	40	24	25%
Total	**449**	**40**	**26**	

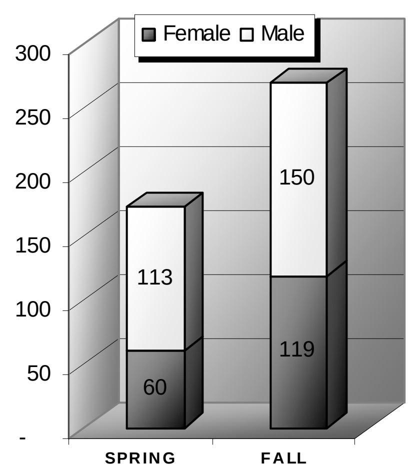
TOTAL HARVEST

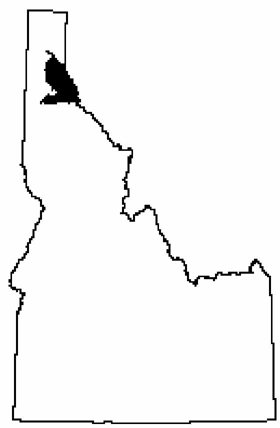


METHOD OF TAKE
1993 - 1997



SEASON
1993 -1997





DAU 1C

Game Management Units 4 and 4A

DESCRIPTION

DAU 1C consists mainly of US Forest Service property and a belt of private property in Silver Valley. Much of this DAU has been burned by wildfires since the early 1900s. It is a popular hunting area for Coeur d'Alene and Silver Valley big game hunters. Road densities are moderate to very high.

This DAU has traditionally supported a substantial harvest for hunters using hounds. This type of use declined abruptly during 1992, concurrent with an increase in other categories. Only 11% of the black bears harvested in this DAU are now taken with the aid of hounds and/or bait. Still hunting and incidental kills made up 54% and 42% of the 1997 harvest, respectively.

Total harvest in DAU 1C has averaged 75 bears from 1993 to 1997. Mature males (≥5 years old) have shown a decline over the past 5 years and in 1997 the 3-year average was 20%. Mature females also have shown declines. Harvest has increased moderately in the past two years. Harvest statistics indicate a moderate to heavily hunted population.

MANAGEMENT OBJECTIVES

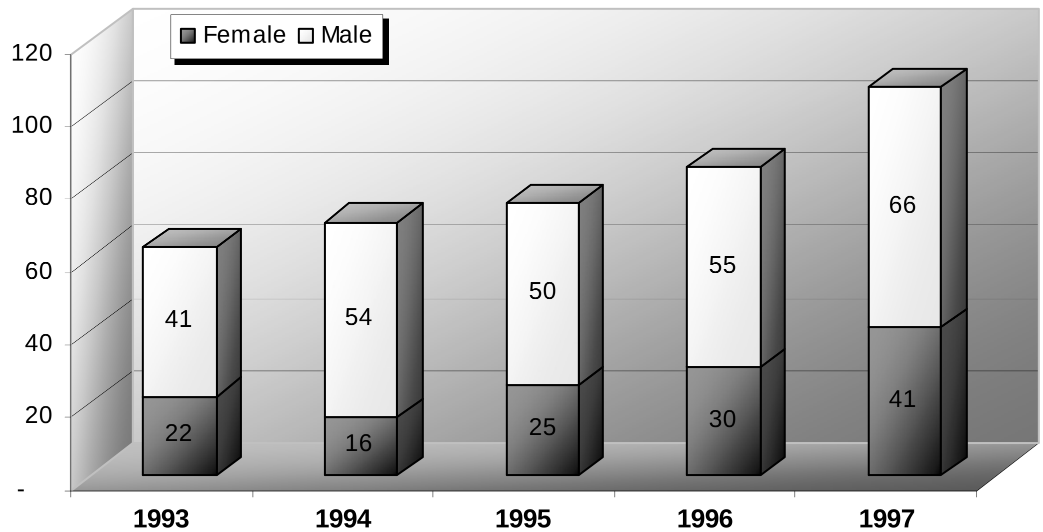
To test the validity of the bear harvest indicators, DAU 1C will be managed to maintain the heavy harvest targets of <25% age 5+ bears in the male harvest and >40% females in the total harvest.

DAU 1C

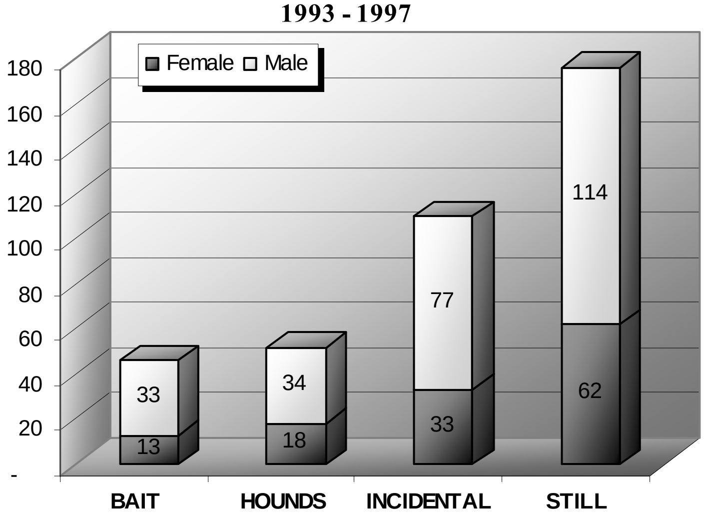
Harvest Statistics

DAU 1C	Total Harvest	Percent Female	Percent Males ≥5	3-Year Average Males ≥5
1993	63	35	42	
1994	70	23	35	
1995	75	33	33	36%
1996	86	35	11	26%
1997	108	38	16	20%
Total	**402**	**33**	**26**	

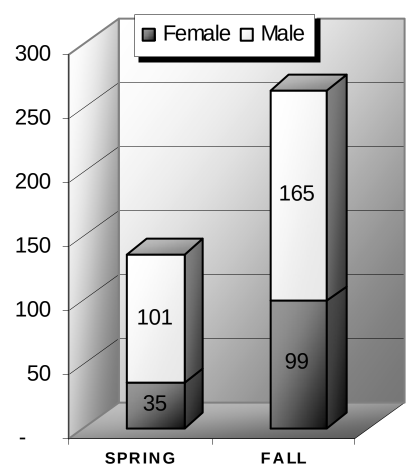
TOTAL HARVEST

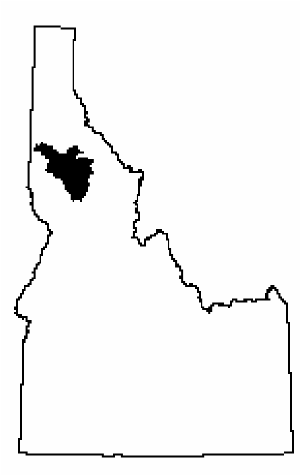


METHOD OF TAKE
1993 - 1997



SEASON
1993 -1997





DAU 1D

Game Management Units
8A and 10A

DESCRIPTION

The first wave of timber harvest in this DAU occurred during the early 1900s and consisted mostly of removing the most commercially valuable timber species and largest trees. During the 1970s, timber harvest increased fairly dramatically, and new roads provided access to previously inaccessible areas. In 1971, Dworshak Reservoir flooded approximately 45 miles of North Fork Clearwater River corridor with slack water, permanently removing thousands of acres of prime low elevation winter range for big game and spring range for bears.

DAU 1D is three-quarters timberland and one-fourth open or agricultural lands and is bisected by canyons leading to the Clearwater River. The timberland is owned predominantly by Potlatch Corporation, IDL, and the USFS. Access is very good throughout the DAU and timber harvest occurs on most available timber ground. High open and closed road densities contribute to high vulnerability for big game species. During the 1980s and 1990s, timber harvest occurred on almost all available state and private land as demand and management of these lands intensified. Despite the reservoir, extensive logging along the river corridor improved winter range in this unit. South aspect forests were cleared to provide timber products and inadvertently provided quality berry brush fields and spring range for bears. The warm and moist maritime climate contributes to rapid plant growth and decay, providing optimal habitat conditions for bears.

Bears occasionally cause damage to fruit trees and apiaries throughout the agricultural lands of this DAU.

MANAGEMENT OBJECTIVES

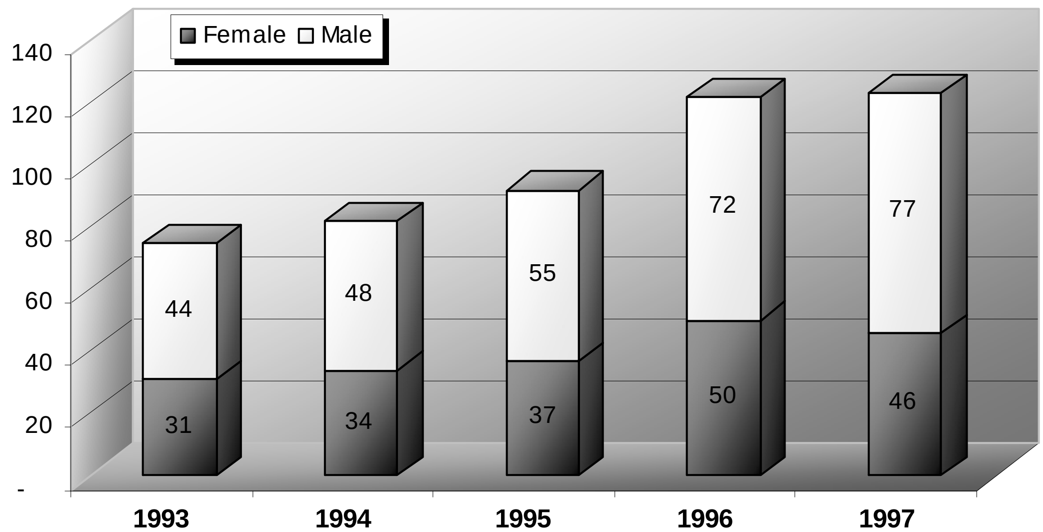
DAU 1D will be managed to maintain the heavy harvest targets of <25% age 5+ bears in the male harvest and >40% females in the total harvest.

DAU 1D

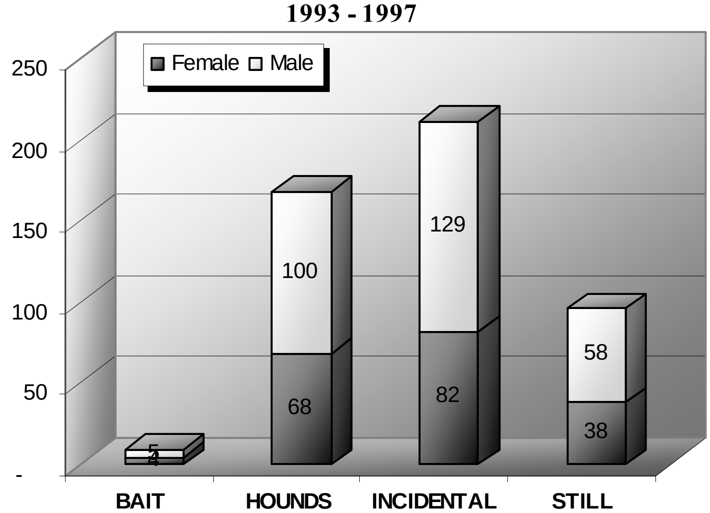
Harvest Statistics

DAU 1D	Total Harvest	Percent Female	Percent Males ≥5	3-Year Average Males ≥5
1993	77	40	22	
1994	82	41	21	
1995	92	40	24	22%
1996	122	41	24	23%
1997	124	37	15	20%
Total	**497**	**40**	**21**	

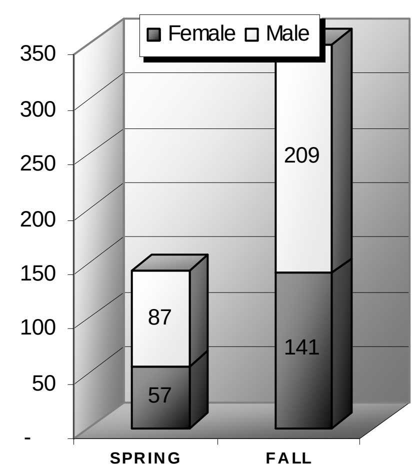
TOTAL HARVEST

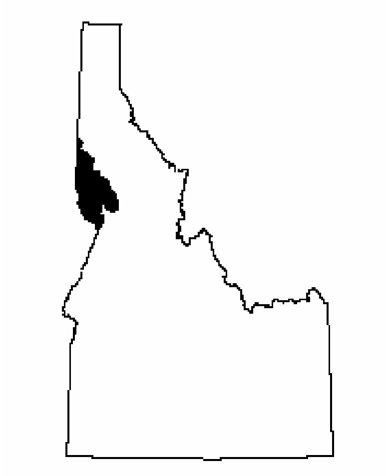


METHOD OF TAKE
1993 - 1997



SEASON
1993 -1997





DAU 1E

Game Management Units
8, 11, 11A, and 13

DESCRIPTION

This DAU contains portions of the highly productive Palouse and Camas prairies, as well as the canyon lands along the Snake and Salmon rivers. Currently, virtually all non-forested land in Units 8 and 11A is either tilled or grazed, and only small, isolated patches of perennial vegetation remain. Cattle grazing occurs on almost all of the available timber ground.

This DAU contains mostly private and some publicly owned land. Unit 11 is mostly private land except for the Craig Mountain Wildlife Management Area (CMWMA) along the Snake and Salmon rivers. Unit 13 has been mostly under private ownership since settlement, and is managed mostly for agriculture and livestock.

Habitat productivity varies widely throughout the DAU with steep, dry, river canyon grasslands having low annual precipitation, to higher elevation forests having good habitat productivity and greater precipitation. Late successional forest cover types have become fragmented within the DAU. Various berry species occur in canyon draws and hillsides providing a diversity of fall foods for bears. Road density is moderate, and access is restricted in many areas.

Bears occasionally cause damage to fruit trees and apiaries located near canyon draws and forest stringers.

MANAGEMENT OBJECTIVES

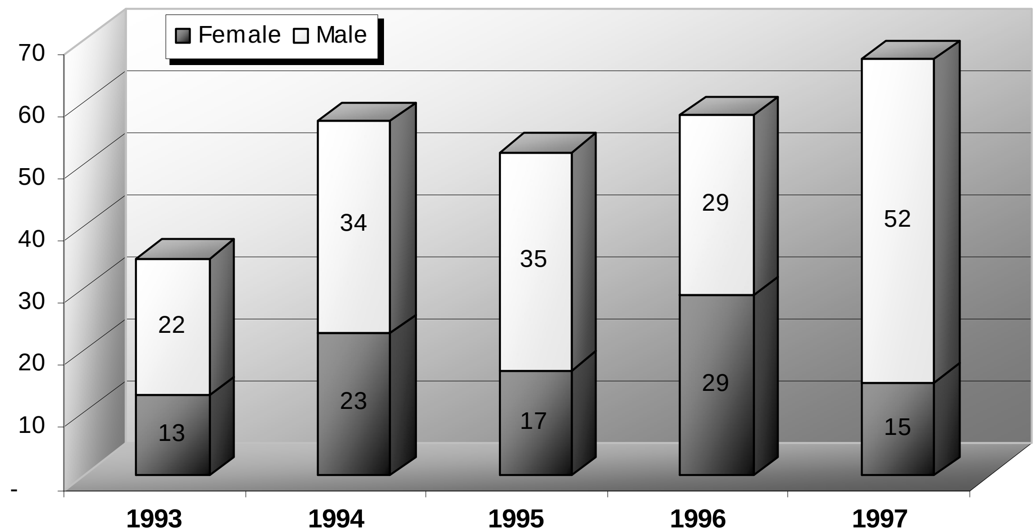
DAU 1E will be managed to maintain the heavy harvest targets of <25% age 5+ bears in the male harvest and >40% females in the total harvest.

DAU 1E

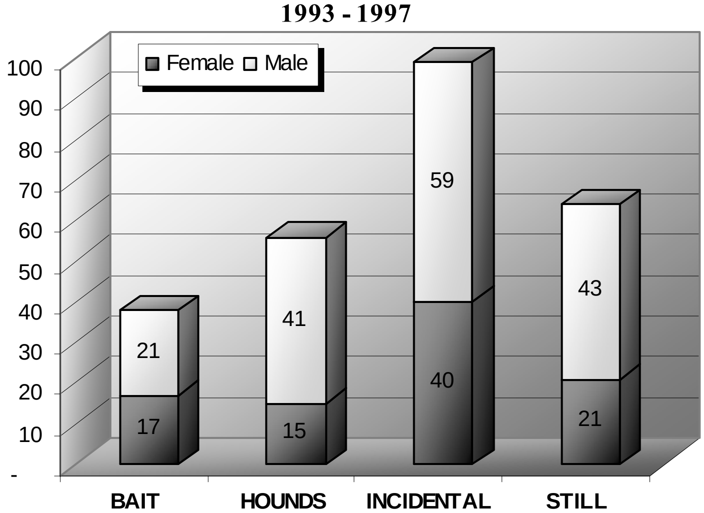
Harvest Statistics

DAU 1E	Total Harvest	Percent Female	Percent Males ≥5	3-Year Average Males ≥5
1993	36	36	26	
1994	59	39	24	
1995	52	33	27	26%
1996	59	49	17	23%
1997	68	22	20	21%
Total	**274**	**35**	**22**	

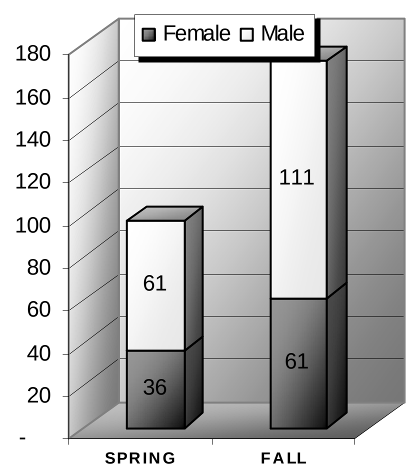
TOTAL HARVEST

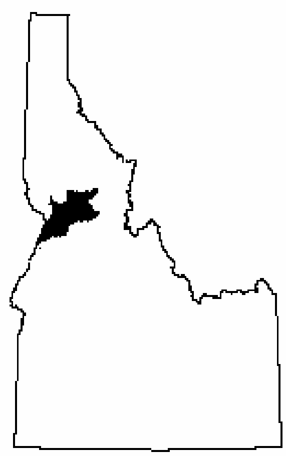


METHOD OF TAKE
1993 - 1997



SEASON
1993 -1997





DAU 1F

Game Management Units
14, 15, 16 and 18

DESCRIPTION

The prairie regions of this DAU were converted to agriculture & ranching by early settlers. In 1862, gold was discovered near the current location of Elk City in Unit 15. After the readily available gold was depleted, miners turned to dredging activities where rivers ran through meadows. Crooked, American, and Red rivers were channelized and rerouted several times during the extraction processes, which continued commercially until the 1950s. Logging began with mining activities to supply wood for the mines, but in the 1940s, logging activities became commercial and resulted in an extensive network of roads throughout a large portion of this DAU. In 1964, with the passage of the Wilderness Act, a small portion of Unit 16 was designated as a part of the Selway-Bitterroot Wilderness. In 1978, portions of Units 14 and 15 were included in the Gospel Hump Wilderness. Unit 18 is two-thirds public land with the remaining private land located at lower elevations along the Salmon River. The majority of the Hells Canyon Recreation Area and Wilderness, which was designated in 1975, is in Unit 18.

Land ownership in this DAU is approximately 80% publicly owned with the remaining 20% private. The privately owned portions are at lower elevations along the Clearwater and Salmon rivers. Approximately 10% of this DAU is Wilderness. Habitat productivity for bears is moderate in comparison to most other Clearwater Region big game units. The majority of this DAU is characterized by productive conifer forests with intermixed grasslands. Many forested areas have become overgrown with lodgepole pine and fir due to fire suppression during the past 40 years. Both open and closed road density is high within the DAU contributing to significant big game vulnerability during hunting season.

MANAGEMENT OBJECTIVES

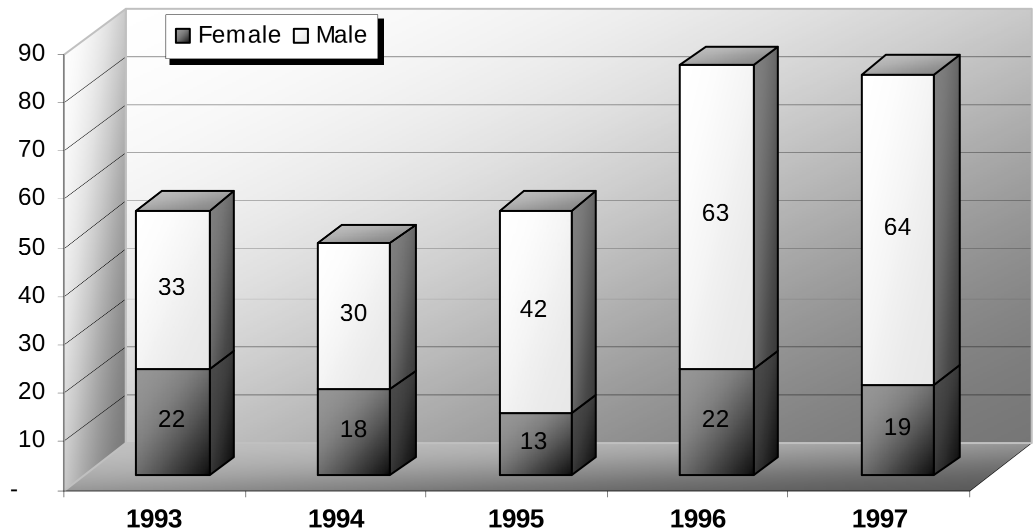
DAU 1F will be managed to maintain the heavy harvest targets of <25% age 5+ bears in the male harvest and >40% females in the total harvest.

DAU 1F

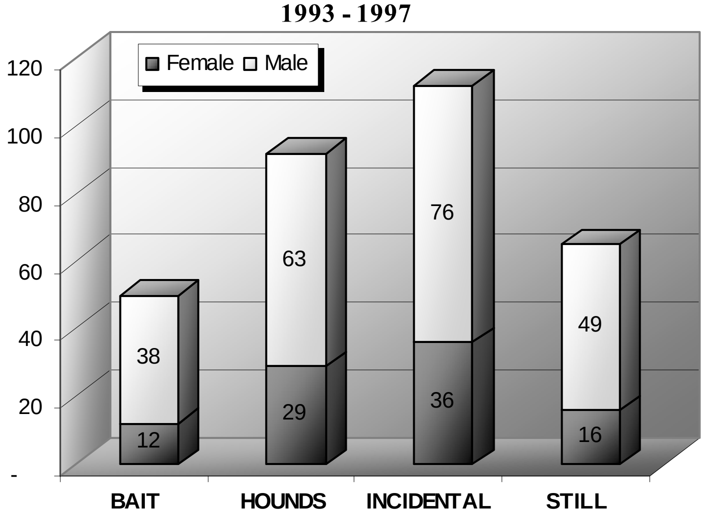
Harvest Statistics

DAU 1F	Total Harvest	Percent Female	Percent Males ≥5	3-Year Average Males ≥5
1993	55	40	22	
1994	48	38	32	
1995	55	24	21	24%
1996	85	26	17	22%
1997	84	23	29	23%
Total	**327**	**29**	**24**	

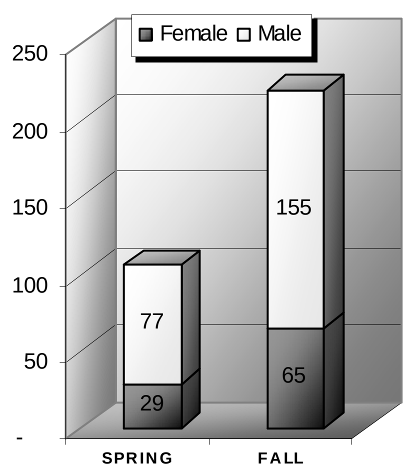
TOTAL HARVEST

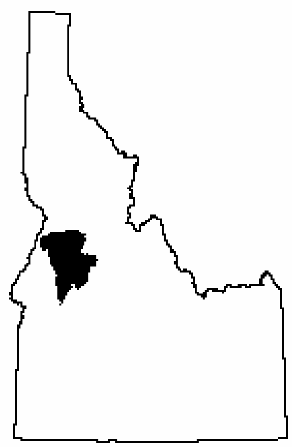


METHOD OF TAKE
1993 - 1997



SEASON
1993 -1997





DAU 1G

Game Management Units
19A, 23, 24, and 25

DESCRIPTION

Extra bear tags and liberal seasons were common in this DAU until the mid-1980s. More restrictive seasons and a one bear limit were implemented with the 1986-90 Black Bear Species Management Plan. Since then, bear harvest has been stable.

Approximately 70% of DAU 1G is in public ownership. Most land is managed by the USFS. Open, scattered shrub communities at lower elevations and mixed-conifer forests at mid to upper elevations characterize habitat. The wide valley bottoms of the upper Little Salmon River and North Fork Payette River are dominated by agri-business and housing developments. Bear habitat is considered good in this DAU.

High road densities exist in the western half of the DAU. Few roads (less than .25 mile per square mile) are found in the rest of the DAU. The Rapid River, Patrick Butte, French Creek, and Needles roadless areas occur in this area.

Livestock depredations and bear nuisance complaints are common in DAU 1G. Bear kills by Wildlife Services in response to sheep depredations average about 5 bears a year. Bear nuisance complaints are mostly related to poor garbage disposal practices and have been numerous during years with poor berry crops.

MANAGEMENT OBJECTIVES

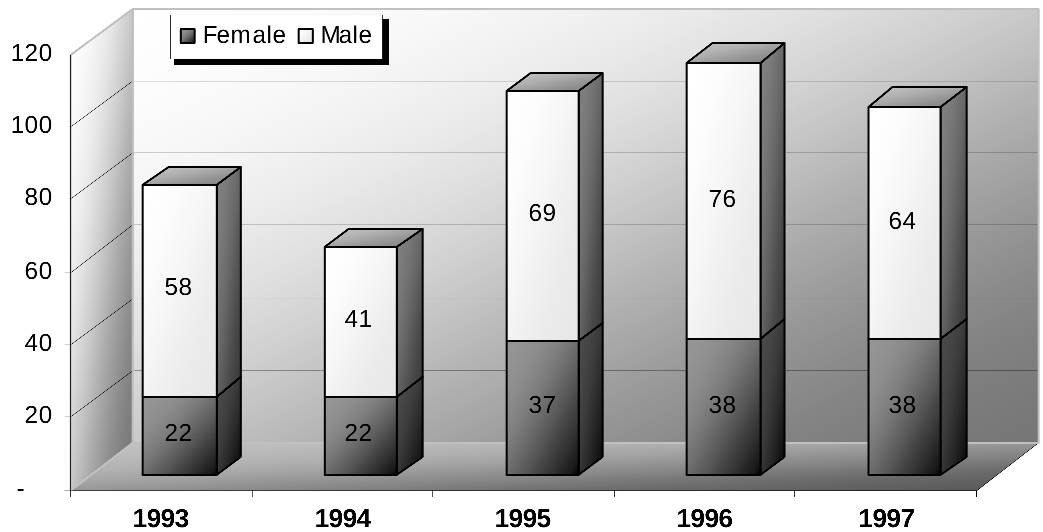
DAU 1G will be managed to maintain the moderate harvest targets of 25-35% age 5+ bears in the male harvest and 30-40% females in the total harvest.

DAU 1G

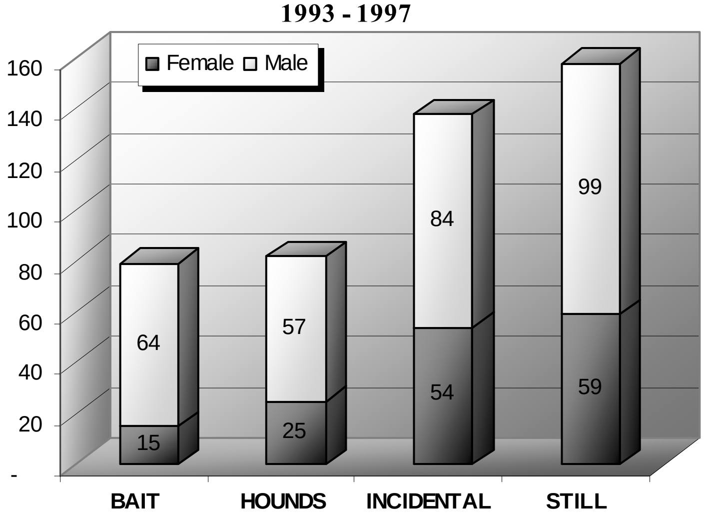
Harvest Statistics

DAU 1G	Total Harvest	Percent Female	Percent Males ≥5	3-Year Average Males ≥5
1993	80	28	40	
1994	66	33	28	
1995	107	35	42	38%
1996	114	33	33	35%
1997	102	37	38	38%
Total	**469**	**33**	**37**	

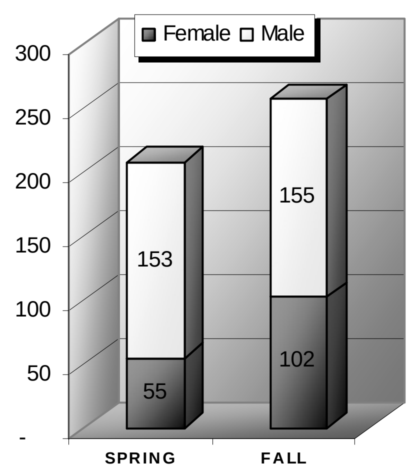
TOTAL HARVEST

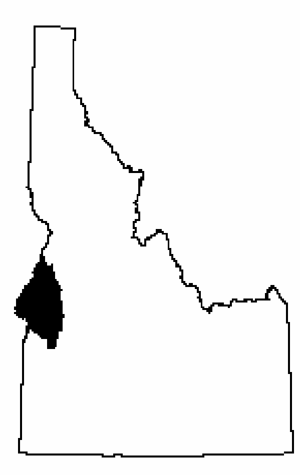


METHOD OF TAKE
1993 - 1997



SEASON
1993 -1997





DAU 1H

Game Management Units
22, 31, 32, and 32A

DESCRIPTION

High vulnerability of bears to hunting in this DAU has been a continual concern to sportsmen. Historically, baiting and hunting bears with the use of hounds have been restricted in DAU 1H. Bear seasons became increasingly more conservative with the implementation of each of the last three black bear species management plans. In 1993, general seasons were eliminated in favor of controlled hunts.

Approximately 60% of DAU 1H is not productive bear habitat, consisting of desert and irrigated agricultural lands. Over 90% of the bear habitat in this DAU is publicly owned and managed by the U.S. Forest Service. Road densities often exceed 3.0 miles per square mile. Bear habitat is characterized by open, scattered shrub communities at lower elevations and mixed-conifer forests and scattered onion beds and shrubfields at mid to upper elevations. Where present, bear habitat is considered excellent in this DAU.

Livestock depredations by bears are rare in this DAU, as cattle occupy most grazing allotments. Depredations on apiaries were infrequent in the past, but have been increasing recently as a result of apiary businesses expanding into bear habitat. Education of apiary owners and installation of electric fences is reducing this concern.

MANAGEMENT OBJECTIVES

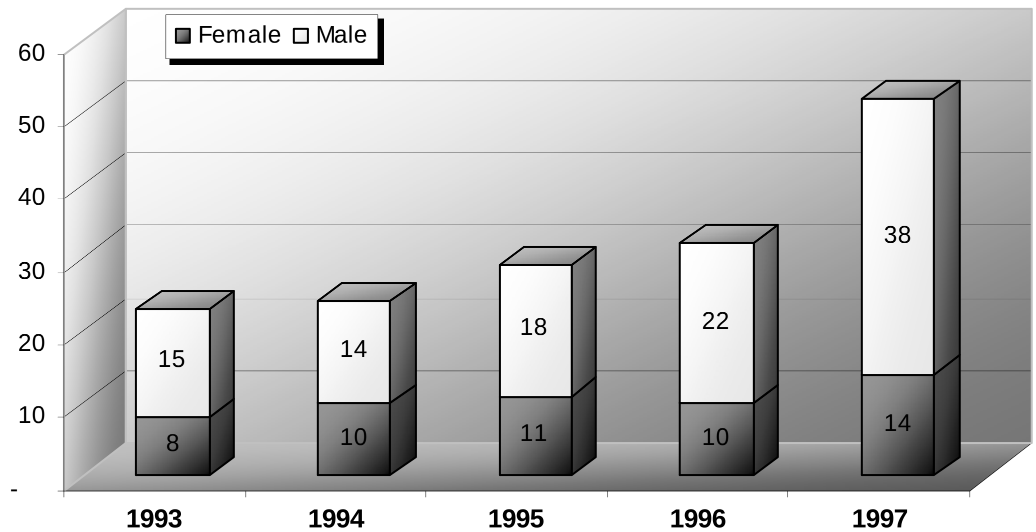
DAU 1H will continue to be managed as a controlled hunt area because of the popularity of this area for bear hunting. Baiting and the use of hounds will continue to be restricted in this DAU. DAU 1H will be managed to maintain the light harvest targets of >35% age 5+ bears in the male harvest and <30% females in the total harvest.

DAU 1H

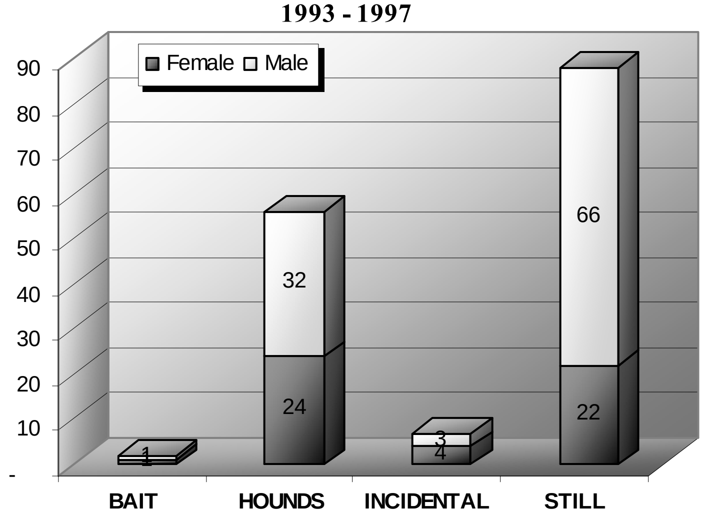
Harvest Statistics

DAU 1H	Total Harvest	Percent Female	Percent Males ≥5	3-Year Average Males ≥5
1993	23	35	9	
1994	25	40	31	
1995	30	37	31	24%
1996	32	31	22	27%
1997	53	26	32	29%
Total	**163**	**33**	**27**	

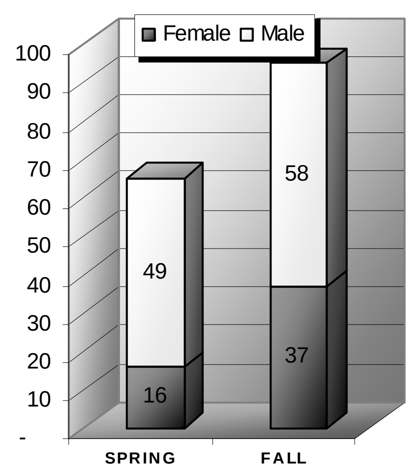
TOTAL HARVEST

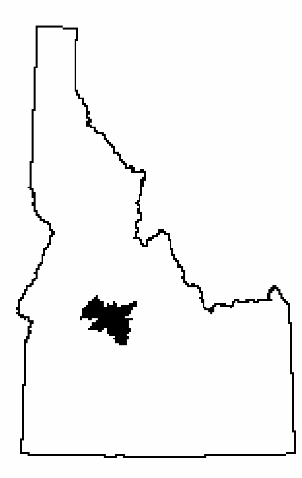


METHOD OF TAKE
1993 - 1997



SEASON
1993 -1997





DAU 1I

Game Management Units
34, 35, and 36

DESCRIPTION

These units contain almost continuous, good quality bear habitat; most of which is forested public land. Topography varies from large areas of flat to gently rolling terrain to the extremely rugged and rocky Sawtooth Mountains. Much of the area is lightly roaded or roadless; some is designated Wilderness, and the large Frank Church River of No Return Wilderness is adjacent to the north and east.

Over the past decade, DAU 1I has averaged about 33 bears harvested per year, or about 1.8 bears per 100 square miles. Relatively short spring seasons, limited road access, and distance to major human populations (2-3 hours driving time) have combined to produce a lightly harvested bear population. Age five and older bears consistently comprise over 40% of the male harvest, averaging 53% over the past decade. Similarly, females average 33% of the total harvest.

DAU 1I, particularly Unit 36, attracts considerable human recreational activity through most of the year. During the peak summer and early fall months, bear depredations are an almost constant concern at campgrounds and summer homes. Unit 36 also experiences an occasional bear attack on domestic sheep. Depredation problems multiply during dry summers when range forage cures early and/or when berry production is low.

MANAGEMENT OBJECTIVES

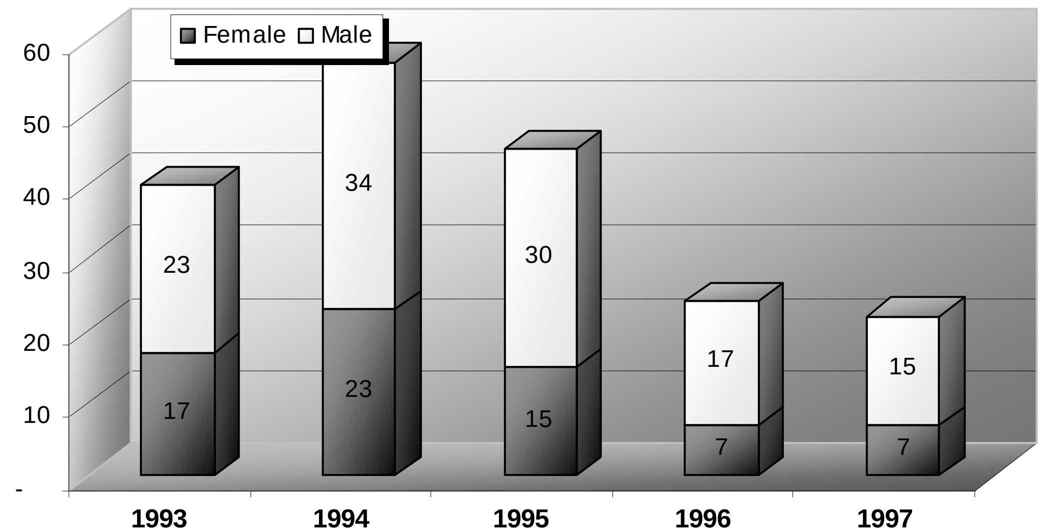
To address depredation concerns and to test the validity of bear harvest rate indicators. DAU 1I will be managed to meet the heavy harvest targets of <25% of the male harvest comprised of age 5+ bears and females comprising >40% of the total harvest.

DAU 1I

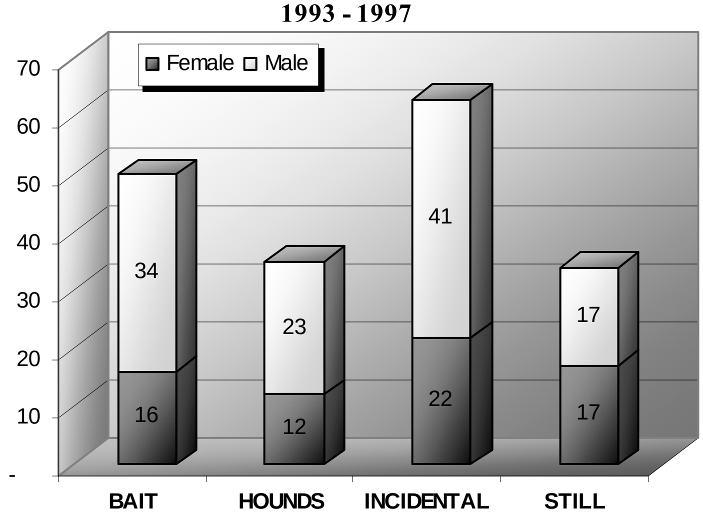
Harvest Statistics

DAU 1I	Total Harvest	Percent Female	Percent Males ≥5	3-Year Average Males ≥5
1993	41	41	62	
1994	57	40	43	
1995	45	33	48	50%
1996	24	29	40	44%
1997	22	32	29	41%
Total	**189**	**37**	**46**	

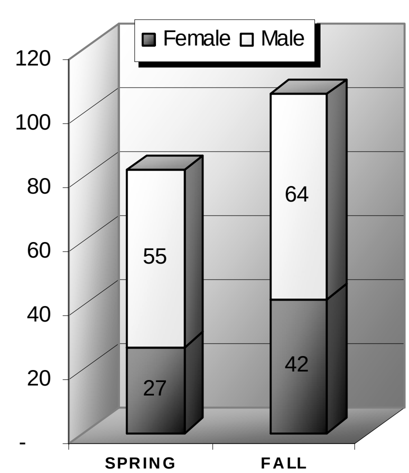
TOTAL HARVEST

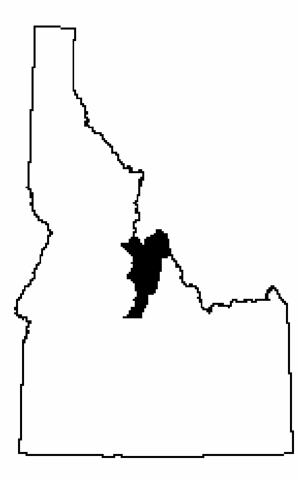


METHOD OF TAKE
1993 - 1997



SEASON
1993 -1997





DAU 1J

Game Management Units 21, 21A, 28, and 36B

DESCRIPTION

The vegetation in DAU 1J varies from dry river breaks and sagebrush grasslands to subalpine, with most of the area in dry to moderately moist coniferous forests. Berry-producing habitats occur as isolated stringers along lower elevation riparian zones; where *Ribes* sp, serviceberry, chokecherry, and elderberry are common; or more generally widespread huckleberry stands at higher elevations in the north end of the DAU. Overall, the topography is steep and rugged, although more gently rolling terrain does exist in some areas. Access is somewhat limited, but varies from unroaded Wilderness to a few logged areas with high road densities. Bear densities are low to moderate, reflecting habitat capacity, and probably could not substantially increase.

Over the past decade, DAU 1J has averaged about 64 bears harvested per year, or about 2.4 bears per 100 square miles. Rugged terrain, limited access, and distance to major human populations (3+ hours driving time) tend to moderate bear harvest. Age five and older bears consistently comprise 35-45% of the male harvest, averaging 40% over the past decade. Similarly, females average 36% of the total harvest. During years with a dry summer and fall, bear harvest significantly increases as bears more actively forage for food in the fall, particularly along streamsides where roads and hunters often occur.

Depredations regularly occur in this DAU every year, typically involving campgrounds, garbage, pet food, beehives, and fruit orchards. Depredation problems multiply during dry summers when range forage cures early and/or when berry production is low.

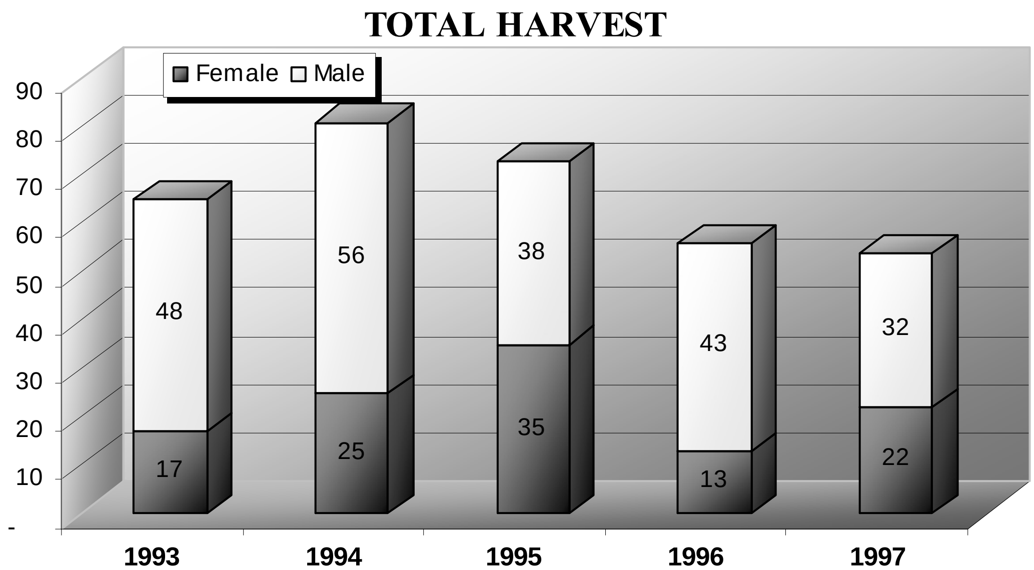
MANAGEMENT OBJECTIVES

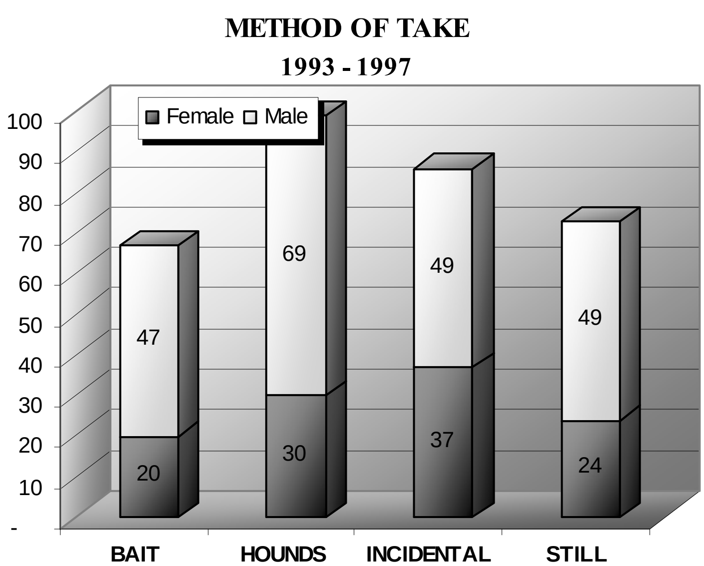
DAU 1J will be managed to maintain the moderate harvest targets of 25-35% age 5+ bears in the male harvest and 30-40% females in the total harvest.

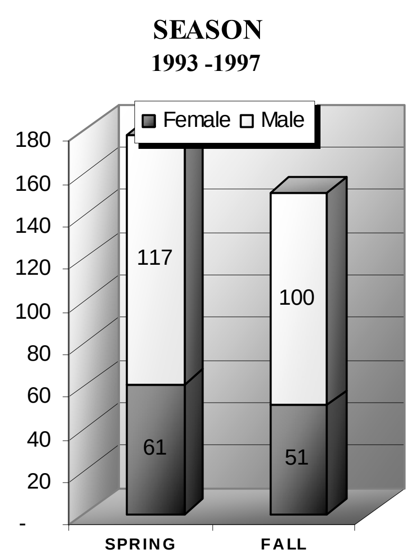
DAU 1J

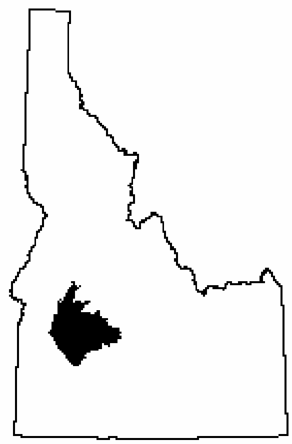
Harvest Statistics

DAU 1J	Total Harvest	Percent Female	Percent Males ≥5	3-Year Average Males ≥5
1993	65	26	28	
1994	82	30	31	
1995	73	48	41	33%
1996	56	23	39	36%
1997	54	41	43	41%
Total	**330**	**34**	**35**	









DAU 1K

Game Management Units
33, 39, and 43

DESCRIPTION

These units are made up of drainage that runs to the south and west. The topography is mainly ridges that run southwest. There is the south side mainly dry and covered with grass-shrub communities. The north sides are treed with conifers and have wetter communities. There are plant communities that have berry producers, there is not a constant supply since drought conditions significantly influence the production levels. All three units have areas that are highly roaded. They all have areas that can be considered reserve areas that hunters do not get into. The units are within easy distance of the Boise metropolitan area and the large number of hunters that are located there. In all units there are some level of depredations. They range from livestock depredations to campground raiders. Another major problem is the movement of bears into the urban areas such as Boise.

Over the past decade, DAU 1K has averaged 133 bears harvested per year. Seasons have gone from long with multiple bear tags to shorter seasons.

MANAGEMENT OBJECTIVES

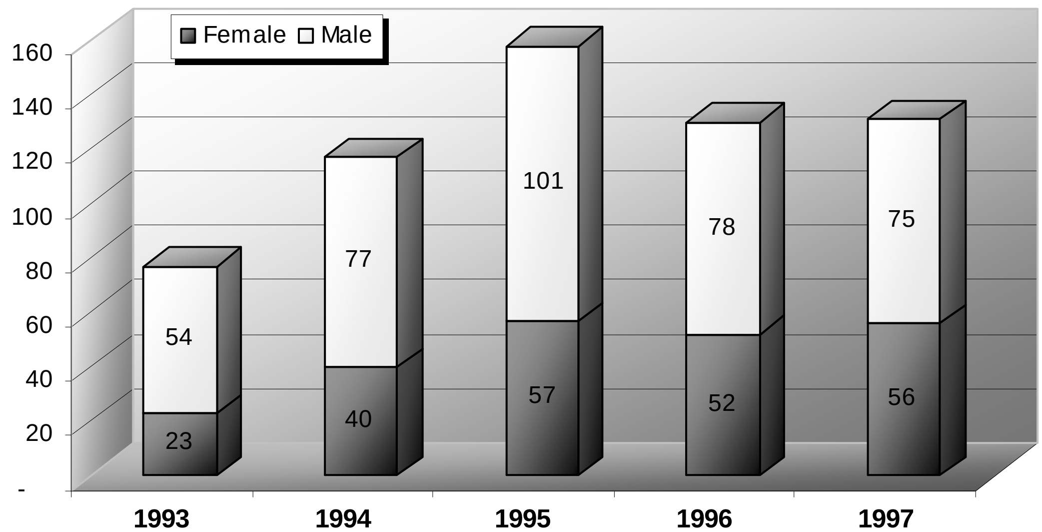
DAU 1K will be managed to maintain the moderate harvest targets of 25-35% age 5+ bears in the male harvest and 30-40% females in the total harvest.

DAU 1K

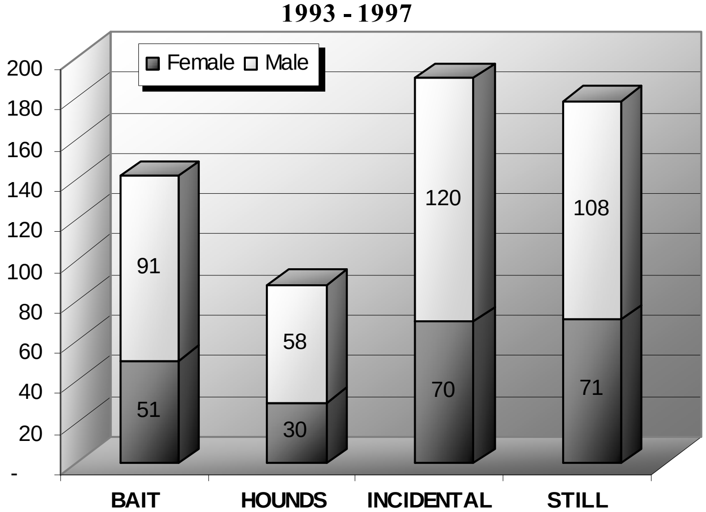
Harvest Statistics

DAU 1K	Total Harvest	Percent Female	Percent Males ≥5	3-Year Average Males ≥5
1993	77	30	36	
1994	119	34	39	
1995	161	35	28	33%
1996	130	40	24	30%
1997	134	42	35	29%
Total	**621**	**37**	**32**	

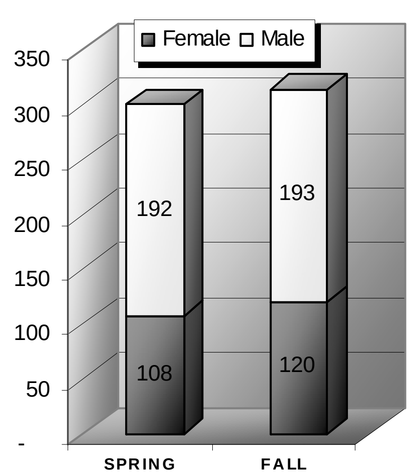
TOTAL HARVEST

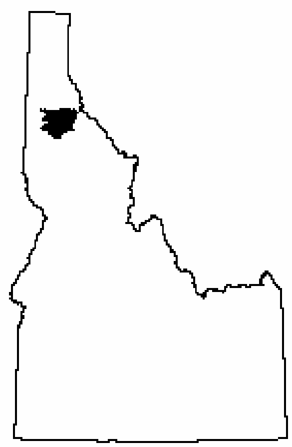


METHOD OF TAKE
1993 - 1997



SEASON
1993 -1997





DAU 1L

Game Management Unit 6

DESCRIPTION

This DAU is a mix of private property, mainly timber company lands, with a mix of US Forest Service, Bureau of Land Management, and Idaho Department of Lands property. This area has been influenced heavily by logging and, to a lesser extent, by the large fires of the early 1900s.

Road densities range from moderate to high. Black bear densities are low, and baiting of black bears has not been allowed since 1983 because of low densities.

Total harvest in DAU 1L has averaged 54 bears from 1993 to 1997. Mature males ($\geq$5 years old) make up 25% to 45% of the harvest and in 1997 the 3 year average was 31%. The harvest has increasingly been made up of females and the percent of mature females in the harvest is fairly high. Harvest statistics indicate a fairly heavily hunted population.

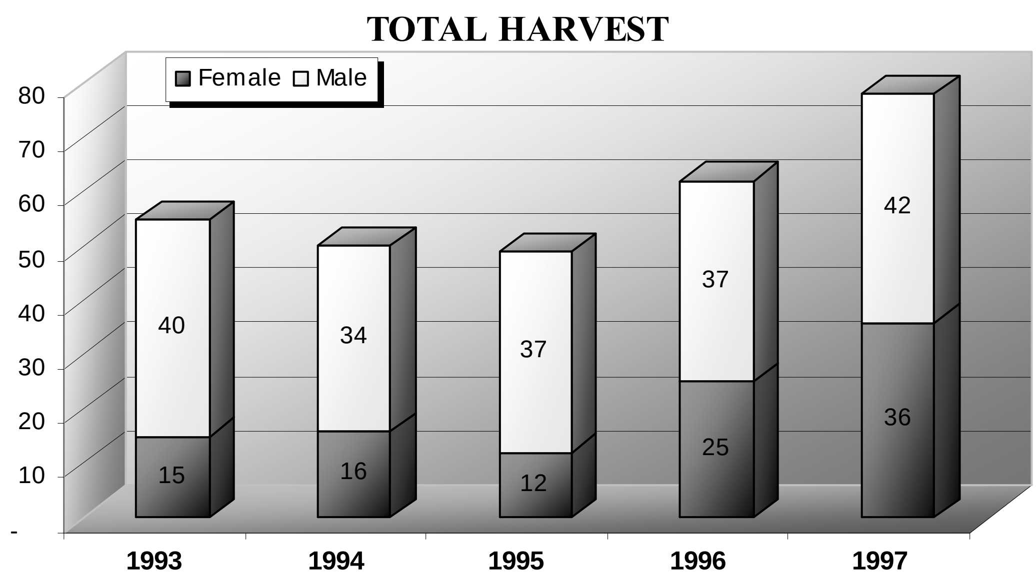
MANAGEMENT OBJECTIVES

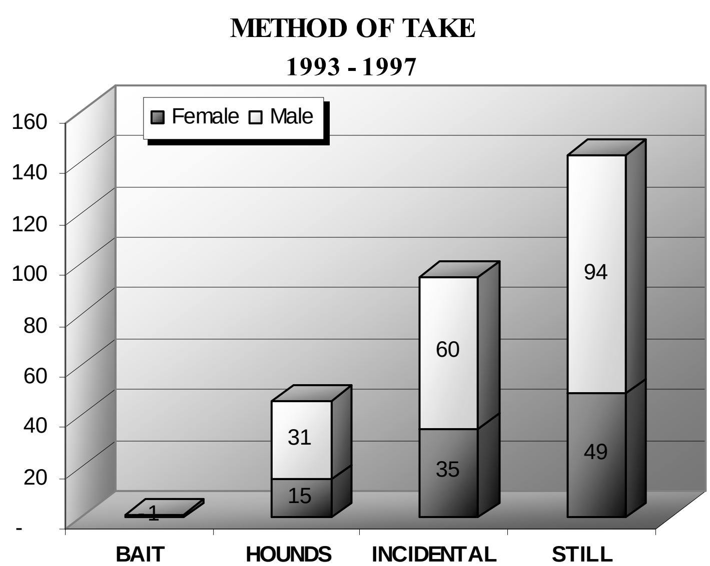
DAU 1L will be managed to maintain the moderate harvest targets of 25-35% age 5+ bears in the male harvest and 30-40% females in the total harvest.

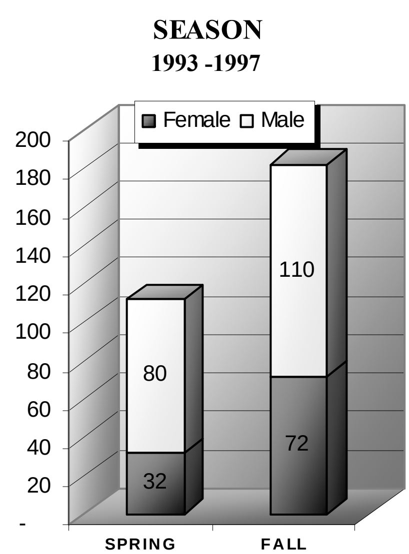
DAU 1L

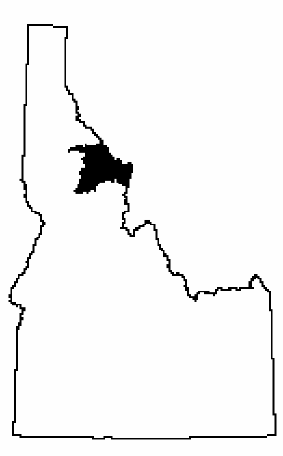
Harvest Statistics

DAU 1L	Total Harvest	Percent Female	Percent Males ≥5	3-Year Average Males ≥5
1993	56	27	26	
1994	50	32	22	
1995	49	24	27	25%
1996	62	40	45	32%
1997	78	46	22	31%
Total	**295**	**35**	**28**	









DAU 2A

Game Management Units
10 and 12

DESCRIPTION

Until the 1930s, wildfires were the primary habitat disturbance mechanism in this DAU. Between 1900 and 1934, approximately 70% of the Lochsa River drainage was burned by wildfires creating a diversity of habitat and shrub species. Between 1926 and 1990, over 1,900 km of roads were built in this area to access marketable timber. State Highway 12 along the Lochsa River was completed in 1962 and became the primary travel corridor. In 1964, most of the southern portion of Unit 12 was designated as part of the Selway-Bitterroot Wilderness.

Land ownership within this DAU is almost entirely publicly owned forest. The southern portion of the DAU is within the Selway-Bitterroot Wilderness Area. Historically, habitat productivity was high in this DAU and remains so in the western portion due mainly to publicly logged forest creating early successional forest with intermixed brush. The remaining portion of the unit has decreased in habitat productivity mainly due to fire suppression. Approximately one-third of the DAU has good access for motorized vehicles with medium road densities. The remaining portion has low road densities with good trails contributing to medium to low big game vulnerability.

The warm maritime climate provides the most productive bear habitat in the Clearwater Region. High precipitation levels, dense forests, and roadless areas allow for relatively dense bear populations.

MANAGEMENT OBJECTIVES

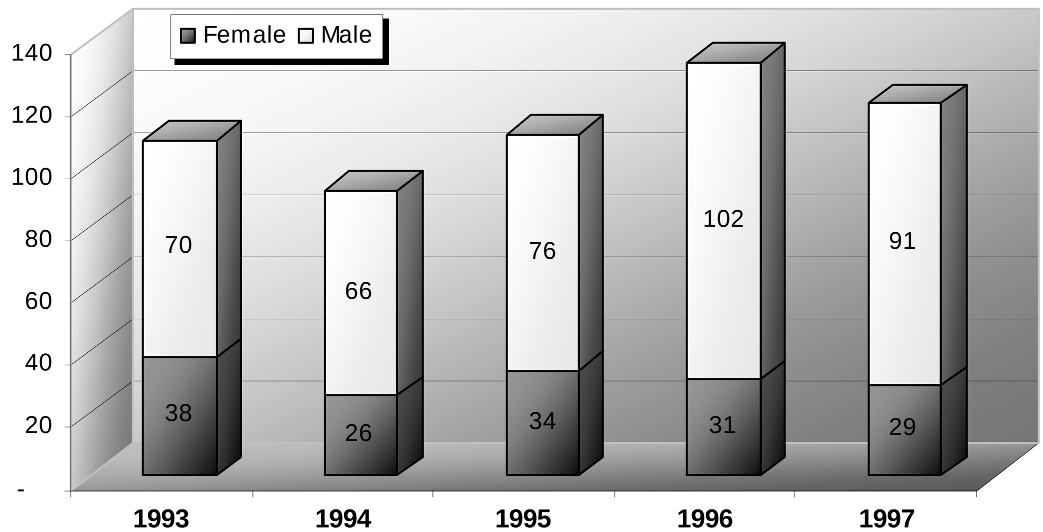
DAU 2A will be managed to maintain the heavy harvest targets of <25% age 5+ bears in the male harvest and >40% females in the total harvest.

DAU 2A

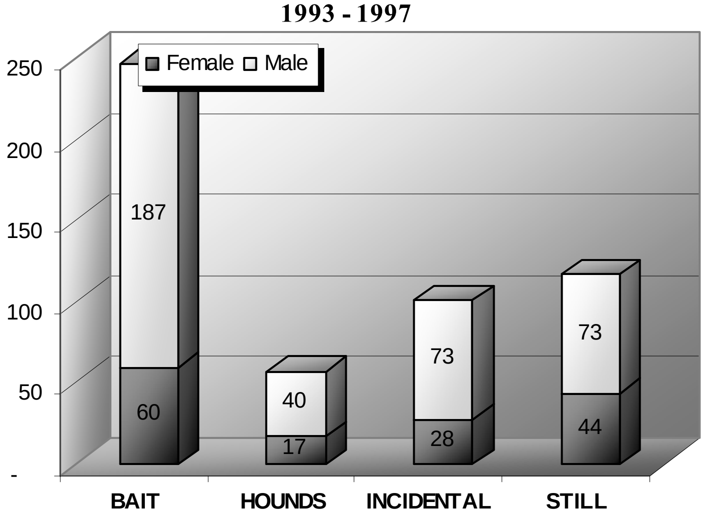
Harvest Statistics

DAU 2A	Total Harvest	Percent Female	Percent Males ≥5	3-Year Average Males ≥5
1993	111	34	57	
1994	93	28	42	
1995	110	31	42	47%
1996	133	23	43	42%
1997	122	24	33	39%
Total	**569**	**28**	**43**	

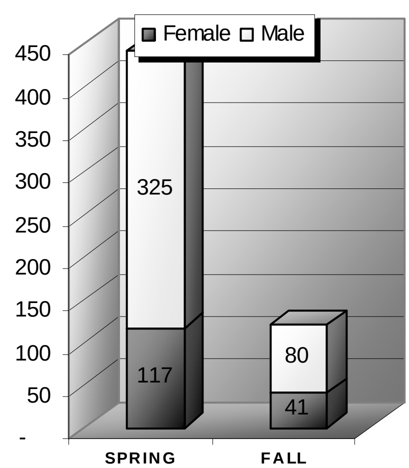
TOTAL HARVEST

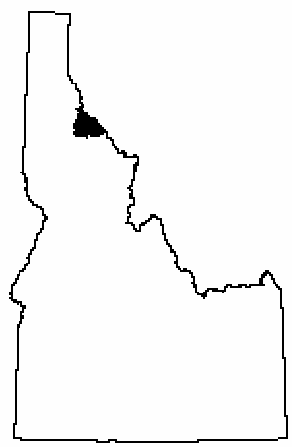


METHOD OF TAKE
1993 - 1997



SEASON
1993 -1997





DAU 2B

Game Management Units
7 and 9

DESCRIPTION

This DAU is the most remote from human population centers of any DAU in the Panhandle Region. In addition, persistent snowdrifts make spring travel difficult, and substantial roadless areas preclude high levels of use. The US Forest Service manages most of the habitat in this DAU.

Total harvest in DAU 2B has averaged 41 bears from 1993 to 1997. Mature males (≥5 years old) make up nearly 40% of the population but have shown a decline in the past 5 years. However, small sample sizes in this DAU can lead to variable results. Females make up a small percent of the harvest and mature females do not appear to be heavily harvested. Harvest statistics indicate a light to moderate harvest level in this DAU.

MANAGEMENT OBJECTIVE

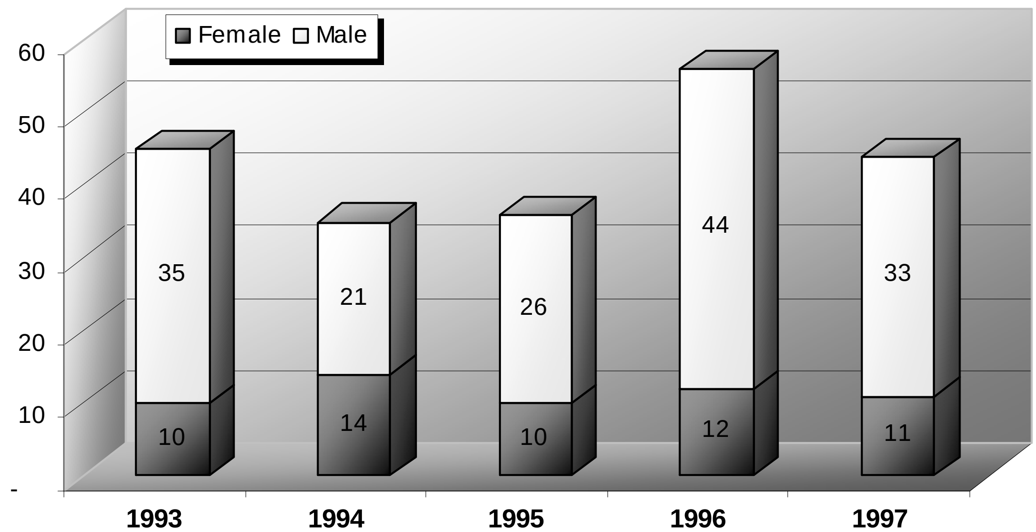
DAU 2B will be managed to increase harvest to the moderate harvest targets of 25-35% age 5+ bears in the male harvest and 30-40% females in the total harvest.

DAU 2B

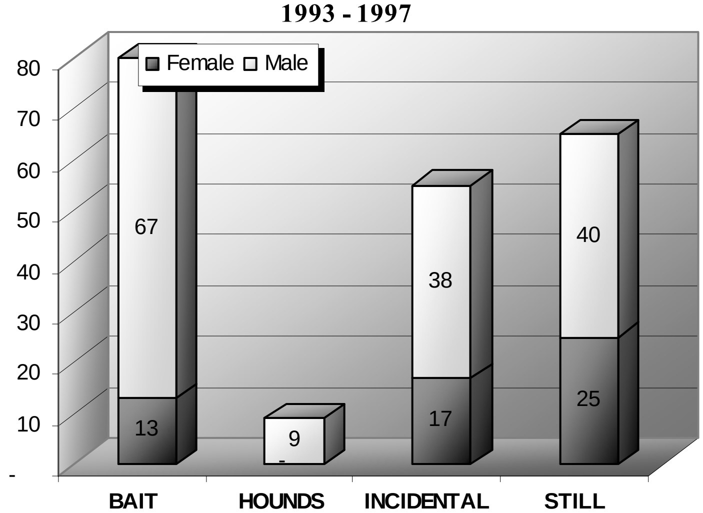
Harvest Statistics

DAU 2B	Total Harvest	Percent Female	Percent Males ≥5	3-Year Average Males ≥5
1993	46	22	63	
1994	35	40	71	
1995	36	28	35	56%
1996	57	21	48	49%
1997	45	24	26	38%
Total	**219**	**26**	**47**	

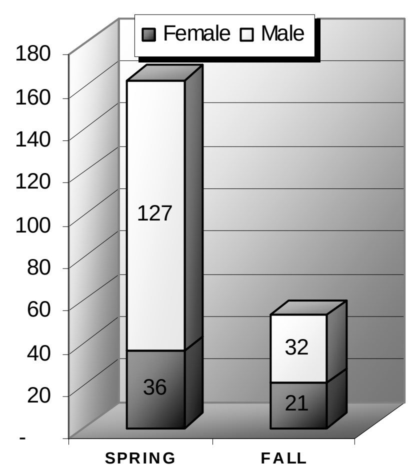
TOTAL HARVEST

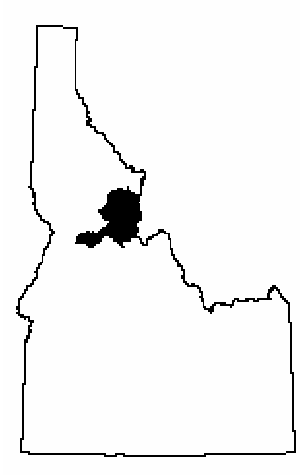


METHOD OF TAKE
1993 - 1997



SEASON
1993 -1997





DAU 3A

Game Management Units
16A, 17, 19, and 20

DESCRIPTION

Due to the rugged and remote nature of this DAU, human impacts have been very limited. In 1964, almost all of Unit 17 and a small portion of Unit 16A were included in the Selway-Bitterroot Wilderness. Most of Unit 19 became part of the Gospel Hump Wilderness in 1978, and in 1980, part of Unit 20 was included in the Frank Church River of No Return Wilderness.

Habitat productivity varies throughout the DAU from high precipitation forested areas along the Lower Selway River to dry, steep, south-facing ponderosa pine and grassland habitat along the Salmon River. High elevation habitats in the southern portion are dominated by Whitebark Pine, an important bear food. Many areas along the Salmon River have a good mix of successional stages due to frequent fires within the Wilderness. Fire suppression within portions of the Selway River drainage has led to decreasing forage production for big game. Road densities are low, contributing to low vulnerability for big game. Large proportions of hunters in this DAU are nonresident.

MANAGEMENT OBJECTIVES

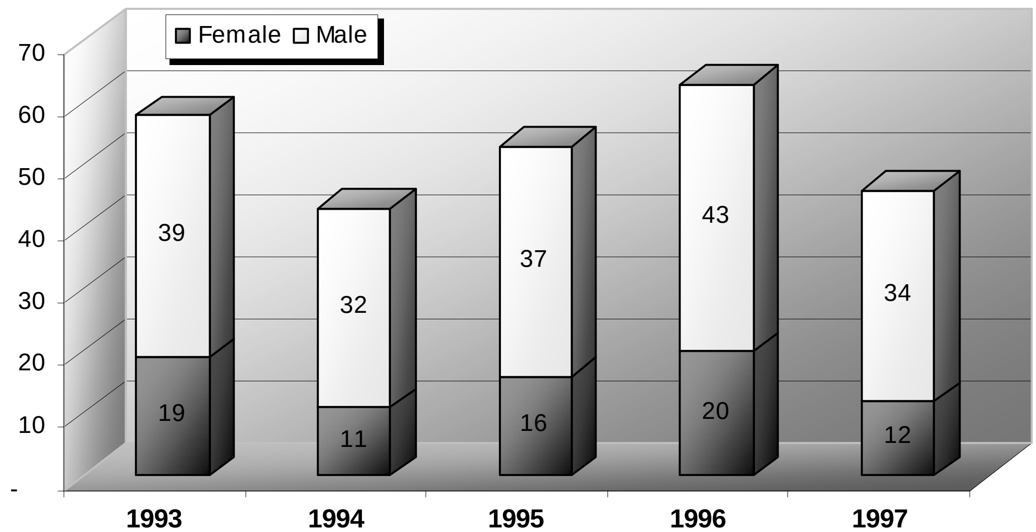
DAU 3A will be managed to maintain the moderate harvest targets of 25-35% age 5+ bears in the male harvest and 30-40% females in the total harvest.

DAU 3A

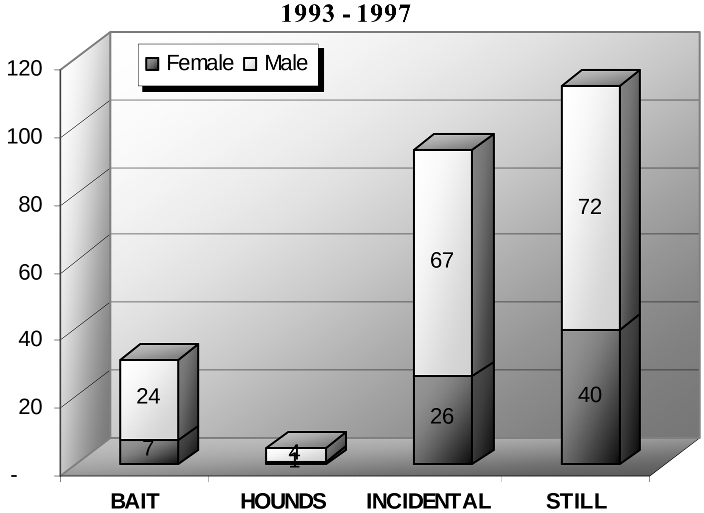
Harvest Statistics

DAU 3A	Total Harvest	Percent Female	Percent Males ≥5	3-Year Average Males ≥5
1993	58	33	53	
1994	44	25	50	
1995	53	30	53	52%
1996	63	32	34	45%
1997	46	26	45	44%
Total	**264**	**30**	**47**	

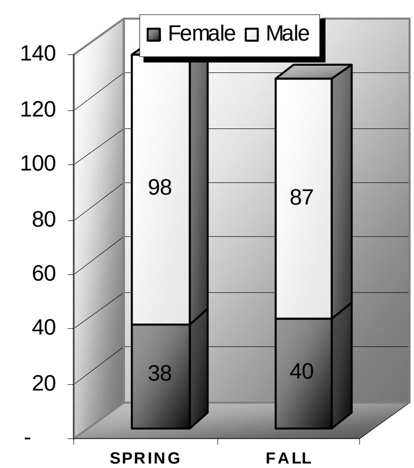
TOTAL HARVEST

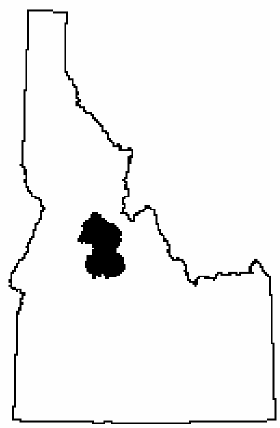


METHOD OF TAKE
1993 - 1997



SEASON
1993 -1997





DAU 3B

Game Management Units
20A, 26, and 27

DESCRIPTION

Extra bear tags and liberal seasons were common in this DAU until the mid-1980s. More restrictive seasons and a one bear limit were implemented with the 1986-90 Black Bear Species Management Plan. Season lengths still remain the most liberal in Idaho. Bear harvest has been light, dominated by young, dispersing bears or occasional older bears, and occurs mostly along river corridors and backcountry landing strips.

Most of DAU 3B is in public ownership, roadless, and lying within wilderness boundaries. Except for a few mining roads penetrating the periphery, access in these units is restricted to airplane, packstring, or foot travel. The steep canyon breaks of the Middle Fork Salmon and main Salmon rivers characterize the lower elevations of this DAU. Mid to upper elevations are dominated by mixed conifer forests. Bear habitat is of moderate productivity in this area.

Livestock depredations and human/bear conflicts generally do not occur in this DAU.

MANAGEMENT OBJECTIVES

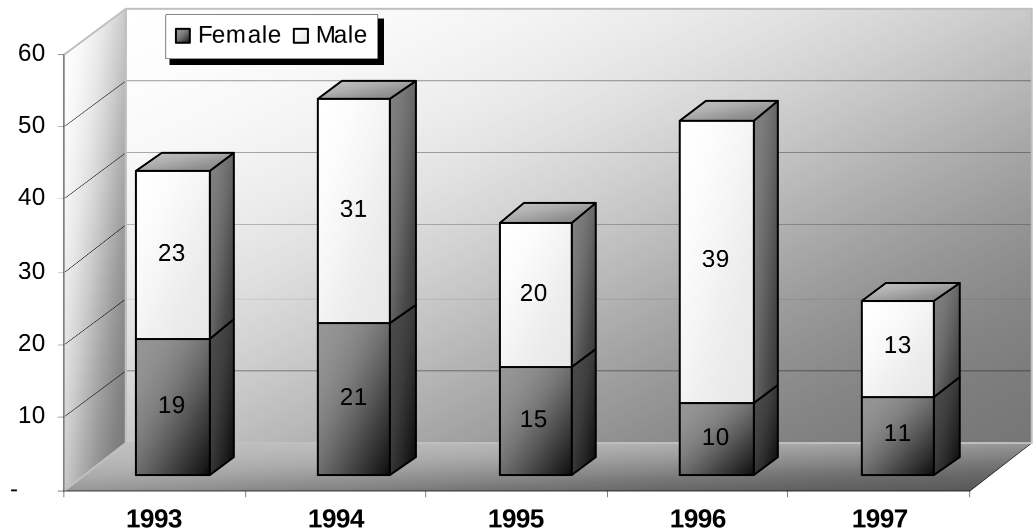
DAU 3B will be managed to maintain the moderate harvest targets of 25-35% age 5+ bears in the male harvest and 30-40% females in the total harvest.

DAU 3B

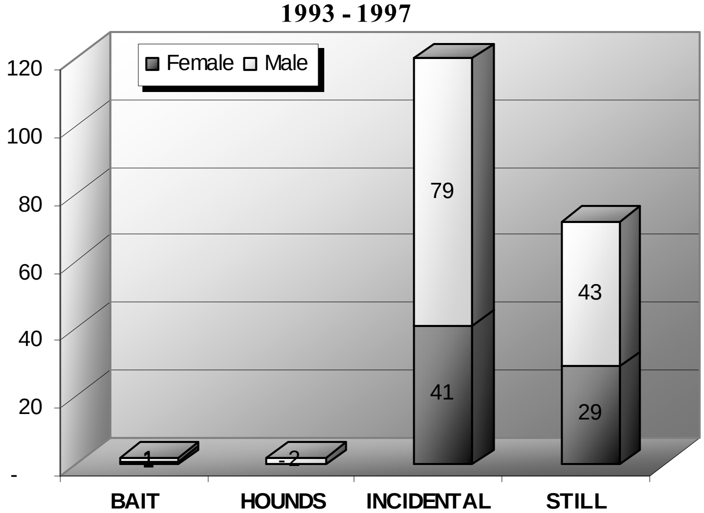
Harvest Statistics

DAU 3B	Total Harvest	Percent Female	Percent Males ≥5	3-Year Average Males ≥5
1993	42	45	55	
1994	53	40	55	
1995	36	42	21	48%
1996	49	20	34	40%
1997	24	46	18	28%
Total	**204**	**37**	**40**	

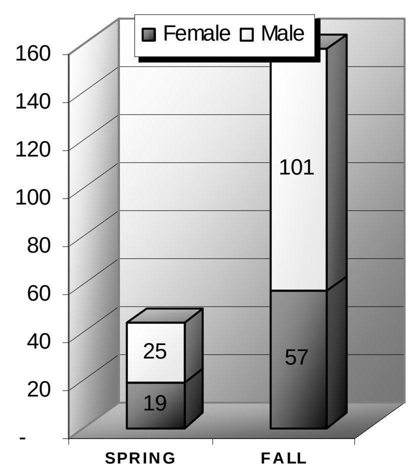
TOTAL HARVEST

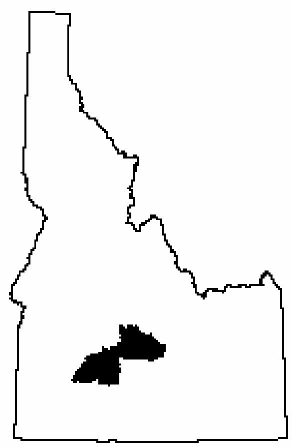


METHOD OF TAKE
1993 - 1997



SEASON
1993 -1997





DAU 4A

Game Management Units
44, 45, 48, and 49

DESCRIPTION

Units comprising DAU 4A are located in the Magic Valley Region in south central Idaho, north of the Snake River. The population centers of Boise, Twin Falls, Sun Valley-Ketchum and Burley are within 100 miles of this area. Elevations range from 2,800 feet in the Bennett Mountains (Unit 45) to over 12,000 feet in the Pioneer Mountains (Unit 49).

The area has moderately long, cold winters and hot, dry summers. Annual precipitation ranges from 10 inches in the lower elevations to 32 inches in the higher elevations and occurs primarily as snow from November to February.

At lower elevations, vegetative communities are composed mostly of sagebrush, aspen, hawthorn, and chokecherry in riparian areas, and some sparse stands of Douglas fir. Middle and high elevation areas are characterized by open, mountain sagebrush on south and west slopes, and ponderosa pine and Douglas fir on north and east slopes. Berry-producing plants are very limited throughout area.

Major land uses affecting this DAU are livestock grazing and year-round recreational activities. Logging was a predominate use in the 1960s and 1970s but is uncommon now because most merchantable timber has been removed. Access throughout most of the DAU is good, except the upper Little Wood River drainage, which is roadless.

MANAGEMENT OBJECTIVES

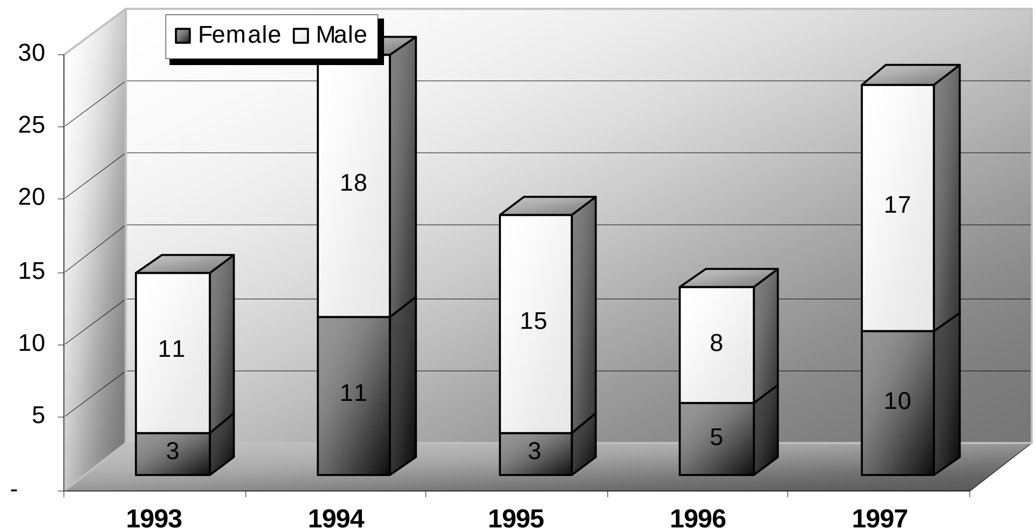
DAU 4A will be managed to maintain the moderate harvest targets of 25-35% age 5+ bears in the male harvest and 30-40% females in the total harvest.

DAU 4A

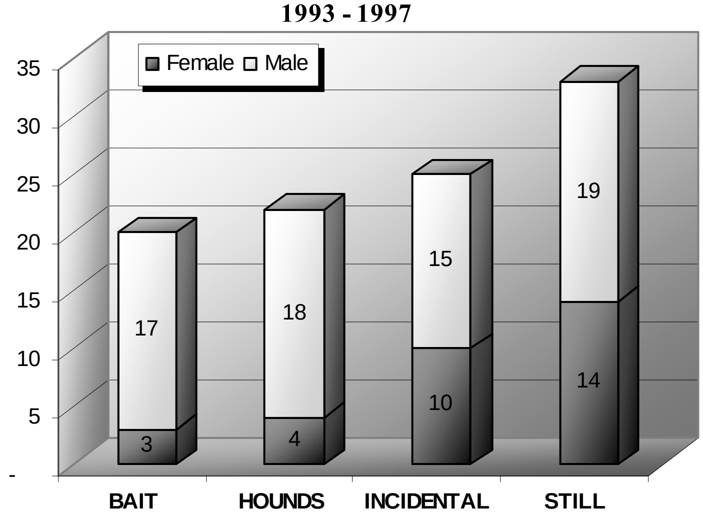
Harvest Statistics

DAU 4A	Total Harvest	Percent Female	Percent Males ≥5	3-Year Average Males ≥5
1993	14	21	22	
1994	30	37	29	
1995	18	17	14	23%
1996	13	38	43	26%
1997	27	37	24	24%
Total	**102**	**31**	**25**	

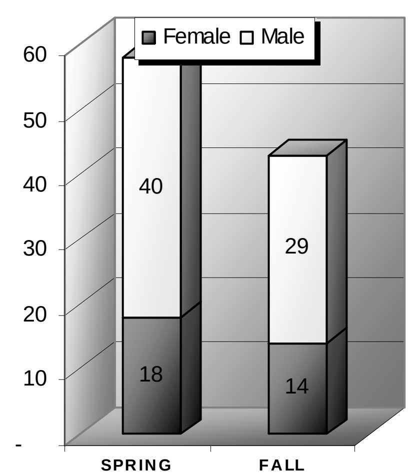
TOTAL HARVEST

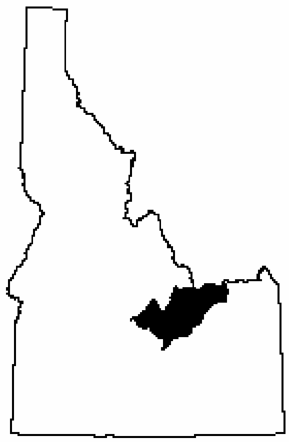


METHOD OF TAKE
1993 - 1997



SEASON
1993 -1997





DAU 4B

Game Management Units
50, 51, 58, 59, and 59A

DESCRIPTION

Data Analysis in Unit 4B is comprised of Big Game Management Units 50, 51, 58, 59, and 59A in eastern/east central Idaho. These mountain and valley units are bisected by the Pioneer, White Knob, Lost River, Lemhi, and Beaverhead mountain ranges.

Elevations range from 4,824’ at Howe to 12,662’ on Mount Borah. The higher elevations are glacial cirque basins and lakes are surrounded by rocky mountain peaks. These peaks give way to alpine basins, flats and benches, and finally more gently sloping hills at lower elevations. Numerous canyons with steep, rocky slopes dissect these mountain ranges.

DAU 4B contains relatively dry bear habitats where timber stands are generally distributed on moister north and east aspects. The majority of this timber is over-mature Douglas fir and lodgepole pine scattered within a sagebrush/grass community. Engelmann spruce and subalpine fir are the most abundant of the secondary species, in addition to quaking aspen, mountain mahogany and some whitebark pine. Wet sedge meadows are common in some portions of the DAU. These habitats are marginal for black bear because they grow few berry-producing shrubs.

Approximately 85 percent of the DAU is publicly owned. Most of the bear habitat occurs on lands administered by the US Forest Service. Some lower elevation habitat occurs on BLM and privately owned lands. Both cattle and sheep allotments occur throughout the area.

There is a sparse human population living within the DAU, and the area receives fairly heavy recreational use on a year-around basis. However, the relatively long distance to major population centers probably keeps bear hunting activity at low to moderate levels.

Although much of the topography in the DAU is rugged and largely unroaded, concern has developed regarding ever increasing ORV use throughout all management units.

MANAGEMENT OBJECTIVES

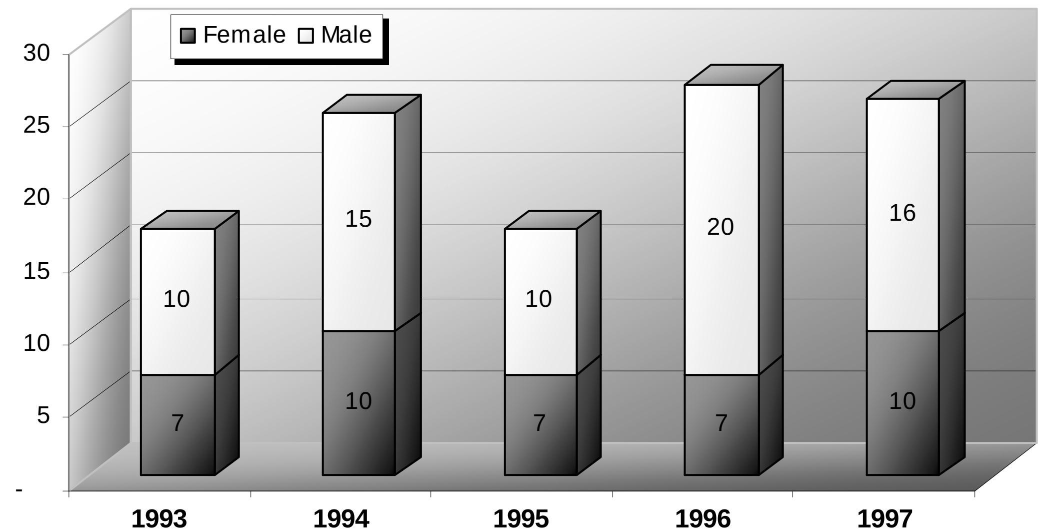
Maintain harvest levels consistent with the moderate harvest targets of 25-35% age 5+ bears in the male harvest and 30-40% females in the total harvest.

DAU 4B

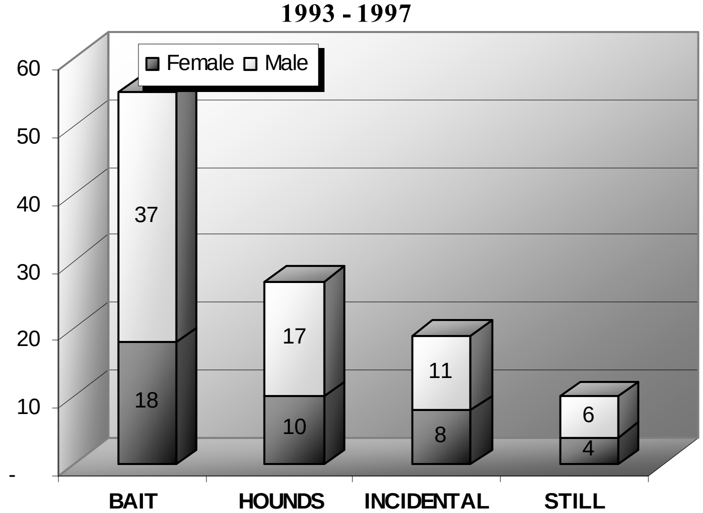
Harvest Statistics

DAU 4B	Total Harvest	Percent Female	Percent Males ≥5	3-Year Average Males ≥5
1993	17	41	20	
1994	25	40	33	
1995	17	41	40	31%
1996	27	26	39	37%
1997	26	38	29	36%
Total	**112**	**37**	**33**	

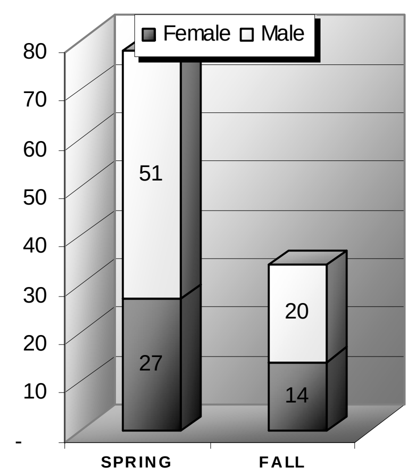
TOTAL HARVEST

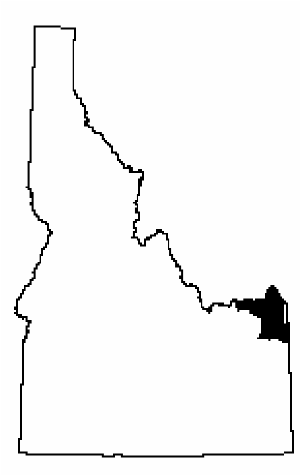


METHOD OF TAKE
1993 - 1997



SEASON
1993 -1997





DAU 4C

Game Management Units
60, 61, 62, and 62A

DESCRIPTION

Data Analysis Unit 4C consists of Big Game Management Units 60, 61, 62, and 62A in eastern Idaho. The most prominent geographical features in DAU 4C include the Centennial Mountain Range, the Island Park Caldera, and the Fall River Ridge. Elevations range from below 5,000' in the southwestern portion of the DAU to many peaks in the 9,000-10,000' range along the Idaho-Montana border.

A large percentage of the black bear habitat in DAU 4C occurs on public land administered by the US Forest Service. DAU 4C contains relatively dry bear habitats that grow few berry-producing plants. Lodgepole pine and Douglas fir communities are common in lower elevation sites. Spruce and subalpine fir communities are prevalent along drainage bottoms. Subalpine fir and whitebark pine communities occur at higher elevations.

DAU 4C has an extensive network of roads and clearcuts throughout the eastern portion of the DAU. Recent implementation of road and area closures in some areas should help to offset some of these affects in the future.

The livestock industry is a major resource user in DAU 4C. Both sheep and cattle allotments occur in the area.

There is a sparse human population living within the DAU on a permanent basis. However, cabins and summer homes are plentiful on the private inholdings in the Island Park area and tourist traffic is heavy. The DAU is readily accessible from the nearest population centers of Rexburg, Idaho Falls, Blackfoot, and Pocatello. However, the distances from population centers keeps bear hunting activity at relatively low to moderate levels.

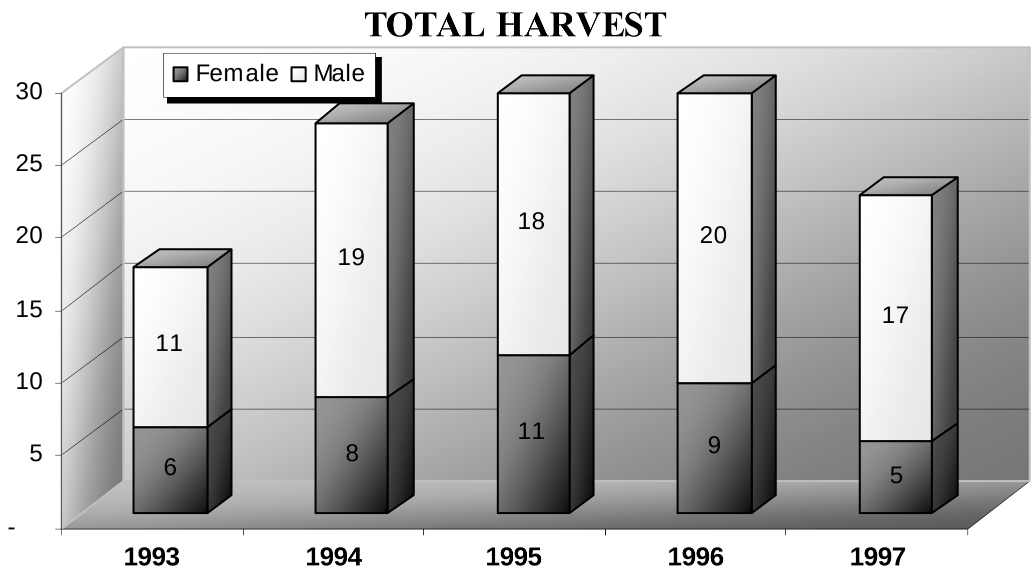
MANAGEMENT OBJECTIVES

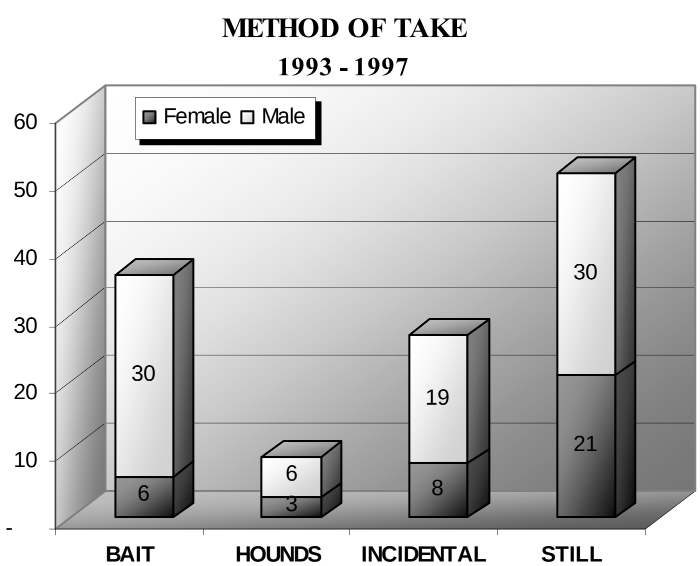
Management options are somewhat limited in DAU 4C due to the existence of an established grizzly bear population in the Greater Yellowstone Ecosystem. This area will continue to be managed to protect this threatened grizzly population by prohibiting baiting and the use of hounds to hunt black bear. Maintain harvest levels consistent with the moderate harvest targets of 25-35% age 5+ bears in the male harvest and 30-40% females in the total harvest.

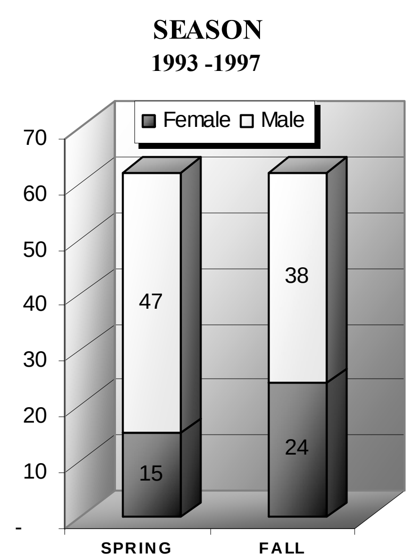
DAU 4C

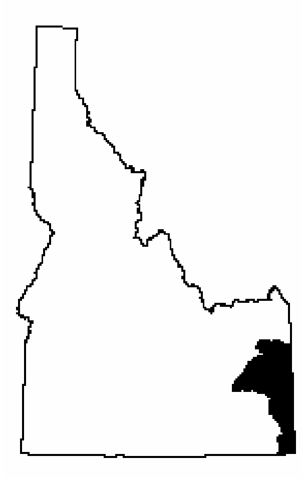
Harvest Statistics

DAU 4C	Total Harvest	Percent Female	Percent Males ≥5	3-Year Average Males ≥5
1993	17	35	64	
1994	27	30	29	
1995	29	38	38	41%
1996	29	31	42	37%
1997	22	23	41	40%
Total	**124**	**31**	**41**	









DAU 4D

Game Management Units
64, 65, 66, 66A, 67, 69, and 76

DESCRIPTION

Data Analysis Unit 4D is comprised of Big Game Management Units 64, 65, 66, 66A, 67, 69, and 76 on the Targhee and Caribou National Forests in eastern and southeastern Idaho.

Elevations range from approximately 4,500’ at Blackfoot to 10,025’ on Mt. Baird in the Snake River Range. The Big Hole Mountains and Snake River Range comprise the northern portion of the DAU. The Big Holes are characterized by steep mountains, rocky slopes, and lush subalpine meadows. The Snake River Range consists of high elevation alpine glaciated mountain peaks, cirques, talus slopes and moraines that connect through numerous steep, parallel canyons, ridges and slopes. The foothills consist of glacial outwash terraces and extensive areas of colluvial deposition. Vegetation varies with elevation and exposure. Scattered stands of subalpine fir, Engelmann spruce and timber pine are interspersed through the alpine meadows in the higher elevations. Intermediate elevations contain grasses, forbs, low growing shrubs and aspen on south and west exposures while dense stands of aspen, spruce, Douglas fir, and lodgepole pine grow on north and east aspects. Lower elevations consist of sagebrush/grass communities. The Caribou Range comprises the southern portion of the DAU. Major vegetation cover types consist of lodgepole pine, Douglas fir, aspen, mountain brush, and sagebrush/grass. DAU 4D provides only marginal bear habitat because it is relatively dry and grows few berry producing plants.

Most of the bear habitat in DAU 4D is found on public land administered by the US Forest Service. Some lower elevation habitat occurs on BLM and privately owned lands. Both cattle and sheep allotments occur throughout the area.

A relatively large human population resides in and immediately adjacent to DAU 4D. Major population centers include Rexburg, Idaho Falls, Blackfoot and Pocatello. The area is characterized by plentiful road access. The combination of easy access and proximity to human population centers results in at least moderate bear hunting activity levels, especially in the northern portion of the DAU.

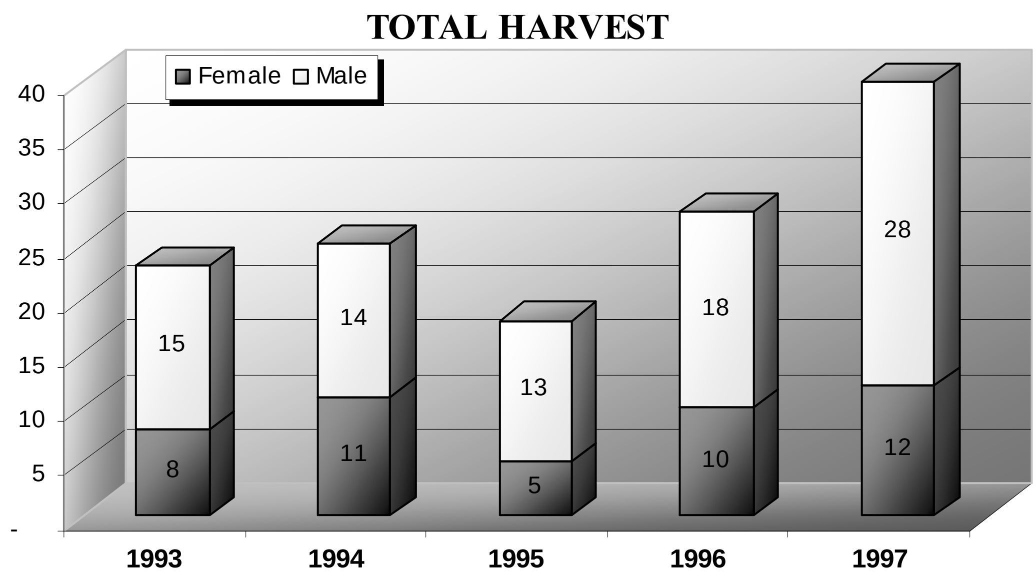
MANAGEMENT OBJECTIVES

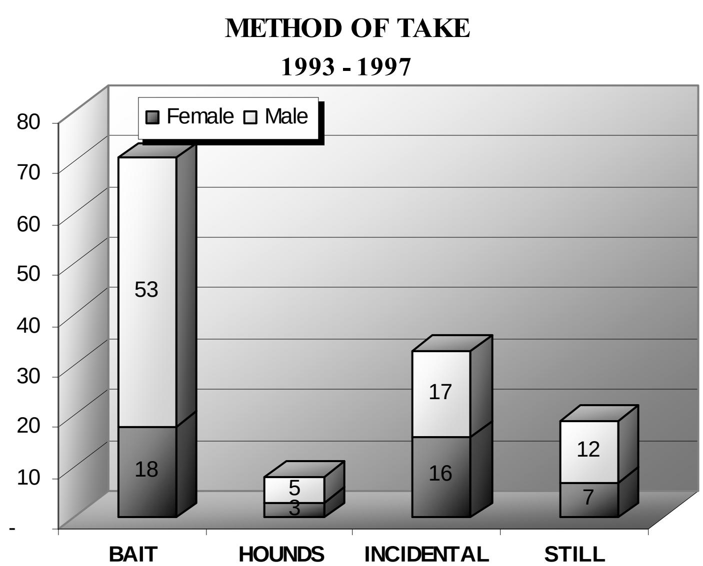
Maintain harvest levels consistent with the moderate harvest targets of 25-35% age 5+ bears in the male harvest and 30-40% females in the total harvest.

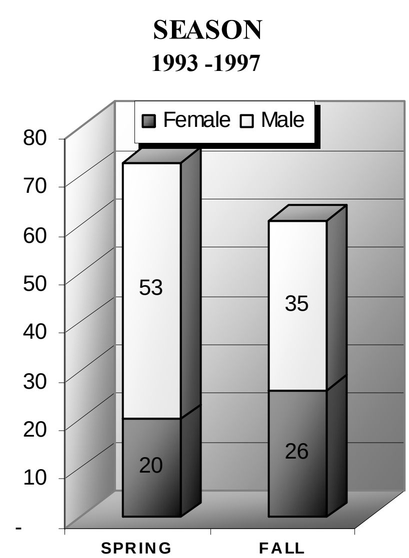
DAU 4D

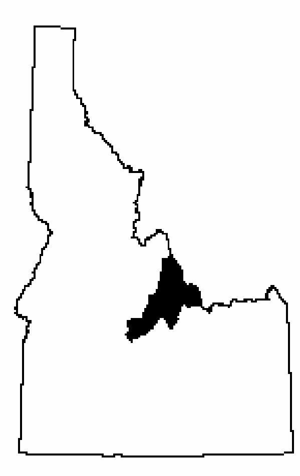
Harvest Statistics

DAU 4D	Total Harvest	Percent Female	Percent Males ≥5	3-Year Average Males ≥5
1993	23	35	46	
1994	25	44	0	
1995	18	28	27	24%
1996	29	34	28	19%
1997	42	29	30	29%
Total	**137**	**34**	**27**	









DAU 4E

Game Management Units 29, 30, 30A, 36A, 37, and 37A

DESCRIPTION

DAU 4E is in general a low precipitation zone with broad, treeless valleys and scattered pockets of bear habitat in the mountains. Much of the DAU is in marginal sagebrush-grassland habitats or agricultural ground. Good quality bear habitat is limited. Consequently, bear populations tend to be low density and isolated. Although the highest elevations in the mountains are extremely rugged and rocky (too much so to be good bear habitat), much of the area is flat to moderately rugged. Most canyon bottoms are roaded, and much of the rest of the relatively gentle topography is accessible to all-terrain vehicles.

Over the past decade, DAU 4E has averaged about 30 bears harvested per year, or about 0.9 bears per 100 square miles. Although moderately distant from major human populations (2-3 hours of driving time), bear populations in these units can be vulnerable to over-harvest because of the limited, isolated habitats and relative ease of motorized access. However, age five and older bears consistently comprise 30-40% of the male harvest, averaging 36% over the past decade. Similarly, females average 35% of the total harvest

Depredations occasionally occur in this DAU, typically involving campgrounds or beehives. Depredation problems multiply during dry summers when range forage cures early and/or when berry production is low.

MANAGEMENT OBJECTIVES

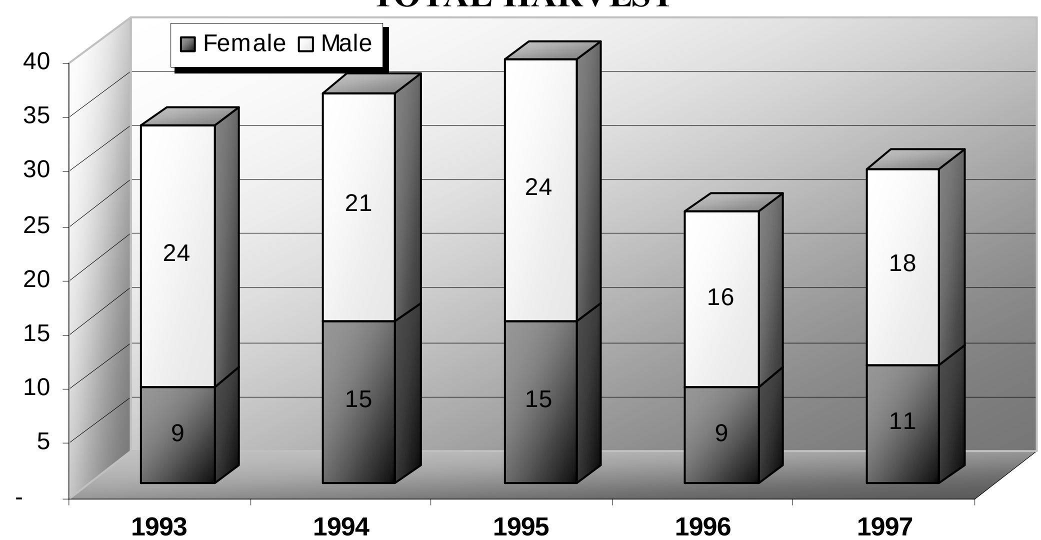
DAU 4E will be managed to maintain the moderate harvest targets of 25-35% age 5+ bears in the male harvest and 30-40% females in the total harvest.

DAU 4E

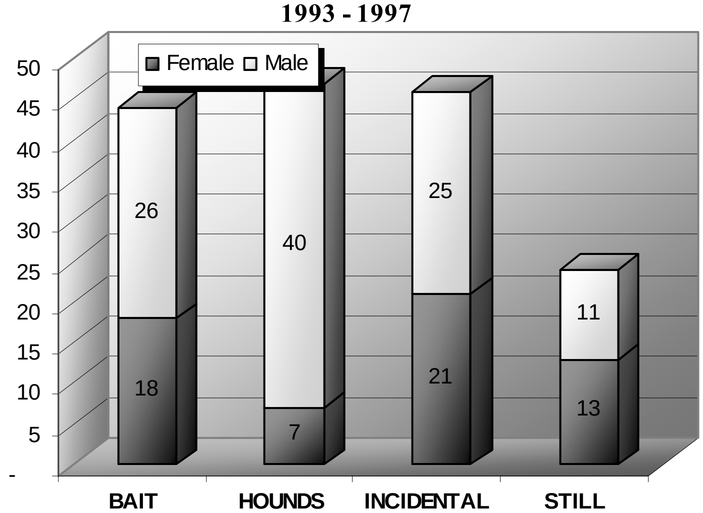
Harvest Statistics

DAU 4E	Total Harvest	Percent Female	Percent Males ≥5	3-Year Average Males ≥5
1993	34	26	24	
1994	36	42	24	
1995	39	38	33	24%
1996	25	36	38	31%
1997	30	37	39	38%
Total	**164**	**36**	**31**	

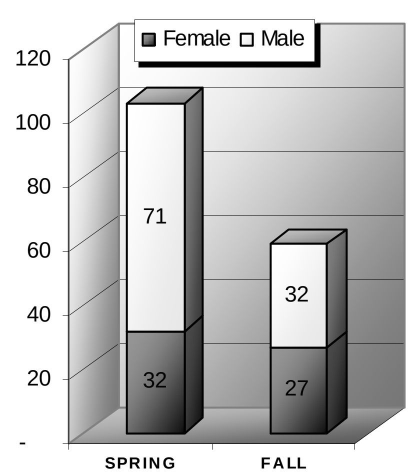
TOTAL HARVEST



METHOD OF TAKE
1993 - 1997



SEASON
1993 -1997



APPENDIX I

GUIDELINES FOR HANDLING BLACK BEAR - HUMAN CONFLICTS:

The Department recognizes that black bears occasionally damage private property, prey on domestic livestock, and jeopardize public safety. The improper storage of human foods and garbage is often the primary factor leading to bear-human conflicts. Other factors include inadequate supplies of natural foods, injuries, and, in the case of sub-adult bears, inexperience in locating natural foods. Human encroachment into black bear habitat is a major cause of many depredation problems. The purpose of this section is to establish guidelines for minimizing damage to private real property and livestock, reducing the potential for public safety concerns regarding black bears, and to provide guidance to Department employees on how to handle situations in which black bears become nuisance or public safety problems.

Areas of Responsibility:

By Memorandum of Understanding, the Department (IDFG) and the U. S. Department of Agriculture's Wildlife Services Program have agreed to share the responsibility for handling depredation situations using the following guidelines:

1. IDFG has the responsibility for controlling black bears in nuisance and human safety situations. Wildlife Services may handle these complaints at the request of IDFG if mutually agreed upon by both parties.
2. Wildlife Services has the responsibility for controlling black bears that commit livestock (including apiaries) depredation problems. IDFG may handle these complaints at the request of Wildlife Services, if mutually agreed upon by both parties.
3. Wildlife Services has the responsibility to investigate all black bear depredation payment claims involving domestic sheep, cattle, apiaries, and berries.
4. In areas where public safety is a concern and in non-livestock agricultural complaints, Wildlife Services and IDFG will use non-lethal methods, preferably culvert traps or trailing dogs, whenever practical.
5. IDFG and Wildlife Services will use culvert traps in classified grizzly bear habitat unless determined to be impractical. Snares used in classified grizzly bear habitat must be sufficient to hold any grizzly bear caught.
6. Any black bear killed in a depredation situation by IDFG or Wildlife Services must be reported to an IDFG Regional office within 14 days of the date of the kill. The skull and a completed Big Game Mortality Report form must be submitted to the Department. All salvageable parts remain the property of the Department and must be submitted to the Regional Office for disposal. Where practical, the meat from any black bear killed in a depredation situation should be salvaged and handled according to Policy E-24.00 in the Department's policy manual.

7. The Regional Supervisor is responsible for assigning personnel to handle black bear depredations and to ensure that they are properly trained and equipped, including training in the use of appropriate immobilization drugs. The responsible employee has the ultimate responsibility for deciding how to handle each depredation situation.

Response and Reporting Requirements:

1. IDFG regional personnel will respond to all reported black bear depredation incidents **within 24 hours**, either by phone or in person. The type and level of response will depend upon the nature of the complaint. Incidents involving human safety or significant property damage will receive high priority and the personal attention of the responsible employee. Those incidents involving low risk situations may be handled by phone, if an obvious solution is available.
2. The responsible employee, under authority of the Regional Supervisor, will verify the validity of each complaint, determine the appropriate action, and, if necessary, initiate control actions.
3. The responsible employee should provide the complainant with specific recommendations on how to prevent depredation problems, document any actions taken, and convey to the complainant that they may be held liable if someone is injured or incurs damage as a result of their providing attractants to nuisance bears.
4. Within seven (7) days of the conclusion of the problem, a report, using form D-3, will be submitted to the Regional Landowner Sportsman Coordinator or Regional Wildlife Manager by the person handling each depredation complaint.

Response Categories and Remedial Actions:

The **prevention** of black bear depredations is the primary goal of these guidelines. To that end, Department personnel are encouraged to work with state and federal land management agencies and the public to eliminate attractants for bears. In situations where chronic bear depredation problems are occurring, Department personnel should be prepared to recommend permanent solutions that will eliminate the attractants.

Category 1 Situations: These situations involve black bears that have caused minimal or no damage and appear to be first time offenders. These situations are characterized by bears involved in **nocturnal** visits around occupied homes to feed in garbage cans or dumpsters, eating pet foods (or the pets themselves), or climbing domestic fruit trees in or adjacent to good habitat or travel corridors. In these situations, attractants should be removed or secured by the landowner (picking fruit and feeding pets indoors) and the bear allowed to resume its natural feeding habits. Hazing and other non-lethal techniques (using hounds, etc.) are appropriate methods to use on bears in these situations. If the bear is located in an area that is not suitable habitat, the bear should be removed from the area using appropriate capture methods and released in suitable habitat.

Category 2 Situations: These situations involve black bears that have become conditioned to human foods or habituated to humans and are nuisance problems. These bears are often involved in repeated **nocturnal** incidents involving garbage cans and dumpsters, feeding on dog or horse food near residences, disturbing campsites, or damaging commercial fruit trees or apiaries. Black bears that have been previously captured and have returned to areas of human habitation are included in this category. **In these situations, increased emphasis should be placed on eliminating attractants from the area.**

Category 2 bears should be trapped, ear-tagged (when practical), removed from the area, and released in areas where they are not expected to return to the original capture site.

Category 3 Situations: These situations involve black bears that have caused significant real property damage to a dwelling, structure, vehicle, are a threat to human safety (the bear is demonstrating aggressive behavior towards humans, is showing little fear of humans, or is causing depredation problems during daylight hours), or are chronic offenders (involved in 3 or more depredation situations). Corrective action in these situations requires that the offending animal be destroyed (euthanized) using the most expedient means. The Regional Supervisor or immediate supervisor should be consulted and concur with the recommendation to destroy any problem bears.

Category 4 Situations: These situations involve black bears that meet the criteria described in Category 3, but involve unique circumstances where the use of culvert traps and snares is not practical or has been ineffective. In these situations, Depredation Kill Permits may be issued to private landowners to assist the Department in solving a depredation problem. In all instances, the Regional Supervisor or his\her designee shall inspect the site prior to issuing the permit to insure there are no obvious human safety concerns in issuing the permit. Depredation Kill permits shall be issued only during the closed season for black bear and should not be issued to landowners if they cannot be safely administered. Depredation Kill permits should not be issued in situations involving female bears accompanied by young. These situations should be handled by trapping and removing the offending animals. If circumstances require the female to be euthanized, the cubs should be taken to a rehabilitation facility and released when their body condition is good and sufficient natural foods are available or, denned in a natural or artificial den. Black bears killed under Depredation Kill Permits remain the property of the state.

GUIDELINES FOR TRAPPING, HANDLING AND RELEASING DEPREDATING BEARS:

1. Only IDFG personnel are authorized to capture and relocate nuisance black bears, except that Wildlife Services personnel may capture bears involved in livestock depredations (including apiaries) as indicated in the MOD between IDFG and Wildlife Services.
2. Any black bear that is trapped and handled by IDFG in a depredation situation should be ear-tagged or otherwise marked (i.e. paint) prior to release.
3. All black bears captured and immobilized during or less than 2 days before an open bear season should be held in a culvert trap or other suitable facility for 24 hours before being released to allow the animal to metabolize any residual drugs from its system. Black bears should be held in captivity in a secure area with adequate water. The person responsible for trapping or caring for the bear should provide shelter from extremes in weather. Biologists using Capture all-5 or Ketamine hydrochloride, alone or in conjunction with a tranquilizer to immobilize captured bears, should administer Yohimbine hydrochloride (antaganil) to reverse the effects of the tranquilizer on the animal.
4. Culvert traps and snares set for black bear should be checked by the person that is responsible for handling the complaint or his\her designee prior to 1000 hours each day the trap is set. Drop-door culvert traps and snares should not be left unattended or set in or adjacent to campgrounds or private residences if there is any concern for human safety in the area.
5. Snares should be anchored to fixed objects (live trees) using a car hood spring or tire (with back-up safety configuration) to minimize the potential for injury to the bear during the period between capture and immobilization.
6. Adequate signs should be posted around all culvert traps and snares to warn people that nuisance bears are in the area and that traps have been set to capture these animals. These signs should be posted near the trap sites and along trails and roads entering the area.
7. As a guideline, black bears should be released not less than 30 (sub-adults) to 50 airline miles (adults) from the capture site in suitable habitat.
8. Release sites for captured nuisance black bears should be selected in advance and must be coordinated with the appropriate land management agency (Idaho Code 36-1109a) and be approved by the Regional Supervisor.
9. To address potential human safety concerns, Department employees are encouraged to request that land management agencies close or restrict the use of campgrounds where nuisance black bears are active until the source of the problem (attractant) has been removed and the offending bear has moved on or is trapped.
10. Black bears that are captured in depredation situations that have serious injuries or disease conditions should be euthanized in a humane manner rather than released.
11. Orphaned cubs of the year should be placed in an approved rehabilitation facility. These cubs should be released only when their body condition has improved to the

point where they have a reasonable probability of surviving on their own and natural food supplies are abundant. If natural foods are scarce, black bear cubs should be retained in a rehabilitation facility until they can be placed in a natural or artificial den or until adequate spring foods are available.

12. Any black bear that has bitten a person will be euthanized and tested for exposure to rabies. Any bear that has injured a person will be euthanized in a humane manner.
13. Black bears involved in killing livestock will be killed in a humane manner. If the offending animal is a female accompanied by young of the year, the young should be captured and relocated or turned over to a wildlife rehabilitator, if it is unlikely that they would survive on their own.

APPENDIX II

<u>BAITING STANDARDS</u>

The following standards are recommended for implementation in this planning period.

1. Timing of the baiting season:

    a. No baits may be placed for the purposes of attracting or taking black bear prior to the opening of the black bear take season.

    b. All structures, bait containers and materials must be removed and excavations refilled when the site is abandoned or within seven (7) days of the close of the black bear take season.

2. Location of bait sites:

    a. No bait site may be located within 200 yards of any free water (lake, pond, reservoir, spring, and stream); maintained trail; or any road.

    b. No bait site may be located within one mile of any designated campground or picnic area, administrative site, or dwelling.

3. Types of bait:

    a. No parts of or whole game animals, game birds, or game fish may be used to attract black bear.

    b. The skin must be removed from any mammal parts or carcasses used as bait.

4. Bait containers:

    a. No bait may be contained within paper, plastic, metal, wood, or other non-biodegradable materials, except that a single, metal container with a maximum size of 55 gallons may be used if securely attached at the bait site.

    b. Baits may be contained in excavated holes if the diameter of the hole does not exceed 4 feet.

5. Establishment of bait sites:

    a. Any structures constructed at bait sites using nails, spikes, ropes, screws, or other materials must be removed when the site is abandoned by the permit holder or within seven (7) days of the close of the black bear take season.

    b. All bait sites must be visibly marked at the nearest tree or on the bait container using a tag supplied by the Department.

6. Baiting permit administration:

    a. All persons placing or hunting over bait must possess a baiting permit issued by the Idaho Department of Fish and Game.

    b. Each hunter (except licensed guides and clients of outfitters) may possess only one Idaho Department of Fish and Game baiting permit each year and may maintain up to three (3) bait sites.

    c. No person may hunt over an unlawful bait site.

    d. Limits on the number of bait sites that can be established by outfitters operating on public lands must be specified in their operating plans. Licensed outfitters operating on private lands must have a letter authorizing a specified number of bait sites from the owner of those lands.

    e. Guides and clients of outfitters are not required to obtain a baiting permit, but they must have a copy of the outfitter's permit in their possession while hunting over a bait site.

    f. Baiting permits will be issued by mail or in person at Idaho Department of Fish and Game regional and sub-regional offices beginning March 1 each year.

    g. Permits will be valid for the calendar year in which they were issued.

    h. Possession of an Idaho Department of Fish and Game baiting permit does not exempt the permit holder from any restrictions placed on users of federal, state, or private lands.

MONTANA MOUNTAIN LION

MONITORING & MANAGEMENT STRATEGY

— *DRAFT, OCT. 2018* —

MONTANA FISH, WILDLIFE & PARKS

WILDLIFE RESTORATION

Cover photo: R. Wiesner

TABLE OF CONTENTS

MOUNTAIN LION CONSERVATION AND MANAGEMENT GUIDELINES

With the publication of this document, Montana Fish, Wildlife & Parks (FWP) reaffirms its commitment, on behalf of the public, to the conservation and responsible management of mountain lion populations in Montana.

Many FWP wildlife biologists might find it redundant to first state that we are committed to conserving mountain lions. We tend to skip instead to describing specific strategies for mountain lion management, while taking our professional dedication to wildlife conservation for granted.

But we've learned over the years that an intensely interested and engaged public does not always accept FWP's commitment to mountain lion conservation as a given, and may not recognize FWP's management strategies as being consistent with conservation. Although our society has a long and evolving heritage of valuing wildlife, we acknowledge that Montana and other western states have risen relatively recently to the challenge of actively conserving mountain lions.

Many Montanans can still remember the bounty years when antagonistic public attitudes toward predatory wildlife were common. Since then, questions and concerns surrounding the management of mountain lions have increased as more people with a stake in mountain lion management come to the table.

One measure of Montana's commitment to wildlife conservation is the abundance, diversity, and distribution of our large predators. Wolves are now biologically and legally recovered, grizzly bear populations exceed restoration milestones, and the mountain lion has re-occupied its historic statewide habitat.

But with this success comes increased management complexity. Local declines in elk abundance and hunting opportunities, concerns about public safety, sharply responsive mountain lion hunting regulations, and uncertainties about management's effects on lion populations have sometimes strained a consensus about our values and management direction.

And conservation itself, we understand, is in the eye of the beholder. So, we strive to be clear. The following are the conservation and management guidelines that will direct FWP's decisions, and against which more specific management objectives will be measured.

FWP will conserve mountain lions as a functional and valued part of Montana's wildland ecosystems.

FWP will help manage suitable and connected habitat at a landscape scale for mountain lions and their prey.

FWP will responsibly manage mountain lions as a public trust resource and consistent with state law.

FWP will maintain and enhance public acceptance of mountain lions by helping landowners, homeowners, and the recreating public prevent conflicts with mountain lions. FWP will respond promptly and professionally when conflicts occur.

FWP will enhance public appreciation for mountain lions by providing information and insight about the role of mountain lions in the ecosystem and on practices for living and recreating in lion habitat.

FWP recognizes that mountain lion hunting is a highly valued recreational pursuit and that hunting plays a critical role in maintaining public advocacy and tolerance for the species. FWP will therefore manage for limited and sustainable mountain lion hunter-harvest opportunity on most lands within its jurisdiction. FWP will allocate hunting opportunities and experiences fairly among Montana resident, nonresident, and outfitted mountain lion hunters using simple and consistent regulations.

FWP will use an adaptive harvest management framework to develop and evaluate most mountain lion management decisions. Potential management objectives will be made explicit to all stakeholders throughout the decision-making process and the best available information will be used to evaluate whether those objectives are being met.

FWP will maintain a balance between mountain lion populations, their prey, and humans by directing local harvest of mountain lions, if and as needed, to manage prey survival and reduce human-lion conflicts. FWP specifically recognizes that mountain lion populations are most effectively conserved at the landscape scale, rather than within smaller individual Lion Management Units where prey survival or points of conflict may be concerns worthy of management.

FWP will develop informed public consent regarding the conservation status of mountain lions and the potential consequences of FWP management actions by instituting a credible, science-based system for estimating and monitoring Montana's lion populations.

FWP will consider, monitor, and conserve mountain lions at a landscape scale, consistent with the species' ecology. Specific management objectives will encourage sustainable and well-connected mountain lion populations within these landscapes.

EXECUTIVE SUMMARY

Despite historic persecution, mountain lions are thriving once again in Montana. Lions have reoccupied their historic statewide range and dispersing individuals now contribute to expanding populations across the western and midwestern U. S. This recovery is a testament to Montana's tradition of protecting habitat, conserving native wildlife populations, and investing in research that provides the scientific basis for sound wildlife management decisions.

The number of lion hunters and hound handlers has also increased during the last 40 years. These sportsmen and women became the state's most effective advocates for lion conservation and they have consistently encouraged FWP's efforts to improve lion management. Montanans, hunters and non-hunters alike, now expect assurances from FWP that lion populations remain healthy and that lion management decisions are informed by objective data instead of emotion.

Unfortunately, many past lion management decisions were controversial. Because it was impossible to precisely count lions or monitor population trends, Montanans who care deeply about lions and their prey often disagreed about the effects of lion harvest on both.

FWP clearly realized the need for better methods to track lion population changes and for a scientific framework upon which to base management recommendations. Over the last 25 years FWP made significant investments in field research that had improved our understanding of lion ecology and the way lions interact with their prey. FWP biologists and partners also developed new methods to monitor lion populations and built innovative population models that predict the effect of past and future harvest.

FWP intends to maintain sustainable lion populations across all suitable habitats within its jurisdiction. An important goal of this Strategy is to provide the public


West Fork Bitterroot River FWP Mountain Lion Study Area

and the Department with accurate and timely information so that both populations and harvest are more stable over time. Accurate monitoring and modeling data will enable simpler harvest regulations, improve our ability to reduce conflicts, and allow FWP to better manage local lion densities while protecting regional populations.

Research in Montana and other states has revealed that lion ecology is remarkably similar across the species' western North American range. Populations in western North America are well connected and generally resilient to moderate harvest. However, hunter harvest is often additive to other forms of mortality and should be limited to prevent unwanted population declines. Critically, we now understand that lion populations are most effectively managed at large spatial scales.

For this management strategy FWP used a habitat model, built using Montana-based research and harvest data, to describe four biologically meaningful mountain lion "ecoregions" within the state. These ecoregions will be the spatial basis of FWP's lion management. FWP will periodically develop estimates of mountain lion abundance within most ecoregions using genetically-based field sampling.

Managers will then include these population estimates, our understanding of lion ecology, and lion harvest data to inform statistical models that predict the effects of lion harvest on statewide populations. Over time, this monitoring program will reduce uncertainty about the effects of lion harvest and will improve FWP's ability to meet lion management objectives.

An adaptive harvest management process will guide most of Montana's mountain lion harvest decisions. FWP will work with the public to develop clear and measurable population objectives at the ecoregion scale, as well as hunting seasons and harvest prescriptions that are most likely to meet those objectives. The effects of lion harvest will be regularly monitored so that harvest can be adjusted based on current information.

Although overall management objectives and harvest prescriptions will be developed at a large (ecoregional) scale, harvest limits will generally be distributed across an ecoregion's lion management units to address social concerns, reduce hunter crowding, and focus or limit harvest where needed.

The following chapters describe FWP's mountain lion monitoring program and methods to produce periodic estimates of mountain lion abundance across the state. This Strategy includes a population model that will allow managers to effectively use those field-based estimates and other information to make predictions about the effect of future mountain lion harvest. We present policies detailing how FWP will reduce and respond to human-lion conflicts. Finally, we describe an adaptive harvest management process that will help FWP and the public build realistic lion management objectives and how to evaluate whether those objectives are being met.

This Management Strategy represents FWP's long term commitment to use the best available scientific information to ensure that mountain lion management decisions are as objective, transparent, and adaptive as possible.

ACKOWLEDGEMENTS

This document is a synthesis, and practical application, of fundamental mountain lion field research conducted over decades in western North America. We sincerely thank the many wildlife biologists, technicians, and managers whose efforts have contributed to our understanding of lion ecology. Their body of work specifically informed this effort and will help ensure the continued conservation of mountain lions in Montana.

Several biologists made specific and fundamental contributions to this strategy. Dr. Hugh Robinson of Panthera guided important Montana lion field research to publication and built lion habitat models that became critical components of this strategy.

Dr. Josh Nowak and Dr. Paul Lukacs, both with the University of Montana, worked with FWP to construct an interactive model that describes how harvest affects mountain lion populations. This model, and the web-based interface they built, will allow FWP to make better lion management decisions going forward.

FWP research scientist Dr. Kelly Proffitt developed innovative field and statistical methods to estimate local lion abundance and to extrapolate those estimates more broadly. Dr. Proffitt's work, and good advice, made this strategy possible.

FWP Game Management Bureau Chief John Vore patiently guided this strategy from its inception. His council and critical reviews vastly improved this document.

Justin Gude, FWP's Wildlife Research Chief, effectively advocated for and helped implement many of the projects that developed core components of this strategy. It would not have been possible without his vision and support.

FWP's Mike Thompson helped make clear that this strategy is intended to conserve Montana's mountain lions, not simply manage them. We sincerely appreciate both his perspective and eloquence.

Many FWP biologists and managers reviewed earlier drafts of this strategy and it was much improved by those efforts. Julie Cunningham, Adam Grove, Jessy Coltrane, Heather Harris, Elizabeth Bradley, Howard Burt, Ben Jimenez, James Jonkel, Jay Newell, Scott Eggeman, Justin Gude, Kelly Proffitt, Nick DeCesare, and Brent Lonner contributed and/or compiled particularly thorough and valuable comment.

Members of the Montana State Houndsmen Association, Northwest Houndsmen Association, Ravalli Co. Fish and Wildlife Association, unaffiliated hound handlers, and others with a stake in lion management provided important input during the development of this draft. Their continued engagement as the strategy is finalized and implemented will be critical.

Mountain lion hunting in snow, D. Neils

CHAPTER 1

MOUNTAIN LIONS IN MONTANA

Mountain lions were historically found in most of Montana except on its open plains and prairies (Young & Goldman 1946). Like other predators, Montana mountain lions had a bounty placed on them from 1879 to 1962. The number of bounties paid declined from a high of 177 in 1908 (at $8) to fewer than 5 per year by 1925 (at $25; $350 in 2016 dollars). At least 1,562 lion bounties were paid between 1900 and 1930 (Riley 1998). Mountain lions were nearly extirpated from the state by 1930 due to widespread persecution and the severe depletion of their ungulate prey.

Mountain lions began to recover in core Montana habitats during the 1950s as deer and elk numbers increased. Lions were designated as a predator from 1963 until 1971 when the state legislature reclassified the species as a game animal and transferred their management to the Fish and Game Commission.

Martin Bright and Ed Lord, Bitterroot Valley, 1890.

Lions expanded their range, and legal harvest increased, over the next 20 years (Figure 1, Table 1). In western Montana during the mid- to late-1990s the number of public lion sightings grew, human-lion conflicts became increasingly common, and harvest quotas filled quickly.

After the severe winter of 1996-97 caused white-tailed deer herds in west-central and northwest Montana to decline by as much as 50% (Montana Fish, Wildlife and Parks 2006), human-lion conflicts (including several nonfatal attacks)

Figure 1. Montana statewide mountain lion harvest, 1971 – 2016.

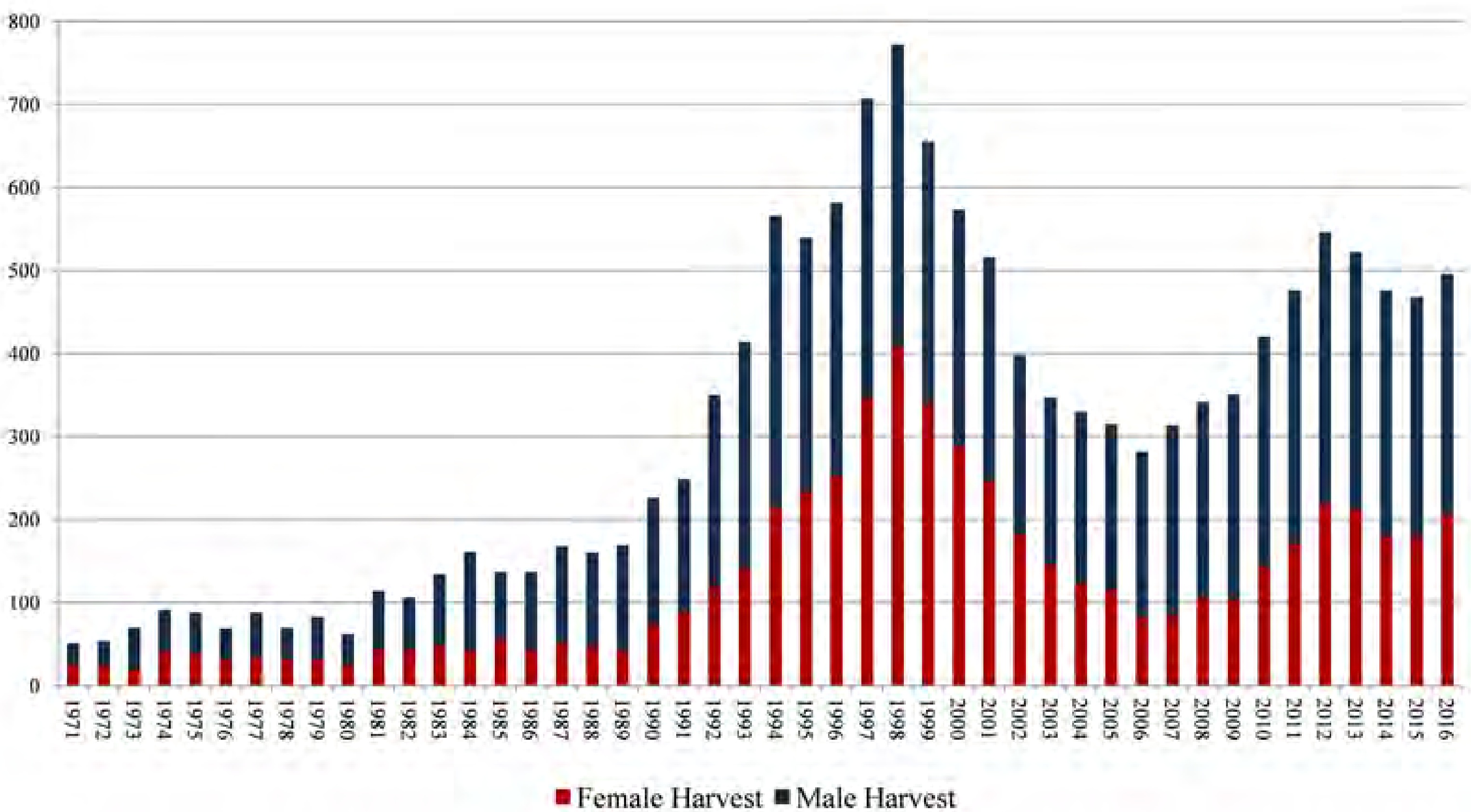


Figure. 2. Distribution of Montana mountain lion harvest, 1988 – 2015 (unshaded counties have had no harvests).

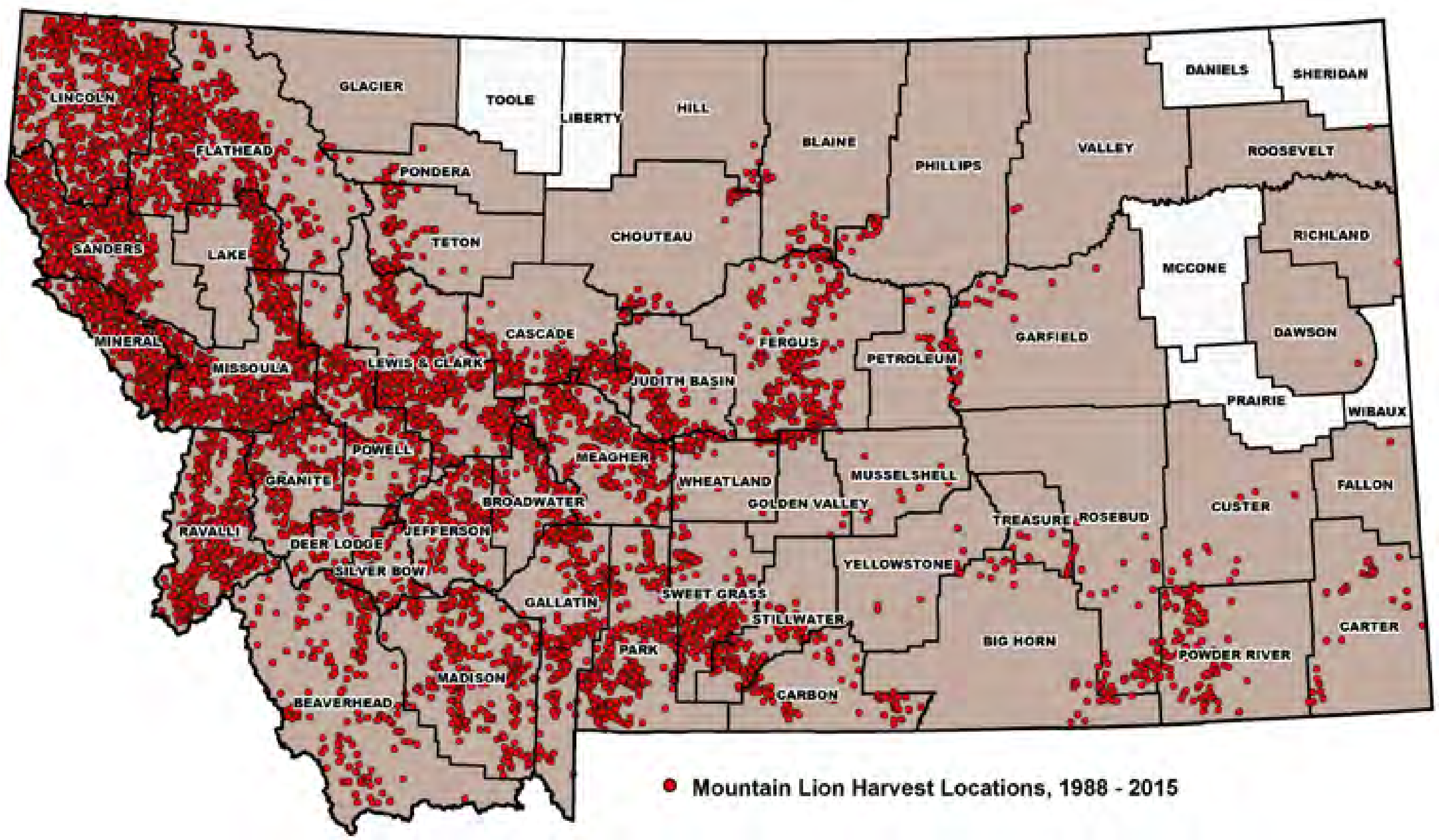


Table 1. Montana statewide mountain lion harvest, 1971 – 2016.

License Year	Statewide F	M	Unk	Tot.
1971	26	25	0	51
1972	24	30	0	54
1973	19	51	2	72
1974	43	48	1	92
1975	40	48	0	88
1976	31	38	1	70
1977	35	53	0	88
1978	32	38	1	71
1979	32	51	0	83
1980	25	37	0	62
1981	45	69	0	114
1982	45	61	1	107
1983	49	85	2	134[1]
1984	43	118	4	161[1]
1985	56	81	6	137[1]
1986	44	93	4	137[1]
1987	50	118	2	168[1]
1988	48	112	1	160
1989	43	126	0	169
1990	74	152	0	226
1991	88	161	0	249[1]
1992	119	231	1	350
1993	141	273	0	414[1]
1994	214	352	0	566[1]
1995	233	307	0	540
1996	253	329	0	582
1997	347	360	0	707
1998	409	363	3	772
1999	339	316	0	655
2000	289	284	1	573
2001	246	270	0	516
2002	183	215	0	398
2003	146	201	0	347
2004	123	207	0	330
2005	116	199	3	315
2006	83	199	0	282
2007	84	230	0	314
2008	106	236	0	342
2009	104	247	0	351
2010	143	278	0	421
2011	171	305	0	476
2012	220	326	0	546
2013	213	309	0	522
2014	180	296	0	476
2015	181	287	0	468
2016	207	288	0	495

[1] Statewide totals differ from the Regions' sum because some harvest was reported as "unknown Region"

spiked. Managers were pressed to maintain historically high lion quotas in FWP Regions 1 and 2 because of concerns about public safety and to aid struggling prey populations. Lion harvest also reached record high levels during the late 1990s in Fish, Wildlife & Parks (FWP) Regions 3, 4, and 5.

By the early 2000s, many hound handlers believed that lion densities had significantly declined—an observation supported by ongoing FWP research in the Garnet Mountains. In response, the Fish and Wildlife Commission restricted the harvest of female lions during that decade in much of the state. By 2006, the Garnet Mountains research population had recovered to near 1990s densities (Robinson et al. 2014). Lions became increasingly common in eastern Montana FWP Regions 6 and 7 during the same period.

Mountain lions are now present in all suitable Montana habitats and continue to reoccupy neighboring states to the east. Between 1990 – 2016, an average of 450 lions were taken by licensed Montana hunters each year. Lions have been legally harvested in 49 of the state's 56 counties (Figure 2).

> **Harvest can be the most important factor affecting population size and growth where harvest occurs**

Montana likely includes some of the most productive mountain lion habitat in North America. Although directly comparing lion densities across research projects and study areas is complicated (because of differences in field methods, inclusion of different sex-age classes in estimates, and the use of different areas over which density is calculated), reported North American lion densities generally range from 1 to 4 lions per 100 km^2 (37 $mile^2$; Hornocker & Negri 2009). In western Montana, researchers using DNA based detection methods have recently documented mountain lion densities exceeding 5 lions per 100 km^2 (Russell et al. 2012, Robinson et al. 2014, Proffitt et al. 2015).

GENETIC CONNECTIVITY

Mountain lion populations across the central Rocky Mountain west are genetically well connected. When wildlife populations are small and isolated, individuals can become more genetically similar over time. Although male lions are more frequent long-range dispersers (Logan & Sweanor 2001), Biek et al. (2006a) found that in Montana and Wyoming, neither male nor female resident lions shared more genes than expected by chance. Thus, frequent introduction of new genes by immigrating males is likely sufficient to maintain genetic diversity in females despite their lower dispersal rates and distances (Goudet et al. 2002).

Similarly, Anderson et al. (2004) found that there is ample gene flow between mountain lion populations in Wyoming and Colorado despite their being separated by large areas of relatively poor habitat. Even small and geographically isolated lion populations in North and South Dakota have maintained genetic diversity over time (Juarez et al. 2016).

In Montana, researchers genetically analyzed the fast-evolving feline immunodeficiency virus that commonly infects wild mountain lions. Although the study's 352 samples were collected as far as 1,000 km apart, there was no evidence of genetic sub-structuring, genetic drift, or barriers to gene flow within Montana populations (Biek et al. 2006b).

MOUNTAIN LION DISEASE, PARASITES, AND HUMAN HEALTH RISK

Mountain lions carry few communicable diseases that potentially threaten humans but certain precautions should still be taken when handling both live animals and carcasses. Fifty-four percent of lions sampled in Montana between 1971 and 1989 tested positive for the Trichinella roundworm. All harvested lions should be treated as if they are infected because a negative lab test does not mean Trichinella is not present. This parasite is transmissible to humans and pets if they consume undercooked infected mountain lion meat. Although mountain lion hunters are not required by Montana law to retain a harvested lion's meat (MCA 87-6-205), many hunters do. Trichinella infected lion meat that has been cooked to at least 165 degrees Fahrenheit is safe for human consumption (Western Wildlife Disease Workshop 2009).

Precautions protecting against the ingestion of other rare, but potentially fatal, air or blood-borne pathogens (i.e. pneumonic plague) should also be taken when handling a harvested lion carcass or one encountered in the field (Wong 2009). Pathogen infections or disease epizootics are not known to limit wild mountain lion populations in Montana.

EFFECTS OF HUNTER HARVEST

Mountain lion reproduction (age at first parturition, maternity, interbirth interval, litter size) and annual non-harvest mortality rates are remarkably consistent across western North American populations. Reproduction and non-harvest survival are also generally unaffected by hunter harvest. However, harvest can be additive to other forms of mortality and is often the most important factor affecting population size and growth in areas where harvest occurs. Lion populations are particularly sensitive to changes in adult female harvest rate (Anderson &

Mountain lion feeding on deer kill, D. Neils

Lindzey 2005, Stoner et al. 2006, Robinson et al. 2008, Cooley et al. 2009, Robinson et al. 2014).

Local mountain lion populations that are reduced by harvest can recover rapidly. Populations that are below prey limited densities can increase up to 30% annually when harvest (especially of females) declines and lions from other areas are able to immigrate (Ross & Jalkotzy 1992, Sweanor et al. 2000, Jenks 2011, Clark et al. 2014a). For example, in Utah, mountain lion densities that were reduced >60% over a 6-year period recovered to pretreatment levels after 5 years of reduced hunter harvest (Stoner et al. 2006). In New Mexico, an adult population that was experimentally reduced by >50% fully recovered in 31 months (Logan & Sweanor 2001), and in Wyoming a population that was lowered >40% by heavy harvest recovered in 3 years after harvest was reduced (Anderson & Lindzey 2005).

Montana lion populations are similarly resilient. Lion numbers in the Garnet Mountains declined nearly 50% during a period of heavy harvest but fully recovered within 5 years after the harvest rate was reduced there and in surrounding areas (Robinson et al. 2014).

The influence of dispersal and immigration on mountain lion population growth cannot be overemphasized. Even heavily hunted local populations may fail to decline if immigrants readily replace harvested lions (Cooley et al. 2009). On the other hand, a population (such as the one within the Garnet Mountains study area) may recover more slowly where high harvest rates are applied across a broader landscape.

Harvest can also alter a population's age structure. However, the interpretation of trends in the age of harvested mountain lions may be confounded by immigration, hunter selectivity, harvest regulations, and other factors. Monitoring changes in harvest-age composition can be a useful indication of a population's status in some cases. In general, the proportion of older age-class mountain lions in harvest—especially females—is higher within growing populations (Anderson & Lindzey 2005, Stoner et al. 2006, Wolfe et al. 2015). This index should only be used when monitored over a period of 3 or more years (Anderson 2003), and after considering other factors (i.e. immigration and harvest) that may be influencing age-at-harvest.

Within a lightly hunted lion population in western Montana's Bitterroot Mountains, 60% of independent aged lions were female (Proffitt et al. 2015). This is similar to the proportion of juvenile (13-24 month) females documented during a 10-year study of a lion population in west-central Montana, although the proportion of adult males to females varied widely during the study period depending on the level of hunter harvest (Robinson et al. 2014). Male:female ratios of 1:2 to 1:3 were commonly reported in other hunted populations (Hornocker & Negri 2009).

MOUNTAIN LION-PREY INTERACTIONS

The relationship between mountain lion predation and their prey populations is complex. This is especially true in Montana where lions often occupy multi-predator/multi-prey species systems. Mountain lions are the most influential ungulate carnivore across much of the state, especially where grizzly bears and wolves are absent or recovering. Therefore, wildlife managers must carefully consider the potential effects of mountain lion predation on prey populations when developing management prescriptions for both.

Mountain lions are opportunistic and adaptable foragers that prey or scavenge on a variety of species (Bauer et al. 2005, Murphy & Ruth 2011). In Montana, lions are obligate ungulate predators primarily preying on deer and elk. Mountain lion diet varies across the state depending on available prey, and lions may switch preferred prey seasonally as ungulate newborns become available or ungulate distribution changes (Williams 1992, Murphy 1998, Kunkel et al. 1999, Ruth & Buotte 2007). Mountain lions may also increasingly prey on pets, livestock (Torres et al. 1996), or other wildlife species (Logan & Sweanor 2001) following a significant decline in wild ungulate populations. Where hunter harvest is not an overriding factor, mountain lion densities are ultimately regulated by prey availability (Pierce et al. 2000a, Logan & Sweanor 2001, Stoner et al. 2006).

Mountain lion feeding on elk kill, western Montana, E. Bradley

GENERAL PREDATOR-PREY RELATIONSHIPS

In theory, compensatory predation removes a number of prey animals from a population that would have died anyway from another cause. Additive predation removes prey that would have otherwise survived. Predators regulate prey populations when the rate at which they remove prey changes along with prey population levels. Predation can limit prey population growth if the predation rate is independent of changes to a prey species' abundance—in these cases, predation can depress, rather than stabilize, prey populations.

Predation is more likely to limit a prey population when 1) an alternative and abundant prey species supports high predator densities, 2) prey is below carrying capacity despite weather and habitat that allow adequate survival and recruitment, and 3) there is a high predation rate relative to recruitment.

Predators can limit prey populations when predation is additive to other sources of mortality (i.e. severe weather or starvation). For example, in Idaho, when experimental mountain lion removals immediately increased mule deer fawn and adult survival, the effect of mountain lion predation initially appeared to be additive. However, reducing lion densities did not significantly affect overall deer population growth. In this case, weather and annual changes in forage quality ultimately regulated mule deer numbers — mountain lion predation was, in fact, compensatory over the long term (Bishop et al. 2009, Hurley et al. 2011).

In systems where most prey biomass is composed of a single, fecund, species (e. g. white-tailed or mule deer), predation itself is unlikely to depress prey populations for extended periods. However, when severe weather or other factors decrease populations significantly below habitat carrying capacity, mountain lion predation can delay the prey species' recovery (Ballard et al. 2001, Logan & Sweanor 2001, Pierce et al. 2012).

Where predator populations are sustained at high densities by an abundant prey species, populations of other relatively vulnerable or scarce prey species might decline or remain depressed (Messier 1994, Mills 2007). This

Montana includes some of the most highly productive mountain lion habitat in North America

apparent competition (Holt 1977) has been implicated in declines of mule deer (Robinson et al. 2002, Cooley et al. 2008), bighorn sheep (Logan & Sweanor 2001), mountain caribou (Kinley & Apps 2001) and other species (Sweitzer et al. 1997) due to lion predation.

Winter severity explained most variation in annual white-tailed deer recruitment in northwest Montana. There, when harsh winter weather depressed reproduction and survival of hunted deer, predation (primarily by lions) became additive to other forms of mortality and exacerbated population declines (Montana Fish, Wildlife & Parks 2006).

Mountain lion kill rates vary by location and ecological system, but are generally reported as 1 kill per 7 days in deer dominated systems and 1 kill per 10 days in systems where elk are also available (Murphy 1998, Anderson & Lindzey 2003, Cooley et al. 2009). Lions tend to kill more frequently in warmer months, when ungulate newborns are available, and when competition with or rates of displacement by other predators is high.

Predation rates also vary depending on a mountain lion's age, sex, and reproductive status. Adults kill prey more frequently than younger lions. While adult females with dependent kittens exhibit the highest kill rate of any lion age/sex class, adult males kill a greater prey biomass on an annual basis (Nowak 1999, Buotte et al. 2008, Clark et al. 2014b). In Alberta, the annual live weight biomass of prey killed by mountain lions averaged 3,180 lbs. for subadult females, 4,520 lbs. for subadult males, 10,380 lbs for adult males, 5,340 lbs. for adult females, 6,160 lbs. for females with kittens < 6 months, and 9,440 lbs. for females with kittens > 6 months (Knopff et al. 2010).

Deer are the most common mountain lion prey species in Montana. In northwest Montana's Salish Mountains, lions were the most common predator of radio marked white-tailed deer (Montana Fish, Wildlife & Parks 2006). Similarly, 87% of lion kills documented in Montana's North Fork of the Flathead River drainage were white-tailed deer, where elk, mule deer, and moose were also present in lower numbers (Kunkel 1999).

However, in northeast Washington mountain lions disproportionately selected for mule deer even though white-tailed deer were more abundant (Cooley et al. 2008). The same was true in south-central British Columbia where mountain lion predation was implicated in mule deer declines (Robinson et al. 2002). Where both elk and mule deer were present, female mountain lions were more likely to kill mule deer, whereas male mountain lions killed elk more frequently (Anderson & Lindzey 2003). Female lions may also select for calf elk and younger or older mule deer (Nowak 1999, Pierce et al. 2000b).

Although most researchers found that mountain lions selected for male elk and deer (Hornocker 1970, Kunkel et al. 1999, Anderson & Lindsey 2003, Atwood et al. 2007, Blake & Gese 2016), others did not (Clark et al. 2014b). Adult male elk and deer are more often killed by mountain lions during and after the rut while most adult female elk and deer are killed before giving birth in late spring (Knopff et al. 2010, Clark et al. 2014b).

The annual risk of mountain lion predation to adult female elk across the western U. S. (Brodie et al. 2013) and in Montana (Hamlin & Cunningham 2009, Eacker et al. 2016) is low compared to other sources of mortality, including hunting. This is important because, in certain situations, adult female survival explains more of the variation in overall elk population growth rate than elk calf survival (Eacker et al. 2017).

Lions are often one of the primary predators of elk during their first year of life. The rate of calf predation by mountain lions increases with overall lion density, decreases when other predators (especially wolves and grizzly bears) are abundant, and increases when herds are nutritionally limited and concentrated during winter (Kortello et al. 2007, White et al. 2010, Griffin et al. 2011, Johnson et al. 2013, Eacker et al. 2016).

Elk calf survival and recruitment can influence a herd's growth and, subsequently, the number of elk available for hunter harvest (Raithel et al. 2007). Although calf survival does not appear to be strongly influenced by the physical (nutritional) condition of cow elk, poor forage on summer range can reduce a herd's pregnancy rate (Reardon 2005, Proffitt et al. 2016). Depressed calf production may then predispose that herd to the effects of mountain lion predation and exacerbate population declines (Clark et al. 2014b, Eacker et al. 2016).

Unlike bears, which primarily kill elk calves during the first 30 days of life, mountain lions prey on them throughout the year. Mountain lions were responsible for 70% of elk calf mortalities in northeastern Oregon where there are black bears but no wolves or grizzly bears (Reardon 2005). On a study site in western Montana where there were wolves

Wildlife managers must carefully consider the potential effects of mountain lion predation on prey populations when developing management prescriptions for both

and black bears (but no grizzlies), Eacker et al. (2016) found that 60% of known cause calf mortality was by mountain lions and male calves were 50% more likely to die than females.

Elk migration to areas of greater or lesser exposure to predation can also affect calf survival (Hebblewhite & Merrill 2007). For example, in Montana, seasonal migration of elk to ranges dominated by agriculture (where predators were rare) lowered predation risk while concentration on winter ranges increased it (Eacker et al. 2016).

The density of mountain lions in an area may itself be enough to explain predation's influence on elk calf recruitment. Where mountain lion densities are high they are capable of limiting elk recruitment enough that annual variation in lion densities explains most of the variation in annual calf survival (Johnson et al. 2013). In Montana's Bitterroot Range, where lion densities were relatively high, grizzlies absent, and wolves were present, lion predation accounted for most calf elk mortality (Eacker et al. 2016). In contrast, on Yellowstone's Northern Range and in Montana's Garnet Mountains where mountain lion density was relatively low, the rate of lion predation of elk calves was also low (Raithel 2005, Barber-Meyer et al. 2008).

The effect of mountain lion predation on bighorn sheep populations varies, but is most likely to limit population growth where herds are small and isolated (Ruth & Murphy 2011). The rate of predation can simply be a function of the overall mountain lion density within a sheep herd's range. However, in some cases bighorn sheep predation is a specialized behavior adopted by individual lions (Logan & Sweanor 2001).

Lion predation of bighorn sheep can increase where lion densities are buoyed by an abundant primary prey species or when a decline in the primary prey causes lions to switch to bighorn sheep (Kamler et al. 2002). Targeted removals of individual lions that specialize on sheep, or sustained efforts to suppress lion density in core bighorn sheep habitat, can effectively reduce the impact of lion predation on small, isolated herds (Ernest et al. 2002, McKinney et al. 2006).

MANAGEMENT CONSIDERATIONS

- Weather and forage availability are more likely than predation to explain chronically low ungulate populations. The influence of these potentially limiting factors should be evaluated before predation is implicated.

- Mountain lion predation is more likely to limit a prey population's growth if that population is below habitat carrying capacity and the lion predation rate is high. For instance, if a severe winter causes a significant deer die off but overall forage availability remains unchanged, mountain lion predation may slow the herd's recovery. In this case, preemptively and temporarily reducing mountain lion density through hunting could increase the deer population's growth rate while potentially reducing human-mountain lion conflicts.

- Mountain lion predation can limit a prey population where lions are the most abundant predator, lion density is supported by another abundant prey species, and the prey population is below its habitat's carrying capacity. In this case, managers should consider whether apparent competition is the ultimate cause of a secondary prey species' (e.g. mule deer or bighorn sheep) decline. Where abundant primary prey support dense mountain lion prey populations, sympatric populations of more vulnerable secondary prey may be disproportionately affected.

- The effect of predation on elk survival increases with the diversity of the predator community – the addition of grizzlies and wolves to a system with established mountain lions and black bears can change the influence of predation on ungulate prey.

- Mountain lion predation is unlikely to limit adult elk survival but can significantly reduce elk calf recruitment where lions are the predominant predator, lions occur at high densities, and where weather and/or habitat quality has reduced elk pregnancy rates.

- Targeted removal of individual lions that specialize on bighorn sheep, or sustained efforts to suppress lion density in core bighorn sheep habitat, may reduce the influence of mountain lion predation on the growth of small and isolated sheep herds.

-Attempts to locally reduce mountain lion populations will likely be confounded by the effect of immigration. Harvest treatments intended to reduce lion density should be sustained, broad scale, or both.

- Any proposal to reduce mountain lion density to benefit prey should be explicitly developed in an adaptive management framework. Managers should make measurable predictions about the outcome of a mountain lion harvest prescription (on lion and prey populations), monitor and evaluate the treatment's effects after a predetermined period, and be prepared to modify management based on that evaluation.

Bighorn sheep cached by a mountain lion, norhtwest Montana

CHAPTER 2

MOUNTAIN LION-HUMAN CONFLICT

Montana law grants FWP and the Fish and Wildlife Commission broad authority and discretion to manage wildlife. However, the legislature provided specific direction to the Department regarding the management of large predators, including mountain lions, that clearly emphasizes the protection of people and property over sport hunting of either mountain lions or their prey:

> 87-1-217. Policy For Management Of Large Predators - Legislative Intent
>
> (1) In managing large predators, the primary goals of the department, in the order of listed priority, are to:
>
> (a) protect humans, livestock, and pets;
> (b) preserve and enhance the safety of the public during outdoor recreational and livelihood activities; and
> (c) preserve citizens' opportunities to hunt large game species.

A mountain lion becomes a public safety concern when it appears habituated to human activity or development, attacks livestock or pets, or in any way behaves aggressively toward humans. FWP has developed specific Mountain Lion Depredation and Control Guidelines (Appendix 3) which describe and direct the Department's actions following a reported conflict between a human and a mountain lion.

The types and rate of conflicts between mountain lions, humans, and livestock are affected by mountain lion abundance, location, presence of attractants, and individual lion behavior. FWP will rely on the expertise and judgment of its field staff and agents (i.e. USDA Wildlife Services personnel) to investigate reported conflicts and determine the most appropriate response to a given situation. FWP's principal consideration when making these decisions will be reducing future risk of harm to people and/or property.

FWP will respond to human-lion conflicts in a manner that protects public safety, reduces property loss, and increases public tolerance for mountain lions. FWP will enforce state law (MCA 87-6-216) and local ordinances that prohibit certain wildlife attractants and will work to remove or contain attractants when a lion localizes in a problematic location. FWP will use hunter harvest when and where appropriate to manage lion density in high conflict areas. Finally, FWP may use targeted hazing or removal of individual offending mountain lions to mitigate ongoing or potential risk to people, pets, or livestock.

FWP will implement and facilitate programs that help livestock and pet owners protect their animals such as those currently offered by FWP, the Montana Livestock Loss Board, and nongovernmental organizations. FWP will continue to emphasize the importance of preventative efforts intended to reduce the risk of livestock loss in memoranda of understanding entered into with USDA Wildlife Services.

FWP does not maintain facilities to rear, hold, or rehabilitate mountain lions. Mountain lions that are injured so severely that they could pose a risk to humans or those that are unlikely to survive without intervention will be euthanized.

Montana hunting regulations prohibit the taking of a female lion accompanied by spotted kittens. However, in the unfortunate circumstance that a lactating female lion is mistakenly taken by a hunter or is otherwise killed, FWP staff may attempt to find the kittens and humanely euthanize them, unless an approved zoo or other facility is prepared to permanently assume responsibility for their care.

Capturing and relocating habituated, aggressive, or depredating mountain lions is not an effective conflict management response (Hornocker & Negri 2009). Mountain lions that are captured and translocated are

Table 2. Recorded non-harvest human-caused lion mortality, 1989 – 2015.

Year [2]	89	90	91	92	93	94	95	96	97	98	99	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17
FWP, Private Party, & Other Removals [1,3]	10	14	17	20	23	15	9	23	53	19	21		3			5		8	22	32	24	23	39	27	35	21	16	41	9
Public Safety																			4	10	9	9	15	9	10	6	1	16	2
Depredation or Protection of Pets			1	2						3	2								5	4	5	2	6	5	2	6	5	10	2
Depredation or Protection of Livestock	1			1						6	1								5	8	4	6	15	6	14	8	4	2	3
Self Defense																			4	10	4	2	2	3	7	1	5	10	1
Other/Unknown	9	14	16	17	23	15	9	23	53	10	18		3			5		8	4		2	4	1	4	2	0	1	3	1
% Female (of those known)																			50%	50%	55%	41%	47%	36%	64%	42%	44%	32%	67%
Livestock Depredation USDAWS/APHIS [4]	2	3	3	4	7	3	9	8	13	21	16	18	9	12	7	3	7	5	8	13	12	14	17	19	15	12	12	3	4
Illegal	2	2	2	4	9	5	11	6	18	7	5	0	2	0	1	0	0	2	4	2	5	6	7	5	9	7	3	3	7
Incidental Trapping [5]	2	2	2	4	5	9	7	4	6	4	2	0	1	3	3	1	1	1	10	9	9	8	8	16	16	12	13	6	4
Snare																			7	2	7	4	6	7	2	6	8	5	3
Foothold																			2	7	2	4	2	9	13	6	5	1	1
Conibear																									1				
Unknown	2	2	2	4	5	9	7	4	6	4	2	0	1	3	3	1	1	1	1										
% Female (of those known)																			60%	78%	63%	50%	88%	75%	50%	89%	73%	67%	50%
Total	16	21	24	32	44	32	36	41	90	51	44	18	15	15	11	9	8	16	44	56	50	51	71	67	75	52	44	53	24

[1] Roadkill incidents are inconsistently reported in MT and are not included in this table

[2] FWP License Year, 8/1 - 7-31, unless otherwise noted

[3] Data from License Year 2000 to 2006 are incomplete and should be considered minimums

[4] Source: USDAWS/APHIS. Data recorded by Federal Fiscal Year, 10/1 - 9/30

[5] Data prior to 2007 are incomplete and should be considered minimums

unlikely to survive, often return (or attempt to return) to their capture location (Ross & Jalkotzy 1995, Ruth et al. 1998), and can cause future conflicts (Belden et al. 1991, Williams 1992). For these reasons, mountain lions shall not be captured and translocated under any circumstances. Mountain lions involved in any form of conflict will be dealt with per the Mountain Lion Depredation and Control Guidelines (Appendix 3).

Statewide records of reported mountain lion-human conflicts are historically incomplete (Table 2). In 2007, FWP created a centralized database to track harvest and most reported human caused non-harvest lion mortality. The same database has since been updated to also archive records of animals, including mountain lions, that are incidentally caught by recreational trappers and successfully released. This system will also be used to record all reported human-mountain lion conflict incidents, and their resolution. These more complete records will allow FWP to identify sources of and trends in mountain lion conflicts so that they can be more effectively addressed.

FWP actively educates the public about safely living with mountain lions, avoiding human-lion conflicts, and reducing the risk of property loss. The agency will continue to employ biologists and technicians who specialize in educating the public about, and responding to, human-predator conflicts. FWP will also maintain and periodically update educational materials and programs that teach the public about lion biology and behavior, ways to avoid and diffuse conflicts, strategies and methods to protect pets and livestock, and how to responsibly live and recreate in mountain lion habitat.

LIVESTOCK DEPREDATION

Mountain lions were confirmed to have killed an average of 136 head of livestock in Montana annually between 2006 and 2015 (USDA Wildlife Services, Table 3). However, only a fraction of actual livestock losses to mountain lions are found and formally documented (Jenks 2011). In Montana, male mountain lions were more likely than females to be removed in response to livestock depredation and most depredating lions were younger adults (1-4 years old) in good physical condition. The peak time period for both

Mountain lion killed following domestic sheep depredation, FWP

The rate of livestock loss may be partly a function of an area's mountain lion density

livestock and human conflict incidents was between June and November (Riley & Aune 1997).

Mountain lions most commonly kill livestock that weigh less than 300 pounds. Although full grown cattle and horses are occasionally killed, mountain lions mainly kill calves/foals and yearlings. Losses are highest where calves or foals are born in lion habitat (Cougar Management Guidelines Working Group 2005). Small livestock (sheep, goats, and fowl) are the domestic species most vulnerable to mountain lion predation in Montana (Figure 3). Livestock depredation predominately occurred in central Montana where sheep production is more common and in western valleys where there is a greater number of hobby livestock.

Montana law (MCA 87-6-106) allows private citizens to legally kill any mountain lion that is attacking, killing, or threatening to kill a person or livestock. Private citizens may also legally kill a mountain lion that is in the act of attacking or killing a domestic dog. A person who kills a mountain lion under this statute must notify a FWP employee within 72 hours and surrender the carcass. FWP may issue a permit to kill a mountain lion to a landowner which allows them to take a mountain lion, within a specific area and time period, that is threatening to or suspected of killing livestock.

FWP annually contracts USDA Wildlife Services to respond to reported depredation of commercial livestock. When a loss is reported, a Wildlife Services agent conducts a field investigation to determine whether the loss is a "probable" or "confirmed" depredation and what predator species is responsible. Based on that investigation, and whether predation is determined to be the likely cause, the agent decides what response is most likely to prevent further livestock losses. This may, but does not always, include attempting to lethally remove the offending individual predator. The annual FWP contract requires Wildlife Services to provide records of all reported incidents (including lethal removals) to FWP at the end of the federal fiscal year (October 1).

Montana's Livestock Loss Board may reimburse stock growers for up to fair market value of probable or confirmed livestock losses due to mountain lion predation. The Board may also issue grants supporting efforts to reduce or mitigate the risk of mountain lion depredation of livestock (MCA 2-15-3110 through 3113).

Table 3. Domestic livestock reported to and/or verified by USDA APHIS Wildlife Services as injured or killed by mountain lions, federal fiscal years 2006 – 2015.

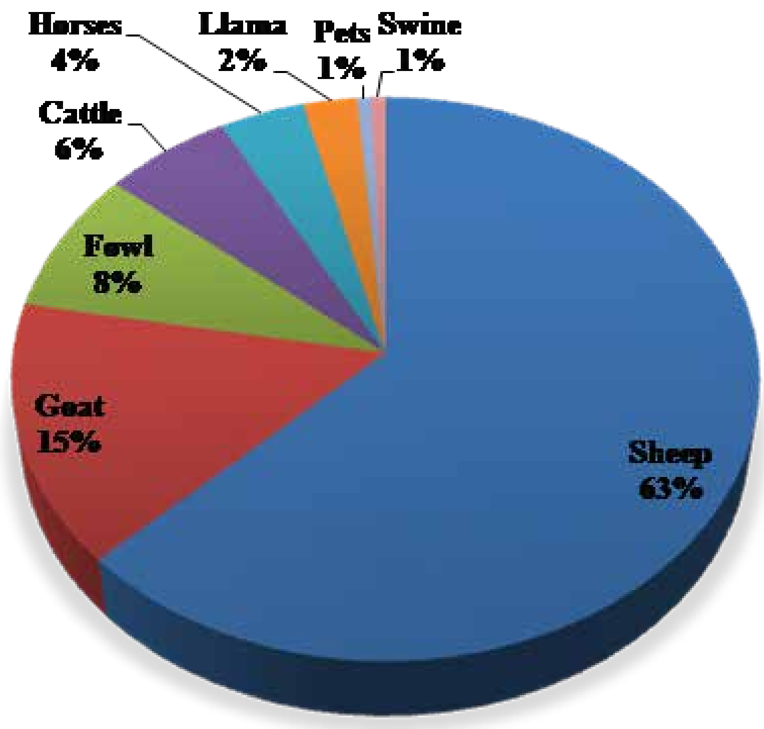
	2006		2007		2008		2009		2010	
	Injured	Killed	Injured	Killed	Injured	Killed	Injured	Killed	Injured	Killed
Cattle		2		10		2		18	2	8
Horses	6	2	8	8	1	2	5	2		3
Goat		2		16	2	20		23	1	22
Llama		1				3		2		4
Sheep		23	1	26	4	115	2	157	2	128
Swine										
Fowl				7		8		49		25
Total	6	30	9	67	7	150	7	251	5	190

The rate of livestock loss may be partly a function of an area's mountain lion density. In Oregon, Hiller et al. (2015) found that as mountain lion population density increased, so did the number of mountain lions killed as a result of livestock predation. This relationship was especially strong at higher mountain lion densities. Livestock conflicts either decreased when mountain lion hunter harvest increased or remained constant where mountain lion densities were relatively low.

There is evidence that a similar relationship between lion abundance and livestock conflict may exist in Montana. There is a correlation ($r^2 = 0.66$) between the number of mountain lions that Wildlife Services agents annually killed in response to livestock depredations and the statewide mountain lion population estimated by FWP's Integrated Population Model (1990 – 2013; Chapter 6; Figure 4). Hunter harvest that maintains mountain lions at moderate densities may be a useful tool in managing livestock predation in some circumstances (Hiller et al. 2015).

Otherwise, there are few practical measures that can completely prevent the loss of commercial livestock to mountain lions. Delaying turnout of cow-calf pairs into remote lion occupied pastures may reduce calf loss. Although guard dogs can reduce livestock losses to canine predators, guard dogs do not effectively protect against mountain lion depredation (Jenks 2011). If economically feasible, switching from raising small livestock (i.e. sheep) to less vulnerable species where mountain lions are common may also reduce depredation losses (Lindzey 1987). Owners of hobby livestock can effectively use practices unavailable to commercial producers such as night penning, lights, and clearing brush around paddocks to reduce depredation risk.

Figure 3. Proportion of livestock killed by mountain lions by species, 2006 – 2015.



2011		2012		2013		2014		2015	
Injured	Killed	Injured	Killed	Injured	Killed	Injured	Killed	Injured	Killed
	3		14		14		2		10
2	2	2	4	2	1	3	1	1	2
	17	3	44		6		11		45
	10		10		5		1		
	67	1	79		162		64		55
					2		2		
	3						24		
2	102	6	151	2	190	3	105	1	112

MOUNTAIN LION-HUMAN INTERACTIONS

Mountain lion attacks on humans in Montana are extremely rare. The only fatal mountain lion attack in modern times was that of a 5-year old boy killed near Evaro, on the Flathead Indian Reservation, in September of 1989. Several nonfatal attacks have also occurred in the state and, like elsewhere, overwhelmingly involved children (Beier 1991). Juvenile and subadult mountain lions are responsible for most human-lion conflicts across the western U. S. (Mattson 2007), including Montana.

Subadult lions of both sexes are also more likely than adults to use urban and exurban residential areas (Kertson et al. 2013). Although in Montana males were more likely than females to take livestock, sex ratios of lions involved in human incidents were not significantly different from 50:50. Human incidents mostly occurred near western intermountain valley communities.

Mountain lions commonly live adjacent to, or travel through, developed areas but most lions travel at night and are rarely seen (Kertson et al. 2013). Individuals that are routinely sighted during daylight hours near homes and people, or those that appear accustomed to human activity and development, have become habituated and are a public safety concern. Individual lion behavior

Mountain lions commonly live adjacent to, or travel through, developed areas but most lions travel at night and are rarely seen


Habituated mountain lion removed by FWP conflict specialist , R. Wiesner

often escalates from natural to habituated to nuisance to dangerous, at which point the lion may begin to kill pets in populated areas and/or to display aggression toward humans (Cougar Management Guidelines Working Group 2005).

If an investigation reveals that a habituated mountain lion has become a nuisance or aggressive, FWP staff should document the behavior, notify area residents of the situation (especially those with children and/or outdoor pets), and immediately attempt to either aversively haze or lethally remove the offending individual.

Field staff should closely follow the approved protocols for responding to human-lion conflicts in the Mountain Lion Depredation and Control Guidelines (Appendix 3).

SPECIAL MANAGEMENT AREAS

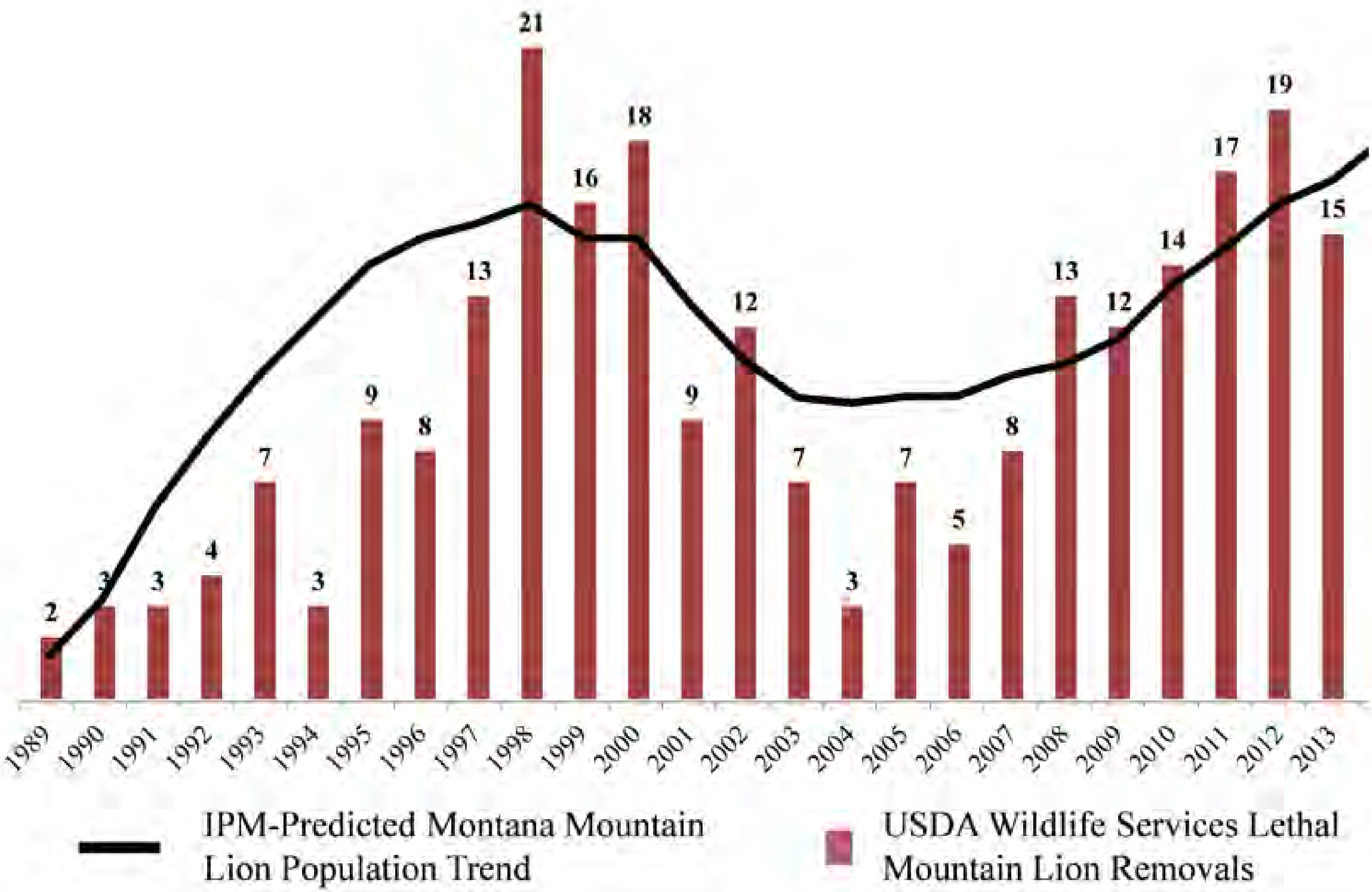
Montana has designed certain Lion Management Units (LMUs) specifically to encompass urban, suburban, or agricultural areas where the tolerance for mountain lion presence is low and the potential for human-mountain lion conflict is high. The Commission may designate these LMUs “Special Management Areas” (described by Logan & Sweanor 2001) and either elect to assign an “unlimited” harvest quota (e.g. LMU 170, immediately surrounding Kalispell) or a high annual quota that it is rarely, if ever, met.

If a Special Management Area contains suitable mountain lion habitat, the management approach may not significantly reduce mountain lion densities because of rapid immigration into vacated home ranges (Robinson et al. 2008, Cooley et al. 2009). However, specifically designating Special Management Areas can ease social and political concerns (Jenks 2011) and, importantly, ensure that legal hunter harvest remains a management tool throughout the fall and winter hunting seasons.

For example, the Missoula Special Management Area (MSMA), a LMU surrounding the highly developed Missoula Valley, was established in 1994. Relatively high quotas in this LMU are rarely met even though the area contains high-quality lion habitat and General License hunting was allowed for nearly 7 months each year.

The average age of a mountain lion harvested within the MSMA between 2000 and 2015 (3.09 years; n = 421) was slightly lower than that of lions harvested during the same period in the remainder of Region 2 (3.58 years; n = 2319). However, this small difference does not indicate that higher hunter harvest opportunity meaningfully increased the proportion of more conflict prone juveniles in the LMU. Although FWP staff lethally removed several nuisance mountain lions from the MSMA each year, FWP hunting regulations were not publicly perceived as limiting legal hunter harvest during established seasons in this high conflict area.

Figure 4. The relationship between Montana's modeled mountain lion population trend and annual mountain lion removals by Wildlife Services in response to livestock depredation, 1989 - 2013.



CHAPTER 3

2016 MONTANA MOUNTAIN LION RESOURCE SELECTION FUNCTION

INTRODUCTION

To produce accurate estimates of mountain lion abundance, managers first need to understand what habitat features are important to lions and how that habitat is distributed across the state. Accurate spatial models that describe mountain lion habitat use can also be used to monitor lion populations over time. While producing reliable maps of relative mountain lion habitat quality and landscape linkages is critically important (Cougar Management Guidelines Working Group 2005, Jenks 2011) they have previously been difficult to produce and validate.

Managers need accurate spatial data that depict mountain lions' use of their habitat in order to predict lion abundance and to monitor their populations over time

Montana FWP will use a "resource selection function" (RSF) model to depict and analyze the state's mountain lion habitat. A RSF is a statistical model that represents the relative probability that an animal will select a particular place or resource (Manly et al. 2002). A RSF is simply a spatial surface of pixels or cells that are each assigned a statistical value based on what we know about a species' habitat selection. This surface can then be used to mathematically analyze and describe the species' habitat use at larger scales.

A RSF is often displayed as a map showing the relative likelihood a species will use a particular resource or available habitat. Biologists construct RSFs from field data that describe an animal's spatial use (such as telemetry relocations collected using radio or GPS collars) and the habitat variables that likely cause the animal to select (or avoid) certain resources or areas. Habitat variables may include vegetation type, canopy closure, elevation, terrain, or other features that affect an animal's habitat selection.

It's impossible to quantify all the habitat variables that cause an animal to select a certain location. However, we can often identify a combination of measurable factors that accurately predict the relative likelihood that a species is present in a certain habitat type. If we also have information about a population's vital rates and population density, we can also estimate how many individuals a larger area likely supports.

A well designed RSF can help biologists better manage wildlife in many important ways. RSFs can describe the kind of habitat where we'd expect to find a certain species, map corridors that are potentially important connections between larger habitat patches, and identify isolated areas of suitable habitat that may support a species, even if the species is not currently there. RSFs help managers identify resources that are important for the conservation of a species or that may be limiting its use of an area. Finally, a RSF allows biologists to make inferences about an animal's abundance across broad landscapes using monitoring data that provides information on the population's current density.

FWP will use a statewide mountain lion RSF to:

1. Define distinct mountain lion ecoregions.
   The RSF surface consists of many small cells, or "pixels", that are each assigned a value based on the habitat features present within them. The average RSF value of all the pixels within a hunting district or lion management unit generally describes the overall quality of that unit's lion habitat. FWP used these average values to define large, biologically meaningful, ecoregions within the state where lion habitat is similar in type and

distribution. These ecoregions will be the primary spatial basis of its mountain lion population monitoring program (Chapter 4).

2. Improve population monitoring.
   The RSF helped FWP identify representative population Trend Monitoring Areas within the Northwest, West-central, and Southwest ecoregions. The RSF will also be used to guide periodic field sampling within these Monitoring Areas (Chapter 4).

3. Enable FWP to estimate mountain lion abundance.
   When the relationship between observed lion abundance and the RSF is known, we can estimate lion abundance within both Trend Monitoring Area(s) and the larger ecoregion. Integrating the RSF with field sampling such as spatial capture-recapture (Chapter 5) makes these monitoring methods more effective. Including a RSF as a covariate in the density estimation model—that is, formally assuming that an animal's activity center is more likely to fall in higher quality habitat—significantly improves the population estimate's biological realism and precision.

MONTANA MOUNTAIN LION RESOURCE SELECTION FUNCTION

Robinson et al. (2015) produced the first comprehensive winter mountain lion resource selection function for the state of Montana. The authors used mountain lion telemetry relocations (both VHF and GPS) from 10 individual mountain lion field research projects conducted throughout Montana and Yellowstone National Park between 1979 and 2012 to train and validate the RSF (Table 4). A significant number of telemetry locations were withheld from the training data for internal model validation. Mountain lion harvest locations (1988 – 2011; generalized to the center of the 640-acre section of harvest) were also used to validate the model. The original manuscript contains a detailed description of how this original RSF was constructed, was tested, and performed.

The most important measure of a RSF's utility is its ability to predict a species' use of available habitat (Boyce et al. 2002). The 2015 RSF model predicted both out-of-sample lion telemetry locations and hunter harvest locations quite well across Montana. Although there was generally excellent agreement between the location of harvested animals and predicted areas of lion habitat use, the 2015 model was most predictive in FWP Regions 1, 2, 4 and 6. In Regions 3, 5, and 7, a higher proportion of animals were harvested in areas that the RSF predicted to be lower quality habitat, compared to other FWP Regions.

Table 4. Field studies and sampling data used to develop the Robinson et al. (2015) and 2016 MT Mountain Lion Resource Selection Function.

Study	Location	Years	N	Telemetry Method	2016 Model Training Locations
Murphy (1983)	Fish Creek	1979–1982	9 (6F, 3M)	VHF	127
Williams (1992)	Sun River	1991–1992	24 (15F, 9M)	VHF	104
Murphy (1998)	Yellowstone National Park	1987–1995	41 (29F, 12M)	VHF	1335
Ruth (2004)	North Fork Flathead	1993–1997	38 (28F, 8M)	VHF	692
Ruth & Buotte (2007)	Yellowstone National Park	1986–2006	39 (21F, 18M)	VHF and GPS	2782
Choate (2009)	National Bison Range	2000–2003	8 (7F, 1M)	VHF	576
Robinson & DeSimone (2011)	Garnet Range	1998–2006	39 (31F, 8M)	VHF and GPS	14,127
Kunkel et al. (2012)	Rocky Boys Reservation	2006–2009	6 (2F, 4M)	GPS	1786
Kunkel et al. (2012)	Fort Belknap Reservation	2008–2010	3 (2F, 1M)	GPS	281
Matchett (2012)	Missouri Breaks	2011–2012	2 (2M)	GPS	785

Table 5. Montana mountain lion winter Resource Selection Functions developed as part of Robinson et al. (2015) and the revised 2016 model.

Covariate	Robinson et al. 2015 Coefficient (SE)	2016 (revised) RSF Coefficient (SE)
South Aspect	0.3181 (0.0274)	0.3716 (0.0249)
High Montane	-1.3883 (0.3093)	-0.4619 (0.2116)
Agriculture	-1.9151 (0.1512)	-1.5664 (0.1115)
Developed	-0.6110 (0.1706)	-1.0656 (0.1642)
Transitional Vegetation	-0.7200 (0.0453)	-1.3047 (0.0417)
Elevation	0.0191 (0.0002)	0.0084 (0.0002)
Elevation^2	-0.000006 (8.67E-08)	-0.000003 (7.13 E-08)
Percent Slope	0.0264 (0.0017)	0.0229 (0.0014)
Percent Slope^2	-0.00015 (1.96E-05)	-0.0001 (1.3E-05)
Distance from forest	-0.0078 (0.0002)	N/A
Canopy	N/A	0.1688 (0.0029)
Canopy^2	N/A	-0.0022 (0.00004)
Constant	-14.9483 (0.2250)	-6.4305 (0.1551)

Figure 5. The 2016 Montana Mountain Lion Resource Selection Function map. Higher values indicate an area is more likely to be used by mountain lions.

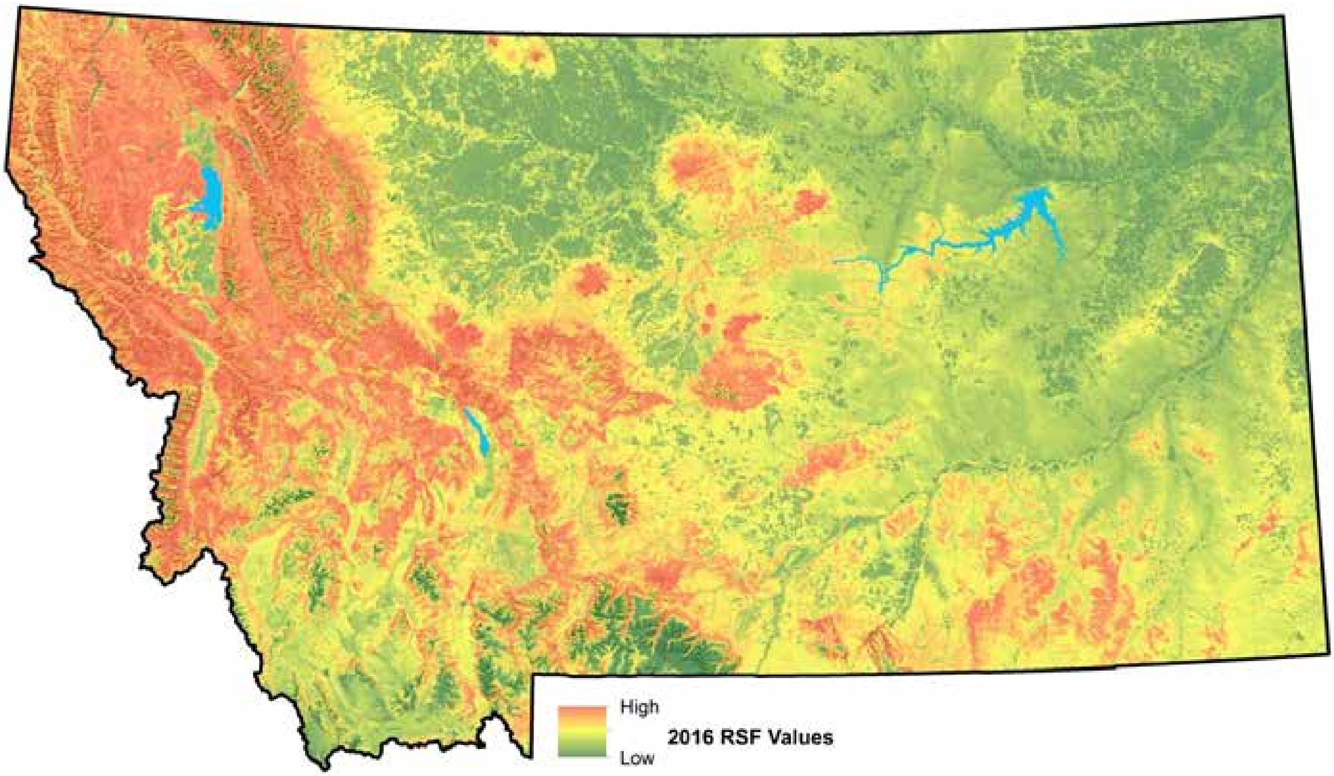


Figure 6. The 2016 Montana Mountain Lion Resource Selection Function map with 22,595 mountain lion telemetry model training points (1979 – 2012) and 10,503 harvest location validation points (1988 – 2015).

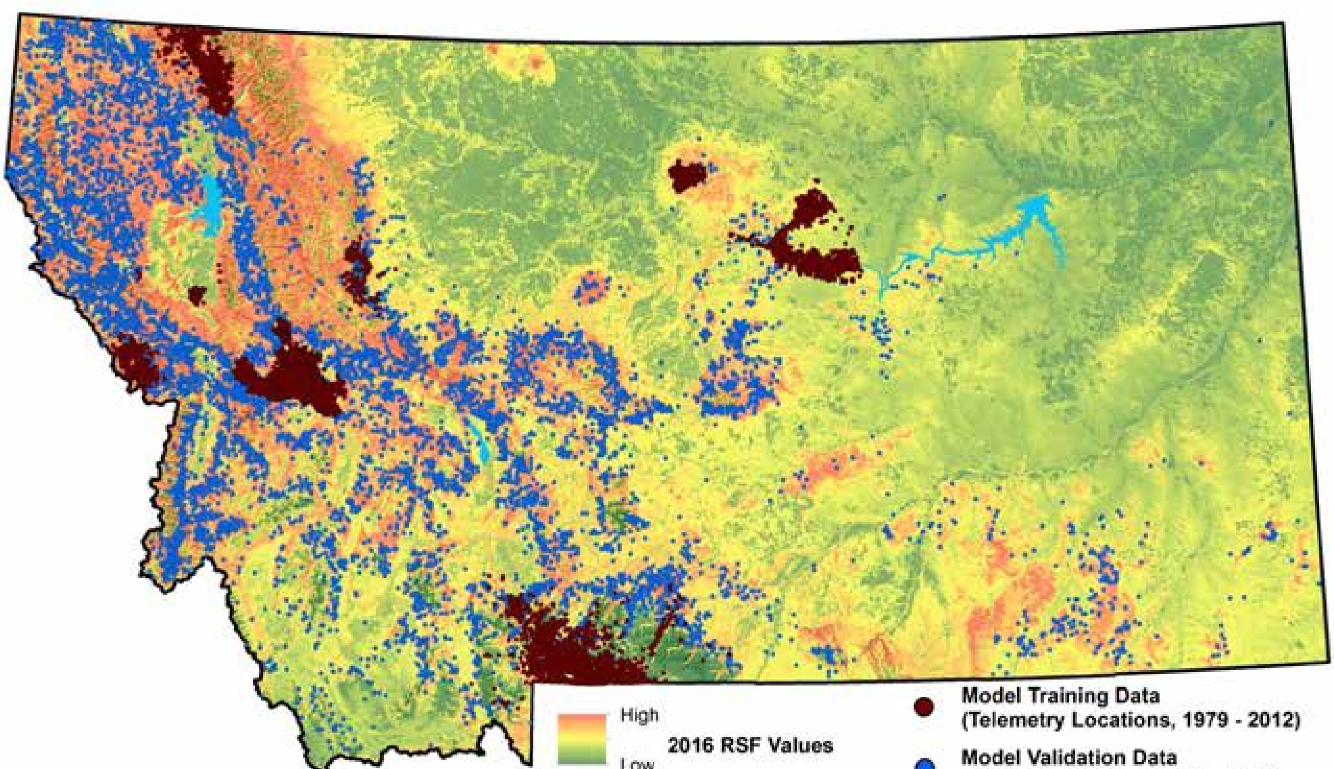
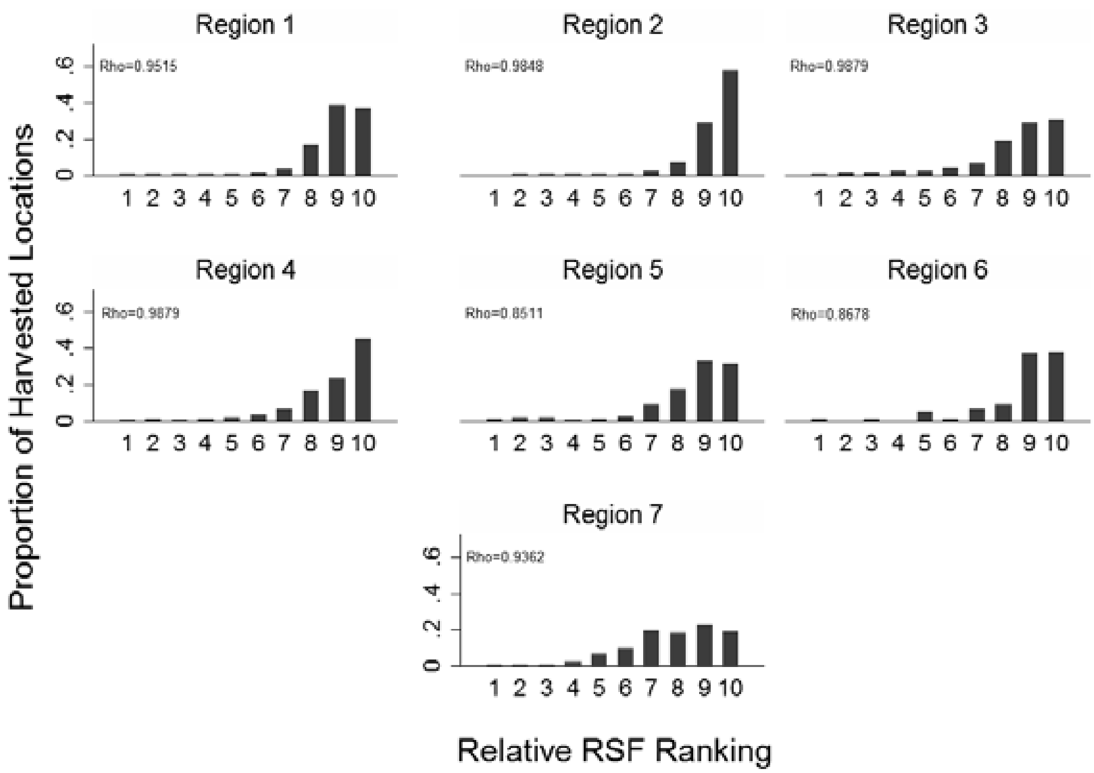


Figure 7. 2016 Montana Mountain Lion Resource Selection Function values and proportion of lion harvest locations per equal-sized bin (bin 1 = lowest quality predicted habitat; bin10 = highest quality habitat) by FWP administrative Region.



2016 MONTANA MOUNTAIN LION RSF

In 2016, FWP and Dr. Robinson worked together to improve the mountain lion RSF's ability to predict lion habitat selection statewide — specifically, in southern and eastern Montana. The same methods used by Robinson et al. (2015) were used to develop a revised version of the RSF, with three important refinements:

1. All available mountain lion telemetry relocations (n = 22,595) from the 10 Montana and Yellowstone National Park studies were used to train the revised model. "Study Area" was then used in the Generalized Linear Model as a random effect to account for varying levels of sampling intensity amongst studies.

2. FWP reexamined approximately 3,800 individual harvest locations reported between 2007 and 2015 - hundreds of location errors were found and corrected. The more accurate and complete 1988 – 2015 harvest data set (totaling 10,503 mountain lion harvest locations) was then used for external validation of the refined winter RSF model.

3. The revised winter RSF contained the same variables as described by Robinson et al. (2015) except that the variable "distance to forest" was replaced by a quadratic of "canopy closure" (Table 5). The revised model included a random intercept for each study area/data set.

We refer to this refined model (Figures 5 and 6) as the 2016 MT Mountain Lion RSF and it is the model used throughout this Strategy. The 2016 RSF performed similarly to Robinson et al.'s original 2015 model in FWP Regions 1, 2, 4, and 6 while the agreement between harvest locations and predicted high-quality habitat in Regions 3, 5 and 7 was significantly improved (Figure 7).

It is important to note that the RSF does not describe all the variables that affect mountain lion distribution or abundance. There are factors such as prey density, habitat disturbance (i.e. wildfire), or harvest history that are important to mountain lions and that vary over time. Therefore, it will be necessary to periodically reassess the relationship between the RSF and actual mountain lion density in an area (as described in Chapter 5).

CHAPTER 4

MONTANA MOUNTAIN LION ECOREGIONS

Mountain lions currently occupy nearly all of their suitable habitat in Montana. However, the quality, quantity, and arrangement of that habitat— thus the number of lions an area can support—varies significantly across the state. Mountain lion habitat in northwest Montana is nearly continuous, but habitat quality generally declines and becomes patchily distributed in more southern and eastern portions of the state (Figure 5).

The average RSF values of individual Lion Management Units reflects this pattern (Figure 8). This gradient in lion habitat quality across Montana allowed FWP to partition the state into distinct mountain lion "ecoregions". These ecoregions are large, contiguous areas of the state within which lion habitat is broadly similar. Mountain lion ecoregions are the spatial basis of FWP's lion population monitoring program.

Mountain lion harvest management is most effective when it's done at a large and biologically meaningful scale (Cougar Management Guidelines Working Group 2005, Jenks 2011). In lightly hunted populations, virtually all males and a significant proportion of females disperse from their natal area. Lion populations are best thought of as many connected sub-populations linked by dispersing animals. Local areas generally depend on immigration to recruit breeding males and, often, a large portion of breeding females.

These local sub-populations (i.e. within a LMU) can be resilient to harvest because lions are able to readily emigrate from adjacent areas and refill available habitat. Dispersal can also cause local populations to exhibit lower growth rates than expected, given their intrinsic vital rates (Sweanor et al. 2000, Logan & Sweanor 2001, Stoner et al. 2006, Cooley et al. 2009, Robinson et al. 2008 & 2011, Newby et al. 2011). Therefore, even if a LMU's harvest rate appears sustainable (when supported by immigration), the same harvest level could cause the unit's population to decline if harvest in adjacent areas increases. Similarly, specific attempts to reduce local lion populations can fail over the long term because of increased immigration from outside the treatment unit (Clark 2014a).

Monitoring and management programs are most effective when implemented across large landscapes. The effects of immigration and emigration on local population dynamics are less pronounced when considering large scale trends (Robinson et al. 2015). Importantly, large-landscape (i.e. > 35,000 km^2, an area ~ 115 x 115 miles) lion populations can be considered statistically "closed" (that is, the influence of immigration/emigration is eliminated) for most analyses (Robinson et al. 2008). Harvest treatments and abundance estimates are therefore less likely to be confounded by metapopulation dynamics if they are conducted across broad landscapes.

Montana includes a diverse range of habitat types, prey communities, weather patterns and other factors that affect mountain lion abundance. The relationship between an area's lion abundance and the range of RSF values within that area is unlikely to be the same across the state. Therefore, conducting field population monitoring and modeling efforts within large but discrete ecoregions (containing similar lion habitat) helps take this habitat variability into account.

FWP can more accurately estimate broad scale (ecoregion) lion abundance when using monitoring data collected from within that same ecoregion because mountain lion habitat and harvest history is more similar within ecoregions than across them (Boyce & McDonald 1999). FWP will produce periodic estimates of lion abundance and forecast the effects of harvest based only on monitoring data collected within those respective ecoregions (Chapters 5 and 6).

Mountain lion harvest management is most effective when it's done at a large and biologically meaningful scale

Figure 8. Avg. Mountain Lion Resource Selection Function values (0 = lowest quality habitat, 1 = highest quality habitat) for Montana’s 2016 Lion Management Units.

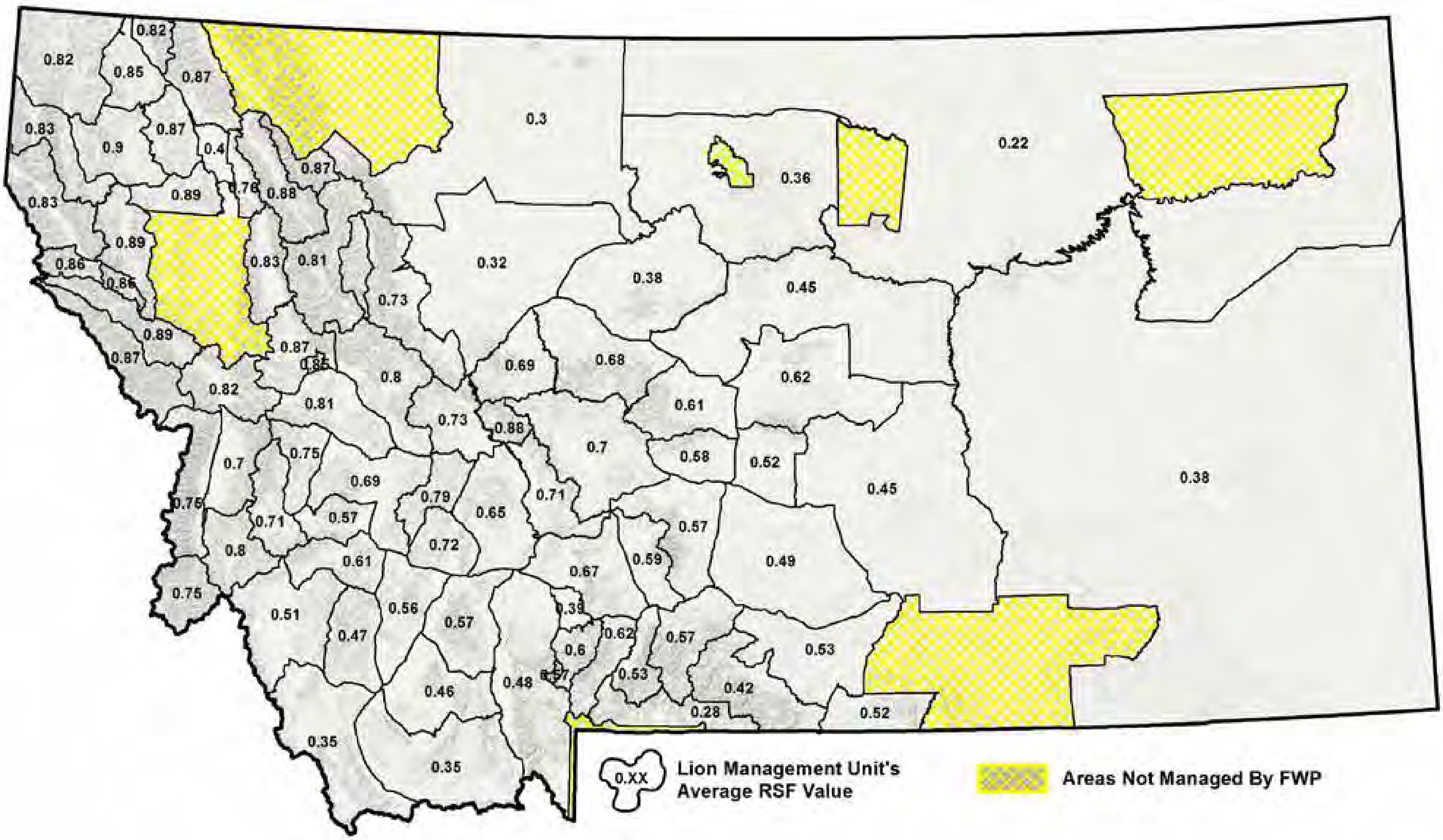
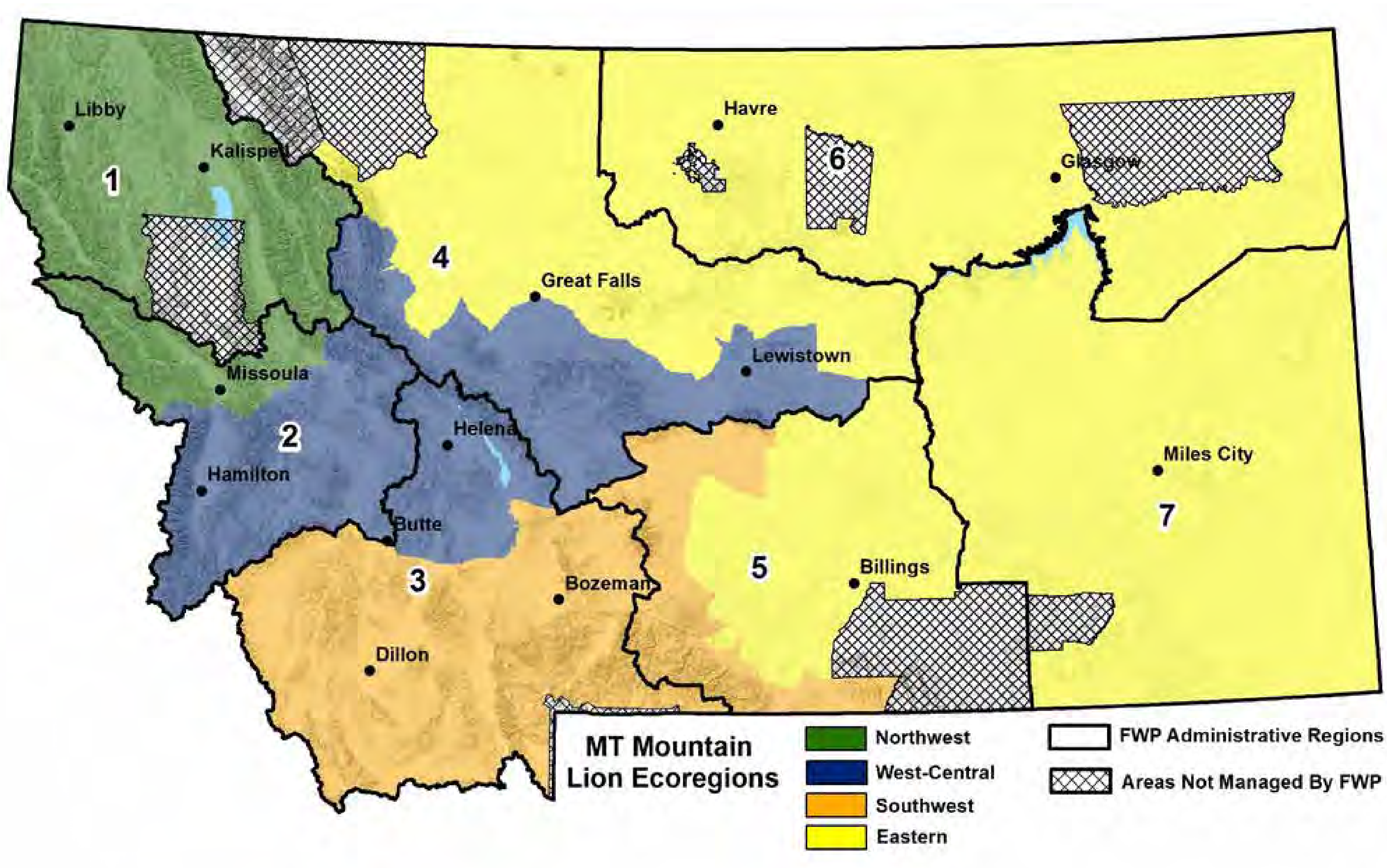


Figure 9. Montana's four mountain lion ecoregions and seven FWP administrative regions.



For the same reason, it is also only statistically and logistically practical to estimate lion population trend at a large scale. Mountain lion ecoregions should contain enough lions that populations can be modeled assuming that those populations are statistically closed. Population models then consider vital rates (from research on marked animals), harvest records, and periodic abundance estimates to allow managers to better understand past and future population trends (Chapter 6). This ability to describe the effects of past harvest and to predict the effect of future harvest prescriptions is a cornerstone of an adaptive harvest management program (Chapter 8).

FWP considered four factors when identifying individual mountain lion ecoregions:

1. They include contiguous LMUs with broadly similar habitat quality (RSF values).
2. They are large enough to allow management prescriptions to be effective despite internal lion metapopulation dynamics.
3. They are well distributed and represent the range of Montana lion habitat types.
4. The total number of ecoregions is limited so that monitoring can occur frequently enough to provide meaningful and timely data to managers. There is a tradeoff between the number of statewide ecoregions and how often each of them can be monitored. Budgets and available personnel limit the amount of effort FWP can expend field sampling lion populations.

FWP grouped 2016 LMUs' using a k-Nearest Neighbor algorithm (ESRI ArcGIS 10.1) based on their RSF values and proximity. Local biologists then helped identify four contiguous mountain lion ecoregions that met the above criteria and that could be reasonably managed as distinct units (Figure 9). FWP will periodically collect field data to produce abundance estimates for each of the three western MT ecoregions (where approximately 90% of harvest annually occurs). Estimates of future lion abundance and trend will also be modeled for these ecoregions.

Each Montana mountain lion ecoregion includes all or portions of two or more FWP administrative Regions. FWP managers and the public from different administrative Regions will collectively evaluate an ecoregion's monitoring data, develop management objectives, and decide on an overall management prescription (harvest) for the ecoregion. Managers will then recommend individual LMU harvest limits that implement the prescription, distribute hunter effort, and address local concerns.

FWP also identified a permanent population Trend Monitoring Area in each of the state's three western ecoregions. These Trend Monitoring Areas will be periodically sampled to produce estimates of lion abundance within them, and in their respective ecoregions. The criteria used to select Trend Monitoring Areas are described in Appendix 1.

To be clear, the following ecoregions will be the basis of Montana's mountain lion population monitoring program. Information about the status and trend of lion populations within these ecoregions will inform adaptive management proposals that affect lion populations at the ecoregion scale. FWP and the public in two or more FWP administrative regions will periodically collaborate to develop certain population objectives for each ecoregion. For example, biologists and the public in FWP Regions 1 and 2 may agree to an objective of a moderately positive, negative, or stable population growth rate over the following 6 years in the Northwest ecoregion.

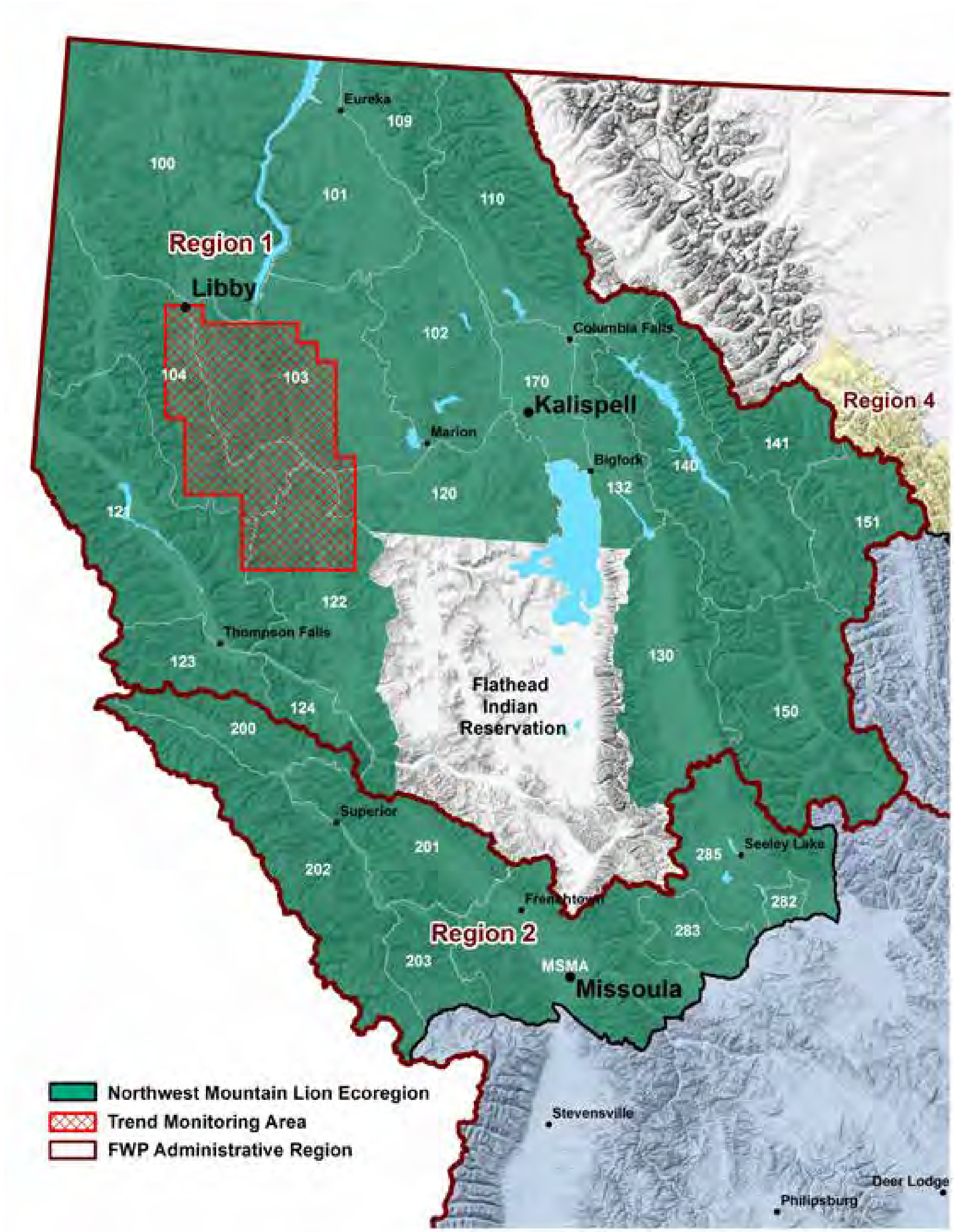
However, biologists and the public in each of the seven FWP administrative regions have local expertise, experience, and relationships. FWP public meetings and many wildlife advocacy groups are also organized by FWP administrative region. Therefore, specific management recommendations about harvest prescriptions and season structure for individual LMUs will be developed by FWP staff and the public in each of the seven administrative regions. The cumulative effect of these individual LMU prescriptions (i.e. the overall harvest within an ecoregion) will be considered, and periodically assessed, at the ecoregion scale.

ECOREGION DESCRIPTIONS

Northwest Ecoregion

The Northwest mountain lion ecoregion encompasses all of FWP Region 1 (except for the Flathead Indian Reservation) and Region 2's northern Blackfoot and middle Clark Fork River drainages (Figure 10). It is Montana's smallest ecoregion at 36,893 km^2 but it contains the state's most continuous and highest quality lion habitat (average LMU RSF value = 0.83). Forests cover more than 90% of the Northwest ecoregion due to its Pacific maritime climate and moderate elevations.

Figure 10. The Northwest mountain lion ecoregion, trend monitoring area, and 2016 FWP hunting districts.



Most of this ecoregion's lion habitat is either public land or publicly accessible private land. Hunter access during winter is extensive outside of designated wilderness areas. Tracking snow is generally present throughout the Winter Season.

The 2,550 km^2 Northwest mountain lion ecoregion Trend Monitoring Area includes the Libby Cr., Thompson River, and Fisher River drainages southeast of Libby. (Figure 11).

Mountain lion harvest in the Northwest ecoregion steadily increased during the 1990s, reaching a historic high of 344 (57% females) in 1998 (Fig 12). White-tailed deer make up as much as 90% of mountain lion prey in northwest Montana (Kunkel 1999, Montana Fish, Wildlife & Parks 2006). The ecoregion's white-tailed deer numbers were high in the mid-1990s before the severe 1996-97 winter significantly reduced this prey base. Lion harvest density, especially of females, was low during the 2000s but increased through the mid-2010s to approximately 4.6 lions per 1,000 km^2 (42% female), less than half the harvest density observed in the late 1990s.

Figure 11. The Northwest mountain lion ecoregion trend monitoring area divided into a grid of 102 5x5 km sampling cells.

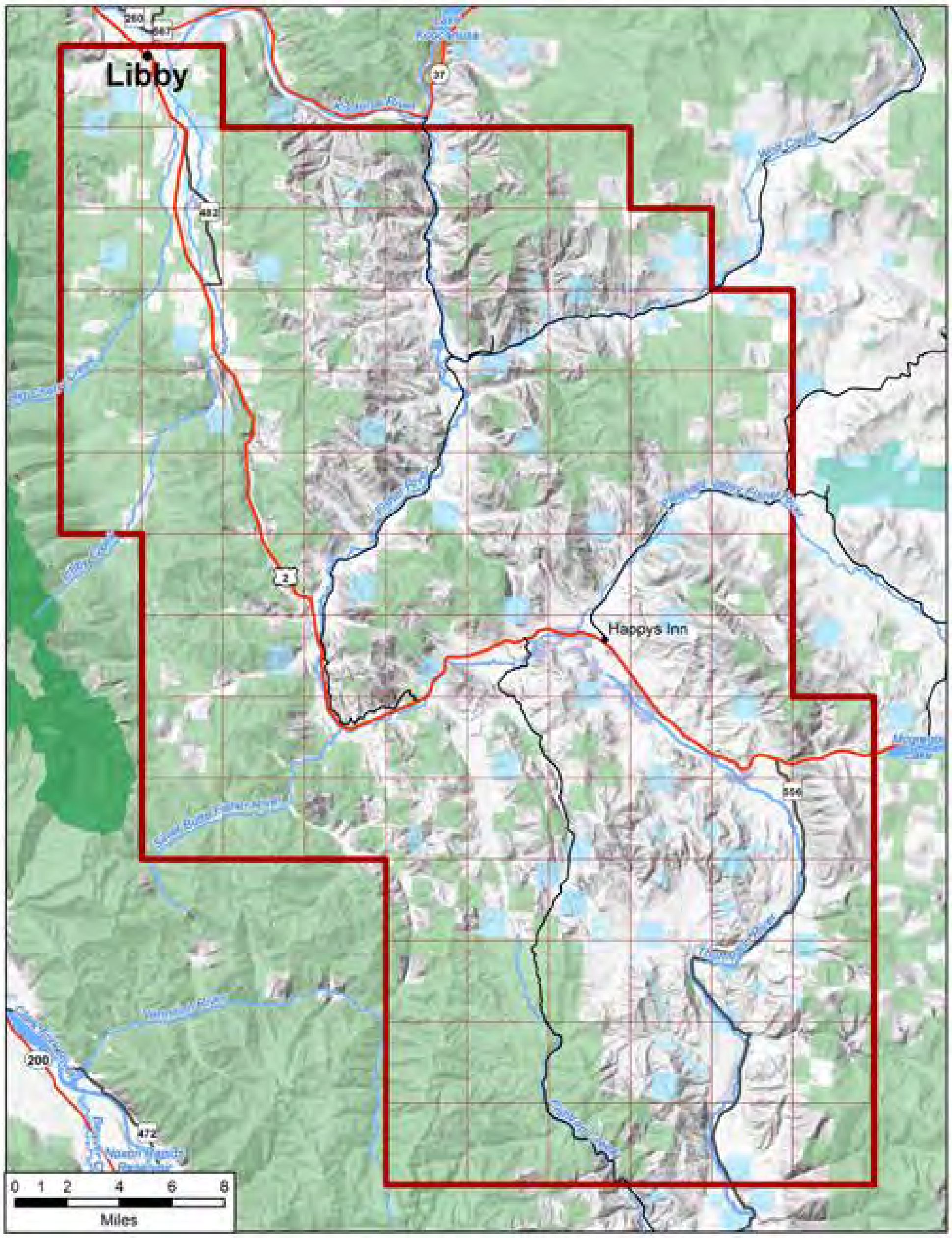
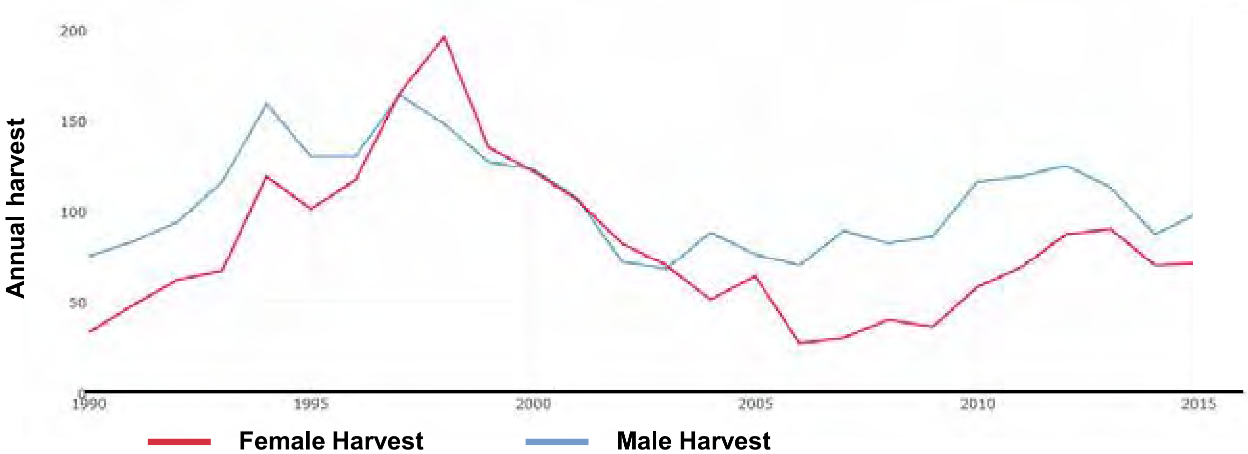


Figure 12. Northwest ecoregion mountain lion harvest, 1990 – 2015.



West-central Ecoregion

The 51,665 km² West-central ecoregion includes the forested mountain ranges and intermountain valleys of the Bitterroot, southern Blackfoot, and upper Clark Fork watersheds west of the Continental Divide and the Rocky Mountain Front, Helena/Boulder valleys, Belt and Snowy Mountains to the east (Figure 13). The ecoregion includes portions of FWP Regions 2, 3 and 4.

Forests across the ecoregion are diverse and often separated by broad intermountain valleys. The average mountain lion habitat quality (average LMU RSF value = 0.72) is generally lower than in northwest Montana because high-quality lion habitat is more intermittent. There is extensive and well distributed public recreational access to winter lion habitat, although some local private land refuges exist. Snow conditions annually vary within and between watersheds—a lack of adequate tracking snow occasionally limits winter lion harvest in some areas.

The ungulate prey base and density varies across the ecoregion. Although white-tailed deer are generally common, mule deer and elk make up a greater proportion of available ungulates than in northwest Montana.

The 2,200 km² West-central ecoregion's Trend Monitoring Area includes the upper Blackfoot and east Nevada Cr. Valleys west of the Continental Divide (Region 2) and the Canyon Creek/Little Prickly Pear drainages east of the Divide in Region 3 (Figure 14).

Mountain lion harvest in the West-central ecoregion climbed to a high of 294 lions (53% female) in 1998 (Figure 15). Hunter harvest, particularly of females, was significantly reduced in the 2000s following perceived population declines. By 2015, overall harvest density increased to 3.1 per 1,000 km², well below the nearly 6.0 per 1,000 km² in the late 1990s—specifically, the 2015 female harvest was one third of the 1998 peak.

Figure 13. The West-central mountain lion ecoregion, trend monitoring area, and 2016 FWP hunting districts.

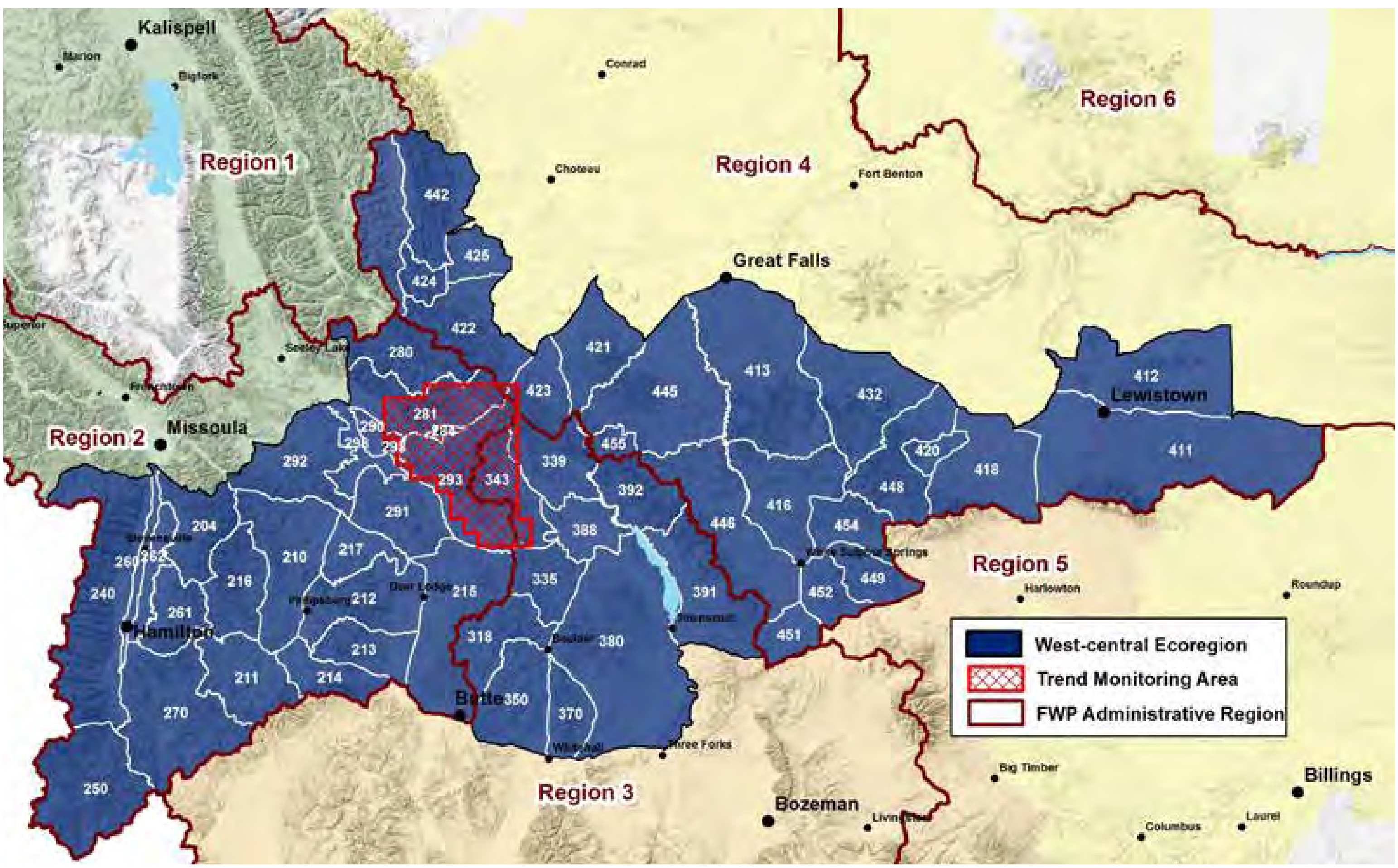


Figure 14. The West-central mountain lion ecoregion trend monitoring area divided into a grid of 101 5x5 km sampling cells.

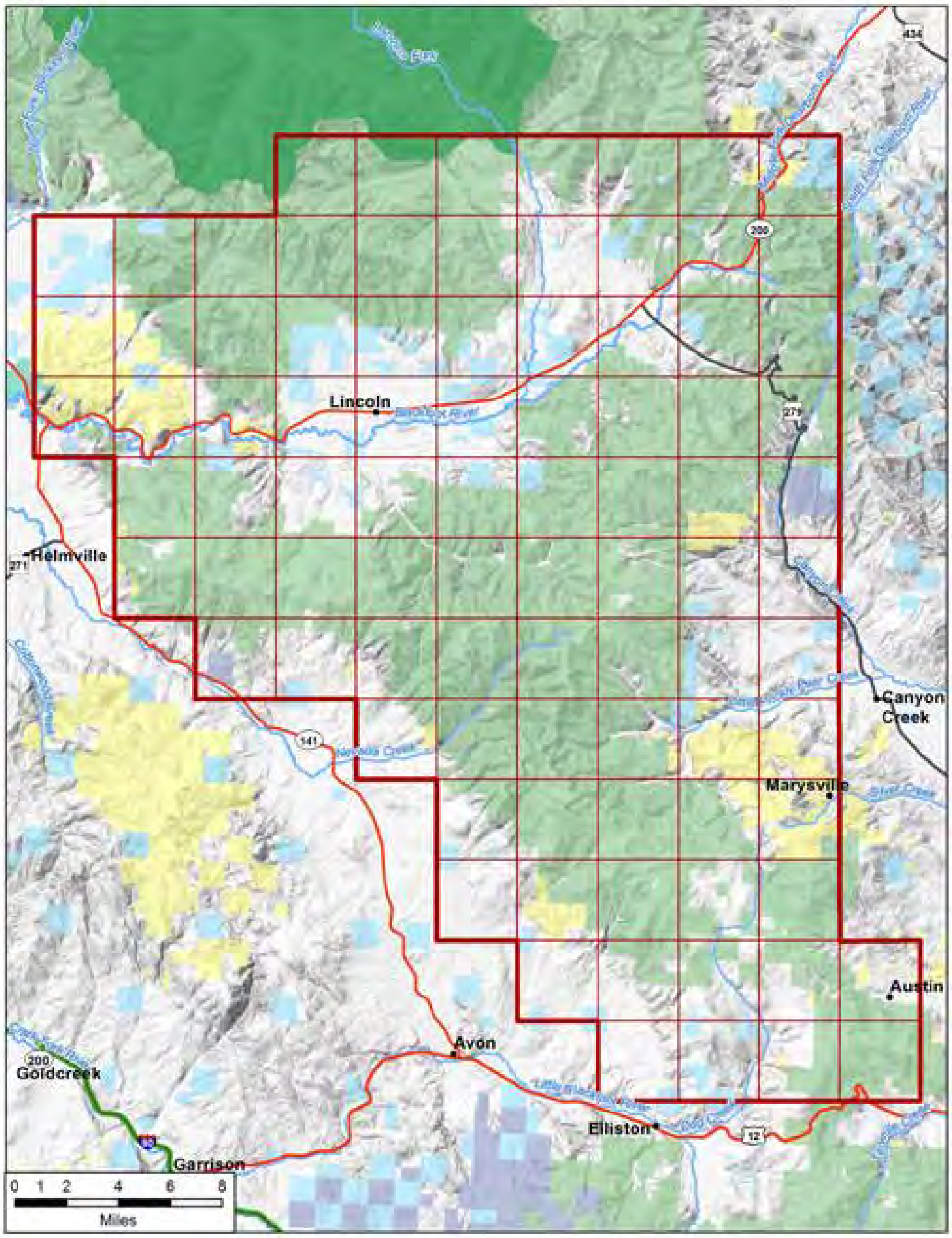
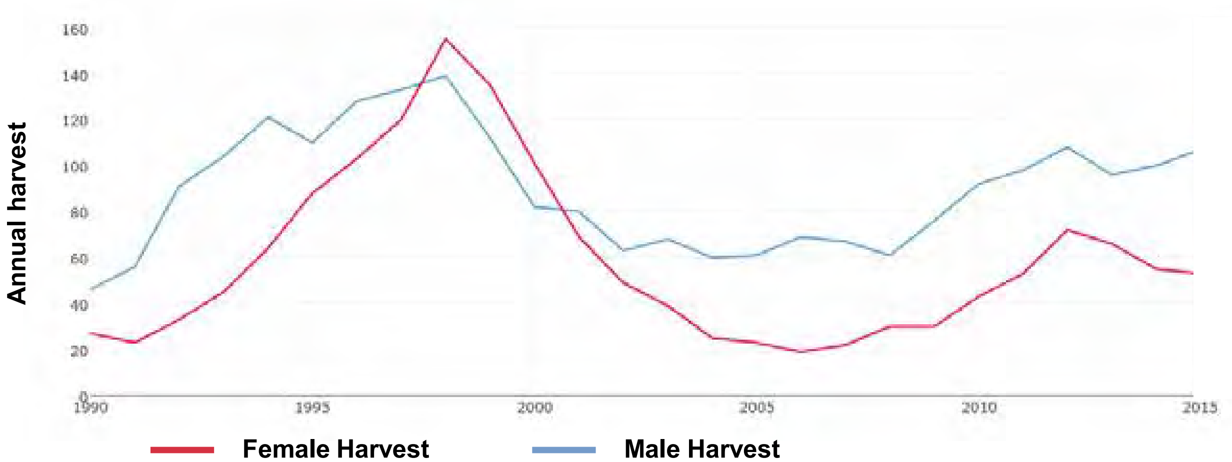


Fig. 15. West-central ecoregion mountain lion harvest, 1990 – 2015.



Southwest Ecoregion

Mountain lion habitat is relatively patchy and linearly distributed in much of the 52,487 km^2 Southwest ecoregion. This area extends from the Continental Divide and southwest Montana's island ranges, across the Greater Yellowstone Ecosystem to the Beartooths, Crazy Mountains, southeastern Little Belts, and southern Big Snowy Mountains. The ecoregion includes much of FWP Region 3 and western Region 5 (Figure 16). Although many portions of the ecoregion include high-quality lion habitat, only about a third of the total area is forested—the average LMU's RSF value in this ecoregion is 0.51.

Public access to winter mountain lion habitat is mixed; approximately 75% of lions harvested between 2007 and 2015 were taken on public land. Winter snow tracking conditions vary and can, at times, limit effective harvest.

The 2,525 km^2 Southwest ecoregion mountain lion Trend Monitoring Area is located in the Gallatin Range between Bozeman and Yellowstone National Park (Figure 17).

Total mountain lion harvest in this ecoregion peaked in the late 1990s, declined in the 2000s, then returned to near the 25-year average level by 2015. Much of this variation, however, was due to fluctuations in female lion harvest; male harvest has remained relatively constant since the mid-1990s (Fig. 18). Overall Southwest ecoregion harvest density was 1.75 lions per 1,000 km^2 in 2015.

Figure 16. The Southwest mountain lion ecoregion, trend monitoring area, and 2016 FWP hunting districts.

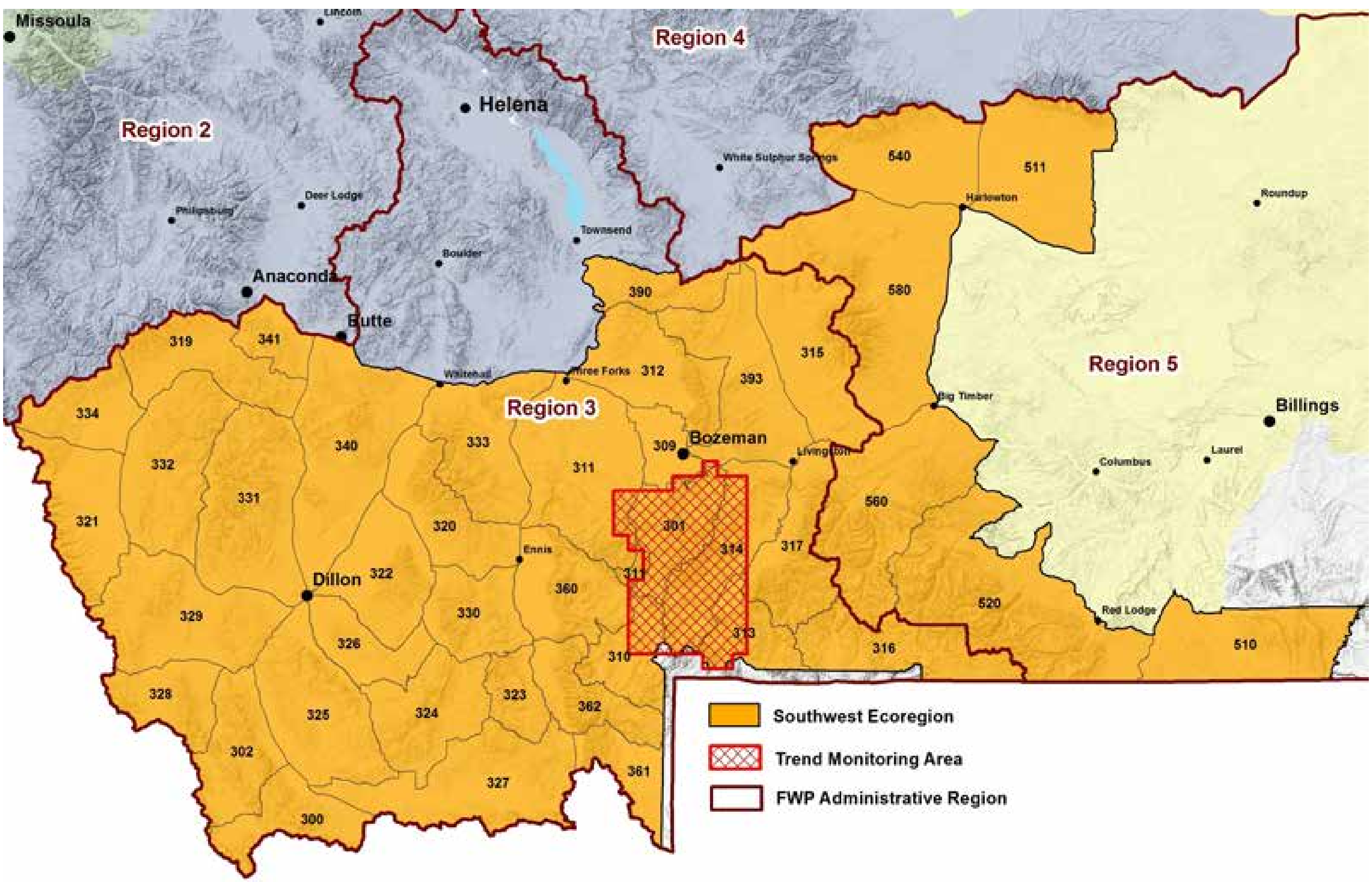


Figure 17. The Southwest mountain lion ecoregion trend monitoring area divided into a grid of 101 5x5 km sampling cells.

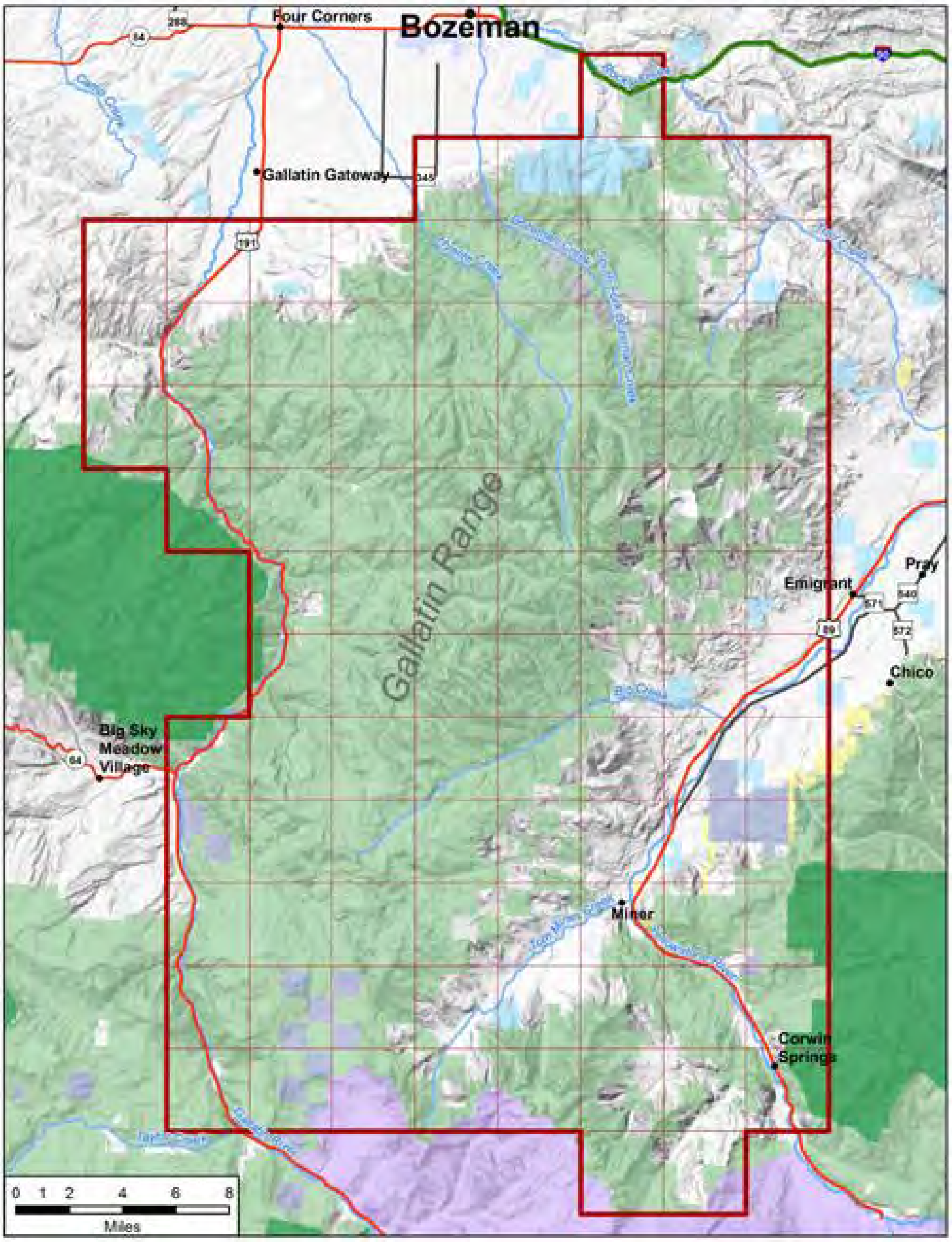
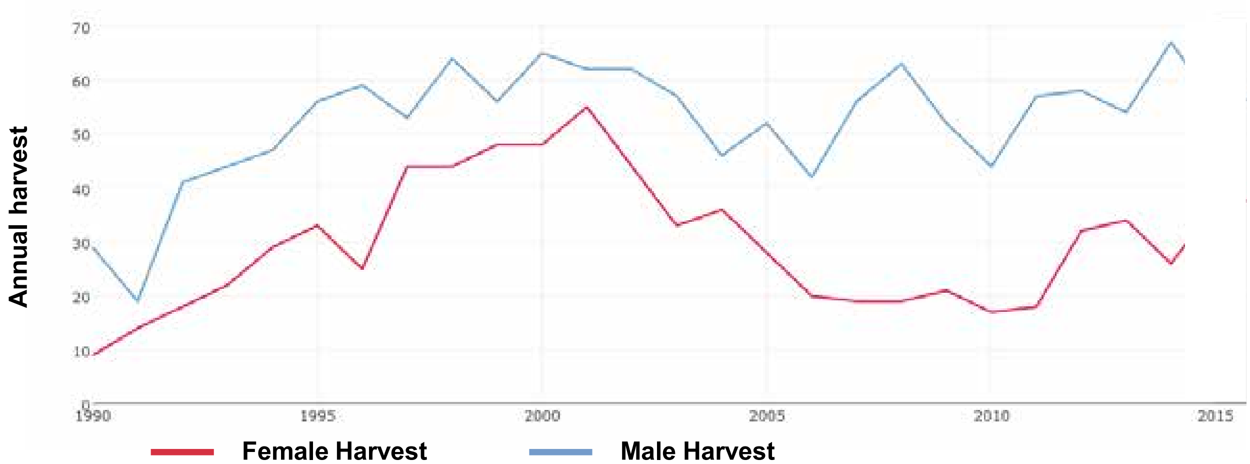


Fig. 18. Southwest ecoregion mountain lion harvest, 1990 – 2015.



Eastern Ecoregion

The 198,175 km^2 Eastern ecoregion is, by far, the largest in the state and includes all or portions of FWP Regions 4, 5, 6 and 7 (Fig 19). Much of the highest quality mountain lion habitat in eastern Montana lies within Indian reservations—FWP does not have routine mountain lion management jurisdiction on these reservations and they are excluded from the ecoregion for analysis and planning purposes. Less than 10% of the remaining ecoregion supports ponderosa pine or juniper-dominated forest. In general, patches of high-quality lion habitat are relatively small and widely distributed (average LMU RSF value = 0.38).

Genetic field monitoring data will not be routinely collected in the Eastern ecoregion and, therefore, no permanent Trend Monitoring Area has been designated. Lions in this ecoregion occur at an overall low density and sub-populations occur in discontinuous patches of suitable habitat. Inferences drawn from field sampling in one area would be of limited use for broad scale management of this ecoregion.

Mountain lion distribution and abundance has significantly increased in eastern Montana since the 1980s and recovery likely continued through the 2010s. Harvest has steadily increased since the 1990s (Fig. 20). Intermittent snow cover in eastern Montana can significantly reduce hound hunting's effectiveness. Therefore, in this ecoregion, quotas are more likely to serve as limits on harvest during years when snow conditions are favorable than as reliable annual harvest prescriptions.

Lion harvest in the Eastern ecoregion generally occurs in areas that the RSF describes as high-quality habitat on or near the Custer National Forest, Bureau of Land Management lands surrounding the Charles M. Russell National Wildlife Refuge, private land in the Bears Paw Mountains, in the Highwood Mountains, and along the northern Rocky Mountain Front.

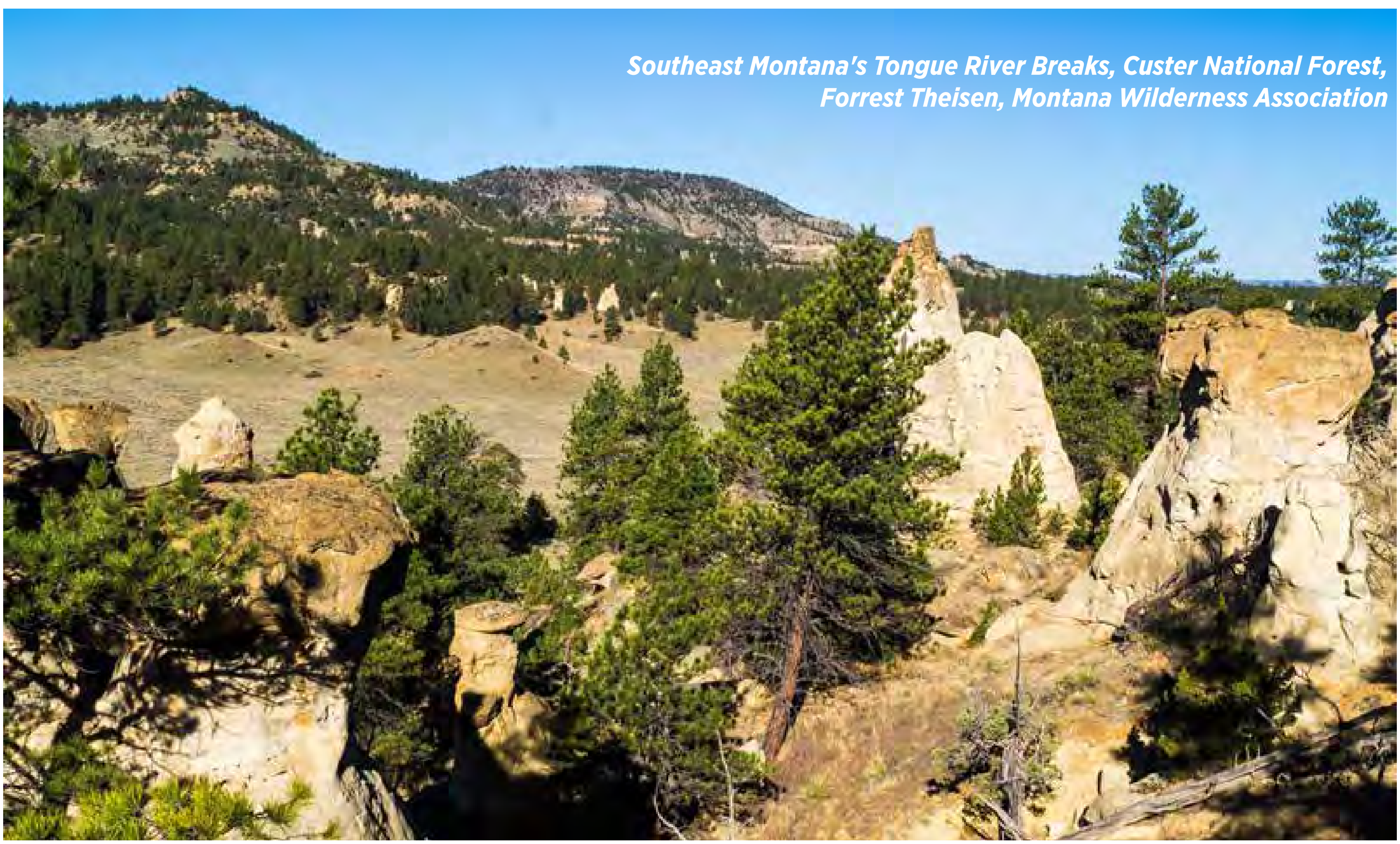

Southeast Montana's Tongue River Breaks, Custer National Forest, Forrest Theisen, Montana Wilderness Association

Figure 19. The Eastern mountain lion ecoregion and 2016 FWP hunting districts.

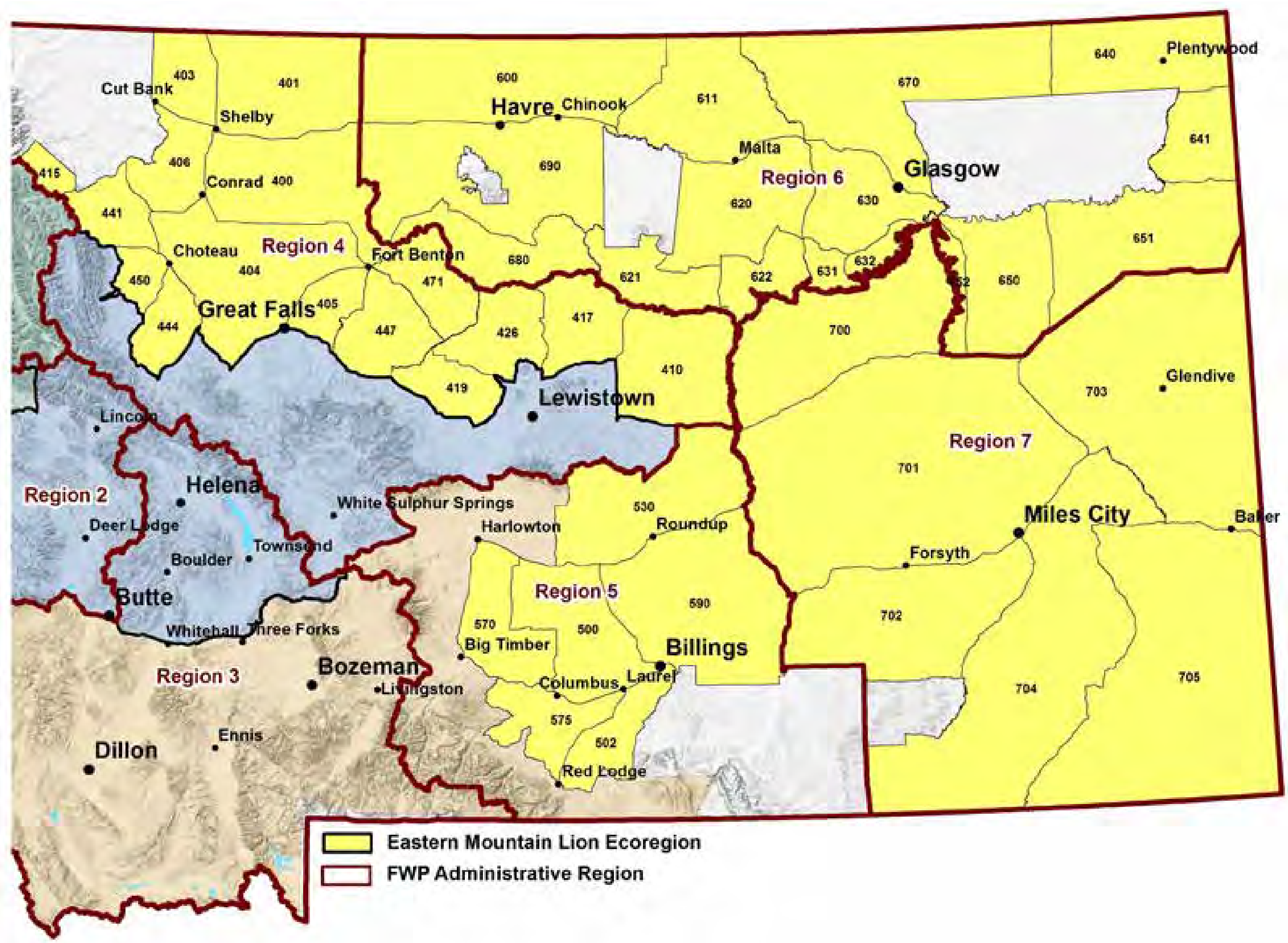
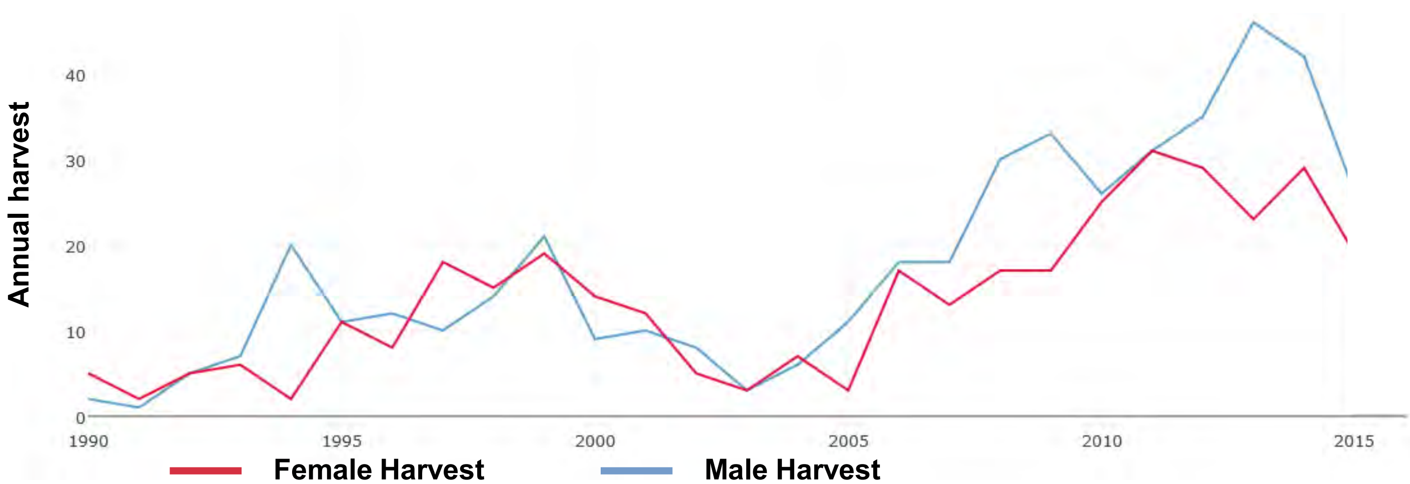


Fig. 20. Eastern ecoregion mountain lion harvest, 1990 – 2015.



CHAPTER 5

MONITORING MOUNTAIN LION ABUNDANCE

“ The Holy Grail of cougar management has always been the question of ‘How many are there?’”

Managing Cougars in North America— J. A. Jenks, editor (2011)


FWP biologist preparing to fire biopsy dart to collect a genetic sample from a treed mountain lion, Western Montana, R. Wiesner

INTRODUCTION

To conserve mountain lions while ensuring sustainable recreational hunting opportunities, FWP needs accurate and up-to-date information about mountain lion population size and trend. In the past, managers used indirect measures of lion abundance, inferences drawn from long term field research projects, or anecdotal information about population status to inform decisions. Unfortunately, these sources of information often fail to accurately describe the effects of previous management actions and don’t allow us to precisely predict the effects of future harvest (Beausoleil et al. 2013).

Developing a method to obtain regular, accurate, extensive, and affordable estimates of the size of lion populations has been one of the highest priority mountain lion management needs (Beausoleil et al. 2008, Jenks 2011). Until recently, there was no cost effective and relatively quick way to produce reliable lion population estimates at a large enough scale to be meaningful for management (Choate et al. 2006, Beausoleil et al. 2016).

Many agencies that are charged with managing mountain lions rely on indirect measures, or indices, of lion abundance to make inferences about population changes because these indirect data are already available or relatively easy to collect. However, the actual relationship (if one exists) between a population index and true population size is rarely known and may be inconsistent over time (Anderson 2003).

When potential indices of abundance were formally compared to known populations, the indices often proved too insensitive to be useful management triggers. For example, Wolfe et al. (2015) found that although the number of lions treed-per-day, permit fill rate, and the proportion of females in harvest were correlated with abundance, those relationships were weak. These indices are also not generally relevant in Montana where most harvest is regulated by sex-specific quotas.

Although the sex and age of harvested lions can eventually indicate significant changes in a lion population’s size or growth rate, these harvest indices are only able to detect relatively large and long term increases or declines (Stoner 2004, Anderson & Lindzey 2005, Robinson & DeSimone 2011).

In Montana, changes in harvest-age structure appear to broadly correspond to observed, long term, changes in lion abundance. When populations were thought to be high and growing during the early 1990s, a greater proportion of the harvest consisted of older lions (Table 6). Lion populations apparently declined during the early 2000s before recovering; both the average ages of harvested lions and the proportion of older lions in the harvest reflected this trend. A similar relationship was documented in western Montana's Garnet Mountains between 1997 and 2006 (Figure 21).

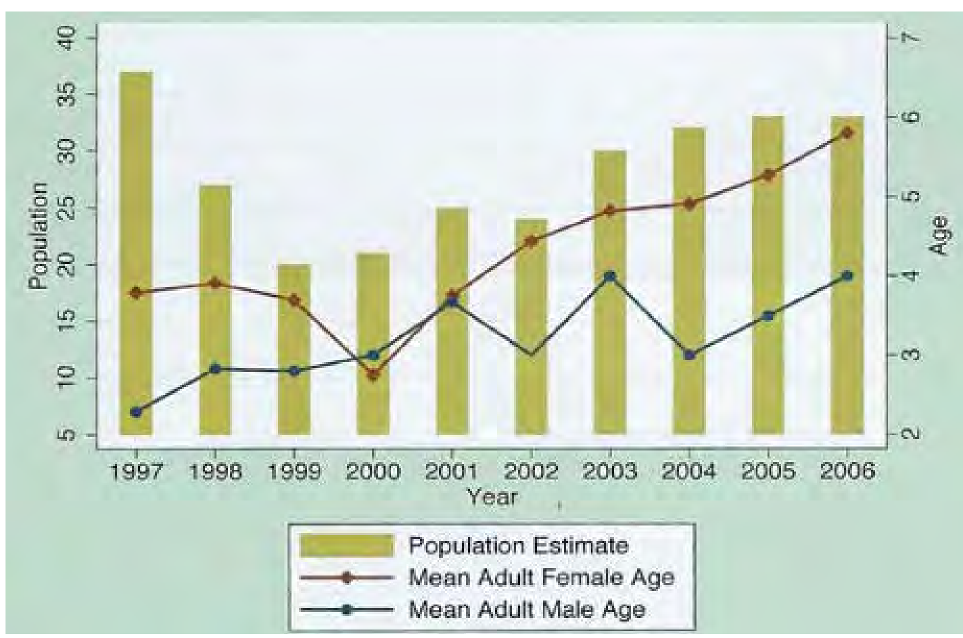
Statewide lion density declined and recovered dramatically between the mid-1990s and late 2000s. This pattern was, in part, driven by dramatic changes in statewide harvest rates that are unlikely to be applied in the future. The current magnitude of variation in statewide age-at-harvest is relatively small and annually variable. During periods when the amplitude of population change is moderate, trends in harvest-age are less informative.

Tracking changes in the ages of harvested animals may be somewhat useful where more direct measures of population trend are not available (such as eastern Montana), but the index is too insensitive to detect moderate, short term changes in an area's lion density. The proportion of older adult animals in harvest (especially females)

Table 6. Montana mountain lion age-in-harvest, 1988 – 2015.

	Female, Average Age	Male, Average Age	Combined, Average Age	% of Harvest > 5 Y.O.
1988	3.45	2.94	3.10	10.3
1989	3.21	3.94	3.75	16.7
1990	4.38	4.38	4.38	26.1
1991	5.04	4.94	4.97	37.6
1992	6.59	6.40	6.46	58.8
1993	4.99	5.39	5.25	39.0
1994	3.67	3.98	3.86	24.0
1995	4.29	4.30	4.29	27.0
1996	3.81	3.07	3.39	13.3
1997	3.70	3.18	3.44	15.4
1998	3.34	2.71	3.04	11.3
1999	3.21	2.60	2.91	12.5
2000	3.42	3.18	3.30	13.2
2001	3.33	3.28	3.31	12.6
2002	3.17	3.07	3.11	4.3
2003	2.93	2.73	2.81	5.5
2004	3.24	2.53	2.79	9.7
2005	3.22	2.95	3.05	10.6
2006	2.76	2.89	2.85	4.7
2007	3.46	3.43	3.44	11.8
2008	3.14	3.53	3.41	14.3
2009	3.34	3.13	3.19	10.8
2010	4.02	3.45	3.65	17.2
2011	3.42	3.00	3.14	10.1
2012	3.76	3.45	3.57	16.7
2013	3.62	3.13	3.33	13.1
2014	3.34	3.35	3.34	11.0
2015	3.09	2.89	2.97	6.8

Figure 21. Minimum mountain lion population estimate, and mean adult (> 24 months) age of harvested lions, Garnet Mountains, MT (Robinson & DeSimone 2011)



is more strongly correlated with annual adult survival than is the overall mean or median age-in-harvest (Wolfe et al. 2015).

Relying on past years' harvest to inform future quotas is also problematic. This "sledgehammer approach" (Logan & Sweanor 2001) uses previous seasons' hunter success rates to determine future harvest quotas. Even if managers reduce harvest quotas as hunter success decreases, these incremental reductions may not match existing population levels and can lead to further declines. Harvest indices are also much less informative in jurisdictions, like Montana, where most harvest is limited by sex-specific quotas.

Patterns in total annual harvest or days required to fill an area's quota can be misleading when factors that are independent of mountain lion population trend most strongly predict year-to-year harvest. For example, in much of the Eastern ecoregion adequate tracking snow is present only sporadically— during winters when there is snow cover, harvest increases. In these cases, quotas effectively prevent excessive harvest during years with favorable tracking conditions even though they will not be routinely met in other years.

Intensive winter track surveys, surveys of public lion observations, and hunter effort generally failed to detect known lion population changes quickly or before large changes in population size had already occurred (Beier & Cunningham 1996, Jenks 2011, Robinson & DeSimone 2011).

Long term capture and radio-telemetry studies were traditionally considered to be the most reliable way to estimate local lion populations (Cougar Management Guidelines Working Group 2005, Jenks 2011). This method requires researchers to attempt to capture and mark all resident individuals within a study area, account for additional unmarked animals, and then extrapolate observed and suspected home ranges across a study area to produce an estimate of abundance (Lambert et al. 2006, Cooley et al. 2009, Robinson et al. 2008 & 2014).

However, capturing, marking, and counting individual lions is impractical for routine lion population monitoring. Intensive capture and radio-tracking projects can take many years to complete, require significant field resources, and are prohibitively expensive (Hornocker & Negri 2009). The uncertainty around estimates developed using this field method is also often difficult, or impossible, to assess. Finally, this technique usually produces only minimum counts because all individuals in a study area are rarely captured and nonresident (transient) individuals are often either missed or discounted (Robinson et al. 2015).

Because it was so difficult to directly monitor mountain lion population size and trend at a large scale, some researchers suggested implementing "zone management" (Logan & Sweanor 2001) or a similar "metapopulation model" (Laundre & Clark 2003) instead. These strategies advise maintaining large and well-distributed lightly hunted refuge areas (sources) that sustain more heavily-hunted areas (sinks) through emigration. Although metapopulation management doesn't rely on accurate population estimates, it does require knowledge of immigration rates between heavily and lightly-hunted areas. Few studies have rigorously estimated these immigration rates and the metapopulation management model's effectiveness remains largely untested.

Although several large patches of un- or lightly-hunted lion habitat (including national parks, wilderness areas, and Indian reservations) undoubtedly act as sources of


FWP biologists recover a DNA biopsy dart from treed mountain lion

lions that disperse to other areas in Montana (Robinson et al. 2015), these refuges are neither extensive or well distributed enough to subsidize unlimited harvest in the remainder of the state.

FWP will not further restrict lion harvest across broad areas of the state in order to create additional specific "source" areas and, therefore, does not intend to use the metapopulation model as the basis for its mountain lion Management Strategy.

Instead, FWP will manage for limited and sustainable mountain lion hunter-harvest opportunity on most lands within its jurisdiction. To enable this approach, FWP will periodically monitor the size and trend of lion populations in the Northwest, West-central and Southwest ecoregions. We will use rigorous, field-based techniques to estimate population size and trend, and we will remain open to incorporating new monitoring methods as they are developed and validated. Distributing this monitoring effort across these three biologically distinct ecoregions will reduce the uncertainty of the estimates developed using local monitoring data (Walters & Holling 1990, Conroy et al. 2012).

Subsequent Trend Monitoring Area abundance estimates can be directly compared to past estimates from the same area. Abundance estimates for the Trend and Supplemental Monitoring Areas (see Montana Mountain Lion Monitoring section, Chapter 5) can also be used to develop abundance estimates for their respective ecoregions. These periodic ecoregional estimates will allow managers to track changes in mountain lion abundance over time and will be included in the Integrated Population Model (Chapter 6) to predict the effect of future harvest prescriptions.

The same regular field monitoring will not be conducted in the Eastern ecoregion. There, lion subpopulations are patchily distributed and the ecoregion annually produces <15% of the state's annual harvest. Other population indices and harvest management strategies will be used in this ecoregion to conserve hunted populations. However, Eastern ecoregion managers may choose to sample lion abundance in specific areas of interest to better understand local populations.

ESTIMATING MOUNTAIN LION POPULATIONS

Capture-recapture (CR) sampling has been a standard method used to estimate a population's abundance for many years (Seber 1982). To produce a traditional CR estimate, some animals in a population are captured, marked, and released. Later, there is another capture effort and the number of marked animals within the second sample is counted. The proportion of the first sample detected in the subsequent sample is then used to calculate a population estimate.

Conventional CR sampling assumes that the effective sampling area's size is known, that animals don't enter or leave the study area, and that all animals have a similar probability of detection (Royle et al. 2013). Species like mountain lion that are wide-ranging, occur at low densities, and are difficult to detect violate these assumptions and may cause CR methods to produce misleading results.

SPATIAL CAPTURE-RECAPTURE

A newer spatial capture-recapture (SCR) method specifically addresses the shortcomings of traditional CR techniques when working with wide ranging, low-density species. SCR has been successfully used to estimate carnivore populations (Royle et al. 2011, Blanc et al. 2013) including mountain lions in Montana (Russell et al. 2012, Proffitt et al. 2015). SCR also works well with less invasive data collection techniques such as acquiring genetic samples from biopsy darts, hair, or scat.

Biopsy darts used to collect genetic samples from mountain lions

The SCR approach allows biologists to estimate population abundance within a defined area while also accounting for animals whose ranges partially or occasionally overlap the area surveyed. SCR methods consider the spatial organization of individual animals and the fact that the probability of an individual being recaptured decreases the farther that animal is from where it was originally detected or is known to reside. SCR methods also allow for sampling effort to vary across a study area when sampling wide ranging species (such as mountain lion) that use heterogeneous habitat.

Mountain lions in Montana prefer areas with habitat features such as forest cover, moderate slopes, forest edges, and intermediate elevations (Newby 2011, Robinson et al. 2015). Consequently, lions are not evenly distributed across different habitat types within an area. SCR methods use information about lion habitat preferences (specifically, the 2016 Montana mountain lion RSF) to inform estimates of population abundance.

Because estimated abundances are spatially explicit, population abundances associated with habitat of a certain quality within a sampling area can be extrapolated across broad landscapes as a function of that landscape's habitat quality. This allows information about lion abundance within Monitoring Areas to be used to estimate lion populations at the ecoregion scale.

SCR methods can also include information from harvested animals in population estimation models, thus allowing sampling to occur where hunter harvest is expected on and around the study area during the period the sampling is taking place (Efford 2014).

ABUNDANCE ESTIMATES

Monitoring an area's mountain lion abundance over time is essential to understanding the effect of hunter harvest on lion populations. However, variation in the ways researchers have defined their study areas, inconsistent reporting of age-classes included in population estimates, and the differences in estimation methodology make directly comparing lion densities reported in the literature nearly impossible (Hornocker & Negri 2009).

FWP will monitor and report the estimated winter density of all non-dependent individual lions—that is, lions that are legal to harvest—within an area

For example, researchers have variously reported densities of all mountain lions (including dependent kittens), the minimum number of resident adults, and the density of lions estimated across both seasonal and annual ranges. FWP will monitor and report the estimated winter density of all non-dependent individual lions—that is, lions that are legal to harvest—within an area.

In Montana, the average age that a young lion becomes independent of its mother is approximately 15 months (Robinson & DeSimone 2011). Montana law prohibits the harvest of young lions with body spots; these spots are nearly gone by 15 months of age (Currier 1983, Lindzey 1987).

Young lions make up a significant proportion of legal harvest. Of the known age lions legally harvested in Montana between 1988 and 2014, 42% were <3 years old and 15% were <2 years old. Many of these juveniles and subadults are transient, having yet to establish a fixed home range. The number of transient mountain lions in a population is difficult to quantify using traditional field sampling methods and this age class is often underrepresented in population estimates reported in the literature (Logan & Sweanor 2001).

Thus, an advantage of the SCR monitoring approach is that abundance estimates will include resident and transient animals, both of which are legal to harvest. The SCR method that FWP will initially use estimates the abundance of all independent aged lions within Trend Monitoring Areas and ecoregions during the winter monitoring period. Because all independent aged lions (including transients) are included, genetically based SCR abundance estimates may well be higher than estimates previously developed using other methods.

MONTANA MOUNTAIN LION MONITORING

FWP will use scientifically sound techniques to monitor Montana lion populations and produce periodic estimates of their size and trend. However, currently available monitoring techniques are both expensive and labor intensive. As field-based monitoring and analytical techniques improve and become more practical, FWP will remain open to incorporating them.

Initially, FWP will use the SCR sampling and analysis methods described by Proffitt et al. (2015) to periodically estimate independent aged mountain lion populations in the Northwest, West-central, and Southwest ecoregions. FWP has identified permanent Trend Monitoring Areas within each of these three western ecoregions which will be sampled on a rotating basis.

An additional Supplemental Monitoring Area within each ecoregion may also be sampled the year after the Trend Monitoring Area is sampled. Unlike the Trend Monitoring Areas, the location of Supplemental Monitoring Areas can change over time. These additional Monitoring Areas will allow FWP to sample a broader range of habitats within the ecoregions. Methods for selecting the permanent Trend and Supplemental Monitoring Areas, the field protocol for collecting data, and a description of the data analysis are included in Appendix 1.

Each new estimate of a Trend Monitoring Area's lion population can be directly compared to past estimates for that same area. In addition, the relationship between lion density and the 2016 RSF within an ecoregion's Trend Monitoring Area (sampled Year 1) and Supplemental Monitoring Area (sampled in subsequent years) can be combined to develop an estimate of population abundance for the larger ecoregion. If, over time, pooling the two Monitoring Areas' data produces ecoregional estimates that are functionally similar to estimates calculated from using the Trend Monitoring Area data alone, continued sampling of Supplemental Monitoring Areas may not be necessary.

Finally, an ecoregion's population estimate will be input into the Mountain Lion Integrated Population Model (Chapter 6) to increase our understanding of past and predicted mountain lion population trend and to evaluate alternative harvest prescriptions. Uncertainty about mountain lion abundance impedes effective harvest management. More accurate abundance estimates will be used in an adaptive management framework to make management more predictable over time. The frequency of monitoring will affect the rate at which this uncertainty is reduced, but monitoring frequency will also depend on the availability of funding and other priorities.

Treed mountain lion, western Montana

CHAPTER 6

THE MONTANA MOUNTAIN LION INTEGRATED POPULATION MODEL

INTRODUCTION

Wildlife biologists use mathematical models to approximate the real ecological systems they manage. These models allow them to better understand how populations work and to make more accurate predictions about how they're likely to change in the future. The most useful models are built using rigorously collected field research data and have a clearly defined purpose. These data (such as the age a male lion will most likely disperse or an adult female's annual survival rate) describe what's most likely to occur as well as the range of probable outcomes we should expect. By combining the best information available about a species or system we can better understand them.

Dr. Paul M. Lukacs and Dr. Joshua Nowak of the University of Montana collaborated with FWP to develop the Montana Mountain Lion Integrated Population Model (IPM; Nowak et al. 2018). The IPM is a tool that combines available information about a mountain lion population (i.e. harvest, abundance, survival, and reproduction) into a single analysis of that population's demography. Managers can use the IPM to describe the effects of past management and make predictions about future population trends.

PREDICTING LION POPULATIONS USING THE IPM

The primary purpose of the IPM is to help wildlife managers, decision makers, and the public understand the effect of past and future harvest on mountain lion populations. The IPM is directly linked to the FWP lion harvest database, and a web interface allows users to input future possible harvest prescriptions (by sex and age class).

Using this information, the model forecasts the future population trend that would likely result from an ecoregion's proposed harvest prescription. The output clearly shows the range and magnitude of the predictions' uncertainty for each year of the analysis; this uncertainty increases the further into the future the model is asked to make predictions.

Periodic abundance estimates that are developed from field-based monitoring (described in Chapter 5) can also be input into the model. These estimates make the IPM's predictions more precise. The IPM outputs the results of model runs as graphs (by population and by age and sex-class) as well as in a tabular format.

Montana's mountain lion IPM was built using the software program PopR which was developed in collaboration with Idaho Fish and Game, South Dakota Game, Fish and Parks and The University of Montana in 2014 (Nowak et al. 2018). PopR is a web based application linked directly to agency harvest databases through an interactive graphic user interface. It allows non-expert users to easily update data and change model parameters (such as assumed survival rates or reproduction) to evaluate the potential effects of future harvest levels. The IPM and web application were specifically designed to be repeatable, transparent, and easy for biologists to use.

The Montana mountain lion IPM can analyze populations within the three western Montana mountain lion ecoregions. Harvest data are input into and analyses are output by the IPM at the ecoregion scale.

The Integrated Population Model is a tool that combines all available information into a single analysis of mountain lion population demographics


Mountain lion traveling through snow, D. Neils

The IPM contains two underlying model components: a biological process model and an observation model (Schaub & Abadi 2011). The biological process model describes what we know about lion population dynamics and vital rates (Caswell 2001). It uses parameters including age-class and sex-specific survival probabilities, fecundity by age-class, and estimates of overall population size (when those field estimates are periodically available). The observation model describes the data collection process and the link between field data, harvest records, and biological parameters.

Field-based estimates of population vital rates have some statistical uncertainty and fluctuate over time. That is, field data (i.e. litter size) occur as a distribution of observed values that produce both a point estimate and a range of likely values. The IPM combines and considers all sources of uncertainty when predicting mountain lion population size and trend.

Field research has shown us that although many lion population vital rates (including reproduction and non-hunting survival) are remarkably consistent across the species' range, variability around average rates can significantly influence populations (Robinson et al. 2014). This variability is explicitly incorporated into the model and carried forward into predictions. The IPM allows users to estimate sex and age-specific population size and growth, as well as the precision of those predictions.

It's difficult to directly measure mountain lion vital rates and population trend frequently or extensively. Fortunately, lion ecology has been studied for decades in Montana and throughout the western U.S. The lion IPM allows for a straightforward application of expert knowledge even when specific information about local or contemporary populations is sparse. The model generates reasonable estimates of those parameters managers cannot directly measure based on the range of values researchers have previously collected in the field.

The IPM uses Bayesian statistics that allow a range of possible but uncertain values to be substituted in lieu of new field data. The range of values can be 'uninformative' (allowing a wide range of values to be equally likely) or 'informative' (where values known to be more likely are given a higher probability). For example, the annual survival probability for mountain lions can take any value from 0 (certain to die) to 1 (certain to live). Field research suggests that annual adult female mountain lion survival is near 0.85 in the absence of harvest. Therefore, an uninformative range of values could be a uniform (0,1) while a more useful informative range of values would have a mean of 0.85 with a standard deviation based on the range of values reported in the research literature. Montana's lion IPM uses informative values based on previous field research to improve model performance because it's impossible to directly measure vital rates every place or every year.

MOUNTAIN LION IPM MULTI-STATE SURVIVAL MODEL

Long-lived species with moderate reproductive rates (like lions) are particularly sensitive to changes in survival rates (Gaillard et al. 1998). The chances of a lion surviving each year also changes as it grows older. Kitten survival is the lowest of any age-class. Field estimates of kitten survival are often biased high because dens are usually located sometime after birth occurs (eg. Robinson et al. 2014) and kitten deaths between birth and when researchers discover the den may not be accounted for. Juveniles and subadults typically experience higher mortality during transient and dispersal movements (Sweaner et al. 2000, Robinson et al. 2008). Once a lion establishes a home range, nonhunting mortality risk decreases until the lion reaches old age. Adult lions typically die from intraspecific strife and human caused sources like road kills, management removals, and sport hunting (Hornocker 1970, Logan et al. 1986, Cooley et al. 2009, Robinson et al. 2014).

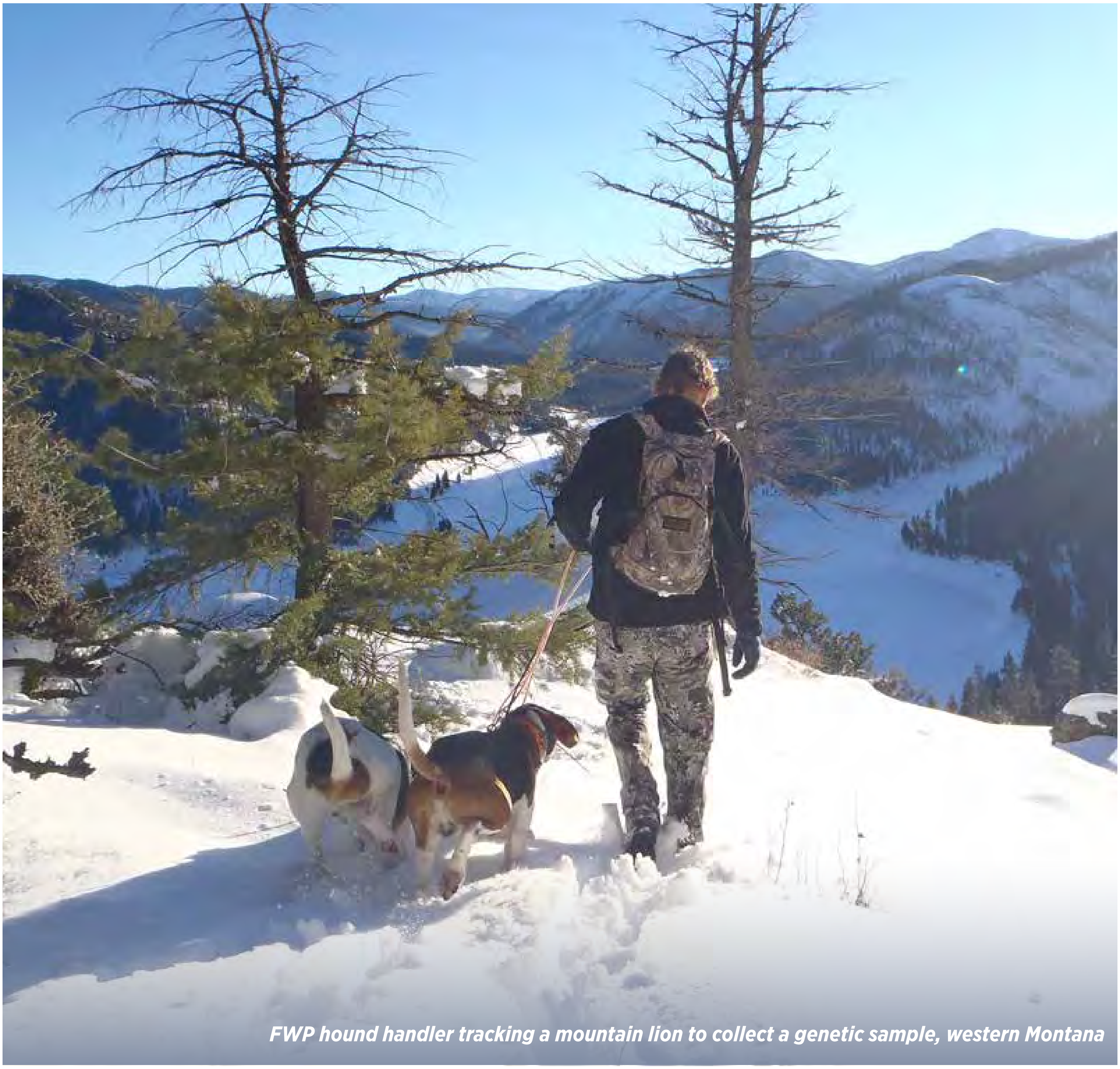
The model generates reasonable estimates of parameters managers cannot directly measure based on the range of values researchers have previously collected in the field

Reported rates of lion survival vary and are plagued by small sample sizes (Hornocker & Negri 2009). The lion IPM default parameters are based on telemetry data from marked lions in Wyoming's Teton Mountains (n = 100, 2001-2012), Washington's Kettle Range (n = 36, 2002-2006) and studies in Montana's Garnet Mountains and National Bison Range (combined n = 127, 1998-2006). These field data describe age and sex-class annual survival probabilities and error distributions used in the model (Appendix 2). Biologists can easily adjust input values if they have reason to believe that vital rates in their area are different from those observed during these field studies.

The IPM uses a known-fate multi-state survival model (Lebreton et al. 1992, Schaub et al. 2010, Servanty et al. 2010, Kery & Schaub 2011). The known fate assumption was necessary because the data included summaries of collar deployments but not true encounter histories. The IPM assumes that at the end of each month an animal could be in one of four states: a lion could be alive, dead by harvest, dead by other causes, or already dead at the beginning of that month. Animals whose fate was unknown because they left the area or whose collar failed are only included in the analysis up until the time they were last observed. Similarly, animals harvested outside Montana were only included up until they left the state so they did not contribute to Montana's estimated harvest rates. A description of these specific biological inputs and assumptions is included in Appendix 2.

POPULATION RECONSTRUCTION

With the exception of kittens, Montana mountain lion reproduction and nonhunting mortality is not significantly affected by typical changes in harvest levels. That is, harvest doesn't reduce the probability of animals otherwise dying and changes in a population's harvest rates don't significantly affect the surviving individuals' fecundity. In much of Montana hunter harvest is the most likely cause of lion mortality. Research on hunted populations in Montana's Garnet Mountains showed harvest to be largely additive to more consistent background nonhunting mortality risk (Robinson et al. 2014), and FWP is not aware of research results demonstrating that harvest of independent aged mountain lions is compensatory with other mortality sources. Because nonhunting mortality occurs at a relatively constant rate, the overall number of animals that die from nonhunting causes will vary with increases or decreases of the overall population.



FWP hound handler tracking a mountain lion to collect a genetic sample, western Montana

Hunter harvest can, and often does, affect lion population growth (Cooley et al. 2009, Hornocker & Negri 2009). Harvest data also gives managers information about past population numbers and sex/age composition in an area. When managers have reliable estimates of past and current population levels, they are better able to predict the effect of future harvest prescriptions on the lion populations they manage. The IPM uses survival estimates along with the annual harvest records to reconstruct past mountain lion populations (Gove et al. 2002, Conn et al. 2008). A description of these specific biological inputs and assumptions is included in Appendix 2.

If we have an estimate of the harvest mortality rate (from telemetry data) and know the number of lions harvested, dividing the number harvested by the harvest mortality rate gives us an estimate of the pre-hunt population size. This is then corrected for an "other mortality" rate, which is relatively constant.

“Population reconstruction” methods have been successfully used to estimate the size and trend of harvested fish and wildlife populations for over 70 years. The technique uses age-at-harvest, total harvest, harvest rate, and the rate of non-harvest mortality to “rebuild” the past population that must have existed in order to have produced the known type and level of harvest.

The IPM uses these age and sex-specific survival estimates (from field research studies) along with the annual harvest rate to reconstruct past mountain lion populations. Current hunter harvest by sex, age, and location (data that, in Montana, are collected during the mandatory lion harvest inspection) is input to the model after the close of the harvest season each year. By combining survival models with observed harvest data, the IPM estimates annual population size as well as a confidence interval around these estimates.

Direct, field-based estimates of population abundance may be input into the model when they are available. These periodic field estimates can significantly improve past and future population estimates for individual lion ecoregions.

MOUNTAIN LION REPRODUCTION INTEGRATED POPULATION MODEL INPUTS

Lions can begin reproducing as early as 17 months of age or as late as 3 years old (López-González & González-Romero 1998). Studies focused on modeling cougar population dynamics often assume females reproduce for the first time at 24 months (Robinson et al. 2008, 2014; Cooley et al. 2009); the IPM uses this same convention.

Lions are induced ovulators, they can conceive during any month of the year (Bonney et al. 1981, Robinson et al. 2014), and gestation lasts about 92 days (Logan & Sweanor 2001). Despite their ability to give birth year round, most researchers working in northern latitudes report a birth pulse in mid or late summer (Laundre & Hernandez 2007, Robinson et al. 2014). The IPM assumes a default birth date of July 1.

Montana mountain lion reproduction and non-hunting mortality is not significantly affected by typical changes in harvest levels

Intervals between subsequent births are a function of gestation length, kitten time to independence, and any lag that may exist between rearing and breeding. Previous population models have assumed a 24-month interbirth period (Robinson et al. 2008 & 2014, Cooley et al. 2009). Field researchers measuring interbirth intervals in the wild report a range of about 17 to 24-months between litters (Lindzey et al. 1994, Logan & Sweanor 2001, Hornocker & Negri 2009). Newborn kittens trail their mothers for 1 to 2 years before dispersing or achieving independence (Hornocker & Negri 2009). In the Garnet Mountains of Montana, Robinson et al. (2014) observed an average dispersal age of 15 months (n = 33, range: 11-23 months), similar to that observed by others (Sweanor et al. 2000; Logan & Sweanor 2001). The IPM uses an interbirth interval of 24 months as the model default.

Mountain lion litter sizes are remarkably similar across a wide range of locations and conditions. A common estimate of litter size is 3 kittens (Spreadbury et al. 1996, Logan & Sweanor 2001, Robinson et al. 2014). Litter size does not appear to vary with harvest intensity, but may fluctuate with prey density (Wilson et al. 2004, Stoner et al. 2006, Robinson et al. 2014). The IPM uses the estimate of an average of 2.92 kittens per litter derived from recent research in Montana's Garnet Mountains (Robinson et al. 2014; n = 24 litters) and it assumes that half of the kittens are female. Throughout the model, the average and range of litter sizes observed in the Garnet study is used to describe a normal distribution of litter sizes truncated between 0 and 3. The model also assumes that litter size remains constant through time and does not fluctuate with population size, prey density, or the female's age. A description of the specific biological inputs and assumptions used is included in Appendix 2.

USER CONTROLS

Biologists can adjust most model inputs such as biological assumptions, future harvest prescriptions, and model controls. The default biological assumptions are based on field research data and should only be changed if users believe that future or local circumstances have changed lion reproduction or non-harvest survival.

Users can easily use sliding scales provided on the user interface to change future harvest prescriptions by sex and to allow the model to estimate the effects of those changes. Users only need to input total anticipated hunting mortality by sex—the model will assign future harvest mortality to age classes that are consistent with the distribution of previously observed harvest ages. If the user believes that the harvest-age distribution will be different than past years, a different distribution can be manually assigned.

For more information on the model controls and settings, including the IPM model's computer code in programming language R, see Appendices 2 and 7.

CHAPTER 7

MOUNTAIN LION HARVEST REGULATION

REGULATION HISTORY

Montana's mountain lion hunting regulations became increasingly complex, and inconsistent, during the 45 years since lions were designated as a big game species. New and modified regulations were adopted in an ad hoc fashion as various Fish and Wildlife Commissions struggled to address public concerns about harvest levels, prey populations, harvest distribution, parity between hound handlers and hunters without dogs, nonresident and outfitter participation, human-lion conflicts, and scores of other issues.

In FWP regions where hunting was allowed, mountain lion harvest was not restricted by quotas or limited licenses until the mid-1980s. Hunters were simply required to purchase a license and allow FWP personnel to inspect lions following harvest. By 1988, most FWP regions had established Lion Management Units with individual harvest quotas (and/or female subquotas) to limit harvest. The Department began to require harvested lions to be reported to a hotline within 48 hours and presented for physical inspection within 10 days. The reporting period was reduced to 12 hours in subsequent seasons.

Until 1997, most Winter lion hunting seasons ran from 12/1 to 2/15, after which hound handlers could continue to pursue lions with dogs during dedicated "chase" or "training seasons" that extended into April. More recently, hound training seasons open 12/2 and run concurrent with established harvest seasons.

Montana lion populations appeared to significantly expand and grow after 1980, as did the popularity of recreational hound hunting. Both resident and nonresident hunter participation increased to historically high levels by the mid-1990s (Figure 22) and the number of nonresident hunters was not limited. During that period, conflicts between resident hound handlers, nonresident hunters, and outfitters were common in portions of northwest and west-central Montana where winter snow is consistently present and there is plentiful access to public land lion habitat. For example, In Region 1 approximately half of harvested mountain lions were taken by outfitted or nonresident hunters during the 1990s—guided hunter harvest often closed LMUs before local "weekend" hunters had an opportunity to hunt. Similarly, over 30% of successful hunters in Region 2 were nonresidents during the 1990s; this proportion rose to 47% by 2005.

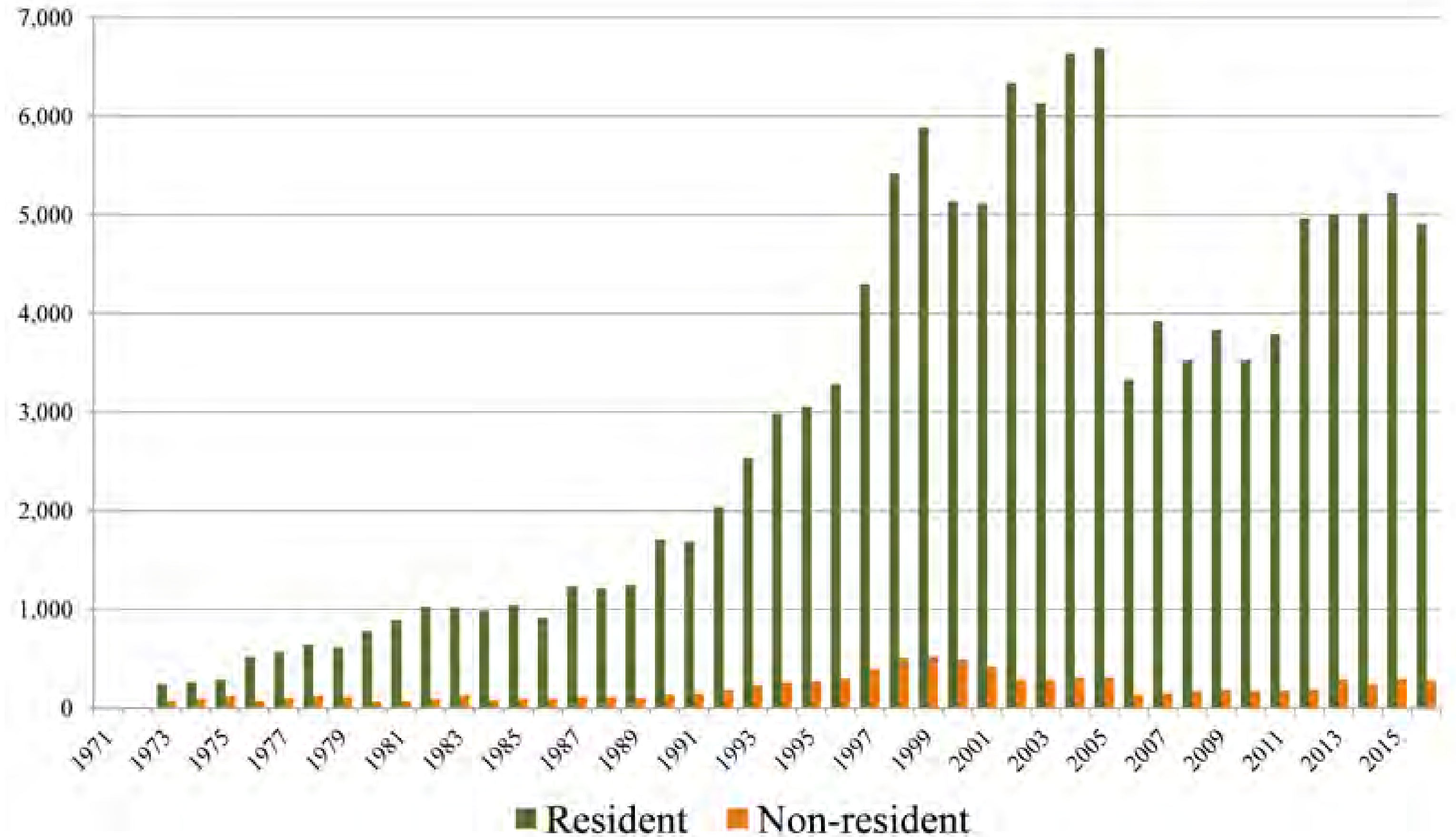
In 2000, FWP's Region 1 began to issue resident mountain lion hunting permits which, in effect, limited nonresident hunters' opportunity. Beginning in 2005, most Region 1 LMUs were managed using limited Special Mountain Lion Licenses that restricted nonresidents to no more than 10% of the licenses offered in a drawing.

Montana's mountain lion hunting regulations became increasingly complex, and inconsistent, during the 45 years since lions were designated as a big game species

Similarly, in 2006, Region 2 began to require that nonresidents draw a Special Mountain Lion License to harvest a lion in most of the region. Resident lion harvest was managed using a quota and nonresident Special License numbers could not exceed 10% of an LMU's total quota. The Fish and Wildlife Commission required that both resident and nonresident hunters draw a Special Mountain Lion License in most Region 2 LMUs beginning in 2008.

In Region 2, managers were not able to achieve predictable harvest using only these Special Mountain Lion Licenses. License fill rates varied widely from year-to-year and across LMUs. Female lion harvest was also virtually eliminated despite rapidly increasing populations. Therefore, in 2012,

Figure 22. Montana mountain lion license sales, 1973 – 2015.



Region 2 introduced an additional Late Winter Season (opening 2/1) during which hunters with a General Lion License could hunt until any quotas previously unfilled by Special Mountain License holders were met (this became known as a "hybrid" season). Nonresident participation was unlimited during the Late Winter Season and nonresident harvest rates more than doubled after the Late Winter Season was adopted.

Regions 3-7 continued to limit harvest during this period using sex-specific quotas and subquotas. Conflict between resident and nonresident hunters in these regions was low and the Fish and Wildlife Commission did not impose restrictions on nonresident harvest opportunity in these Regions.

Prior to 1997, all legal harvest occurred during the Winter Season (that immediately followed the 5-week fall General Deer/Elk season) during which hunting with the aid of dogs was allowed. Beginning that year, portions of the state began to also allow lion harvest during the fall General Deer/Elk Season but without the use of dogs—fall seasons were adopted statewide in 1999. In 2010, the Commission added a statewide Archery Only Season that corresponded with the Archery Only Deer/Elk Season.

The Commission responded to concerns that Fall Season harvest could significantly reduce winter hound harvest opportunity by adopting separate LMU harvest quotas for the combined Archery Only and Fall Seasons. In most cases, if harvest prior to the Winter Season(s) exceeded 20% of a lion management unit's total quota or number of Special Lion Licenses, that LMU's Fall Season would be closed.

The separate quota for Archery Only and Fall Season harvest added complexity to the regulations but did not appear to meaningfully affect the seasonal distribution of lion harvest. Between 2007 and 2016, 95% of all hunter harvested lions in Montana were taken during the Winter Seasons with the aid of dogs. During that same period 11% of the state's LMUs were closed during any given Archery

Only or Fall Season due to the 20% quota being met and 85% of those LMUs had an Archery Only/Fall quota equal to only one lion. Harvest that met fall quotas in these LMUs occurred a median of 16 days from the end of the 85-day Archery Only/Fall Season. The Archery Only/Fall Season quota was unlikely to reduce overall harvest in LMUs because that harvest was deducted from the LMU's quota and subquota.

However, harvest during the fall seasons is additive to prescribed Winter Season harvest in LMUs where the number of Special Mountain Lion Licenses issued serves as the effective harvest limit. Because of this difference, maintaining a separate Archery Only/Fall Season harvest quota may be necessary in LMUs where harvest is managed using Special Mountain Lion Licenses, instead of quotas.

HARVEST SEASON SETTING

This Strategy identifies four mountain lion ecoregions within the state that will be the basis for both monitoring populations and establishing broad harvest objectives. Within an ecoregion, FWP managers will work with the public and the Fish and Wildlife Commission to:

1. Develop clear and measurable population, harvest, and hunter opportunity objectives for the ecoregion.
2. Determine an overall harvest prescription that is likely to achieve the ecoregion's explicit population objectives.
3. Distribute harvest opportunity across the ecoregions' LMUs to address local concerns, reduce hunter crowding, and to focus or limit harvest where necessary.
4. Actively monitor the effect of the harvest prescription over time.
5. Adjust management objectives and harvest prescriptions, as necessary.

This process is described, in detail, in Chapter 8.

The amount of harvest that occurs in any one LMU matters much less to an ecoregion's mountain lion population than the overall harvest within that LMU's ecoregion. That is, whether an individual LMU's harvest limit (or quota) is reached or exceeded during a given year (due to weather, hunter participation, or other factors) is less important that the total annual ecoregional harvest.

Managers may intentionally recommend a relatively high harvest rate in certain LMUs (e.g. those including urban areas) or relatively low harvest rate in others (where access is challenging or tolerance for lions is high). As long as harvest is generally distributed across an ecoregion, the sum total of harvest is what will affect the ecoregion's population status and trend.

Therefore, in an LMU where harvest is limited by a quota, that quota will simply serve as "trigger" to initiate the closing of the LMU to further harvest. A quota is not necessarily a harvest objective for the LMU. When setting LMU quotas, biologists will anticipate how much additional harvest (if any) is likely to occur between the time the LMU's Season closure is publicly noticed and when the closure is effective. Subsequent ecoregional harvest decisions will consider the actual harvest that occurred in previous years' Seasons. Individual LMU quota "over runs" or "under runs" will be fully accounted for in future management decisions.

From a population standpoint, harvest that occurs in any one LMU matters much less than the overall level of harvest within that LMU's ecoregion

In LMUs managed using Special Mountain Lion Licenses, an area's average Special License fill rate (by sex) will be used to determine the overall number of licenses that should be offered to meet the ecoregion's harvest objective. Any differences between projected and observed Special License fill rates will be considered when determining future license levels. As with General License areas, decisions about future harvest prescriptions will be based on the modeled and measured effect the actual past harvest had on ecoregional populations.

There is little biological justification to frequently adjust mountain lion harvest prescriptions. Large scale mountain lion populations are very resilient to moderate changes in harvest and updated population estimates (both within trend areas and for the western ecoregions) will be available only periodically. Therefore, although FWP will routinely consider changes to mountain lion hunting season structure and quota levels, actual adjustments could be made less frequently.

LEGAL AUTHORITY

The Montana Fish and Wildlife Commission has statutory authority to regulate the management of wildlife (87-1-201), specifically "Large Predators" (87-1-217), including mountain lions. The Commission may determine seasons, bag limits, possession limits, and means of take for mountain lions as it deems appropriate (87-1-304). Montana statute describes specific resident and nonresident licenses required to hunt mountain lions (87-2-507, 508) and the license necessary for residents to pursue lions with dogs during the Training Season (87-2-521). Montana law limits hunters to taking no more than one mountain lion per license year (87-2-702) and allows the use of dogs to hunt or capture mountain lions during designated seasons (87-6-404). It is legal to kill a mountain lion at any time that is attacking, killing, or threatening to kill a person or livestock (87-6-106), using dogs if necessary (87-3-127).
Consistent with Montana law and Administrative Rules, when the Commission decides that it's necessary to limit nonresident harvest opportunity

Montana law specifically allows the Commission broad discretion to regulate the allocation of hunting opportunity among resident and nonresident hunters:

87-1-301. Powers Of Commission

(6) (a) The commission may adopt rules to:
(i) limit the number of nonresident mountain lion hunters in designated hunting districts; and
(ii) determine the conditions under which nonresidents may hunt mountain lion in designated hunting districts

(b) The commission shall consider, but is not limited to consideration of, the following factors:

(i) harvest of lions by resident and nonresident hunters;
(ii) history of quota overruns;
(iii) composition, including age and sex, of the lion harvest;
(iv) historical outfitter use;
(v) conflicts among hunter groups;
(vi) availability of public and private lands; and;
(vii) whether restrictions on nonresident hunters are more appropriate than restrictions on all hunters.

under the above statute, nonresident licenses will be limited to numbers not exceeding 10% of the total licenses or quotas assigned to a given hunting area (87-2-506, 12.3.105). LMUs with a quota (or number of licenses) of less than 10 will be combined with similar Regional LMUs and a number of nonresident licenses, not exceeding 10% of the combined total quota(s), will be allocated among those districts on a rotating basis (as described in ARM 12.3.116)

MODEL HARVEST REGULATIONS

Following are the three mountain lion hunting season structure alternatives Montana will use to manage hunter harvest. Managers may select an LMU's Season Type from among these three alternatives to consistently address the diversity of management challenges and needs across the state while minimizing regulation complexity. In most cases, changes to an individual LMU's season structure and/or quota(s) will be considered every second year.

Season Type 1: Special Mountain Lion License LMU

MCA 87-1-304(e) allows the Fish and Wildlife Commission to issue limited Resident (Class D-2) and Nonresident (Class D-1) Special Mountain Lion Licenses. These licenses are valid in a single LMU and hunters can harvest a mountain lion only in that LMU during the Winter Season. FWP offers a limited number of these Special Licenses each season. Therefore, they are allocated by a random drawing and nonresident hunters are limited to no more than 10% of the total number of available licenses (87-1-301). Sex-specific licenses or subquotas may also be designated to help achieve harvest objectives. Once a subquota is met (and the season for that sex closes), Special License holders may continue to hunt for lions of the remaining sex through the end of the legal harvest season. Both Special License holders and General License holders may harvest a lion during the Archery Only and Fall Season Without Dogs in these LMUs, but that harvest will be subtracted from any sex-specific subquotas for that LMU. Managers may choose to implement a combined Archery Only/Fall Season quota or subquota where necessary.

Season Type 2: General License LMU

Hunters possessing a General License may harvest a mountain lion during the Archery Only, Fall Season Without Dogs, or Winter Seasons until the total or sex-specific quota for that LMU is met. There is no additional limit to nonresident opportunity to harvest a mountain lion using this Season Type.

Season Type 3: Resident General License, Nonresident Special Mountain Lion License LMU

Resident hunters possessing a General License may harvest a mountain lion during the Archery Only, Fall Season Without Dogs, or Winter Seasons until the total or sex-specific quota for that LMU is filled. Nonresident hunters must apply for, and receive, a LMU-specific Special Mountain Lion License to harvest a mountain lion in that LMU during the Archery Only, Fall Season Without Dogs or Winter Season. Special Mountain Lion Licenses will be offered to nonresident applicants in quantities not exceeding 10% of the LMUs total combined harvest quota(s). LMUs with a total quota of less than 10 will be combined with similar Regional LMUs and a number of nonresident licenses, not exceeding 10% of the combined total quota(s) for those LMUs, will be allocated among those LMUs on a rotating basis (as described in ARM 12.3.116).

CHAPTER 8

ADAPTIVE HARVEST MANAGEMENT

This Strategy will provide FWP and the public with more accurate information about Montana's current, and likely future, mountain lion populations. However, there will always be some uncertainty about the precise effects of our management actions on lion populations. Although the overriding Conservation and Management Guidelines that direct Montana's mountain lion management decisions will not change, specific local management objectives may well need to be refined over time as more information becomes available and conditions change.

In this chapter, we describe the adaptive harvest management process FWP will use to develop, evaluate, and adjust specific mountain lion management actions. This process relies on field monitoring and population modeling data (described earlier in this Strategy) to measure the results of management actions against explicit objectives that the public, FWP, and the Fish and Wildlife Commission collaboratively develop.

FWP hound handler collects genetic sample during mountain lion SCR monitoring in western Montana's Region 2.

Adaptive management can help reduce decision-making gridlock by making it clear that decisions are provisional, their effects will be carefully monitored, and that modifications are expected

Adaptive management is a science based approach to decision making that's useful when there is uncertainty about a decision's outcome. It is a cycle of planning for an action, doing the action, measuring what happened, and then modifying the next action (if needed) based on what you learned. The basic principles of adaptive management have been used for centuries (Falaruw 1984) and are increasingly employed by natural resource management agencies, including FWP (Montana Fish, Wildlife and Parks 2001).

The process works to continually improve our understanding of a system by comparing the resource's actual versus predicted response to management treatments (Nichols & Williams 2006, Williams et al. 2007). Adaptive management emphasizes 'learning while doing' and then adjusting management based on what was learned (Walters & Holling 1990). It is specifically not 'trial and error'— instead, managers explore alternative ways to meet management objectives, predict the outcomes of those alternatives based on the current state of knowledge, implement one or more alternatives, monitor the impacts of the management actions, and then use the results to adjust management actions as needed to more effectively meet objectives. Over time, resource management improves while uncertainty is reduced.

An adaptive management system requires the following conditions (Williams & Brown 2012):

- Resources are responsive to management but actual outcomes are uncertain;
- Management objectives are clear and measurable;
- There is both a range of management alternatives and the flexibility to change prescriptions as understanding improves over time;
- Monitoring can effectively describe the effect of the management action;
- There is a sustained commitment to the process by both stakeholders and decision makers.

Resource models are a critical component of the adaptive management approach. Models allow managers to use the most current information to predict the effect of possible treatments. They also represent what we don't yet know about how the system works—these uncertainties are explicitly incorporated into the model. The credibility of predictive models can improve through time as new information becomes available and uncertainty is reduced.

The effects of management actions must also be monitored so that the actual response can be compared to what was initially predicted. A successful monitoring program provides data that specifically describes the effects of the management action. Monitoring efforts must be designed from the start with that goal in mind (Szaro et al. 1999, Nichols and Williams 2006).

Disagreement about the past, and potential, effects of management decisions often leads to conflict among stakeholders. Adaptive management can help reduce decision making gridlock by making it clear that decisions are provisional, that their effects will be carefully monitored, and that modifications are expected. Management itself allows us to learn about, and therefore better manage, the resource through time.

Stakeholders and managers work collaboratively to develop mountain lion harvest reguations in Region 2 (2012).

MONTANA'S ADAPTIVE MOUNTAIN LION HARVEST MANAGEMENT PROGRAM

An adaptive harvest management process will guide most of Montana's mountain lion harvest decisions. FWP will use the best available science to develop the modeling and monitoring methods necessary to fully implement this Strategy. The modeling and monitoring techniques described in this document will be periodically reviewed and updated to ensure that we continue to use the most rigorous and up-to-date scientific methods practically available.

FWP used a habitat model (Chapter 3) to describe four distinct and biologically meaningful mountain lion "ecoregions" within the state (Chapter 4). These ecoregions will be the spatial basis of FWP's lion monitoring program. FWP will work with stakeholders to periodically develop measurable mountain lion management objectives for each of these ecoregions. These objectives will be periodically reviewed, and potentially refined, by FWP and the public.

The likely effects of alternative harvest prescriptions will be evaluated using an Integrated Population Model (Chapter 6). These predictions will help stakeholders and FWP recommend an alternative to the Fish and Wildlife Commission that is most likely to meet that ecoregion's objectives.

In most cases, management alternatives will include an overall harvest prescription for each ecoregion. Harvest opportunity will then be allocated among the ecoregions' individual lion management units to distribute hunter effort and address local issues.

FWP will use field data to periodically estimate mountain lion population size, composition, and trend within the Northwest, West-central, and Southwest ecoregions (Chapter 5). These periodic population estimates will be used to improve the IPM's predictions, to assess how well management objectives are being met, and to inform decisions about future harvest prescriptions.

Other monitoring data including hunter effort and success, location and age of harvested animals, conflict rates, and prey status will be collected annually throughout the state. These additional data will be considered when evaluating management alternatives. Harvest data, weather, patterns of conflict, harvest success and other metrics will be the primary data used to guide management in the Eastern ecoregion.

The adaptive management approach includes the following basic steps (Figure 23):

Step 1 – Involve stakeholders

Stakeholders (including the public, managers, and decision makers) help design an adaptive management program, set management objectives, and develop management actions. Stakeholders must be committed to the adaptive management process for the long term.

FWP biologists and managers routinely meet with hound handlers, other hunters, and mountain lion advocates to share data and solicit public input concerning ongoing mountain lion management. The Fish and Wildlife Commission will generally consider proposals to adjust harvest season structure and/or harvest quotas every two years during the biennial season setting process.

Step 2 – Set objectives

Objectives must be clear and measurable. These objectives are benchmarks against which to compare the potential effects of management alternatives. They also serve as means to evaluate how effective management actions were, once implemented.

There may be discrete objectives for population composition and trend, hunter experience, harvest distribution, rates of reported conflict, etc. It's important that an objective identifies a clear time by which it should be met and clearly describes how progress toward that objective will be measured.

An example of clear and measurable objectives would be:

> ***"The 2023 Northwest ecoregion estimated population of independent age mountain lions will be between 1,100 and 1,300 animals", and***
>
> ***"The proportion of >5-year-old male mountain lions harvested in the Northwest ecoregion will exceed 12% during 4 of the next 6 hunting seasons"***

Step 3 – Develop management alternatives

Identify a set of potential management actions that, based on the best information available, are likely to help meet the objectives.

For example, competing harvest alternatives could be:

> ***Alternative 1: "Offer a total of 160 Special Licenses with a male subquota of 70 in LMUs 100 – 130; maintain a total "any legal" mountain lion quota of 30 in LMUs 132 – 170; and maintain a quota of 30 females and 50 males distributed across LMUs 200 – 203, the MSMA, and 283/285 during the 2018 – 2019 hunting seasons in order to harvest an average of 130 male and 90 female lions annually", or***
>
> ***Alternative 2: "Offer a total of 200 Special Licenses with a male subquota of 80 in LMUs 100 – 130 and maintain a total any legal mountain lion quota of 30 in LMUs 132 – 170; and maintain a quota of 45 females and 70 males distributed across LMUs 200 – 203, the MSMA, and 283/285 during the 2018 – 2019 hunting seasons in order to harvest an average of 150 male and 110 female lions annually"***

Step 4 – Use models to predict the alternatives' effects

Models can describe our current understanding about how a system works and explicitly represent our uncertainties. Models are used to predict likely responses of a resource to management actions.

In our example, biologists would use the Integrated Population Model to evaluate which of the previous alternatives is most likely to move the overall Northwest Ecoregion's independent aged mountain lion population toward the 1,100-1,300-objective range in 6 years and recruit sufficient older age-class toms each year to also meet the harvest-age composition objective. If neither alternative is likely to meet both objectives, new alternatives will be developed and evaluated.

Step 5 – Develop monitoring plans

Design a monitoring plan that effectively tracks the resource's status relative to the objectives. Monitoring must produce data relevant to the management situation that motivated the monitoring in the first place.

For our example, there would be three monitoring plans in place:

> ***1. Teeth will be extracted from all harvested lions upon mandatory inspection resulting in a >90% age assignment rate using cementum annuli analysis, and***
>
> ***2. Actual 2018 and 2019 Northwest ecoregion harvest, by sex, will be input into the Integrated Population Model following the 2019 season to reassess population trend relative to the population objective, and***
>
> ***3. A Spatial Capture-Recapture field estimate of lion abundance will be developed for the Northwest ecoregion Trend Monitoring Area in 2023 and Supplemental Monitoring Area in 2024. Biologists will directly compare the 2018 and 2023 Trend Monitoring Area population estimates. The relationship between observed mountain lion abundance and the RSF for both monitoring areas will be combined to produce an estimate of independent age mountain lions in 2024, which will be input into the IPM.***

Step 6 – Make management decisions

Select management actions that are likely to move the resource toward the objectives.

For our example:

> ***Managers will recommend a preferred alternative or alternatives to the Fish and Wildlife Commission who will make a management decision for the upcoming hunting seasons.***

Step 7 – Monitor the resource

Measure the resources' response to management actions.

FWP will implement the monitoring plans described in Step 5.

Step 8 – Assess management success

Compare the predicted vs. observed changes in the resource's status to improve our understanding of the system and allow better decisions to be made in the future.

For our example:

> ***Monitoring data indicate that the overall population objective has been (or is likely to be) achieved but the harvest-age composition objective has not.***

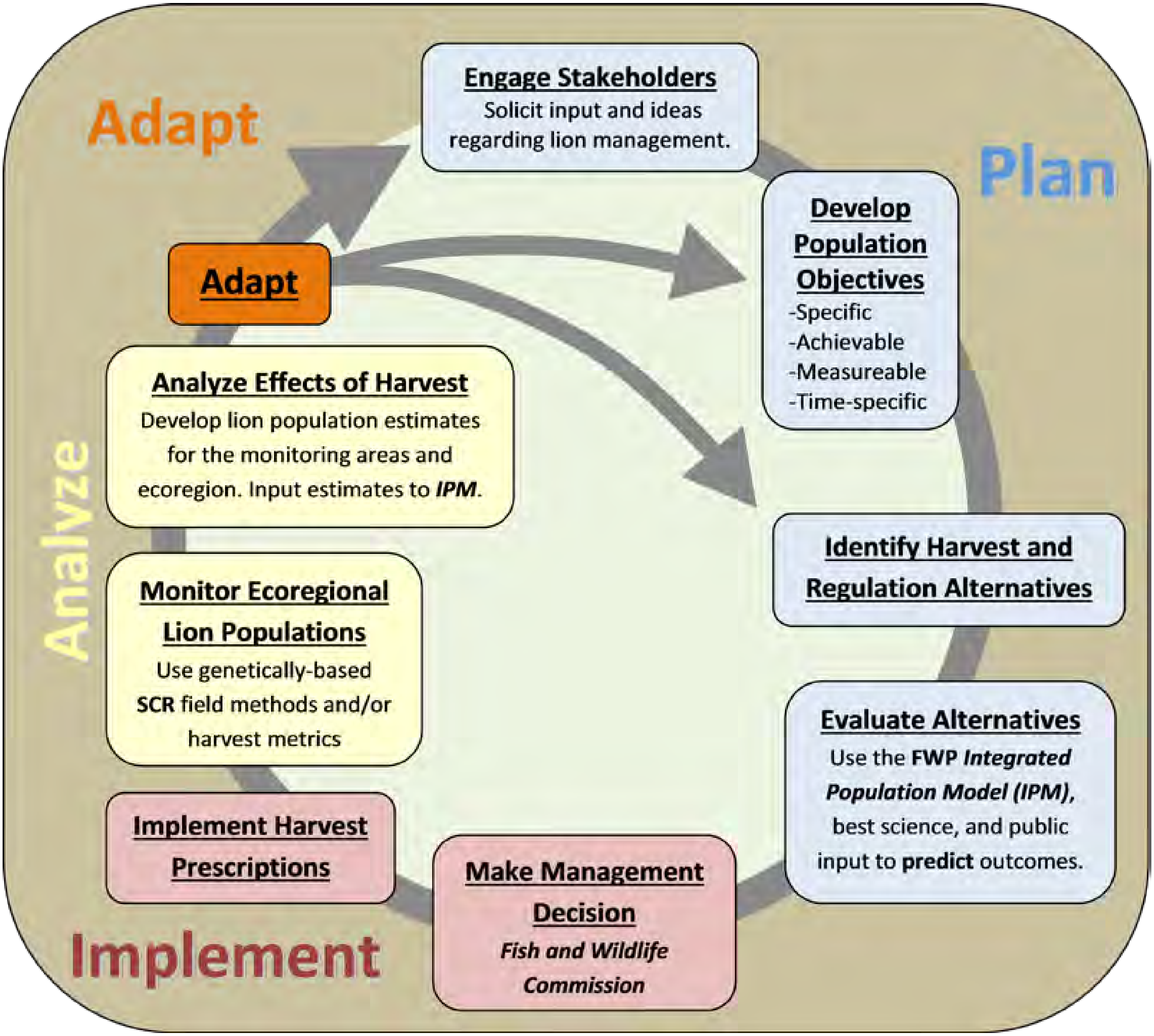
Step 9 – Repeat the process

Cycle back to Step 6 and, less frequently, to Step 1. Predictive models will improve based on new information. Objectives can change over time.

For our example:

> ***Managers propose a revised harvest prescription that maintains female harvest at a similar level while reducing male harvest.***

Figure 23. Adaptive mountain lion harvest management process.



CHAPTER 9

REGIONAL MANAGEMENT CONSIDERATIONS AND OBJECTIVES

Mountain lion populations will be monitored, modeled, and managed at the ecoregion scale. However, it is important to recognize the social and biological issues that are unique to each FWP administrative Region. FWP wildlife managers are experts in their regional landscapes and communities, opportunities to gather public input are organized regionally, and regional managers develop and submit individual hunting season proposals for Fish and Wildlife Commission consideration. Responses to human-lion conflicts are also coordinated by Regional managers and field staff.

This Strategy will require that FWP and the public work across FWP regional boundaries to develop management objectives and alternatives for each of the 4 broader mountain lion ecoregions. They will also need to collaboratively work to distribute an ecoregion's harvest prescription because the ecoregion's constituent LMUs lie within more than one FWP administrative region.

This chapter presents each FWP administrative region's mountain lion management history and some local factors that will need to be considered as ecoregional management proposals are developed and evaluated.

This Strategy will require that FWP and the public work across FWP regional boundaries to develop management objectives and alternatives for each of the 4 broader mountain lion ecoregions

REGION 1

Approximately 80% of FWP Region 1's area is high-quality mountain lion habitat (Chapter 3), the most of any of the state's 7 administrative Regions (Figure 24). Because of this, and the Region's abundant white-tailed deer, it may support the highest overall mountain lion density in the state. Mountain lion habitat occurs almost entirely on either public or publicly accessible private land and tracking snow is generally present throughout the Winter Season.

Region 1 lion harvest was unlimited until specific LMU quotas were adopted in 1986. Harvest was managed using a system of total quotas and female subquotas through 1994, followed by a total quota system until 1999 (Table 8).

Regional harvest steadily increased throughout the 1990s (Table 7) and the average age of harvested lions also increased during this same period. In the late 1980s, only 38% of the harvest was made up of older (≥ 3 years) lions. That proportion increased to 66% older individuals as the harvest steadily increased from 1990 to 1996.

Mountain lion harvest increased during the 1990's such that even historically-high quotas were exceeded in 1995 and 1997. Harvest then began to decline in 1999 following a drop in harvest-age structure that began in 1997. The effect of high harvest levels (especially of females) was likely exacerbated by a severe winter in 1996-1997 that significantly reduced both the Region's deer populations and subsequent recruitment (Montana Fish, Wildlife and Parks 2006).

Quota-based, General License harvest regulations did not limit nonresident hunter participation during the 1990s and conflicts between nonresident/outfitted hunters (who in some years took nearly half of all Region 1 lions) and resident hunters became unacceptably common.

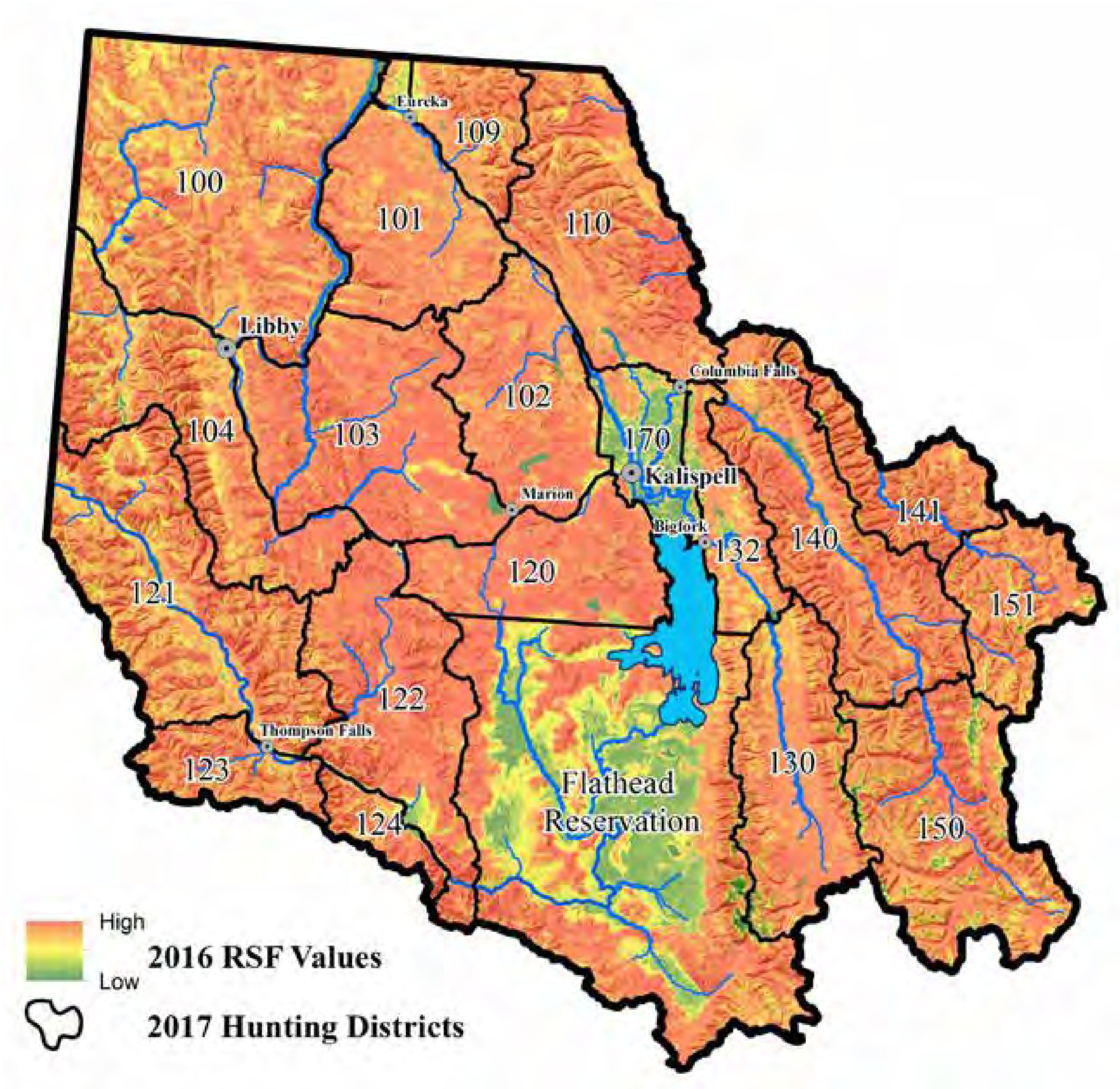
Between 1997 and 2004, only 39% of harvested lions were 3 years old or older. In 2000, declines in the Region's age-in-harvest and overall harvest, combined with a public demand to prioritize resident hunter opportunity, led the Fish and Wildlife Commission to change the Region's management approach. The Commission restricted resident and nonresident harvest by requiring a Special Lion License, obtained through a drawing, across much of the Region that year.

Table 7. Region 1 mountain lion harvest, 1971 – 2016.

License Year	R1 F	R1 M	R1 Unk	R1 Tot.
1971	10	11	0	21
1972	9	13	0	22
1973	4	19	0	23
1974	23	23	0	46
1975	27	27	0	54
1976	18	20	0	38
1977	21	21	0	42
1978	12	14	0	26
1979	8	21	0	29
1980	9	6	0	15
1981	20	25	0	45
1982	18	26	1	45
1983	27	31	0	58
1984	13	29	1	43
1985	17	30	1	48
1986	16	32	0	48
1987	22	25	0	47
1988	18	34	0	52
1989	20	46	0	66
1990	30	55	0	85
1991	40	69	0	109
1992	50	67	1	118
1993	53	86	0	139
1994	81	122	0	203
1995	80	100	0	180
1996	87	94	0	181
1997	119	112	0	231
1998	139	105	1	245
1999	92	86	0	178
2000	103	93	0	196
2001	80	83	0	163
2002	67	61	0	128
2003	57	47	0	104
2004	42	69	0	111
2005	52	59	2	113
2006	20	50	0	70
2007	20	64	0	84
2008	32	62	0	94
2009	29	63	0	92
2010	42	83	0	125
2011	53	89	0	142
2012	46	78	0	124
2013	50	79	0	129
2014	43	57	0	100
2015	41	68	0	109
2016	49	56	0	105

In 2005, a combination of limited entry (Special Licenses) and quota systems were adopted in Region 1. The goals of this harvest strategy were to 1) maintain a high-quality hunting experience, 2) limit nonresident hunter harvest in some LMUs, 3) prevent the overharvest of adult females while recruiting more mature males into the population, and 4) prevent FWP regulations from limiting effective harvest in LMUs where tolerance for lion presence was low. Region 1 documented a higher percentage (55%) of older individuals (≥ 3 years) in the harvest during the years following the change (2005 – 2013). In 2014, the Commission adopted a male subquota, limited entry hunting season type for most Region 1 LMUs.

Figure 24. FWP Region 1 2016 mountain lion winter RSF and hunting districts.



In 2017, 13 of the Region's 18 LMUs issued a limited number of Special Licenses, available through a drawing, with nonresidents limited to 10% of the total number of Licenses offered. The Region's remaining 5 LMUs managed harvest using General Lion Licenses; harvest in these Units is generally limited by overall quotas and male subquotas. LMU 170 (the Flathead Valley) is the single exception. An unlimited number of lions could be taken each season in this highly developed, urban, LMU. In practice, however, lions are rarely harvested in LMU 170—only 4 lions were taken by hunters in that Unit between 2007 and 2016.

The predominant use of limited Special Licenses in Region 1 has effectively emphasized resident hunter harvest—between 2007 and 2016 an average of only 13% of harvested lions were taken by nonresidents there.

Region 1 lies entirely within the Northwest mountain lion ecoregion (Figure 25). The Region's biologists and public will work with their counterparts in Region 2 (that includes the remainder of the Northwest ecoregion) to adaptively manage the ecoregion's mountain lion population.

Model Harvest Regulation **Season Type 1: Special Mountain Lion License** and **Season Type 2: General License** will initially need to be employed to address Region 1's diverse social and biological management needs.

Figure 25. FWP Region 1 hunting districts and mountain lion ecoregion.

Specific harvest and population objectives will be identified and evaluated through the adaptive harvest management process (Chapter 8). However, Region 1 will generally advocate for limited adult female harvest in the Northwest ecoregion so that the overall, long term, population growth rate within the ecoregion is stable or positive. Region 1 will also support harvest proposals designed to recruit and maintain older age-class males in the ecoregion. Mountain lion harvest across the Region will be generally distributed in proportion to the various LMUs' estimated mountain lion habitat quantity and quality.

Region 1 will recommend season types that effectively limit nonresident hunter harvest, where necessary, to maintain a high-quality hunting experience for resident mountain lion hunters.

Region 1 will also ensure that hunting regulations do not limit hunter harvest in densely populated areas of the Region (such as LMU 170) where human-lion conflicts are likely. Human-lion conflicts will be mitigated using both hunter harvest and effective responses to individual incidents that are consistent with the Depredation and Control Guidelines (Appendix 3).

Table 8. Summary of Region 1 mountain lion harvest regulations, 1971 – 2017.

License Year	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
Mandatory Inspection	None		10 Day Inspection					4 Day Inspection				48 Hr. Inspection		10 Day Inspection	72 Hr. Inspection	48 Hr. Inspection
Hunting season	Opening of General D/E - 4/30			Opening of General D/E - 4/30; HD 150 9/15 - 11/24			12/1 - 4/30; HD 150 9/15 - 11/27	12/1 - 4/30; HD 150 9/15 - 4/30	12/1 - 2/15; HD 150 9/15 - 2/15	12/1 - 2/15; HD 150 & 151 9/15 - 2/15						
Chase/Hound Training	None								2/16 - 4/30							
Regional Quotas	UNLIMITED; One ES Adult Lion per Hunter															Total = 52; FSQ = 26

License Year	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Mandatory Inspection	48 Hr. Report; 10 Day Inspection								24 Hr. Report; 5 Day Inspection			24 Hr. Report; 10 Day Inspection	12 Hr. Report; 10 Day Inspection			
Hunting season	12/1 - 2/15; HD 150 & 151 9/15 - 2/15										Fall Season w/o dogs; 12/1 - 2/15; HDs 150 & 151, 9/15 - 2/15	Fall Season w/o dogs; Winter Season, 12/1 - 4/14; HDs 150 & 151, 9/15 - 4/14				
Chase/Hound Training Season	2/16 - 4/30											No dedicated Chase Season, Hound Training allowed during Winter Hunting Season				
Regional Quotas	Total = 52; FSQ = 26	Total = 55; FSQ = 28	Total = 68; FSQ = 32	Total = 77; FSQ = 38	Total = 98; FSQ = 51	Total = 95; FSQ = 53	Total = 97; FSQ = 51	Total = 119; FSQ = 90	Total = 145, Any Legal Lion	Total = 175, Any Legal Lion	Total = 204, Any Legal Lion	Total = 229, Any Legal Lion	Total = 216, Any Legal Lion	Total = 203, Any Legal Lion	Total = 199, Any Legal Lion	Total = 164, Any Legal Lion

License Year	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Mandatory Inspection	12 Hr. Report; 10 Day Inspection														
Hunting season	Fall Season w/o dogs; Winter Season, 12/1 - 4/14; HDs 150 & 151, 9/15 - 4/14							Archery-only Season w/o dogs; Fall Season w/o dogs; Winter Season, 12/1 - 4/14; HDs 150 & 151, 9/15 - 4/14							
Chase/Hound Training Season	Hound Training Season 12/2 - 4/14														
Regional Quotas	Total = 154, Any Legal Lion	Total = 141, Any Legal Lion	Total = 141, Any Legal Lion	Total = 136; FSQ (some LMUs) = 41	Total = 148; FSQ (some LMUs) = 41	Total = 158; FSQ (some LMUs) = 51	Total = 172; FSQ (some LMUs) = 54	Total = 191; FSQ (some LMUs) = 55	Total = 191; FSQ (some LMUs) = 55	Total = 223; FSQ (some LMUs) = 69	Total = 223; FSQ (some LMUs) = 69	Total = 190; MSQ (some LMUs) = 71	Total = 190; MSQ (some LMUs) = 71	Total = 190; MSQ (some LMUs) = 71	Total = 190; MSQ (some LMUs) = 71

REGION 2

High-quality mountain lion habitat is distributed throughout FWP Region 2, especially in the lower Clark Fork, Blackfoot, and portions of the Bitterroot Valleys (Figure 26). The Region has a diverse and abundant ungulate prey base. Recent field estimates of mountain lion abundance (using SCR) in portions of the Blackfoot and Bitterroot Valleys were high compared to the range of densities previously reported for western North America.

Important field research into mountain lion ecology, the effects of harvest, and new population monitoring techniques has been conducted in Region 2 and the results of this work were used to develop this Strategy (Hornocker & Negri 2009, Robinson & DeSimone 2011, Russell et al. 2012, Proffitt et al. 2015).

Region 2 lion abundance and harvest opportunity increased dramatically during the 1990s, reaching a peak of 267 lions taken (more than half of them females) during the 1998 seasons (Table 9). Historically high harvest continued through the late 1990s even after the severe winter of 1996-97 reduced deer and elk herds in several areas of the Region.

Table 9. Region 2 mountain lion harvest, 1971 – 2016.

License Year	R2			
	F	M	Unk	Tot.
1971	10	8	0	18
1972	10	10	0	20
1973	11	26	2	39
1974	16	19	0	35
1975	8	13	0	21
1976	7	12	1	20
1977	5	14	0	19
1978	8	16	0	24
1979	8	16	0	24
1980	6	14	0	20
1981	9	21	0	30
1982	13	17	0	30
1983	13	22	1	36
1984	14	34	1	49
1985	13	13	0	26
1986	9	22	1	32
1987	4	56	1	61
1988	16	34	1	51
1989	12	39	0	51
1990	19	44	0	63
1991	18	42	0	60
1992	30	84	0	114
1993	36	82	0	118
1994	62	99	0	161
1995	64	88	0	152
1996	84	103	0	187
1997	112	127	0	239
1998	143	123	1	267
1999	107	101	0	208
2000	60	70	0	130
2001	43	56	0	99
2002	26	36	0	62
2003	26	47	0	73
2004	14	37	0	51
2005	12	41	0	53
2006	8	43	0	51
2007	10	48	0	58
2008	10	36	0	46
2009	10	52	0	62
2010	31	73	0	104
2011	34	74	0	108
2012	76	97	0	173
2013	68	72	0	140
2014	45	71	0	116
2015	47	78	0	125
2016	47	69	0	116

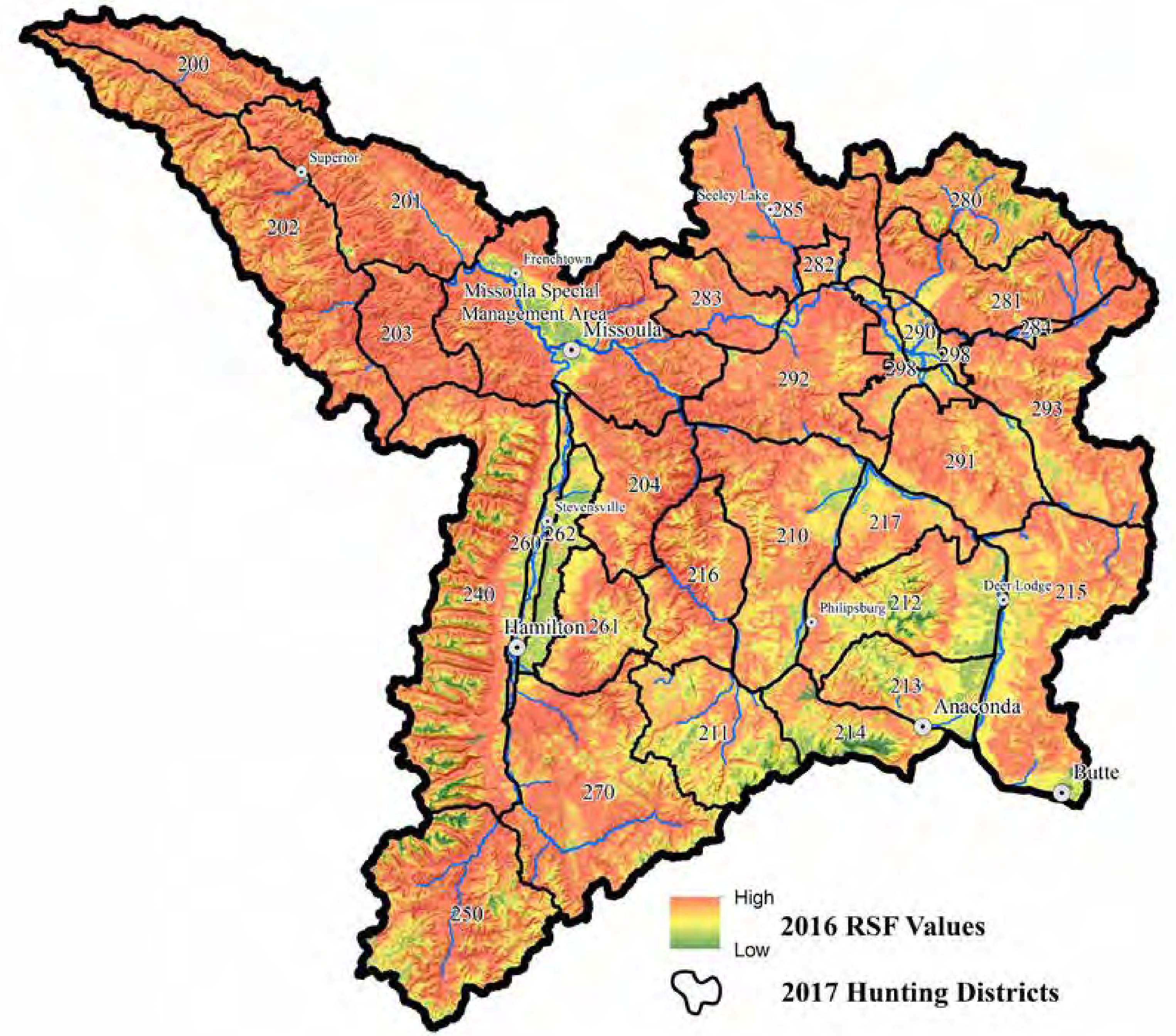
By the early 2000s, the average age of harvested lions had fallen. FWP significantly reduced harvest quotas during the 2000s after both ongoing research and hound handlers' field observations indicated that lion numbers had declined (Table 10). Research in the Garnet Mountains (Robinson & DeSimone 2011), public observations, and rates of human-lion conflict all suggested that Region 2 lion populations had recovered to near 1990s levels by the late 2000s.

In 1994, Region 2 established a new LMU—the Missoula Special Management Area—surrounding the densely populated Missoula Valley. FWP prescribed high quotas (that were rarely met) in this LMU to ensure that hunting regulations were not publicly perceived as limiting legal hunter harvest in this high conflict area.

Tension between Region 2 nonresident/outfitted and resident hunters increased during the 1990s and early 2000s; By 2005, nonresident hunters harvested nearly 50% of the Region's lions. These conflicts were particularly acute in the Bitterroot and Blackfoot watersheds. In 2006, Region 2 began to require that nonresident hunters draw a limited Special Lion License to harvest a lion in most Region 2 LMUs—the number of these nonresident Special Licenses were equal to 10% of the total harvest quota.

In 2008, the Commission began to require that both resident and nonresident hunters draw a Special Lion License to harvest a lion in most of the Region's LMUs. This season type resulted in unpredictable harvest rates and female harvest objectives were rarely met using Special Lion Licenses alone. Therefore, in 2012 the Commission adopted a Late Winter Season (beginning 2/1) in most Region 2 LMUs. During the late Winter Season, hunters with a General Lion License could harvest lions until any quotas previously unfilled by Special Lion License holders

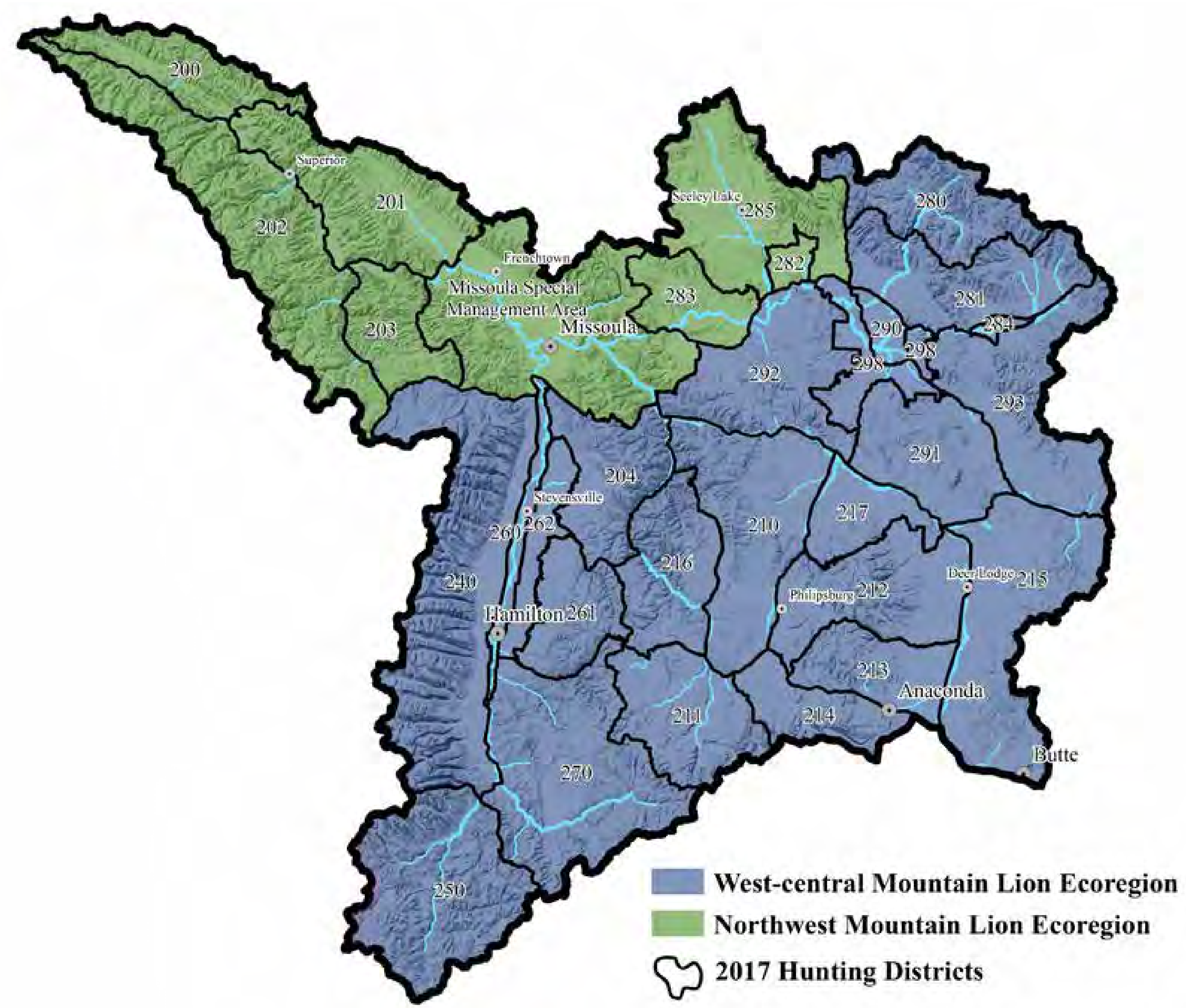
Figure 26. FWP Region 2 2016 mountain lion winter RSF and hunting districts.



were met (this became known as a "hybrid" season). Although this season type allowed more precise harvest management, nonresident participation was unlimited during the Late Winter Season and Region 2 nonresident harvest rates more than doubled after the Late Winter Season was adopted.

Most Region 2 lion habitat is on public or publicly accessible private land. Tracking snow is generally present during the Winter Season, although snow conditions are more likely to limit effective harvest in the upper Clark Fork and Bitterroot drainages.

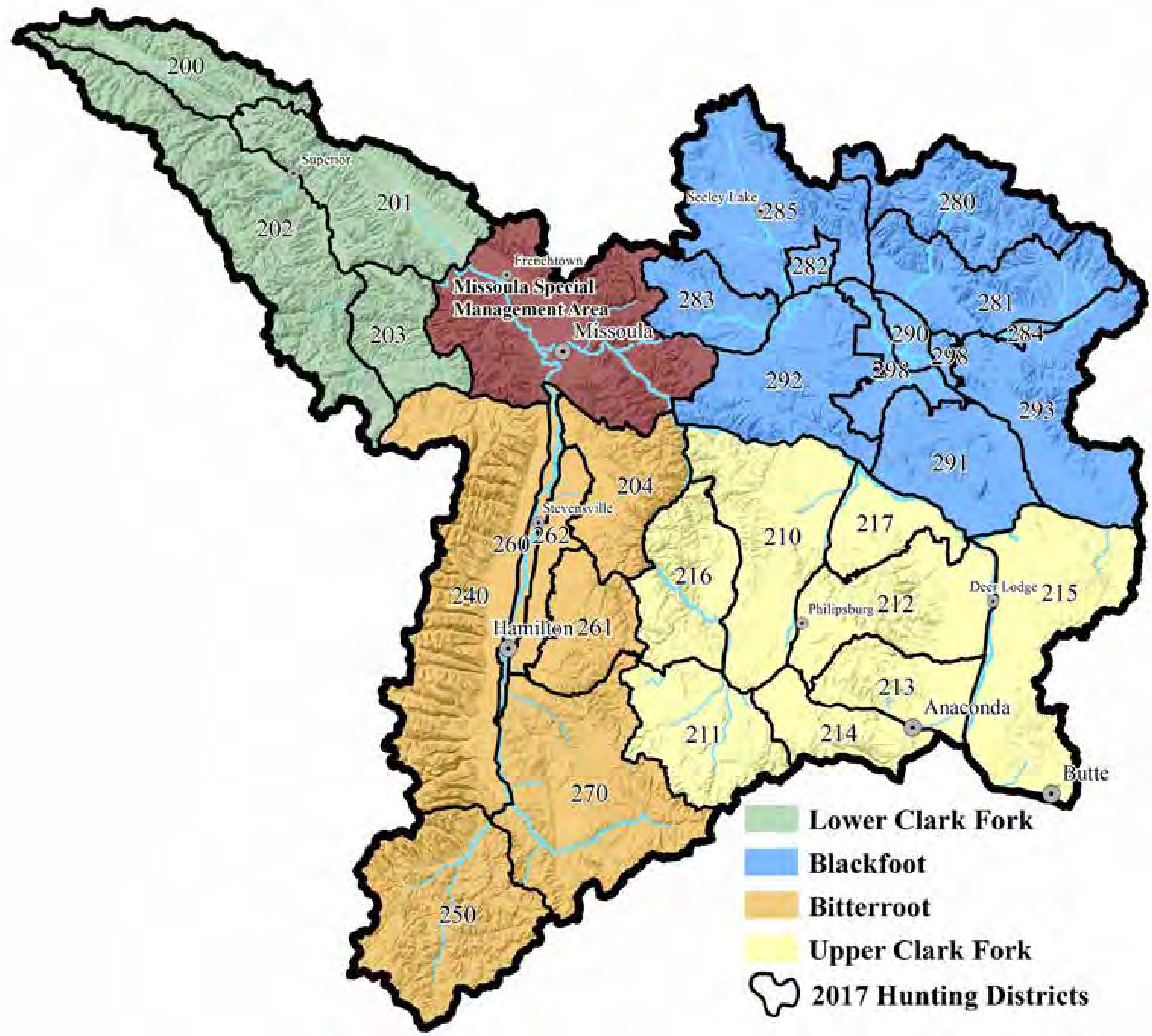
Figure 27. FWP Region 2 hunting districts and mountain lion ecoregions.



FWP Region 2 includes portions of both the Northwest and West-central mountain lion ecoregions (Figure 27). Region 2's biologists and public will work with their counterparts in Regions 1, 3 and 4 to set specific objectives for, and adaptively manage, these ecoregions' mountain lion populations.

Region 2 is comprised of 5 distinct management areas: the Region's four major watersheds and the Missoula Special Management Area (Figure 28). Region 2 will initially recommend either Model Harvest Regulation **Season Type 2: General License** or **Season Type 3: Resident General License**, **Nonresident Special Mountain Lion License** for each of these distinct areas.

Figure 28. Region 2's four major watersheds and the Missoula Special Management Area.



Specific harvest and population objectives will be identified and evaluated through the adaptive harvest management process (Chapter 8). In general, Region 2 will support ecoregion management objectives that result in generally stable lion populations and annual harvest levels. FWP will consider adjustments to management prescriptions based on contemporary monitoring data and significantly changed local circumstances.

Region 2 will minimize human-lion conflicts using both hunter harvest and effective responses to individual incidents that are consistent with the Depredation and Control Guidelines. Hunting regulations and harvest quotas for the Missoula Special Management Area will not significantly limit hunter harvest opportunity there during open seasons.

Region 2 will recommend season types that effectively limit nonresident hunter harvest where necessary to maintain a high-quality hunting experience for resident mountain lion hunters.

Table 10. Summary of Region 2 mountain lion harvest regulations, 1971 – 2017.

License Year	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
Mandatory Inspection	None		10 Day Inspection					4 Day Inspection				48 Hr. Inspection		10 Day Inspection	72 Hr. Inspection	48 Hr. Inspection
Hunting season	Opening of General D/E - 4/30			Opening of General D/E - 4/30; HD 280, 9/15 - 11/24	Opening of General D/E - 4/30; HD 280 9/15 - 4/30	12/1 - 4/30; HD 280 9/15 - 4/30	12/1 - 4/30; HD 280 9/15 - 11/27; HD 282, CLOSED	12/1 - 4/30; HD 280 9/15 - 4/30; HD 282, CLOSED	12/1 - 2/15; HD 280 9/15 - 2/15; HD 282, CLOSED							
Chase/Hound Training Season	None								2/16 - 4/30; HD282, CLOSED							
Regional Quotas	UNLIMITED; One ES Adult Lion per Hunter															

License Year	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Mandatory Inspection	48 Hr. Report; 10 Day Inspection								24 Hr. Report; 5 Day Inspection			24 Hr. Report; 10 Day Inspection	12 Hr. Report; 10 Day Inspection			
Hunting season	12/1 - 2/15; HD 280, 9/15 - 2/15; HD282, CLOSED											12/1 - 4/14; HD 280, 9/15 - 4/14; HD282, CLOSED	Fall Season w/o dogs; 12/1 - 4/14; HD282, CLOSED			
Chase/Hound Training Season	2/16 - 4/30; HD282, CLOSED											No dedicated Chase Season, Hound Training allowed during Winter Hunting Season; HD 282 Closed				
Regional Quotas	UNLIMITED One ES Adult Lion per Hunter	Total = 46; FSQ = 21	Total = 52; FSQ = 21	Total = 55; FSQ = 22	Total = 74; FSQ = 28	Total = 104; FSQ = 46	Total = 106; FSQ = 47	Total = 133; FSQ = 78	Total = 172; Male = 94; Female = 78	Total = 212; Male = 109; Female = 103	Total = 299; Male = 135; Female = 164	Total = 305; Male = 127; Female = 178	Total = 232; Male = 101; Female = 131	Total = 167; Male = 96; Female = 71	Total = 111; Male = 61; Female = 50	Total = 93; Male = 57; Female = 36

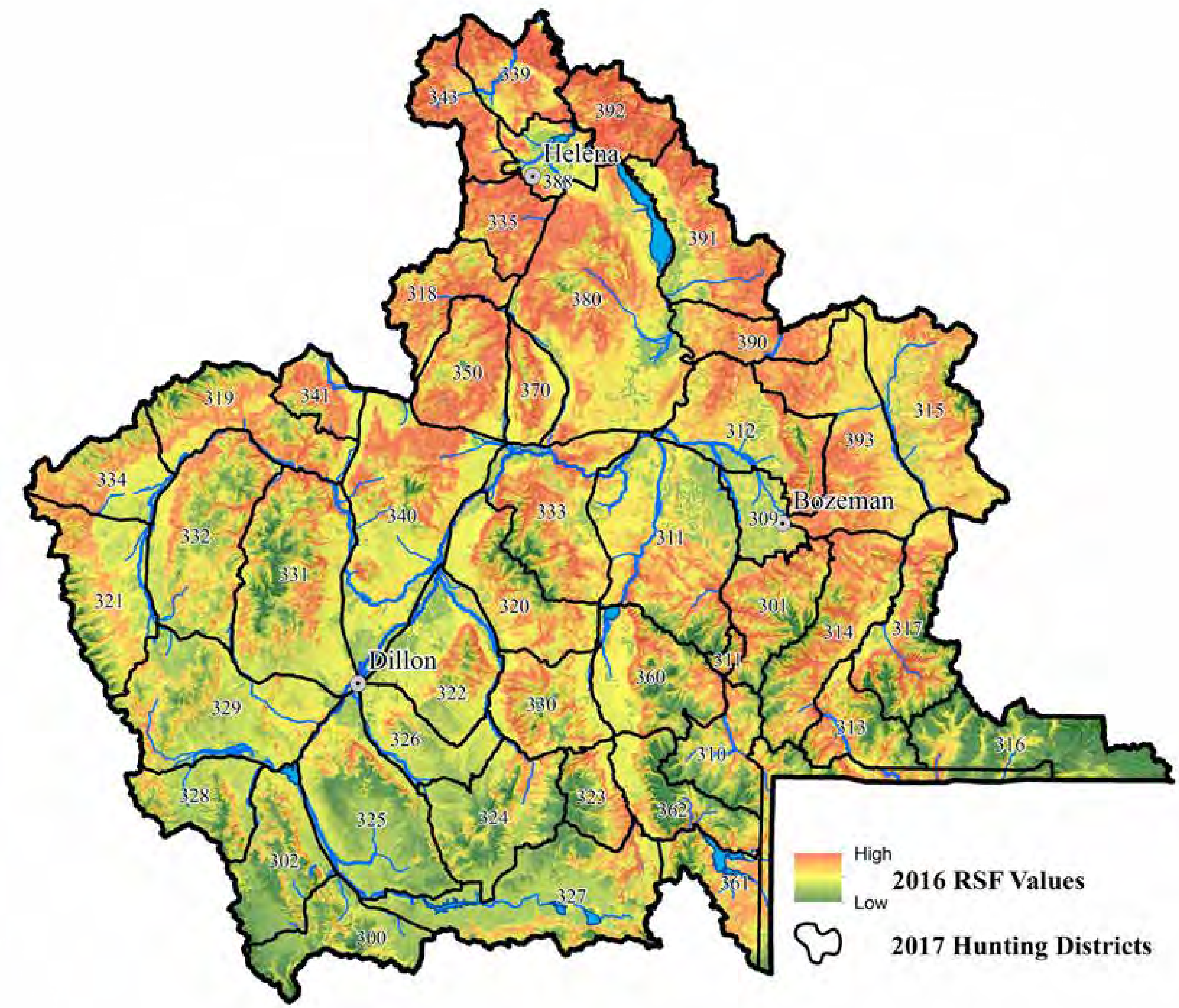
License Year	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Mandatory Inspection	12 Hr. Report; 10 Day Inspection														
Hunting season	Fall Season w/o dogs; 12/1 - 4/14; HD282, CLOSED							Archery-only Season; Fall Season; 12/1 - 4/14; HD282, CLOSED		Archery-only Season; Fall Season w/o dogs; 12/1 - 4/14; Late Winter Season, 2/1 - 4/14; HD282, CLOSED					
Chase/Hound Training Season	Hound Training Season 12/2 - 4/14														
Regional Quotas	Total = 85; Male = 48; Female = 36	Total = 72; Male = 44; Female = 28	Total = 70; Male = 47; Female = 23	Total = 71; Male = 52; Female = 12	Total = 64; Male = 48; Female = 12	Total = 88; FSQ (some LMUs) = 16	Total = 126; FSQ (some LMUs) = 19	Total = 192; FSQ (some LMUs) = 38	Total = 219; FSQ (some LMUs) = 54	Total = 202; Male = 119; Female = 81	Total = 197; Male = 110; Female = 85	Total = 163; Male = 96; Female = 65	Total = 160; Male = 102; Female = 56	Total = 158; Male = 100; Female = 56	Total = 158; Male = 100; Female = 56

REGION 3

Mountain lions occur throughout their suitable habitat in southwest Montana's Region 3 (Figure 329). The Region has a diverse and abundant ungulate prey base that inhabits a mix of publicly accessible and privately-owned land.

Lion abundance increased in Region 3 during the 1980s and 1990s but, unlike other areas of the state, did not appear to fall as sharply during the 2000s. Instead, anecdotal evidence and harvest records suggest that mountain lion distribution and abundance have remained relatively stable

Figure 29. FWP Region 3 2016 mountain lion winter RSF and hunting districts.



in the Region since the mid-1990s. Variation in the total annual harvest (Table 11) is almost entirely due to changes in female harvest quotas. Sustained harvest in the late 2010s was similar to harvest levels in both Regions' 1 and 2 during the same period.

Table 11. Region 3 mountain lion harvest, 1971 – 2016.

License Year	R3			
	F	M	Unk	Tot.
1971	1	2	0	3
1972	2	2	0	4
1973	1	0	0	1
1974	2	2	1	5
1975	2	2	0	4
1976	2	0	0	2
1977	1	8	0	9
1978	7	6	0	13
1979	9	5	0	14
1980	1	6	0	7
1981	6	10	0	16
1982	7	11	0	18
1983	4	12	1	17
1984	5	21	0	26
1985	10	11	2	23
1986	4	13	1	18
1987	5	15	0	20
1988	1	17	0	18
1989	2	16	0	18
1990	6	23	0	29
1991	11	19	0	30
1992	11	33	0	44
1993	18	41	0	59
1994	32	52	0	84
1995	33	53	0	86
1996	29	60	0	89
1997	43	56	0	99
1998	51	66	0	117
1999	54	63	0	117
2000	55	55	1	111
2001	52	57	0	109
2002	46	64	0	110
2003	32	57	0	89
2004	34	44	0	78
2005	23	51	1	75
2006	16	45	0	61
2007	12	57	0	69
2008	13	61	0	74
2009	14	53	0	67
2010	17	50	0	67
2011	17	57	0	74
2012	33	68	0	101
2013	33	61	0	94
2014	33	70	0	103
2015	44	72	0	116
2016	44	69	0	113

Region 3 generally managed harvest using simple harvest quotas and female subquotas (Table 12). However, the Region historically designated a large number of LMUS (23 in 2017)—the number of these individual LMUs may be reduced during future season setting processes. Region 3 quotas serve as harvest limits in all LMUs.

Public access to winter mountain lion habitat is mixed, although most harvest occurs on public land. Winter snow tracking conditions vary annually and can, at times, limit effective harvest. Nonresidents accounted for 15% of all successful hunters in the Region between 2007 and 2016 even though there was no regulatory limit on nonresident hunter harvest during that period.

Region 3 manages LMU 309, (the Gallatin Valley around Bozeman) as a Special Management Area. Lions are rarely harvested in this LMU (2 between 2007 and 2016), but the quota is high enough to ensure that FWP regulations do not limit legal harvest. Similarly, the Fall Season Without Dogs in LMU 309 opened with the beginning of the Deer/Elk Archery Only Season and remained open through the General Deer/Elk Season. The Region also designated a specific quota for the Spanish Peaks portion of LMU 311 to reduce lion predation on the resident bighorn sheep herd.

FWP Region 3 contains portions of both the Southwest and West-central Mountain Lion Ecoregions (Figure 30). Region 3's biologists and public will work with their counterparts in Regions 2, 4 and 5 to set objectives for, and adaptively manage, these ecoregions' mountain lion populations.

Region 3 will be able to meet lion management objectives by primarily using Model Harvest Regulation **Season Type 2: General License**.

FWP and public stakeholders will determine and evaluate specific lion population objectives using the Adaptive Harvest Management process (Chapter 8). The Region will generally support objectives for stable lion populations and annual harvest, while considering contemporary monitoring data and local circumstances. Region 3 will recommend the least complex harvest regulations that will allow management objectives to be met.

Hunting regulations will not limit hunter harvest in highly developed areas where human-lion conflicts are likely (such as LMU 309) or where suppression of local lion density is desired (such as the Spanish Peaks portion of LMU 311).

FWP will minimize human-lion conflicts using both hunter harvest and effective responses to individual incidents that are consistent with the Depredation and Control Guidelines.

Figure 30. FWP Region 3 hunting districts and mountain lion ecoregions.

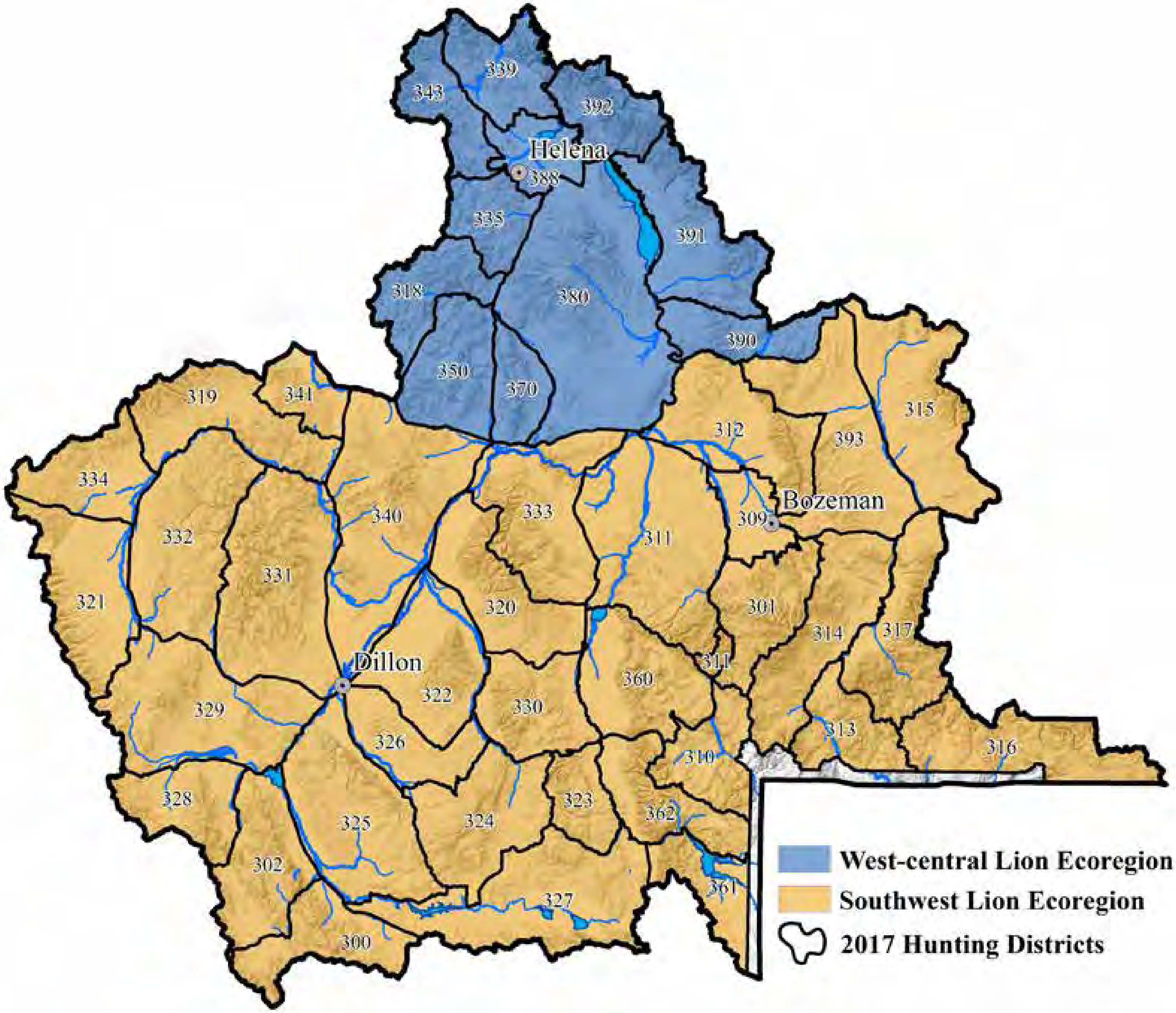


Table 12. Summary of Region 3 mountain lion harvest regulations, 1971 – 2017.

License Year	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
Mandatory Inspection	None		10 Day Inspection					4 Day Inspection				48 Hr. Inspection		10 Day Inspection	72 Hr. Inspection	48 Hr. Inspection
Hunting season	Opening of General D/E - 4/30					12/1 - 4/30			12/1 - 2/15							
Chase/Hound Training Season	None								2/16 - 4/30;							
Regional Quotas	UNLIMITED; One ES Adult Lion per Hunter															Total = 32; FSQ = 16 [1]

License Year	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Mandatory Inspection	48 Hr. Report; 10 Day Inspection								24 Hr. Report; 5 Day Inspection			24 Hr. Report; 10 Day Inspection	12 Hr. Report; 10 Day Inspection			
Hunting season	12/1 - 2/15											12/1 - 4/14	Fall Season w/o dogs; 12/1 - 4/14			
Chase/Hound Training Season	2/16 - 4/30											No dedicated Chase Season, Hound Training allowed during Winter Hunting Season				
Regional Quotas	Total = 32; FSQ = 20	Total = 34; FSQ = 21	Total = 34; FSQ = 21	Total = 34; FSQ = 21	Total = 39; FSQ = 21	Total = 37; FSQ = 21	Total = 45; FSQ = 23	Total = 69; FSQ = 33	Total = 86; FSQ = 39; MSQ (R8) = 19	Total = 89; FSQ = 41; MSQ (some LMUs) = 19	Total = 104; FSQ = 49; MSQ (some LMUs) = 21	Total = 123; FSQ = 47; MSQ (some LMUs) = 22	Total = 123; FSQ = 60; MSQ (some LMUs) = 22	Total = 134; FSQ = 67; MSQ (some LMUs) = 25	Total = 132; FSQ = 60; MSQ (some LMUs) = 19	Total = 136; FSQ = 63; MSQ (some LMUs) = 23

License Year	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Mandatory Inspection	12 Hr. Report; 10 Day Inspection														
Hunting season	Fall Season w/o dogs; 12/1 - 4/14							Archery-only Season; Fall Season w/o dogs; 12/1 - 4/14							
Chase/Hound Training Season	Hound Training Season 12/2 - 4/14														
Regional Quotas	Total = 117; FSQ (some LMUs) = 41	Total = 105; FSQ (some LMUs) = 40	Total = 101; FSQ (some LMUs) = 30	Total = 76; FSQ (some LMUs) = 16	Total = 66; FSQ (some LMUs) = 12	Total = 73; FSQ (some LMUs) = 12	Total = 72; FSQ (some LMUs) = 12	Total = 80; FSQ (some LMUs) = 16	Total = 77; FSQ (some LMUs) = 16	Total = 109; FSQ (some LMUs) = 34	Total = 109; FSQ (some LMUs) = 34	Total = 126; FSQ (some LMUs) = 41	Total = 135; FSQ (some LMUs) = 46	Total = 140; FSQ (some LMUs) = 48	Total = 138; FSQ (some LMUs) = 48

REGION 4

Mountain lion abundance and distribution generally increased in Region 4 from the 1980s to mid-2010s — only toward the end of that period was all suitable habitat (including the Missouri River Breaks and Sweet Grass Hills) fully reoccupied (Figure 31).

Region 4 includes portions of both the West-central and Eastern Mountain Lion Ecoregions (Figure 32). Most of the Region's high-quality lion habitat lies within the West-central ecoregion, although quality habitat exists in portions of the Eastern ecoregion along the northern Rocky Mountain front, the Highwoods, the Sweet Grass Hills and Missouri River Breaks. Most lion harvest within Region 4 occurs on public land.

Region 4's annual harvest peaked in the late 1990s and stabilized somewhat below those historic high levels in the mid-2010s (Table 13). The Region traditionally managed harvest by prescribing male and female quotas to individual LMUs. Nonresident hunters accounted for 19% of all lions harvested between 2007 and 2016; less than 20% of those successful nonresident hunters used the services of an outfitter.

Reducing and mitigating conflicts between lions and agricultural interests is a high Regional priority. Region 4 staff will actively respond to potential and ongoing mountain lion conflicts, consistent with the Depredation and Control Guidelines, in order to maintain landowner tolerance for lions.

Region 4 will generally support management objectives that maintain stable lion abundance, distribution, and harvest across the Region's suitable habitat. Region 4's biologists and public will work with their counterparts in other Regions to set objectives for, and adaptively manage, the West-central and Eastern ecoregions' mountain lion populations.

Region 4 will recommend the least complex harvest regulation that will allow management objectives to be met, primarily using Model Harvest Regulation **Season Type 2: General License** with male and female quotas.

Table 13. Region 4 mountain lion harvest, 1971 – 2016.

License	R4			
Year	F	M	Unk	Tot.
1971	3	3	0	6
1972	2	4	0	6
1973	1	5	0	6
1974	2	4	0	6
1975	2	4	0	6
1976	1	5	0	6
1977	4	6	0	10
1978	2	2	1	5
1979	2	3	0	5
1980	5	7	0	12
1981	7	7	0	14
1982	4	5	0	9
1983	1	10	0	11
1984	7	18	1	26
1985	10	14	3	27
1986	4	7	1	12
1987	10	16	0	26
1988	6	16	0	22
1989	5	16	0	21
1990	10	17	0	27
1991	10	17	0	27
1992	15	22	0	37
1993	16	39	0	55
1994	24	46	0	70
1995	32	39	0	71
1996	37	47	0	84
1997	44	41	0	85
1998	54	39	0	93
1999	56	37	0	93
2000	45	36	0	81
2001	39	36	0	75
2002	24	26	0	50
2003	21	27	0	48
2004	17	27	0	44
2005	17	26	0	43
2006	18	35	0	53
2007	25	30	0	55
2008	32	37	0	69
2009	30	35	0	65
2010	32	43	0	75
2011	32	46	0	78
2012	35	44	0	79
2013	34	48	0	82
2014	31	47	0	78
2015	28	37	0	65
2016	38	42	0	80


R. Wiesner

Figure 31. FWP Region 4 2016 mountain lion winter RSF and hunting districts.

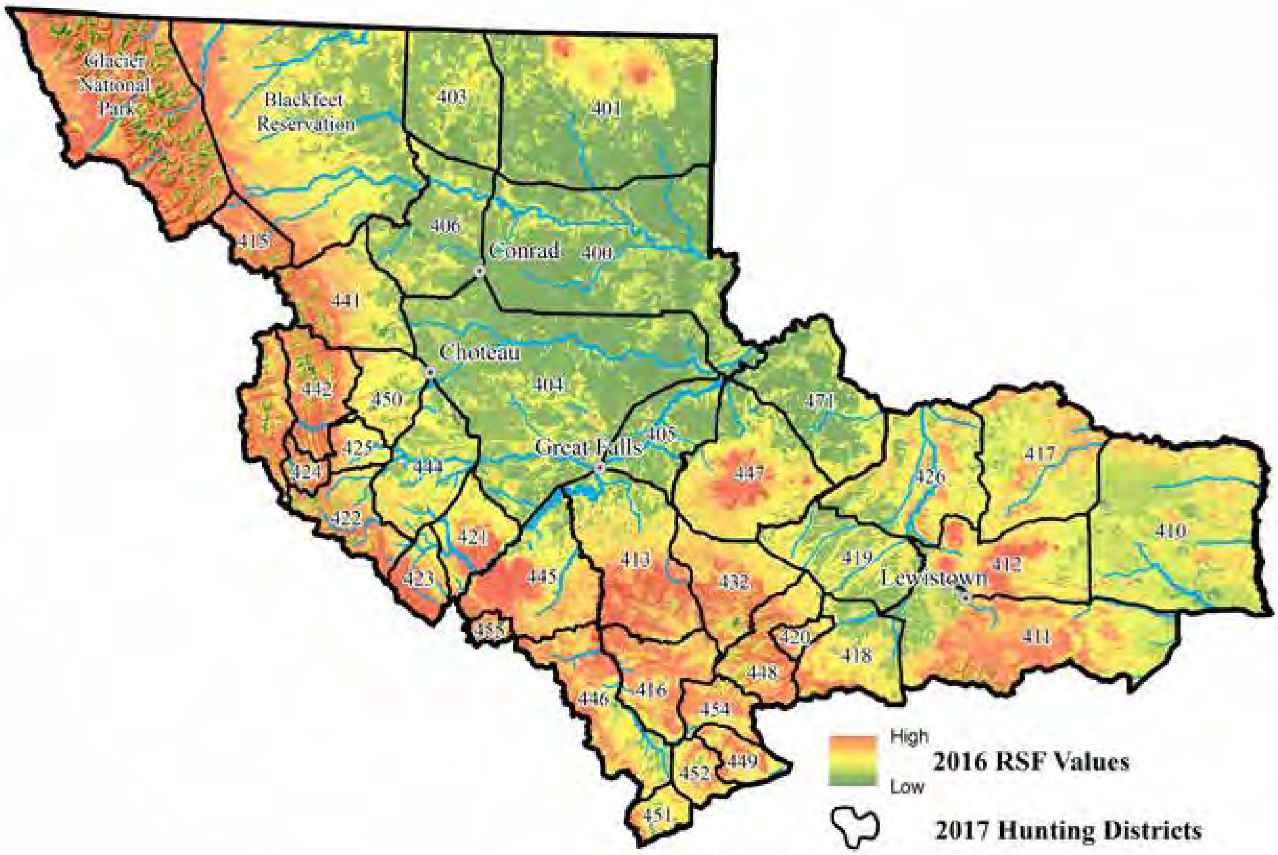


Figure 32. FWP Region 4 hunting districts and mountain lion ecoregions.

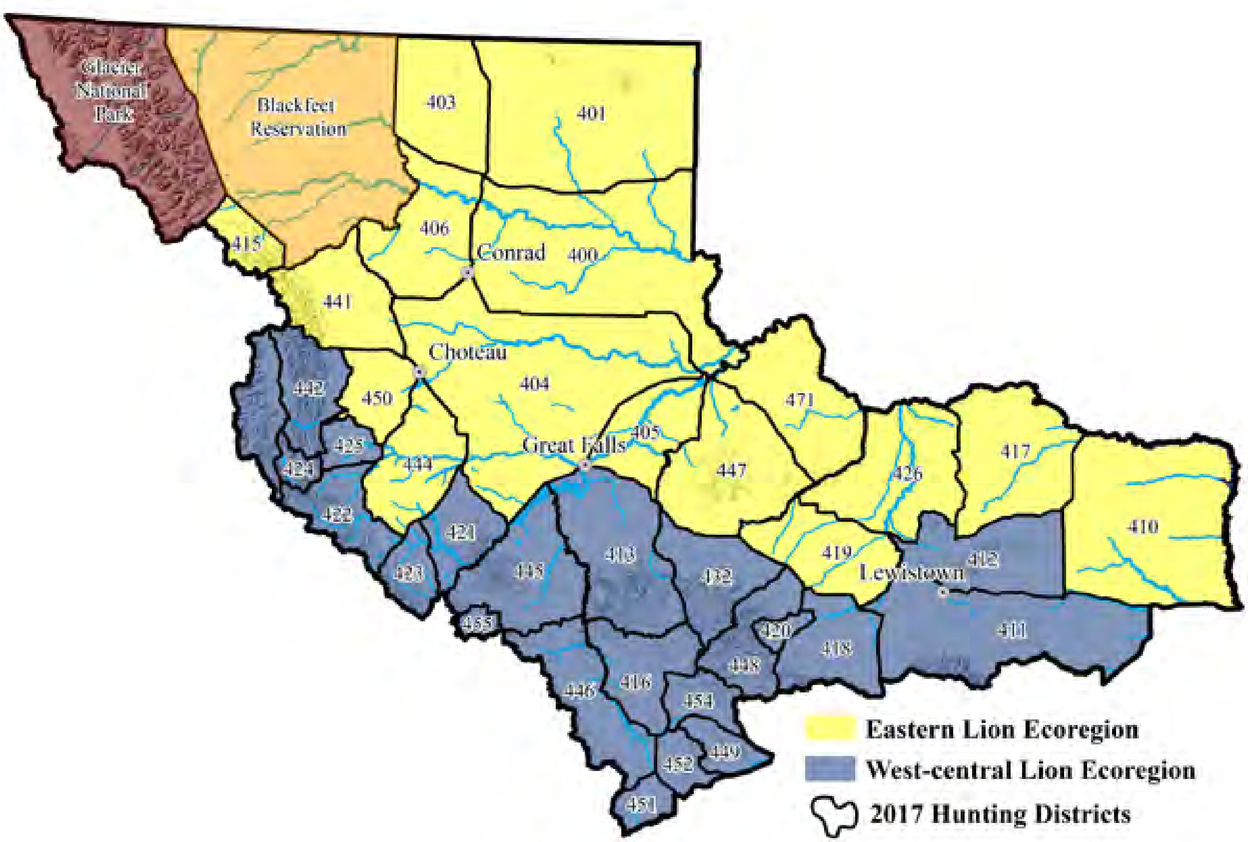


Table 14. Summary of Region 4 mountain lion harvest regulations, 1971 – 2017.

License Year	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
Mandatory Inspection	None		10 Day Inspection					4 Day Inspection				48 Hr. Inspection		10 Day Inspection	72 Hr. Inspection	48 Hr. Inspection
Hunting season	Opening of General D/E - 4/30					12/1 - 4/30			12/1 - 2/15			12/1 - 2/15; HDs 427 & 428, 1/1 - 2/15				
Chase/Hound Training Season	None								2/16 - 4/30							
Regional Quotas	UNLIMITED; One ES Adult Lion per Hunter															

License Year	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Mandatory Inspection	48 Hr. Report; 10 Day Inspection								24 Hr. Report; 5 Day Inspection			24 Hr. Report; 10 Day Inspection	12 Hr. Report; 10 Day Inspection			
Hunting season	12/1 - 2/15; HDs 427 & 428, 1/1 - 2/15							12/1 - 2/15				12/1 - 4/14	Fall Season w/o dogs; 12/1 - 4/14			
Chase/Hound Training Season	2/16 - 4/30											No dedicated Chase Season, Hound Training allowed during Winter Hunting Season				
Regional Quotas	UNLIMITED One ES Adult Lion per Hunter	Total = 30; FSQ = 10	Total = 35; FSQ = 10	Total = 35; FSQ = 10	Total = 40; FSQ = 12	Total = 46; FSQ = 14	Total = 46; FSQ = 14	Total = 65; FSQ = 26	Total = 80; Male = 46; F = 34	Total = 110; Male = 57; F = 53	Total = 108; Male = 49; Female = 59	Total = 133; Male = 52; Female = 81	Total = 126; Male = 48; Female = 78	Total = 124; Male = 48; Female = 76	Total = 110; Male = 47; Female = 63	Total = 106; Male = 48; Female = 58

License Year	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Mandatory Inspection	12 Hr. Report; 10 Day Inspection														
Hunting season	Fall Season w/o dogs; 12/1 - 4/14							Archery-only Season; Fall Season w/o dogs; 12/1 - 4/14							
Chase/Hound Training Season	Hound Training Season 12/2 - 4/14														
Regional Quotas	Total = 103; Male = 48; Female = 55	Total = 91; Male = 45; Female = 46	Total = 91; Male = 45; Female = 46	Total = 83; Male = 43; Female = 40	Total = 85; Male = 45; Female = 40	Total = 80; Male = 40; Female = 40	Total = 80; Male = 40; Female = 40	Total = 88; Male = 44; Female = 44	Total = 91; Male = 46; Female = 45	Total = 93; Male = 46; Female = 47	Total = 93; Male = 46; Female = 47	Total = 98; Male = 48; Female = 50	Total = 98; Male = 48; Female = 50	Total = 98; Male = 48; Female = 50	Total = 100; Male = 48; Female = 52

— DRAFT, OCT. 2018 —

REGION 5

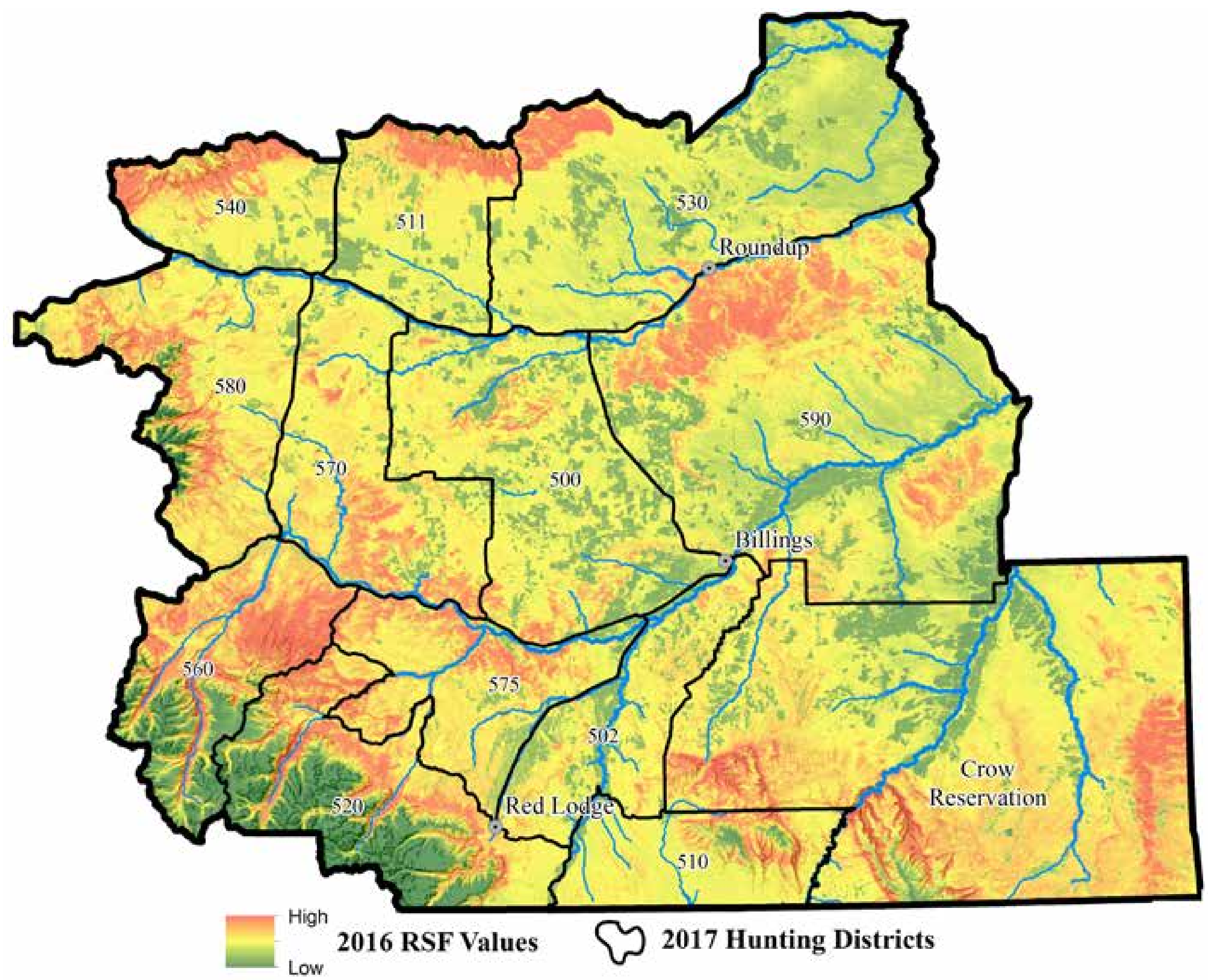
Mountain lion hunter harvest opportunity was generally stable in Region 5 from the 1990s to late 2010s. However, annual harvest success varied year-to-year depending on winter snow-tracking conditions. Most of the Region's publicly accessible, high-quality, lion habitat lies in its peripheral mountain foothills (Figure 33). While the Region includes portions of both the Southwest and Eastern Mountain Lion ecoregions, most lions are harvested in the Southwest ecoregion (Figure 34). Nonresidents took 18% of all lions harvested in Region 5 between 2007 and 2016, most without the aid of an outfitter.

Although Region 5 harvest is well distributed across suitable lion habitat, individual LMU quotas may not be consistently reached because annual harvest is dependent on the presence of adequate tracking snow. Region 5 may consider reducing the number of Regional LMUs to simplify harvest management.

Managers will generally recommend harvest objectives that maintain stable lion abundance, distribution, and harvest across all suitable habitat in Region 5. Biologists and the public will work with their counterparts in other Regions to set objectives for, and adaptively manage, the Southwest and Eastern Ecoregions' mountain lion populations.

Region 5 historically used overall LMU quotas (with female subquotas) to manage harvest (Table 16). The Region will be able to meet lion management objectives by using the similar Model Harvest Regulation **Season Type 2: General**

Figure 33. FWP Region 5 2016 mountain lion winter RSF and hunting districts.



License season type that employs individual male and female quotas.

Minimizing human-lion conflicts and livestock depredation is a high Regional priority. Region 5 will use both hunter harvest and effective responses to individual incidents that are consistent with the Depredation and Control Guidelines to reduce potential conflicts.

Table 15. Region 5 mountain lion harvest, 1971 – 2016.

License Year	R5 F	R5 M	R5 Unk	R5 Tot.
1971	2	0	0	2
1972	1	1	0	2
1973	2	1	0	3
1974	0	0	0	0
1975	1	2	0	3
1976	3	1	0	4
1977	4	4	0	8
1978	3	0	0	3
1979	5	6	0	11
1980	4	4	0	8
1981	3	6	0	9
1982	3	2	0	5
1983	4	7	0	11
1984	2	12	0	14
1985	3	6	0	9
1986	4	11	0	15
1987	9	6	0	15
1988	7	11	0	18
1989	4	9	0	13
1990	8	13	0	21
1991	8	12	0	20
1992	10	21	0	31
1993	15	20	0	35
1994	13	19	0	32
1995	19	23	0	42
1996	13	22	0	35
1997	23	21	0	44
1998	17	23	1	41
1999	23	21	0	44
2000	19	24	0	43
2001	25	25	0	50
2002	16	17	0	33
2003	9	18	0	27
2004	12	22	0	34
2005	12	15	0	27
2006	12	13	0	25
2007	10	18	0	28
2008	10	21	0	31
2009	12	24	0	36
2010	8	10	0	18
2011	13	21	0	34
2012	11	20	0	31
2013	16	20	0	36
2014	8	28	0	36
2015	11	12	0	23
2016	13	26	0	39

Figure 34. FWP Region 5 hunting districts and mountain lion ecoregions.

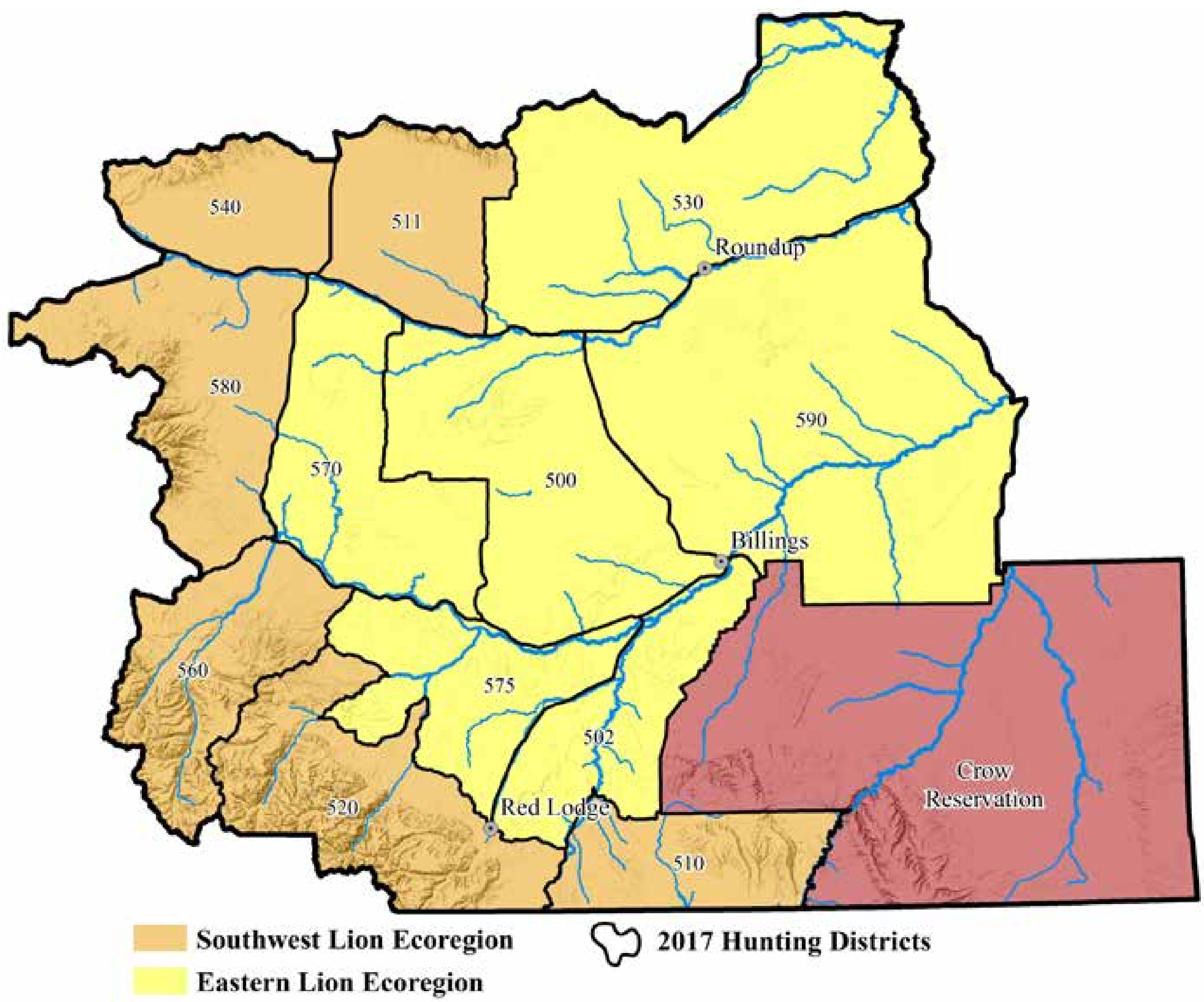


Table 16. Summary of Region 5 mountain lion harvest regulations, 1971 – 2017.

License Year	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
Mandatory Inspection	None		10 Day Inspection					4 Day Inspection				48 Hr. Inspection		10 Day Inspection	72 Hr. Inspection	48 Hr. Inspection
Hunting season	Opening of General D/E - 4/30					12/1 - 4/30		12/1 - 2/15								
Chase/Hound Training Season	None							2/16 - 4/30								
Regional Quotas	UNLIMITED; One ES Adult Lion per Hunter															

License Year	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Mandatory Inspection	48 Hr. Report; 10 Day Inspection								24 Hr. Report; 5 Day Inspection			24 Hr. Report; 10 Day Inspection	12 Hr. Report; 10 Day Inspection			
Hunting season	12/1 - 2/15											12/1 - 4/14	Fall Season w/o dogs; 12/1 - 4/14			
Chase/Hound Training Season	2/16 - 4/30											No dedicated Chase Season, Hound Training allowed during Winter Hunting Season				
Regional Quotas	UNLIMITED One ES Adult Lion per Hunter	Total = 22; FSQ = 10	Total = 25; FSQ = 11	Total = 30; FSQ = 13	Total = 33; FSQ = 13	Total = 37; FSQ = 15	Total = 37; FSQ = 15	Total = 44; FSQ = 22	Total = 44; FSQ = 22	Total = 50; FSQ (some LMUs) = 20	Total = 52; FSQ (some LMUs) = 21	Total = 58; FSQ (some LMUs) = 23	Total = 56; FSQ (some LMUs) = 22	Total = 56; FSQ (some LMUs) = 22	Total = 57; FSQ (some LMUs) = 22	Total = 57; FSQ (some LMUs) = 22

License Year	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Mandatory Inspection	12 Hr. Report; 10 Day Inspection														
Hunting season	Fall Season w/o dogs; 12/1 - 4/14							Archery-only Season; Fall Season w/o dogs; 12/1 - 4/14							
Chase/Hound Training Season	Hound Training Season 12/2 - 4/14														
Regional Quotas	Total = 57; FSQ (some LMUs) = 22	Total = 49; FSQ (some LMUs) = 18	Total = 49; FSQ (some LMUs) = 18	Total = 49; FSQ (some LMUs) = 18	Total = 49; FSQ (some LMUs) = 18	Total = 49; FSQ (some LMUs) = 18	Total = 49; FSQ (some LMUs) = 21	Total = 44; FSQ (some LMUs) = 15	Total = 44; FSQ (some LMUs) = 15	Total = 44; FSQ (some LMUs) = 15	Total = 44; FSQ (some LMUs) = 15	Total = 47; FSQ (some LMUs) = 15	Total = 47; FSQ (some LMUs) = 15	Total = 47; FSQ (some LMUs) = 15	Total = 47; FSQ (some LMUs) = 15

REGION 6

Most suitable mountain lion habitat in Region 6 lies in the Bears Paw and Little Rockies ranges, as well as along the Missouri River (Figure 35). A significant portion of the Region's lion habitat is included within the Rocky Boy's and Fort Belknap Reservations—FWP does not have wildlife management authority within these jurisdictions.

There was no open mountain lion hunting season between 1976 and 1992 in Region 6 (Table 18); mountain lions became increasingly common in the Region 6 during this period. Harvest quotas have remained relatively stable since hunting seasons were re-opened in 1993 but the annual FWP managed harvest varies annually depending on winter tracking conditions, hunter access, and individual hunters' participation in the harvest season (Table 17).

Mountain lion harvest that occurs on the Rocky Boy's and Fort Belknap reservations may not be reported to FWP, and thus, regional harvest totals should be viewed as minimums. Kunkel et al. (2012) documented a relatively high annual hunter harvest rate and low adult survival for Region 6 lions during their study. The authors suggested that Region 6 lion populations may be sustained by immigration rather than local recruitment. If so, continuing to protect adult females from harvest may allow local reproduction to supplement lions that disperse into the Region.

Table 17. Region 6 mountain lion harvest, 1971 – 2016.

License Year	R6		
	F	M	Tot.
1971	0	0	0
1972	0	0	0
1973	0	0	0
1974	0	0	0
1975	0	0	0
1976	0	0	0
1977	0	0	0
1978	0	0	0
1979	0	0	0
1980	0	0	0
1981	0	0	0
1982	0	0	0
1983	0	0	0
1984	0	0	0
1985	0	0	0
1986	0	0	0
1987	0	0	0
1988	0	0	0
1989	0	0	0
1990	0	0	0
1991	0	0	0
1992	2	2	4
1993	2	2	4
1994	2	4	6
1995	3	3	6
1996	1	2	3
1997	5	2	7
1998	4	3	7
1999	4	4	8
2000	2	1	3
2001	3	2	5
2002	1	1	2
2003	0	0	0
2004	0	1	1
2005	0	0	0
2006	0	1	1
2007	1	2	3
2008	0	7	7
2009	1	3	4
2010	2	4	6
2011	5	4	9
2012	4	3	7
2013	2	3	5
2014	2	3	5
2015	2	4	6
2016	4	9	13

Lions are only likely to be resident in hunting districts 680, 690, 621, 622, 631 and 632. The remainder of the Region may be considered a Special Management Area where tolerance for lions is low. In this area, liberal quotas may be recommended so that hunter harvest is available when needed to minimize conflict while still allowing for lion movement between resident populations.

All of Region 6 lies within the Eastern Mountain Lion ecoregion (Figure 36). Routine lion abundance estimates and population modeling will not be available in this ecoregion. Because of annual variations in tracking snow cover, annual harvest varies independent of population trend. Regional managers will therefore rely on indirect indications of lion abundance and public input to monitor lion populations. Region 6 may also choose to produce a baseline Regional abundance estimate (either alone or in collaboration with Tribal partners) following SCR or other field methods (Chapter 5) if funding is available.

Region 6 will be able to meet lion management objectives by using Model Harvest Regulation **Season Type 2: General License** with individual male and female quotas or subquotas.

Figure 35. FWP Region 6 2016 mountain lion winter RSF and hunting districts.

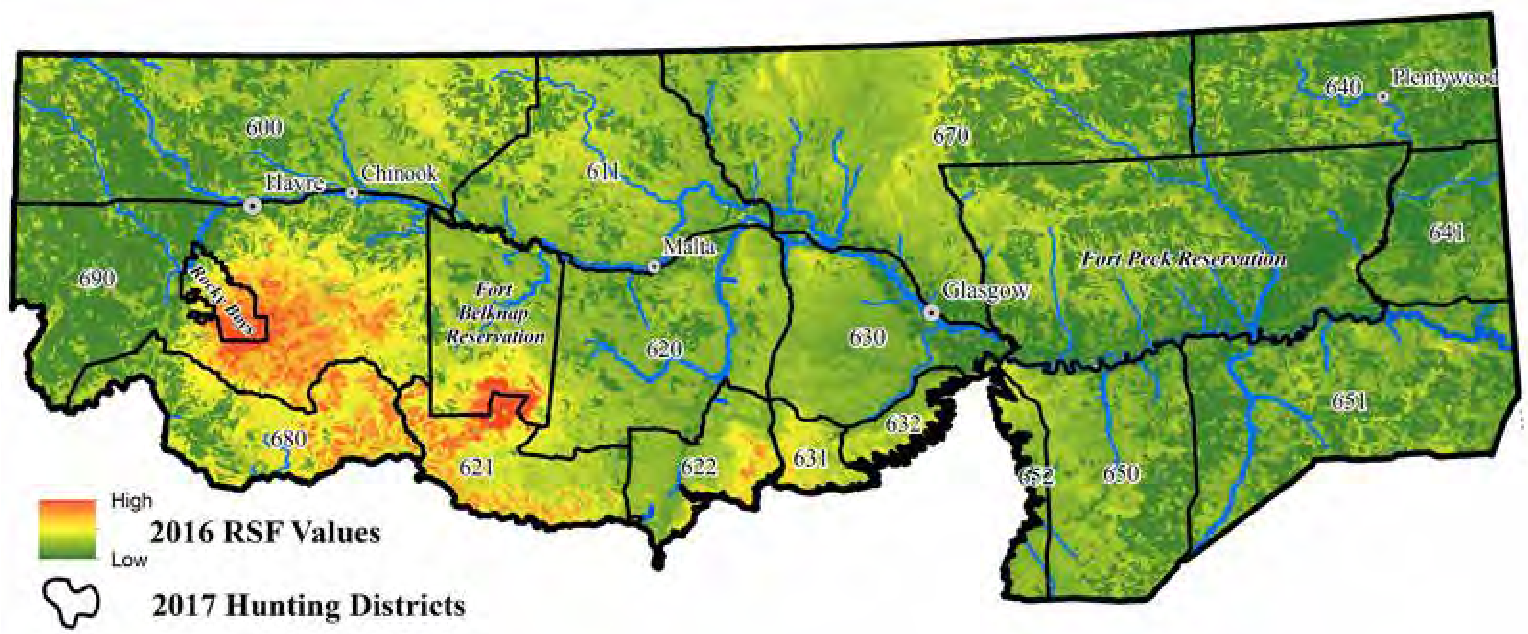


Figure 36. FWP Region 6 hunting districts and mountain lion ecoregion.

Table 18. Summary of Region 6 mountain lion harvest regulations, 1971 – 2017.

License Year	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
Mandatory Inspection	NONE		10 Day Inspection													
Hunting season	Opening of General D/E - 4/30					CLOSED										
Chase/Hound Training Season	NONE								CLOSED						2/16 - 4/30	
Regional Quotas	UNLIMITED; One ES Adult Lion per Hunter					CLOSED										

License Year	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Mandatory Inspection						48 Hr. Report; 10 Day Inspection			24 Hr. Report; 5 Day Inspection			24 Hr. Report; 10 Day Inspection	12 Hr. Report; 10 Day Inspection			
Hunting season	CLOSED					12/1 - 2/15						12/1 - 4/14	Fall Season w/o dogs; 12/1 - 4/14			
Chase/Hound Training Season	12/1 - 4/30					2/16 - 4/30						No dedicated Chase Season, Hound Training allowed during Winter Hunting Season				
Regional Quotas	CLOSED					3 Any Legal Lion	3 Any Legal Lion	5 Any Legal Lion	Total = 10; FSQ = 3	Total = 10; FSQ = 3	Total = 13; FSQ (some LMUs) = 5; MSQ (some LMUs) = 3	Total = 13; FSQ (some LMUs) = 6	Total = 13; FSQ (one LMUs) = 6	Total = 16; FSQ (one LMUs) = 5	Total = 11; FSQ (one LMUs) = 3	Total = 11; FSQ (one LMU) = 3

License Year	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Mandatory Inspection	12 Hr. Report; 10 Day Inspection														
Hunting season	Fall Season w/o dogs; 12/1 - 4/14							Archery-only Season; Fall Season w/o dogs; 12/1 - 4/14							
Chase/Hound Training Season	Hound Training Season 12/2 - 4/14														
Regional Quotas	Total = 11; FSQ (one LMU) = 3	Total = 11; FSQ (one LMU) = 3	Total = 11; FSQ (one LMU) = 3	Total = 11; FSQ (one LMU) = 3	Total = 11; FSQ (one LMU) = 3	Total = 11; FSQ (one LMU) = 3	Total = 12; FSQ = 3	Total = 11; FSQ (one LMU) = 2	Total = 11; FSQ (one LMU) = 2	Total = 11; FSQ (one LMU) = 2	Total = 12; FSQ = 4	Total = 12; FSQ = 4	Total = 12; FSQ = 4	Total = 12; FSQ = 4	Total = 12; FSQ = 4

REGION 7

Mountain lions have expanded their range into eastern Montana since the 1980s and are now found in all suitable Region 7 habitats (Figure 37). The first mountain lion hunting season in Region 7 occurred in 1985 but no harvest was recorded until 1990. FWP incrementally raised quotas as the Region's lion abundance and distribution increased. Mountain lion age-in-harvest, harvest sex ratios, and hunter effort remained stable through the late 2010s.

Because lions only recently recovered in Region 7, neither biological nor social carrying capacities are as well known. Incidents of human-lion conflict and livestock depredation remained low through the mid-2010s and landowners were generally tolerant of mountain lion presence.

Region 7 lies entirely within the Eastern mountain lion ecoregion (Figure 38). Estimates of lion abundance will not be routinely produced using SCR or other field methods for this ecoregion. Managers will need to instead rely in indirect indices of abundance, harvest success, and public input to help guide management decisions.

Intermittent winter snow cover in the Region limits hound hunting's effectiveness. Annual lion harvest is correlated with the number of days the Region has snow cover (FWP data). Therefore, Region 7 quotas are more likely to serve as limits on harvest during years when snow conditions are favorable than as reliable annual harvest prescriptions. If quotas are met despite annually variable environmental conditions, managers may consider whether an increase is appropriate. Overharvest in Region 7 is unlikely because these favorable tracking conditions are rare and hunters have limited access to occupied habitat.

Region 7 traditionally prescribed a single, Region-wide, harvest quota. This approach was intended to both maximize hunter opportunity and regulation simplicity. It also allowed flexibility to direct harvest to areas with higher lion densities, more conflicts, or better tracking conditions. Region 7 may continue to comprise a single LMU within the Eastern ecoregion to maintain this management approach.

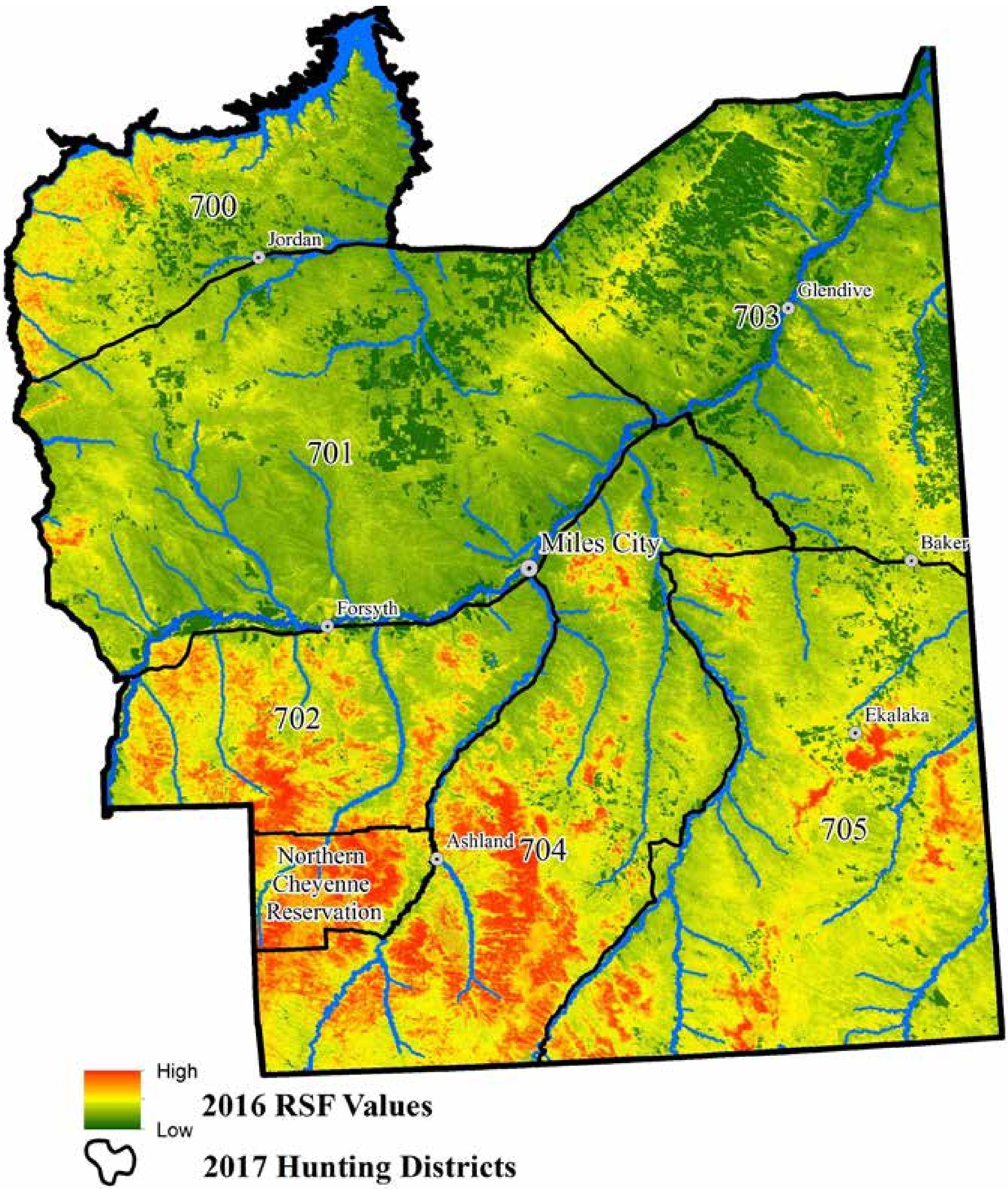
Table 19. Region 7 mountain lion harvest, 1971 – 2016.

License Year	R7		
	F	M	Tot.
1971	0	1	1
1972	0	0	0
1973	0	0	0
1974	0	0	0
1975	0	0	0
1976	0	0	0
1977	0	0	0
1978	0	0	0
1979	0	0	0
1980	0	0	0
1981	0	0	0
1982	0	0	0
1983	0	0	0
1984	0	0	0
1985	0	0	0
1986	0	0	0
1987	0	0	0
1988	0	0	0
1989	0	0	0
1990	1	0	1
1991	0	0	0
1992	1	2	3
1993	1	2	3
1994	0	5	5
1995	2	1	3
1996	2	1	3
1997	1	1	2
1998	1	4	5
1999	3	4	7
2000	5	5	10
2001	4	11	15
2002	3	10	13
2003	1	5	6
2004	4	7	11
2005	0	7	7
2006	9	12	21
2007	6	11	17
2008	9	12	21
2009	8	17	25
2010	11	15	26
2011	17	14	31
2012	15	16	31
2013	10	26	36
2014	18	20	38
2015	8	16	24
2016	12	17	29

FWP biologists will carefully monitor harvest distribution within the Region. Region 7 contains three lion management areas: 1) the Ashland Ranger District of the Custer National Forest (where the majority of Region 7 mountain lion harvests occurs) and adjacent lands, 2) the Sioux Ranger District (Chalk Butte, Ekalaka Hills and Long Pines units) of the Custer National Forest, plus several adjacent large tracts of BLM and private land and, 3) lands on and adjacent to the Charles M. Russell Wildlife Refuge.

Patterns in harvest among these units will be tracked over time. If there is a significant reduction in the distribution of harvest that cannot be attributed to tracking conditions

Figure 37. FWP Region 7 2016 mountain lion winter RSF and hunting districts.

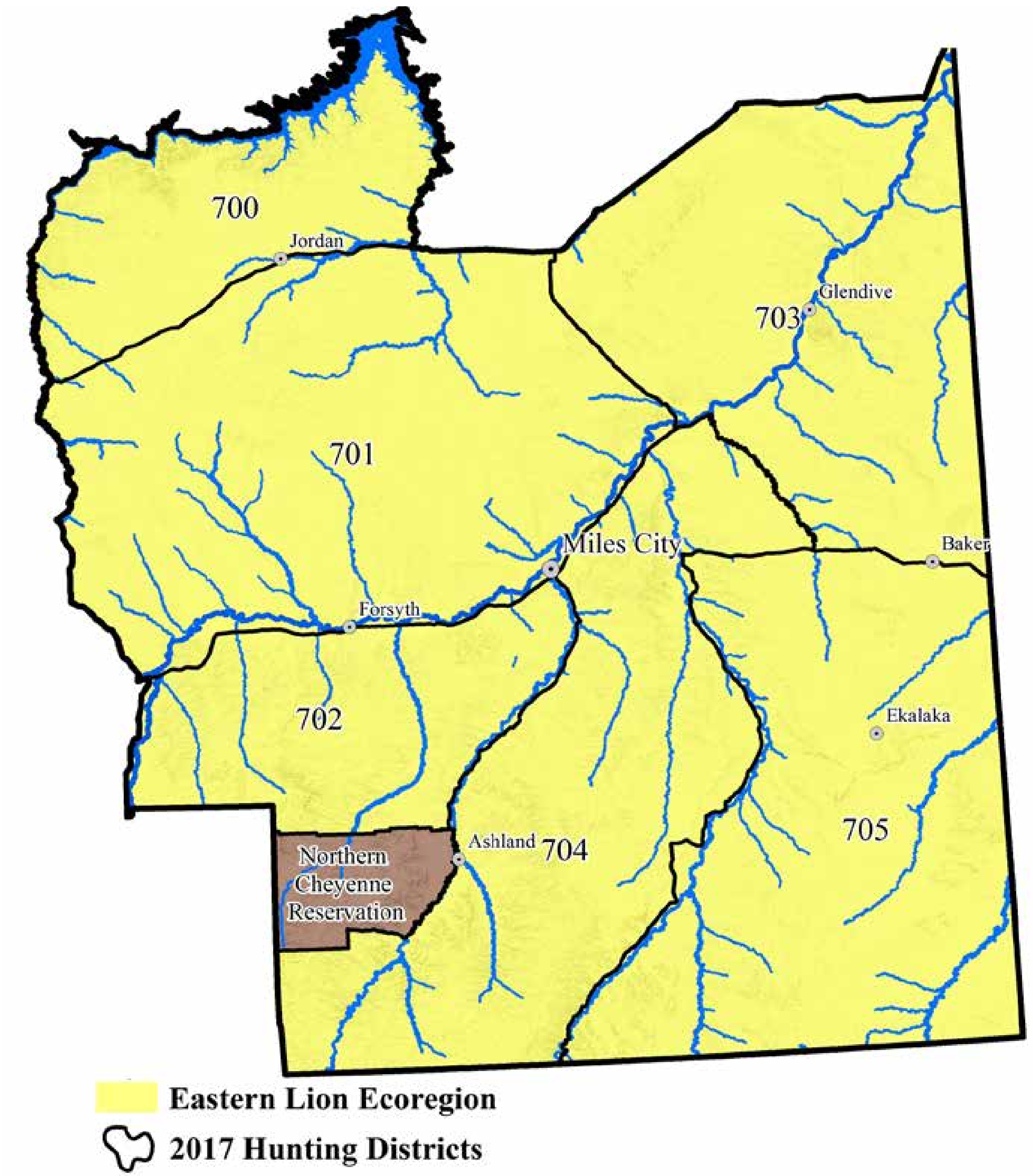


or changes in hunter access, the Region may consider management alternatives. Regional managers will also consider the pattern and rate of Regional human-lion conflicts and landowner input when evaluating these alternatives.

Nonresident hunters take an average of 15% of the lions harvested in Region 7 each year.

Minimizing human-lion conflicts and livestock depredation is a high priority in Region 7. The Region will use both

Figure 38. FWP Region 7 hunting districts and mountain lion ecoregion.



hunter harvest and effective responses to individual incidents that are consistent with the Depredation and Control Guidelines to minimize potential conflicts.

Region 7 will be able to meet lion management objectives by using Model Harvest Regulation **Season Type 2: General License**.

Table 20. Summary of Region 7 mountain lion harvest regulations, 1971 – 2017.

<table>
<tr><th>License Year</th><th>1971</th><th>1972</th><th>1973</th><th>1974</th><th>1975</th><th>1976</th><th>1977</th><th>1978</th><th>1979</th><th>1980</th><th>1981</th><th>1982</th><th>1983</th><th>1984</th><th>1985</th><th>1986</th></tr>
<tr><td>Mandatory Inspection</td><td colspan="2">None</td><td colspan="5">10 Day Inspection</td><td colspan="4">4 Day Inspection</td><td colspan="2">48 Hr. Inspection</td><td>10 Day Inspection</td><td>72 Hr. Inspection</td><td>48 Hr. Inspection</td></tr>
<tr><td>Hunting season</td><td colspan="5">Opening of General D/E - 4/30</td><td colspan="9">CLOSED</td><td colspan="2">12/2 - 2/15</td></tr>
<tr><td>Chase/Hound Training Season</td><td colspan="8">NONE</td><td colspan="8">CLOSED</td></tr>
<tr><td>Regional Quotas</td><td colspan="5">UNLIMITED; One ES Adult Lion per Hunter</td><td colspan="9">CLOSED</td><td colspan="2">3 Any Legal Lion</td></tr>
</table>

<table>
<tr><th>License Year</th><th>1987</th><th>1988</th><th>1989</th><th>1990</th><th>1991</th><th>1992</th><th>1993</th><th>1994</th><th>1995</th><th>1996</th><th>1997</th><th>1998</th><th>1999</th><th>2000</th><th>2001</th><th>2002</th></tr>
<tr><td>Mandatory Inspection</td><td colspan="8">48 Hr. Report; 10 Day Inspection</td><td colspan="3">24 Hr. Report; 5 Day Inspection</td><td>24 Hr. Report; 10 Day Inspection</td><td colspan="4">12 Hr. Report; 10 Day Inspection</td></tr>
<tr><td>Hunting season</td><td colspan="11">12/1 - 2/15</td><td>12/1 - 4/14</td><td colspan="4">Fall Season w/o dogs; 12/1 - 4/14</td></tr>
<tr><td>Chase/Hound Training Season</td><td colspan="2">CLOSED</td><td colspan="9">2/16 - 4/30</td><td colspan="5">No dedicated Chase Season, Hound Training allowed during Winter Hunting Season</td></tr>
<tr><td>Regional Quotas</td><td>3 Any Legal Lion</td><td>3 Any Legal Lion</td><td>3 Any Legal Lion</td><td>3 Any Legal Lion</td><td>3 Any Legal Lion</td><td>3 Any Legal Lion</td><td>3 Any Legal Lion</td><td>5 Any Legal Lion</td><td>7 Any Legal Lion</td><td>7 Any Legal Lion</td><td>7 Any Legal Lion</td><td>7 Any Legal Lion</td><td>7 Any Legal Lion</td><td>10 Any Legal Lion</td><td>15 Any Legal Lion</td><td>20 Any Legal Lion</td></tr>
</table>

<table>
<tr><th>License Year</th><th>2003</th><th>2004</th><th>2005</th><th>2006</th><th>2007</th><th>2008</th><th>2009</th><th>2010</th><th>2011</th><th>2012</th><th>2013</th><th>2014</th><th>2015</th><th>2016</th><th>2017</th></tr>
<tr><td>Mandatory Inspection</td><td colspan="15">12 Hr. Report; 10 Day Inspection</td></tr>
<tr><td>Hunting season</td><td colspan="7">Fall Season w/o dogs; 12/1 - 4/14</td><td colspan="8">Archery-only Season; Fall Season w/o dogs; 12/1 - 4/14</td></tr>
<tr><td>Chase/Hound Training Season</td><td colspan="15">Hound Training Season 12/2 - 4/14</td></tr>
<tr><td>Regional Quotas</td><td>20 Any Legal Lion</td><td>20 Any Legal Lion</td><td>20 Any Legal Lion</td><td>20 Any Legal Lion</td><td>25 Any Legal Lion</td><td>25 Any Legal Lion</td><td>25 Any Legal Lion</td><td>25 Any Legal Lion</td><td>30 Any Legal Lion</td><td>30 Any Legal Lion</td><td>35 Any Legal Lion</td><td>45 Any Legal Lion</td><td>45 Any Legal Lion</td><td>45 Any Legal Lion</td><td>45 Any Legal Lion</td></tr>
</table>

APPENDIX 1

POPULATION MONITORING, FIELD PROTOCOL, AND DATA ANALYSIS

Trend Monitoring Area Selection

FWP identified permanent trend monitoring areas within the Northwest, West-central, and Southwest ecoregions based on the following criteria:

- The area is approximately 2,600 km^2 (1,000 mi^2) in size, and
- The habitat quality (assessed both qualitatively and as predicted by the 2016 RSF) within the trend area is representative of the lion habitat type and quality present in the remainder of the ecoregion, and
- There is current and long term physical and legal access to the majority of the trend monitoring area during winter, and
- Regional wildlife managers and the public are committed to prescribing annual mountain lion harvest rates for the trend monitoring area's LMUs that are representative of the annual harvest rate in the larger ecoregion.

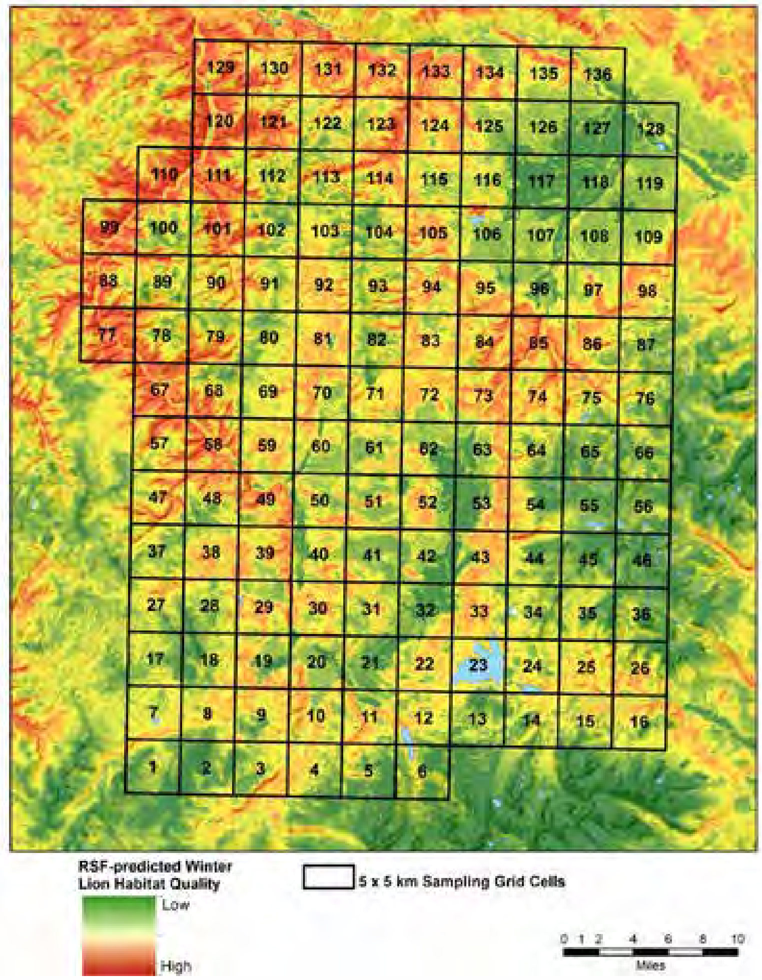
Locations of the Northwest, West-central, and Southwest trend monitoring areas are shown in Chapter 4.

Supplemental Monitoring Area Selection

Supplemental monitoring areas in each of the Northwest, West-central, and Southwest ecoregions may be sampled the year after each ecoregion's trend monitoring area is sampled. The supplemental monitoring areas will be selected using the following criteria:

- The area is approximately 2,600 km^2 (1,000 mi.2) in size, and
- There is sufficient physical and legal access (i.e. public land or prior permission from private landowners) to allow sampling of most of the predicted mountain lion habitat in the monitoring area during winter, and
- Harvest rates for the proposed supplemental monitoring area's LMUs have been representative of the annual harvest rate in the larger ecoregion for at least the last 6 years.

Figure 39. An example of a sampling grid overlaid on a 3,400 km^2 monitoring area and the underlying 2016 RSF for the area (Proffitt et al. 2014; Upper Clark Fork River, MT).



Initial Field Protocol

Collection and analysis of field data will initially follow methods described in detail by Proffitt et al. (2015). Population monitoring and field sampling techniques may change as improved methods are developed and validated in the future.

Monitoring areas will be sampled between 12/1 and 4/15. Field staff will overlay a 5x5 km grid across the study area and assign each cell a number. Cells will then be stratified into classes according to their habitat quality (RSF value) and a random search order will be assigned to cells in each class. Although each day's search effort will begin in a randomly assigned grid cell, more overall search effort will be dedicated to cells with higher quality habitat (Figure 39).

Trackers and hound handlers will search their assigned cell(s) to collect genetic samples from mountain lion hair, scat, and muscle. The location where each sample is collected will be recorded, as will the search route trackers used to survey the cells (Figure 40).

When a fresh track of a suspected independent-aged mountain lion is located, the hound handlers will attempt to tree the lion and collect a muscle sample using a biopsy dart fired from a pneumatic gun. The tracks will then be backtracked and inspected to determine if the lion was independent or associated with a family group—if it was traveling with other animals, the group size will be recorded. Sex of the treed lion will be determined based on genetic analysis.

When older mountain lion tracks are located, a tracker or hound handler will backtrack and collect any hair or scat samples present along the track. All field crews will use a Global Positioning System to record the length and location of their search effort (Figure 40).

Figure 40. An example of the distribution of search effort within a SCR sampling area. In total, 12,785 km of trails within 127 grid cells were sampled over 121 days (Proffitt et al. 2014; Upper Clark Fork River, MT).

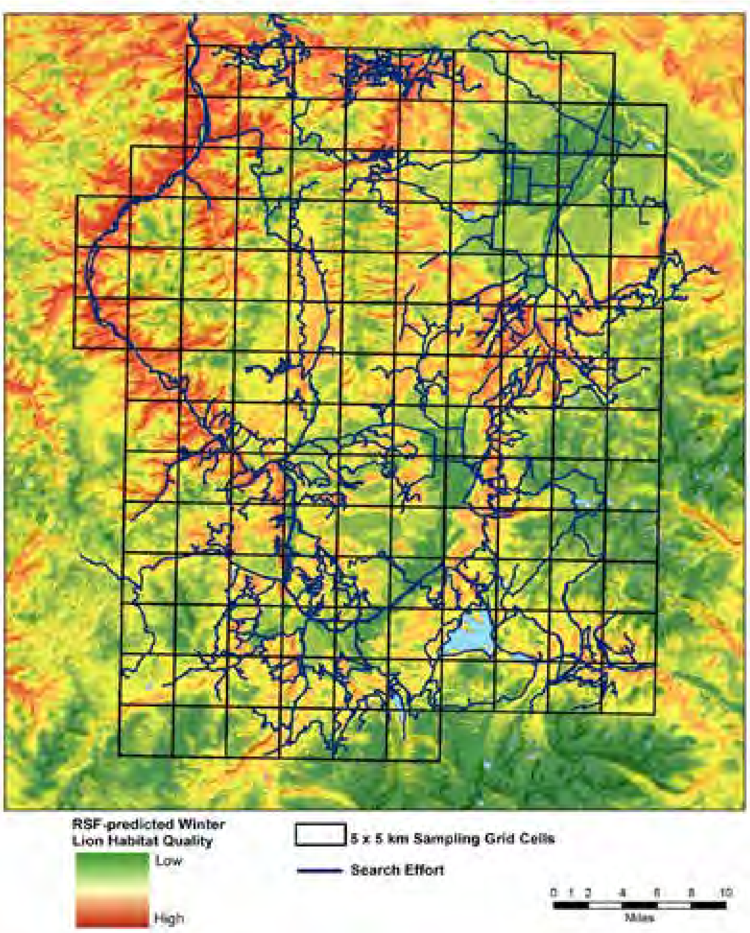
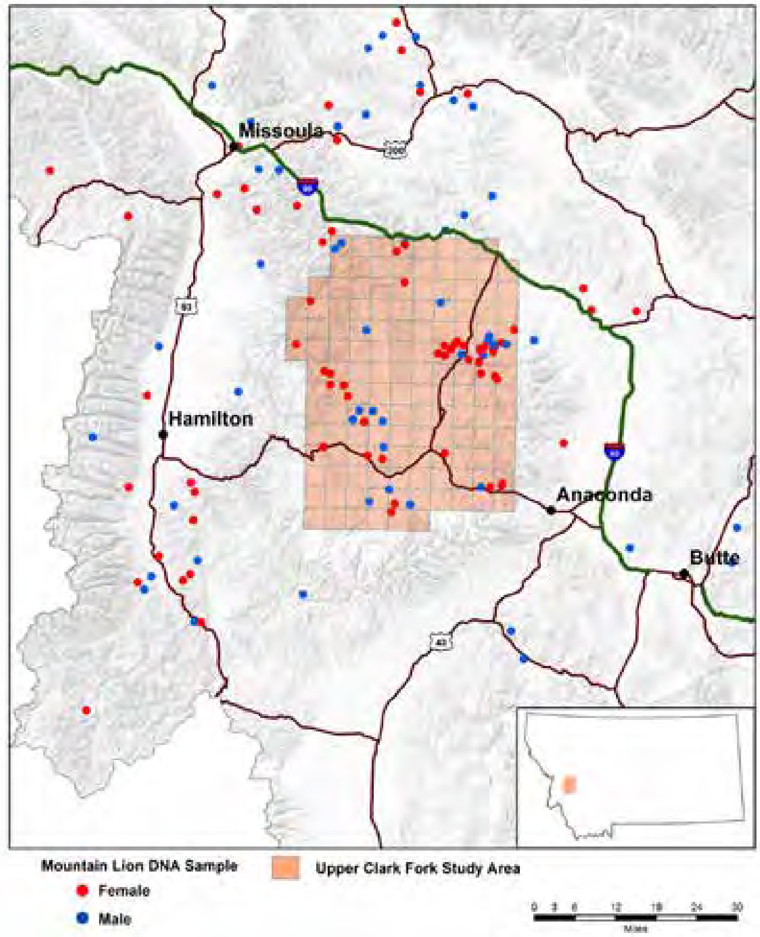


Figure 41. An example of a SCR sampling area and the locations of 132 mountain lion tissue samples (from both field sampling and harvest) that had DNA successfully extracted and analyzed to determine individual ID (Proffitt et al. 2014).



In Montana, the hide and skull of all harvested mountain lions must be presented to a FWP employee within 10 days. FWP will collect genetic samples from all know lion mortalities that occur in or adjacent to the monitoring area. Hair and muscle samples from these lions will be genetically analyzed to determine sex and the individual lions' identities (Figure 41).

Field Sampling Recommendations

A "sample" is a successfully extracted and identified individual mountain lion DNA sequence. Because not all non-invasive DNA samples will generate amplifiable DNA, not all material collected in the field will provide a useful DNA sample. Even after a single sample is collected in a cell, field staff are generally encouraged to continue to expend effort in that cell to obtain either additional lower quality samples (scat, hairs) or a high-quality sample (muscle biopsy). For hound handlers, this means collecting a biopsy dart sample, and a backup high-quality hair sample. For snow backtrackers, multiple scat samples from different scats, and/or hair samples are ideal.

Field staff will collect tissue from biopsy darts, scats from backtracking, hairs from both biopsy darting (as a backup sample) and hairs from snow tracking, and harvested lion muscle samples. During previous studies (Russell et al. 2012, Proffitt et al. 2015) DNA extraction success was highest for muscle/biopsy samples and lowest for hair and scat. Because not all biopsy samples generate successful DNA sequences, a second set of high-quality hair samples (with follicles attached) should also be collected. Hound handlers should collect these samples opportunistically while tracking the animal to the tree, then search for hair and/or scat around the tree and while back tracking from the tree.

There is a critical difference between when a survey cell has been searched versus when a cell has been successfully sampled. Survey effort was an important predictor of detection in previous SCR studies of lions (Russell et al. 2012). Therefore, field staff must carefully collect a GPS track log of all daily search effort. If a cell is searched and lion sign is present but a sample is not obtained, then the cell was not successfully sampled.

Search effort should be spatially distributed by randomly assigning cells to be searched each day. These random grid cells are the starting point for the day's search. However, if new tracks are encountered while traveling to the days starting grid cell, the tracker should follow those tracks if that grid cell has not been successfully sampled yet. If tracks of a lion previously captured in that grid cell are detected, however, the tracker should proceed to the day's assigned starting location.

The hound handler/tracker should confine search activity to the assigned focal cell or its 8 adjacent grid cells on any particular day. Field crews may choose to skip a randomly assigned cell if multiple teams are working nearby and the randomly assigned cell could lead to survey overlap. Likewise, assigned cells may be skipped if that cell has been surveyed within the previous month and a high-quality sample already obtained. Field crews may choose to skip assigned cells if conditions in the assigned cell will not allow snow tracking.

Once a hound handler is assigned a starting grid cell, subsequent sampling effort may proceed in one of several ways. If the assigned cell and adjacent cells are searched, no sign is detected, and the hound handler believes the area is likely void of lions at that time (e.g. too high of an elevation, too much snow, etc.), the hound handler will receive a new randomly assigned starting cell the next day. The cell will remain on the sampling list for that period.

If after the assigned cell and adjacent cells are searched, all tracks are followed, and the hound handler believes that all lions currently detected within the area have been sampled, the cell(s) from which samples were collected will be removed from the sample list for that period. The hound handler will then get a new starting cell from the sampling list the next day.

If the assigned cell and adjacent cells are searched, multiple tracks are found, and the hound handler believes that NOT all lions currently within the area have been sampled, only the cell(s) from which samples were collected will be removed from the list. The hound handler will then return to the area and continue to work there until their shift is over, or they believe they have sampled all of the lions thought to be in the area. A new starting cell from the sampling list will be assigned the next day.

All samples will be carefully stored in desiccant and labeled with a unique sample ID. Hound handlers and trackers will record their daily search effort using GPS tracks from GPS units.

Estimating Ecoregional Lion Abundance

Montana FWP will monitor and manage mountain lions within large (>35,000 km^2) ecoregions. To do so, managers will need to periodically estimate lion population size within these ecoregions and make predictions about the effect of future harvest at this scale. Once an overall harvest prescription has been developed for an ecoregion, individual harvest limits will be assigned to the ecoregions' LMUs to distribute harvest and address local management objectives.

Spatially explicit abundance estimates from representative sampling areas can be extrapolated across a broader area of inference to estimate that landscape's population size (Boyce & McDonald 1999). This method of extrapolating animal abundance as a function of RSF-predicted habitat quality has been used to estimate populations of many species (Boyce et al. 2016), including mountain lions in Montana (Robinson et al. 2015).

Several important factors must be considered when using data collected from sampling areas to estimate a species' population size across a larger area (Wiens et al. 2008, Boyce et al. 2016):

- The relationship between the observed number of animals and available habitat (ie. the 2016 RSF) within a sampling area should be similar to that same relationship across the larger landscape, and
- Harvest management within sampling areas should be representative of the broader area of inference (Reynolds et al. 2016). Specifically, it's important that the long-term mountain lion hunter-harvest rate within an ecoregion's monitoring areas is similar to the harvest rate within the larger landscape for which the estimate is being made, and
- Because a species' abundance can vary over time for reasons unrelated to habitat quality (ie. hunting or changes in prey density), representative sampling area(s) must be periodically re-sampled. This helps ensure that up-to-date relationships between abundance and RSF values are used to estimate current populations.

Producing Ecoregion Population Estimates

The relationship between mountain lion density and habitat within an ecoregion's monitoring area(s) will be most similar to other areas within that same ecoregion. Therefore, the mountain lion abundance data collected on monitoring areas will only be used to estimate the population size of the ecoregion where that monitoring area is located—they will not be used to develop population estimates for other ecoregions.

Even within ecoregions, the relationship between mountain lion abundance and habitat quality varies. To improve the accuracy of an ecoregion's population estimate, FWP may initially collect data from both a fixed Trend Monitoring Area (sampled Year 1) and a Supplemental Monitoring Area (sampled Year 2). The locations of Supplemental Monitoring Areas may vary over time, Trend Monitoring Area locations will not.

Combining the data collected from both the trend and supplemental monitoring areas may generate a more representative ecoregional estimate of the relationship between lion abundance and the RSF as compared to using data from the trend monitoring area alone (Howe et al. 2013). Therefore, the results of the two subsequent samples will be pooled to describe the current relationship between lion abundance and the RSF within an ecoregion. This pooled relationship will be used to estimate the population of independent-aged mountain lions within that ecoregion.

Ecoregion population estimates will also be produced using monitoring data from the fixed trend monitoring area alone. FWP will compare the estimate derived using the pooled areas' data and the estimate using only the trend monitoring area data. If the two methods consistently produce similar estimates, supplemental monitoring areas will not continue to be sampled.

The initial FWP SCR model predicts the abundance of independent-aged mountain lions at a 4 km^2 resolution (Proffitt et al. 2015). The following regression equation is an example of one way to estimate the effect of RSF on abundance across the ecoregion:

$$\text{Abundance} = \beta 0+\beta 1*\text{RSF}+e$$

FWP continues to test and validate extrapolation methods.

FWP will estimate the mean RSF value over the same spatial extent (4 km^2) for both the trend and supplemental monitoring areas, and use these mean RSF values in the regression model. The above regression equation represents the effect of the mean 4 km^2 RSF on predicted spatial abundances within the pooled trend and supplemental monitoring areas. Using this relationship, FWP will predict mountain lion abundance for the entire ecoregion by extrapolating the observed relationship between RSF values and mountain lion abundance (Boyce & McDonald 1999). FWP will use the 95% confidence interval around β RSF to estimate the 95% upper and lower confidence intervals around the predicted mean abundance for the ecoregion.

FWP will periodically sample mountain lion populations and produce estimates for the Northwest, West-central, and Southwest ecoregions. An estimate of the overall abundance of mountain lions within these ecoregions will then be developed based on the sampling data. These estimates will be input into the IPM (Chapter 6) as additional data. The IPM then considers the field-based abundance estimates along with harvest prescriptions and lion vital rates when generating more complete predictions of past and future ecoregional population trends.

Data Analysis

To estimate the abundance of independent lions in the sampling area, FWP will initially fit the SCR model to a dataset that includes only samples from independent animals or the adult female of a family group. This eliminates multiple samples from within family groups as well as all groups where only a subadult animal was sampled.

The monitoring period will be divided into sampling periods within the winter season (December, January, February, and March-April). An encounter history will be developed for each detected individual during each sampling period and the detection probability for harvested animals will be adjusted to '0' for the sampling periods following their death.

FWP will initially use a Bayesian SCR model to estimate the number of mountain lions present within the sampling area. This method explicitly incorporates the spatial organization of individuals through the estimation of specific capture probabilities (Efford 2004, Efford et al. 2009, Gardner et al. 2010, Royle et al. 2013).

To account for individuals that had a home range only partially within the sampling area, FWP will buffer the study area by 10 km and estimate spatial densities within the larger area. We will then evaluate potential models that include all possible combinations of the covariates for search effort and sex, RSF-driven densities, and sex-specific activity center distributions (Russell et al. 2012). We will conduct model selection using a combination of Bayesian Information Criteria (BIC), examination of the posterior significance of the parameters in each model, and two goodness of fit statistics (as described in Proffitt et al. 2015). All of these factors will be weighted by our prior knowledge of mountain lion biology.

We will then estimate the independent-aged lion abundance, with confidence intervals, for the trend and supplemental monitoring areas. Because these abundances are spatially explicit functions of the areas' underlying habitat quality, we will then extrapolate the monitoring areas' relationship between abundance and the RSF to produce an estimate of lion abundance across the larger ecoregion.

Cost

Field monitoring will occur at a significant periodic cost to Fish, Wildlife and Parks. The Department will need to hire one staff biologist who will work half-time (6 months) to plan and organize logistics, contract field staff, coordinate day-to-day field operations, and prepare data for analysis. Enough hound handlers will be contracted to successfully sample approximately 60% of grid cells within the Monitoring Area during the four sampling periods. The number of contractors may vary depending on each contractor's seasonal availability. Genetic analysis of the collected samples will also be contracted through an independent laboratory.

Table 21. Approximate costs (2016) to collect and analyze mountain lion monitoring area data.

Contracted Hound Handlers	$65,000
Genetic Analysis	$9,500
Fuel and housing	$6,500
FWP Biologist (1/2 FTE)	$32,500
Misc. Supplies	$2,000
Total	$115,500

APPENDIX 2

MOUNTAIN LION INTEGRATED POPULATION MODEL DEFINITION AND USER INPUTS

The Montana mountain lion integrated population model is generally described in Chapter 6 and in Nowak et al. 2018. Following are more complete descriptions of the several internal models, the data and prior assumptions that the IPM includes, and an explanation of the controls that users can manipulate to improve the IPM's outputs.

Reproduction Model Definition

The equation describing the number of kittens in year y is as follows:

$$N_{kit,f,y} = \left(N_{sa,f,y} * P_s a * LS_s a * 0.5 + N_{a,f,y} * P_a * LS_a * 0.5 * 0.5\right) * Survival_{kit,y-1}$$

Thus, we calculate the number of female kittens ***f*** in year ***y*** as a function of the number of subadult ***SA*** and adult ***A*** females ***f*** in year ***y***. For the subadult contribution we take the product of the number of subadults, the age specific pregnancy rate ***P***, and litter size ***LS***.

Only a fraction of the resulting kittens will be female and so the final term in the product simply assumes that half of the kittens born are female. The adult contribution to the kitten population is calculated as the product of the number of adults, the age specific pregnancy rate, litter size, and 0.25 (0.5 * 0.5). Because we assume the adult inter-birth interval is 24 months, only half of the adult females are available to reproduce in any given year. We therefore multiply the reproductive term by 0.5. Said another way, the first 0.5 represents the assumption that half of the kittens born are females and the second 0.5 reflects our assumption that the birth interval is 24 months, which results in half of the adult female population giving birth each year.

Multi-state Survival Model Definition

The mountain lion IPM in ***PopR*** is built around a 4-age class and 2-sex population model. The 4 age classes are ***kittens*** (0-6 months), ***juveniles*** (6-18 months), ***subadults*** (18-30 months) and ***adults*** (30+ months). We assume a 50:50 sex ratio at birth but, starting with the juvenile age class, each sex is modeled separately. The process model describing lion ecology is represented by a series of equations that describe transitions from one age class to the next each year.

$$N_{kit,f,y} = \left(N_{sa,f,y} * P_s a * LS_s a * 0.5 + N_{a,f,y} * P_a * LS_a * 0.5 * 0.5\right) * Survival_{kit,y-1}$$

$$N_{juv,f,y} = N_{kit,f,y-1} * Survival_{juv,f,y-1} - harvest_{juv,f,y-1} + \epsilon_{juv,f,y}$$

$$N_{sa,f,y} = N_{juv,f,y-1} * Survival_{sa,f,y-1} - harvest_{sa,f,y-1} + \epsilon_{sa,f,y}$$

$$N_{ad,f,y} = \left(N_{sa,f,y-1} + N_{ad,f,y-1}\right) * Survival_{ad,f,y-1} - harvest_{ad,f,y-1} + \epsilon_{ad,f,y}$$

where,

$$N_{age,sex,y}$$
is the abundance of age class age, sex sex in year y

$$Survival_{age,sex,y}$$
is the survival of age class age, sex sex in year y

$$P_{age}$$
is the age-specific pregnancy rate

$$LS_{age}$$
LS is the age-specific litter size

$$\epsilon_{age,sex,y}$$
is the age, sex and year-specific residual variation

Kittens born to subadults and adults the previous year are recruited as juveniles on December 1st each year. The number of subadults and adults is indexed to year ***y*** based on the number of reproductive females in the population on December 1. The model then takes into account the probability these females will survive until they give birth (assumed to be July 1). We also assume that kittens whose mothers die within the first six months after giving birth will not survive.

The model does not make kittens available for harvest because it assumes they become juveniles on December 1 at 6 months old but would not be independent (and legally harvestable) until after the winter hunting season ends. Although some subadults may reproduce, they do so at a lower rate than adults. Subadults transition to adults on December 1st of the following year. Any mountain lion older than 30 months is considered either an adult male or female. As adults, the model assumes that each sex survives (except for harvest) and reproduces at the same respective rate for the remainder of their lives.

The lion IPM primarily uses estimates and variability of documented vital rates (from the research literature) rather than raw field data itself (Table 22). This model structure provides several advantages. First, it allows lion research data collected using a wide variety of field sampling protocols to fit into the IPM framework—once the parameter and its error distribution is described it can be entered into the IPM. Because we also include a measure of the field estimate's precision, all sources of uncertainty remain in the IPM.

The general form of the observation model in ***PopR*** is:

$$\hat{\theta} \sim Normal\left(\bar{\theta}, \widehat{SE}(\hat{\theta})\right)$$

where,

$\theta =$ field estimate

$\widehat{SE}(\hat{\theta}) =$ estimated standard error of

$\bar{\theta} =$ IPM parameter.

The observation model is like a multi-dimension regression model. The model fitting process seeks to minimize the distance between the IPM parameter (ie. Adult Female Survival) and the associated field estimate simultaneously across all IPM parameters.

Population Reconstruction Model Definition

The IPM uses survival estimates along with the annual harvest rate to reconstruct past mountain lion populations. It is based on examples of live recapture/dead recovery models from the literature that consider sex, age and year specific abundance estimates from records of harvested animals (Brownie et al. 1985, Link et al. 2003, Conn et al. 2008, Buderman et al. 2014). Current hunter harvest by sex, age, and location is input to the model after the close of the harvest season each year. By combining the multi-state survival model with observed harvest data, we can intuitively estimate population size by assuming a simple binomial distribution whose expectation is equivalent to:

$$N_{age,sex,y} = \frac{harvest_{age,sex,y}}{harvestMortality_{age,sex,y}}$$

where,

$$harvest_{age,sex,y}$$

is the number of age a, sex s, animals harvested in year y

$$N_{age,sex,y}$$

is the age, sex and year specific abundance

$$harvestMorality_{age,sex,y}$$

describes the relationship between abundance and harvest.

In practice, we implement harvest reconstruction as a binomial distribution:

$$harvest_{age,sex,y} \sim Binomial\left(harvestMortality_{age,sex,y}, N_{age,sex,y}\right)$$

Because the model requires that annual harvest data are input annually by both sex and age, FWP determines the age of harvested lions using cementum age analysis (Trainer & Matson 1988). In cases where teeth cannot be successfully extracted or an age confidently determined, the model randomly samples the distribution of known-age animals by sex and assigns an age to that animal for the purpose of the population reconstruction.

Direct estimates of population abundance (Proffitt et al. 2015) will be input into the model when they are available. These periodic field estimates can significantly improve past and future population estimates for individual lion ecoregions. Direct population estimates will be periodically developed for most lion ecoregions following the methods described in Chapter 5.

PopR uses Markov Chain Monte Carlo (MCMC) methods to "fit" IPM population estimates to the available data. MCMC methods estimate parameters in complex models by systematically updating informed prior distributions with information gleaned from field data (e.g. observed harvest). Therefore, they allow us to describe each parameter in terms of a distribution and that distribution's shape. Parameters described by a narrow and peaked distribution are more precisely estimated than those that are flatter and less peaked.

PopR provides generally acceptable default MCMC settings but also allows users to easily adjust them in the web-based user interface. Typically, 25,000-100,000 MCMC iterations will be required to fit an IPM. ***PopR*** provides convergence diagnostics in the output report.

IPM USER CONTROLS

Demographic Variation

These settings allow users to decide whether to allow estimates of population vital rates to be drawn from a single distribution ("Constant") or from a range of all possible distributions that differs every year ("Time Varying"). Biologists should only choose "Time Varying" if they have reason to believe that non-harvest factors (such as weather or prey density) introduce additional volatility in these vital rates that would not have been present during the field research projects from which the "Constant" rate distribution was developed. Research has demonstrated that mountain lion non-harvest survival and reproductive rates are remarkably stable and the "Constant" setting should be considered the default.

Burn-in Length

"Burn-in" is a colloquial term for an initial process that gives the Markov Chain time to approach the solution to the problem by throwing away some less reasonable starting points at the beginning of a Markov Chain Monte Carlo run. Allowing the Burn-in process to establish an equilibrium distribution reduces the number of subsequent MCMC sampling iterations needed to provide an estimate with reasonable certainty. In PopR, managers should simply use the default Burn-in Length setting when developing an estimate through the standard user interface.

Markov Chain Monte Carlo (MCMC) Iterations

If the number of MCMC iterations is set too low the uncertainty about an estimate is likely to be misrepresented. In ***PopR***, we use the Brooks-Gelman-Rubin (BGR) statistic as an initial assessment and this is the statistic used when automating convergence. The BGR statistic suggests convergence when estimates of Rhat are below 1.1 or more generally close to 1. This statistic is reported under the "Table" tab and highlighted in red when Rhat estimates are above 1.1. The default settings will produce results that are unlikely to change even if run longer, but users should increase the number of MCMC iterations to 15,000 or greater if either Rhat estimates are above 1.1 and/or computing time allows.

Thinning Rate

Thinning tells the sampler to only retain every nth value from the chains. This technique is sometimes used to reduce autocorrelation in the chains, but comes at the cost of reduced efficiency of the sampler. A more reasonable use of thinning is when hardware limitations are being reached, which typically comes in the form of running out of memory. This will not be an issue in ***PopR*** and, therefore, the recommended setting for the Thinning slider is ***1.***

Automate Convergence

Users may choose to simply check the "Automate Convergence" box below the MCMC sliders menu in the ***PopR*** interface. Although this option will increase the time necessary to produce an estimate, it will assure that an adequate Burn-in Length and number of MCMC Iterations have been used to produce a statistically sound estimate and error distribution.

Table 22. Default mountain lion vital rates used in Montana's 2016 Integrated Population Model. Rates are based on field data collected from 263 radio-monitored lions from Montana, Wyoming and Washington.

Parameter	Age	Sex	Mean	SE
Survival	YOY	F	0.5	0.1
Survival	Juvenile	F	0.75	0.1
Survival	SubAdult	F	0.57	0.1
Survival	Adult	F	0.8	0.05
Survival	YOY	M	0.5	0.1
Survival	Juvenile	M	0.75	0.1
Survival	SubAdult	M	0.49	0.1
Survival	Adult	M	0.65	0.05
HarvMort	Juvenile	F	0.01	0.01
HarvMort	SubAdult	F	0.25	0.1
HarvMort	Adult	F	0.1	0.1
HarvMort	Juvenile	M	0.01	0.1
HarvMort	SubAdult	M	0.35	0.1
HarvMort	Adult	M	0.2	0.1
OtherMort	Juvenile	F	0.24	0.1
OtherMort	SubAdult	F	0.18	0.1
OtherMort	Adult	F	0.05	0.1
OtherMort	Juvenile	M	0.24	0.1
OtherMort	SubAdult	M	0.16	0.1
OtherMort	Adult	M	0.15	0.1
Fetus Count	SubAdult	F	3	0.1
Fetus Count	Adult	F	3	0.1
Pregnancy	SubAdult	F	0.5	0.01
Pregnancy	Adult	F	1	0.01

APPENDIX 3

MOUNTAIN LION DEPREDATION AND CONTROL GUIDELINES

In accordance with Montana Code Annotated 87-1-201, 87-1-217, 87-1-225, 87-1-301, 87-1-304, 87-3-127, 87-3-128, 87-5-713, 87-5-725, and 87-6-106, Montana Fish, Wildlife and Parks (FWP) and the Fish and Wildlife Commission are both authorized and charged with the duties of protecting persons and personal property from damage and depredation resulting from ingress or attack by wildlife. The goal of the **Mountain Lion Depredation and Control Guidelines** is to minimize damage to property and to prevent public safety problems. For the purpose of these Guidelines, a Public Safety Problem is defined as: Any situation where a FWP employee (or their agent) reasonably determines that a human has been physically injured or killed as a result of contact with a mountain lion, that an attack by a mountain lion has resulted in the loss of livestock or pets, or that the continued presence of a mountain lion poses a threat to human safety.

Any mountain lion that is lethally removed by FWP or its agents must be retained and transferred to the Montana Livestock Loss Board for sale or auction pursuant to MCA 2-15-3110 to 3113 and 87-1-217.

I. DEFINITIONS

The following are definitions designed to standardize the vocabulary used in the investigation and reporting of human/lion conflicts. It is important that the same terms be used to describe the different types of encounters that occur between humans and mountain lions. The definitions presented here are similar to those used in other western states.

<u>Sighting</u>: A visual observation of a mountain lion.

<u>Encounter</u>: An unexpected direct meeting between a human and a mountain lion without incident or the recurrent sighting in close proximity to human development or habitation.

<u>Incident</u>: A conflict between a human and mountain lion that may have serious results (i.e. a mountain lion killing or attempting to kill a pet that must be forced to back down).

<u>Attack</u>: When a human is bodily injured or killed by physical contact by a mountain lion.

<u>Nuisance Lion</u>: A mountain lion involved in encounters and incidents (i.e. pet attacks, continual presence around humans or areas of high human activity, presence near where children are or will be shortly) but is showing no aggression and/or flees when encountered by a human.

<u>Depredation Lion</u>: A mountain lion involved in the killing of livestock.

<u>Aggressive Lion</u>: An individual mountain lion exhibiting aggressive behavior towards humans including a mountain lion that attacks a person without provocation, intentionally approaches humans or fails to retreat when a human takes aggressive actions, or forces a human to take evasive action to avoid attack.

<u>Livestock Depredation</u>: Livestock attacked or killed by a mountain lion.

<u>Conflict</u>: When a human and mountain lion are involved in an encounter, incident or attack, or a mountain lion is determined to be aggressive, a nuisance, or involved in livestock depredation.

II. DOCUMENTATION OF HUMAN-MOUNTAIN LION CONFLICTS

1. Each FWP Region is responsible for responding to reports of mountain lion damage to property and human-mountain lion encounters, incidents, or attacks. Regional Supervisors shall ensure the following procedures are used upon FWP employees' receiving such reports.

    a. Obtain the name, address, and telephone number of the person making the report, the person receiving the call, and the time and date of the call.

    b. Record if the conflict involves an Encounter, an Incident, an Attack, or a Livestock Depredation.

    c. If a Livestock Depredation is reported or suspected, record the number and type of livestock involved and immediately contact the USDA APHIS Wildlife Services agent with responsibility for the area where the incident occurred.

    d. Record the number of mountain lions involved, its/their age class (if known), and the date and time of the conflict.

    e. If the conflict was a human Attack, record the name, sex, and age of the victim, location, and the extent of any injuries. IMMEDIATELY notify both 911 (if that had not already occurred) AND FWP Enforcement Division staff, who will determine whether a Wildlife Human Attack Response Team (WHART) should be convened to initiate a response following WHART Guidelines (Appendix 4).

    f. Record the location of Encounters, Incidents, and Attacks as specifically as possible, including physical address and/or geospatial coordinates.

    g. For Encounters, Incidents, or Attacks, record the behavior of the mountain lion and what, if any, action was taken on the part of the person involved.

    h. Record which FWP personnel responded to investigate, the time and date of the response, and what action(s) was taken.

2. A description of all reported conflict incidents, including the above information, will be entered into the designated FWP wildlife conflict database as soon as possible following receipt of the report. This record should be updated when the situation is resolved.

III. FWP ACTIONS TO BE TAKEN WHEN HUMAN-MOUNTAIN LION CONFLICTS ARE REPORTED

A FWP employee shall promptly investigate the validity, severity, and details of any reported human-mountain lion conflict. The following guidelines are the minimum actions required of FWP when conflicts are reported. Additional investigation into a conflict, or higher levels of response, will occur at the discretion of the Regional Supervisor and the investigating FWP employee. All interviews and investigations will begin no more than 48 hours after the conflict is reported in accordance with MCA 87-1-225.

CONFLICT	ACTIONS THAT WILL BE TAKEN
Encounter	The reporting party will be contacted and the details of the Encounter (Section II. (1)) will be documented. If the mountain lion involved in the conflict is determined to be a Nuisance Lion, the responding FWP employee and Regional Supervisor may choose to either haze (i.e. using less-than-lethal ammunition or pursued with trained dogs) or lethally remove the mountain lion(s). This decision will depend on the severity of the conflict, location, pattern of habituation, escalation of behavior, or other relevant factors. FWP may also issue a kill permit to the affected landowner. Mountain lions shall not be captured and translocated under any circumstances. Information about the Encounter and FWP's response will be

recorded and entered into the FWP wildlife conflict database.

Incident

Depredation

A FWP employee will conduct an on-site investigation to determine if the mountain lion involved in the conflict is Aggressive. All Aggressive mountain lions will be lethally removed as soon as is practical. If the mountain lion involved in the conflict is determined to be a Nuisance Lion, the responding FWP employee and Regional Supervisor may choose to either haze (i.e. using less-than-lethal ammunition or pursued with trained dogs) or lethally remove the mountain lion(s) depending on the severity of the conflict, location, pattern of habituation, escalation of behavior, or other relevant factors. FWP may also issue a kill permit to the affected landowner. Mountain lions shall not be captured and translocated under any circumstances. Information about the Encounter and FWP's response will be recorded and entered into the FWP wildlife conflict database.

Attack

The FWP employee receiving a report of an Attack will record the name, sex, and age of the victim, location, and the extent of any injuries. The employee will IMMEDIATELY notify both 911 (if that had not already occurred) AND FWP Enforcement Division staff, who will determine whether a Wildlife Human Attack Response Team should be convened and to initiate a response following WHART Guidelines. Measures to lethally remove the offending mountain lion(s) will be immediately initiated.

Montana law (MCA 87-6-106) gives private citizens the right to kill, without fear of penalty, any mountain lion attacking, killing, or threatening to kill a person or livestock. Private citizens may also kill a mountain lion that is in the act of attacking or killing a domestic dog. A person who kills a mountain lion under this statute must notify a FWP employee within 72 hours and surrender the carcass to FWP.

Livestock

If a Livestock Depredation is reported or suspected, the FWP employee will record the number and type of livestock involved, location, livestock owner's contact information, and number of mountain lions involved. The FWP employee will then immediately contact the USDA APHIS Wildlife Services agent with responsibility for the area where the incident occurred and convey that information. That Wildlife Services agent will be responsible for investigating the reported Livestock Depredation and determining the appropriate response.

Montana law (MCA 87-6-106) gives private citizens the right to kill, without fear of penalty, any mountain lion attacking, killing, or threatening to kill a person or livestock. Private citizens may also kill a mountain lion that is in the act of attacking or killing a domestic dog. A person who kills a mountain lion under this statute must notify a FWP employee within 72 hours and surrender the carcass to FWP.

These **Mountain Lion Depredation and Control Guideline**s are effective upon Fish and Wildlife Commission's adoption of this Strategy and supersede any previously-adopted versions.

APPENDIX 4

GUIDELINES FOR RESPONDING TO WILDLIFE ATTACKS THAT RESULT IN HUMAN INJURY OR DEATH: "WHART" GUIDELINES

(Note: attachments and appendices referenced in this section are available from FWP Enforcement Division, upon request)

INTRODUCTION:

This document will provide guidance in the process for handling responses to a wildlife attack that causes human injury or death. In order to provide guidance and standardize the response of FWP personnel, the following guidelines will direct their actions in dealing with wildlife attacks on humans that result in injury and/or death to human victims. It may not be possible to follow these guidelines in every situation.

FIRST RESPONDERS:

An immediate field response is required for any wildlife-caused human injury or death.

In the event of an attack, the responding department employee may take any action necessary that is in the scope of the employee's authority to protect public safety. The following steps should be taken:

1. Secure the safety of the public (ensure proper medical aid for the victim, aid with evacuation of injured or other members of a group, and assist other agencies in removal of the body or victim. Identify the victim's name, address and phone number).

2. Report the incident to 911.

3. Immediately notify the Regional FWP Enforcement Personnel and/or WHART Team personnel.

4. FWP Enforcement personnel confirm as wildlife attack and identify species if possible; if the offending animal is identified the wild animal may be humanely killed, if possible and depending on the circumstances. Always consult with WHART Team leader and Warden Captain if unsure of actions to be taken with offending animal.

5. If medical, rescue and/or sheriff department personnel arrive on scene before the FWP Incident Commander, advise them about the Wildlife Attack-Victim Kit (Attachment 1 (follow guidelines in Appendix B)) for collecting possible animal saliva stains or hair that might be on the victim prior to cleaning the victim's wounds.

INITIATE THE INCIDENT COMMAND SYSTEM:

- **If a human death or injury has occurred, the Region Warden Captain or other Enforcement designee shall:**

  - Respond to the scene and assume the lead role for FWP.

  - The County Sheriff's Office/Coroner has the initial lead in the investigation of a human death and at first FWP's role is that of assistance.

  - The Warden Captain or Enforcement designee holds FWP Incident Commander responsibility and authority over the scene, locating the animal, its resultant carcass, and any other physical evidence from the attack.

  - The Warden Captain or Enforcement designee will ensure proper collection, transfer, and disposition of all physical evidence and reports.

  - Contact the appropriate landownership, enforcement, and wildlife governing agencies. (refer to Inter Agency Jurisdiction Section)

- **The first warden on the scene shall secure the area in order:**

  1. To protect as much of the immediate attack scene as possible, establishing a perimeter as large as possible to avoid contamination or destruction of any evidence.

  2. To determine the offending animal and preserve as much on-scene evidence as possible.

  3. The area should be excluded from public access by using flagging tape and/or signing stating "Do Not Enter".

  4. To preserve the scene, one entry and exit port should be established; only essential personnel should be permitted in the area.

- **If a warden is the first Law Enforcement person on the scene of an attack:**

  1. Their first notification should be the County Sheriff's Office.

  2. If it appears the incident is an attack only and not a death then FWP will be the lead agency in the in the incident investigation.

  3. If it appears there is a human death the warden should advise the Sheriff's Office that a Coroner will be needed.

  4. In the case of a death it should be clear that FWP would at first be in an assisting role to the Sheriff's Office and the Coroner, but FWP's guidelines should be followed as closely as possible.

  5. In a human fatality FWP is the lead agency in processing and handling of the offending wildlife, if possible in coordination with County Sheriff/Coroner.

  6. Before the victim's body is removed and with the Coroners assistance it is important to use a Wildlife Attack -Victim Kit (Appendix B and Attachment 1) to collect any forensic evidence possible.

  7. The lead investigator must complete Attachment 5 and the investigator will need to work with the Coroner, in the case of a fatality, or the attending physician/medical personnel, in the case of an attack incident victim(s).

- **Once the Warden Captain or the Enforcement designee has been notified of an attack that resulted in human injury or death, he/she must:**

  1. Notify the FWP Regional Supervisor (who will notify the Directors Office), FWP Regional Wildlife Management Specialist, and Regional Wildlife Manager.

  2. Notify the Regional Information Officer to give him/her initial information; and once notified the Regional Information Officer will become the only contact with the media for FWP in regards to this incident.

- **Upon arrival on scene the Warden Captain or Enforcement designee will set up an area outside the initial crime scene as the Command Post.**

- **The Warden Captain or Enforcement designee will formulate a plan for the systematic investigation of the scene using available manpower and resources.**

- **If applicable, (not all FWP regions utilize this option) activate the Wildlife Human Attack Response Team (WHART).**

- **If applicable, the Enforcement designee, shall assume the role of WHART leader, and shall coordinate and delegate duties before attending the attack site and are responsible for the management of the attack scene from the FWP purview.**

- **WHART Team members will wear fluorescent vests with the Team leader wearing a different color fluorescent vest. These vests will designate the team to other individuals and aid in the safety of the team members while at the scene.**

At this time, with the information available, options should be discussed with the Regional Supervisor and Regional Wildlife Manager on what actions to take regarding the offending animal.

- The suggested approach to a systematic investigation would include:

    1. The Warden Captain, Enforcement designee, or WHART leader will appoint a lead investigator. The lead investigator will conduct the investigation and write a final report of their investigation findings. The lead investigator will be responsible for the investigation at the attack site. The lead investigator should have a team of at least three individuals to assist in evidence collection, securing the scene and photographing and logging of all evidence. One of those members should be the Wildlife Management Specialist or another person that is very experienced in wildlife behavior. The lead investigator shall refer to the "Forensic Guidelines/Wildlife attack Scene Investigation/ Management" (Appendix A) as a possible baseline to conduct their investigation and should have attended at least one Wildlife Human Attack Response Training Course. If necessary, the Warden Captain, Enforcement Designee, or WHART leader will appoint a lead person for the potential capture or kill of the offending animal. This person will have to rely on their experience/training and the resources available to locate the offending animal as quickly as possible. If necessary, the animal may be tranquilized, captured, held for DNA testing, or removed from the system. The animal should be shot in the body, to preserve the head. After capture, use the Wildlife Carcass Collection Kit (Appendix C & Attachment 4) and the Wildlife Attack Kit for Sampling the Animal and Evidence at the Scene (Appendix D & Attachment 4); and the listed Appendices are only suggested guides. The animal should be handled with rubber gloves. The animal must be treated as evidence and be handled to protect the animal's external body from loss of bloodstains or other such physical evidence originating from the victim. Tape paper or cloth bags over the head and paws. Plug wounds with tight gauze to minimize contamination of the animal with its own blood. Place the carcass inside a protective durable body bag. Avoid dragging the carcass, if possible.

    2. The Warden Captain, Enforcement Designee, or WHART leader will designate the task of notifying surrounding residences or persons of the event and safety concerns (usually wildlife biologists will be assigned this task). Land/ area closures will have to involve the agencies or owner of the property involved, but it is necessary to restrict public access to the area until the attack scene has been processed and the offending animal captured.

    3. The Warden Captain, Enforcement Designee, or WHART leader will notify the FWP Wildlife Lab of the attack and inform them that a potential offending animal will be transported as quickly as possible to the FWP Lab directly for forensic examination/necropsy. A completed Wildlife Attack Response Form and Animal Necropsy form (Appendix E & F) must accompany the animal to the lab.

    4. In a fatal incident, the Warden Captain and the Enforcement Designee or WHART leader will meet with the County Coroner/Sheriff, the Regional Supervisor, and the Regional Information Officer to decide how and who will approach the victim's family to gather information and to provide the family with investigation information.

5. In an attack incident, the Warden Captain, Enforcement Designee, or WHART leader will determine who will meet with the victim and family members in order to obtain investigative information and disseminate investigation information to the victim and family. All interviews will follow Attachment 2 and should be recorded when possible.

6. All media questions should be directed to the Regional Information Officer and the media will not be allowed on scene or at the Command Post.

7. Once evidence has been collected, photographed and logged (Attachment 3) it shall be placed into the custody of the Regional Investigator or designee, who will maintain the evidence and the chain of custody.

8. The Warden Captain, Enforcement designee, or WHART leader will keep a log of the events (Attachment 6) as they occurred at the Command Post and this will be included in the final report.

INFORMATION/MEDIA:

In conjunction with the wildlife attack response guidelines listed above, the following provides direction and guidance in handling the media in the event of an attack on a human by wildlife.

1. The Regional Information Officer (RIO) will be notified immediately in the event of an attack resulting in human injury from big game animals or any wildlife species. Complete and accurate information should be provided to the RIO and inquiries regarding the incident should be handled by the RIO or Regional Supervisor. Media consultation regarding human injuries resulting from federally listed grizzly bears will be coordinated with the USFWS.

   Incidents that result from interaction with other species of wildlife will be managed by personnel within the region where the incident occurred.

   County Sheriff/Coroner's offices will coordinate all media regarding status of human deaths. In the event of taking of federally listed species by a public citizen, the USFWS will coordinate all media responses.

2. Department personnel should be helpful and open with the media, but specific questions relating to the incident should be directed to the RIO. It is imperative that appropriate personnel with the region be kept current on developments and all involved receive the same information.

3. A fact sheet and/or statewide press release may be developed with information about the situation and provided upon request to media outlets.

4. If deemed necessary by the RIO, Regional Supervisor, Regional Wildlife Manager, and Warden Captain or Enforcement designee a press conference may be initiated.

5. Appropriate information will be made available to citizens in the vicinity of the incident upon request.

GUIDELINE TRAINING:

The Warden Captain or Enforcement designee is responsible for the distribution of the guidelines and annual training of employees that may be involved in wildlife attack incidents, including first responders.

The Warden Captain or Enforcement designee will assign employees to contact County Sheriff and Search and Rescue teams, and Land Management agencies and offer a review of the guidelines and training.

Employees' responding to attacks incidences, as investigators on the incident shall participate in at least one formal Wildlife Attack Response training each year. The FWP Law Enforcement Program Training Officer will approve these annual Wildlife Human Attack Response training sessions.

INTER-AGENCY JURSIDICTION ISSUES:

U.S. Fish and Wildlife Service, Grizzly Bear Recovery Coordinator

U.S. Fish and Wildlife Service Special Agent – based upon their administrative region.

Land Management Agencies, Companies and Emergency Response Teams

The Warden Captain or Enforcement designee will delegate FWP personnel to work in advance with the US Forest Service, BLM, DNRC, Plum Creek Timber, and Search & Rescue Teams to arrange for FWP to enact temporary closures or post warnings to protect the public at a moment's notice as needed. This advanced contact will include an offer to review the guidelines with all contacts. As soon as possible thereafter, FWP would follow up with the agencies to keep them informed and address any issues or concerns. Search and Rescue Teams and other emergency response units should be kept abreast of special risks on recreational lands in the event that these teams are deployed while the risk of a dangerous bear encounter is elevated.

County Sheriff and Coroner

If an FWP employee is the first on the scene of an attack their first notification should be the County Sheriff's Office and if it appears there is a human death the employee should advise the Sheriff's Office that a Coroner will be needed. In the event of a human death, FWP will, at first, be in an assisting role to the Sheriff's Office and the Coroner, but FWP's guidelines should be followed as closely as possible. Before the victim's body is removed and with the Coroners assistance it is important to use a Wildlife Attack -Victim Kit (Attachment 1 & Attachment 5) to collect any forensic evidence possible.

FINAL REPORT:

The Warden Captain, Enforcement designee, or WHART leader is responsible for producing a final report. The report will include a detailed Investigative Summary of the events, how it was resolved, evidence and lab reports, and conclusions. The completed report will be reviewed and released in a timely manner by the Regional Supervisor.

Attachments and WHART Appendices (available from FWP Enforcement Division, upon request)

Attachment 1 – First Responder Kit Wildlife Attack Human Victim Kit

Attachment 2 – Interview with Victim and/or witness

Attachment 3 – Wildlife Attack Scene Evidence Log

Attachment 4 – Wildlife Attack Animal Evidence Collection Information

Attachment 5 – Wildlife Attack Victim Evidence Collection Information

Attachment 6 – Events/Contacts Log

Appendix A – Wildlife Attack Scene Investigations/ Management

Appendix B – Carnivore Attack Victim Sampling Kit

Appendix C – Carnivore Carcass Collection Kit

Appendix D – Carnivore Attack Animal Sampling Kit

Appendix E – Wildlife Attack Response Form

Appendix F – Wildlife Attack Animal Necropsy Form

MONTANA MOUNTAIN LION LICENSE SALES, PRICE, AND REVENUE, 1973 - 2015

	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
License Type											
Res. Mountain Lion	**241**	**259**	**286**	**517**	**574**	**639**	**614**	**787**	**893**	**1,027**	**1,021**
Nonres. Mountain Lion	**70**	**92**	**120**	**70**	**102**	**123**	**111**	**61**	**69**	**91**	**132**
Total	**311**	**351**	**406**	**587**	**676**	**762**	**725**	**848**	**962**	**1,118**	**1,153**
Fees											
Res. Mountain Lion	$5	$5	$5	$5	$5	$5	$5	$5	$5	$5	$5
Nonres. Mountain Lion	$25	$25	$25	$25	$25	$25	$25	$100	$100	$100	$100
License Revenue											
Res. Mountain Lion	$1,205	$1,295	$1,430	$2,585	$2,870	$3,195	$3,070	$3,935	$4,465	$5,135	$5,105
Nonres. Mountain Lion	$1,750	$2,300	$3,000	$1,750	$2,550	$3,075	$2,775	$6,100	$6,900	$9,100	$13,200
Total	$2,955	$3,595	$4,430	$4,335	$5,420	$6,270	$5,845	$10,035	$11,365	$14,235	$18,305

	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
License Type											
Res. Mountain Lion	**984**	**1,045**	**916**	**1,237**	**1,210**	**1,250**	**1,708**	**1,687**	**2,038**	**2,535**	**2,984**
Nonres. Mountain Lion	**80**	**92**	**92**	**108**	**109**	**98**	**136**	**146**	**177**	**230**	**258**
Total	**1,064**	**1,137**	**1,008**	**1,345**	**1,319**	**1,348**	**1,844**	**1,833**	**2,215**	**2,765**	**3,242**
Fees											
Res. Mountain Lion	$10	$10	$10	$10	$10	$10	$10	$10	$13	$13	$15
Nonres. Mountain Lion	$300	$300	$300	$300	$320	$320	$320	$320	$320	$320	$320
License Revenue											
Res. Mountain Lion	$9,840	$10,450	$9,160	$12,370	$12,100	$12,500	$17,080	$16,870	$26,494	$32,955	$44,760
Nonres. Mountain Lion	$24,000	$27,600	$27,600	$32,400	$34,880	$31,360	$43,520	$46,720	$56,640	$73,600	$82,560
Total	$33,840	$38,050	$36,760	$44,770	$46,980	$43,860	$60,600	$63,590	$83,134	$106,555	$127,320

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
License Type											
Res. Mountain Lion	**3,056**	**3,287**	**4,297**	**5,421**	**5,886**	**5,138**	**5,116**	**6,337**	**6,130**	**6,635**	**6,688**
Nonres. Mountain Lion	**270**	**301**	**394**	**510**	**519**	**493**	**421**	**281**	**282**	**312**	**311**
Res. Hound Training									**207**	**289**	**340**
Total	**3,326**	**3,588**	**4,691**	**5,931**	**6,405**	**5,631**	**5,537**	**6,618**	**6,619**	**7,236**	**7,339**
Fees											
Res. Mountain Lion	$15	$15	$15	$15	$15	$15	$15	$15	$15	$15	$15
Nonres. Mountain Lion	$320	$320	$320	$320	$320	$320	$320	$320	$320	$320	$320
Res. Hound Training									$5	$5	$5
License Revenue											
Res. Mountain Lion	$45,840	$49,305	$64,455	$81,315	$88,290	$77,070	$76,740	$95,055	$91,950	$99,525	$100,320
Nonres. Mountain Lion	$86,400	$96,320	$126,080	$163,200	$166,080	$157,760	$134,720	$89,920	$90,240	$99,840	$99,520
Res. Hound Training									$1,035	$1,445	$1,700
Total	$132,240	$145,625	$190,535	$244,515	$254,370	$234,830	$211,460	$184,975	$183,225	$200,810	$201,540

	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
License Type											
Res. Mountain Lion	**3,331**	**3,922**	**3,529**	**3,832**	**3,535**	**3,788**	**4,964**	**5,007**	**5,016**	**5,221**	**4,912**
Nonres. Mountain Lion	**133**	**145**	**167**	**179**	**170**	**172**	**182**	**286**	**240**	**292**	**271**
Res. Hound Training	**488**	**423**	**471**	**424**	**441**	**405**	**352**	**364**	**389**	**239**	**216**
Total	**3,952**	**4,490**	**4,167**	**4,435**	**4,146**	**4,365**	**5,498**	**5,657**	**5,645**	**5,752**	**5,399**
Fees											
Res. Mountain Lion	$19	$19	$19	$19	$19	$19	$19	$19	$19	$19	$19
Nonres. Mountain Lion	$320	$320	$320	$320	$320	$320	$320	$320	$320	$320	$320
Res. Hound Training	$5	$5	$5	$5	$5	$5	$5	$5	$5	$5	$5
License Revenue											
Res. Mountain Lion	$63,289	$74,518	$67,051	$72,808	$67,165	$71,972	$94,316	$95,133	$95,304	$99,199	$93,328
Nonres. Mountain Lion	$42,560	$46,400	$53,440	$57,280	$54,400	$55,040	$58,240	$91,520	$76,800	$93,440	$86,720
Res. Hound Training	$2,440	$2,115	$2,355	$2,120	$2,205	$2,025	$1,760	$1,820	$1,945	$1,195	$1,080
Total	$108,289	$123,033	$122,846	$132,208	$123,770	$129,037	$154,316	$188,473	$174,049	$193,834	$181,128

APPENDIX 6

APPLICABLE MONTANA STATUTE AND ADMINISTRATIVE RULES

Montana Code Annotated statutes and Administrative Rules of Montana describing FWP and the Fish & Wildlife Commission's authorities and responsibilities, regulation of the licensed hunting of mountain lions, enumeration of stock grower and personal protection rights, and disclosure of information.

2-15-3110. (Temporary) Livestock loss board - purpose, membership, and qualifications

(1) There is a livestock loss board. The purpose of the board is to administer the programs called for in the Montana gray wolf conservation and management plan, the Montana mountain lion management plan, and the Montana grizzly bear management plan and established in 2-15-3111 through 2-15-3113, with funds provided through the accounts established in 81-1-110, in order to minimize losses caused by wolves, mountain lions, and grizzly bears to livestock producers and to reimburse livestock producers for livestock losses from wolf, mountain lion, and grizzly bear predation.

(2) The board consists of five members, appointed by the governor, as follows:

(a) three members who are actively involved in the livestock industry and who have knowledge and experience with regard to wildlife impacts or management; and

(b) two members of the general public who are or have been actively involved in wildlife conservation or wildlife management and who have knowledge and experience with regard to livestock production or management.

(3) The board is designated as a quasi-judicial board for the purposes of 2-15-124. Notwithstanding the provisions of 2-15-124(1), the governor is not required to appoint an attorney to serve as a member of the board.

(4) The board is allocated to the department of livestock for administrative purposes only as provided in 2-15-121.

(5) The board shall adopt rules to implement the provisions of 2-15-3110 through 2-15-3114 and

(6) The board shall prioritize grants for prevention of wolf and grizzly bear predation over those for mountain lion predation.

2-15-3111. Livestock loss reduction program

The livestock loss board shall establish and administer a program to cost-share with individuals or incorporated entities in implementing measures to prevent wolf, mountain lion, and grizzly bear predation on livestock, including:

(1) eligibility requirements for program participation;

(2) application procedures for program participation and procedures for awarding grants for wolf, mountain lion, and grizzly bear predation prevention measures, subject to grant priorities and the availability of funds;

(3) criteria for the selection of projects and program participants, which may include establishment of grant priorities based on factors such as chronic depredation, multiple depredation incidents, single depredation incidents, and potential high-risk geographical or habitat location;

(4) grant guidelines for prevention measures on public and private lands, including:

(a) grant terms that clearly set out the obligations of the livestock producer and that provide for a term of up to 12 months subject to renewal based on availability of funds, satisfaction of program requirements, and prioritization of the project;

(b) cost-share for prevention measures, which may be a combination of grant and livestock producer responsibility, payable in cash or in appropriate services, such as labor to install or implement preventive measures, unless the board adjusts the cost-share because of extenuating circumstances related to chronic or multiple depredation; and

(c) proactive preventive measures, including but not limited to fencing, fladry, night penning, increased human presence in the form of livestock herders and riders, guard animals, providing hay and dog food, rental of private land or alternative pasture allotments, delayed turnouts, and other preventive measures as information on new or different successful prevent ion measures becomes available; and

(5) reporting requirements for program participants to assist in determining the effectiveness of loss reduction relative to each grant."

2-15-3112. Livestock loss mitigation program - definitions

The livestock loss board shall establish and administer a program to reimburse livestock producers for livestock losses caused by wolves, mountain lions, and grizzly bears, subject to the following provisions:

(1) The board shall establish eligibility requirement s for reimbursement, which must provide that all Montana livestock producers are eligible for coverage for losses by wolves, mountain lions, and grizzly bears to cattle, swine, horses, mules, sheep, goats, llamas, and livestock guard animals on state, federal, and private land and on tribal land that is eligible through agreement pursuant to 2-15-3113(2).

(2) Confirmed and probable livestock losses must be reimbursed at an amount not to exceed fair market value as determined by the board.

(3) Other losses may be reimbursed at rates determined by the board.

(4) A claim process must be established to be used when a livestock producer suffers a livestock loss for which wolves, mountain lions, or grizzly bears may be responsible. The claim process must set out a clear and concise method for documenting and processing claims for reimbursement for livestock losses.

(5) A process must be established to allow livestock producers to appeal reimbursement decisions. A producer may appeal a staff adjuster's decision by notifying the staff adjuster and the board in writing, stating the reasons for the appeal and providing documentation supporting the appeal. If the documentation is incomplete, the board or a producer may consult with the U.S. department of agriculture wildlife services to complete the documentation. The board may not accept any appeal on the question of whether the loss was or was not a confirmed or probable loss because that final determination lies solely with the U.S. department of agriculture wildlife services and may not be changed by the board. The board shall hold a hearing on the appeal within 90 days of receipt of the written appeal, allowing the staff adjuster and the producer to present their positions. A decision must be rendered by the board within 30 days after the hearing. The producer must be notified in writing of the board's decision.

(6) As used in this section, the following definitions apply:

(a) "Confirmed" means reasonable physical evidence that livestock was actually attacked or killed by a wolf, mountain lion, or grizzly bear, including but not limited to the presence of bite marks indicative of the spacing of tooth punctures of wolves, mountain lions, or grizzly bears and associated subcutaneous hemorrhaging and tissue damage indicating that the attack occurred while the animal was alive, feeding patterns on the carcass, fresh tracks, scat, hair rubbed off on fences or brush, eyewitness accounts, or other physical evidence that allows a reasonable inference of wolf, mountain lion, or grizzly bear predation on an animal that has been largely consumed.

(b) "Fair market value" means:

(i) for commercial sheep more than 1 year old, the average price of sheep of similar age and sex paid at the most recent Billings livestock sale ring or other ring as determined by the board;

(ii) for commercial lambs, the average market weaning value;

(iii) for registered sheep, the average price paid to the specific breeder for sheep of similar age and sex during the past year at public or private sales for that registered breed;

(iv) for commercial cattle more than 1 year old, the average price of cattle of similar age and sex paid at the most recent Billings livestock sale ring or other ring as determined by the board;

(v) for commercial calves, the average market weaning value;

(vi) for registered cattle, the average price paid to the owner for cattle of similar age and sex during the past year at public or private sales for that registered breed;

(vii) for other registered livestock, the average price paid to the producer at public or private sales for animals of similar age and sex. A producer may provide documentation that a registered animal has a fair market value in excess of the average price, in which case the board shall seek additional verification of the value of the animal from independent sources. If the board determines that the value of that animal is greater than the average price, then the increased value must be accepted as the fair market value for that animal.

(viii) for other livestock, the average price paid at the most recent public auction for the type of animal lost or the replacement price as determined by the board.

(c) "Probable" means the presence of some evidence to suggest possible predation but a lack of sufficient evidence to clearly confirm predation by a particular species. A kill may be classified as probable depending on factors including but not limited to recent confirmed predation by the suspected depredating species in the same or a nearby area, recent observation of the livestock by the owner or the owner's employees, and telemetry monitoring data, sightings, howling, or fresh tracks suggesting that the suspected depredating species may have been in the area when the depredation occurred."

2-15-3113. Additional powers and duties of livestock loss board

(1) The livestock loss board shall:
(a) process claims;
(b) seek information necessary to ensure that claim documentation is complete;
(c) provide payments authorized by the board for confirmed and probable livestock losses, along with a written explanation of payment;
(d) submit monthly and annual reports to the board of livestock summarizing claims and expenditures and the results of action taken on claims and maintain files of all claims received, including supporting documentation;
(e) provide information to the board of livestock regarding appealed claims and implement any decision by the board;
(f) prepare the annual budget for the board; and
(g) provide proper documentation of staff time and expenditures.
(2) The livestock loss board may enter into an agreement with any Montana tribe, if the tribe has adopted a wolf, mountain lion, or grizzly bear management plan for reservation lands that is consistent with the state wolf, mountain lion, or grizzly bear management plan, to provide that tribal lands within reservation boundaries are eligible for mitigation grants pursuant to 2-15-3111 and that livestock losses on tribal lands within reservation boundaries are eligible for reimbursement payments pursuant to 2-15-3112.
(3) The livestock loss board shall:
(a) coordinate and share information with state, federal, and tribal officials, livestock producers, nongovernmental organizations, and the general public in an effort to reduce livestock losses caused by wolves, mountain lions, and grizzly bears;
(b) establish an annual budget for the prevention, mitigation, and reimbursement of livestock losses caused by wolves, mountain lions, and grizzly bears;
(c) perform or contract for the performance of periodic program audits and reviews of program expenditures, including payments to Individuals, incorporated entities, and producers who receive loss reduction grants and reimbursement payments;
(d) adjudicate appeals of claims;
(e) investigate alternative or enhanced funding sources, including possible agreements with public entities and private wildlife or livestock organizations that have active livestock loss reimbursement programs in place;
(f) meet as necessary to conduct business; and
(g) report annually to the governor, the legislature, members of the Montana congressional delegation, the board of livestock, the fish and wildlife commission, and the public regarding results of the programs established in 2-15-3111 through 2-15-3113.
(4) The livestock loss board may sell or auction any carcasses or parts of carcasses from wolves or mountain lions received pursuant to 87-1-217. The proceeds, minus the costs of the sale including the preparation of the carcass or part of the carcass for sale, must be deposited into the livestock loss reduction and mitigation special revenue account established in 81-1-110 and used for the purposes of 215-3111 through 2-15-3114."

81-1-110. Livestock loss reduction and mitigation accounts

(1) There are livestock loss reduction and mitigation special revenue accounts administered by the department within the state special revenue fund and the federal special revenue fund established in 17-2-102.
(2)(a) All state proceeds allocated or budgeted for the purposes of 2-15-3110 through 2-15-3114, 81-1-110, and 81-1-111, except those transferred to the account provided for in 81-1-112 [or 81-1-113] or appropriated to the department of livestock, must be deposited in the state special revenue account provided for in subsection (1) of this section.
(b) Money received by the state in the form of gifts, grants, reimbursements, or allocations from any source intended to be used for the purposes of 2-15-3111 through 2-15-3113 must be deposited in the appropriate account provided for in subsection (1) of this section.
(c) All federal funds awarded to the state for compensation for wolf, mountain lion, or grizzly bear depredations on livestock must be deposited in the federal special revenue

account provided for in subsection (1) for the purposes of 2-15-3112.

(3) The livestock loss board may spend funds in the accounts only to carry out the provisions of 2-15-3111 through 2-15-3113.

87-1-201. Powers And Duties

(1) Except as provided in subsection (11), the department shall supervise all the wildlife, fish, game, game and nongame birds, waterfowl, and the game and fur-bearing animals of the state and may implement voluntary programs that encourage hunting access on private lands and that promote harmonious relations between landowners and the hunting public. The department possesses all powers necessary to fulfill the duties prescribed by law and to bring actions in the proper courts of this state for the enforcement of the fish and game laws and the rules adopted by the department.

(2) Except as provided in subsection (11), the department shall enforce all the laws of the state regarding the protection, preservation, management, and propagation of fish, game, fur-bearing animals, and game and nongame birds within the state.

(3) The department has the exclusive power to spend for the protection, preservation, management, and propagation of fish, game, fur-bearing animals, and game and nongame birds all state funds collected or acquired for that purpose, whether arising from state appropriation, licenses, fines, gifts, or otherwise. Money collected or received from the sale of hunting and fishing licenses or permits, from the sale of seized game or hides, from fines or damages collected for violations of the fish and game laws, or from appropriations or received by the department from any other sources is under the control of the department and is available for appropriation to the department.

(4) The department may discharge any appointee or employee of the department for cause at any time.

(5) The department may dispose of all property owned by the state used for the protection, preservation, management, and propagation of fish, game, fur-bearing animals, and game and nongame birds that is of no further value or use to the state and shall turn over the proceeds from the sale to the state treasurer to be credited to the fish and game account in the state special revenue fund.

(6) The department may not issue permits to carry firearms within this state to anyone except regularly appointed officers or wardens.

(7) Except as provided in subsection (11), the department is authorized to make, promulgate, and enforce reasonable rules and regulations not inconsistent with the provisions of Title 87, chapter 2, that in its judgment will accomplish the purpose of chapter 2.

(8) The department is authorized to promulgate rules relative to tagging, possession, or transportation of bear within or outside of the state.

(9) (a) The department shall implement programs that:

(i) manage wildlife, fish, game, and nongame animals in a manner that prevents the need for listing under 87-5-107 or under the federal Endangered Species Act, 16 U.S.C. 1531, et seq.;

(ii) manage listed species, sensitive species, or a species that is a potential candidate for listing under 87-5-107 or under the federal Endangered Species Act, 16 U.S.C. 1531, et seq., in a manner that assists in the maintenance or recovery of those species;

(iii) manage elk, deer, and antelope populations based on habitat estimates determined as provided in 87-1-322 and maintain elk, deer, and antelope population numbers at or below population estimates as provided in 87-1-323. In implementing an elk management plan, the department shall, as necessary to achieve harvest and population objectives, request that land management agencies open public lands and public roads to public access during the big game hunting season.

(iv) in accordance with the forest management plan required by 87-1-622, address fire mitigation, pine beetle infestation, and wildlife habitat enhancement giving priority to forested lands in excess of 50 contiguous acres in any state park, fishing access site, or wildlife management area under the department's jurisdiction.

(b) In maintaining or recovering a listed species, a sensitive species, or a species that is a potential candidate for listing, the department shall seek, to the fullest extent possible, to balance maintenance or recovery of those species with the social and economic impacts of species maintenance or recovery.

(c) Any management plan developed by the department pursuant to this subsection (9) is subject to the requirements of Title 75, chapter 1, part 1.

(d) This subsection (9) does not affect the ownership or possession, as authorized under law, of a privately held listed species, a sensitive species, or a species that is a potential candidate for listing.
(10) The department shall publish an annual game count, estimating to the department's best ability the numbers of each species of game animal, as defined in 87-2-101, in the hunting districts and administrative regions of the state. In preparing the publication, the department may incorporate field observations, hunter reporting statistics, or any other suitable method of determining game numbers. The publication must include an explanation of the basis used in determining the game count.
(11) The department may not regulate the use or possession of firearms, firearm accessories, or ammunition, including the chemical elements of ammunition used for hunting. This does not prevent:
(a) the restriction of certain hunting seasons to the use of specified hunting arms, such as the establishment of special archery seasons;
(b) for human safety, the restriction of certain areas to the use of only specified hunting arms, including bows and arrows, traditional handguns, and muzzle loading rifles;
(c) the restriction of the use of shotguns for the hunting of deer and elk pursuant to 87-6-401(1)(f);
(d) the regulation of migratory game bird hunting pursuant to 87-3-403; or
(e) the restriction of the use of rifles for bird hunting pursuant to 87-6-401(1)(g) or (1)(h).

87-1-214. Disclosure Of Information - Legislative Finding - Large Predators
(1) Except for information that is required by law to be reported to state or federal officials, the department may not disclose any information that identifies any person who has lawfully taken a large predator as defined in 87-1-217 during a hunt without the written consent of the person affected. Information that may not be disclosed includes but is not limited to a person's name, address, phone number, date of birth, social security number, and driver's license number.
(2) The legislature finds that the prohibition on disclosure of information pursuant to subsection (1) is necessary to protect an individual's privacy, safety, and welfare.

87-1-217. Policy For Management Of Large Predators - Legislative Intent
(1) In managing large predators, the primary goals of the department, in the order of listed priority, are to:
(a) protect humans, livestock, and pets;
(b) preserve and enhance the safety of the public during outdoor recreational and livelihood activities; and
(c) preserve citizens' opportunities to hunt large game species.
(2) With regard to large predators, it is the intent of the legislature that the specific provisions of this section concerning the management of large predators will control the general supervisory authority of the department regarding the management of all wildlife.
(3) For the management of wolves in accordance with the priorities established in subsection (1), the department may use lethal action to take problem wolves that attack livestock if the state objective for breeding pairs has been met. For the purposes of this subsection, "problem wolves" means any individual wolf or pack of wolves with a history of livestock predation.
(4) The department shall work with the livestock loss board and the United States department of agriculture wildlife services to establish the conditions under which carcasses or parts of carcasses from wolves or mountain lions are retrieved during management activities and when those carcasses or parts of carcasses are made available to the livestock loss board for sale or auction pursuant to 2-15-3113.
(5) The department shall ensure that county commissioners and tribal governments in areas that have identifiable populations of large predators have the opportunity for consultation and coordination with state and federal agencies prior to state and federal policy decisions involving large predators and large game species.
(6) As used in this section:
(a) "consultation" means to actively provide information to a county or tribal government regarding proposed policy decisions on matters that may have a harmful effect on agricultural production or livestock operations or that may pose a risk to human health or safety in that county or on those tribal lands and to seek information and advice from counties or tribal governments on these matters;
(b) "large game species" means deer, elk, mountain sheep, moose, antelope, and mountain goats; and

(c) “large predators” means bears, mountain lions, and wolves.

87-1-225. Regulation of Wild Animals Damaging Property - Public Hunting Requirements

(1) Subject to the provisions of subsection (2), a landowner is eligible for game damage assistance under subsection (3) if the landowner:
(a) allows public hunting during established hunting seasons; or
(b) does not significantly reduce public hunting through imposed restrictions.
(2) The department may provide game damage assistance when public hunting on a landowner’s property has been denied because of unique or special circumstances that have rendered public hunting inappropriate.
(3) Within 48 hours after receiving a request or complaint from any landholder or person in possession and having charge of any land in the state that wild animals of the state, protected by the fish and game laws and regulations, are doing damage to the property or crops on the property, the department shall investigate and arrange to study the situation with respect to damage and depredation. The department may then decide to open a special season on the game or, if the special season method is not feasible, the department may destroy the animals causing the damage. The department may authorize and grant the holders of the property permission to kill or destroy a specified number of the animals causing the damage. A wild, ferocious animal damaging property or endangering life is not covered by this section.

87-1-271. Annual Lottery Of Hunting Licenses - Proceeds Dedicated To Hunting Access Enhancement

(1) The commission may issue through a lottery one license each year for each of the following:
(a) deer;
(b) elk;
(c) shiras moose;
(d) mountain sheep;
(e) mountain goat;
(f) wild buffalo or bison;
(g) antelope; and
(h) mountain lion.
(2) The restriction in 87-2-702(4) that a person who receives a moose, mountain goat, or mountain sheep special license is not eligible to receive another license for that species for the next 7 years does not apply to a person who receives a license through a lottery conducted pursuant to this section.
(3) The commission shall establish rules regarding:
(a) the conduct of the lottery authorized in this section;
(b) the use of licenses issued through the lottery; and
(c) the price of lottery tickets.
(4) Except as provided in 87-2-903, all proceeds from a lottery conducted pursuant to this section must be used by the department for hunting access enhancement programs and law enforcement.

87-1-301. Powers Of Commission

(1) Except as provided in subsections (7) and (8), the commission:
(a) shall set the policies for the protection, preservation, management, and propagation of the wildlife, fish, game, furbearers, waterfowl, nongame species, and endangered species of the state and for the fulfillment of all other responsibilities of the department related to fish and wildlife as provided by law;
(b) shall establish the hunting, fishing, and trapping rules of the department;
(c) except as provided in 23-1-111 and 87-1-303(3), shall establish the rules of the department governing the use of lands owned or controlled by the department and waters under the jurisdiction of the department;
(d) must have the power within the department to establish wildlife refuges and bird and game preserves;
(e) shall approve all acquisitions or transfers by the department of interests in land or water, except as provided in 23-1-111 and 87-1-209(2) and (4);
(f) except as provided in 23-1-111, shall review and approve the budget of the department prior to its transmittal to the office of budget and program planning;
(g) except as provided in 23-1-111, shall review and approve construction projects that have an estimated cost of more than $1,000 but less than $5,000;
(h) shall manage elk, deer, and antelope populations based on habitat estimates determined as provided in 87-1-322 and maintain elk, deer, and antelope population numbers at or below population estimates as provided in 87-1-323. In developing or implementing an elk management plan,

the commission shall consider landowner tolerance when deciding whether to restrict elk hunting on surrounding public land in a particular hunting district. As used in this subsection (1)(h), “landowner tolerance” means the written or documented verbal opinion of an affected landowner regarding the impact upon the landowner’s property within the particular hunting district where a restriction on elk hunting on public property is proposed.

(i) shall set the policies for the salvage of antelope, deer, elk, or moose pursuant to 87-3-145; and

(j) shall comply with, adopt policies that comply with, and ensure the department implements in each region the provisions of state wildlife management plans adopted following an environmental review conducted pursuant to Title 75, chapter 1, parts 1 through 3.

(2) The commission may adopt rules regarding the use and type of archery equipment that may be employed for hunting and fishing purposes, taking into account applicable standards as technical innovations in archery equipment change.

(3) The commission may adopt rules regarding the establishment of special licenses or permits, seasons, conditions, programs, or other provisions that the commission considers appropriate to promote or enhance hunting by Montana’s youth and persons with disabilities.

(4) (a) The commission may adopt rules regarding nonresident big game combination licenses to:

(i) separate deer licenses from nonresident elk combination licenses;

(ii) set the fees for the separated deer combination licenses and the elk combination licenses without the deer tag;

(iii) condition the use of the deer licenses; and

(iv) limit the number of licenses sold.

(b) The commission may exercise the rulemaking authority in subsection (4)(a) when it is necessary and appropriate to regulate the harvest by nonresident big game combination license holders:

(i) for the biologically sound management of big game populations of elk, deer, and antelope;

(ii) to control the impacts of those elk, deer, and antelope populations on uses of private property; and

(iii) to ensure that elk, deer, and antelope populations are at a sustainable level as provided in 87-1-321 through 87-1-325.

(5) (a) Subject to the provisions of 87-2-115, the commission may adopt rules establishing license preference systems to distribute hunting licenses and permits:

(i) giving an applicant who has been unsuccessful for a longer period of time priority over an applicant who has been unsuccessful for a shorter period of time; and

(ii) giving a qualifying landowner a preference in drawings. As used in this subsection (5)(a), “qualifying landowner” means the owner of land that provides some significant habitat benefit for wildlife, as determined by the commission.

(b) The commission shall square the number of points purchased by an applicant per species when conducting drawings for licenses and permits.

(6) (a) The commission may adopt rules to:

(i) limit the number of nonresident mountain lion hunters in designated hunting districts; and

(ii) determine the conditions under which nonresidents may hunt mountain lion in designated hunting districts.

(b) The commission shall consider, but is not limited to consideration of, the following factors:

(i) harvest of lions by resident and nonresident hunters;

(ii) history of quota overruns;

(iii) composition, including age and sex, of the lion harvest;

(iv) historical outfitter use;

(v) conflicts among hunter groups;

(vi) availability of public and private lands; and

(vii) whether restrictions on nonresident hunters are more appropriate than restrictions on all hunters.

(7) The commission may not regulate the use or possession of firearms, firearm accessories, or ammunition, including the chemical elements of ammunition used for hunting. This does not prevent:

(a) the restriction of certain hunting seasons to the use of specified hunting arms, such as the establishment of special archery seasons;

(b) for human safety, the restriction of certain areas to the use of only specified hunting arms, including bows and arrows, traditional handguns, and muzzle loading rifles;

(c) the restriction of the use of shotguns for the hunting of deer and elk pursuant to 87-6-401(1)(f);

(d) the regulation of migratory game bird hunting pursuant to 87-3-403; or

(e) the restriction of the use of rifles for bird hunting pursuant to 87-6-401(1)(g) or (1)(h).

(8) Pursuant to 23-1-111, the commission does not oversee department activities related to the administration of state parks, primitive parks, state recreational areas, public camping grounds, state historic sites, state monuments, and other heritage and recreational resources, land, and water administered pursuant to Title 23, chapter 1, and Title 23, chapter 2, parts 1, 4, and 9.

87-1-304. Fixing Of Seasons And Bag And Possession Limits

(1) Subject to the provisions of 87-5-302 and subsection (7) of this section, the commission may:
(a) fix seasons, bag limits, possession limits, and season limits;
(b) open or close or shorten or lengthen seasons on any species of game, bird, fish, or fur-bearing animal as defined by 87-2-101;
(c) declare areas open to the hunting of deer, antelope, elk, moose, sheep, goat, mountain lion, bear, wild buffalo or bison, and wolf by persons holding an archery stamp and the required license, permit, or tag and designate times when only bows and arrows may be used to hunt deer, antelope, elk, moose, sheep, goat, mountain lion, bear, wild buffalo or bison, and wolf in those areas;
(d) subject to the provisions of 87-1-301(7), restrict areas and species to hunting with only specified hunting arms, including bow and arrow, for the reasons of safety or of providing diverse hunting opportunities and experiences; and
(e) declare areas open to special license holders only and issue special licenses in a limited number when the commission determines, after proper investigation, that a special season is necessary to ensure the maintenance of an adequate supply of game birds, fish, or animals or fur-bearing animals. The commission may declare a special season and issue special licenses when game birds, animals, or fur-bearing animals are causing damage to private property or when a written complaint of damage has been filed with the commission by the owner of that property. In determining to whom special licenses must be issued, the commission may, when more applications are received than the number of animals to be killed, award permits to those chosen under a drawing system. The procedures used for awarding the permits from the drawing system must be determined by the commission.
(2) The commission may adopt rules governing the use of livestock and vehicles by archers during special archery seasons.
(3) Subject to the provisions of 87-5-302 and subsection (7) of this section, the commission may divide the state into fish and game districts and create fish, game, or fur-bearing animal districts throughout the state. The commission may declare a closed season for hunting, fishing, or trapping in any of those districts and later may open those districts to hunting, fishing, or trapping.
(4) The commission may declare a closed season on any species of game, fish, game birds, or fur-bearing animals threatened with undue depletion from any cause. The commission may close any area or district of any stream, public lake, or public water or portions thereof to hunting, trapping, or fishing for limited periods of time when necessary to protect a recently stocked area, district, water, spawning waters, spawn-taking waters, or spawn-taking stations or to prevent the undue depletion of fish, game, fur-bearing animals, game birds, and nongame birds. The commission may open the area or district upon consent of a majority of the property owners affected.
(5) The commission may authorize the director to open or close any special season upon 12 hours' notice to the public.
(6) The commission may declare certain fishing waters closed to fishing except by persons under 15 years of age. The purpose of this subsection is to provide suitable fishing waters for the exclusive use and enjoyment of juveniles under 15 years of age, at times and in areas the commission in its discretion considers advisable and consistent with its policies relating to fishing.
(7) In an area immediately adjacent to a national park, the commission may not:
(a) prohibit the hunting or trapping of wolves; or
(b) close the area to wolf hunting or trapping unless a wolf harvest quota established by the commission for that area has been met.

87-2-101. Definitions

As used in Title 87, chapter 3, and this chapter, unless the context clearly indicates otherwise, the following definitions apply:
(1) "Angling" or "fishing" means to take or the act of a person possessing any instrument, article, or substance for

the purpose of taking fish in any location that a fish might inhabit.
(2) (a) “Bait” means any animal matter, vegetable matter, or natural or artificial scent placed in an area inhabited by wildlife for the purpose of attracting game animals or game birds.
(b) The term does not include:
(i) decoys, silhouettes, or other replicas of wildlife body forms;
(ii) scents used only to mask human odor; or
(iii) types of scents that are approved by the commission for attracting game animals or game birds.
(3) “Fur-bearing animals” means marten or sable, otter, muskrat, fisher, mink, bobcat, lynx, wolverine, northern swift fox, and beaver.
(4) “Game animals” means deer, elk, moose, antelope, caribou, mountain sheep, mountain goat, mountain lion, bear, and wild buffalo.
(5) “Game fish” means all species of the family Salmonidae (chars, trout, salmon, grayling, and whitefish); all species of the genus Sander (sandpike or sauger and walleyed pike or yellowpike perch); all species of the genus Esox (northern pike, pickerel, and muskellunge); all species of the genus Micropterus (bass); all species of the genus Polyodon (paddlefish); all species of the family Acipenseridae (sturgeon); all species of the genus Lota (burbot or ling); the species Perca flavescens (yellow perch); all species of the genus Pomoxis (crappie); and the species Ictalurus punctatus (channel catfish).
(6) “Hunt” means to pursue, shoot, wound, kill, chase, lure, possess, or capture or the act of a person possessing a weapon, as defined in 45-2-101, or using a dog or a bird of prey for the purpose of shooting, wounding, killing, possessing, or capturing wildlife protected by the laws of this state in any location that wildlife may inhabit, whether or not the wildlife is then or subsequently taken. The term includes an attempt to take by any means, including but not limited to pursuing, shooting, wounding, killing, chasing, luring, possessing, or capturing.
(7) “Migratory game birds” means waterfowl, including wild ducks, wild geese, brant, and swans; cranes, including little brown and sandhill; rails, including coots; Wilson’s snipes or jacksnipes; and mourning doves.
(8) “Nongame wildlife” means any wild mammal, bird, amphibian, reptile, fish, mollusk, crustacean, or other animal not otherwise legally classified by statute or regulation of this state.
(9) “Open season” means the time during which game birds, game fish, game animals, and fur-bearing animals may be lawfully taken.
(10) “Person” means an individual, association, partnership, or corporation.
(11) “Predatory animals” means coyote, weasel, skunk, and civet cat.
(12) “Trap” means to take or participate in the taking of any wildlife protected by the laws of the state by setting or placing any mechanical device, snare, deadfall, pit, or device intended to take wildlife or to remove wildlife from any of these devices.
(13) “Upland game birds” means sharp-tailed grouse, blue grouse, spruce (Franklin) grouse, prairie chicken, sage hen or sage grouse, ruffed grouse, ring-necked pheasant, Hungarian partridge, ptarmigan, wild turkey, and chukar partridge.
(14) “Wild buffalo” means buffalo or bison that have not been reduced to captivity.

87-2-506. Restrictions On Hunting Licenses

Restrictions on hunting licenses. (1) The department may prescribe by rule the number of hunting licenses to be issued. Any license sold may be restricted to a specific administrative region, hunting district, or other designated area and may specify the species, age, and sex to be taken and the time period for which the license is valid.
(2) When the number of valid resident applications for big game licenses or permits of a single class or type exceeds the number of licenses or permits the department desires to issue in an administrative region, hunting district, or other designated area, then the number of big game licenses or permits issued to nonresident license or permit holders in the region, district, or area may not exceed 10% of the total issued.
(3) Disabled veterans who meet the qualifying criteria provided in 87-2-817(1) must be provided a total of 50 Class A-3 deer A tags, 50 Class A-4 deer B tags, 50 Class B-7 deer A tags, 50 Class B-8 deer B tags, and 50 special antelope licenses annually, which may be used within the administrative region, hunting district, or other designated area of the disabled veteran’s choice, except in a region, district, or area where the number of licenses are less than

the number of applicants, in which case qualifying disabled veterans are eligible for no more than 10% of the total licenses for that region, district, or area.

87-2-507. Class D-1-Nonresident Mountain Lion License

Except as otherwise provided in this chapter, a person who is not a resident, as defined in 87-2-102, but who is 12 years of age or older or who will turn 12 years old before or during the season for which the license is issued may, upon payment of a fee of $320, receive a Class D-1 license that entitles a holder who is 12 years of age or older to hunt mountain lion and possess the carcass of the mountain lion as authorized by department rules.

87-2-508. Class D-2-Resident Mountain Lion License

Except as otherwise provided in this chapter, a person who is a resident, as defined in 87-2-102, and who is 12 years of age or older or who will turn 12 years old before or during the season for which the license is issued may, upon payment of a fee of $19, receive a Class D-2 license that entitles a holder who is 12 years of age or older to hunt mountain lion and possess the carcass of the mountain lion as authorized by department rules.

87-2-521. Class D-3-Resident Hound Training License

A person who is a resident, as defined in 87-2-102, and who is 12 years of age or older or who will turn 12 years old before or during the season for which the license is issued, upon payment of a fee of $5, may receive a Class D-3 hound training license that entitles the holder to use a dog or dogs to aid in pursuing mountain lions or bobcats during the training season established in 87-6-404(4).

87-2-702. Restrictions On Special Licenses - Availability Of Bear And Mountain Lion Licenses

(1) A person who has killed or taken any game animal, except a deer, an elk, or an antelope, during the current license year is not permitted to receive a special license under this chapter to hunt or kill a second game animal of the same species.
(2) The commission may require applicants for special permits authorized by this chapter to obtain a valid big game license for that species for the current year prior to applying for a special permit.
(3) Except as provided in 87-2-815, a person may take only one grizzly bear in Montana with a license authorized by 87-2-701.
(4) (a) Except as provided in 87-1-271(2) and 87-2-815, a person who receives a moose, mountain goat, or limited mountain sheep license, as authorized by 87-2-701, with the exception of an antlerless moose or an adult ewe game management license issued under 87-2-104, is not eligible to receive another special license for that species for the next 7 years. For the purposes of this subsection (4)(a), "limited mountain sheep license" means a license that is valid for an area in which the number of licenses issued is restricted.
(b) Except as provided in 87-1-271(2) and 87-2-815, a person who takes a mountain sheep using an unlimited mountain sheep license, with the exception of a mountain sheep taken pursuant to an adult ewe license, as authorized by 87-2-701, is not eligible to receive another special license for that species for the next 7 years. For the purposes of this subsection (4)(b), "unlimited mountain sheep license" means a license that is valid for an area in which the number of licenses issued is not restricted.
(5) An application for a wild buffalo or bison license must be made on the same form and is subject to the same license application deadline as the special license for moose, mountain goat, and mountain sheep.
(6) (a) Licenses for spring bear hunts must be available for purchase at department offices after April 15 of any license year. However, a person who purchases a license for a spring bear hunt after April 15 of any license year may not use the license until 24 hours after the license is issued.
(b) Licenses for fall bear hunts must be available for purchase at department offices after August 31 of any license year. However, a person who purchases a license for a fall bear hunt after August 31 of any license year may not use the license until 24 hours after the license is issued.
(7) Licenses for mountain lion hunts must be available for purchase at department offices after August 31 of any license year. However, a person who purchases a license for a mountain lion hunt after August 31 of any license year may not use the license until 5 days after the license is issued.

87-2-806. Taking Fish Or Game For Scientific Purposes

(1) An accredited representative of an accredited school, college, university, or other institution of learning or

of any governmental agency or an individual who is investigating a scientific subject for which collection is necessary, may take, kill, capture, and possess for that purpose any birds, fish, or animals protected by Montana law or department or commission rule if a permit to collect is authorized by the department. Under the provisions of this section, a permittee may take, kill, and capture protected or unprotected birds, fish, or animals in any way that is approved by the department, except by the use of explosives. A permittee may not take, kill, or capture more birds, fish, or animals than are necessary for the investigation. A collection permit may not be given for a species for which a taking is prohibited by statute or rule.
(2) A person who desires to engage in the scientific investigation shall apply to the department for a permit. The department may require the applicant to submit a plan of operations that includes the purpose for the collection, collection methodology to be employed, and the qualifications of the person who will be doing the collecting. The department may set qualifications for persons to whom permits are issued and may place special authorizations or special requirements and limitations on any permit. If the department is satisfied of the good faith and qualifications of the applicant and that the collecting is necessary for a valid purpose, the department:
(a) may issue a permit that must place a time limit on the collections and may place a restriction on the number of birds, fish, or animals to be taken; and
(b) shall require a report of the numbers and species of animals taken by collection areas.
(3) The department may deny a permit if:
(a) the applicant is not qualified to make the scientific investigation;
(b) the proposed collecting is not necessary for the proposed scientific investigation;
(c) the method of collecting is not appropriate;
(d) the proposed collecting may threaten the viability of the species; or
(e) there is no valid reason or need for the proposed scientific investigation.
(4) By December 31 of each year, a permittee shall submit a report to the department that lists the species and numbers of individuals of the species taken and locations from which collections were taken. A permittee who fails to file a required report may not be issued another permit.
(5) The permittee shall pay $50 for the permit, except that a permittee who is a representative of an accredited school, college, university, or other institution of learning or of any governmental agency is exempt from payment of the fee.
(6) The permittee may not take, have, or capture any other or greater number of birds, fish, or animals than are allowed in the permit.
(7) A representative of an accredited school, college, university, or other institution of learning or an individual permittee who may have various students or associates assisting throughout the year may apply to have a permit issued that includes the individual and the students or associates. The department shall approve the qualifications of a student or an associate and the level of supervision required by the primary permittee. The students or associates, when carrying a copy of the permit, have the same authorizations and restrictions as the primary applicant. The primary applicant shall keep a record of all students or associates listed on the permit and of the dates when each student or associate conducts a collection under the permit. The primary applicant is responsible for the students' or associates' use of the permit or copies of the permit.

87-3-127. Taking Of Stock-killing Animals

(1) Livestock owners, their agents, or employees of the department or a federal agency may use dogs in pursuit of stock-killing black bears, stock-killing mountain lions, and stock-killing bobcats. Other means of taking stock-killing black bears, stock-killing mountain lions, and stock-killing bobcats may be used, except the deadfall.
(2) Traps used in capturing bears must be inspected twice each day with the inspections 12 hours apart.

87-3-128. Exceptions - Department Personnel

The provisions of this chapter relating to methods of herding, driving, capturing, taking, locating, or concentrating of fish, game animals, game birds, or fur-bearing animals do not apply to the department or to any employee thereof while acting within the scope and course of the powers and duties of the department.

87-5-713. Control Of Wildlife Species Permitted To Be Transplanted Or Introduced

Any wildlife species listed in 87-5-714 or approved by the commission for introduction or transplantation may be introduced or transplanted only subject to a plan developed by the department to assure that the population can be controlled if any unforeseen harm should occur.

87-5-725. Notification Of Transplantation Or Introduction Of Wildlife

Notification of transplantation or introduction of wildlife.
(1) When the decision to introduce or transplant a wolf, bear, or mountain lion is made pursuant to this part, the department shall:
(a) provide public notice on its website and, when practical, by personal contact in the general area where the animal is released; and
(b) notify the public through print and broadcast media of the availability of release information on the department's website.
(2) Prior permission from the landowner is required before any animal may be transplanted onto private property.

87-6-106. Lawful Taking To Protect Livestock Or Person

(1) This chapter may not be construed to impose, by implication or otherwise, criminal liability for the taking of wildlife protected by this title if the wildlife is attacking, killing, or threatening to kill a person or livestock. However, for purposes of protecting livestock, a person may not kill or attempt to kill a grizzly bear unless the grizzly bear is in the act of attacking or killing livestock.
(2) A person may kill or attempt to kill a wolf or mountain lion that is in the act of attacking or killing a domestic dog.
(3) A person who, under this section, takes wildlife protected by this title shall notify the department within 72 hours and shall surrender or arrange to surrender the wildlife to the department.

87-6-404. Unlawful Use Of Dog While Hunting

(1) Except as provided in subsections (3) through (6), a person may not:
(a) chase any game animal or fur-bearing animal with a dog; or
(b) purposely, knowingly, or negligently permit a dog to chase, stalk, pursue, attack, or kill a hooved game animal. If the dog is not under the control of an adult at the time of the violation, the owner of the dog is personally responsible. A defense that the dog was allowed to run at large by another person is not allowable unless it is shown that at the time of the violation, the dog was running at large without the consent of the owner and that the owner took reasonable precautions to prevent the dog from running at large.
(2) Except as provided in subsection (3)(d), a peace officer, game warden, or other person authorized to enforce the Montana fish and game laws who witnesses a dog chasing, stalking, pursuing, attacking, or killing a hooved game animal may destroy that dog on public land or on private land at the request of the landowner without criminal or civil liability.
(3) A person may:
(a) take game birds during the appropriate open season with the aid of a dog;
(b) hunt mountain lions during the winter open season, as established by the commission, with the aid of a dog or dogs;
(c) hunt bobcats during the trapping season, as established by the commission, with the aid of a dog or dogs; and
(d) use trained or controlled dogs to chase or herd away game animals or fur-bearing animals to protect humans, lawns, gardens, livestock, or agricultural products, including growing crops and stored hay and grain. The dog may not be destroyed pursuant to subsection (2).
(4) A resident who possesses a Class D-3 resident hound training license may pursue mountain lions and bobcats with a dog or dogs during a training season from December 2 of each year to April 14 of the following year.
(5) (a) A person with a valid hunting license issued pursuant to Title 87, chapter 2, may use a dog to track a wounded game animal during an appropriate open season. Any person using a dog in this manner:
(i) shall maintain physical control of the dog at all times by means of a maximum 50-foot lead attached to the dog's collar or harness;
(ii) during the general season, whether handling or accompanying the dog, shall wear hunter orange material pursuant to 87-6-414;
(iii) may carry any weapon allowed by law;
(iv) may dispose of the wounded game animal using any weapon allowed by the valid hunting license; and
(v) shall tag an animal that has been reduced to possession in accordance with 87-6-411.

(b) Dog handlers tracking a wounded game animal with a dog are exempt from licensing requirements under Title 87, chapter 2, as long as they are accompanied by the licensed hunter who wounded the game animal.
(6) Any person or association organized for the protection of game may run field trials at any time upon obtaining written permission from the director.
(7) A person who is convicted of or who forfeits bond or bail after being charged with a violation of this section shall be fined not less than $50 or more than $1,000 or be imprisoned in the county detention center for not more than 6 months, or both. In addition, the person, upon conviction or forfeiture of bond or bail, may be subject to forfeiture of any current hunting, fishing, or trapping license issued by this state and the privilege to hunt, fish, and trap in this state or to use state lands, as defined in 77-1-101, for recreational purposes for a period of time set by the court.
(8) A violation of this section may also result in an order to pay restitution pursuant to 87-6-905 through 87-6-907.

87-6-701. Failure To Report Or Tattoo

Failure to report or tattoo. (1) Any bear, wolf, tiger, mountain lion, or coyote that is captured alive to be released later or that is held in captivity for any purpose must be reported to the department within 3 days of the capture or commencement of captivity.
(2) Each animal reported as required in subsection (1) must be permanently tattooed or otherwise permanently identified in a manner that will provide positive individual identification of the animal. No tattoo is required if the animal is subject to a permanent, individual identification process by another state or federal agency.
(3) Any person holding a bear, wolf, tiger, mountain lion, or coyote in captivity shall immediately report to the department any death, escape, release, transfer of custody, or other disposition of the animal.
(4) A person convicted of a violation of this section shall be fined not less than $50 or more than $1,000 or be imprisoned in the county detention center for not more than 6 months, or both. In addition, the person, upon conviction or forfeiture of bond or bail, may be subject to forfeiture of any current hunting, fishing, or trapping license issued by this state and the privilege to hunt, fish, or trap in this state or to use state lands, as defined in 77-1-101, for recreational purposes for a period of time set by the court.

ADMINISTRATIVE RULES OF MONTANA

12.3.105 Limitation On Number Of Hunting Licenses

(1) When the department sets a limitation or quota for the number of hunting licenses to be issued in any hunting district or other designated area, resident applicants shall receive at least 90% of the total hunting licenses to be issued for that game species in that district. When the number of resident applicants totals less than 90% of the quota for that district, all resident applicants shall receive a hunting license for that game species.
(2) The remaining licenses will be issued to the nonresident applicants for that district by drawing.
(3) Any thereafter remaining licenses for that district shall be issued in such manner as the director determines.

12.3.111. License/Permit Prerequisites

(1) Deer. All valid resident conservation license holders and all valid nonresident big game (class B-10) and deer combination (class B-11) license holders may apply for deer permits. However, a holder of a B-11 license obtained through a landowner sponsor can only apply for a deer permit where the permitted area includes the landowner sponsor's property and can only use the permit for hunting on the landowner sponsor's property. All valid conservation license holders may apply for deer B licenses. All nonresident conservation license holders who do not possess a B-10 or B-11 license may apply for a nonresident deer A (B-7) license, if available.
(2) Elk. Only persons who possess a valid resident A-5 elk license or a valid nonresident class B-10 license may apply for a special elk permit or A-7 license.
(3) All valid conservation license holders may apply for moose, sheep, goat, deer B, antelope, black bear, grizzly bear, buffalo, swan, and mountain lion licenses, and turkey permits/licenses. Resident sportsman and nonresident big game combination license holders may not apply for a black bear license if the black bear license is included as part of the combination license.
(4) A nonresident who uses a class B-11 landowner sponsored license in conjunction with a deer permit or a wild turkey license may hunt only on the landowner

sponsor's property. A nonresident who possesses a class B-1 landowner sponsored license and who hunts turkey off the landowner sponsor's property must also hold a class B-1, nonresident bird license valid statewide which is different than the restrictive B-1 license contained in the B-11 license. A nonresident holding both the class B-11 license and the class B-1 license valid statewide may purchase only the number of wild turkey licenses specified on the annual regulations for that season.

12.3.116 Moose, Sheep, And Goat Licenses

(1) The department shall issue moose, sheep, and goat licenses as described in sections 87-2-701 and 87-2-506 , MCA according to the following policy and procedures:
(a) Applicants for moose and goat must specify one choice for a hunting district. However, for bighorn sheep, an applicant may specify a second choice.
(b) Application for unlimited sheep must be postmarked no later than May 1. The deadline may be extended by the department if necessary to provide adequate time for the applicants to apply.
(2) The following procedure will be used when allocating 10% license opportunities for nonresidents in moose, sheep and goat drawings:
(a) The total regional license quota, by species and region, will be used to determine 10% nonresident quota.
(b) Nonresident license allocations will be applied to those hunting districts and season types with a quota of ten or more in the tentative regulations.
(c) Any remaining license allocation will be put, on a rotating basis, in those districts and season types with a quota of less than ten of the tentative regulations.
(d) If no district in a region has a quota of ten or more licenses on the tentative regulations, all of the nonresident license authority will be allocated as described in (c).
(e) If a region has a total quota of less than ten, no nonresident license allocations will be made for that region.

12.3.140 Application For Drawings

(1) The deadline date for the moose, sheep, and goat special drawings is on or before May 1. The deadline date for elk, deer and antelope special drawings is on or before June 1. All applications for participation in any special permit/license drawing, except drawings under ARM 12.9.801 (damage hunts) provided for by these regulations must be postmarked by the U.S. Postal Service on or before the deadline date of the current license year, or delivered by private mail service on or before the deadline date; or if personally delivered, received in the Helena Fish, Wildlife and Parks office by 5:00 p.m., on the deadline date of the current license year. If the deadline date for application for any license or drawings, as set by the department, falls on a Sunday or state holiday, that date shall be automatically extended to 5:00 p.m. of the next full work day. The deadline may be extended by the department if necessary to provide adequate time for the applicants to apply.
(2) The department shall reject an application for any permit/license drawing or for surplus, mountain lion, black bear, trapping, buffalo, or grizzly bear licenses if:
(a) application is not made on the current year's form provided by the department;
(b) applicant fails to provide mandatory information on the form;
(c) applicant fails to sign the application; or
(d) applicant fails to submit the proper fee. The department will not accept personal checks from nonresidents for nonresident license applications and drawing fees.
(3) Submittal of more than one application for any one drawing by an individual will disqualify that individual's applications from the drawing for which the multiple applications were submitted.
(4) No corrections or changes may be made after the department has received the drawing application, except those types that can be made without contacting the applicant. These include:
(a) adding hunter safety numbers;
(b) moving valid district choices up to replace invalid choices;
(c) eliminating species choices on those applications that are short money when the shortfall is the amount for that species; and
(d) adjusting party applications to insure party consistency.
(5) Any category of correction made by the department must be applied to all applications. In addition, the department will accept corrections on the applications of those seeking landowner preference. Unless otherwise provided by these rules, all drawings will take place in Helena.
(6) All applications for participation in buffalo, spring grizzly bear, swan and turkey drawings must be

postmarked by the U.S. Postal Service by the advertised deadline date, or delivered by private mail service on or before the date to the address indicated for the particular drawing which is being applied for.
(7) If an application for any species is rejected by the department pursuant to this rule:
(a) the application must not be included in the procedure for awarding the permits/licenses applied for;
(b) the applicant must not be awarded a bonus point for that drawing for that species; and
(c) the drawing fee, and any bonus point fee, once the application is entered into the drawing, will be retained by the department. Applications not processed in the drawing because of errors will be returned to the applicant with all fees.

12.3.185. Super-tag Hunting Licenses

(1) The department will issue one deer, one elk, one shiras moose, one mountain sheep, one mountain goat, one wild buffalo or bison, one antelope, and one mountain lion hunting license each year through a lottery. These hunting licenses are known as "super-tags."
(2) For each species, an unlimited number of chances to draw a super-tag will be sold at $5 per chance. Chances will be sold by license agents as defined in ARM 12.3.201A or through the department authorized web site on the internet. License agents will receive a commission of $0.50 for each super-tag transaction for a species. A transaction in this case means the purchase of one or more super-tag chances of the same species at one time. Individuals purchasing a ticket through the internet shall pay a convenience fee in accordance with the current internet provider contract.
(3) After the completion of the special license drawing for a species, the department will conduct a computerized drawing selecting randomly the super-tag winner for that species. The department shall issue the appropriate super-tag to the lottery winner.
(4) Only a person legally able to be licensed under current Montana statutes may purchase chances to draw a super-tag or use a super-tag. A person must possess a valid conservation license to be eligible to purchase a chance to draw a super-tag.
(5) The super-tag is valid for the taking of one animal of the species for which it is issued and is valid only for the current license year. A super-tag may be used in any legally described hunting district open for hunting of that species. A super-tag may be used only during the legal hunting season for the species for which it is issued. The person using the super-tag may use it only during a hunting district's open season and is subject to all hunting regulations, including special weapons regulations, that apply to a hunting district. However, if a hunting district requires a permit to hunt that species in that district, a super-tag can be used without the special permit.
(6) In the event that a person who drew a license or purchased a license is also drawn for the super-tag for the same species, the person must surrender the license to the department before receiving the super-tag. The department will refund the license fee paid by the winner of the super-tag. The person winning the super-tag shall retain any accumulated bonus points for that species.
(7) The super-tag is a nontransferable license.

APPENDIX 7

MONTANA MOUNTAIN LION IPM MODEL CODE

The Montana Mountain Lion Integrated Population Model was constructed using the statistical programming language R (R Development Core Team 2013).

```
model{
     #  Naming
     #  Parameter names begin with a capitalized letter
     #  Data are all lower case
     #  Indexing always follows - DAU, Year, Age, Sex
     #  If fewer indices are needed they follow the same order despite
     #   omissions

     #  Priors
     #  Pregnancy rates - [age, sex, mean:tau]
     Preg[1] ~ dnorm(preg[3,1,1], preg[3,1,2])T(0,1)
     Preg[2] ~ dnorm(preg[4,1,1], preg[4,1,2])T(0,1)

     #  Fetus Counts - [age, sex, mean:tau]
     FC[1] ~ dnorm(fc[3,1,1], fc[3,1,2])T(0,3)
     FC[2] ~ dnorm(fc[4,1,1], fc[4,1,2])T(0,3)

     #  Survival
     #  Priors on survival - First age class, not available for harvest, so
     #   survival is the only parameter
     #  Informative prior stored as probability
     yS_mu ~ dnorm(means[1,1,1], means[1,1,2])T(0,1)

     #  Transform probability back to real scale and use as the intercept
     for(u in 1:ndau){
       for(yr in 1:nyr){
         for(s in 1:2){
           logit(S[u,yr, 1, s]) <- log(yS_mu/(1 - yS_mu))
           H[u,yr,1,s] <- 0
           O[u,yr,1,s] <- 0
         }
       }
     }

     #  Priors on survival - Juveniles - two sexes, cause specific mortality
     for(s in 1:2){
       #  Informative priors are stored as probabilities
       jS_tmp[1,s] ~ dnorm(means[2,s,1], means[2,s,2])T(0, 1)
       jS_tmp[2,s] ~ dnorm(meanh[2,s,1], meanh[2,s,2])T(0, 1)
       jS_tmp[3,s] ~ dnorm(meano[2,s,1], meano[2,s,2])T(0, 1)

       #  Transform probability to real scale
       for(i in 1:3){
         jS_mu[i,s] <- log(jS_tmp[i,s]/jS_tmp[3,s])
       }

       #  Describe rate as function of linear predictor and define link
       #   function
       for(u in 1:ndau){
         for(yr in 1:nyr){
           log(jS_log[u,yr,s]) <- jS_mu[1,s]
           log(jH_log[u,yr,s]) <- jS_mu[2,s]
```

```
      log(jO_log[u,yr,s]) <- 0
      jSums[u,yr,s] <- jS_log[u,yr,s] + jH_log[u,yr,s] + jO_log[u,yr,s]
      S[u,yr,2,s] <- jS_log[u,yr,s]/jSums[u,yr,s]
      H[u,yr,2,s] <- jH_log[u,yr,s]/jSums[u,yr,s]
      O[u,yr,2,s] <- jO_log[u,yr,s]/jSums[u,yr,s]
    }
  }
}

#  Priors on survival - SubAdults - two sexes, cause specific mortality
for(s in 1:2){
  #  Informative priors are stored as probabilities
  sS_tmp[1,s] ~ dnorm(means[3,s,1], means[3,s,2])T(0, 1)
  sS_tmp[2,s] ~ dnorm(meanh[3,s,1], meanh[3,s,2])T(0, 1)
  sS_tmp[3,s] ~ dnorm(meano[3,s,1], meano[3,s,2])T(0, 1)

  #  Transform probability to real scale
  for(i in 1:3){
    sS_mu[i,s] <- log(sS_tmp[i,s]/sS_tmp[3,s])
  }

  #  Describe rate as function of linear predictor and define link
  #   function
  for(u in 1:ndau){
    for(yr in 1:nyr){
      log(sS_log[u,yr,s]) <- sS_mu[1,s]
      log(sH_log[u,yr,s]) <- sS_mu[2,s]
      log(sO_log[u,yr,s]) <- 0
      sSums[u,yr,s] <- sS_log[u,yr,s] + sH_log[u,yr,s] + sO_log[u,yr,s]
      S[u,yr,3,s] <- sS_log[u,yr,s]/sSums[u,yr,s]
      H[u,yr,3,s] <- sH_log[u,yr,s]/sSums[u,yr,s]
      O[u,yr,3,s] <- sO_log[u,yr,s]/sSums[u,yr,s]
    }
  }
}

#  Priors on survival - Adults, two sexes, cause specific mortality
for(s in 1:2){
  #  Informative priors are stored as probabilities
  aS_tmp[1,s] ~ dnorm(means[4,s,1], means[4,s,2])T(0, 1)
  aS_tmp[2,s] ~ dnorm(meanh[4,s,1], meanh[4,s,2])T(0, 1)
  aS_tmp[3,s] ~ dnorm(meano[4,s,1], meano[4,s,2])T(0, 1)

  #  Transform probability to real scale
  for(i in 1:3){
    aS_mu[i,s] <- log(aS_tmp[i,s]/aS_tmp[3,s])
  }


  #  Describe rate as function of linear predictor and define link
  #   function
  for(u in 1:ndau){
    for(yr in 1:nyr){
      log(aS_log[u,yr,s]) <- aS_mu[1,s]
      log(aH_log[u,yr,s]) <- aS_mu[2,s]
      log(aO_log[u,yr,s]) <- 0
      aSums[u,yr,s] <- aS_log[u,yr,s] + aH_log[u,yr,s] + aO_log[u,yr,s]
      S[u,yr,4,s] <- aS_log[u,yr,s]/aSums[u,yr,s]
      H[u,yr,4,s] <- aH_log[u,yr,s]/aSums[u,yr,s]
      O[u,yr,4,s] <- aO_log[u,yr,s]/aSums[u,yr,s]
    }
  }
}

###  Prior on first year population size
#  Indexing - Year, Age, Sex
for(u in 1:ndau){
  N[u,1,1,1] ~ dnorm(n1[1,2], 1/n1[1,2])T(0,)
```

```
  N[u,1,1,2] <- N[u,1,1,1]

  for(a in 2:nage){
    for(s in 1:2){
      N[u,1,a,s] ~ dnorm(n1[a,s+1], 1/n1[a,s+1])T(0,)
    }
  }

  yN[u,1] <- N[u,1,1,1] + N[u,1,1,2]
  fN[u,1] <- N[u,1,2,1] + N[u,1,3,1] + N[u,1,4,1]
  mN[u,1] <- N[u,1,2,2] + N[u,1,3,2] + N[u,1,4,2]
  totN[u,1] <- yN[u,1] + fN[u,1] + mN[u,1]
}

###  Process model - 4 ages, 2 sex
#  Using normal approximation because it is fast and mixes well
#  Sex = 1 is a female
#  Indexing follows - DAU, Year, Age, Sex
for(u in 1:ndau){
  for(yr in 2:nyr){
    #  Kittens
    #  Normal approximation of Poisson
    nMu[u,yr,1,1] <-
      ((N[u,yr,3,1] * 0.5 * FC[1] * Preg[1]) +
        (N[u,yr,4,1] * 0.5 * FC[2] * Preg[2])) *
        S[u,yr-1,1,1]
    nMu[u,yr,1,2] <- nMu[u,yr,1,1]

    N[u,yr,1,1] ~ dnorm(nMu[u,yr,1,1], 1/(nMu[u,yr,1,1]))
    N[u,yr,1,2] <- N[u,yr,1,1]

    for(s in 1:2){
      #  Juveniles
      #  Normal approximation of Binomial
      nMu[u,yr,2,s] <-
        (1 - O[u,yr-1,2,s]) * (N[u,yr-1,1,s] - harv[u,yr-1,2,s])

      nTau[u,yr,2,s] <- 1/((N[u,yr-1,1,s] - harv[u,yr-1,2,s]) *
        (O[u,yr-1,2,s]) * (1 - O[u,yr-1,2,s]))

      N[u,yr,2,s] ~ dnorm(nMu[u,yr,2,s], nTau[u,yr,2,s])

      #  SubAdults
      #  Normal approximation of Binomial
      nMu[u,yr,3,s] <-
        (1 - O[u,yr-1,3,s]) * (N[u,yr-1,2,s] - harv[u,yr-1,3,s])

      nTau[u,yr,3,s] <- 1/((N[u,yr-1,2,s] - harv[u,yr-1,3,s]) *
        (O[u,yr-1,3,s]) * (1 - O[u,yr-1,3,s]))

      N[u,yr,3,s] ~ dnorm(nMu[u,yr,3,s], nTau[u,yr,3,s])


      #  Adults
      #  Normal approximation of Binomial
      #  Female Other Mortality shared between the sexes
      nMu[u,yr,4,s] <-

        (N[u,yr-1,3,s] + N[u,yr-1,4,s] - harv[u,yr-1,4,s]) *
          (1 - O[u,yr-1,4,s])

      nTau[u,yr,4,s] <-
        1/((N[u,yr-1,3,s] + N[u,yr-1,4,s] - harv[u,yr-1,4,s]) *
        (O[u,yr-1,4,s]) * (1 - O[u,yr-1,4,s]))


      N[u,yr,4,s] ~ dnorm(nMu[u,yr,4,s], nTau[u,yr,4,s])
```

```
      }

    #  Totals in each year
    yN[u,yr] <- N[u,yr,1,1] + N[u,yr,1,2]
    fN[u,yr] <- N[u,yr,2,1] + N[u,yr,3,1] + N[u,yr,4,1]
    mN[u,yr] <- N[u,yr,2,2] + N[u,yr,3,2] + N[u,yr,4,2]
    totN[u,yr] <- yN[u,yr] + fN[u,yr] + mN[u,yr]
    }
  }

  ####################  Observation Models
  #  Indexing/columns always follows
  #    1   2     3    4    5    6
  #  DAU, Year, Age, Sex, Mean, Tau

  #  Abundance Observation - [dau, yr]
  for(i in 1:nn){
    ndat[i,5] ~ dnorm(totN[1,ndat[i,2]], ndat[i,6])T(0,)
  }

  #  Harvest Observations - [dau,yr,a,s]
  for(u in 1:ndau){
    for(yr in 1:nobs_yr){
      for(a in 1:nage){
        for(s in 1:2){
          harv[u,yr,a,s] ~ dbinom(H[u,yr,a,s], round(N[u,yr,a,s]))
        }
      }
    }
  }

  #  Survival Observations
  for(i in 1:ns){
    sdat[i,5] ~ dnorm(S[1, sdat[i,2], sdat[i,3], sdat[i,4]], sdat[i,6])T(0, 1)
  }
  #  Harvest Mortality Rate Observations
  for(i in 1:nhm){
    hmdat[i,5] ~ dnorm(H[1, hmdat[i,2], hmdat[i,3], hmdat[i,4]], hmdat[i,6])T(0, 1)
  }
  #  Other (Non-Harvest) Mortality Rate Observations
  for(i in 1:nom){
    omdat[i,5] ~ dnorm(O[1, omdat[i,2], omdat[i,3], omdat[i,4]], omdat[i,6])T(0, 1)
  }

  #  Derived - the constant is added to avoid division by 0
  for(u in 1:ndau){
    for(yr in 1:nyr){

      mf[u,yr] <- (mN[u,yr] + 0.001)/(fN[u,yr] + 0.001)
    }
  }

  #  Incomplete vectors cannot be monitored, so aribitrary value is given
  #  to the first year
  #  Same constant trick is used here for the division
  #  Using the log and exp handles 0 gracefully, recall that
  #  log(x) + log(y) = log(xy), so the geometric mean is calculated using
  #  an algebraic rearrangment that is more robust to 0's
  for(u in 1:ndau){
    lambda[u,1] <- 1
    for(yr in 2:nyr){
      lambda[u,yr] <- (totN[u,yr] + 0.001)/(totN[u,yr-1] + 0.001)
      logla[u,yr] <- log(lambda[u,yr])
    }
    geoLambda[u] <- exp((1/(nyr-1))*sum(logla[u,2:(nyr)]))
  }
}
```

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Hound baying treed mountain lion near Missoula, Montana, O. Smith

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Utah Cougar Management Plan V.3

2015-2025

Photo Credit: Tom Becker, Utah Division of Wildlife Resources

Utah Division of Wildlife Resources

and the

Cougar Advisory Group

DWR Publication No. 15-28

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* These members of the Cougar Advisory Group support the majority of the plan but are *of the opinion* that the approved targets allow for the possibility of excessive cougar harvest as judged from the standpoint of the best available science.

Utah Cougar Management Plan V. 3
2015 – 2025

PLAN GOAL: Maintain a healthy cougar population within their current distribution while considering human safety, economic concerns, other wildlife species, and maintaining hunting traditions through 2025.

Definition: A healthy cougar population is one that maintains: 1) a reasonable proportion of older age animals; 2) breeding females; 3) healthy individuals; 4) balance with its natural prey; 5) and genetic variability.

Introduction

The purpose of the Utah Cougar Management Plan is to direct the management of cougars (*Puma concolor*) in accordance with the mission of the Utah Division of Wildlife Resources (Division or DWR) through 2025. An internal review of the plan will be completed 5 years after implementation to ensure that established targets, goals, and objectives meet both management and social needs.

The mission of DWR is:

> *Serve the people of Utah as trustee and guardian of the state's wildlife*

In 1997, the DWR initiated a process to obtain public input on issues and concerns with cougar management. Individuals representing many diverse points of view were invited to form a Cougar Advisory Group. The mission of this group was to aid the Division in preparing a cougar management plan that would gain agreement from diverse groups.

The first version of the Utah Cougar Management Plan (UDWR 1999) resulted from these meetings and was used to direct cougar management efforts from 1999 to 2009. In 2009, the DWR reformed the Cougar Advisory Group to review and update the plan. The group met 8 times between December and May 2010 which resulted in Version 2 (UDWR 2010). After approval of this version several social and management issues led to an emergency meeting of the Wildlife Board. The outcome of the meeting was Version 2.1 of the Utah Cougar Management Plan (UDWR 2011). Subsequently, this version did not fully address the concerns of the public or wildlife managers and the Wildlife Board directed the Division to reform the Cougar Advisory Group with the goal of simplifying the cougar management plan.

This document is version 3 of the Utah Cougar Management Plan which seeks to simplify cougar management and address social and management issues created through previous versions of the plan. The Cougar Advisory Group met 5 times between December and April 2015. The first meeting of the group focused on developing a list of issues and concerns that the group could focus on and address in this document (see Attachment D. Issues and Concerns).

The natural history and ecology of cougars is not included or described in this document because more detailed information on cougar ecology can be found in "Managing Cougars in North America" (WAFWA 2011).

Management History

Cougars were persecuted as vermin in Utah from the time of European settlement in 1847 until 1966. In 1967 the Utah State Legislature changed the status of cougars to that of *protected wildlife,* and since that time they have been considered a game species with established hunting regulations. The first Utah Cougar Management Plan (UDWR 1999) guided cougar management through 2009. Consequently, two additional versions of the plan were adopted by the Wildlife Board to guide cougar management between 2010 and 2014 (UDWR 2010, 2011).

Cougars use very broad and diverse areas in Utah. The large scale dynamics and interconnectivity of the states cougar populations have been demonstrated through multiple telemetry and GPS radio collar studies (Stoner et al. 2006; 2008: 2013b). Evaluation of the genetic relatedness of cougars in Utah also provides evidence that gene flow occurs over large geographic areas (Sinclair et al. 2001). Cougar harvest has traditionally been controlled in specific geographic areas or hunting units. Version 2 of the management plan sought to tie smaller hunting units to larger home ranges or eco-regions to account for the large spatial scale and source-sink population dynamics (Stoner et al. 2013b; cougar management areas; Figure 1). However, implementation of the eco-region concept limited the ability of the Division to distribute hunters adequately which resulted in heavy hunting pressure and high harvest in easily accessible areas and low to no harvest in areas with limited access.

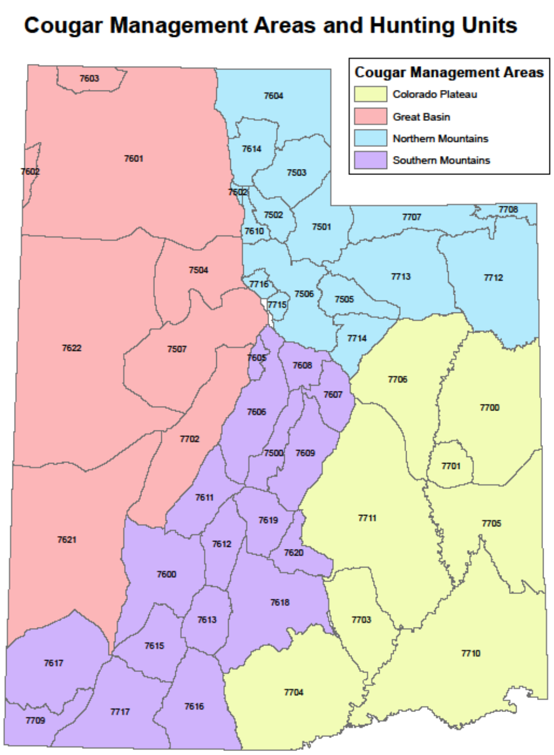

Figure 1. Cougar Management Areas and Hunting Units

Cougar harvest in Utah has been accomplished using three harvest strategies: harvest objective (quota), limited entry and split (limited entry followed by harvest objective). Under the *harvest objective strategy*, managers prescribe a quota, or number of cougars to be harvested on the unit. An unlimited number of licensed hunters are allowed to hunt during a season which closes as soon as the quota is filled or when the season end date is reached. Hunters are required to check daily to ensure the quota has not been filled. Under the *limited entry strategy*, harvest is managed by limiting the number of hunters on a unit. The number of hunters is determined based upon an expectation of hunting success and the desired harvest size. Individuals are usually selected for hunting on the unit through a random drawing process. Under the *split strategy*, units start the season under the limited entry strategy and then transition to a harvest objective strategy on a set date using the number of limited entry permits that remained unfilled at the time of the transition as the quota for the remaining weeks of the season.

Predator-Prey Relationships

Mule deer are known to be the preferred prey species of cougars (Seidensticker et al. 1973, Ackerman 1982, Mitchell 2013), and in Utah both deer and elk have been identified as primary prey species. In areas where both deer and elk co-exist cougars will usually select deer (Lindzey et al. 1989, Mitchell 2013). Other prey species include lagomorphs, turkey, skunk, fox, porcupines, rodents, bighorn sheep, feral horses, domestic sheep, cattle, bobcat and coyote (Russell 1978, Ackerman et al.1982, Knopf 2010, Mitchell 2013).

Cougar populations may be limited by prey abundance, availability, and vulnerability (Pierce et al 2000*b*, Logan and Sweanor 2001), and the relationship between predator and prey is very complex. Much controversy surrounds whether cougar predation can restrict or limit population growth of prey species; the majority of evidence is circumstantial, revolving around observations that deer are preferred prey, high cougar densities, and/or prey populations are declining. Most research indicates that cougars and predation alone are not a major limiting factor of prey species abundance (Hornocker 1970, Russell 1978, Lindzey et al. 1994, Logan et al. 1996, Pierce et al. 2012). Ballard et al. (2001) reviewed a total of 17 published studies and concluded that deer-predator relationships are confounded by many factors including the relationship of deer to available habitat and carrying capacity. For example in New Mexico, Logan et al. (1996) found that cougar predation was the major cause of mortality in mule deer but that habitat quality was the critical limiting factor. Conversely, when habitat quality was good and the deer population was below carrying capacity, cougar predation did not prevent the deer population from increasing. In Idaho, Hurley et al. (2011) examined mule deer survival in response to removal of both coyote and cougars. Their data indicated that winter severity had the largest influence on population growth rate and predator removal only resulted in slight prey population increases for short term periods.

In contrast, predator-prey dynamics between cougar and bighorn sheep are less ambiguous because most bighorn sheep populations are small in number and isolated in space. Cougar predation on bighorn sheep typically occurs randomly and most often when one individual learns to specialize on bighorn sheep (Logan et al. 1996, Ross et al. 1997, Ernst et al. 2002, Sawyer and Lindzey 2002, Festa-Bianchet. et al. 2006). In a population of desert bighorn sheep radio collared in southeastern Utah, cougar predation was responsible for 53% of radio collared adult mortalities (UDWR unpublished data). In California and Arizona, cougars were implicated in the decline of bighorn sheep populations (Hayes et al. 2000, Schaefer et al. 2000, Kamler et al. 2002), and in Alberta, a single cougar was responsible for killing 9% of the early-winter bighorn sheep population including 26% of the lambs (Ross et al. 1997). Targeted removal of cougar that learn to specialize on bighorn sheep can be beneficial for both cougar and sheep populations (Ernest et al 2002).

The availability and abundance of different prey species in an area as well as the presence of other predators are also factors that may influence prey populations. In some cases a “predator pit” effect can occur when the primary prey experiences a reduction in numbers but an alternate prey source is available to the predator. This helps artificially keep predator populations high because the predator can switch to other prey, and their population size does not decrease in response to lower availability or preferred prey. The predator can then keep the primary prey species from recovering (Dale et al. 1994, Gassaway 1992).

In 1996 the Utah Wildlife Board approved a Predator Management Policy (DWR Policy No. W1AG-4, last updated in 2006) that authorizes the Division to increase cougar harvest on management units where big game populations are depressed, or where big game has recently been released to establish or supplement new populations. The policy acts under the assumption that predators can slow recovery of prey populations when they are depressed or that a prey population can be kept at a lower density due to predation (Cougar Management Guidelines Working Group 2005). Predator management plans are reviewed by regional staff, the Mammals Program Coordinator, and approved by both the Wildlife Section Chief and DWR Director.

Most predator management plans that affect cougars have been designed to benefit mule deer and/or bighorn sheep. Cougar harvest has been liberalized where mule deer or bighorn sheep are below population management objective, and adult survival is lower than normal under the assumption that large harvests will reduce cougar numbers and hence predation rates, therefore encouraging growth of populations by improving survival. However, drought, habitat alteration and loss and predation all substantially impact big game populations making the effectiveness of predator management plans difficult to evaluate.

This version of the cougar management plan differs from previous versions in that aspects of the Divisions predator management policy are being incorporated into the plan. Mule deer and bighorn sheep population abundance and survival estimates will be used to help determine annual cougar harvest recommendations. This was one of the key social and management issues with previous versions of the Cougar

Management Plan identified through both the public recommendations process and by the Cougar Advisory Group.

In 1999, UDWR implemented a Nuisance Cougar Complaints policy (DWR Policy No. W5WLD-5, last updated in 2006) to provide guidance for reducing damage to private property, reducing public safety concerns, and direction to Division personnel responding to cougar depredation, nuisance, and human safety situations. Any cougar that poses a threat to human safety or preys upon livestock or pets is euthanized, as are sick or injured adult cougars and kittens that are unable to care for themselves in the wild. The Division does not rehabilitate cougars. The only cougars that are captured and translocated are healthy adults and subadults that wander into urban or suburban areas in situations where they have not been aggressive toward humans, pets, or livestock.

Harvest Information

The Division began managing cougar harvests through statewide limited entry hunting in 1990 and increased numbers of permits through 1995-1996. In 1996-1997, additional harvest pressure was added by switching some management units to the harvest objective (quota) system and a record high of 1,496 Permits were sold (Table 1).

Utah’s cougar population is monitored through mandatory reporting of all hunter-harvested cougars, cougars that are killed on highways or in accidents and those taken as a result of livestock depredation. Location of kill, sex and age (through a premolar for age estimation) are recorded for every cougar killed and provide the data used to assess management performance in relation to established target values that serve as indicators of population status. Since 1990 cougar mortality in Utah has ranged from 275 (1990) to 666 (1996) and has averaged 421 animals (Figure 2).

	Limited Entry Permits				Harvest Objective Permits			Total Permits	Pursuit Permits
Year	Resident	Nonresident	Conservation / Expo	Total	Resident	Nonresident	Total		
1989-90	385	142		527				527	355
1990-91	383	142		525				525	364
1991-92	383	142		525				525	524
1992-93	431	160		591				591	570
1993-94	479	180		659				659	552
1994-95	559	232		791				791	505
1995-96	611	261		872				872	627
1996-97	425	170		595			901	1,496	638
1997-98	381	128		509	472	199	671	1,180	635
1998-99	337	109		446	386	189	575	1,021	630
1999-00	259	84		343	374	170	544	887	545
2000-01	206	66		272	880	290	1,170	1,442	692
2001-02	228	30	8	266	897	300	1,197	1,463	681
2002-03	326	36	12	374	685	266	951	1,325	703
2003-04	215	29	20	264	533	209	742	1,006	772
2004-05	233	30	10	273	841	290	1,131	1,404	703
2005-06	356	38	12	406	464	222	686	1,092	730
2006-07	313	35	18	366	600	245	845	1,211	714
2007-08	283	34	20	337	587	238	825	1,162	880
2008-09	271	34	18	323	543	220	763	1,086	855
2009-10	263	32	18	313	566	192	758	1,071	900
2010-11	330	38	15	383	595	190	785	1,168	909
2011-12	312	36	16	364	613	202	815	1,178	777
2012-13	312	36	17	365	564	226	790	1,096	769
Total	**8,281**	**2,224**	**184**	**10,689**	**9,600**	**3,648**	**14,149**	**24,778**	**16,030**
Mean	**345**	**93**	**15**	**445**	**600**	**228**	**832**	**1,032**	**668**

Table 1. Utah Cougar Permits 1990-2013.

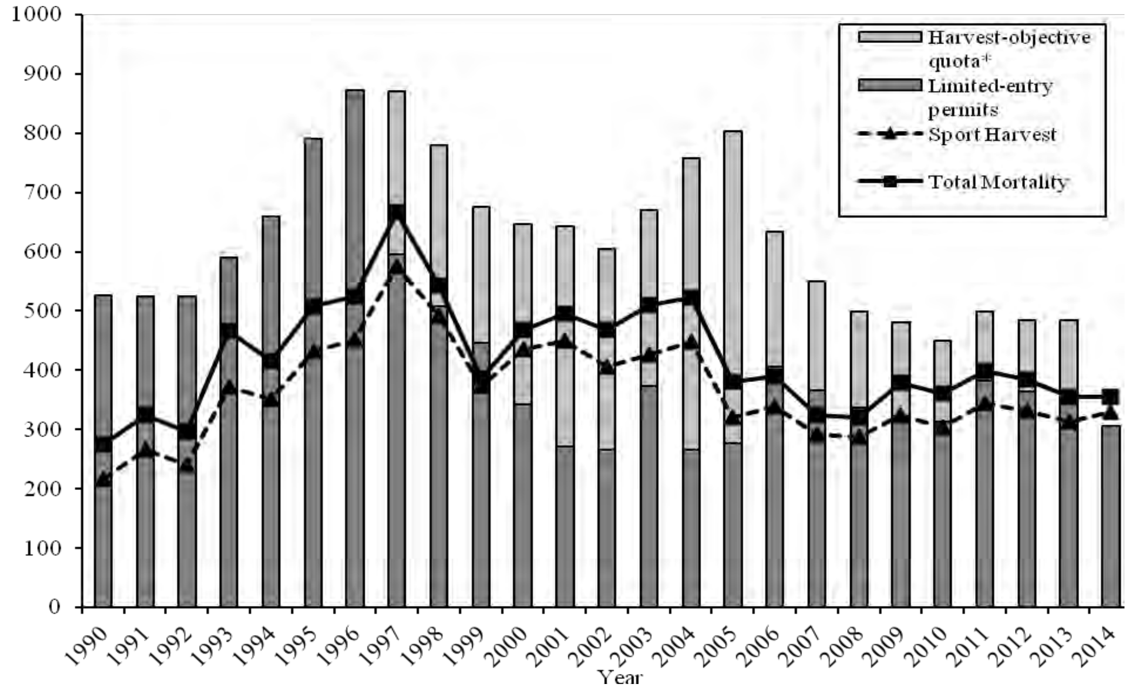

Figure 2. Cougar Mortality1990-2014

Nearly all cougars harvested in Utah are taken with the aid of dogs. An individual hunter is restricted to holding either a limited entry permit or a harvest objective permit per season, and must wait 3 years to reapply once they acquire a limited entry permit. The bag limit is 1 cougar per season. Kittens and females accompanied by young are protected from harvest. The cougar hunting season runs from late November through early June on both limited entry and most harvest objective units. Some units are open year round and some have earlier or later opening dates. Because harvest objective units close as soon as the objective (quota) is reached, hunters must call a toll-free number or check the Division website daily to ensure that the unit they plan to hunt is still open.

Pursuit (chase or no-kill) seasons provide additional recreational opportunities over most of the state. The pursuit season generally follows the hunt season, but specific units have year round pursuit, and a few units are closed to pursuit.

A valuable way to assess cougar population response to hunting is to follow the trend of age structure in harvest over time. The effect hunting has on cougar populations depends on the level of harvest and the sex and age of cougars that are removed. In general transient males are most susceptible to harvest (Barnhurst 1996). Under more intensive harvest pressures fewer juveniles tend to be harvested, followed by a decrease in adult males, and then finally a steady increase in adult females. The longer and more intensive the harvest pressure the more young females will occur in the harvest. This happens because older age animals and males are not available in the population. Likewise, relatively light harvest allows hunters to be more selective and tends to produce more males and older animals (WAFWA 2011).

Most cougar populations can sustain harvest rates of 20-30% of the adult population depending on the age and sex composition of the harvest (Beck et al. 2005). However, recent work in Washington state suggests the natural rate of increase is approximately 12-14% per year (Beausoleil et al. 2013). Large and well connected cougar populations can recover rapidly from over-exploitation (Cougar Management Guidelines 2005) given relaxation from hunting pressure and an adequate influx of immigrants. Cougar populations are most sensitive to the survival or removal of adult females (Martorello and Beusoleil 2003) which may slow or reduce population growth and may eventually lead to population decline (Stoner et al. 2006, Robinson et al. 2008, Cooley et al. 2009*a*; 2009*b*). For example, evaluation of cougar harvest for two different hunting regimes in Utah demonstrated negative impacts on fecundity, density, and age structures when the annual harvest consisted of >30% of the adult population with ≥42% females for periods greater than 3 years (Stoner 2004). Harvest and population data from southern Wyoming indicates that cougar populations can maintain themselves with a harvest comprised of 10-15% adult females (Anderson and Lindzey 2005). For these reasons most states limit female hunting mortality to <50% of the total harvest.

Distribution and Abundance

In Utah cougars occupy 92,696 km^2 (35,790 mi^2) of habitat. Cougars are distributed throughout all available eco-regions (Figure 3) and exhibit a broad habitat tolerance occurring from the semi-arid low-elevation pinion-juniper belt, to the mesic, aspen and conifer dominated forests of the higher mountains and plateaus. Habitat quality varies by ecoregion with the Colorado Plateau and Great Basin containing smaller, naturally fragmented habitats with lower cougar densities, and the mountain ecoregions comprised of relatively large, mesic patches (Stoner et al. 2013a). Residential and commercial development is incrementally reducing cougar distribution through habitat alteration and destruction, particularly along the western border of the Wasatch Mountains in northern and central Utah.

The last statewide cougar population estimates were developed in conjunction with the Utah Cougar Management Plan in 1999 (UDWR 1999). These estimates used extrapolations of cougar densities from published studies in the southwestern United States to: 1) the total area within all management units that comprise cougar range, and 2) the total amount of occupied cougar habitat within Utah. The habitat quality within each management unit was classified as either high, medium or low based on vegetative characteristics, terrain ruggedness (Riley 1998) and prey density. Cougar densities derived from research within Utah, California and New Mexico were associated with each habitat quality level. High quality habitat was assigned a density range of 2.5-3.9 cougars/100 km^2, medium quality habitat was assigned a density of 1.7-2.5 cougars/100 km^2 and a density of 0.26-0.52 cougar/100 km^2 was assigned to low quality habitat. The first statewide population estimate of 2,528-3,936 cougars resulted from summing unit population estimates.

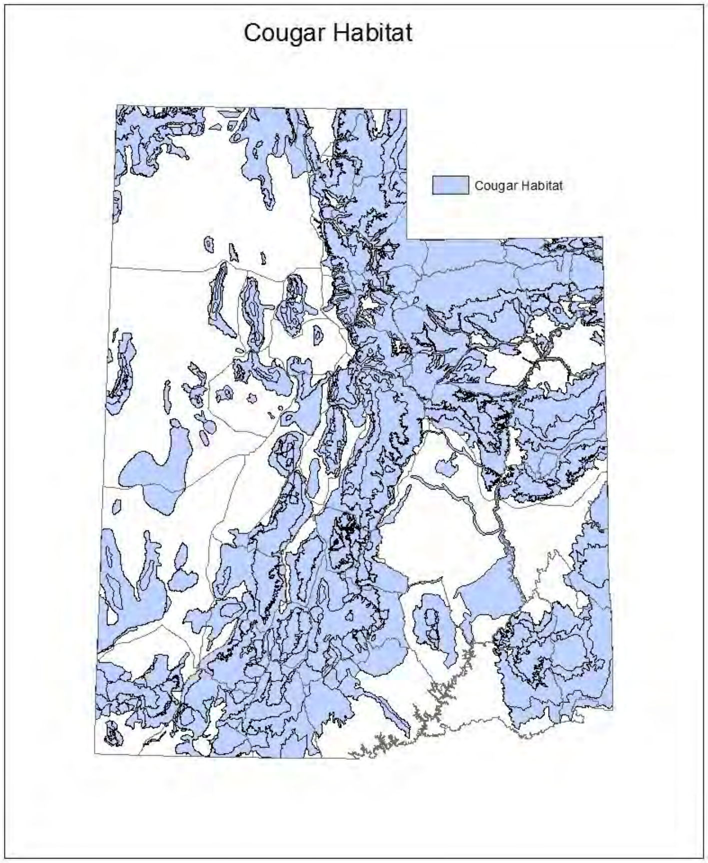

Figure 3. Cougar Habitat in Utah

For comparison, a second estimate of 2,927 cougars statewide was generated based upon mean cougar densities and total occupied cougar habitat within the state. Each management unit's cougar population was estimated by extrapolating the mean cougar density assigned to the unit (based on the respective range indicated above) to the amount of occupied cougar habitat within the unit, and unit estimates were summed to obtain the statewide figure. The two methods produced population estimates that show considerable agreement, but they should be only viewed as general approximations of the statewide cougar population.

Research

Beginning with the observational work of Connolly (1949), up through current investigations of cougar-coyote-mule deer interactions by Julie Young and colleagues, Utah has a rich history of research on cougar ecology and management. Two topics dominate the literature on the species: predation effects on big game species, and population estimation techniques. In Utah and most western states cougars are often managed from conflicting standpoints. As a predator of mule deer, elk, and bighorn sheep, cougars can be managed as a pest, in which measureable changes in density are desired in order to evaluate the numerical responses of prey. However, when prey survival is not a concern, cougars may be managed as a trophy game species, in which harvest can be fairly conservative. Under both conditions, the ability to estimate and track changes in local abundance is central to effective management.

Cougar research can be subdivided into a few broad topics; natural history, foraging habits and predation, habitat use, and population dynamics. The latter category has received the most attention and involves estimation of abundance, reproduction, and survival rates. In order for management to be effective, a solid understanding of these life history characteristics is essential. The earliest work in Utah was conducted by houndsman and district Predatory Animal and Rodent Control agent, Edward Connolly, who used snow tracking to evaluate predation rates and prey selection in the Wasatch Mountains. These efforts were followed in the 1950s by W. L. Robinette who made further evaluations of food habits by examining the stomach contents of harvested cougars (Robinette et al. 1959). Similarly, these authors used necropsy of females removed through harvest and depredation control to evaluate pregnancy rates, litter size, and breeding seasons (Robinette et al. 1961). Other investigations elaborated on causes of natural mortality (Gashwiler and Robinette 1957). Robinette et al (1977) summarized their findings about cougars and their role in mule deer population dynamics in their study, *The Oak Creek Mule Deer Herd in Utah*. Because of the large sample sizes and relatively simple analyses, some of these papers are still relevant as more recent efforts have only reinforced early findings.

The advent of radio-telemetry in the 1960's facilitated a detailed view of cougar behavior. This tool removed much of the speculation from field work by providing investigators a means of tracking animals in real time. Telemetry allowed for rigorous measures of home range size, sociality, movement behavior, and predation rates. The work of Lindzey et al. (1989) was the first use of radio-telemetry on cougars in the state. This project was conducted on the Boulder Plateau and adjacent Henry Mountains in southern Utah from 1978 to 1989. By the time this study was initiated, cougars had been classified as a big game species for over a decade, and many of the uncertainties associated with managing a secretive carnivore were apparent. Lindzey focused on applied questions related to cougar predation impacts on deer, elk, and livestock (Ackerman et al. 1984, 1986), population dynamics (Hemker et al. 1984, 1986; Lindzey et al. 1988, 1994), and survey techniques (Van Dyke et al. 1986; Van Sickle and Lindzey 1991, 1992). During the latter years of the study, Lindzey and his students evaluated cougar demographic responses to typical harvesting regimes (Barnhurst and Lindzey 1989; Lindzey et al.1992; Laing and Lindzey 1993). In 1991 Lindzey published a brief paper on recommendations for future research. Due largely to an inability to accurately census cougars and an increasing concern over human/cougar conflicts the development of reliable survey techniques and evaluation of cougar behaviors in and around urban settings were top among managers concerns.

As the human population in the west have increased and became progressively more urban, societal values have evolved. Along with these changes restructuring of wildlife management policy has changed to include greater public input. Wildlife commissions and advisory boards are the avenue for public input in most western states. Continued debate over abundance, reactions to hunting pressure, and the burgeoning issue of cougars living near people prompted the initiation of Utah's second radio-telemetry effort to examine cougars. This project was led by Dr. Michael Wolfe at Utah State University, and Clint Mecham, a veteran from Lindzey's fieldwork on the Boulder. This new project involved two study areas; one in central Utah on the Fishlake National Forest (Monroe Mountain), and the other due west of the rapidly expanding Salt Lake metro area in the Oquirrh Mountains. The primary difference between these sites was the pattern of land ownership. The Monroe Mountain site was public land and open to hunting whereas the Oquirrh Mountain site was a patchwork of private properties with restricted access, including large holdings by the Utah Army National Guard and the Kennecott Copper Company. This created a vast region of un-hunted habitat on the edge of an expanding metro area.

Wolfe's study had three central objectives: 1) evaluating cougar enumeration techniques under differing densities, 2) assessing the demographic effects of sustained harvest on cougar demographics, and 3) assessing cougar movement behavior and resource use in an urban-wildland setting. This project ran from 1996 to 2013 and represents the longest comparative study ever conducted on the species. Unlike many diurnally active, herding, or numerically abundant species, there are no robust and widely accepted techniques for cougar enumeration (Choate et al. 2006) and findings from this study underscored the severe limitations imposed by cougar behavior on the development and use of robust survey techniques. Stubbornly small sample sizes, the inherently open nature of cougar populations, and wide dispersal tendencies mean that classic mark-recapture techniques are of limited utility at scales relevant to management (Sinclair et al. 2001, Stoner et al. 2008).

During his Boulder Plateau study, Lindzey addressed the question of harvest effects, but it was an experiment in time on a single study area (before-after). The second objective Wolfe's project was an attempt to replicate the Boulder study in space. The effort here was the first to employ a Before-After-Control-Impact study design in which two populations were monitored simultaneously while varying harvest levels on one site. The Monroe-Oquirrh study lasted 12 years and demonstrated notable demographic differences between populations subjected to different management regimes. Based on these results and combined with the uncertainty of local abundance, Wolfe et al. (2004) recommended statewide implementation of a source-sink type management structure in which known behavioral tendencies, such as male-biased dispersal are used to backfill territories left vacant following harvest. This idea was developed further by Stoner et al.

(2013*a*, 2013*b*), who parameterized cougar dispersal and identified a series of *de facto* refugia, i.e. areas of suitable habitat that exhibit low levels of hunting.

The third objective of this study was pursued by Rieth (2009), Stoner (2011) and Mitchell (2013). These authors looked at habitat use, movement patterns, and predation behavior in the Oquirrh Mountains- a region that encompassed military training, industrial activities, and suburban land-use. Rieth (2009) demonstrated a shift in cougar habitat selection by behavior, which is correlated with time-of-day. Notably, cougars are farthest from human activity during diurnal hours when human activity is highest, and nearest at night when actively hunting. Subsequently, Stoner (2011) found cougars generally avoided areas of predictable human activity, but that aversion was not absolute and some individuals, particularly males and older females with dependent kittens passed occasionally used human dominated landscapes. Mitchell (2013) followed on this work and noted that despite proximity to urban and mixed-use landscapes, cougar depredation on pets and hobby livestock were rare, and that most livestock depredations were on free-ranging cattle in wilderness parts of the study area.

The capstone of the Monroe-Oquirrh cougar project were the evaluations by Wolfe et al. (2015, in review) of commonly used cougar performance measures with respect to known demographics, and an assessment of the degree to which harvest mortality acts in an additive or compensatory manner in cougar populations. These analyses used radio-telemetry data to calibrate catch-per-unit-effort, survival rates, and percent females in the harvest as an index of population performance. Following these efforts the project moved into a second phase in which the Oquirrh Mountain site was closed and remaining resources were directed to a new study objective on the Monroe site. This segment of the project was lead by Julie Young of the National Wildlife Research Center at Utah State University and changed focus from population demographics to the interaction between coyotes, cougars and mule deer. Results are forthcoming.

Objective, Strategies and Management Systems

Outreach and Education

Objective 1:

Increase awareness and appreciation within the general public for the role of cougars in Utah's ecosystems.

Strategy:

1. Determine (survey) the general public's knowledge and attitudes toward the role of cougars in Utah's ecosystems.
2. Implement the new Wild Aware Utah program; an effort generated by the Conservation Outreach Section.

Objective 2:

Educate and increase awareness of the public that utilize cougar habitat about cougar safety.

Strategy:

1. Implement the Wild Aware Utah program.

Objective 3:

Provide educational opportunities to the big game hunting public about the relationship between cougar and prey populations.

Strategies:

1. Develop an educational presentation highlighting cougar-prey interactions geared toward hunting/conservation organizations such as Sportsmen for Fish and Wildlife, Mule Deer Foundation, Rocky Mountain Elk Foundation, Utah Bowman's Association and others.
2. Write articles addressing cougar prey interactions for publication in sportsmen magazines/news letters published by hunting/conservation organizations such as: Sportsmen for Fish

and Wildlife, Mule Deer Foundation, Rocky Mountain Elk Foundation, Utah Bowman's Association and others

3. Explain cougar-prey interactions through radio, television and print media.
4. Periodically assess big game hunter opinions about the effect of cougars on big game populations.

Objective 4:

Educate all cougar hunters on how to determine the age/sex of cougars to increase harvest selectivity and continue to educate Division employees tagging cougars.

Strategies:

1. Continue to publish information about sex and age identification techniques in the Cougar Guidebook and online.
2. Evaluate the effectiveness of the voluntary online orientation course to determine if desired results are being obtained.
3. Modify the harvest reporting form to gather data on effectiveness of orientation course.
4. Survey unsuccessful cougar hunters to gather data on the effectiveness of orientation course.
5. Obtain high quality digital photographs of cougars for sex and age identification education purposes. Examples: treed cougars, lactating females and track and paw sizes for sex and age differentiation.
6. Explore ways to reward hunters for selective harvest.
7. Train Division employees responsible for tagging cougars at least biannually.

Objective 5:

Increase and develop educational opportunities for sportsmen and other user groups prior to the RAC and Board process

Strategy:

1. Hold informational meetings on recommendations prior to taking them through the public process.

Population Management

Objective 1

Maintain cougar populations within their current statewide distribution in a manner that: 1) recognizes the large geographic and temporal scales at which cougar populations operate, 2) stresses the importance of social structure for long-term viability, 3) directs hunter pressure on a management unit or subunit basis, and 4) manages cougar abundance with respect to their ungulate prey species.

Performance Targets:

- **Primary Target** - Proportion of all females in the harvest < 40% (within a management unit averaged over 3 years)
- **Secondary Target** – Proportion of cougars ≥5 years old in harvest between 15-20% (within a management unit averaged over 3 years)

Strategies (See Attachment A: Cougar Management Tree):

1. Implement the management system based on data for the previous 3 years for all units that mule deer and bighorn sheep triggers are not met as follows:

a. Select limited entry, harvest objective, or split strategy based on the needs of the unit and what type of hunting pressure is appropriate.

b. If proportion of all females in the harvest <40% then:

1). Proportion of cougars ≥5 years old in harvest ≥ 20 % then permits/quota may increase.

2). Proportion of cougars ≥5 years old in harvest =15-20% then permits/quota may be maintained or decrease/increase at biologist discretion.

3) Proportion of cougars ≥5 years old in harvest <15% then permits/quota may decrease.

4) Small sample sizes may bias both sex and age data. In these instances the biologist may increase, decrease or maintain permits at their discretion.

c. If proportion of all females in the harvest ≥40% then:

1). Decrease permits/quota

Objective 2:

Be responsive to prey population objectives. Manage cougar populations to reduce predation on big game herds that are below objective when cougar predation is considered a potential limiting factor for herd growth or recovery. Consider development of a predator management plan and implement according to UDWR policy W1AG-4 if annual recommendations are not meeting the needs of the unit.

Performance Targets for units where mule deer or bighorn sheep triggers are met (See Attachment B: Predator Management Tree – Mule Deer):

- **Primary Target -** Proportion of female cougars in the harvest ≥ 40% (within a management area averaged over 3 years)

Strategies:

1. Implement the management system based on data for the previous 3 years for all units that mule deer and bighorn sheep triggers are met as follows:

a. Select limited entry, harvest objective, or split strategy based on the needs of the unit and what type of hunting pressure is appropriate.

b. If mule deer populations are <90% of unit or subunit objective and conditions listed in 1) or 2) below are met:

1). Adult deer survival on the representative unit <84% for 2 of the past 3 years and the herd unit is demonstrating a declining population trend (lambda is <1) or;

2). Adult deer survival on the representative unit is <80% in the previous year and the herd unit is demonstrating a declining population trend (lambda is <1).

i. Proportion of all females in the harvest <40% then permits/quota may be increased and may not exceed +100% of the previous years permits/quota.

ii. Proportion of all females in the harvest ≥40% then permits/quota may be maintained at the current level.

c. If mule deer populations are <65% of unit or subunit objective in the previous year.

1). Proportion of all females in the harvest <40% then permits/quota may be increased and may not exceed +100% of the previous years permits/quota.

2). Proportion of all females in the harvest ≥40% then quota/permits should be maintained at the current level.

d. Bighorn sheep populations where any of the following conditions are met (See Attachment C: Predator Management Bighorn Sheep and Transplants):

1). Population is <90% of unit or subunit objective or;

2). Bighorn sheep population is below viable levels of <125 animals.

i. Proportion of all females in the harvest <40% then permits/quota may be increased and may not exceed +100% of the previous years permits/quota.

ii. Proportion of all females in the harvest ≥40% then quota/permits may remain the same.

e. When a bighorn sheep, mountain goat, or mule deer transplant or reintroduction will occur in the next year then (See Attachment C: Predator Management Bighorn Sheep and Transplants):

i. Proportion of all females in the harvest <40% then permits/quota may be increased and may not exceed +100% of the previous years permits/quota.

ii. Proportion of all females in the harvest ≥40% then quota/permits may be maintained.

f. Evaluate ungulate population response annually (based on 3 year average) to determine the need to continue or discontinue predator management direction.

g. When a split unit transitions from limited entry to harvest objective the quota will equal the number of limited entry permits that were not filled during the limited entry season.

h. Bighorn sheep only management areas are management units that don't have an appreciable deer population. On these units the cougar prey base consists primarily of bighorn sheep. These units consist of low elevation primarily snow-free habitat and as a result too few cougars are harvested to analyze relative to performance targets. No quota is assigned to these management units (San Rafael, Kaiparowits, Book Cliffs-Rattlesnake).

i. Offer multiple permits or allow harvest of up to 2 cougars on units/subunits where harvest and access is limited.

j. In special circumstances where it is determined that a cougar may be preying on bighorn sheep the Division may use DWR employees, contract with USDA Wildlife Services (WS), or hire/authorize a contractor outside of the agency to remove the offending animal. The director may authorize removal of depredating cougars as needed.

<u>Chronic Depredation Criteria:</u>

- The depredation is occurring on private land and;
- The depredation has occurred in the same area for 3 consecutive years or 4 out of 5 years and;

- WS has attempted to remove the offending animal(s) but has been unsuccessful.

Strategies:

1. WS increase efforts and/or bring cougar specialists in from other areas to help resolve chronic depredation problems – option to implement after 2 years.
2. Division request that WS continue efforts to remove the offending animal after livestock have left the area, or before they have arrived to resolve chronic depredation problems – option to implement after 2 years.
3. The Division may authorize the livestock owner, an immediate family member or an employee of the owner (not someone specifically hired to take cougar) to remove the offending animal beyond the 72hr period stipulated in Utah Admin Code R657-10-21.

   Conditions to the authorization to remove a cougar(s) should include:

   i. The time period during which the cougar(s) can be removed;
   ii. A description of the geographic area from which a cougar(s) can be removed;
   iii. A description of the cougar(s) authorized to be removed (i.e. male, female……)
   iv. Other relevant conditions

   Any cougars removed are considered depredating cougars and are subject to the reporting and possession requirements in the Utah Administrative Code R657-10-21.

4. DWR and WS will work with the houndsmen community to develop a list of houndsmen willing to volunteer their time to help livestock owners resolve chronic depredation issues.

Cougar Research

Objective:

Increase base understanding through continued research designed to address questions relative to cougar management in Utah. Potential research projects are listed below in order of priority.

High Cost Research Priorities (> $100,000 / Year)

1. Investigate alternative population estimation techniques for cougars using the relationships between primary productions, ungulate abundance, and cougar home range size.
2. Radio collar cougars in bellwether units to obtain adult survival estimates to monitor population trends. Consider using bellwether mule deer units to evaluate efficacy of predator control on mule deer survival.
3. Prey switching in cougars. In multi-prey systems, do cougars switch to alternative prey (e.g. livestock, elk, or feral horses) when mule deer numbers decline? To what extent is cougar predation additive to other sources of mule deer mortality?
4. Cougar habitat use and predation behavior in multi-prey communities (bighorn sheep, mule deer, elk, feral horses). Can we predict bighorn vulnerability to cougar predation in space?
5. Indirect effects of predation risk on foraging behavior of livestock.

Low to Moderate Cost Research Priorities (< $100,000 / Year)

1. Examining DWR livestock depredation records to evaluate the influence or efficacy of cougar removal on depredation rates. Does cougar removal affect depredation losses in subsequent years? How does depredation risk vary in space, i.e. are there depredation hotspots? What are the demographic patterns in cougar depredation of livestock – cattle vs sheep vs. pets?

2. Examine DWR pet depredation and public safety complaints with respect to cougar management in adjacent units. Are conflicts predicatable in time and space? What are management regimes in units defined by high and low complaints?
3. To what extent can we manipulate the cougar-deer relationship through habitat manipulation? For example can we use prescribed fire to simultaneously increase forage and reduce stalking cover?
4. Evaluate cougar occupancy of military lands, national parks, and other de facto refugia during winter.
5. Modeling the long-term data set to examine cougar population ecology and demographics; population persistence; possible PhD student interested in population models.

Strategies:

1. Continue collaborative research efforts to maximize knowledge base, funding sources and available resources.
2. Explore new funding sources and ways to leverage those resources.
3. Whenever possible use Division employees enrolled in the educational assistance program to conduct research.
4. Work closely with the big game program, and where possible, develop research projects that improve knowledge and understanding of mule deer and cougar.

Re-visit prioritized list every 5 years after implementation to determine if research direction or funding change or new opportunities become available.

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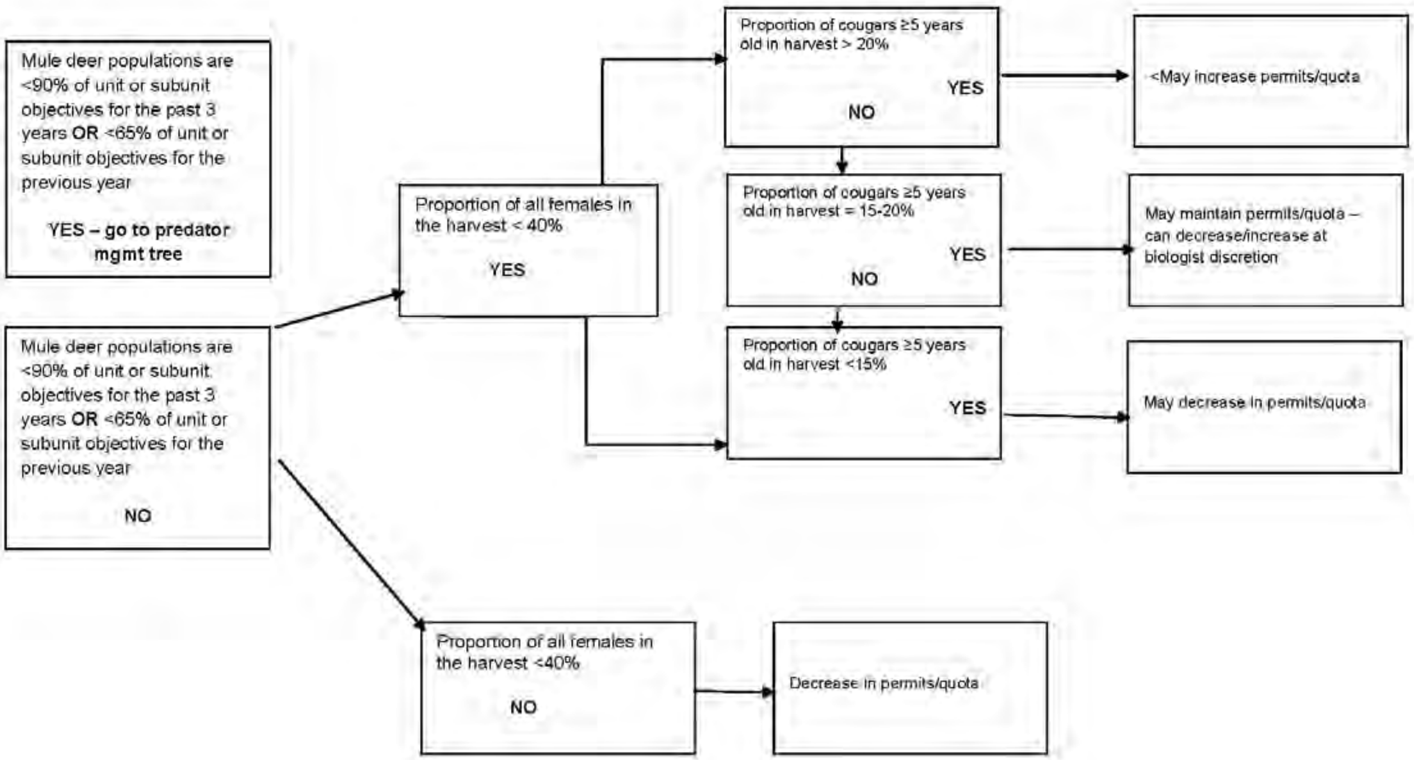
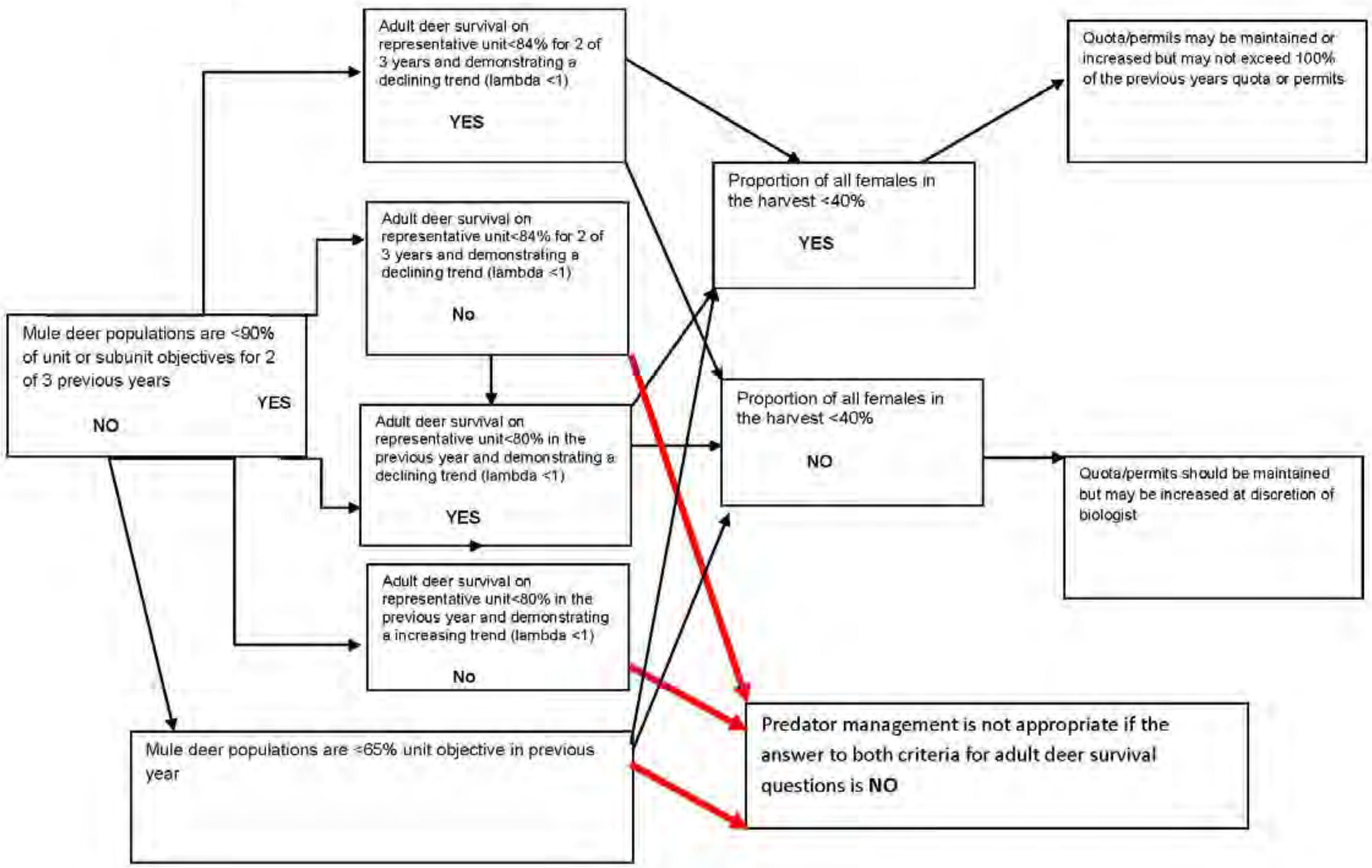
Attachment A: Cougar Management Tree

- **Primary Target** - Proportion of all females in the harvest < 40% (within a management area averaged over 3 years)
- **Secondary Target** – Proportion of cougars ≥5 years old in harvest between 15-20% (within a management area averaged over 3 years)



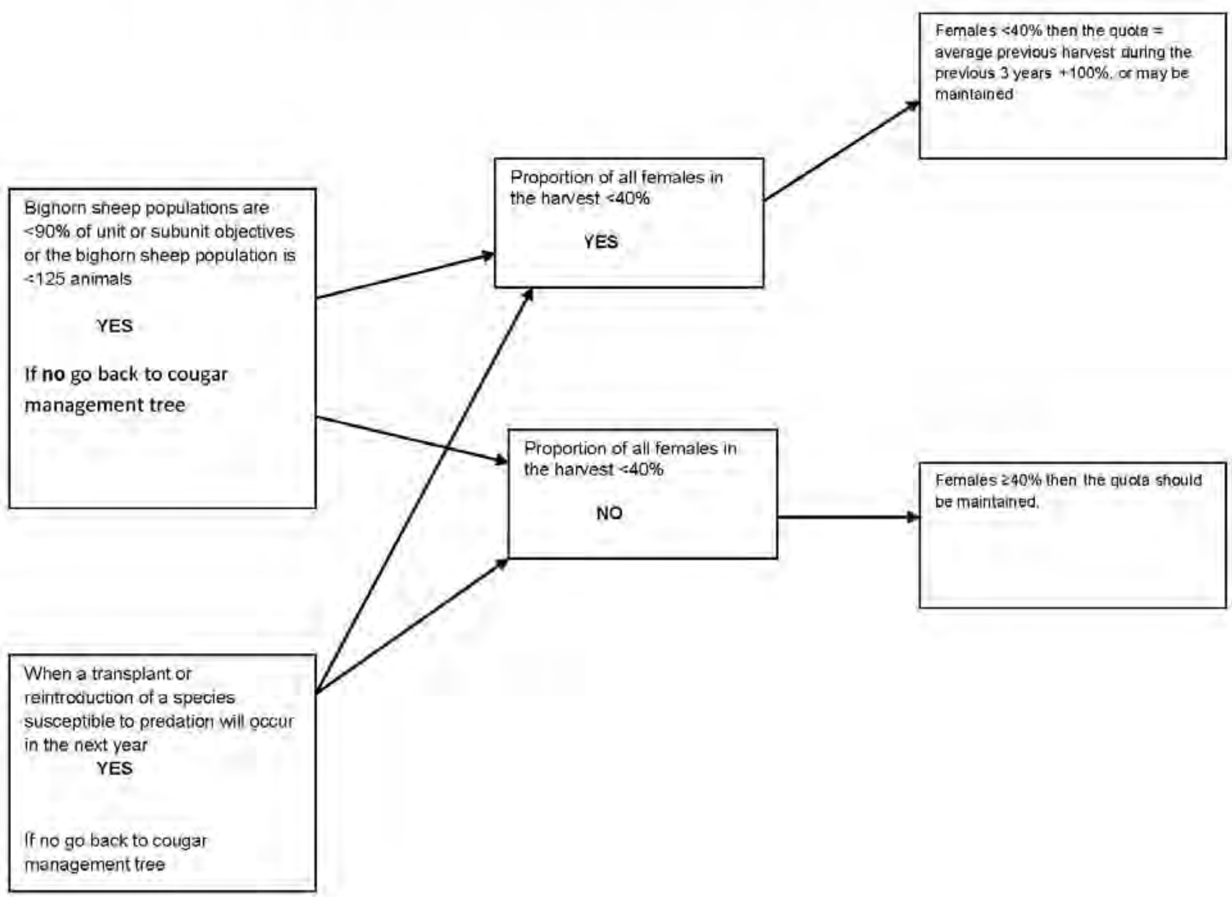
Attachment B: Predator Management Tree - Mule Deer

- **Primary Target -** Proportion of cougar females in the harvest ≥ 40% (within a management area averaged over 3 years)



Attachment C: Predator Management Tree Bighorn Sheep and Transplants

- **Primary Target -** Proportion of cougar females in the harvest > 40% (within a management area averaged over 3 years)



Attachment D: Issues and Concerns

During the meetings of the Cougar Advisory Group the following list of issues and concerns were established by the group members. Subsequent meetings focused on discussion, perceptions, and developing, objectives, strategies and management systems to address issues and concerns.

Outreach / Education

- Need to educate the public about the relationship between cougar and prey populations and the need to integrate management of both predator and prey.
- Need to educate hunters on sex/age identification to help protect females and kittens.
- Need to educate the general public about cougars and cougar safety. Especially in communities situated along the urban-wildland interface.
- Need to improve efforts to educate sportsmen and interest groups on our decision making and recommendations process – need more education prior to RAC and Wildlife Board meetings.

Population Management / Harvest Management

- Need tools to solve non-resident issues (pursuit permits, commercial vs recreational).
- Three year plan and recommendation process was too inflexible and didn't allow for responsiveness to depredation, nuisance or population concern responses .
- Need to simplify the management criteria (performance targets).
- Revisit performance criteria.
- Need tools designed to protect all females.
- Female performance targets in previous plan made it difficult to address livestock damage and nuisance using sport harvest .
- Ecoregion/cougar management areas were too broad for hunter management.

- Eco-region/cougar management area quotas shut down entire units too quickly and didn't allow for targeted harvest to address problem areas.
- Need to harvest more females in some situations – female subquota reduces ability to manage in balance with prey.
- Need to recognize the importance of adult males in the social demographic .
- Need to recognize social structure as a predictor of population.
- Need more knowledge and information on source-sink populations.
- Does transition on split units from limited entry to harvest objective lead to over harvest.
- Does harvest objective hunting lead to over harvest of females.
- Hard to encourage harvest in areas that are difficult to hunt.
- Belief that population estimates are too high – need to reevaluate population estimates.
- Would like to require GPS location on all cougar harvests.

Predator Management

- Need to integrate cougar and prey (mule deer and bighorn sheep) management .
- Need to move away from predator management plans.
- Need for evaluation of predator management plans and their effectiveness.
- Need to reduce units under predator management and find a way to balance prey populations with predator populations.
- Need for triggers to be related to livestock depredation, deer survival and populations.

Livestock Depredation

- Need to identify the sex of depredating cougars.
- Develop a way to deal with chronic depredation problems.
- Triggers need to be to related to livestock depredation and deer survival.

Research

- Compare ungulate and cougar populations
    - Develop monitoring system to measure deer herd response to variation in cougar abundance on units under predator management
- Explore mark recapture population estimates (DNA sampling).
- Explore cougar survival estimates for population management in relation to representative deer survival units.
- Need more robust population estimates.
- Identify limiting factors for predator management units.

WYOMING GAME & FISH DEPARTMENT

Mountain Lion Management Plan

Prepared By: Trophy Game Section (Management/Research Branch), Wyoming Game & Fish Department, Lander, Wyoming

Sept. 7, 2006

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EXECUTIVE SUMMARY

- The goal of mountain lion management in Wyoming is to sustain mountain lion populations throughout core habitat at varying densities depending on management objectives to provide for recreational/hunting opportunity, maintain ungulate populations at established objectives or in line with current habitat conditions, and minimize mountain lion depredation to pets and livestock and reduce the potential for human injury.

- The intent of this document is to provide guidelines to direct future management efforts for mountain lion populations in Wyoming and not to specifically address local management issues throughout the state; a process that occurs during the 3 year season setting process, when hunt area specific data are presented in the annual mountain lion mortality summaries. The management approach addressed in this document favors an adaptive management process where management objectives are established based on local biological and social conditions and modified/adapted over time relative to management criteria suggesting whether or not objectives have been met, to achieve balance between predator and prey populations, and address changing social factors related to depredation incidents and human-mountain lion interactions.

- Core occupied habitats for adult mountain lions during the winter will be delineated statewide to evaluate impacts from the density of human-caused mountain lion mortalities and to evaluate potential impacts from future development projects. Local (by hunt area) and regional (by Mountain Lion Management Unit-LMU) management objectives will be developed and evaluated based on harvest data. A source-stable-sink adaptive management approach will be applied evaluating (1) density of human-caused mortalities, (2) sex-age composition of mountain lion harvest focusing on relative proportion of adult female harvest, and (3) the relative age of harvested adult females.

- Hunt area management objectives will be based on Regional desires to meet localized situations relative to maintaining low population densities (sink), stable population densities, or to maintain areas with low mountain lion mortality to serve as source areas for mountain lion dispersal into areas experiencing negative population growth (sink areas). Sink management will be applied to maintain low mountain lion densities in areas experiencing high nuisance incidents (livestock depredation, human-lion interactions) and areas where ungulate populations are believed to be depressed primarily due to mountain lion predation; stable management objectives will be implemented to sustain long term hunting opportunity; and source management objectives will be applied to areas where nuisance incidents and predation impacts to prey populations are not an issue. Management objectives at the LMU level will strive for a combination of source, stable, and sink management that will allow for the department to sustain mountain lion populations throughout core habitat at varying densities depending on management objectives.

- Status of representative source areas will be periodically evaluated to verify that these areas are functioning as source areas for mountain lion dispersal using monitoring techniques that can be reasonably applied relative to Department budget constraints. Success of sink management to address nuisance incidents or predation pressures on ungulate populations will be evaluated over time following the adaptive management process outlined in this plan. Similarly, mountain lion population monitoring criteria will be evaluated and modified as information becomes available addressing the utility of the proposed criteria in defining source, stable, or sink mountain lion habitats.

- Hunting season structure will be based on mountain lion mortality quotas. Mortality quotas will be established for each hunt area, and the hunting season will be closed when the quota has been met. Most of the hunting seasons will run from September 1 through March 31, with the exception of a few hunt areas with chronic livestock depredations. Hunting with hounds will continue to be allowed. Hunters shall present the pelt and skull of harvested mountain lions to Department personnel within 72 hours of harvest so specific data can be recorded. These data will be used to determine the management status, age and sex structure of harvested mountain lions, distribution of mortalities, hunter effort, hunter success, and to account for and set future mortality quotas. Mortality quotas will be established every 3 years to allow sufficient time to reach management objectives and to permit adequate analysis of potential impacts of specific harvest quotas. The process by which these 3-year mortality quotas are set includes annual data analyses and summary by the Trophy Game Section, internal review and recommendations at the regional level, public review of the recommendations, and final approval by the Commission.

- The Department will continue to use a variety of options ranging from no action to lethal removal, which will be assessed on a case-by-case basis, to address mountain lion depredation on domestic livestock and pets and mountain lion/human interactions. All management actions and responses will be documented for future evaluation.

- Adaptive management will be implemented to address short and long-term management needs where appropriate, and additional research efforts will be conducted to address other management priorities as funds become available relative to other Department priorities.

- A previous draft of this management plan was revised based on comments received from 4 peer reviewers and 73 separate public comments. We thank Brad Compton, Idaho Department of Fish and Game, Fred Lindzey, Wyoming Cooperative Fish & Wildlife Research Unit-retired, Ken Logan, Colorado Division of Wildlife, Dale Strickland, Western Ecosystems Technology, Inc, Cheyenne, WY, and members of the public submitting comments for suggestions on improving this management plan. Comments from peer reviewers were evaluated and most have been addressed throughout the revised document. Comments concerning various aspects of the proposed plan (e.g. surveying all mountain lion license holders for hunter effort data, educating hunters about sexing lions in the field, including all human-caused mortality towards quotas, oppose sink management every 3 years, balance source-sink management and reducing the reporting period for harvested lions to 48 hours) were addressed and included in the plan for consideration by the Commission.

- The Department will continue to update and expand, where feasible, information and education efforts across the state including development of a website to educate hunters on sexing mountain lions in the field, and periodically conducting public attitude surveys of Wyoming residents.

- The Department will begin to survey all mountain license holders to enhance the management database.

- All human caused mountain lion mortalities will be counted towards quotas.

MOUNTAIN LION LIFE HISTORY AND ECOLOGY

Distribution

The historic range of the mountain lion was the largest of any terrestrial mammal in the western Hemisphere, with the exception of humans (Logan and Sweanor 2001). The mountain lion continues to range from the southern tip of South America to northern British Columbia (Logan and Sweanor 2001), but were apparently extirpated from the eastern US and Canada, with the exception of southern Florida, by the late 1800s to early 1900s. Between the mid 1960s and the early 1990s, mountain lion populations increased in many western states and they expanded their distribution into some of the mid-western states including Nebraska, South Dakota, and North Dakota likely due to reclassifying mountain lions from unregulated predator status to game animals and the restricted use of predicides since the early 1970s. Similarly, mountain lions in Wyoming have increased in abundance and distribution and currently occupy most timbered and tall-shrub covered regions statewide. In the early part of the 20th century, efforts to remove mountain lions from many areas of Wyoming caused local extirpations. However, robust populations are currently found in the Black Hills of northeastern Wyoming, the pinyon-juniper country of southwestern Wyoming, and all major mountain ranges throughout the state. This reestablishment of mountain lions throughout Wyoming (and likely throughout much of their former range) is likely due to a shift in management practices and policies that favored increases in numbers and distribution (see Appendix I for mountain lion management history in Wyoming) and habitat conditions favoring increases in some prey abundance (e.g., elk, *Cervus elaphus*, white-tailed deer, *Odocoileus virginianus*).

Dispersal patterns and genetic evidence suggest mountain lion populations throughout most of the western US are well connected (Culver et al. 2000, Sinclair et al. 2001, Anderson et al. 2004). Movements of male mountain lions in excess of 1,000 km have been documented (Thompson and Jenks 2005). These long-range movements provide a very effective means of genetic transfer and population maintenance to mountain lion populations in distant regions. In addition, much of Wyoming's mountain lion habitats are extensions of mountain ranges in other states. This provides excellent connectivity to other habitats, and hence, other mountain lion populations. Overall, gene flow among mountain lion populations in the Central Rocky Mountains suggests this region exists as one large mountain lion population with rapid genetic exchange among suitable habitat patches throughout the region (Anderson et al. 2004).

Habitat Use

The broad geographic distribution of the mountain lion in North America attests to its ability to persist anywhere that provides adequate prey and cover [Cougar Management Guidelines Working Group (CMGWG) 2005]. Previous mountain lion habitat studies in the western US suggest mountain lions select conifer, deciduous timber, riparian, and tall shrub habitat types at mid-high elevations in steep or rugged terrain (Logan and Irwin 1985, Laing 1988, Koehler and Hornocker 1991, Williams et al. 1995, Dickson and Beier 2002). Tall vegetation or rugged terrain sufficient for concealment provides the necessary hiding and stalking cover for securing prey and raising young (CMGWG 2005). Mountain lions may be found in climates ranging from arid regions of desert environments to temperate rainforests of the Pacific Coast. Besides prey availability, the only biophysical limitations for mountain lions are vast, open areas with little hiding cover and severely cold winter temperatures of northern climates (Pierce and Bleich 2003).

Despite the mountain lions broad distribution and adaptability, human impacts from development and habitat fragmentation can negatively impact mountain lion populations (Beier 1993). Increased construction of roads and homes in mountain lion habitat not only reduces the amount and quality of habitat available to mountain lions and their prey [e.g., deer (*Odocoileus* spp.) and elk (*Cervus* spp.)], but also increases human presence in these areas. Increased human activity ultimately leads to increases in mountain lion/human interactions and mountain lion deaths (CMGWG 2005). Even in sparsely human populated states like Wyoming, where most mountain lion range is still relatively contiguous, subdivisions, new road construction, and oil and gas development may negatively impact mountain lion habitats.

Mountain Lion Social Structure and Reproduction

Social behavior of mountain lions likely evolved to maximize individual survival and reproductive success (Logan and Sweanor 2001). Mountain lions are solitary carnivores exhibiting a polygynous breeding strategy where dominant males typically breed with females that reside within their home range (Murphy 1998). Resident males aggressively defend their territories against male intruders, whereas females allow more overlap, but express mutual avoidance (Lindzey et al. 1989, Ross and Jalkotzy 1992, Logan and Sweanor 2001). Size of female home ranges tend to be large enough to provide sufficient prey for themselves and their young (~50-100 km^2, 20-40 mi^2), while male home ranges tend to be larger (~150-300 km^2, 60-120 mi^2), overlapping several females, apparently to maximize their reproductive success (Murphy 1998). Young females commonly express philopatric behavior (remain in their natal range) upon independence, but males typically disperse from their natal range (Anderson et al. 1992, Ross and Jalkotzy 1992, Lindzey et al. 1994, Logan and Sweanor 2001). Partially due to their solitary and territorial nature and ultimately limited by prey abundance, mountain lion densities are low relative to other large mammals ranging from about 10 independent (>1 year old and self sufficient) mountain lions/1,000 km^2 (386 mi^2) in arid climates (e.g., southern Utah, Lindzey et al. 1989) to about 35 independent mountain lions/1,000 km^2 in more mesic areas (e.g., the Diablo Range, California, Hopkins 1989, southwest Alberta, Ross and Jalkotzy 1992).

Female mountain lions typically produce their first litter at 2-3 years old (Anderson 1983, Ashman et al. 1983, Logan and Sweanor 2001) and may breed at any time of the year, but exhibit seasonal birth pulses. Data from 7 mountain lion studies in western North America indicate May through October are the peak months for mountain lion parturition (CMGWG 2005). Gestation lasts 82-96 days and mountain lions typically produce 2 to 4 young. The average size of 53 nursling litters documented in New Mexico was 3.0, with 13 (26%) 2-kitten litters, 26 (49%) 3-kitten litters, and 14 (26%) 4-kitten litters (Logan and Sweanor 2001). Other studies reported average litter sizes <6 months old, ranging from 2.2 in Alberta (Ross and Jalkotzy 1992) to 2.9 in Wyoming (Logan et al. 1986). Kittens are usually weaned at 2–3 months and typically remain with the female for 12–18 months before becoming independent (Pierce and Bleich 2003).

Food Habits and Prey Relationships

Mountain lion diets consist primarily of large vertebrate prey species. In much of North America, deer comprise the majority of mountain lion diets (Pierce and Bleich 2003), but other large ungulates such as elk, bighorn sheep (*Ovis canadensis*), moose (*Alces alces*), and pronghorn (*Antilocapra americana*) may also be consumed (Ross and Jalkotzy 1996, Ross et al. 1997, Murphy 1998, Anderson and Lindzey 2003). Although mountain lions primarily subsist on large ungulates, small mammals including porcupines (*Erethizon dorsatum*), lagomorphs (hares and rabbits), ground squirrels (*Spermophilus* spp.), and beavers (*Castor canadensis*) may also supplement mountain lion diets. Mountain lions also occasionally prey on domestic livestock and pets. Sheep and goats are the most commonly killed domestic livestock, but mountain lions also kill cattle, horses, and pets including dogs, and cats (CMGWG 2005).

The mountain lion can be an influential predator on some ungulate populations. Mountain lions were an important source of predation on a bighorn sheep population in Alberta (Ross et al. 1997), and were implicated in the decline of another bighorn population by causing avoidance of high quality forage (Wehausan 1996). Logan and Sweanor (2001) reported that mountain lion predation was the strongest proximate cause limiting a New Mexico mule deer (*O. hemionus*) population by slowing the rate of growth during a population increase phase, and hastening the decline of the population during drought conditions that degraded forage quantity and quality. Mountain lions have annually removed an estimated 15-20% of a mule deer population on the Kaibab Plateau, Arizona (Shaw 1980), 8-12% of a mule deer population on the Uncompahgre Plateau, Colorado (Anderson et al. 1992), and 2-3% of elk and 3-5% of mule deer in the northern Yellowstone Ecosystem (Murphy 1998). Mountain lion predation, however, does not necessarily indicate suppression or regulation of the prey population. Regulation is more likely in systems with multiple prey and multiple predator species. In these situations, predator populations that would normally decrease as their prey populations are reduced, are supported by other, more numerous prey populations (Pierce and Bleich 2003).

The potential impacts of mountain lions on prey populations are largely dependent on the condition of the prey and their habitat. In areas where prey habitat is in good condition, prey body condition will also be greater. Thus, most individuals in the prey population are likely to survive in the absence of predation. In prey populations where individuals are in poor condition due to poor forage quality, however, those individuals are more likely to die regardless of predation. Therefore, mountain lion predation on ungulates in good physical condition is more likely to be *additive* to other causes of mortality. Conversely, mountain lion predation on ungulates in poor physical condition is more likely to be *compensatory* (Logan and Sweanor 2001). In addition, healthy prey populations likely exhibit higher reproductive rates and are more likely to offset predatory regulation by producing more young than are consumed by predators. Ungulate populations exhibiting the characteristics of limitation by predation (Table 1) may benefit from increased mountain lion harvest. Populations limited mainly by habitat conditions will not likely benefit from increases in local mountain lion harvest except during the initial phases of habitat recovery allowing more rapid response of the prey population to improved forage conditions. Additionally, in situations where alternative prey species are lacking, a decline in mountain lion numbers will naturally follow the decrease in the ungulate population regardless of mountain lion harvest levels (CMGWG 2005).

Table 1. Characteristics of ungulate-prey populations regulated by predation and populations regulated by forage conditions (from the Cougar Management Guidelines 2005, page 15).

Life history characteristic	Population size mainly affected by predation[b]	Population size mainly affected by forage
Physical condition of adult females	better	poorer
Pregnancy rate of adult females	higher	lower
Pause in annual production by adult females	less likely	more likely
Yearlings pregnant[a]	usually	seldom
Corpora lutea counts of adult females[a]	higher	lower
Litter size[a]	higher	lower
Age at first reproduction for females	younger	older
Weight of neonates	heavier	lighter
Mortality of young	additive	compensatory
Age at extensive tooth wear	older	younger
Diet quality	higher	lower

[a]Some species of ungulates may show limited variability in these characteristics.

[b]These traits will be evident in *any* population far below carrying capacity, even if it experiences *no* predation. The manager should have evidence that predation is a limiting factor before concluding that reducing predation would increase ungulate recruitment.

TRADITIONAL MOUNTAIN LION MANAGEMENT IN WYOMING

Mountain lion management in Wyoming (and throughout its range) has traditionally consisted of more art than science largely due to the secretive nature and naturally low densities typical of this solitary large carnivore and the rugged terrain it typically inhabits. Agencies charged with mountain lion management attempt to address the public's desires, where values vary and sometimes compete between maintaining abundant populations, providing hunting opportunity, and minimizing human conflicts by addressing depredation incidents and potential for mountain lion-human interactions. The goal of mountain lion management in Wyoming is to sustain mountain lion populations throughout suitable mountain lion habitat at varying densities depending on management objectives, and to provide for recreation/hunting opportunity, maintain ungulate populations at established objectives or in line with current habitat conditions, and minimize mountain lion depredation and potential for human injury resulting from mountain lion-human encounters.

Although population estimates have traditionally been lacking, evidence based on professional experience and opinion (i.e., local wildlife biologists, game wardens), increasing mountain lion harvest levels (Appendix II, Fig. II-1), hunter observations, sightings, and nonharvest-human caused mortalities (Appendix II, Fig. II-3) indicate mountain lion populations have increased in Wyoming over the past 30 years. In response to perceived increases in mountain lion numbers, harvest quotas were increased annually during the mid to late 1990s (Appendix II, Fig. II-1). Approaches to how we manage mountain lion populations have changed gradually since 1974 when regulated hunting was first established in Wyoming, including establishment of fall-winter hunting seasons, developing management units and hunt areas to address local management issues, requiring mandatory inspection of harvested mountain lions for annual data collection, and developing total and female harvest quotas to address hunt area management objectives (Appendix I). Traditionally, mountain lion harvest quotas were set based on perceived densities and the history of or potential for human conflicts (e.g., mountain lion-human interactions, depredation incidents, potential impacts to big game species) and adjusted based on perceived mountain population trends relative to annual harvest data, and how quickly quotas were filled each year loosely reflecting hunter effort. Although mountain lion populations in Wyoming increased under this management scheme, this general approach to mountain lion management provided managers with limited ability to determine whether or not management objectives were achieved. The previous Draft Wyoming Mountain Lion Management Plan (1997) identified the lack of data necessary to identify whether or not management objectives have been met and supported research investigating potential methods to adequately monitor mountain lion population responses to varying management prescriptions. Subsequently, mountain lion research was conducted from 1997-2003 (Anderson 2003) to investigate potential approaches for evaluating mountain lion management.

Local and Regional Mountain Lion Management and Annual Data Collection

Wyoming is currently divided into 5 Mountain Lion Management Units (LMU), which are further divided into 29 mountain lion hunt areas (Appendix III). Due to the large size of the West LMU, covering several connected mountain ranges and associated foothill winter mountain lion habitats, the West LMU is divided into 3 separate Data Analysis Units (DAUs) called the Absaroka (hunt areas 19 and 20), Wyoming Range (hunt areas 2, 14, 17, 26, and 29) and Wind River (hunt areas 3, 4, 18 and 28) DAUs (Appendix III). This subdivision provides managers improved capability to monitor the effects of harvest strategies designed to meet potentially different management objectives among these 3 regions.

Mountain lion management units primarily represent connected regions of contiguous mountain lion habitat (i.e., geographic populations), and the smaller hunt areas allow managers to address local management issues while maintaining the overall management objective for the regional population (i.e., within the LMU). The Cougar Management Guidelines Working Group (2005) recently suggested managing mountain lion populations with respect to source-sink dynamics, where source areas would be managed for positive growth and sustain sink areas where management objectives call for reducing mountain lion densities. The current hunt area and management unit structure in Wyoming lends itself well to this concept, where hunt areas within management units can be managed as source and sink subpopulations, depending on local management issues, and can continue to support desired mountain lion population densities at landscape levels.

Mountain lion management objectives shall be based on ecological data and social conditions to ensure management strategies benefit both the species of concern and the people who are impacted by mountain lion conflicts. Mountain lion mortality data in Wyoming include information obtained annually from harvest or other documented forms of mortality [e.g., natural causes, damage removals, road kills; Appendix II]. Since 1974, hunters have been required to present the pelt and skull of harvested mountain lions to a district game warden, biologist, or a Wyoming Game and Fish Department regional office for registration. Information collected include: harvest date, location (legal description, Universal Transverse Mercator location, and hunt area), sex, lactation history (whether or not females have ever produced young from nipple characteristics; Anderson and Lindzey 2000), estimated age from tooth wear and degree of staining, and collection of teeth for cementum annuli aging, number of days spent hunting, hunting method, and number of mountain lions and mountain lion tracks observed while hunting (Appendix IV). Trainer and Golly (1992) reported 76% agreement ≤1 year of annuli ages compared using blind tests of 2 premolars from the same mountain lion (n = 426; 92% agreement for lions <4 years old), and annuli age comparisons of known age mountain lions were 95% accurate (within 1 year; Trainer and Golly 1992:14/15, Anderson 2003:6/6). In addition to mortality data, the Wyoming Game & Fish Department compiles data on mountain lion observations, sign, depredations, human interactions and gauges social concerns through public meetings, hunter surveys, public attitude surveys, and contacts with the public.

Mountain lion mortality data are used to assess: (1) population status, (2) age and sex structure of harvested mountain lions, (3) distribution of mountain lion mortalities, (4) effort expended per mountain lion harvested (Appendix II, Fig. II-2), and (5) to account for and set mortality quotas. Sex and age composition of mountain lion harvests are useful to assess mountain lion population trends (Anderson and Lindzey 2005), and the age of reproductive females can be useful to examine the reproductive potential of mountain lion populations (Stoner 2004, Anderson and Lindzey 2005); populations maintaining older-age females have higher reproductive potential, and thus resiliency, than populations where female survival is reduced. Recording distribution of mountain lion harvest and other human-caused mortalities allows assessment of potential source areas where little or no mountain lion mortality occurs, and sink areas where mountain lion mortalities may be relatively high. Changes in hunter effort may indicate changes in mountain lion densities, assuming the time required to harvest a mountain lion is related to the number of mountain lions in an area. This information is used to establish total and/or female mortality quotas by hunt area every 3 years. Setting mountain lion seasons every 3 years allows sufficient time for management reductions in areas with sufficient hunter access (Anderson and Lindzey 2005) and recovery for previously suppressed populations (Logan and Sweanor 2001, Anderson and Lindzey 2005). The process by which these 3-year mortality quotas are set include (1) annual data analyses and summary by the Trophy Game Section, (2) internal regional review and recommendations provided by each of the 7 Wyoming Game and Fish regions, (3) a public input process, and (4) final hunting season regulations submitted from the regions for action to the Wyoming Game and Fish Commission.

Mountain Lion Hunting Season Structure

Regulation of sport hunting for mountain lions in the western states typically follows 1 of 3 harvest strategies including general seasons, limited entry, and harvest quota systems (CMGWG 2005). General seasons allow unlimited hunting of mountain lions of either sex, and the only restrictions include the number of licenses issued per hunter (typically 1 per season) and timing and length of the hunting season. General seasons provide the highest hunting opportunity, but likely result in uneven hunting pressure (i.e., accessible areas are heavily hunted and inaccessible areas are not) limiting control over harvest level, composition of the harvest, and distribution of the harvest. Limited entry programs limit the number of hunters per hunt area through limited license allocation, using either first come first serve or lottery license sales. This approach is most limiting in terms of hunter opportunity, but can be useful to disperse hunting pressure, control harvest levels, and may increase the opportunity for hunters to be selective (increasing male harvest) in areas where hunting pressure is low. Harvest quota management requires setting a limit on the total harvest and/or number of female mountain lions harvested from an area. The hunting season is closed in an area once the harvest quota has been met. Hunters are required to monitor status of the hunting season by calling a harvest quota hotline. Advantages to the quota management approach are that hunting opportunity remains high and harvest distribution and level can be regulated. Female sub quotas can be used to support a management objective of sustaining harvest levels with reduced impact on the mountain lion population. Potential disadvantages of harvest quota management include the number of hunters per hunt area is unlimited until quotas are filled and harvest quotas may be exceeded if more than 1 mountain lion is harvested the same day the quotas is filled. Harvest quota management has traditionally been used in Wyoming for mountain lion management.

Methods of Mountain Lion Hunting

Mountain lion hunting in Wyoming is accomplished using various hunting methods including opportunistic harvest (spot and stalk) during big game (e.g., elk and deer) seasons, calling mountain lions using predator calls, and tracking and baying mountain lions using trained hunting dogs (i.e., hunting with hounds). The majority of mountain lions harvested annually in Wyoming are taken by hunting with hounds (typically >90%).

Some groups and individuals, both nationally and locally (Gasson and Moody 1995), are concerned about the use of dogs as a hunting method for mountain lions, and some states have recently banned hunting with hounds (e.g., Oregon, Washington). In states where hunting with hounds is not allowed, opportunistic mountain lion hunting (during big game seasons, predator calling) appears comparably successful based on harvest levels observed in Washington and South Dakota. Results from Washington (Martorello and Beausoleil 2003) suggest opportunistic mountain lion hunting is less selective than hunting with hounds and/or female mountain lions are more vulnerable to opportunistic hunting; relative female harvest levels increased from 42% to 59% when hunting with hounds was banned in Washington (mean annual harvest before hound hunting ban = 157 and after hound hunting ban = 199, but harvest rates were not significantly different due to annual harvest variability).

Mountain lion harvest data from Wyoming the past 5 years suggest an average of 32% of successful hound hunters (range = 25-44%; mean total lion harvest from hunting with hounds = 176/year) report being selective while mountain lion hunting and averaged 1.8 days longer in the field than unselective hunters (4.8 days versus 3.0 days). Harvest comparisons indicate on average 49% of unselective and 32% of selective hunters harvest females each year (mean total female harvest = 44%), averaging 9 fewer females and 9 additional males harvested by selective hound hunters in Wyoming annually. Although selectivity reduces female mountain lion harvest, it does not completely explain differences observed between Washington and Wyoming. These differences likely also relate to differences in mountain lion vulnerability between hunting methods.

Anderson (2003) observed that nightly movement distances from Global Positioning System (GPS) data averaged over 3 times longer for male mountain lions than for females (mean end-point distance = 4.6 km versus 1.5 km, 2.9 mi versus 0.9 mi). These longer distance movements expose males more than females to hunting methods where tracking is involved (i.e., hunting with hounds). Opportunistic hunters who do not track mountain lions while hunting are also more likely to harvest the less mobile and more abundant sex (typically females, CMGWG 2005:40) because relative abundance rather than movement patterns drive harvest vulnerability when mountain lions are hunted opportunistically. In addition, hunters with hounds have an increased ability to avoid family groups by detecting young while tracking mountain lions, whereas opportunistic hunters have limited opportunity to determine if young are present.

Potential for Orphaning Young

Because mountain lions can breed and reproduce any time of the year, orphaning of young can result from the harvest of female mountain lions with young. This issue draws emotionally negative responses from some segments of the public and deserves formal appraisal of the potential biological consequences of orphaning young from the harvest of adult female mountain lions. Wyoming law prohibits the harvest of mountain lions accompanied by young, but females may not be accompanied by young while searching for prey (Barnhurst and Lindzey 1989), and therefore may mistakenly be harvested by mountain lion hunters.

Number of mountain lion litters orphaned from hunting can be estimated if data are collected addressing the number of adult females harvested annually. All mountain lions harvested in Wyoming are subjected to mandatory inspection where sex, age, and lactation history data (from nipple characteristics; Anderson and Lindzey 2000) are collected to determine the number of subadult (estimated age <4 years old and have never nursed young) and adult females (nipple characteristics suggest previous lactation and/or estimated age >3 years old) harvested each year. Logan and Sweanor (2001) reported that on average 50% of adult females reproduce and 75% were with dependent young each year. Thus, about 25% of adult females are without young and 25% are with yearlings. Because young may become independent as early as 12 months old or earlier and average dispersal age is about 14-15 months (Anderson et al. 1992, Sweanor et al. 2000), it is unlikely yearling survival is influenced by death of their mother, but survival of young ≤12 months old is likely reduced. Applying these assumptions, timing of female mountain lion harvest, and estimates of monthly birthing rates we can estimate the number of litters orphaned each year due to hunting. Two Wyoming mountain lion studies identified birth month for 31 litters in north central (n = 10, Logan 1983) and southeast Wyoming (n = 21, Anderson 2003) and provide estimates of monthly birth rates for Wyoming mountain lions (Table 2). Female harvest of both age classes (non-reproducing subadults, reproductive adults) averaged 88 the past 5 years (fall 2000-spring 2005) and averaged 32 adult females (Table 3). Assuming 50% of reproductive females produce young each year, we estimated about 16 litters ≤12 months old may be orphaned in Wyoming annually due to harvest of adult female mountain lions (Table 3).

Table 2. Monthly birth rate from 2 Wyoming mountain lion studies.

	Number of litters			
Birth month	North-central, Wyo.[a]	Southeast, Wyo.[b]	Total	Monthly birth rate
January	0	1	1	0.032
February	0	1	1	0.032
March	0	0	0	0
April	0	1	1	0.032
May	2	1	3	0.097
June	0	4	4	0.129
July	0	3	3	0.097
August	2	5	7	0.226
September	2	1	3	0.097
October	0	1	1	0.032
November	3	2	5	0.161
December	1	1	2	0.065

[a]From Logan 1983.
[b]From data collected by Anderson 2003.

This annual estimate of the number of mountain lion litters orphaned in Wyoming may be high (i.e., assumes 50% of adult females are with young when harvested) because our approach ignores the possibility of hunters detecting and passing females with young while hunting, therefore shifting the harvest toward barren females, which likely occurs at some level when mountain lion tracks are followed in the snow while hunting with hounds. To investigate the estimate, we compared the average number of lactating females harvested the past 5 years (mean = 2.6, range 1-3/year) to that expected when compared to data from Tables 2 and 3. Assuming juvenile mountain lions quit nursing at 2-3 months of age (Pierce and Bleich 2003), we would expect annual harvest of lactating females to range somewhere between 2.8 and 4.7. Whether the lower than expected harvest of lactating females is due more to hunter selectivity or reduced vulnerability resulting from the more sedentary nature of young family groups is unknown but further indicates that some degree of harvest selectivity is occurring.

Based on the estimate of orphaned litters from average adult female mountain lion harvest in Wyoming the past 5 years, 8.7 litters <6 months old and 7.5 litters 6-12 months old (Table 3) would be orphaned in a given year. Survival of orphaned young <6 months old is unlikely, but survival of orphaned young 6-12 months has been documented during at least 3 mountain lion studies (Lindzey et al. 1989, Logan and Sweanor 2001, Anderson 2003) suggesting about 71% survival for this age group; total sample size from the 3 studies was small, resulting in 5 of 7 young orphaned at 6-10 months old surviving. If we assume on average 2 kittens/litter survive to independence (Logan and Sweanor 2001), orphaned young <6 months do not survive, and about 71% of orphaned young 6-12 months old survive, the estimated biological impact to Wyoming mountain lion populations would be an average loss of about 22 juvenile mountain lions annually [$2 \times 8.7 = 17.4$ young <6 months old, $(2 \times 7.5) \times 0.29 = 4.4$ young 6-12 months old]. Based on mountain lion occupancy throughout most timbered and shrub-covered habitats statewide, this level of loss is biologically insignificant, but is still a concern to some segments of the public. If opportunistic hunting increased and hunting with hounds were reduced, we would expect the actual number of young being orphaned to increase because of the apparent increased vulnerability and the higher proportion of females harvested when compared to hunting with hounds (Martorello and Beausoleil 2003).

Table 3. Monthly female mountain lion harvest in Wyoming (recent 5 year average), and estimated number of litters orphaned (<6 months old, 6-12 months old) from adult female harvest.

Month	Mean total female harvest	Mean adult female harvest	Est. mean No. of females w/young[a]	Est. mean No. orphaned litters <6 moths old[b]	Est. mean No. orphaned litters 6-12 months old[c]
Sept.	1.4	0.4	0.2	0.12	0.08
Oct.	6.0	2.4	1.2	0.77	0.43
Nov.	17.2	6.0	3.0	1.74	1.26
Dec.	26.4	8.6	4.3	2.64	1.66
Jan.	15.6	6.2	3.1	1.80	1.30
Feb.	15.8	5.8	2.9	1.12	1.78
Mar.	6.0	3.0	1.5	0.48	1.02
Total	88.4	32.4	16.2	8.67	7.53

[a]Assumes 50% of adult females reproduce annually (Logan and Sweanor 2001).
[b]Estimated number of females w/young × sum of previous 5-month birth rate from Table 2.
[c]Estimated number of females w/young – estimated number of litters <6 months old.

Mountain Lion Habitat Management

Mountain lions are habitat generalists evident in their broad geographic distribution ranging throughout a variety of habitat types in much of the western hemisphere. The primary habitat component necessary for mountain lion survival includes some form of hiding cover for securing large prey (e.g., ungulates) and raising young. Although open vegetative communities are rarely used, mountain lions are found in virtually all other vegetation types including coniferous and deciduous forests, woodlands, swamps, savannahs, chaparral, riparian forests, desert canyons and mountains, and semi-arid shrub lands (Hansen 1992). In Wyoming, Logan and Irwin (1985) reported that mountain lions preferred mixed conifer-curlleaf mountain mahogany (*Cercocarpus ledifolius*) habitats in rugged terrain, and Anderson et al. (in review) reported mountain lion use of timbered and tall-shrub covered regions occurring near the base of mountain ranges during winter.

Mountain lions, depend on healthy prey populations (e.g., deer, elk), therefore, habitats supporting abundant prey are also important to mountain lion populations. Habitat protection and improvement projects are currently in place for ungulate populations in Wyoming (Wyoming Game & Fish Department 2001), which will undoubtedly benefit mountain lion populations. In addition, Anderson et al. (in review) recently developed a mountain lion habitat model and efforts are currently in place to delineate core winter mountain lion habitat statewide (Fig. 1). Current habitat projects for mountain lion prey species and application of the mountain lion habitat model allow evaluation of potential impacts of proposed development projects to habitats supporting mountain lions and their prey.

Mountain Lion Population Monitoring

Monitoring Mountain Lion Population Trend: Although mountain lion populations have previously been monitored with intensive capture efforts over relatively small areas, reliable and affordable techniques to monitor mountain lion populations for large-scale management programs are lacking. Mountain lion management has traditionally employed harvest strategies with little understanding of the quantitative effect differing harvest levels have on mountain lion population demographics. Sex and age classes of mountain lions exhibit different and relatively predictable movement patterns, where males move longer distances than females and subadults (1-2.5 years old) generally move longer distances than adults (Barnhurst 1986, Anderson 2003). Conceptually, the likelihood of a specific sex or age class of mountain lion being harvested would reflect its relative abundance in the population and its relative vulnerability based on daily movement patterns. In areas where dogs are used to track mountain lions, those mountain lions that typically move longer distances would most likely be detected first (males/subadults). The least vulnerable individuals (adult females) should become prominent in the harvest only after the population has been reduced in size by removal of more vulnerable/available mountain lions. Anderson and Lindzey (2005) tested these predictions applying varying levels of hunter harvest and found harvest composition to be predominantly subadults for a high-density population with low harvest levels, shift to adult males as harvest levels increased, and then a shift from adult males to adult females with continued high harvest as the population declined. When harvest levels were reduced, composition of the harvest returned to primarily subadults. The male segment of the reduced population recovered within 2 years primarily due to male immigration

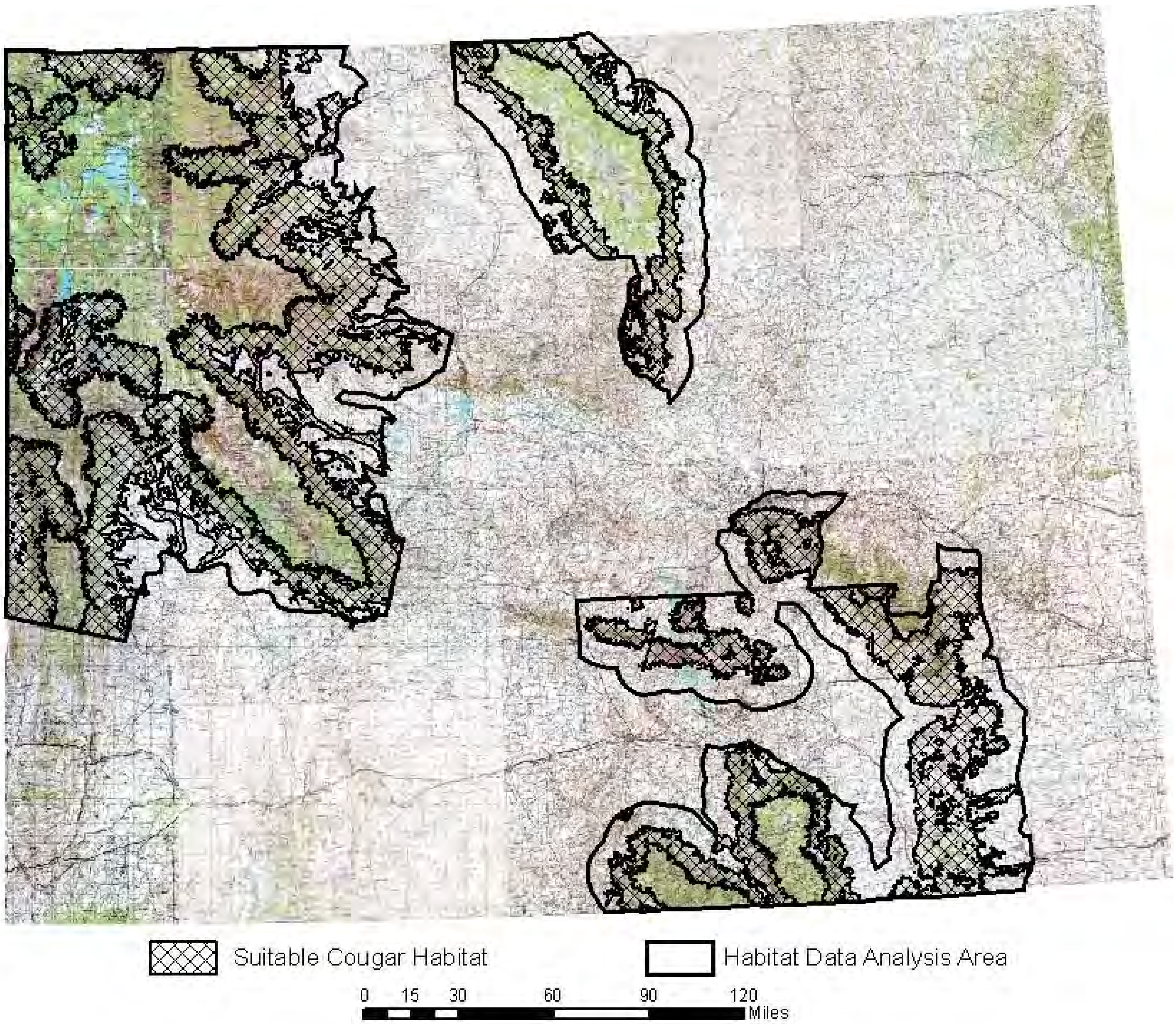
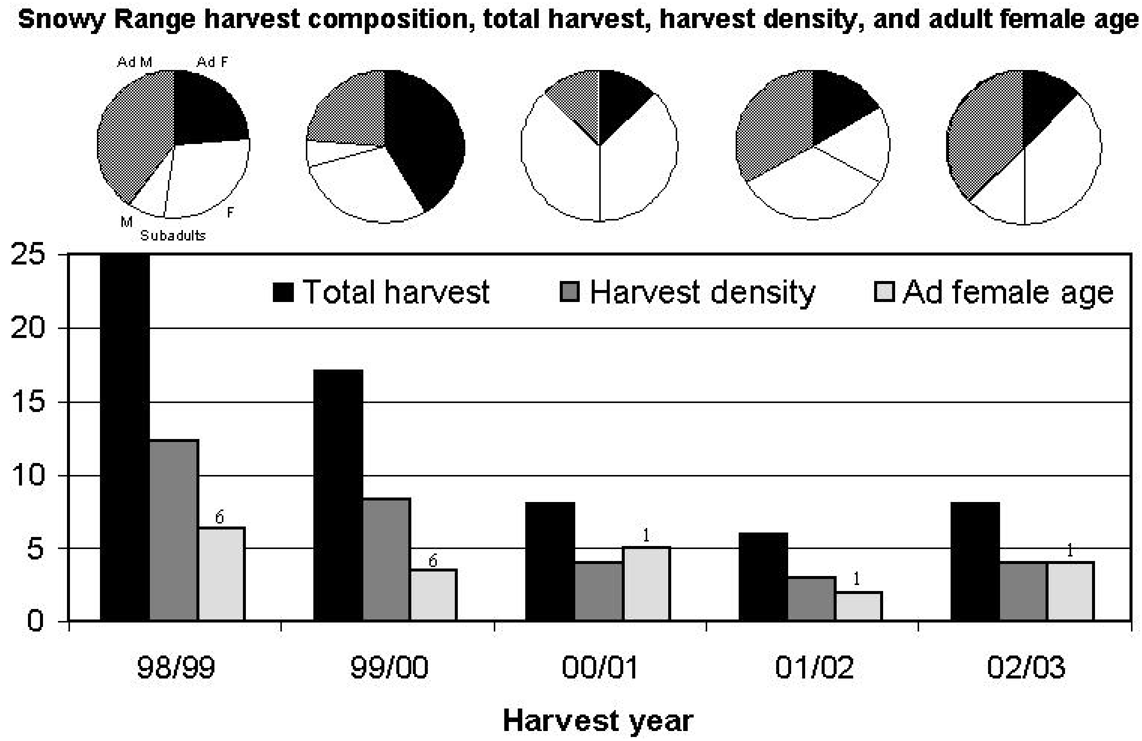


Figure 1. Wyoming mountain lion winter habitat based on model predictions for those portions of Wyoming with suitable vegetation data available for analyses (Anderson et al. in review). Winter mountain lion habitat represents areas suitable for resident adult mountain lions and not necessarily transient subadults (i.e., core mountain lion habitat). Background represents USGS 1:250,000 scale maps. Mountain lion habitat analyses will be completed for areas outside the habitat data analysis area (e.g., northeast and southwest Wyoming) when sufficient vegetation data layers are developed for those regions of the state.

from other populations and the female segment within 3 years from an increased number of females producing young within the population (Anderson and Lindzey 2005).

We compared harvest composition and age of harvested adult females from the Snowy Range (Fig. 2; Anderson and Lindzey 2005) to 2 other areas in Wyoming (Fig. 3; Star Valley and the Laramie Range) where management objectives called for increasing harvest levels to reduce mountain lion populations (i.e., where comparable data were available). We then applied the



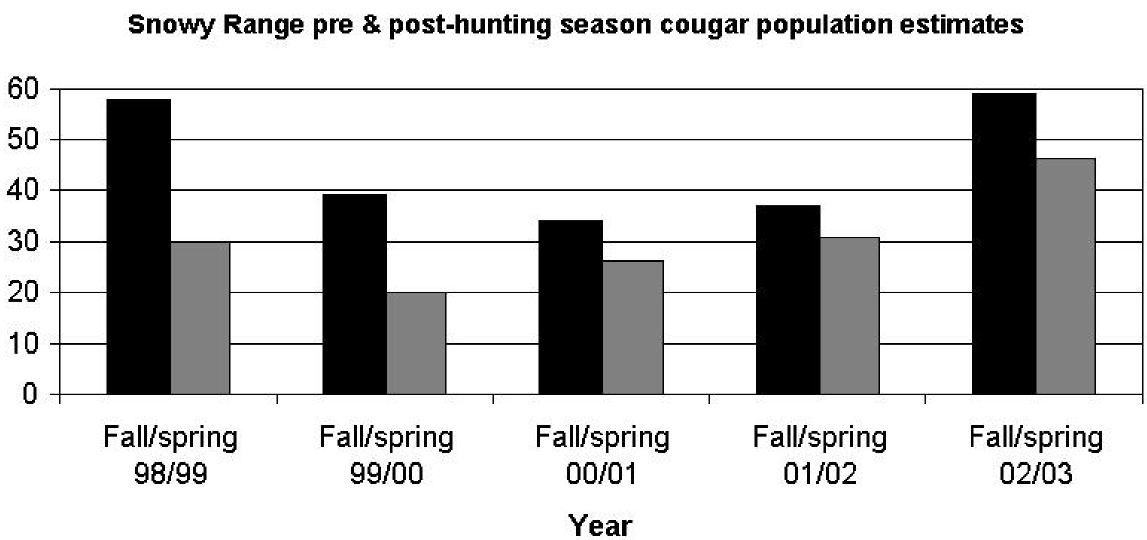
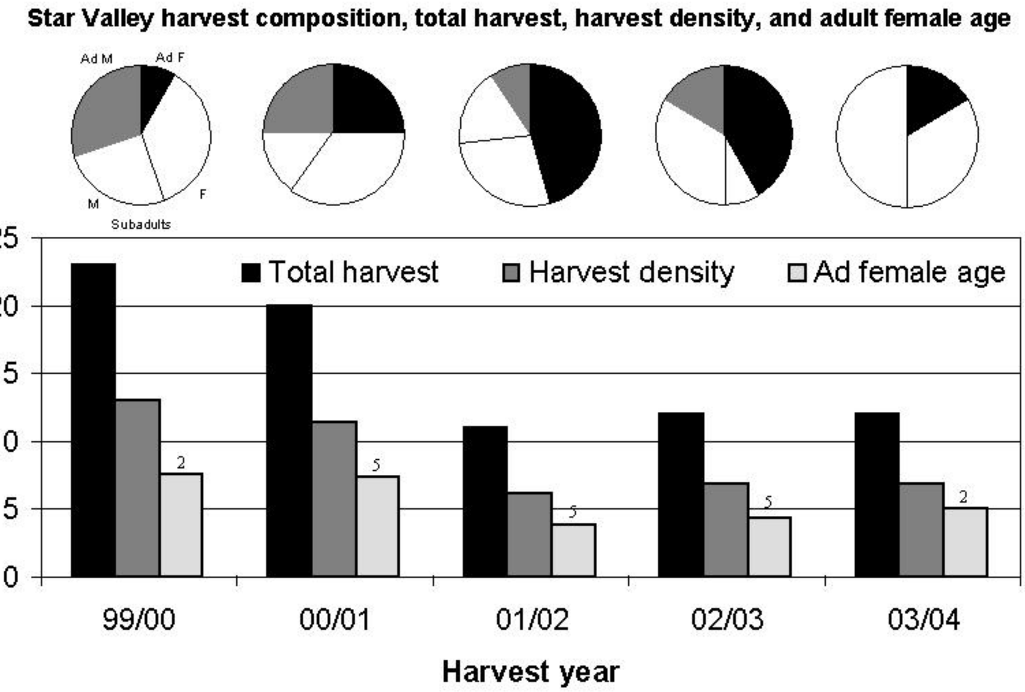


Figure 2. Sex/age composition of mountain lion harvest (pie charts), total harvest, harvest density (mountain lions/1,000 km^2), and mean annuli age of adult females (top bar graph) and pre and post-hunting season mountain lion population estimates (bottom bar graph; Anderson and Lindzey 2005) from the Snowy Range, Wyoming, 1998-2003. Numbers above adult female age represent sample size. Note initial high harvest density (>12 mountain lions/1,000 km^2), decline in adult male harvest, increase in adult female harvest, and decline in age of harvested adult females as the population decreased in size. Also note low harvest densities (<5 mountain lions/1,000 km^2) and low adult female harvest levels during population increase.



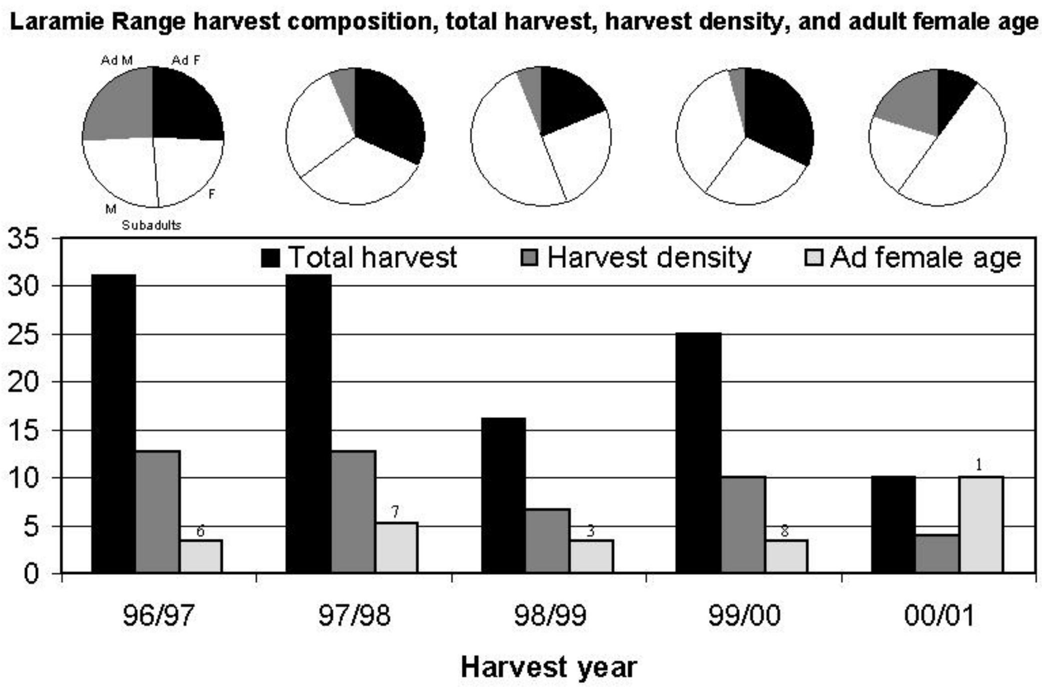


Figure 3. Sex/age composition of mountain lion harvest (pie charts), total harvest, harvest density (mountain lions/1,000 km^2), and mean age of adult females harvested from Star Valley (hunt area 26), Wyoming, 1999-2004 (top bar graph) and from the Laramie Range (hunt areas 6 and 27), Wyoming, 1996-2001 (bottom bar graph). Numbers above adult female age represent sample size. Mountain lion harvest was increased >40% during the first harvest year in each area to achieve the management objective of reducing mountain lion populations.

Wyoming mountain lion habitat model (Anderson et al. in review; Fig. 1) to evaluate harvest densities among areas. The Snowy Range mountain lion population declined about 33% (fall population estimates) following a harvest density of 12.3 mountain lions/1,000 km^2 (386 mi^2; 1998/99 harvest year) and continued to decline another 13% following a harvest density of 8.4 mountain lions/1,000 km^2 (386 mi^2; 1999/00 harvest year). Harvest composition shifted from primarily adult males to adult females and mean annuli age of harvested adult females declined from 6.3 to 3.6 years old as the population declined (Fig. 2). The Snowy Range mountain lion population recovered to previous levels following a 3-year period where harvest densities were between 3.0-4.0 mountain lions/1,000 km^2 (386 mi^2) and harvest composition consisted primarily of subadults, buffering the adult female segment of the population during recovery (2000/01-2002/03 harvest years; Fig. 2). We noted similar progressions in harvest density, harvest composition, and mean age of harvested adult females for Star Valley and the Laramie Range (Fig. 3), except that harvest composition shifting from adult males to adult females was more gradual in Star Valley. Harvest densities remained moderate (typically between 6-7 mountain lions/1,000 km^2) following initial high harvest densities (>10/1,000 km^2) in both areas, and older age females (>5 years old) were not evident in the harvest until the second year of high harvest density in the Laramie Range. The more gradual increase in adult female harvest for Star Valley is likely due to this area being more connected to adjacent mountain lion habitat than the Snowy or Laramie ranges (i.e., more resilient to mountain lion harvest allowing animals from adjacent areas to replace harvested animals). Based on relatively high adult female harvest and intermediate harvest densities (Fig. 3), Star Valley and Laramie Range mountain lion populations were likely maintained at low-moderate densities during the periods examined.

Population Estimation Methods: Obtaining accurate and precise estimates of mountain lion population size for each managed population can be logistically and financially challenging, limiting application of estimation methods to relatively small areas every several years. Methods that have been evaluated or hold promise for estimating mountain lion populations for large-scale management programs include ground-based track surveys, sampling mountain lion tracks during helicopter surveys (i.e., helicopter probability sampling; Van Sickle and Lindzey 1991), and DNA or camera-based mark-recapture efforts. Application of DNA or camera-based mark-recapture methods to estimate mountain lion populations is currently limited because there does not appear to be a reliable attractant for luring mountain lions into hair collection or photo detection sites and individual identification of mountain lions from photos appears unreliable for the camera approach. Until these methods are further developed for mountain lions, track surveys and helicopter probability sampling mountain lion tracks appear most promising in estimating mountain lion populations for management application.

Track surveys have been used to monitor mountain lion populations in California (Smallwood 1994, Smallwood and Fitzhugh 1995) and Arizona (Cunningham et al. 1995). This method requires transect sampling areas where mountain lion tracks are detectable and provides presence-absence data with confidence interval estimates. Beier and Cunningham (1996) reported that sampling 140 and 110 8-km-long transects would be required to detect 30% and 50% population declines, respectively (80% power, $\alpha = 0.05$). The difficulty in implementing track surveys is ensuring transects are well distributed throughout the population in areas where access may be limited and the unpredictability of favorable tracking conditions. The level of effort required to detect useful population changes likely limits application of this method to once every few to several years.

Becker (1991) and Becker et al. (1998) addressed helicopter probability sampling of snow tracks to estimate lynx and wolf population size in Alaska. This method requires sampling animal tracks during helicopter surveys and then following tracks from beginning to end to estimate the probability of detection for each track observed during surveys, and therefore requires consistent snow conditions for the duration of the survey. Helicopter probability sampling provides population and confidence interval estimates derived from the inverse of the detection probabilities for tracks in the sample. Van Sickle and Lindzey (1991) applied this method to a low-density Utah mountain lion population of known size and obtained an accurate but imprecise (high variance) population estimate. Anderson et al. (2003) investigated this method further using computer simulations of mountain lion GPS data (≤6 locations/night) to simulate mountain lion tracks and reported that mountain lion population changes of 15-30% could be detected (90% probability) for medium-high density mountain lion populations (23-35 independent mountain lions/1,000 km^2 or 386 mi^2) depending on sampling effort (transects spaced 2 to 3 km apart). Both Becker (1991) and Anderson et al. (2003) noted the logistical difficulty and added expense of completely following tracks during surveys and suggested using telemetry data from radiocollared animals in the population or GPS movement data from similar habitat types during similar seasons to estimate track lengths. Anderson et al. (2003) noted that an area of about 2,000 km^2 (771 mi^2) could be surveyed in 2 helicopter days for about $8,000-$10,000. Thus, helicopter probability sampling mountain lion populations would be limited to relatively small areas and likely only affordable to management agencies every few to several years.

ADAPTIVE MOUNTAIN LION MANAGEMENT APROACH FOR WYOMING

Mountain Lion Hunting Season Structure, Hunting Methods, and Hunter Effort Indices: Since 1980, mountain lion harvest in Wyoming has been controlled using harvest quota management. Harvest quota management maximizes management flexibility by maintaining high hunting opportunity and controlling harvest by assigning total and sometimes female subquotas by hunt area depending on local management objectives. Rarely are harvest quotas exceeded in Wyoming, but heavily roaded areas are more prone to multiple hunters harvesting mountain lions at the end of the season thereby exceeding harvest quotas. If exceeding harvest quotas becomes a recurring problem, limited entry seasons could be established in those areas or quotas could be adjusted anticipating additional harvest similar to past seasons.

Mountain lion hunting seasons in Wyoming typically occur from September 1 through March 31 lasting 212 days. Year round seasons are established in 2 areas with high depredation incidents to provide opportunity for licensed hunters to take depredating mountain lions as a substitute for removal by agency personnel. Most mountain lion harvest (>90% annually) occurs during the winter months (November-March) when snow cover provides optimal tracking conditions. Although few mountain lions are harvested during September and October, this period provides hunting opportunity for hunters opportunistically during big game seasons or using predator calls.

Although some individuals and groups criticize the use of hounds for hunting mountain lions, this hunting method is an efficient management tool, which allows optimal dispersal of hunting pressure and minimizes harvest of adult females primarily due to vulnerability differences between hunting methods. Tracking mountain lions while hunting with hounds also increases the opportunity for hunters to detect and avoid family groups.

Currently, hunting information is only recorded from successful hunters when registering harvested mountain lions during the mandatory inspection process. Catch-per-unit-effort indices can be useful to monitor impacts to hunted populations assuming there is an identifiable relationship between hunter effort and the number of animals in the area hunted. Hunter effort data from only successful hunters has changed little the past 20 years has not proved useful in assessing mountain lion population trends (Appendix II, Fig. II-2). Additional information from unsuccessful hunters may prove more useful in evaluating these indices and knowledge about the number of unsuccessful and successful hunters hunting an area may explain changes in harvest level in cases where other information does not (i.e., due to changes in the number of hunters hunting an area). Regardless, data from unsuccessful hunters will enhance the management database and likely contribute to other harvest data currently collected.

Mountain Lion Habitat Management: Anderson et al. (in review) developed a winter mountain lion habitat model from GPS data collected in the Snowy Range, Wyoming, and validated model predictions using historic harvest locations 1996-2005 from the Bighorn, Sierra Madre, and Snowy Mountain Ranges. Habitat modeling efforts by Anderson et al. (in review) focused on the winter period (November-May) because this is the period when mountain lion activity is most limited due to deep snow at higher elevations resulting in ungulate concentrations on low elevation winter ranges, human development projects are vastly more common on low elevation winter ranges than on higher elevation summer ranges, and the vast majority of human-caused mountain lion mortality occurs during this period (>90% annually). The winter mountain lion habitat model is currently being used to delineate core winter mountain lion habitat statewide (Figs. 1 and 5). Thus far, most contiguous core mountain lion habitat in Wyoming has been delineated with the exception of the Southwest LMU, Northeast LMU, and hunt areas 14, 22, 25 and the Converse County portion of hunt area 6 (refer to Appendix III). Habitat maps for the other areas will be completed when detailed vegetation data layers are mapped and ground verified (e.g., Landsat Enhanced Thematic Mapper data at 30 m resolution); efforts are currently in place to complete vegetation data layers statewide.

Our intent for the mountain lion habitat model is to delineate suitable winter mountain lion habitat for resident adults (i.e., core mountain lion habitat) and exclude marginal habitats used as transition areas by transient subadults. Delineating core mountain lion habitat allows assessment of potential impacts from proposed development projects and application of mountain lion mortality densities to be used in development and assessment of management objectives (see next section below). Based on evaluations using historic harvest distribution (Fig. 4), the model appears to work well in most regions of Wyoming. Final acceptance of mountain lion habitat model predictions is pending regional review based on local knowledge of mountain lion habitat use during winter.

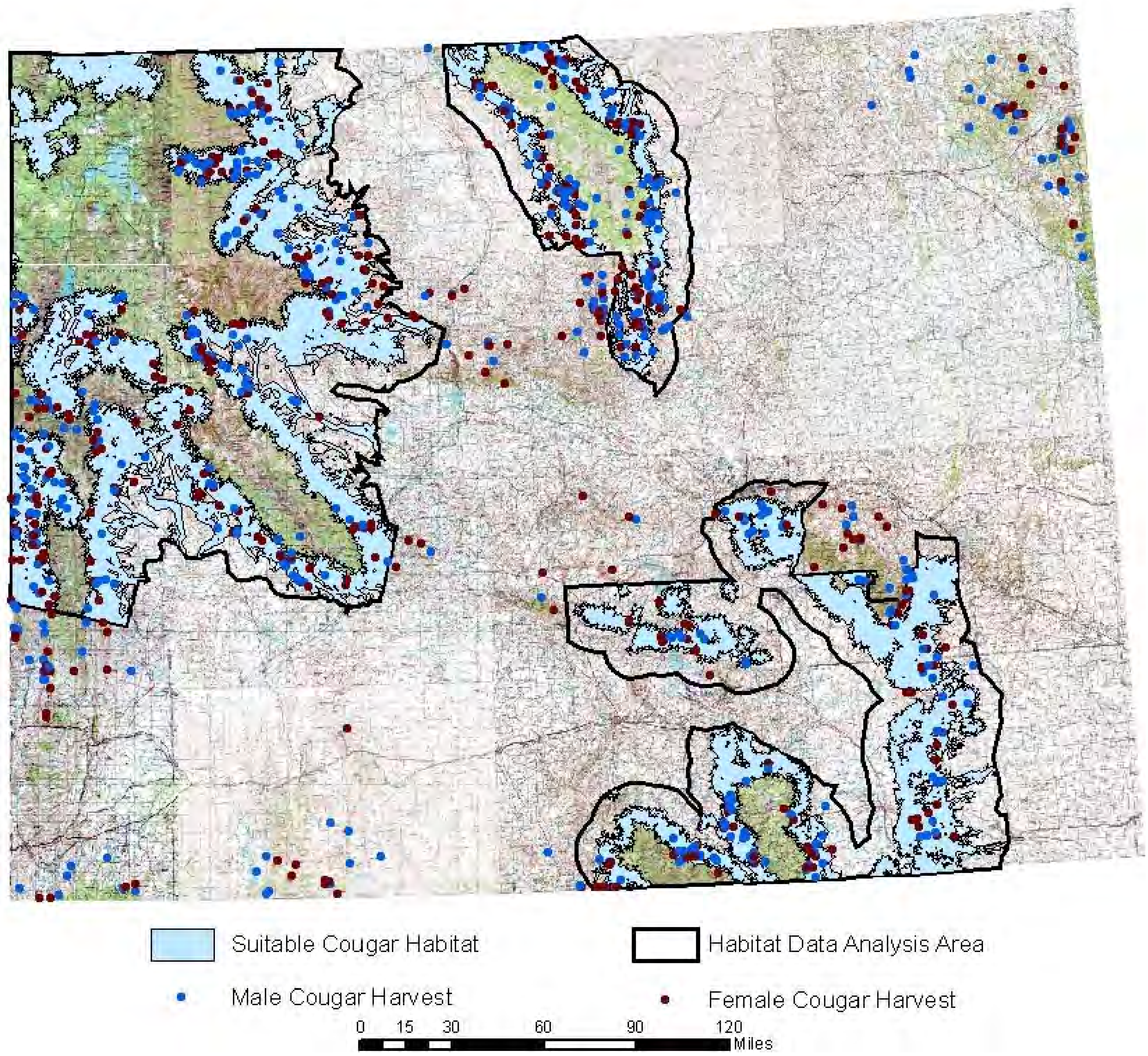


Figure 4. Winter mountain lion habitat model predictions relative to mountain lion harvest locations by sex, fall 2000-spring 2005. Winter mountain lion habitat represents core habitat of resident adult mountain lions and excludes marginal habitats occasionally used as transition areas by transient subadult mountain lions.

Habitat management efforts should include conserving large tracts of connected habitats that have the characteristics preferred by mountain lions and their prey. The Department's efforts to maintain high quality ungulate habitat should benefit mountain lion populations, and application of the mountain lion habitat model will provide opportunity to evaluate potential impacts from proposed development projects.

Management Criteria for Establishing Mountain Lion Management Objectives: The Cougar Management Guidelines Working Group (2005) suggested managing mountain lion populations by managing source and sink subpopulations. As stated previously, the hunt area and management unit approach currently used in Wyoming lends itself well to this concept and has likely, by default, maintained source-sink mountain lion population dynamics since the early 1970s by maintaining relatively high lion densities in some portions of the state (i.e., source areas) which support recruitment of young lions into other areas managed at low population densities (i.e., sink areas); maintaining source mountain lion habitats allow persistence of mountain lions in other habitats experiencing high mortality rates. The CMGWG did not provide specific guidelines on how to delineate source and sink mountain lion habitats other than to establish large-unhunted refuge areas to offset population sinks that experience high human-caused mortality. However, refining this approach by applying sex-age composition of harvest and annuli age of harvested adult females addressed by Anderson and Lindzey (2005) and applying the Wyoming mountain lion habitat model (Anderson et al. in review) to evaluate density of human-caused mortality provides criteria to establish source and sink mountain lion management. Based on Anderson and Lindzey (2005) and evaluation of harvest densities presented here for mountain lion population decline (Figs. 2 and 3) and increase (Fig. 2), the following criteria appear appropriate for establishing source-stable-sink mountain lion management:

Hunt area management objectives:

1. Sink management: reduce mountain lion densities
    a) Maintain density of human-caused mortality >8 mountain lions/1,000 km^2 (386 mi^2).
    b) Achieve adult female harvest >25% of total harvest for 2 of 3 seasons.
    c) Progression in mean age of harvested adult females should decline to <5 years old.

2. Source management: maintain human-caused mortality levels that allow mountain lion population growth or maintenance of relatively high mountain lion densities.

    a) Maintain density of human-caused mortality <5 mountain lions/1,000 km^2 (386 mi^2)
    b) Maintain adult female harvest <20% of total harvest.
    c) Maintain older-age adult females in the population (>5 years old). This will be difficult to identify without additional sampling due to low sample size from harvest, but would be expected for lightly hunted populations.

3. Manage for stable mountain lion populations: maximize long-term hunting opportunity.

    a) Maintain human-caused mortality density between 5-8 mountain lions/1,000 km^2 (386 mi^2)
    b) Adult female harvest should not exceed 20% of total harvest for more than 1 season.

c) Maintain intermediate aged adult females (mean ≅ 4-6 years old) in the harvest. Adequate age evaluation may require averaging age data over time to achieve meaningful sample sizes.

LMU management objectives:

- The LMU management objective should attempt to achieve the criteria above for source, stable, or sink mountain lion management at the LMU level. The objectives chosen by managers will be based on the adjacent management priorities, size of the LMU, maintaining recreational opportunity, maintaining source mountain lion populations, as well as depredations and other factors to achieve the overall management goal of sustaining mountain lion populations throughout core habitat at varying densities depending on management objectives.

- Coordinating management efforts with adjacent states would be most desirable for the smaller LMUs (i.e., Northeast and Southwest LMUs) where the majority of connected mountain lion habitat extends beyond Wyoming. Source or stable management could be maintained without interagency coordination, but sink management could also be implemented when sufficient source habitat has been identified in adjacent areas.

Acknowledging managers rarely, if ever, have precise information to measure success of management objectives, that mountain lion densities vary regionally, and the criteria proposed here are general guidelines, these guidelines should be compared to one another and applied adaptively to assess success of management prescriptions. For example, an area managed with the objective of stability and receiving a mountain lion removal density of 7 mountain lions/1,000 km^2 (386 mi^2), but relative adult female harvest exceeds 25% and harvested adult female annuli ages have declined below 5 years old likely suggests mountain lion population decline rather than stability. Conversely, an area managed with the objective of sink and receiving harvest densities of 10 mountain lions/1,000 km^2 (386 mi^2), but relative adult female harvest remains below 20% and older-age females (>5 years old) are consistently harvested suggests population stability (e.g., hunt area 23 in Table 4). Applying management objectives in an adaptive management framework, where density of human-caused mortality, harvest composition, and age of harvested adult females are monitored relative to expectations (criteria above) allows assessment of whether or not management objectives are being achieved and if management strategies should be modified to produce the desired outcome. Based on mountain lion management criteria averaged over the past 5 years for single or combined hunt areas of at least 1,000 km^2 of core mountain lion habitat (Table 4), 9 regions (1 to 3 hunt areas each) currently qualify as source areas, 7 as stable areas, and 1 as a sink area; 2 regions appear intermediate between source and stable and 2 regions intermediate between stable and sink (Fig. 5).

In implementing and evaluating mountain lion management objectives based on human-caused mortality density, proportion of total harvest comprised of adult females, and mean age of harvested adult females, it may be necessary to maintain consistent harvest objectives and combine data spatially or temporally to obtain meaningful information. Examples include hunt

Table 4. Annual 5-year average (fall 2001-spring 2006) of human-caused mountain lion mortality density (mountain lions/1,000 km^2), proportion of adult females in the total harvest, adult female annuli age (n = sample size), management status (source, stable, or sink), and area of core winter mountain lion habitat for Wyoming mountain lion hunt areas[a] and management units (LMU).

LMU Hunt area	Density of human caused mortalities	Proportion of total harvest including adult females	n/Annuli age[b]	Management status[c]	Core habitat (km^2)
Northeast					
1 & 24[d]	a	0.13	5/4.4	source/stable[e]	Undetermined
Southeast					
5 & 25[d]	1.9	0.26	3/7.0	Source/stable[e]	2,889[f]
7	6.2	0.20	8/4.1	Stable to stable/sink[e]	2,185
8 & 16[d]	2.9	0.08	3/5.3	Source	1,475[f]
9 & 10[d]	6.3	0.12	3/5.0	Stable	1,138
6 & 27[d]	5.6	0.13	6/4.2	Stable	2,480[f]
Southwest					
11, 12 & 13[d]	a	0.06	2/4.0	Source	Undetermined
North central					
15	15.4	0.11	8/4.4	Sink	1,221
21	9.6	0.14	6/4.8	Sink to stable[e]	1,295
22	a	0.19	8/3.4	stable to stable/sink	Undetermined
23	11.2	0.12	7/6.6	Stable	1,377
West					
Absoraka DAU					
19	4.6	0.13	8/6.8	Source	3,905
20	2.8	0.15	4/6.3	Stable to source[e]	3,045
Wind River DAU					
18	6.8	0.16	5/6.4	Stable	1,235
28	0.5	0.00	0/-	Source	1,720
4	4.5	0.16	3/4.3	Source	1,023
3	3.4	0.14	3/7.0	Source	2,151

Continued

Table 4. Continued.

LMU Hunt area	Density of human caused mortalities	Proportion of total harvest including adult females	*n*/Annuli age[b]	Management status[c]	Core habitat (km^2)
West (cont.)					
Wyoming Range DAU					
2 & 29[d]	3.2	0.23	12/6.4	Source	3,372
26	6.2	0.27	13/4.3	Sink to stable[e]	1,762
17	2.0	0.09	1/2.0	Source	1,838
14	a	0.22	10/5.5	Stable	Undetermined

[a]Insufficient vegetative data for hunt areas 1, 11-14, 16, 22, and 24-25 to calculate core mountain lion habitat and mortality density.

[b]Annuli age estimated from the number of rings evident after cross sectioning of the first premolar. Mean annuli ages from small sample sizes ($n < 5$) should be interpreted with caution.

[c]Status assigned based on the majority of the 3 criteria examined. Status criteria: source = mortality density <5 mountain lions/1,000 km^2, <20% of total harvest includes adult females, mean adult female annuli age >5 years old; stable = mortality density of 5-8 mountain lions/1,000 km^2, proportion of harvested adult females should not exceed 25% of total harvest for more than 1 year, mean annuli age of adult females should be intermediate to source and sink areas (e.g., 4-6 years old); sink = mortality density >8 mountain lions/1,000 km^2, >25% of total harvest includes adult females for 2 years, mean adult female annuli age declines to <5 years old.

[d]Hunt areas with <1,000 km^2 of core mountain lion habitat were combined with adjacent hunt areas within the same mountain range.

[e]Criteria separated with “ / ” indicate intermediate management status. Management criteria separated with “to” indicate a transition in management status over the 5-year period based on trends in annual data.

[f]Amount of core mountain lion habitat subject to change in hunt areas 5 and 6 following completion of improved habitat data layers and Regional review. Lack of vegetative data for hunt areas 16 and 25 precludes core habitat delineation and mortality density calculations for these hunt areas.

areas receiving low harvest levels or hunt areas of small geographic size. Small hunt areas can be combined with adjacent hunt areas and information from lightly hunted areas can be averaged over time to improve sample sizes (e.g., Table 4). Evaluating annual changes in management criteria are also important to determine if the population may be changing due to annual shifts in mortality density, harvest sex/age composition, and/or age of adult females, especially in areas experiencing moderate to high harvest levels; averaging management criteria over time may mask shifts in management status that are otherwise evident from annual changes in management criteria (e.g., hunt areas 7, 21, 22, 20, 2 & 29, and 26; Table 4). For example, mountain lion population reduction can be achieved in a short time period (>50% reduction; Logan and Sweanor 2001, Anderson and Lindzey 2005) in areas that are accessible to hunters where high harvest densities, increase in adult female harvest, and decline in age of adult females occurs within 2-3 years and subsequent management criteria suggest stability following the initial reduction (Fig. 3).

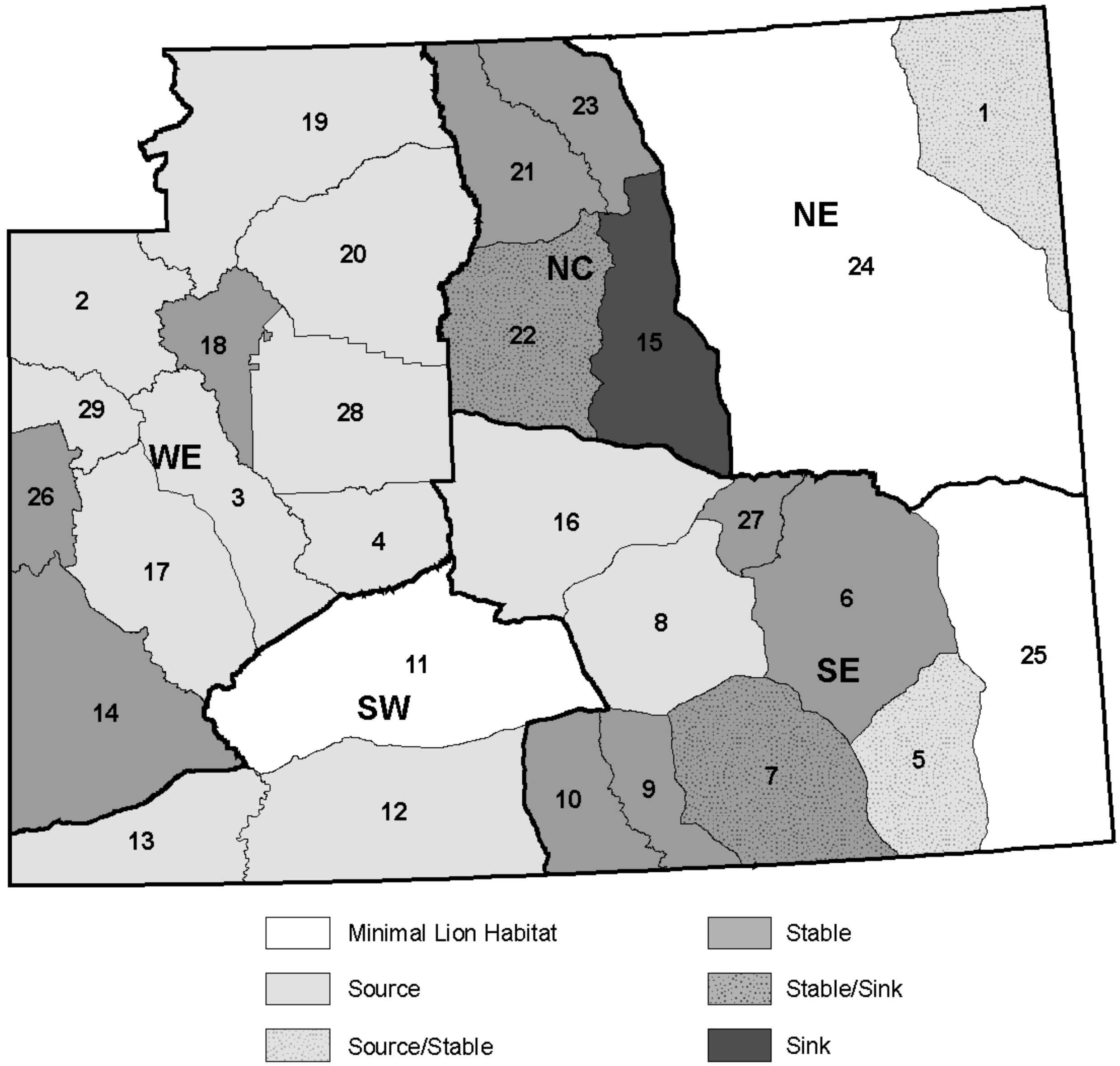


Figure 5. Current Wyoming mountain lion management status by hunt areas (numbered) within mountain lion management units (WE = west, NC = north central, NE = northeast, SE = southeast, SW = southwest). Status assigned based on the majority of the 3 criteria examined: source = human caused mortality density <5 mountain lions/1,000 km^2, <20% of total harvest includes adult females, mean adult female annuli age >5 years old; stable = human caused mortality density of 5-8 mountain lions/1,000 km^2, proportion of harvested adult females should not exceed 25% of total harvest for more than 1 year, mean annuli age of adult females should be intermediate to source and sink areas (e.g., 4-6 years old); sink = human caused mortality density >8 mountain lions/1,000 km^2, >25% of total harvest includes adult females for 2 years, mean adult female annuli age declines to <5 years old (Table 4). Unable to calculate mortality density for hunt areas 1, 12, 13, 14, 16, and 22 due to incomplete habitat data. White areas represent primarily open vegetative types and contain low-density mountain lion habitats.

Other factors to consider are the similarity in harvest composition for high and low-density populations and the duration for establishing source management areas. Anderson and Lindzey (2005) observed that harvest composition progressed from primarily subadults, to adult males, and finally to adult females with mountain lion population decline, but observed similar harvest composition to a high-density population, composed primarily of subadults, when the population was at low density. Harvest composition composed primarily of subadults may suggest a high density population where the less vulnerable adults have not yet been greatly exposed to harvest or conversely that the population is actually at low density where the majority of the adult segment of the population has previously been removed (via disease, past harvest levels, etc.) and most of the individuals in the population are immigrants from other populations. Approaches to determining whether high subadult harvest/low adult harvest suggests high or low mountain lion densities include comparing other harvest criteria, evaluating changes in harvest data over time (e.g., Table 4), and evaluating relative harvest of subadult females. Based on the current season setting structure in Wyoming where management objectives are established every 3 years, we suggest monitoring management criteria for the previous 2 management cycles (6 years) to adequately determine whether populations may be increasing, decreasing, or remaining stable. Low density of human-caused mortalities ($<5/1,000\ km^2$) for a 6-year period would indicate a high-density population, as would a majority of females in the subadult harvest suggesting numerous adult females producing young within the population. Ideally, source management areas should be maintained over time. If changes in social or biological conditions warrant shifting from source to sink management, 3 years should be sufficient to reduce mountain lion densities assuming sufficient access, but returning to source status will likely take longer. Numerical recovery can occur within 3 years (Logan and Sweanor 2001, Anderson and Lindzey 2005), but returning to the older age structure consistent with a functioning source population will benefit from source management for 2 management cycles (i.e., 6 years).

Another issue relative to source-stable-sink mountain lion management that should be addressed is the size at which an area may serve as a source subpopulation and the relative area and juxtaposition of source-sink mountain lion habitat necessary to sustain mountain lion populations at landscape levels. This issue has not been well addressed at this time, but work by Beier (1993) may offer some guidance. Beier (1993) suggested areas as small as 600-1,600 km^2 (231-617 mi^2) would likely sustain viable mountain lion populations assuming 4 immigrants every 10 years, and higher levels of immigration would allow even smaller areas to support mountain lions. Genetic evidence suggests Wyoming mountain lion populations are well connected, with the estimated number of migrants per generation ranging from 6-30 among geographically distinct regions (i.e., LMUs; Anderson et al. 2004). Thus, areas of at least 1,000 km^2 (386 mi^2) would appear sufficient to serve as source areas in Wyoming. The amount and juxtaposition of source mountain lion habitat relative to sink habitat necessary to sustain mountain lion populations at landscape levels, however, is still unresolved. Past mountain lion management and recent management status (Table 4, Fig. 5) suggests the current amount of source mountain lion habitat has been sufficient to sustain mountain lion populations statewide. In addition, maintaining source or stable management objectives at the LMU level should support large-scale mountain lion population persistence and this approach may preclude the need to specifically delineate the ratio of source:sink mountain lion habitat relative to hunt area management objectives.

In addition to assessing mountain lion population trends for stable or sink management areas, periodic mountain lion population monitoring will also be useful to confirm the status of source populations. Harvest data may be sufficient to reasonably evaluate trends for areas managed as stable or sink populations, but likely insufficient to adequately evaluate status of source populations. Confirming the status of areas intended to support mountain lions at landscape scales will be a useful component in source-stable-sink management of mountain lion populations in Wyoming. Population estimation methods (e.g., track surveys, helicopter probability sampling, mark-recapture methods if they become applicable for estimating mountain lion populations) should be applied every 3-5 years (e.g., 1 hunt area/LMU) to confirm mountain lion densities are consistent with populations that are at or near carrying capacity. Ability to formally survey source areas, however, will be dependent on Department budget constraints. If budget constraints do not allow formal surveys of source areas, other approaches should be investigated to confirm the status of source populations (e.g., less intensive track surveys, hunter interviews, etc.).

Mountain lion management objectives should be based on local and regional biological and social considerations. Management objectives to reduce mountain lion densities should be proposed when the expected outcome will result in (1) reduced human conflicts (e.g., human-mountain lion encounters, mountain lion incidents near human development), (2) reduced depredation incidents, or (3) to alleviate predation pressures on ungulate populations that are below the ungulate population management objective primarily due to mountain lion predation rather than habitat conditions. Success of management actions should be monitored to determine if reducing mountain lion densities achieve the desired outcome by recording changes in human conflict levels, depredation incidents, or ungulate population parameters (e.g., changes in female:young ratios). In the case of predation impacts to ungulate populations, additional data collection may be necessary to determine if reducing mountain lion numbers has resulted in increased ungulate numbers, and will depend on the availability of additional funding to monitor the ungulate population response. Changing management strategies over time, while monitoring the effects will provide an adaptive management approach to evaluate the success of mountain lion management prescriptions.

In areas where human conflicts and depredation incidents are not an issue and ungulate populations do not appear to be strongly influenced by predation, stable or source management objectives should be implemented. Managing areas for stable mountain lion populations should maximize long-term hunting opportunity, and source population management should offset reduction in other areas managed as sink populations. In areas of Wyoming where hunter access is limited (National Parks, refuges, ungulate winter range closures, private lands), sink (e.g., hunt area 2) or even stable management at lower densities (e.g., hunt area 28) may not be possible. These areas have served and will continue to serve as source mountain lion populations as long as access remains limited.

NUISANCE MOUNTAIN LION MANAGEMENT

Livestock Depredations

Mountain lions will kill most species of domestic livestock, although sheep and cattle tend to dominate depredation records (Lindzey 1987). In Arizona, Shaw (1983) reported that 93% of mountain lion-killed cattle examined were calves (typically <300 lbs.), and although all age classes of sheep were killed, lambs were preferred. Cattle losses to mountain lions are rare in Wyoming (Fig. 6) primarily due to calves being born away from mountain lion habitat compared to other areas of the southwestern U.S. where calves are born in mountain lion habitat (e.g., the desert southwest; Shaw 1977, Cunningham et al. 1995). Mountain lion depredations of horses, llamas, goats, poultry, pigs, and other types of livestock have also been documented (Tully 1991). Data from Wyoming, 2000-2005, indicate approximately 97% of the damage claims submitted for reimbursement were for sheep, primarily lambs and ewes (Fig. 6; Wyoming Game & Fish Department 2005). Other livestock occasionally killed include horses, cattle, goats, and pigs. The loss of domestic pets near residential areas is also on the increase in urban areas, primarily due to human development into occupied mountain lion habitat (Davies 1991).

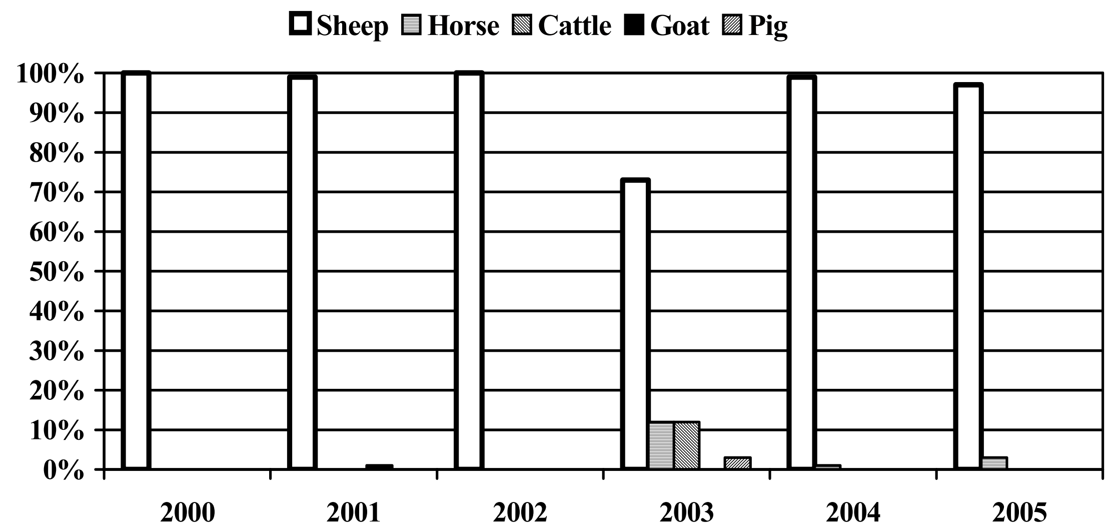


Figure 6. Percentage of mountain lion damage compensation in Wyoming by type, fiscal year 2000-2005.

Wyoming Statute §23-1-901 provides for monetary compensation of damage to livestock caused by mountain lions, and W.S. §§23-3-115 allows property owners or their employees and lessees to kill mountain lions damaging private property, given they immediately notify the nearest game warden of the incident. They may keep the pelt and skull if they purchase a Wyoming game tag. Because of this statute, Wyoming obtains annual information on the number of reported conflicts between mountain lions and domestic livestock and provides compensation for those losses. The number of damage claims submitted to the Department has varied between 1980 and 2005, ranging from under 5 to over 40 (Fig. 7). During that same time period, compensation paid to livestock producers ranged from just over $7,400 to just under $110,000 (Fig. 8). Compensation does not correspond to the number of claims submitted in all years. For example, in fiscal year 2003, 21 damage claims were submitted for payment and only $10,131 was paid to producers compared to 2005 when only 10 claims were submitted that resulted in $39,000 in compensation. This is due primarily to the loss of expensive livestock, primarily horses, in some years.

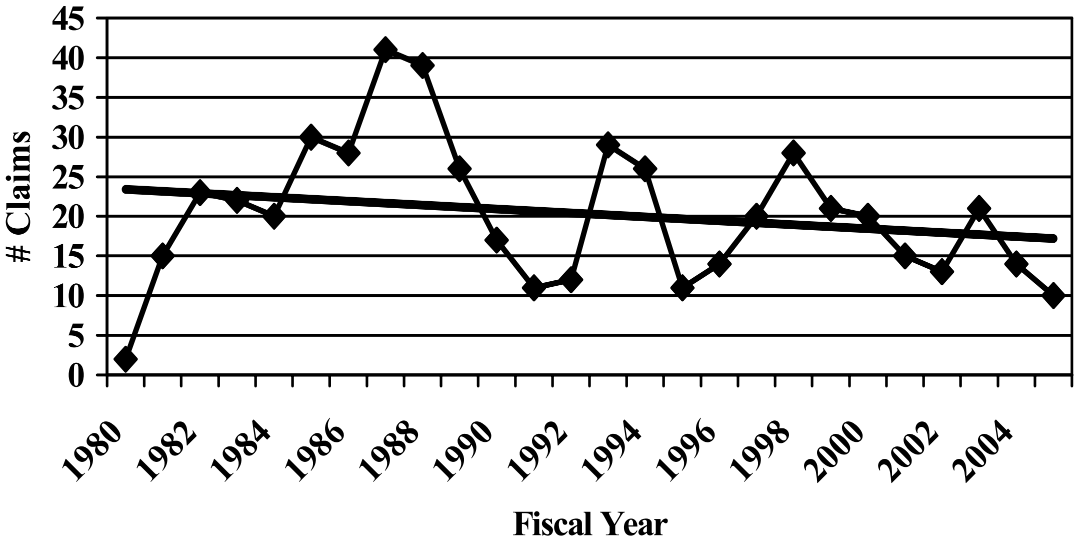


Figure 7. Trend in the number of damage claims submitted for Wyoming mountain lion depredations, fiscal year 1980-2005.

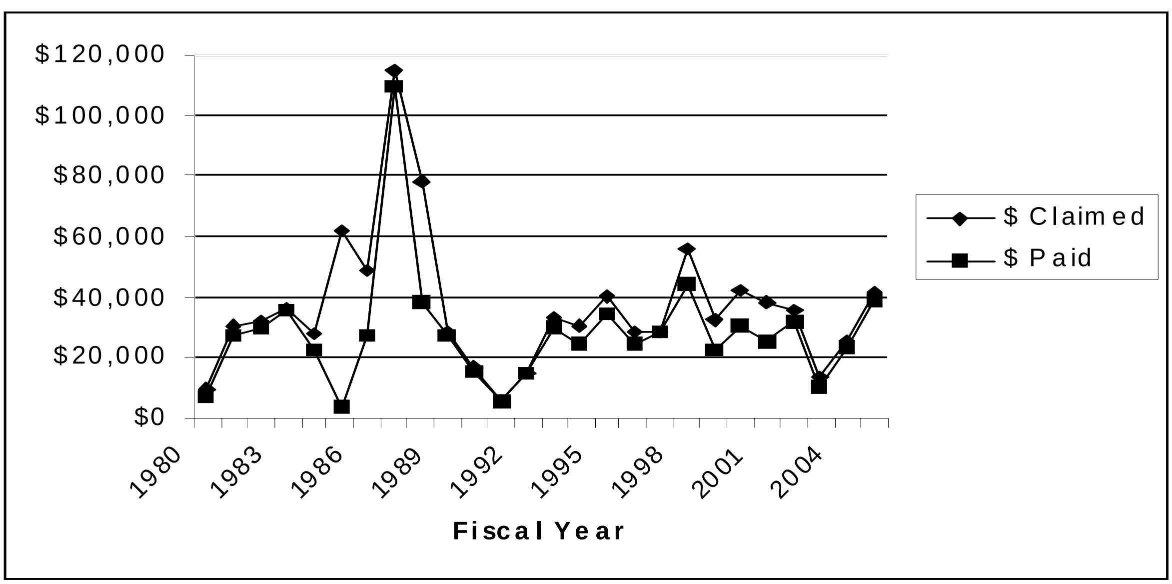


Figure 8. Mountain lion damage claims versus payments to livestock producers in Wyoming, fiscal year 1980-2005.

Although Wyoming Statute allows for the take of mountain lions depredating livestock, mountain lions also have aesthetic value, trophy value, and removal costs that should be considered when making removal decisions (Lindzey 1987). In Wyoming, there are currently 2 approaches to reduce mountain lion damage including (1) remove the offending mountain lion and (2) increase take through sport hunting. Removal of individuals appears to be more accepted by the public than overall population reductions (Gasson and Moody 1995). Killing the offending mountain lion has been successful as a short-term solution, but livestock losses may eventually continue in the future where livestock remain in mountain lion habitat. Conversely, attempting to reduce mountain lion populations also does not appear to entirely resolve the depredation issue because it is usually very difficult to maintain a reduction program that is sufficient to reduce a population to the level required to reduce depredations. Public acceptance of such a program may or may not be maintained over a sustained period of time. We currently do not know the harvest level or length of time required to reduce lion populations to the point that livestock reductions would be reduced, but the adaptive management approach outlined in this plan will allow evaluation of this issue in the future. Therefore the Department will continue to consider all issues, including livestock depredation, to establish harvest quotas. Mountain lion populations have the ability to rebound from this level of reduction fairly quickly. Lindzey et al. (1992) documented that a population of mountain lions in Utah recovered from a reduction of approximately 42% in only 9 months. Similarly, mountain lion populations recovered from comparable reductions in New Mexico and Wyoming in 31 and 36 months, respectively (Logan and Sweanor 2001, Anderson and Lindzey 2005). Licensed hunters are occasionally directed to areas with damage in hopes of removing problem individuals, but agency personnel, either the Department of Agriculture's APHIS-Wildlife Services or the Wyoming Game & Fish Department, do most individual removals.

Management actions that target mountain lions that are a potential threat to human safety or cause livestock damage normally result in the lethal removal of the offending mountain lion. Current protocols provide agency personnel with a variety of options to address conflicts ranging from no action to relocation of the offending animal to lethal removal. Agency personnel respond and resolve incidents based on site-specific conditions. The Department will continue to document incident circumstances and outcomes.

Reducing non-harvest mortality should allow for increased hunter opportunity through season/quota regulations. Nevertheless, in most instances agency removal of specific individuals will be necessary to resolve specific depredation incidents. Striving for removal of only responsible individuals should help minimize losses, increase public acceptance, and maintain hunter opportunity.

Mountain Lion - Human Interactions

Interactions between humans and mountain lions have increased during the last 2 decades throughout most of the western United States and Canada (Beier 1991). Although mountain lion attacks are extremely rare, there were 9 fatal and at least 44 non-fatal attacks reported in North America between 1890 and 1990 (Beier 1991). The majority (66%) of the humans attacked were either unsupervised children or lone adults. Approximately 30% of the attacks occurred within sight of some type of developed area. Fitzhugh et. al. (2003) updated this information through

2003, and determined an additional 7 fatal and 38 non-fatal attacks had occurred since Beier (1991) published his data. The first recorded physical injury resulting from a human-mountain lion encounter in Wyoming occurred in 2006 near Laramie; fortunately, the injuries were minor. It appears younger-aged males, primarily yearlings, accounted for 42% of the attacks on humans (Beier 1991). Increased mountain lion numbers along with increased recreational use and urbanization of mountain lion habitat has created greater opportunity for mountain lion-human encounters. For example, new homes have been built on traditional mule deer winter range in Boulder County, Colorado, resulting in increased mountain lion sightings along with a dramatic increase in mountain lion predation on domestic pets (Sanders and Halfpenny 1991). Typically, when a mountain lion interacts with another animal, including a human, it determines whether the other animal is either prey or non-prey. If the animal is determined to be non-prey, it might become the target of aggressive behavior as the mountain lion may think the animal is a threat. Humans should attempt to maintain eye contact with an aggressive mountain lion and attempt to increase one's potential size by standing erect. It appears that attacks can be reduced if the mountain lion is aware that you are not a typical prey species. If an attack does occur, humans should fight back as aggressively as possible. Several attacks have been broken off due to this type of response (Fitzhugh et al. 2003). If humans have the ability to observe a mountain lion prior to an attack, they can interpret specific mountain lion behavior to assess the level of threat from the mountain lion (Appendix IV).

Not all mountain lion-human interactions can be avoided and, in some cases, humans do have the opportunity to modify their behavior to reduce the chance of an attack. It is much more effective for humans to modify their behavior than it is for people to modify mountain lion behavior. Guidelines that can reduce the chance of an attack are presented in Appendix V.

The Wyoming Game and Fish Department strives to minimize human conflicts with mountain lions while maintaining sustainable mountain lion populations for ecological, recreational, scientific, and aesthetic purposes. Coordination with county planning boards to minimize conflicts in suitable mountain lion habitats (Anderson et al. in review) should help reduce conflicts.

A "Protocol for Managing Aggressive Wildlife/Human Interactions", which includes mountain lions, was completed in 1999 (Moody et al. 1999). Major components of this protocol include procedures for reporting, documenting, and investigating incidents. This document is designed to aid Wyoming Game and Fish Department personnel in conducting investigations and assure appropriate coordination with other State and/or Federal agencies. Accurate reporting and periodic analysis of this information will improve our understanding of the factors that promote conflicts and how to better address them.

PUBLIC INFORMATION AND EDUCATION EFFORTS

As with all large predators, some aspects of mountain lion management are increasingly controversial. The public is much more cognizant of issues associated with mountain lion management compared to the early 1990s. The Department traditionally relied on public contacts, open houses, and public meetings held in conjunction with season setting meetings to gauge constituent attitudes and values about managed species. This process does not appear to provide a forum that all interest groups are comfortable participating in. The Department will consider alternative methods to engage these segments of the public, such as increased involvement in establishing population management objectives.

The Wyoming Game & Fish Department completed an attitude survey of Wyoming residents to assess public values and attitudes that might influence mountain lion management (Gasson and Moody 1995). No attempt was made to calculate confidence intervals around the survey results. As a result, these data are qualitative indicators of public attitudes. The distribution of the sample by county roughly approximated the distribution of Wyoming's population. Approximately 67% of the respondents reported they hunted at some point in their lives, and over 54% presently engaged in some form of hunting. Less than 9% of the respondents hunted mountain lions, and 65% of mountain lion hunters used dogs to pursue mountain lions. Over 71% of the respondents felt that mountain lions were a benefit to Wyoming. Only 11% felt that mountain lions were not a benefit to the state. Approximately 50% agreed or strongly agreed that mountain lion hunting should continue, while 29% of respondents believed mountain lion hunting should be discontinued, and 57% felt hunting with dogs should be eliminated. However, only 51% of the people surveyed were aware mountain lion hunting was legal in Wyoming, suggesting the Wyoming public may be uninformed about the issues surrounding mountain lion management in the state. Sixty percent of the respondents indicated they would benefit from additional information and education about this species.

Based on the results of this survey it was apparent the Wyoming Game and Fish Department should expand its efforts to educate the public on mountain lion management and provide those interested with the information necessary to aid the Wyoming Game and Fish Commission/Department in future management strategies. The Wyoming Game and Fish Commission/Department recognize the importance of keeping the public informed.

To address these concerns, the Department provided additional information to the public about mountain lion biology, management, and how to avoid conflicts with lions beginning in 1996. One specific publication entitled "Living in Lion Country" was developed and distributed to WGFD Regional offices throughout the state. The Department has worked closely with The Center for Wildlife Information to integrate this material into existing programs that have traditionally focused on grizzly bears. Mountain lion information has been included in the Department's "Living in Lion and Bear Country" workshops that are presented every spring around the state. These workshops include information on grizzly bear, black bear, and mountain lion biology and how to reduce conflicts. An updated public attitude survey would be useful to assess the success of additional information and education efforts implemented since the previous survey in 1995.

Although a species management plan provides direction for the responsible agency, it also provides a concise, complete overview of important issues surrounding the species, which can easily be circulated to the public. Thus, wide circulation of this plan will help inform and educate the public about current mountain lion management topics. Issues can change, as well as attitudes, so periodically surveying public opinion will be necessary, along with education updates following completion of surveys. Collectively, adequate ongoing education and information efforts coupled with periodic public surveys will help the Commission optimally manage mountain lions to address the public trust.

The Department will institute new programs. Additional information will be put on the Game and Fish web site to assist hunters in being able to differentiate sex of individuals. Additional and continued training of Department employees will be implemented to assure personnel who field check harvested lions are adequately trained to determine sex and age.

FUTURE RESEARCH AND MANAGEMENT NEEDS

The adaptive management approach outlined in this plan will provide opportunity to evaluate many of the management needs listed below, while other management needs will likely require additional research efforts. Addressing mountain lion management needs that require additional research efforts will be implemented when and if additional funding becomes available with respect to other management priorities for the Wyoming Game & Fish Department.

Short Term Needs:

- Develop or cooperate with other agencies in the development of vegetation data layers sufficient for application of the mountain lion habitat model in regions of the state where data are currently lacking.
- Further evaluation and refinement of population monitoring techniques.
  - Explore the potential for new approaches that are cost effective and logistically feasible for management application.
  - Evaluate track surveys and helicopter probability sampling for periodically monitoring mountain lion subpopulations the size of hunt areas.
  - Investigate the utility of DNA and camera based mark-recapture methods for estimating mountain lion populations. Explore reliability of different attractants for enticing mountain lions into hair collection or photo detection sites, and evaluate ability of photographic technology to differentiate individual mountain lions from digital photographs.
  - Include hunter effort data from unsuccessful hunters to that collected from successful hunters to better evaluate catch-per-unit-effort indices in evaluating mountain lion population trends.
- Test mountain lion habitat model predictions using independent data sets (e.g., GPS locations) as they become available.
- Monitor success of sink management objectives in reducing human conflicts and depredation incidents.
- Conduct placental analyses from harvested females to confirm accuracy of female age class determination.

Long-Term Needs:

- Identify juxtaposition and amount of source mountain lion habitat necessary to sustain mountain lion populations at landscape scales.

- Evaluate the level at which sink management successfully reduces human conflicts, depredation incidents, and predation impacts to prey populations.
- Develop and evaluate application of simulation models to examine vital rates relative to source-sink mountain lion management.
- Improve knowledge of mountain lion-prey relationships.
- Investigate population dynamics of multi predator-prey systems.
- Investigate potential influences of exploitation on mountain lion population dynamics.

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APPENDIX I. History of mountain lion management regulations in Wyoming.

As in other western states, management in Wyoming became increasingly conservative during the mid 1970s through the early 1990s, primarily to control the number and sex of lions harvested. Emphasis was placed on controlling the take of females until sufficient information was available to warrant increased harvest. Harvest quotas have been increased since that time in an effort to limit population increase in specific portions of the state.

From territorial days to 1973, mountain lions received no legal protection. The earliest statutory reference to mountain lions was in 1882 when the Council and House of Representatives of the Territory of Wyoming enacted Chapter 108, Section 1. This legislation authorized county commissioners to encourage the destruction of wolves (*Canis lupus*), wild cats (i.e., bobcats; *Lynx rufus*), lynx (*Lynx canadensis*), bears (*Ursus* spp.), and mountain lions by offering bounty payments. Although property owners, employees, and lessees are still allowed to kill any mountain lion causing damage to private property, bounty payments are no longer authorized. In 1973, the mountain lion was reclassified from a predator to a trophy game animal. Since then, regulations governing the take of mountain lions have become more restrictive with the establishment of shorter seasons, total mortality quotas, and female sub-quotas.

CHRONOLOGICAL SUMMARY OF MOUNTAIN LION MANAGEMENT REGULATIONS IN WYOMING

1882 The Wyoming Territorial Legislature passed a law authorizing County Commissioners to encourage the destruction of wolves, bobcats, lynx, bears, and mountain lions. The County Fund paid $2.50 for each mountain lion killed. This was the first law authorizing bounty payments for mountain lions.

1884 The bounty payment for mountain lions was raised to $5.00.

1890 The bounty payment was raised to $6.00. The Territorial Legislature passed a law prohibiting the killing of mountain lions outside of the Wyoming Territory. Violation of the law resulted in a penalty ranging from $25.00 to $50.00.

1907 Applications for bounty payments had to be accompanied by an affidavit stating that the person presenting the skin, in said county, and within Wyoming, killed the animal. The animal had to be taken after March 1st. Persons could take predators (mountain lions) within State Game Preserves with the permission of the State Game Warden.

1910-1911 It was unlawful to enter the forest reserves of Wyoming for the purpose of chasing or coursing predators with dogs, unless the dogs were licensed. The license was $1.00 per dog, per calendar year. It was permissible to take mountain lions during closed big game seasons on State Game Preserves with a permit from the State Game Warden.

1913-1914 It was lawful to use dogs on predatory species and on State Game Preserves with permit from State Game Warden.

1915-1916 Game animals could not be used as bait for the purpose of trapping predatory animals within Wyoming.

1917-1972 No changes in mountain lion regulations.

1973 The mountain lion was reclassified from a predator to a trophy game animal.

1974 The first mountain lion hunting season established. The hunt area was considered the entire state. The season ran for the entire calendar year, with a bag limit of 1 mountain lion per season. A license and fee was required, and hunters had to present the pelt and skull to the nearest Wyoming Game and Fish District Office within 10 days of harvest. Hunting with dogs was allowed and females with kittens at side and kittens were protected from harvest. The owner, employees, or lessee of said property could take mountain lions damaging private property.

1978 Mountain lion season ran from September 1—December 31 and January 1—March 31.

1980 Wyoming was divided into 22 hunt areas and 5 LMUs. Mortality quotas (total mountain lions) by hunt area were established. The season ran from September 1 - March 31.

1983 Hunt area 15 was divided into hunt areas 15 and 23.

1985 Hunters must report mountain lion kills within 72 hours to nearest Wyoming Game and Fish District Office or game warden.

1993 The pelt and skull were required to be presented in an unfrozen condition to allow extraction of two premolar teeth for aging, and to allow examination of the pelt to determine sex. Female mortality quotas established in some hunt areas.

1994 Hunt area boundaries revised to more closely correspond with known distribution. A total of 27 hunt areas existed.

1999 Hunt area 26 was eliminated from the Southeast LMU. Hunt area 6 was expanded in its place. Regulations revised to allow for the take of 2 mountain lions per person per year in hunt areas 7 and 21 to assist the Snowy Range mountain lion study. Hunters must purchase an additional license ($15 for resident and $75 for non-resident). Hunt Area 25 added to the southeast LMU.

2000 Hunt area 17 split with hunt area 26 being created in the West LMU to separate the Wyoming Range from the Salt River Range in the Jackson Region. Hunt area 27 added to the areas where two mountain lions can be taken in a calendar year. Biological year for analysis of harvest information changed to September 1–August 31. Hunt area 28 created to address potential harvest and damage on fee title lands within the Wind River Reservation. Hunt area 7 was eliminated from those where 2 mountain lions can be harvested annually.

2001 Hunt area 21 eliminated from those where 2 mountain lions can be harvested annually.

2003 Hunt area 2 in the Jackson region split to address hunter pressure issues. Hunt area 29 established in the southern portion of hunt area 2. Quotas set for three-year cycle to address data assessment issues.

Appendix II. Wyoming mountain lion harvest and harvest quotas, hunter effort for successful mountain lion hunters, and nonharvest-human caused mountain lion mortalities.

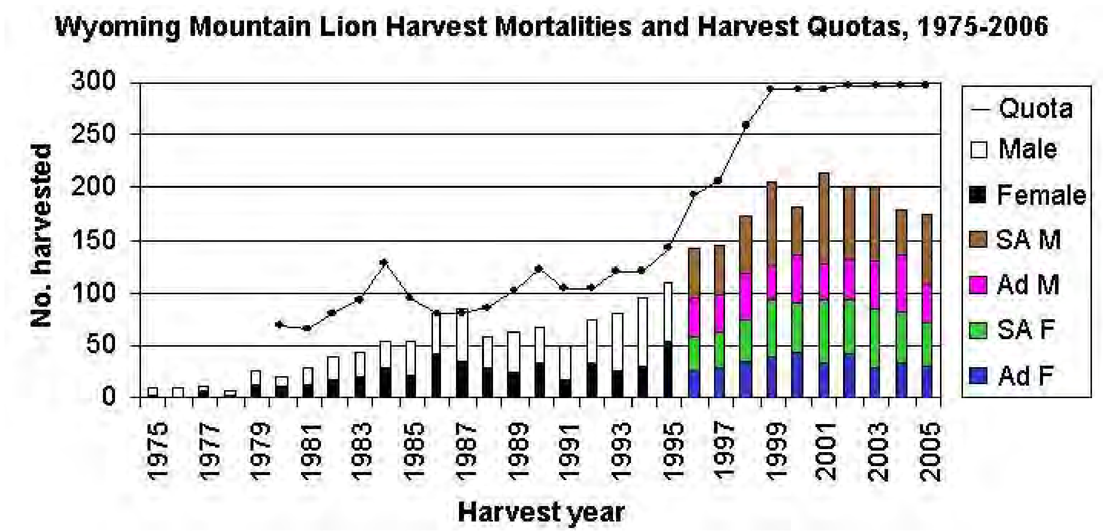


Figure II-1. Wyoming mountain lion harvest mortalities by sex (1975-1995) and age class (subadult = SA, adult = Ad; 1996-2006) and annual harvest quotas (1980-2006). Harvest year represents September of the given year through March of the following year; quotas reported from 1980-1984 were based on calendar year (Jan.-Mar. and Sept.-Dec. of the year reported). No harvest quotas were in place 1975-1979 and for hunt areas 15 and 22 (i.e., the southern Bighorn Mtns.) from 1986-1989.

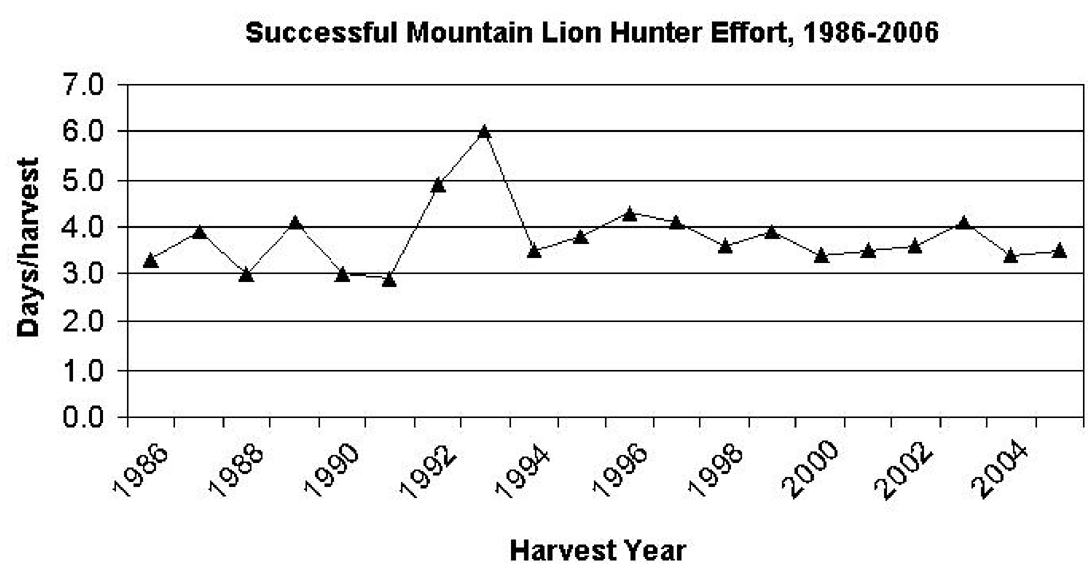


Figure II-2. Hunter effort (average days hunted per harvest) for hunters successfully harvesting a mountain lion, 1986-2006. Harvest year represents September of the given year through March of the following year. Harvest years exceeding 4 days per harvest were primarily due to a single hunter hunting for unusually long periods during the hunting season (e.g., a hunter reported hunting for 90 days in 1993).

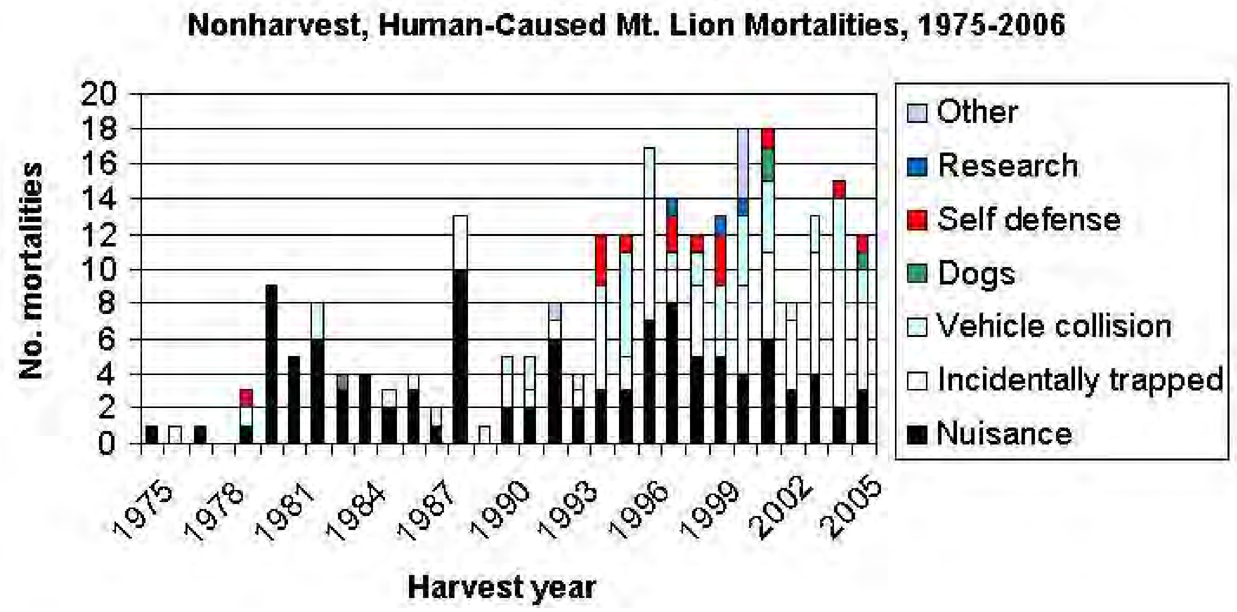
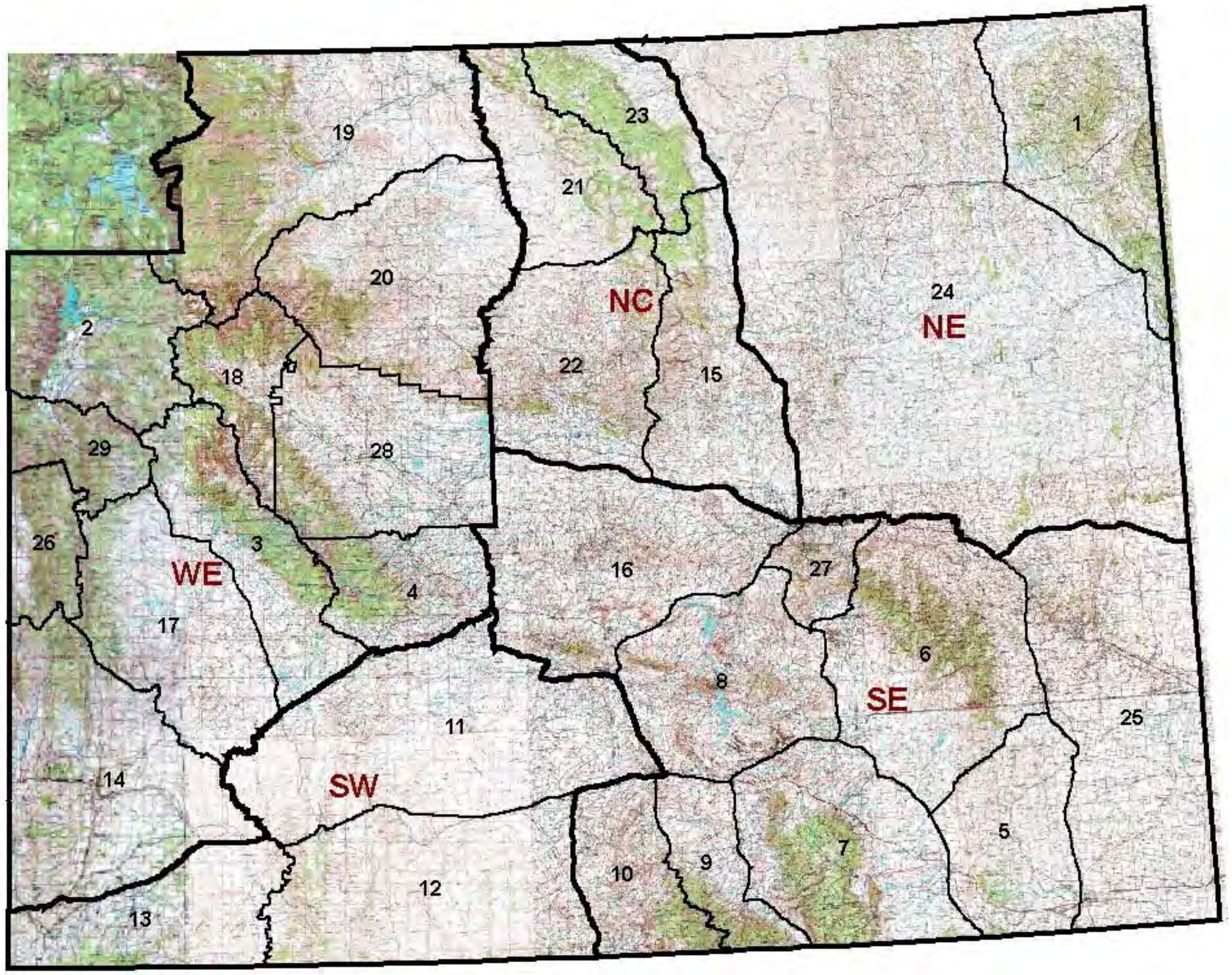


Figure II-3. Nonharvest, human caused mountain lion mortalities by cause reported in Wyoming, 1975-2006. Harvest year represents September of the given year through March of the following year. Other represents an electrocution in 1992 and a family group (1 female with 3 young) illegally poisoned in 2000. Nuisance mortalities include mountain lions depredating livestock or coming into close contact with human residence.



APPENDIX III. Wyoming mountain lion management units and hunt areas (numbered). Mountain lion management units: WE = West, SW = Southwest, SE = Southeast, NE = Northeast, and NC = North central.

APPENDIX IV. Wyoming mountain lion mortality form.

MOUNTAIN LION MORTALITY FORM

Hunt Area ____ Region ____

Date of kill: ______________ TYPE: Legal____; Illegal____; Damage Control____; Other____; Unknown____

If "Other" or "Unknown", probable cause of mortality ______________________________

PERSON WHO HARVESTED LION: Name: ______________________________

Address: ______________________________ City: ______________

State: _____ Zip: ____________ Phone: ______________ Resident: _____ Nonresident: _____

METHODS/EFFORT: Days hunted: _____ Were dogs used? (Y/N) _____ If not, how was lion harvested? ____________

Was a guide/outfitter used? (Y/N): _____ Name: ______________ Dog owner: ______________

Number of lions observed: _____ Were you selective while hunting? (Y/N): _____ Number of lions treed and released: _____

Number of lions that were marked: _____ (Ear tag / tattoo / radio collar frequency : ______________)

Number of fresh tracks not pursued: _____ (How many were single adults?: _____ How many were adults with kittens?: _____)

LOCATION/DRAINAGE: Where was lion harvested? ______________________________

Sec: _____ Twnshp: _____ Rng: _____ UTM Zone: _____ UTM Easting: _________ UTM Northing: __________

SEX AND AGE: Sex: _____ Est. Age: _____

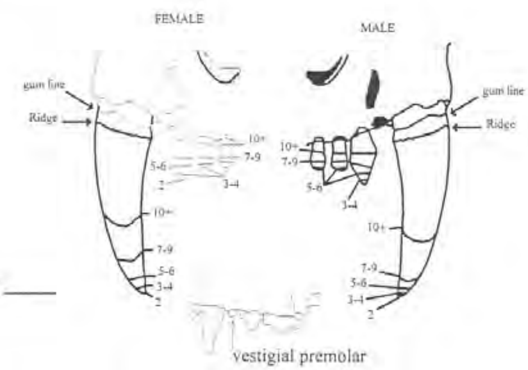
If female, presently lactating? (Y[≥2] / N) _____

Appear to have lactated in past? (Y / N) _____

Canine ridge below gumline? (Y[≥2.5] / N) _____

Any visible spotting on rear legs? (Y[≤3] / N / ?) _____

Visible bars on inside of front legs? (Y[<4] / N / ?) _____



REQUIRED SAMPLES:

Number of teeth collected: 0 1 2 Pictures of teeth (Y/N): _____

Hair/Hide sample (1/2" X 1/2") taken (Y/N): _____

Remarks: ______________________________

____

____

Date record was WOFed: ______________ Date Biological Services Called: ______________

I, ______________________ of ______________________

being duly sworn, depose and say that I am the holder of Wyoming Mountain Lion license # __________,

and lawfully took the above lion on ________ - __________, 20____ in Hunt Area # ________.

Inspected by	Date	Hunter's Signature

Any person who makes a false statement on the registration form regarding the date the mountain lion was taken or the hunt area in which it was taken shall be in violation of this regulation and, such violation shall be punishable as provided by Title 23, Wyoming statutes for violation of Commission regulations.

Note: The person that checked the lion should forward the completed form and all tooth & hair samples to the Regional Office of registration and call Biological Services to update the harvest database. The Regional Office of registration will keep a copy of the completed form and send the original, along with the tooth and hair samples to the Trophy Game Section. Revised 01/04.

Appendix V. Interpretation of mountain lion behaviors arranged in order of increasing risk to a human interacting with the mountain lion. Do not rely solely on these behaviors to assess risk, because mountain lions are ambush predators whose behavior usually is not observed before an attack on a human (from the Cougar Management Guidelines 2005, page 89).

Observation	Interpretation	Human Risk
Opportunistically viewed at distance	Secretive	Low
Flight, hiding	Avoidance	Low
Lack of attention, various movements not directed toward person	Indifference, or actively avoiding inducing aggression	Low
Various body positions, ears up, may be shifting positions, intent attention, following behavior.	Curiosity	Low-provided human response is appropriate
Intense staring, following and hiding behavior	Assessing success of attack	Moderate
Hissing, snarling, vocalization	Defensive behaviors, attack may be imminent	Moderate, depending on distance to animal
Crouching, tail twitching, intense staring, ears flattened like wings, body low to ground, head may be up	Pre-attack	High
Ears flat, fur out, tail twitching, body and head low to ground, rear legs "pumping"	Imminent attack	Very high and immediate

Appendix VI. Some measures, with supporting information, that humans can take during an encounter to prevent injury (from the Cougar Management Guidelines 2005, page 93).

Recommendations	Supporting Information
Keep children under close control, and in view. Pick up small children immediately if you Encounter a mountain lion. Do not hike alone.	60% of victims have been unsupervised children or lone adults.
Do not run.	Running and quick movements may Stimulate chasing and catching response.
Stand. Wave your arms. Raise jacket over your Head. Appear as large as possible. Move to higher ground if nearby. Throw sticks, rocks, or other objects if within reach and accessible without bending to low.	Prey size vulnerability, and "positioning" influences mountain lion response.
Avoid dead animals and never approach kittens. Talk calmly. Back away.	Non-prey may be attacked if viewed as a threat.
Maintain eye contact. Do not look away. But if mountain lion appears agitated use peripheral vision to keep track if its location.	Eye-to-eye contact often restrains large cats. Direct eye contact from prey may inhibit predatory action.
Be alert to your surroundings.	Cats exploit all vantage points/cover when investigating prey.
If attacked, fight back. Humans have successfully deterred attacks by becoming aggressive.	A cat grasps with its teeth only if it meets with no resistance. Violently struggling Prey may be released.
Secure pets and hobby animals in predator proof enclosures between dusk and dawn. Keep pets on leashes and off trails in the backcountry.	Domestic prey animals may sustain mountain lion populations at unnaturally high levels.
Keep garbage under control to avoid attracting raccoons, skunks, etc. Do not feed pets outside and remove extra feed from domestic animal pens. Do not feed wildlife.	Mountain lions may be attracted to concentrations of potential prey.
A mountain lion that treats humans as prey is a public safety threat.	Once a learned behavior develops it may not be possible to modify this behavior.
Mountain lions that enter yards or campsites to kill pets may be candidates for removal. Keep pets under control.	Once a learned behavior develops it may not be modifiable.

May 9, 2019

Table 1. Annual Bear Mortality Statistics 2001-19, New Mexico Department of Game and Fish

	Sport Harvest			**Depredation Kill**			**Other (road kill, accident, etc.)**				
Black Bear	Female	Male	Unknown*	Female	Male	Unknown	Female	Male	Unknown	**Total**	**% Female**
2001-02	213	318	3	8	38	1	6	9	0	596	38.2%
2002-03	271	397	6	13	33	2	8	15	0	745	39.7%
2003-04	167	255	1	5	13	0	10	7	1	459	39.7%
2004-05	78	154	1	2	1	0	2	8	0	246	33.3%
2005-06	103	168	0	8	9	0	2	4	0	294	38.4%
2006-07	112	210	3	4	15	0	2	10	1	357	33.3%
2007-08	105	226	0	7	14	0	3	13	0	368	31.3%
2008-09	86	189	0	2	31	0	6	19	0	333	28.2%
2009-10	119	238	0	2	19	0	5	15	0	398	31.7%
2010-11	104	223	0	13	43	0	8	12	0	403	31.1%
2011-12	189	287	2	62	179	1	17	37	3	777	34.7%
2012-13	221	347	0	29	59	2	18	34	4	714	37.9%
2013-14	219	325	1	47	125	1	27	29	4	778	37.7%
2014-15	190	283	2	10	39	0	9	19	7	559	37.2%
2015-16	169	244	0	11	23	1	4	16	0	468	39.3%
2016-17	154	284	0	9	39	2	7	6	0	501	33.9%
2017-18	178	305	2	23	60	2	16	35	3	624	34.8%
2018-19	188	308	0	14	54	0	11	23	2	600	35.5%

*Unknown, sometimes the sex is impossible to determine due to decomposition or physical damage.

Table 1. Black Bear Mortality in New Mexico, 2012, New Mexico Department of Game and Fish.

		Sport Harvest			Depredation			Road Kill/Other			
Zone	**Game Management Units**	**Fem**	**Male**	**Unk***	**Fem.**	**Male**	**Unk**	**Fem.**	**Male**	**Unk**	**Totals**
1	4 - 7, 51, 52	43	85	0	9	12	0	2	6	1	158
2	2	0	0	0	0	0	0	0	0	0	0
3	48 - 50, 53	15	30	0	8	3	0	1	2	0	59
4	45, 46	29	69	0	2	5	0	2	7	1	114
5	54, 55	31	20	0	0	8	0	3	9	1	74
6	41 - 43, 47, 59	3	5	0	0		0	2	2	0	12
7	56, 57, 58	12	11	0	2	1	0	1	2	0	29
8	8	1	0	0	1	1	0	2	1	0	6
9	9, 10	6	11	0	1	3	0	2	0	0	23
10	12, 13, 15 - 18, 20 - 24, 26, 27	48	76	0	3	14	1	1	3	0	145
11	37, 38	5	7	0	0	1	0	0	1	0	14
12	34	11	19	0	0	3	1	0	0	0	34
13	36	12	13	0	2	4	0	1	0	0	32
14	14	5	1	0	1	4	0	1	1	1	14
		221	347	0	29	59	2	18	34	4	714

*Unk – Unknown, sometimes the sex is impossible to determine due to decomposition or physical damage.

Table 2. Black Bear Mortality in New Mexico, 2013, New Mexico Department of Game and Fish.

		Sport Harvest			Depredation			Road Kill/Other			
Zone	**Game Management Units**	**Fem**	**Male**	**Unk***	**Fem**	**Male**	**Unk**	**Fem**	**Male**	**Unk**	**Totals**
1	4 - 7, 51, 52	47	81	1	5	12	1	5	2	0	154
2	2	3	2	0	0	0	0	0	0	0	5
3	48 - 50, 53	15	16	0	3	12	0	1	0	0	47
4	45, 46	28	42	0	5	18	0	3	7	0	103
5	54, 55	15	24	0	7	21	0	3	3	2	75
6	41 - 43, 47, 59	6	13	0	0	3	0	0	1	0	23
7	56, 57, 58	11	11	0	4	7	0	1	5	0	39
8	8	1	0	0	6	11	0	9	2	0	29
9	9, 10	10	14	0	0	6	0	1		0	31
10	12, 13, 15 - 18, 20 - 24, 26, 27	52	84	0	6	22	0	2	4	0	170
11	37, 38	6	14	0	0	2	0	0	0	0	22
12	34	10	4	0	0	2	0	0	0	0	16
13	36	11	16	0	6	4	0	1	1	0	39
14	14	4	4	0	5	4	0	1	5	2	25
		219	325	1	47	125	1	27	29	4	778

Table 3. Black Bear Mortality in New Mexico, 2014, New Mexico Department of Game and Fish.

		Sport Harvest			Depredation			Road Kill/Other			
Zone	**Game Management Units**	**Fem**	**Male**	**Unk***	**Fem**	**Male**	**Unk**	**Fem**	**Male**	**Unk**	**Totals**
1	4 - 7, 51, 52	44	85	1	1	2	0	0	0	0	133
2	2	2	3	0	0	0	0	0	0	0	5
3	48 - 50, 53	18	19	0	0	2	0	0	1	0	40
4	45, 46	20	21	0	1	3	0	1	5	0	51
5	54, 55	15	7	0	2	8	0	2	6	1	41
6	41 - 43, 47, 59	2	4	0	0	1	0	0	1	0	8
7	56, 57, 58	10	22	0	2	3	0	1	0	1	39
8	8	0	1	0	0	0	0	1	0	0	2
9	9, 10	12	6	0	0	2	0	2	2	3	27
10	12, 13, 15 - 18, 20 - 24, 26, 27	39	79	1	2	13	0	1	2	0	137
11	37, 38	5	11	0	0	0	0	0	1	0	17
12	34	13	8	0	1	1	0	1	1	1	26
13	36	5	12	0	1	4	0	0	0	0	22
14	14	5	5	0	0	0	0	0	0	1	11
		190	283	2	10	39	0	9	19	7	559

Table 4. Black Bear Mortality in New Mexico, 2015, New Mexico Department of Game and Fish.

		Sport Harvest			Depredation			Road Kill/Other			
Zone	**Game Management Units**	**Fem**	**Male**	**Unk***	**Fem**	**Male**	**Unk**	**Fem**	**Male**	**Unk**	**Totals**
1	4 - 7, 51, 52	59	82	0	4	4	1	1	4	0	155
2	2	4	3	0	0	0	0	0	0	0	7
3	48 - 50, 53	11	21	0	0	1	0	0	0	0	33
4	45, 46	9	17	0	0	0	0	0	4	0	30
5	54, 55	10	7	0	0	7	0	1	2	0	27
6	41 - 43, 47, 59	3	1	0	0	1	0	0	3	0	8
7	56, 57, 58	8	6	0	1	4	0	1	0	0	20
8	8	1	0	0	0	1	0	0	0	0	2
9	9, 10	9	7	0	1	1	0	0	2	0	20
10	12, 13, 15 - 18, 20 - 24, 26, 27	34	62	0	1	0	0	0	1	0	98
11	37, 38	8	8	0	0	0	0	0	0	0	16
12	34	8	20	0	0	1	0	0	0	0	29
13	36	5	5	0	2	3	0	1	0	0	16
14	14	0	5	0	2	0	0	0	0	0	7
		169	244	0	11	23	1	4	16	0	468

Table 5. Black Bear Mortality in New Mexico, 2016, New Mexico Department of Game and Fish.

		Sport Harvest			Depredation			Road Kill/Other			
Zone	**Game Management Units**	**Fem**	**Male**	**Unk***	**Fem**	**Male**	**Unk**	**Fem**	**Male**	**Unk**	**Totals**
1	4 - 7, 51, 52	43	95	0	4	7	0	3	1	0	153
2	2	4	3	0	1	0	0	0	0	0	8
3	48 - 50, 53	13	14	0	0	0	0	0	0	0	27
4	45, 46	13	8	0	0	5	0	0	1	0	27
5	54, 55	7	14	0	0	8	0	1	2	0	32
6	41 - 43, 47, 59	2	2	0	0	2	0	1	0	0	7
7	56, 57, 58	5	26	0	0	2	0	1	0	0	34
8	8	0	0	0	0	0	0	0	0	0	0
9	9, 10	10	8	0	1	3	2	1	0	0	25
10	12, 13, 15 - 18, 20 - 24, 26, 27	29	69	0	0	8	0	0	2	0	108
11	37, 38	9	8	0	1	0	0	0	0	0	18
12	34	8	22	0	2	1	0	0	0	0	33
13	36	5	11	0	0	3	0	0	0	0	19
14	14	6	4	0	0	0	0	0	0	0	10
		154	284	0	9	39	2	7	6	0	501

Table 6. Black Bear Mortality in New Mexico, 2017, New Mexico Department of Game and Fish.

		Sport Harvest			Depredation			Road Kill/Other			
Zone	**Game Management Units**	**Fem**	**Male**	**Unk***	**Fem**	**Male**	**Unk**	**Fem**	**Male**	**Unk**	**Totals**
1	4 - 7, 51, 52	25	45	0	1	7	1	3	6	1	89
2	2	4	12	0	0	3	0	1	3	0	23
3	48 - 50, 53	10	32	0	4	5	0	2	1	1	55
4	45, 46	18	21	0	4	3	0	1	4	0	51
5	54, 55	12	18	0	8	12	0	1	7	0	58
6	41 - 43, 47, 59	3	8	0	0	2	0	2	3	1	19
7	56, 57, 58	12	19	0	3	7	0	4	6	0	51
8	8	0	0	0	0	1	0	1	3	0	5
9	9, 10	8	8	0	0	1	0	0	1	0	18
10	12, 13, 15 - 18, 20 - 24, 26, 27	57	96	1	1	10	1	0	1	0	167
11	37, 38	6	16	0	0	0	0	0	0	0	22
12	34	13	16	1	0	1	0	0	0	0	31
13	36	2	11	0	0	4	0	0	0	0	17
14	14	8	4	0	2	4	0	0	0	0	18
		178	305	2	23	60	2	16	35	3	624

Table 7. Black Bear Mortality in New Mexico, 2018, New Mexico Department of Game and Fish.

		Sport Harvest			Depredation			Road Kill/Other			
Zone	**Game Management Units**	**Fem**	**Male**	**Unk***	**Fem**	**Male**	**Unk**	**Fem**	**Male**	**Unk**	**Totals**
1	4 - 7, 51, 52	44	77	0	4	6	0	0	2	0	133
2	2	1	4	0	0	0	0	0	0	0	5
3	48 - 50, 53	10	16	0	0	2	0	1	0	0	29
4	45, 46	20	30	0	3	8	0	3	3	1	68
5	54, 55	9	12	0	1	5	0	2	2	0	31
6	41 - 43, 47, 59	2	3	0	0	4	0	0	4	1	14
7	56, 57, 58	11	19	0	1	6	0	1	4	0	42
8	8	0	2	0	0	4	0	1	2	0	9
9	9, 10	8	12	0	0	1	0	0	1	0	22
10	12, 13, 15 - 18, 20 - 24, 26, 27	54	89	0	2	9	0	1	3	0	158
11	37, 38	8	13	0	0	1	0	0	0	0	22
12	34	13	19	0	3	5	0	0	1	0	41
13	36	4	9	0	0	0	0	0	0	0	13
14	14	4	3	0	0	3	0	2	0	0	12
None	GMU 32	0	0	0	0	0	0	0	1	0	1
		188	308	0	14	54	0	11	23	2	600

10/24/16

Bear Population and Harvest Management Matrix (2016-17 through 2019-20)

Zone	Game Management Units	Estimated Primary black bear habitat[a] (km²)	Bear population point estimate [b]	Population Density (bears/100 km²)	% Harvest	Harvest Limit[c] (Female Harvest Limit) 2016/17 – 2019/20
1	4, 5, 6, 7, 51, 52	9,296	1,580	17	10%	158 (63)
2	2	880	150	17	10%	15 (6)
3	49, 50, 53	2,109	544	17 + 21.5	12%	65 (26)
4	45, 46, 48	5,778	1,093	18.6 + 23.4	10%	109 (43)
5	54, 55	4,723	919	21.5	10%	92 (37)
6	39, 40, 41, 42, 43, 47, 59	4,689	328	7	10%	33 (13)
7	56, 57, 58	1,645	354	21.5	10%	35 (14)
8	8	719	132	18.4	8%	11 (4)
9	9, 10	2,963	356	13.2	10%	36 (14)
10	12, 13, 15, 16, 17, 18, 20, 21, 22, 23, 24, 26, 27	15,488	1,456	9.4	10%	146 (58)
11	37, 38	1,811	360	19.9	10%	36 (14)
12	34	2,428	325	13.4	10%	33 (13)
13	36	1,184	159	13.4	10%	16 (6)
14	14	1,267	233	18.4	8%	19 (7)
Totals		**54,793**	**7,989**			**804 (318)**

[a] Population estimates are based solely on primary habitat and do not include Secondary or Edge habitats.
[b] The bear population estimate was derived from the NM Bear Study (Costello et al. 2001) and Gould et al. (2016) does not include populations on most tribal jurisdictions.
[c] All BMZs will close when a number 10% below the harvest limit or female harvest limit is reached, whichever comes first. Only sport harvest is included in the harvest limit.

Bear Zone Closures

	2012	2013	2014	2015	2016	2017	2018
1	Oct. 10	Oct. 10	Oct. 7	Oct. 16			
2	Sept. 25			Oct. 19		Oct 30	
3	Sept. 4	Sept. 3					
4							
5							
6		Oct. 3					
7	Aug. 24	Aug 23	Oct. 14	Aug. 25	Aug 25	Aug 25	Aug 24
8	Sept. 7	Oct. 9		Sept. 10			
9		Oct. 15	Oct. 9				
10	Sept. 17	Sept. 25	Nov. 5			Nov 9	Oct 15
11	Aug. 21	Aug. 23	Aug. 26	Oct. 5	Nov 14		
12	Sept. 13	Aug. 23	Oct. 7	Sept. 26	Oct 31	Oct 5	Sept 26
13		Oct. 7					
14	Oct. 19	Oct. 28	Oct. 29	Oct. 21	Nov 3	Oct 20	

Table 1. Annual Cougar Mortality Statistics 2001-2019, New Mexico Department of Game and Fish

	Sport Harvest			**Depredation Kill**			**Bighorn Sheep Protection**			**Other (road kill, accident, etc.)**				
License Year	Fem	Male	Unk[a]	Fem	Male	Unk	Fem	Male	Unk	Fem	Male	Unk	**Total**	**% Female**
2001-02	76	110	0	3	3	1	5	6	0	3	0	2	209	41.2%
2002-03	82	120	1	14	13	1	14	11	0	6	3	2	267	43.4%
2003-04	84	114	0	17	5	0	5	12	0	3	2	0	242	45.0%
2004-05	72	89	0	16	16	1	3	8	0	4	0	0	209	46.3%
2005-06	34	72	0	5	5	0	6	8	0	1	3	0	134	34.8%
2006-07	82	95	0	11	13	1	8	10	0	3	1	0	224	46.7%
2007-08	59	104	0	13	13	0	3	8	0	1	1	0	202	37.6%
2008-09	50	72	0	5	11	0	4	11	0	4	1	0	158	39.9%
2009-10	55	103	0	7	11	0	8	7	0	1	5	0	197	36.0%
2010-11	57	110	1	1	3	0	8	6	0	5	5	0	196	36.2%
2011-12	75	123	0	14	7	0	4	8	0	5	7	0	243	40.2%
2012-13	87	170	0	14	6	0	7	23	0	4	5	1	317	35.3%
2013-14	85	117	1	12	12	0	5	12	0	5	4	0	253	42.4%
2014-15	102	130	0	12	10	1	8	10	0	4	7	0	284	44.8%
2015-16	88	151	0	14	9	0	6	5	1	7	13	0	294	39.1%
2016-17[b]	89	154	1	15	6	0	5	12	0	7	9	2	300	38.7%
2017-18[c]	94	143	1	10	10	0	9	10	0	5	9	1	292	40.4%
2018-19[d]	117	227	0	14	11	0	5	22	0	5	6	2	409	34.5%

[a] Unk – Unknown, sometimes the sex is impossible to determine due to decomposition or physical damage.

[b] Four cougars were lawfully harvested by trapping, on private lands, as sport harvests during the 2016-17 season as allowed under the 2016-2020 Bear and Cougar Rule.

[c] Twenty cougars were lawfully harvested by trapping, on private or state trust lands, as sport harvests during the 2017-18 season as allowed under the 2016-2020 Bear and Cougar Rule.

[d] Thirteen cougars were lawfully harvested by trapping, on private or state trust lands, as sport harvests during the 2018-19 season as allowed under the 2016-17-2019-20 Bear and Cougar Rule.

Table 1. Cougar Mortality in New Mexico, 2012-13, New Mexico Department of Game and Fish.

		Sport Harvest			Depredation			Road Kill/Other			Bighorn Sheep Removal			
Zone	**GMUs**	**Fem**	**Male**	**Unk***	**Fem**	**Male**	**Unk**	**Fem.**	**Male**	**Unk**	**Fem**	**Male**	**Unk**	**Totals**
A	2, 7	9	15	0	0	0	0	0	0	0	0	0	0	24
B	5, 50, 51	6	17	0	0	0	0	0	0	0	0	0	0	23
C	43,45,46, 48, 49, 53	13	21	0	3	0	0	0	1	0	0	0	0	38
D	41, 42, 47, 59	4	8	0	1	1	0	1	1	0	0	0	0	16
E	9, 10	0	4	0	0	0	0	0	0	0	0	0	0	4
F	6	11	8	0	0	0	0	1	0	0	0	0	0	20
G	13, 17, 18	4	6	0	0	0	0	0	0	0	1	1	0	12
H	19, 20	0	0	0	0	0	0	0	0	0	3	4	0	7
I	36-38	4	10	0	1	0	0	1	1	0	0	0	0	17
J	15, 16, 21, 25	9	26	0	1	0	0	0	2	0	0	2	0	40
K	22-24	8	9	0	3	5	0	0	0	0	1	11	0	37
L	26, 27	0	2	0	0	0	0	0	0	0	2	4	0	8
M	31-33, 39, 40	5	1	0	0	0	0	0	0	0	0	0	0	6
N	4, 52	4	4	0	0	0	0	0	0	0	0	0	0	8
O	12	1	4	0	0	0	0	0	0	0	0	0	0	5
P	56-58	1	5	0	0	0	0	0	0	0	0	0	0	6
Q	28-30, 34	2	7	0	2	0	0	0	0	0	0	0	0	11
R	54, 55	4	19	0	3	0	0	0	0	1	0	0	0	27
S	8, 14	2	4	0	0	0	0	1	0	0	0	1	0	8
	Totals	87	170	0	14	6	0	4	5	1	7	23	0	317

*Unk – Unknown, sometimes the sex is impossible to determine due to decomposition or physical damage.

May 13, 2019

Table 2. Cougar Mortality in New Mexico, 2013-14, New Mexico Department of Game and Fish.

		Sport Harvest			Depredation			Road Kill/Other			Bighorn Sheep Removal			
Zone	**GMUs**	**Fem**	**Male**	**Unk***	**Fem**	**Male**	**Unk**	**Fem.**	**Male**	**Unk**	**Fem**	**Male**	**Unk**	**Totals**
A	2, 7	11	8	0	0	0	0	0	0	0	0	0	0	19
B	5, 50, 51	7	10	0	2	0	0	0	0	0	0	0	0	19
C	43,45,46, 48, 49, 53	7	17	1	0	0	0	1	1	0	0	0	0	27
D	41, 42, 47, 59	4	8	0	2	3	0	0	0	0	0	0	0	17
E	9, 10	5	2	0	1	0	0	0	1	0	0	0	0	9
F	6	4	5	0	0	0	0	1	0	0	0	0	0	10
G	13, 17, 18	5	3	0	0	0	0	0	0	0	1	2	0	11
H	19, 20	0	0	0	0	0	0	0	0	0	1	0	0	1
I	36-38	7	10	0	1	2	0	1	0	0	0	0	0	21
J	15, 16, 21, 25	12	15	0	1	0	0	1	0	0	0	0	0	29
K	22-24	3	9	0	1	5	0	1	0	0	2	1	0	22
L	26, 27	1	4	0	0	0	0	0	0	0	1	5	0	11
M	31-33, 39, 40	0	1	0	2	1	0	0	0	0	0	0	0	4
N	4, 52	4	1	0	0	0	0	0	1	0	0	0	0	6
O	12	0	1	0	0	0	0	0	0	0	0	0	0	1
P	56-58	3	7	0	1	1	0	0	1	0	0	0	0	12
Q	28-30, 34	8	6	0	1	0	0	0	0	0	0	0	0	15
R	54, 55	2	8	0	0	0	0	0	0	0	0	0	0	10
S	8, 14	2	2	0	0	0	0	0	0	0	0	4	0	8
	Totals	85	117	1	12	12	0	5	4	0	5	12	0	253

Table 3. Cougar Mortality in New Mexico, 2014-15, New Mexico Department of Game and Fish.

		Sport Harvest			Depredation			Road Kill/Other			Bighorn Sheep Removal			
Zone	**GMUs**	**Fem**	**Male**	**Unk***	**Fem**	**Male**	**Unk**	**Fem.**	**Male**	**Unk**	**Fem**	**Male**	**Unk**	**Totals**
A	2, 7	7	7	0	0	0	0	0	0	0	0	0	0	14
B	5, 50, 51	6	19	0	1	0	0	0	0	0	0	0	0	26
C	43,45,46, 48, 49, 53	17	18	0	1	1	0	0	1	0	0	0	0	38
D	41, 42, 47, 59	3	7	0	0	2	0	0	0	0	0	0	0	12
E	9, 10	4	5	0	1	1	0	0	0	0	0	0	0	11
F	6	4	4	0	0	0	0	1	0	0	0	0	0	9
G	13, 17, 18	6	6	0	0	0	0	0	0	0	1	1	0	14
H	19, 20	0	0	0	0	0	0	0	0	0	1	3	0	4
I	36-38	13	8	0	2	2	0	2	0	0	0	0	0	27
J	15, 16, 21, 25	9	11	0	2	0	0	0	0	0	1	0	0	23
K	22-24	6	13	0	4	1	0	1	1	0	1	4	0	31
L	26, 27	0	1	0	0	0	0	0	0	0	3	1	0	5
M	31-33, 39, 40	1	0	0	0	0	0	0	0	0	0	0	0	1
N	4, 52	0	5	0	0	1	0	0	0	0	0	0	0	6
O	12	1	2	0	0	0	0	0	0	0	0	0	0	3
P	56-58	7	1	0	0	0	0	0	1	0	0	0	0	9
Q	28-30, 34	10	5	0	1	2	1	0	2	0	0	0	0	21
R	54, 55	4	16	0	0	0	0	0	2	0	0	0	0	22
S	8, 14	4	2	0	0	0	0	0	0	0	1	1	0	8
	Totals	102	130	0	12	10	1	4	7	0	8	10	0	284

Table 4. Cougar Mortality in New Mexico, 2015-16, New Mexico Department of Game and Fish.

		Sport Harvest			Depredation			Road Kill/Other			Bighorn Sheep Removal			
Zone	**GMUs**	**Fem**	**Male**	**Unk***	**Fem**	**Male**	**Unk**	**Fem.**	**Male**	**Unk**	**Fem**	**Male**	**Unk**	**Totals**
A	2, 7	10	10	0	0	1	0	1	0	0	0	0	0	22
B	5, 50, 51	2	10	0	0	0	0	0	0	0	0	0	0	12
C	43,45,46, 48, 49, 53	14	14	0	1	0	0	2	0	0	0	0	0	31
D	41, 42, 47, 59	1	4	0	0	2	0	0	0	0	0	0	0	7
E	9, 10	2	6	0	11	1	0	0	0	1	0	0	0	21
F	6	4	6	0	0	0	0	0	0	0	0	0	0	10
G	13, 17, 18	5	12	0	0	1	0	1	0	0	5	4	0	28
H	19, 20	2	1	0	0	1	0	0	1	0	0	5	0	10
I	36-38	8	15	0	0	0	0	0	1	0	0	0	0	24
J	15, 16, 21, 25	12	23	0	0	0	0	0	0	0	0	0	0	35
K	22-24	8	15	0	0	0	0	0	1	0	0	0	0	24
L	26, 27	1	1	0	0	0	0	0	0	0	2	4	0	8
M	31-33, 39, 40	1	3	0	0	1	0	0	0	0	0	0	0	5
N	4, 52	2	4	0	0	0	0	0	0	0	0	0	0	6
O	12	1	3	0	0	0	0	0	0	0	0	0	0	4
P	56-58	3	8	0	1	0	0	0	1	0	0	0	0	13
Q	28-30, 34	9	8	0	0	1	0	0	0	0	0	0	0	18
R	54, 55	1	7	0	1	0	0	2	1	0	0	0	0	12
S	8, 14	2	1	0	1	0	0	0	0	0	0	0	0	4
	Totals	88	151	0	14	9	0	6	5	1	7	13	0	294

Table 5. Cougar Mortality in New Mexico, 2016-17, New Mexico Department of Game and Fish.

		Sport Harvest			Depredation			Road Kill/Other			Bighorn Sheep Removal			
Zone	**GMUs**	**Fem**	**Male**	**Unk***	**Fem**	**Male**	**Unk**	**Fem.**	**Male**	**Unk**	**Fem**	**Male**	**Unk**	**Totals**
A	2, 7	3	9	0	0	0	0	0	0	0	0	0	0	12
B	5, 50, 51	8	14	0	0	0	0	0	0	0	0	0	0	22
C	43,45,46, 48, 49, 53	5	20	0	3	0	0	0	3	0	0	0	0	31
D	41, 42, 47, 59	1	4	0	1	0	0	0	0	0	0	0	0	6
E	9, 10	1	0	0	0	1	0	0	1	0	0	0	0	3
F	6	2	9	0	1	0	0	1	0	0	0	0	0	13
G	13, 17, 18	7	6	0	1	0	0	1	0	0	2	3	0	20
H	19, 20	0	0	0	0	0	0	0	0	0	0	3	0	3
I	36-38	3	11	0	1	1	0	0	1	0	0	0	0	17
J	15, 16, 21, 25	19	29	1	0	1	0	0	0	0	0	0	0	50
K	22-24	15	9	0	1	2	0	0	0	0	0	3	0	30
L	26, 27	2	3	0	0	0	0	0	0	0	3	3	0	11
M	31-33, 39, 40	0	2	0	0	0	0	1	0	0	0	0	0	3
N	4, 52	5	5	0	0	0	0	0	1	1	0	0	0	12
O	12	2	3	0	1	1	0	0	0	0	0	0	0	7
P	56-58	2	11	0	2	0	0	1	0	1	0	0	0	17
Q	28-30, 34	5	8	0	3	0	0	1	0	0	0	0	0	17
R	54, 55	6	10	0	1	0	0	1	2	0	0	0	0	20
S	8, 14	3	1	0	0	0	0	1	1	0	0	0	0	6
	Totals	89	154	1	15	6	0	7	9	2	5	12	0	300

Table 6. Cougar Mortality in New Mexico, 2017-18, New Mexico Department of Game and Fish.

		Sport Harvest			Depredation			Road Kill/Other			Bighorn Sheep Removal			
Zone	**GMUs**	**Fem**	**Male**	**Unk***	**Fem**	**Male**	**Unk**	**Fem.**	**Male**	**Unk**	**Fem**	**Male**	**Unk**	**Totals**
A	2, 7	7	7	0	1	0	0	0	0	0	0	0	0	15
B	5, 50, 51	5	15	0	0	0	0	0	0	0	0	0	0	20
C	43,45,46, 48, 49, 53	8	16	0	0	0	0	1	3	0	0	0	0	28
D	41, 42, 47, 59	6	5	0	0	0	0	0	0	0	0	0	0	11
E	9, 10	2	1	0	0	0	0	0	0	0	0	0	0	3
F	6	4	12	0	1	0	0	0	2	0	0	0	0	19
G	13, 17, 18	3	8	0	0	0	0	0	0	0	3	1	0	15
H	19, 20	2	2	0	0	0	0	0	0	0	2	1	0	7
I	36-38	7	4	0	1	0	0	0	0	0	0	0	0	12
J	15, 16, 21, 25	9	30	0	0	1	0	0	0	0	0	0	0	40
K	22-24	13	12	0	5	5	0	0	1	0	0	4	0	40
L	26, 27	1	2	0	0	0	0	0	0	0	4	4	0	11
M	31-33, 39, 40	3	1	0	0	0	0	0	0	1	0	0	0	5
N	4, 52	3	7	0	0	0	0	1	0	0	0	0	0	11
O	12	1	0	0	0	0	0	0	0	0	0	0	0	1
P	56-58	10	5	0	1	0	0	1	1	0	0	0	0	18
Q	28-30, 34	2	5	0	0	1	0	0	1	0	0	0	0	9
R	54, 55	7	10	0	2	2	0	1	1	0	0	0	0	23
S	8, 14	1	1	1	0	0	0	0	0	0	0	0	0	3
	Totals	94	143	1	10	10	0	5	9	1	9	10	0	292

Table 7. Cougar Mortality in New Mexico, 2018-19, New Mexico Department of Game and Fish.

		Sport Harvest			Depredation			Road Kill/Other			Bighorn Sheep Removal			
Zone	**GMUs**	**Fem**	**Male**	**Unk***	**Fem**	**Male**	**Unk**	**Fem.**	**Male**	**Unk**	**Fem**	**Male**	**Unk**	**Totals**
A	2, 7	9	12	0	0	1	0	0	0	0	0	0	0	22
B	5, 50, 51	10	17	0	0	0	0	0	0	0	0	0	0	27
C	43,45,46, 48, 49, 53	14	33	0	1	1	0	2	0	0	0	0	0	51
D	41, 42, 47, 59	3	5	0	0	0	0	0	1	0	0	0	0	9
E	9, 10	4	3	0	2	0	0	0	0	0	0	0	0	9
F	6	4	16	0	0	0	0	0	1	1	0	0	0	22
G	13, 17, 18	6	21	0	0	1	0	0	0	0	2	9	0	39
H	19, 20	2	1	0	0	0	0	0	0	0	0	2	0	5
I	36-38	7	12	0	0	0	0	0	0	0	0	0	0	19
J	15, 16, 21, 25	22	52	0	0	1	0	0	1	0	0	0	0	76
K	22-24	9	16	0	2	1	0	0	0	0	1	2	0	31
L	26, 27	2	2	0	0	2	0	0	0	0	0	3	0	9
M	31-33, 39, 40	2	2	0	2	0	0	0	0	0	0	0	0	6
N	4, 52	6	4	0	0	0	0	1	0	0	0	0	0	11
O	12	2	3	0	0	0	0	0	0	0	0	0	0	5
P	56-58	5	8	0	2	2	0	0	2	0	0	0	0	19
Q	28-30, 34	4	5	0	0	0	0	0	1	0	2	6	0	18
R	54, 55	5	12	0	4	2	0	2	0	1	0	0	0	26
S	8, 14	1	3	0	1	0	0	0	0	0	0	0	0	5
	Totals	117	227	0	14	11	0	5	6	2	5	22	0	409

10/24/16 – Amended 3/26/18

Cougar Population and Harvest Management Matrix (2016-17 through 2019-20).

Zone	Game Management Units	Estimated Cougar Habitat (km²)[a]	Cougar Population Point Estimate[b]	Cougar Population Management Objectives 2016-2020[c]	2016-20 Total Mortality Limit [d]	2016-20 Female Sub-Limit
A	2, 7	13,728	207-285	Manage for stable cougar populations	42	13
B	5, 50, 51	6,526	142-192		28	8
C	43,45,46, 48, 49, 53	11,482	289-387		85	43
E	9, 10	13,674	251-341		50	15
I	36-38	7,138	121-165		24	7
J	15, 16, 21, 25	22,714	445-603		89	27
M	31-33, 39, 40	21,394	146-215		31	9
N	4, 52	2,801	76-102		15	5
O	12	6,663	103-141		21	6
Q	28, 29, 30, 34	11,752	170-235		35	11
R	54, 55	4,557	131-175		26	8
D	41, 42, 47, 59	6,468	76-106	Manage for decreasing cougar populations	23	12
F[e]	6	6,659	156-209		37	19
G	13, 17	14,422	247-338		73	37
H	18-20	11,878	140-197		42	21
K	22-24	11,299	225-305		66	33
L	26, 27	6,456	64-91		19	10
P	56-58	2,700	49-66		14	7
S	8, 14	4,661	85-116		25	13
Totals:		**186,972**	**3,123-4,269**		749	303

[a]The quantity of the habitat was derived from a model designed by G&F and T. Perry, PhD. The habitat is classed as Excellent, Good, Moderate, and Fair; Excellent has a density of 3.0-4.0/100km2, Good has a density of 1.2-1.7/100km2, Moderate has a density of 0.6-0.9/100km2 and Fair has a density of 0.4-0.5/100km2 adult cougars. Densities derived from studies conducted in New Mexico. 64% of the state is considered cougar habitat, 5% is tribal jurisdiction.

[b]The point estimate total cougar population is used, management objectives and removal/harvest level calculations and may not reflect the true value for the population. The population estimated is that of independent cougars, ≥18 months of age.

[c] Stable = harvest ≤ 17% of total estimated population w/max of 30% female; Stable to decrease = harvest ≤ 25% of total estimated population with ≤ 50% females.

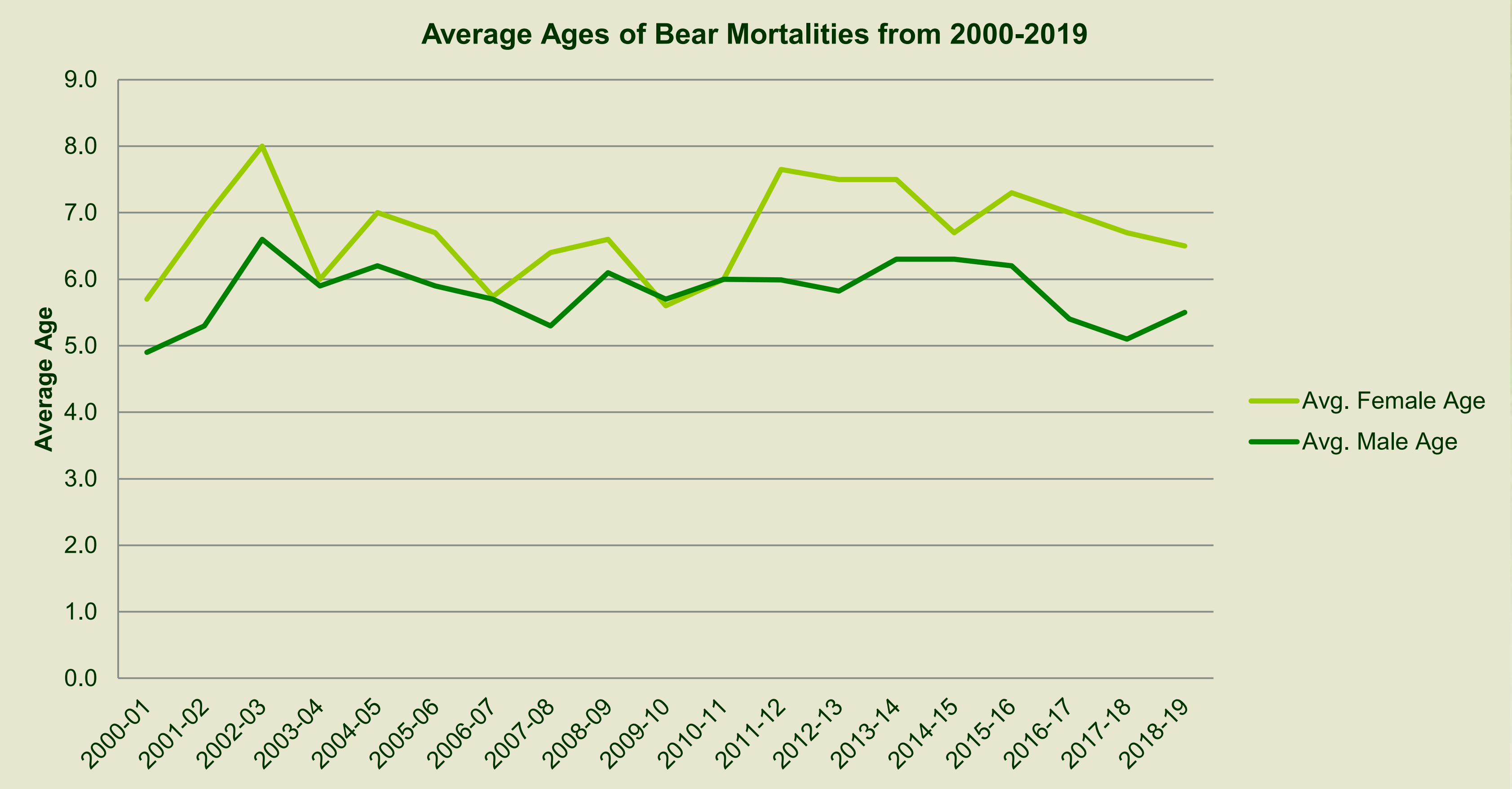
[d] 90% of Total mortality limit and/or female sub-limit will close harvest in any zone, whichever occurs first.

[e] Amended March 26, 2018 in Cougar Management Zone F from 46/23 to 37/19, a 20% reduction based on new research.

Cougar Zone Closures

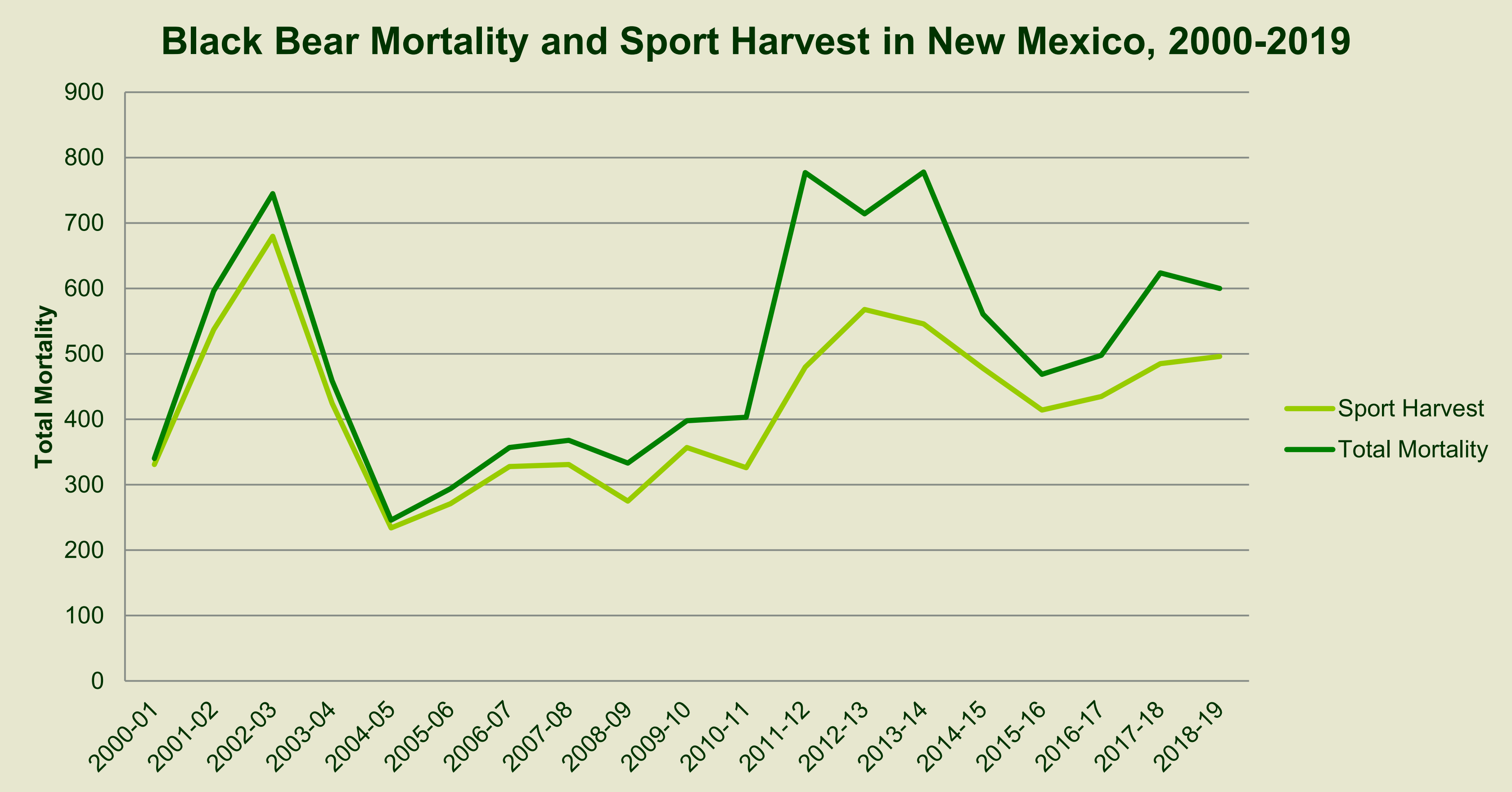
	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19
A		Mar 17		No zones			
B		Jan 6	Jan 29	Closed		Feb 22	Jan 2
C				this			
D				season			
E							
F							
G							
H							
I			Jan 5			Jan 24	Dec 31
J							
K							
L							
M							
N	Feb 15	Dec 17			Jan 17	Feb 22	Dec 17
O							
P			Dec 29		Jan 13	Feb 13	Jan 4
Q			Feb 15				
R						Mar 9	
S							

Bear Age at Mortality

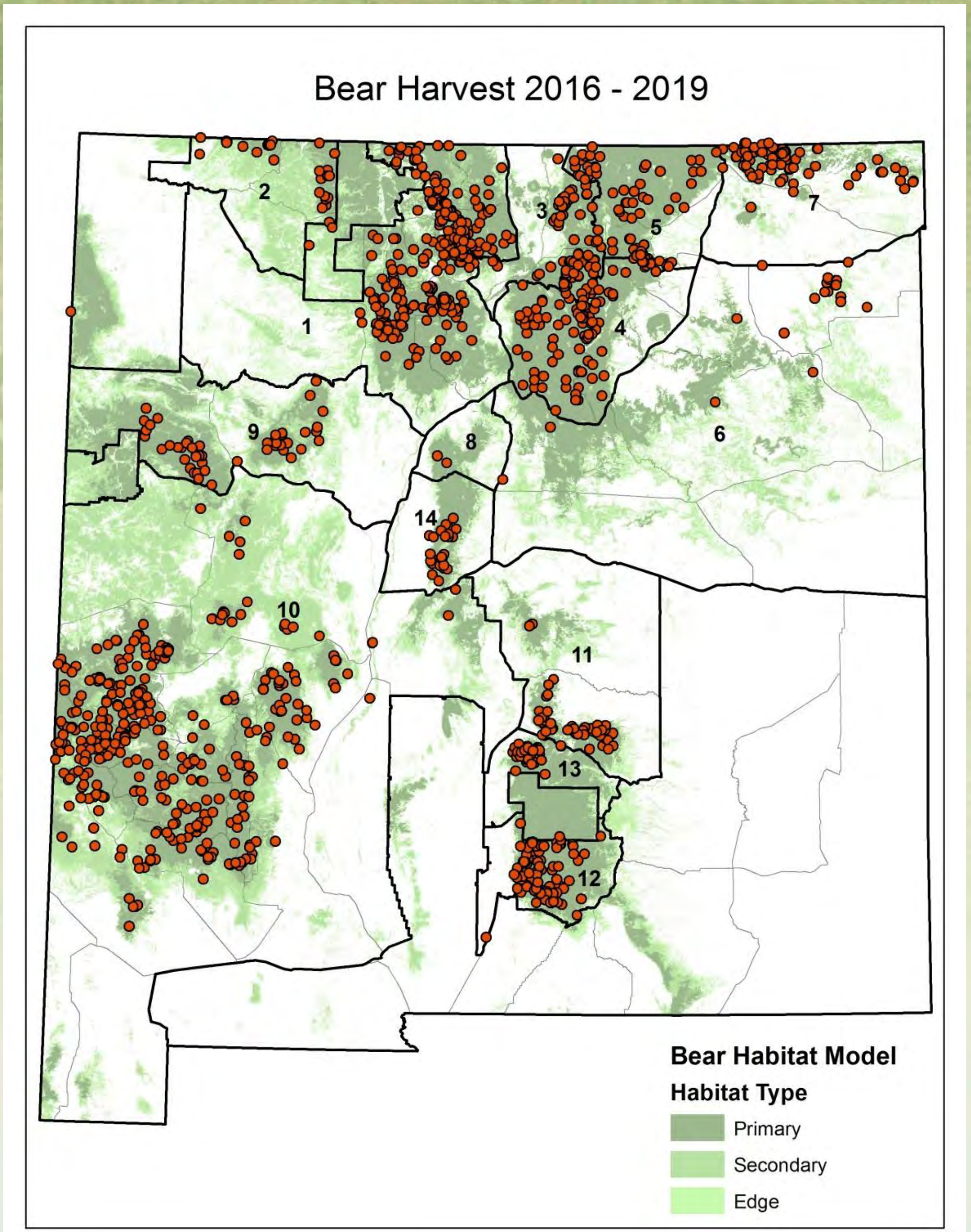


Wildlife Management Division

Bear Harvest

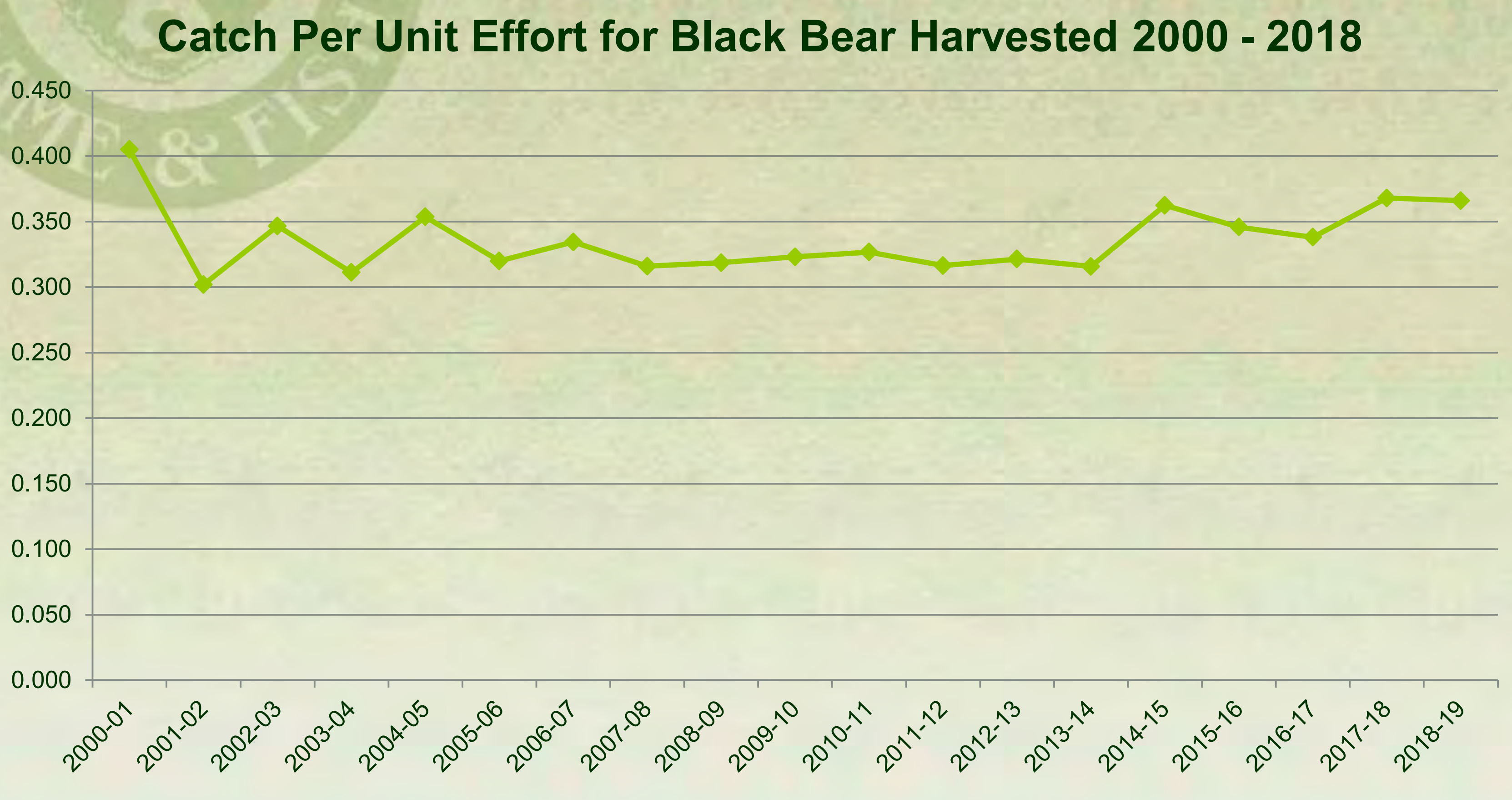


Wildlife Management Division



Wildlife Management Division

Bear – Catch Per Unit Effort



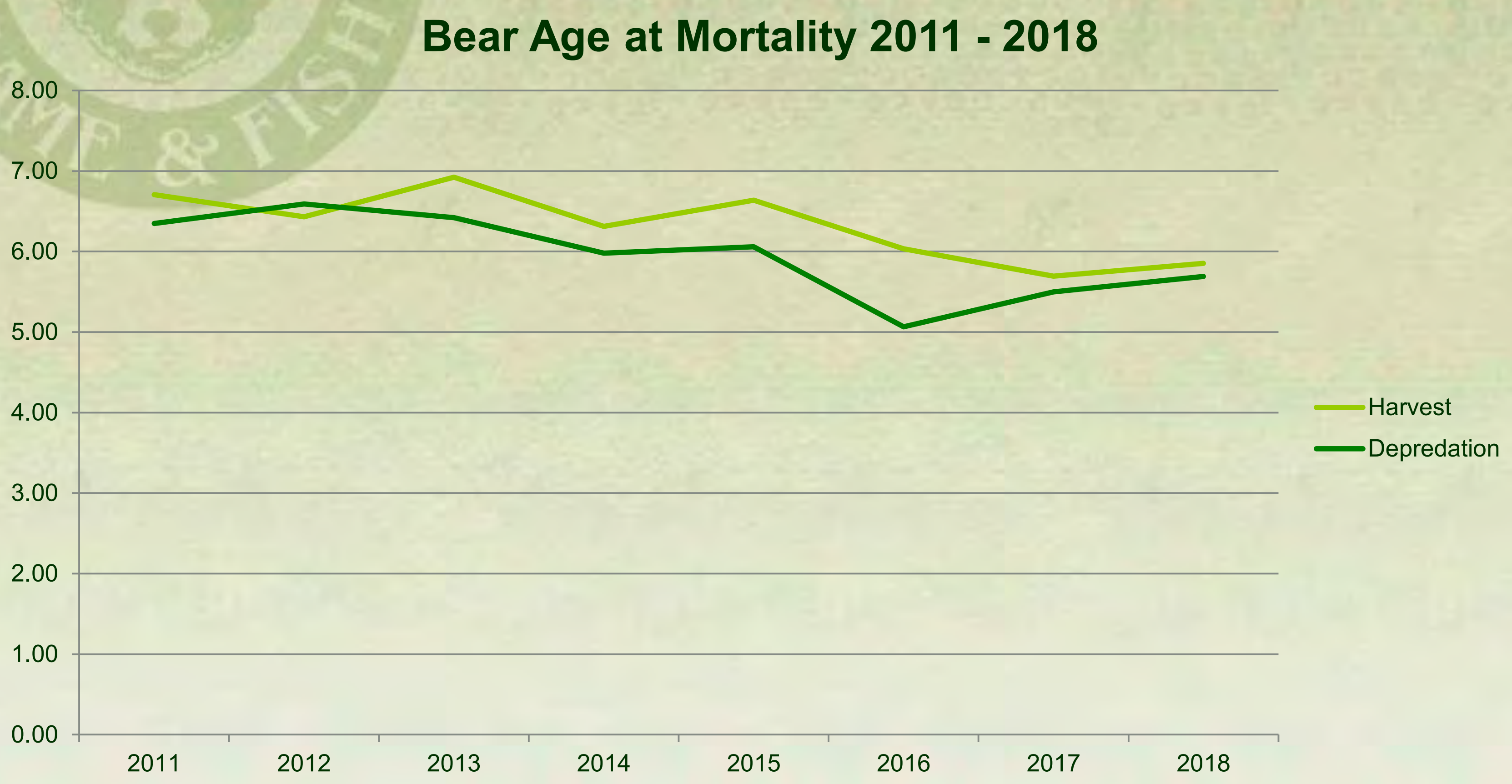
Wildlife Management Division

Bear Harvest Limits

BMZ	*Max*	2016 Actual	2017 Actual	2018 Actual
1	*158*	**138**	**70**	**121**
2	*15*	**7**	**16**	**5**
3	*65*	**27**	**42**	**26**
4	*109*	**21**	**39**	**50**
5	*92*	**21**	**30**	**21**
6	*33*	**4**	**11**	**5**
7	*35*	**31**	**31**	**30**
8	*11*	**0**	**0**	**2**
9	*36*	**18**	**16**	**20**
10	*146*	**98**	**154**	**143**
11	*36*	**17**	**22**	**21**
12	*33*	**30**	**30**	**32**
13	*16*	**16**	**13**	**13**
14	*19*	**10**	**12**	**7**

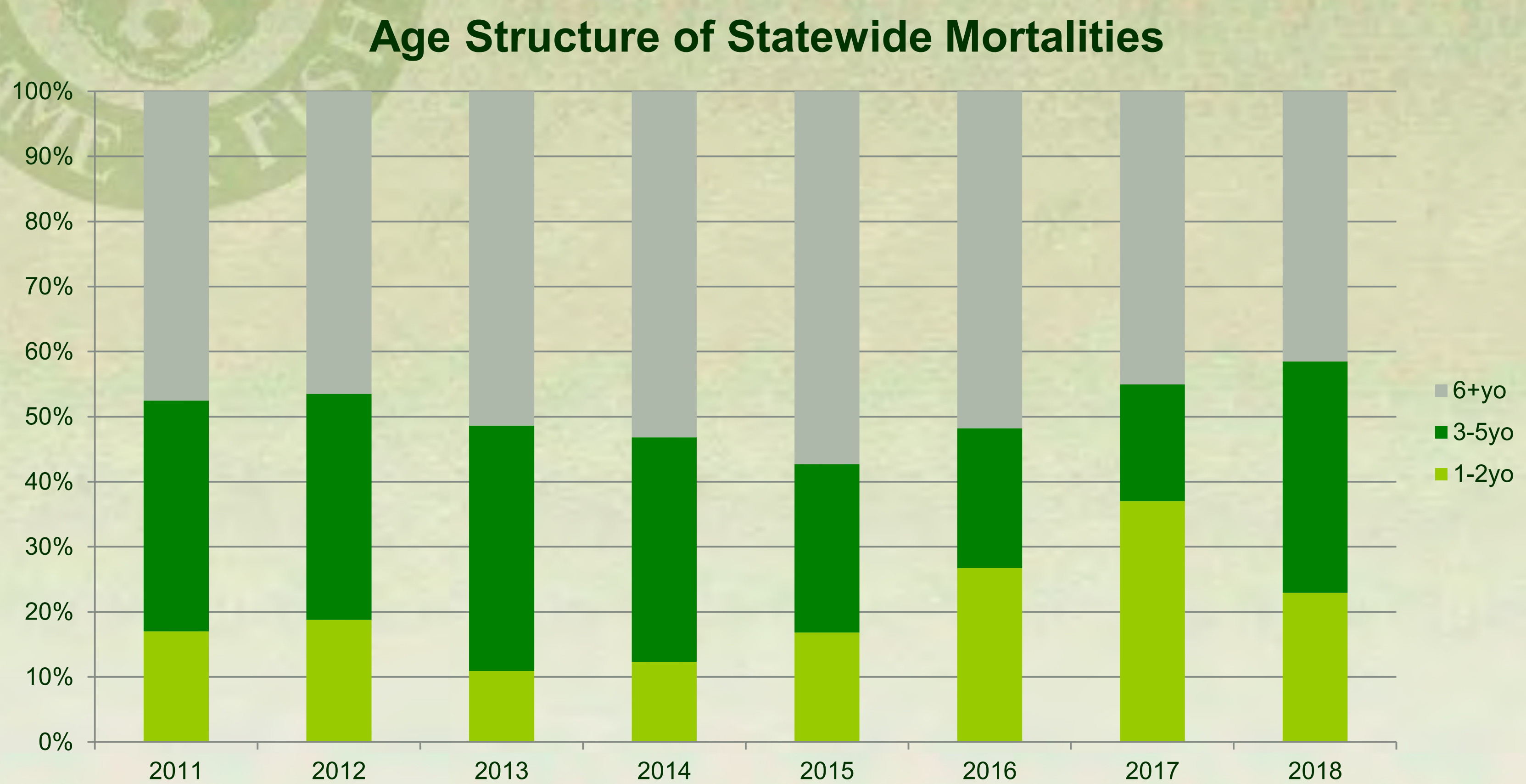
Wildlife Management Division

Bear Age at Mortality



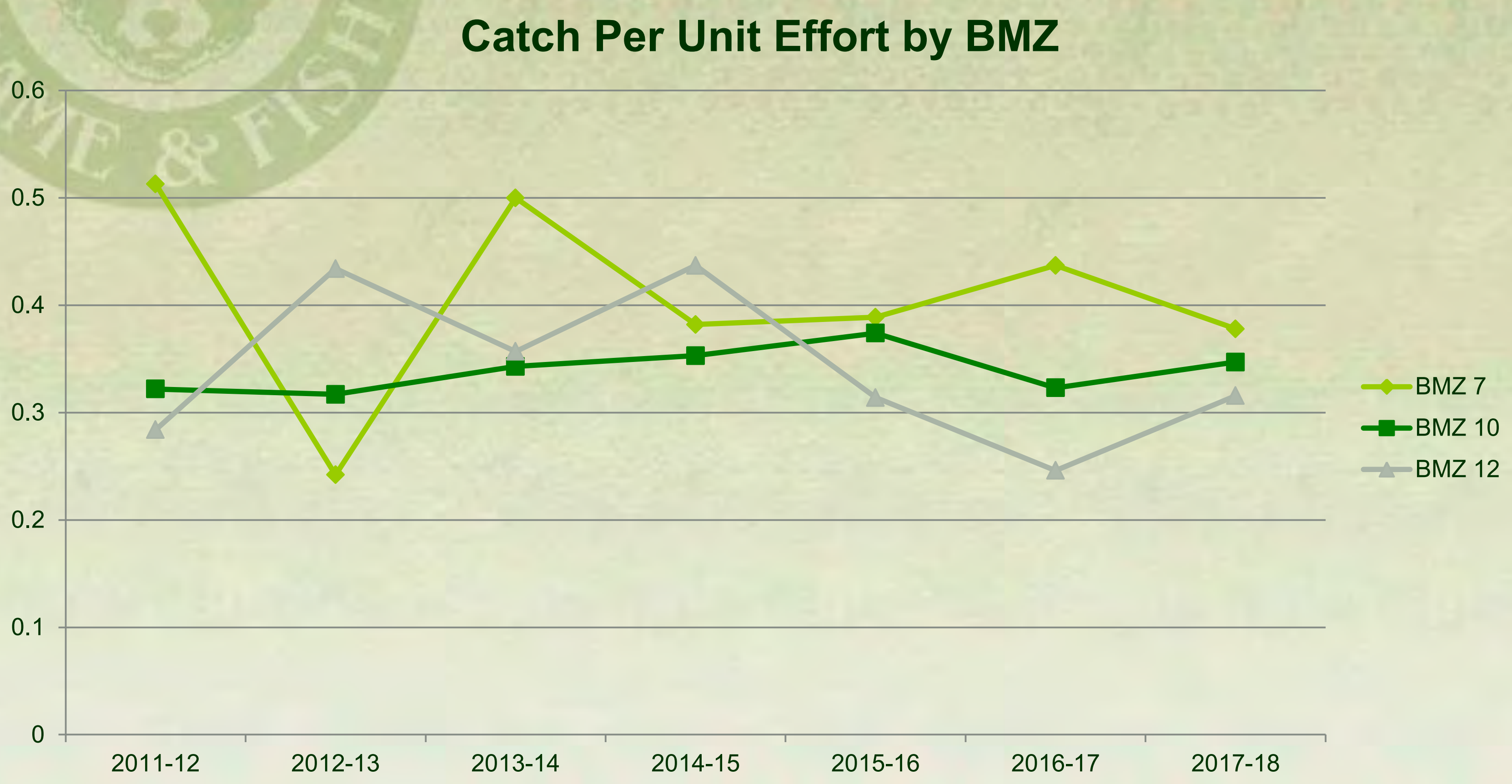
Wildlife Management Division

Bear Age at Mortality



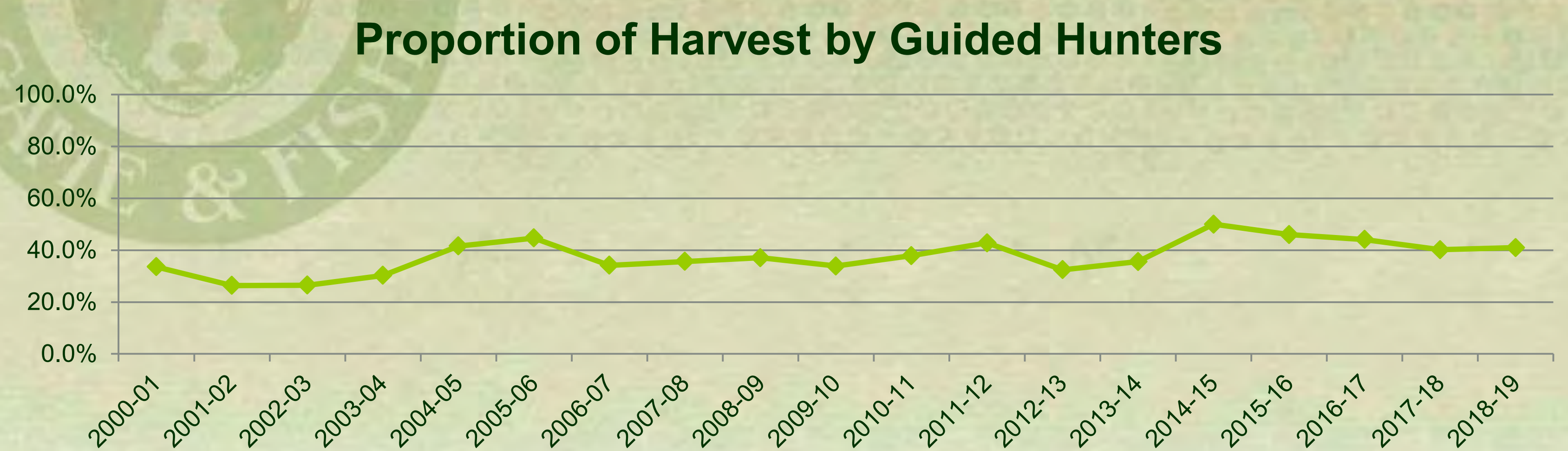
Wildlife Management Division

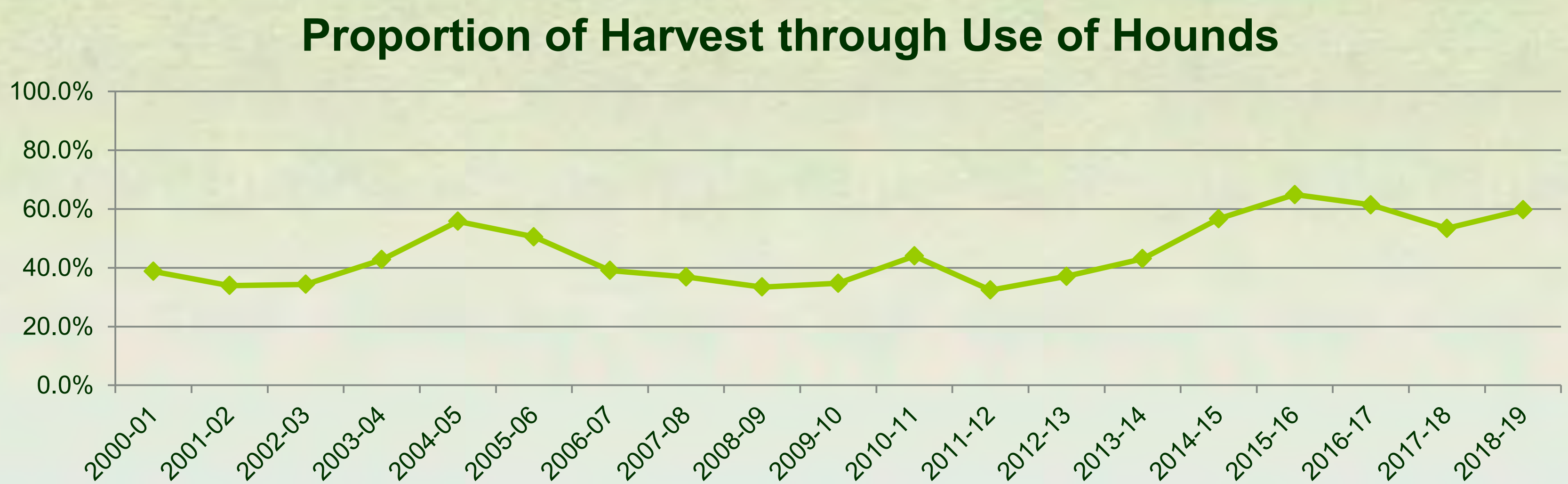
Bear – CPUE in Zones that Close



Wildlife Management Division

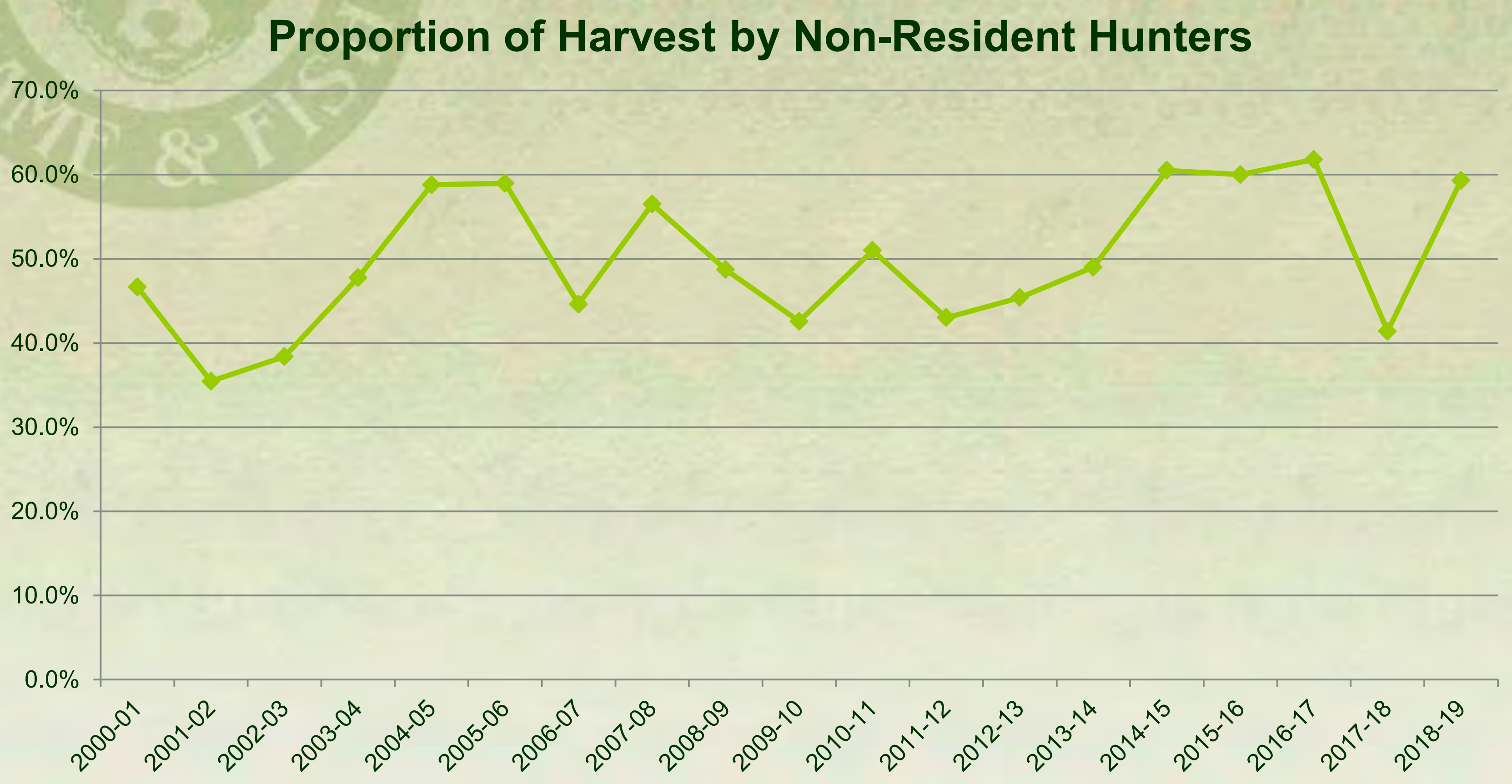
Bear – Guided and/or with dogs





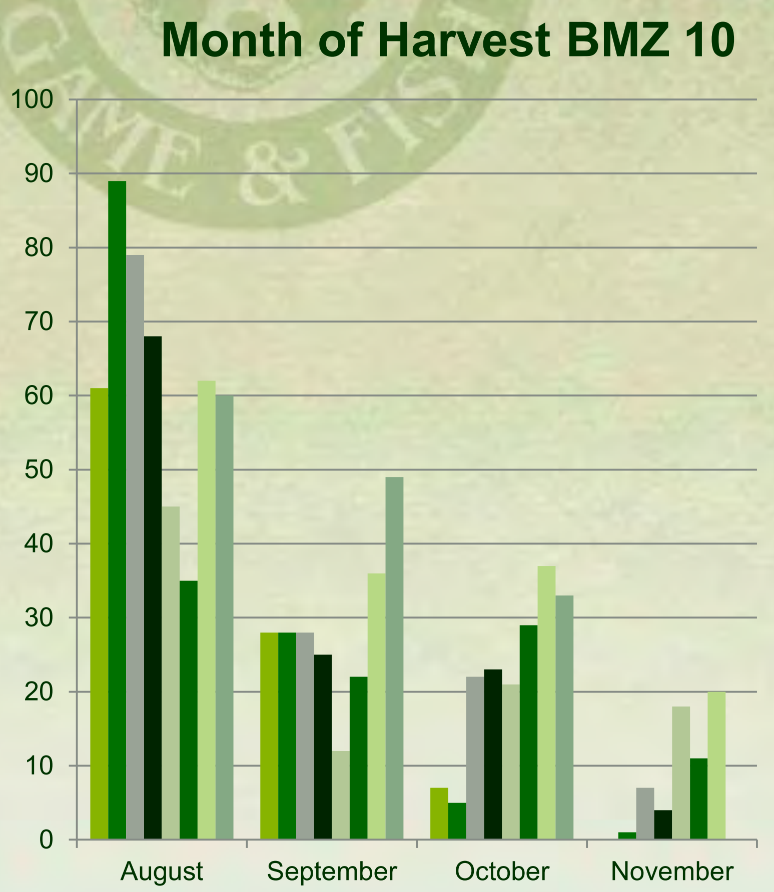
Wildlife Management Division

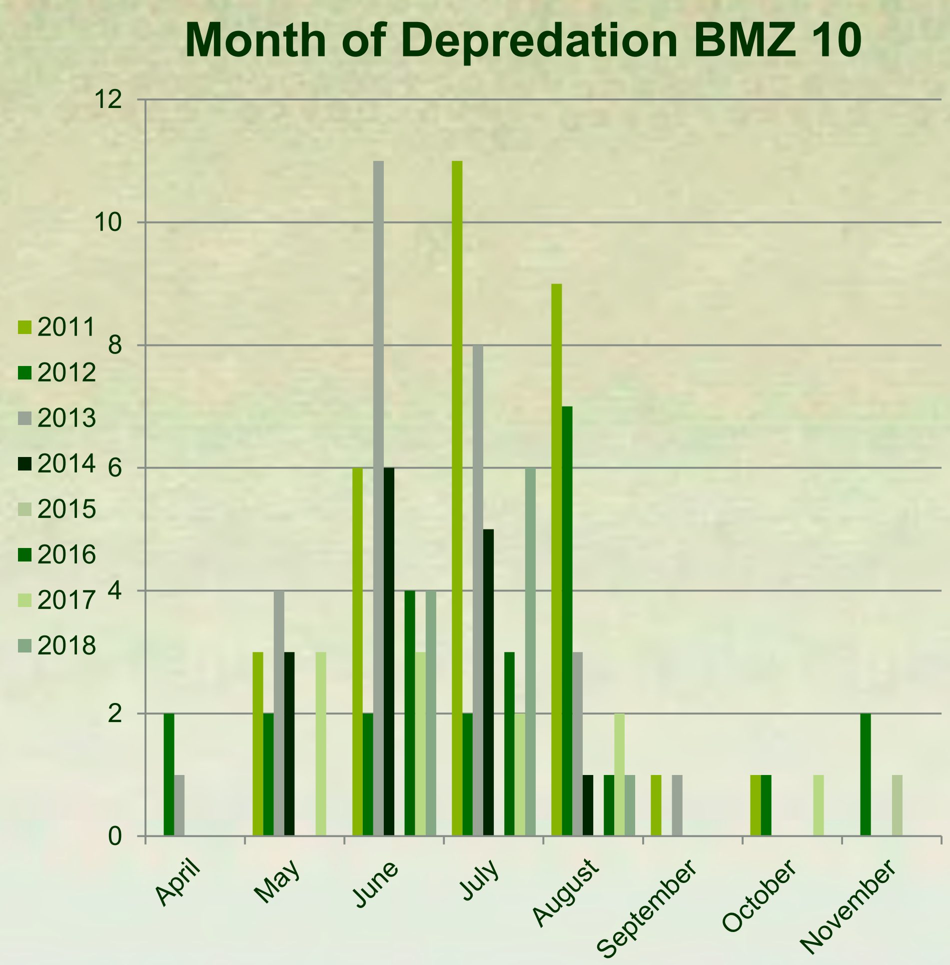
Bear – Non-resident Harvest



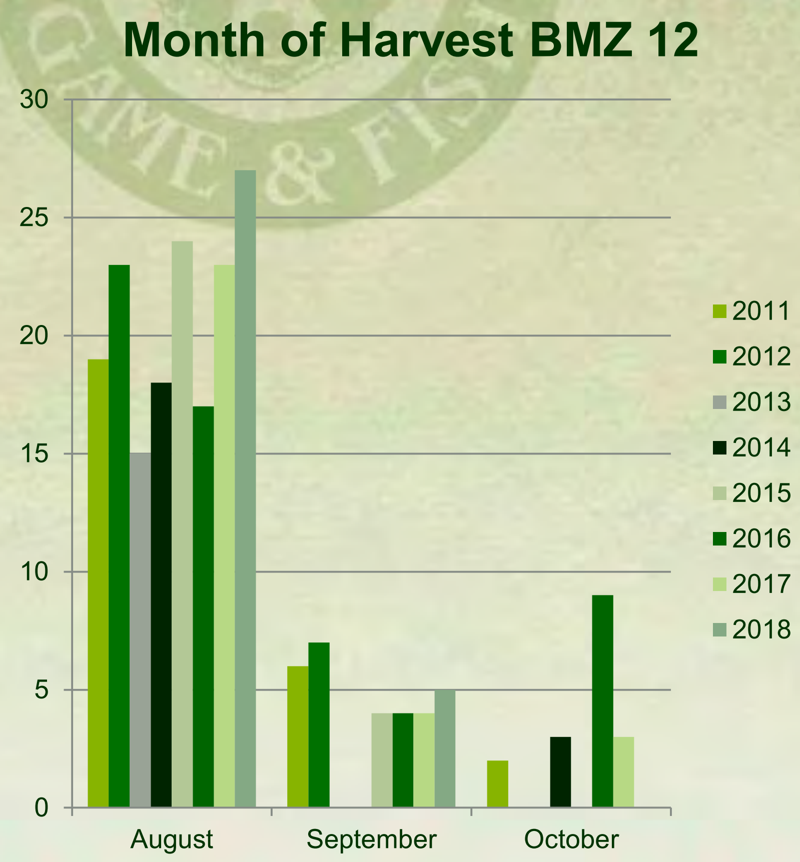
Wildlife Management Division

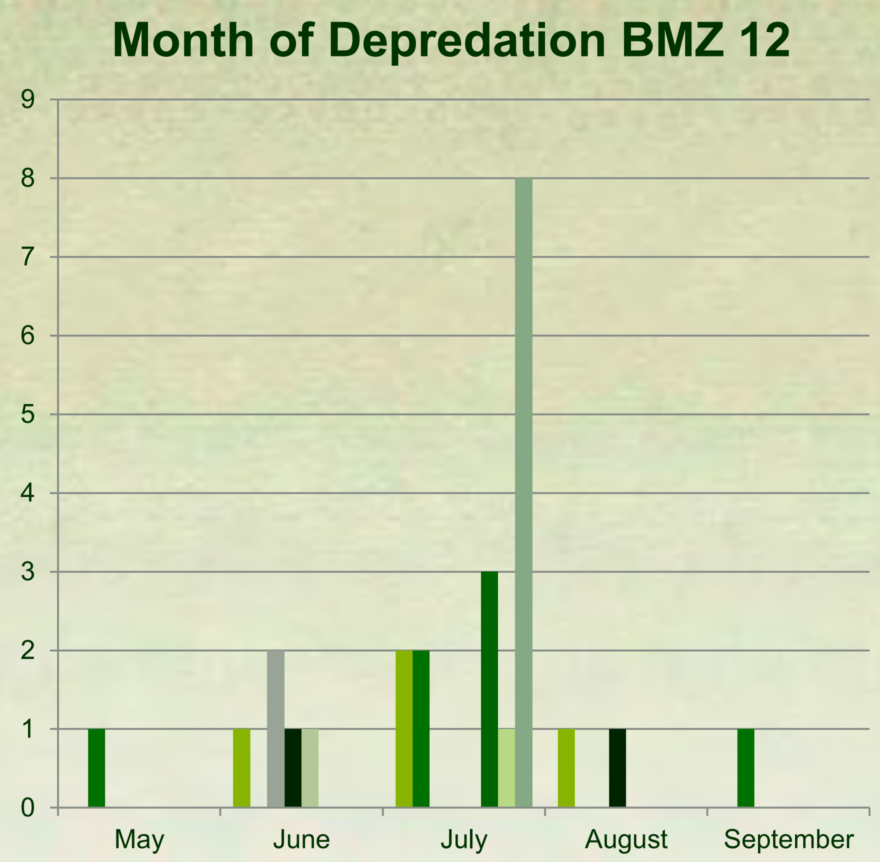
Bear – Harvest Dates vs Depredation Dates



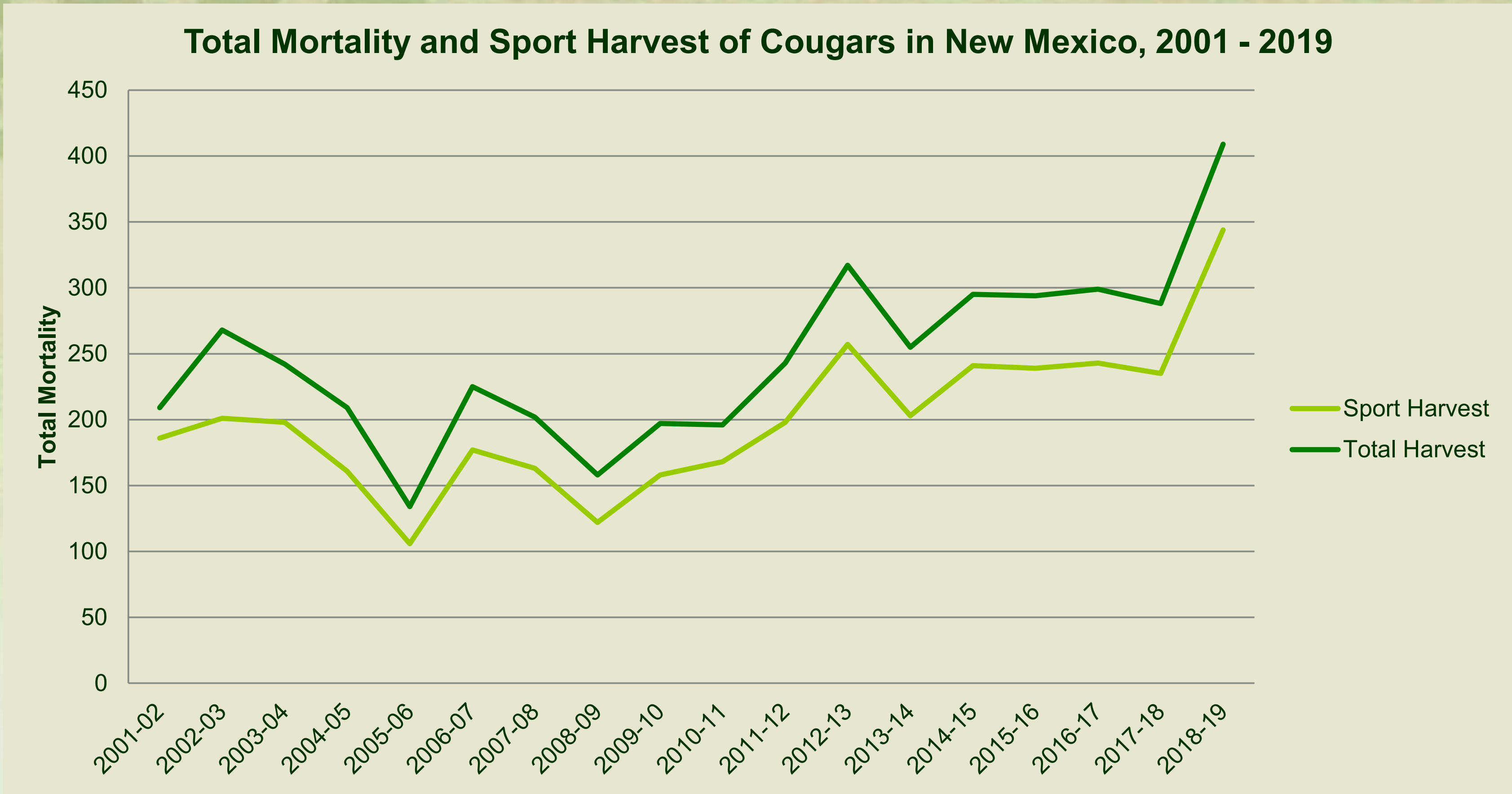


Bear – Date of Harvest vs Depredation Dates

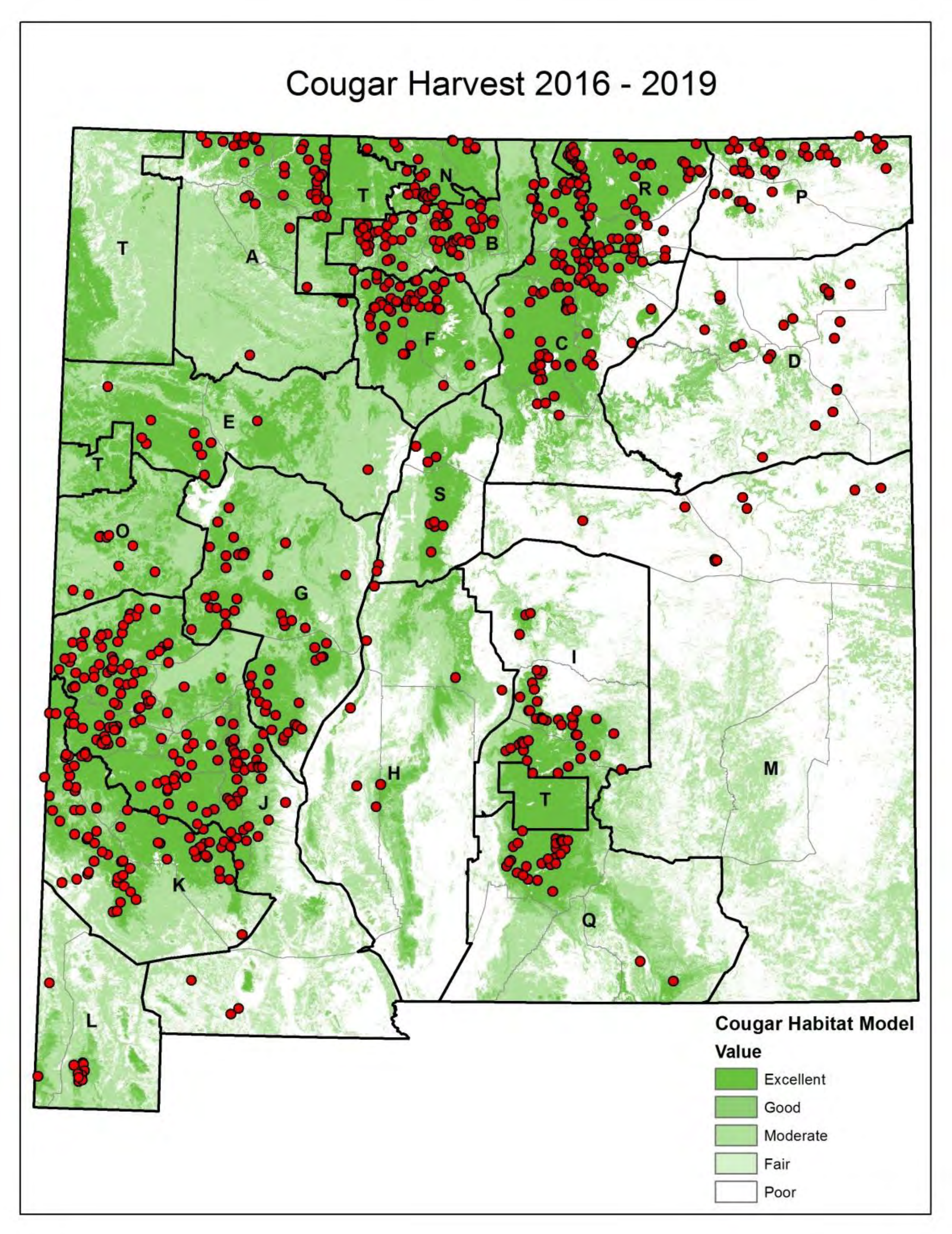




Cougar Harvest



Wildlife Management Division



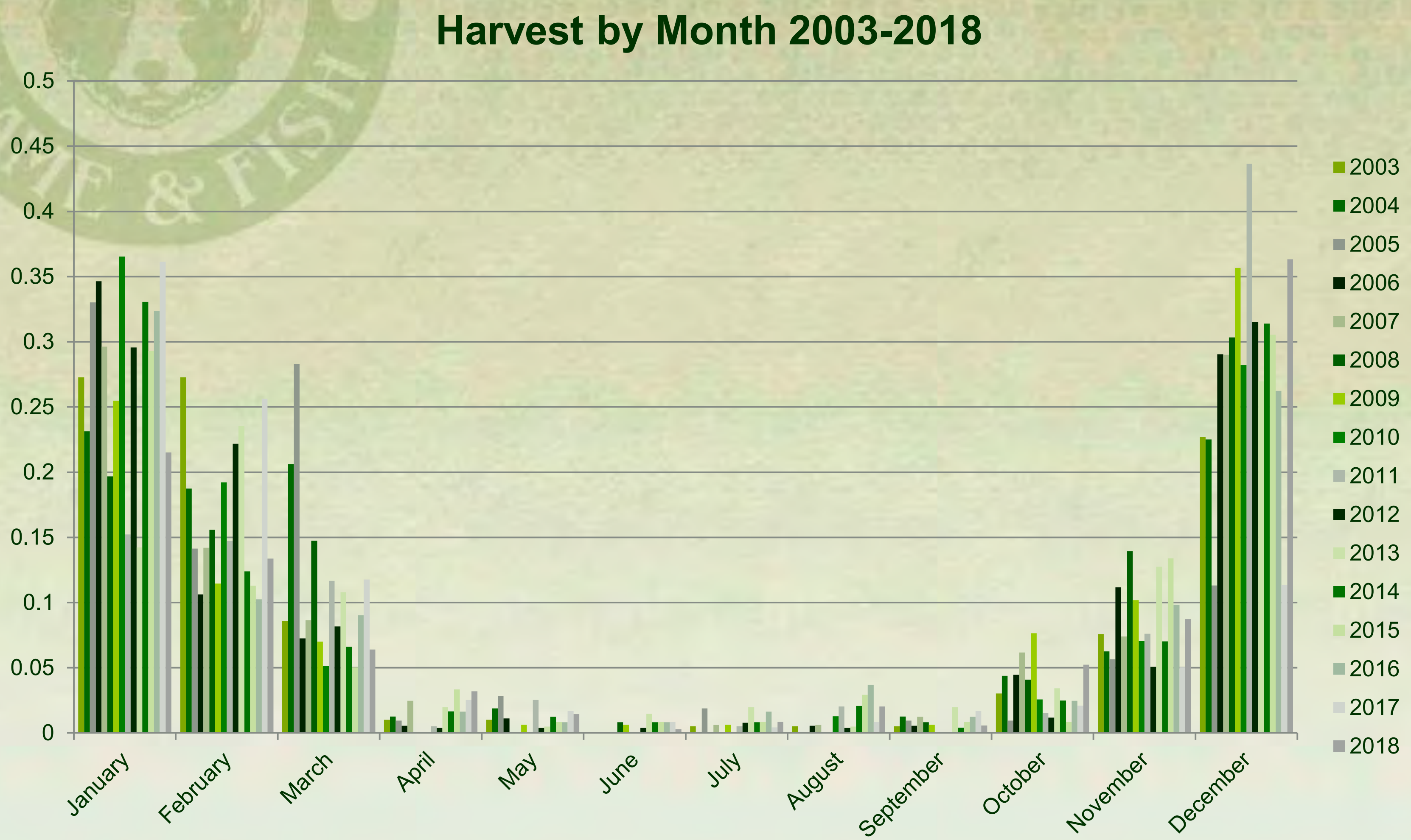
Wildlife Management Division

Cougar Sport Harvest Limits

	Max	2016	2017	2018
A	*42*	**12**	**14**	**21**
B	*28*	**22**	**20**	**27**
C	*85*	**25**	**24**	**47**
D	*23*	**5**	**11**	**8**
E	*50*	**1**	**3**	**7**
F	*46*	**11**	**16**	**20***
G	*73*	**13**	**11**	**27**
H	*37*	**0**	**4**	**3**
I	*24*	**14**	**11**	**19**
J	*89*	**49**	**39**	**74**
K	*66*	**24**	**25**	**25**
L	*19*	**5**	**3**	**4**
M	*31*	**2**	**4**	**4**
N	*15*	**10**	**10**	**10**
O	*21*	**5**	**1**	**5**
P	*14*	**13**	**15**	**13**
Q	*35*	**13**	**7**	**9**
R	*26*	**16**	**17**	**17**
S	*25*	**4**	**3**	**4**

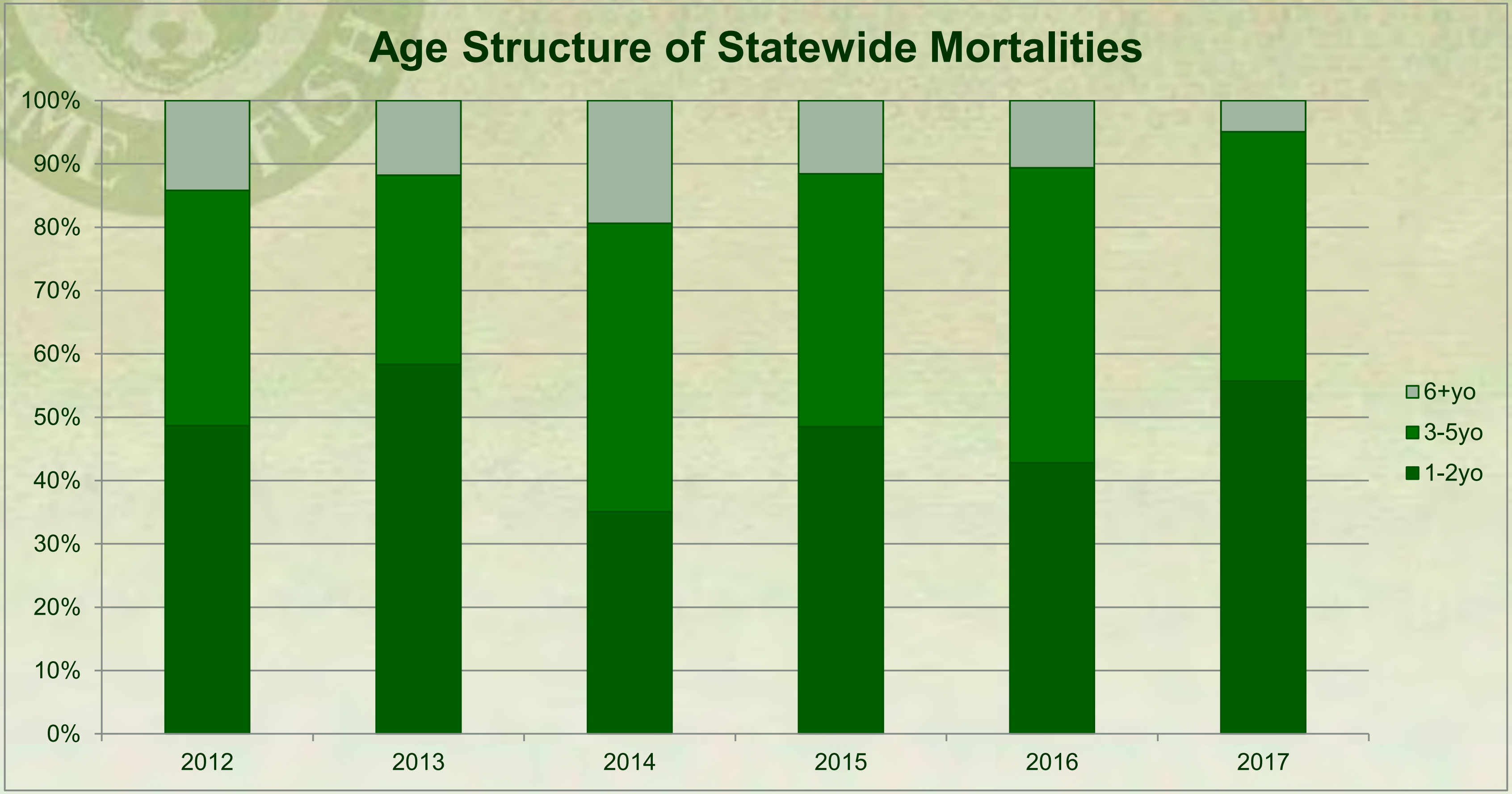
*2018 CMZ F limit was reduced to 37

Cougar Harvest by Month



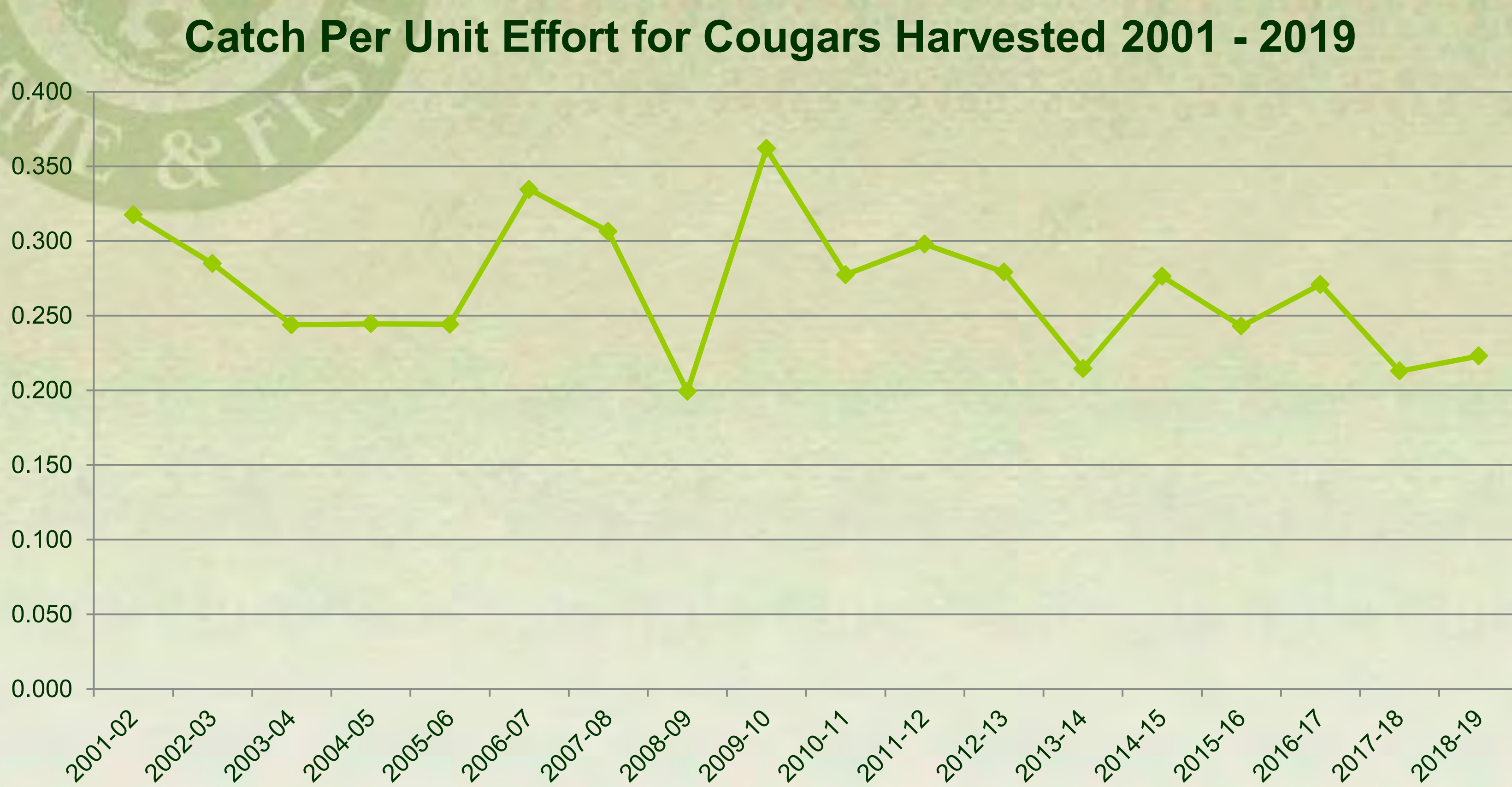
Wildlife Management Division

Cougar Population Age Structure



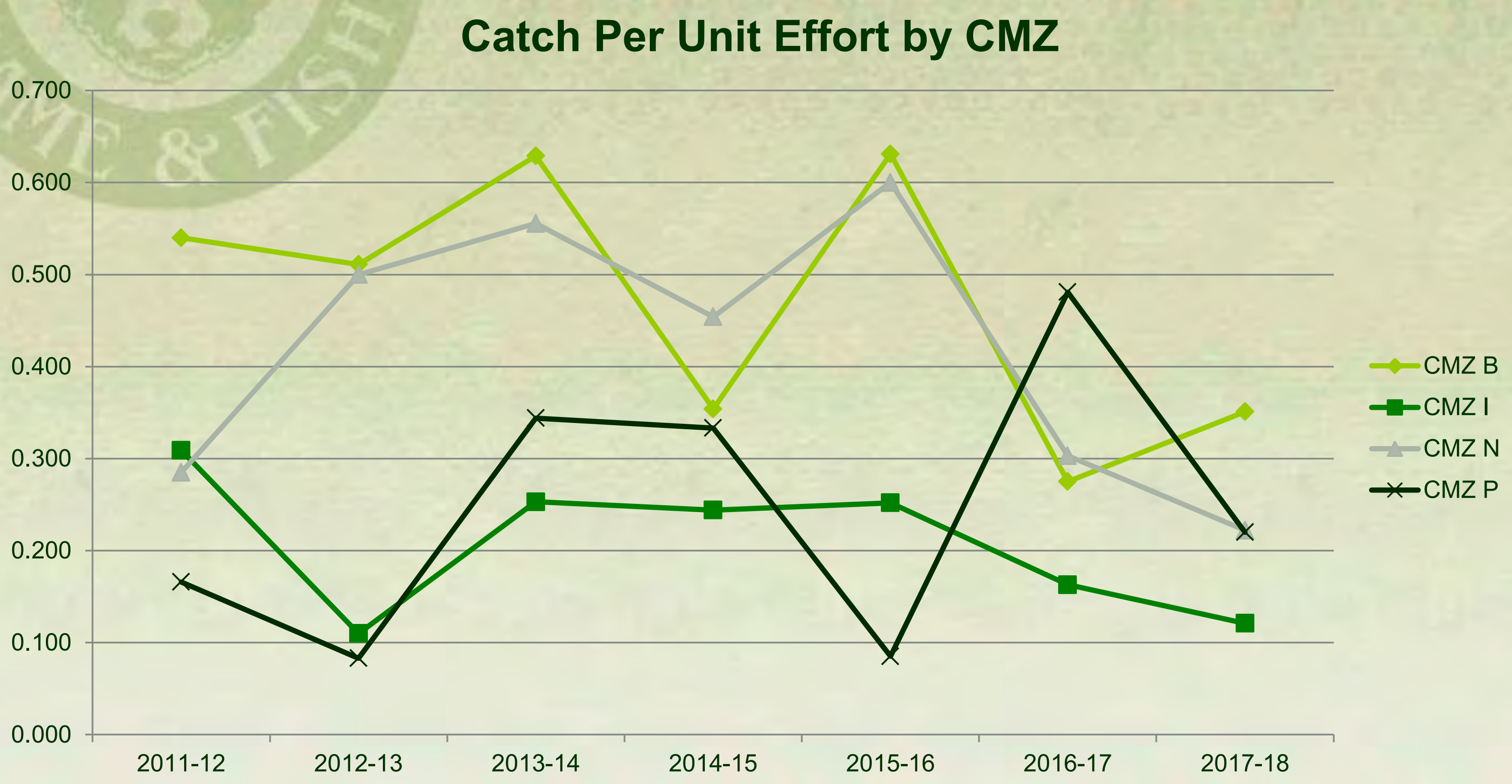
Wildlife Management Division

Cougar: Catch Per Unit Effort



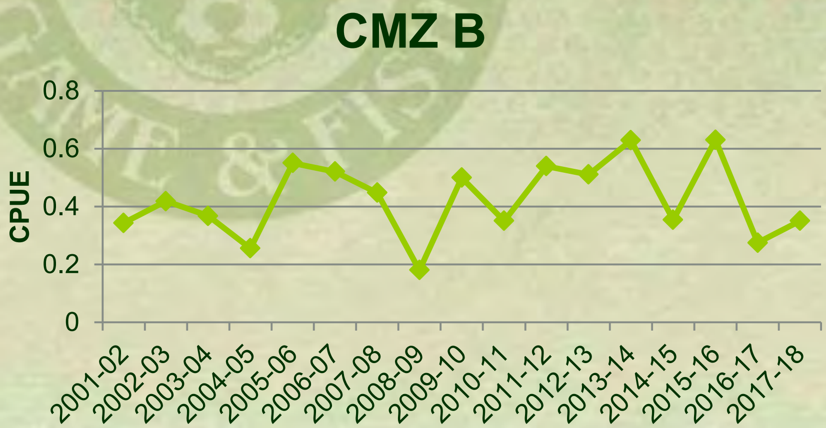
Wildlife Management Division

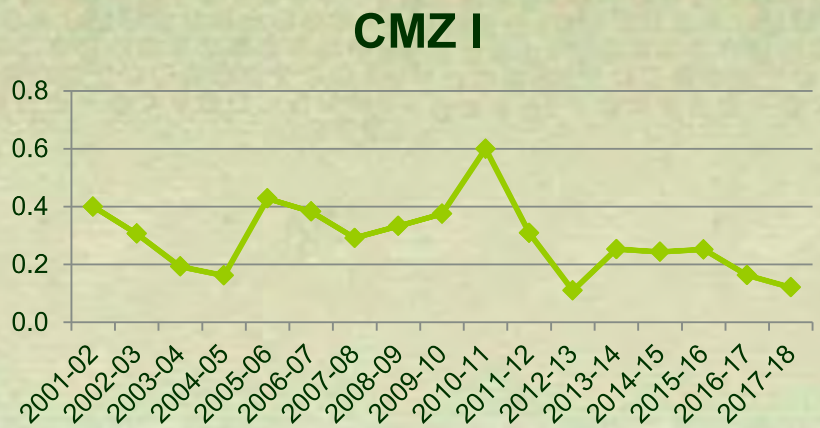
Cougar – CPUE in Zones that Close

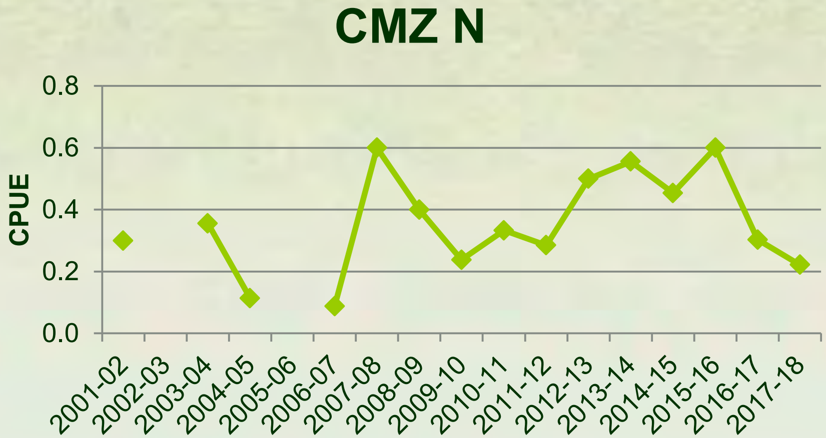


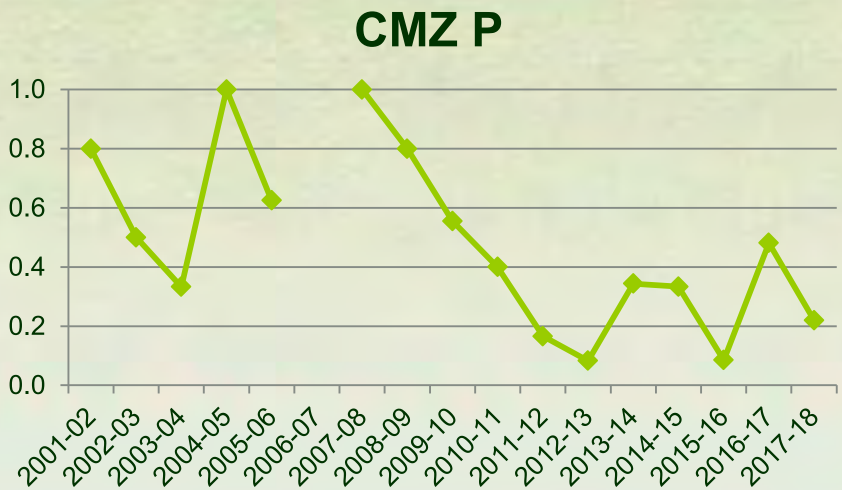
Wildlife Management Division

Cougar – CPUE in Zones that Close







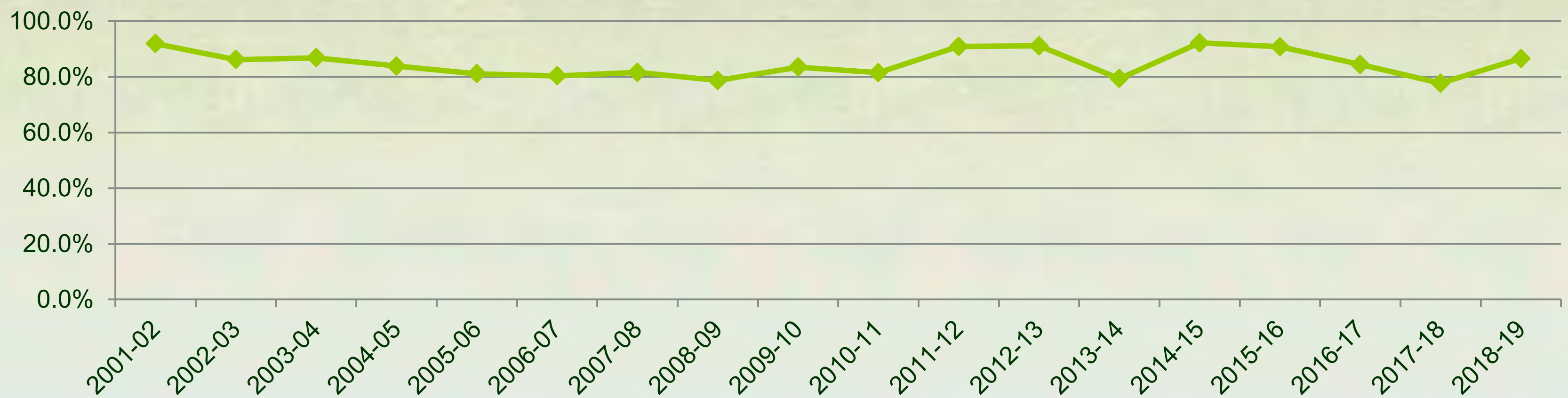


Wildlife Management Division

Cougar – Guided and/or with dogs

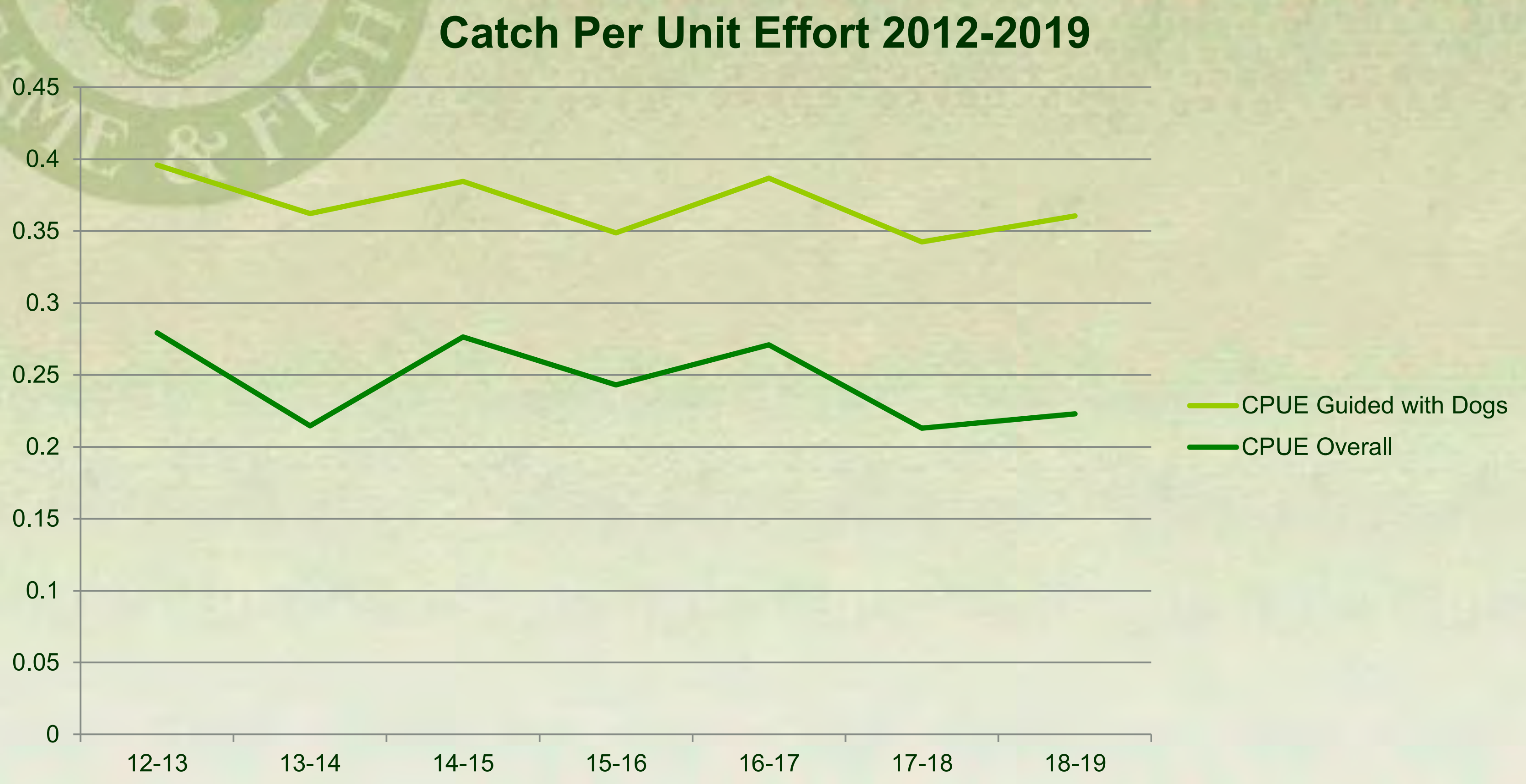
Proportion of Harvest by Guided Hunters 2001 - 2019

Proportion of Harvest through use of Hounds 2001 - 2019



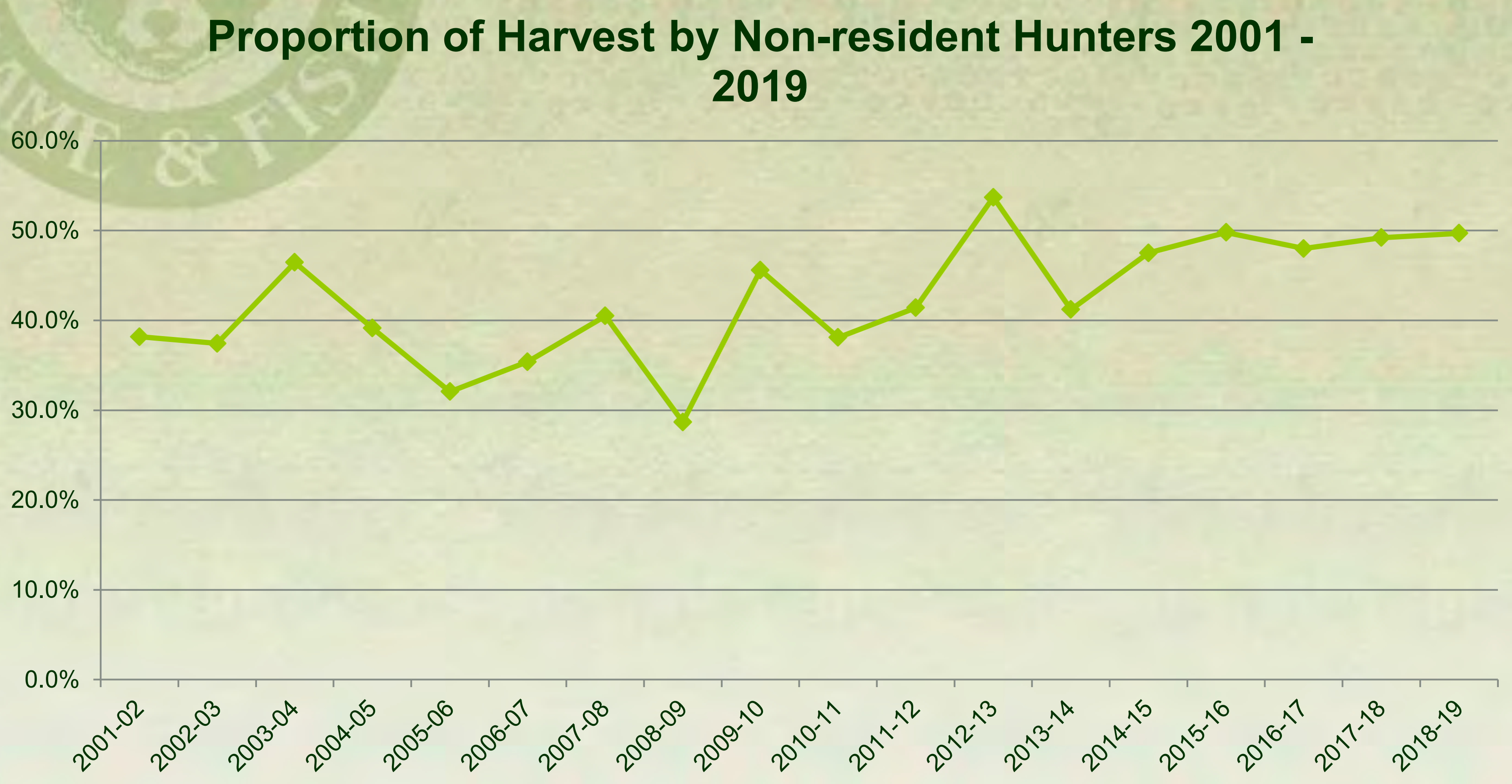
Wildlife Management Division

Cougar – Catch Per Unit Effort with Guide and Dogs



Wildlife Management Division

Cougar – Harvest by Non-Residents

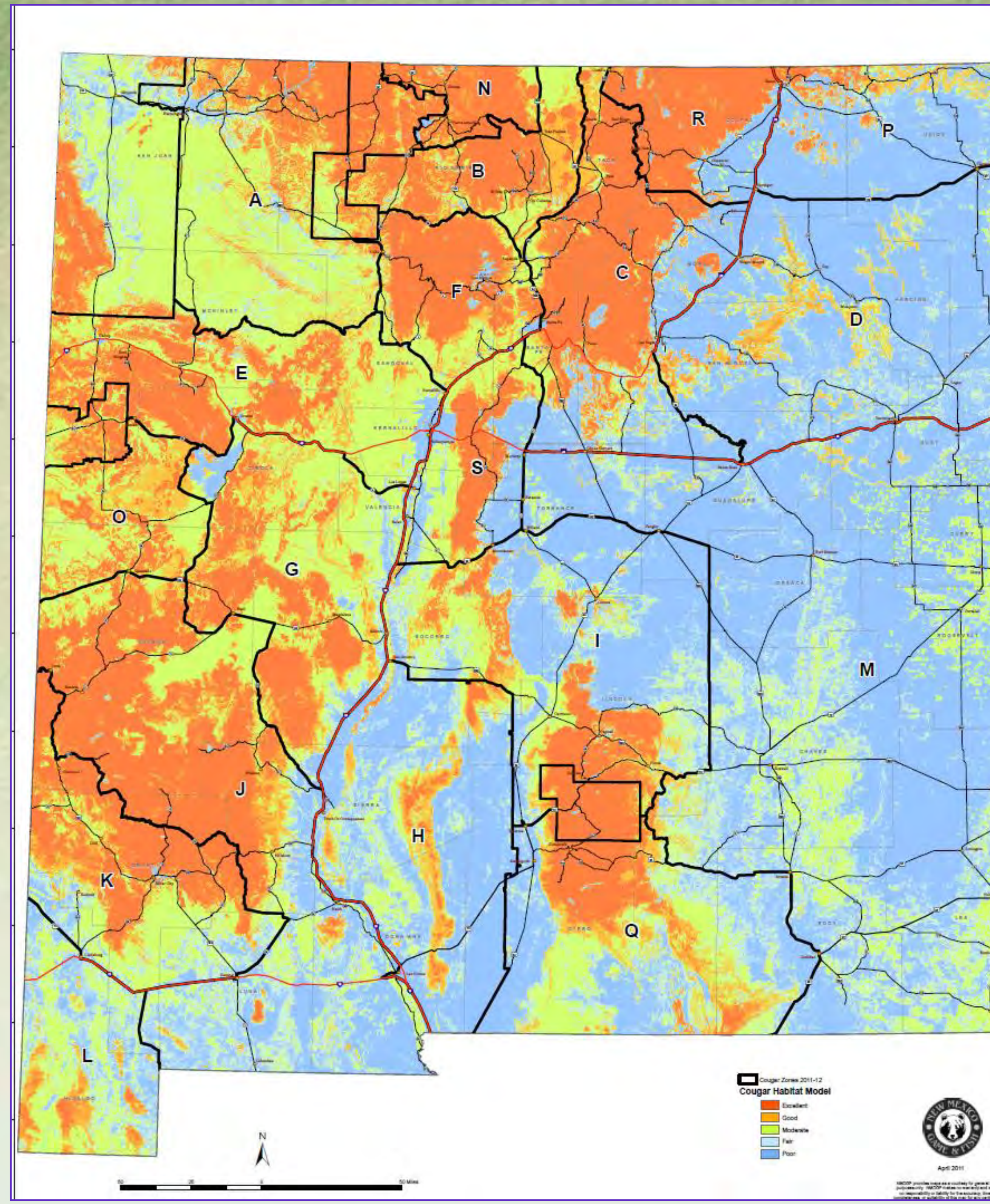


Wildlife Management Division

Cougar – Harvest both tags or additional tags

	2016	2017	2018
Harvested 2	13	22	23
Harvested > 2	2	1	4

Cougar Habitat Map



Wildlife Management Division

PERFORMANCE REPORT

State: New Mexico **Grant Number**: W-93-R-56

Grant Title: Big Game Surveys, Inventories, and Management

Grant Period: From: July 1, 2015 to: June 30, 2016

Grant Objective: To survey New Mexico's big game populations and their hunters and to manage these big game species according to the mission, goals, and plans of the New Mexico State Game Commission and the Department of Game and Fish.

Project Number: 1 **Project Title**: Grant Administration and Coordination

Project Objective: To provide administrative support and coordination for New Mexico's Big Game Surveys, Inventories, and Management Grant.

I. Job Objectives and Summary of Progress:

Bear (*Ursus americanus*). Hunter harvest and other human-caused mortality were evaluated against of the quality, quantity, and distribution of bear habitat in New Mexico. The Black Bear Population Assessment and Harvest Management Matrix was re-evaluated to ensure assumptions of population estimates and the quality, quantity, and distribution of habitats were as accurate as possible and that our management goals remain viable and sustainable. The bear study was completed and results were used in conjunction with the updated bear habitat model to amend the Bear and Cougar Rule.

Cougar (*Puma concolor*). The sustainability of hunter harvest programs was examined in the context of the quality, quantity, and distribution of habitats for this large carnivore. Data were used to amend the Bear and Cougar Rule. The Cougar Population Assessment and Harvest Management Matrix was modified to better track mortalities from all causes, to identify sport harvest limits, estimate population densities, habitat, and management goals. Research is ongoing to determine the effect of cougar predation on ungulate populations and to estimate cougar population densities statewide. A new research project was implemented in collaboration with NMSU to estimate cougar densities in different habitat qualities to develop density estimates statewide and in individual Cougar Management Zones.

PERFORMANCE REPORT

State: New Mexico **Grant Number**: W-93-R-56

Grant Title: Big Game Surveys, Inventories, and Management

Grant Period: **From**: July 1, 2015 **to:** June 30, 2016

Grant Objective: To survey New Mexico's big game populations and their hunters and to manage these big game species according to the mission, goals, and plans of the New Mexico State Game Commission and the Department of Game and Fish.

Project Number: 2 **Sections 2.A.1. and 2.2** **Project Title**: Population and Harvest Surveys, Inventories, and Big Game Management

Objective: To survey New Mexico big game populations and their hunters to develop hunt season recommendations, restore big game populations where biological, ecological and sociological information indicates it is feasible and ascertain health status of big game populations, identify the nature and extent of any disease affecting big game and understand the disease process.

2.A.1. and 2.2. Estimate big game population size and/or trend, sex and age composition, and geographical distribution. Evaluate survey techniques and develop new methods where appropriate.

Bear. The bear habitat model was revised this segment. It incorporates improvements in remote sensing technology and is thus able to model bear habitat more accurately. Bear research indicates that the bear population has remained stable or is increasing, depending on the location. This may be due to an actual increase in bear numbers, improved technology increasing our ability to detect bears, and/or developments in statistical theory allowing for more accurate estimates. While the state may still be in a long term drought, 2014-2016 have had wet summers with good to excellent mast production in most of the state, which suggests that at least some of the increased population estimate represents an actual increase.

Population estimates were derived from average densities found by the New Mexico bear studies (2001 and 2016) and applied to the areas designated as primary bear habitat in the habitat model revision (2015). The results provide the basis of the Departments population estimates (Table 2.A.25). The population estimation technique using DNA gathered from non-invasive hair snagging techniques has been developed and implemented These in turn provide the basis for the maximum harvest levels.

Table 2.A.25. Black Bear Population Estimates and Mortality Limits by Zones, NMDGF.

Zone	GMUs	Population point estimate	Total mortality limit	Female sub-limit
1	4-7, 51, 52	1,580	158	63
2	2	150	15	6
3	48, 49, 50, 53	544	65	26
4	45, 46, 48	1,093	109	43
5	54, 55	919	92	37
6	39, 40, 41, 42, 43, 47, 59	328	33	13
7	56, 57, 58	354	35	14
8	8	132	11	4
9	9, 10	356	36	14
10	12, 13, 15-18, 20-24, 26, 27	1,456	146	58
11	37, 38	360	36	14
12	34	325	33	13
13	36	159	16	6
14	14	233	19	7
Total		7,989	804	318

Cougar. Sport harvest has slowly increased over the last 16 years primarily due to increased opportunity and interest. The female proportion of the harvest has averaged ~40%. Licenses sold since 2000 have stabilized at ~2000 licenses annually. The harvest is primarily dependent on weather, particularly snowfall which allows for better tracking conditions, while depredation kills, road kill and bighorn sheep protection kills have fluctuated annually. Non-resident harvest and license sales are a distinct factor in cougar harvest as non-residents generally hire guides using hounds and have a higher success rate.

Cougar population estimates and sustainable harvest levels were derived from a combination of habitat and average density from the New Mexico cougar study (1996), mortality and harvest data, recent research in New Mexico, and cougar research in the western states (Table 2.A.26). Research has continued on cougar predation effects on the Gallinas Mountains deer population. A second research project was initiated estimating statewide cougar populations using non-invasive genetic and camera-trapping techniques.

Table 2.A.26. Cougar Population Estimates and Mortality Limits by Zones, NMDGF.

Zone	GMUs	Population Estimate	Total Mortality Limit	Female 25%Sub-limit
A	2, 7	207-285	42	13
B	5, 50, 51	142-192	28	8
C	43-46, 48, 49, 53-55	289-387	85	43
D	41, 42, 47, 59	76-106	23	12
E	9, 10	251-341	50	15
F	6	156-209	46	23
G	13 and 17	247-338	73	37
H	18, 19, 20	140-197	42	21
I	36-38	121-165	24	7
J	15, 16, 21, 25	445-603	89	27
K	22 and 24	225-305	66	33
L	26 and 27	64-91	19	10
M	31-33, 39, 40	146-215	31	9
N	4 and 52	76-102	15	5
O	12	103-141	21	6

P	56-58	49-66	14	7
Q	28-30 and 34	170-235	35	11
R	45 and 55	131-175	26	8
S	8 and 14	85-116	25	13
Totals:		3,123-4,269	749	303

PERFORMANCE REPORT

State: New Mexico **Grant Number**: W-93-R-56

Grant Title: Big Game Surveys, Inventories, and Management

Grant Period: **From**: July 1, 2015 **to:** June 30, 2016

Grant Objective: To survey New Mexico's big game populations and their hunters and to manage these big game species according to the mission, goals, and plans of the New Mexico State Game Commission and the Department of Game and Fish.

Project Number: 2 **Sections 2.B.1. and 2.3-2.10** **Project Title**: Population and Harvest Surveys, Inventories, and Big Game Management

Objective: To survey New Mexico big game populations and their hunters to develop hunt season recommendations, restore big game populations where biological, ecological and sociological information indicates it is feasible and ascertain health status of big game populations, identify the nature and extent of any disease affecting big game and understand the disease process.

II. Job Objectives and Summary of Progress:

2.1.B Estimate hunter numbers, harvest, effort, and success rates.

Bear. Harvest continued to be managed by the hunter harvest/total sustainable mortality system. During the hunting season, each zone remained open to black bear hunting during the respective bear seasons until the total number of sport-harvested bears (as determined by mandatory check-in for successful hunters) or the female portion of the harvest, equaled the total sustainable mortality limit for that zone or the female sub-limit, respectively, whichever came first. Only 40% of the harvest may be female in all bear management zones. Total bear mortality from all human causes has declined in each of the past 2 years (Table 2.B.4)

Table 2.B.4. Annual Bear Mortality Statistics 2001-2014/15, NMDGF.

	Sport Harvest				Depredation Kill				Other (road kill, accident, etc.)					
Black Bear	Female	Male	Unk.*	**Sport Total**	Female	Male	Unk.	**Depred. Total**	Female	Male	Unk.	**Other Total**	**Total**	**% Female**
2001-02	213	318	3	**534**	8	38	1	**47**	6	9	0	**15**	**596**	38.2%
2002-03	271	397	6	**674**	13	33	2	**48**	8	15	0	**23**	**745**	39.7%
2003-04	167	255	1	**423**	5	13	0	**18**	10	7	1	**18**	**459**	39.7%
2004-05	78	154	1	**233**	2	1	0	**3**	2	8	0	**10**	**246**	33.3%
2005-06	103	168	0	**271**	8	9	0	**17**	2	4	0	**6**	**294**	38.4%
2006-07	112	210	3	**325**	4	15	0	**19**	2	10	1	**13**	**357**	33.3%
2007-08	105	226	0	**331**	7	14	0	**21**	3	13	0	**16**	**368**	31.3%
2008-09	86	189	0	**275**	2	31	0	**33**	6	19	0	**25**	**333**	28.2%
2009-10	119	238	0	**357**	2	19	0	**21**	5	15	0	**20**	**398**	31.7%
2010-11	104	223	0	**327**	13	43	0	**56**	8	12	0	**20**	**403**	31.1%
2011-12	189	287	2	**478**	62	179	1	**242**	17	37	3	**57**	**777**	34.7%
2012-13	221	347	0	**568**	29	59	2	**90**	18	34	4	**56**	**714**	37.9%
2013-14	219	325	1	**545**	47	125	1	**173**	27	29	4	**60**	**778**	37.7%
2014-15	190	283	2	**475**	10	39	0	**49**	9	19	7	**35**	**559**	37.2%
2015-16	169	244	0	**413**	11	23	1	**35**	4	16	0	**20**	**468**	39.3%

*Unk – Unknown, sometimes the sex is impossible to determine due to decomposition or physical damage.

Cougar. Harvest continued to be managed by the hunter harvest/total sustainable mortality system. During the hunting season, each zone remained open to mountain lion hunting from April 1 until March 31 or when the total number of hunter kills (as determined by mandatory check-in for successful hunters) equaled the total sustainable mortality limit for that zone, or the female sub-limit had been met, whichever came first. Only 30% of the harvest may be female in cougar management zones where the long term goal is stable cougar population, and only 50% in cougar management zones where the goal is population reduction. Cougar harvest has been slowly increasing over the past 3 years (Table 2.B.5).

Table 2.B.5. Annual Cougar Mortality Statistics 2001/02 - 2015/16, NMDGF.

	Sport Harvest				Depredation Kill				Bighorn Sheep Protection				Other (road kill, accident, etc.)					
Cougar	Fem.	Male	Unk.*	**Total Sport**	Fem.	Male	Unk.	**Total Depred.**	Fem.	Male	Unk.	**Total BHS**	Fem.	Male	Unk.	**Total Other**	**Total**	% Female
2001-02	76	110	0	**286**	3	3	1	**7**	5	6	0	**11**	3	0	2	**5**	**209**	41.2%
2002-03	82	120	1	**203**	14	13	1	**28**	14	11	0	**25**	6	3	2	**11**	**267**	43.4%
2003-04	84	114	0	**198**	17	5	0	**22**	5	12	0	**17**	3	2	0	**5**	**242**	45.0%
2004-05	72	89	0	**161**	16	16	1	**33**	3	8	0	**11**	4	0	0	**4**	**209**	46.3%
2005-06	34	72	0	**106**	5	5	0	**10**	6	8	0	**14**	1	3	0	**4**	**134**	34.8%
2006-07	82	95	0	**177**	11	13	1	**25**	8	10	0	**18**	3	1	0	**4**	**224**	46.7%
2007-08	59	104	0	**163**	13	13	0	**26**	3	8	0	**11**	1	1	0	**2**	**202**	37.6%
2008-09	50	72	0	**122**	5	11	0	**16**	4	11	0	**15**	4	1	0	**5**	**158**	39.9%
2009-10	55	103	0	**158**	7	11	0	**18**	8	7	0	**15**	1	5	0	**6**	**197**	36.0%
2010-11	57	110	1	**167**	1	3	0	**4**	8	6	0	**14**	5	5	0	**10**	**196**	36.2%
2011-12	75	123	0	**198**	14	7	0	**21**	4	8	0	**12**	5	7	0	**12**	**243**	40.2%
2012-13	87	170	0	**257**	14	6	0	**20**	7	23	0	**30**	4	5	1	**10**	**317**	35.3%
2013-14	85	117	1	**203**	12	12	0	**24**	5	12	0	**17**	5	4	0	**9**	**253**	42.4%
2014-15	102	130	0	**232**	12	10	1	**23**	8	10	0	**18**	4	7	0	**11**	**284**	44.8%
2015-16	88	151	0	**239**	14	9	0	**23**	7	13	0	**20**	6	5	1	**12**	**294**	39.1%

*Unk – Unknown, sometimes the sex is impossible to determine due to decomposition or physical damage.

2.4. Bear density estimation

The black bear density estimation study in the northern (NSC; sampled in 2012) and southern Sangre de Cristo Mountains (SSC; sampled in 2013), the Sandia Mountains (Sandias; sampled in 2014), and the northern (NSacs) and southern Sacramento Mountains (SSacs; both sampled in 2014) was concluded (Appendix A). Hair samples from black bears were collected using two concurrent non-invasive sampling methods, hair traps and bear rubs and estimated density in a spatially explicit capture-recapture framework (SECR). A suite of SECR candidate models was constructed using sex, elevation, land cover type, and time to model heterogeneity in detection probability and the spatial scale over which detection probability declines.

We set 554 hair traps and 117 bear rubs, and 4,083 hair samples were collected. We identified 725 (367 M, 358 F) individuals; the sex ratio for each study area was approximately equal. Our density estimates varied within and among mountain ranges with an estimated density of 21.86 bears/100 km2 (95% CI: 17.83 – 26.80) for the NSC, 19.74 bears/100 km2 (95% CI: 13.77 – 28.30) in the SSC, 25.75 bears/100 km2 (95% CI: 13.22 – 50.14) in the Sandias, 21.86 bears/100 km2 (95% CI: 17.83 – 26.80) in the NSacs, and 16.55 bears/100 km2 (95% CI: 11.64 – 23.53) in the SSacs. These estimates will aid the NMDGF in setting sustainable harvest limits.

2.5. Cougar density estimation.

The goal of this study is to provide relevant population and density data that will contribute to developing harvest management strategies and directing other cougar management activities in New Mexico. The objectives of this study are to: 1) estimate cougar abundance and density in replicated survey areas across New Mexico to provide data for the development of data-based harvest objectives and limits; 2) compare data-derived density estimates to those used in the habitat model currently employed by NMDGF to develop harvest limits; and 3) test a remote camera-based method for estimating cougar abundance and density in the absence of marked individuals. Below is a summary of our work to date:

- Implement noninvasive sampling using scat detection dogs, genetic analysis, and mark-recapture techniques to estimate cougar abundance within each of 15, 225 km^2 study areas.
- During 2016, we completed surveys of 4 study areas using scat detection dogs.
- Two of the four study areas completed with scat detection dogs were also sampled using a remote camera array.
- Scat samples are being prepared for genetic analysis to be conducted at the University of Idaho.
- Camera data is being pre-processed and photos organized.

U.S. Fish and Wildlife Service

Estimating Black Bear Density in New Mexico Using Noninvasive Genetic Sampling Coupled with Spatially Explicit Capture-Recapture Methods

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Cooperator Science Series # 120-2016

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Estimating Black Bear Density in New Mexico Using Noninvasive Genetic Sampling Coupled with Spatially Explicit Capture-Recapture Methods

Federal Aid in Wildlife Restoration Project W93 R56 2.0

Final Report to The New Mexico Department of Game and Fish

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EXECUTIVE SUMMARY

During the 2004–2005 to 2015–2016 hunting seasons, the New Mexico Department of Game and Fish (NMDGF) estimated black bear abundance (*Ursus americanus*) across the state by coupling density estimates with the distribution of primary habitat generated by Costello et al. (2001). These estimates have been used to set harvest limits. For example, a density of 17 bears/100 km^2 for the Sangre de Cristo and Sacramento Mountains and 13.2 bears/100 km^2 for the Sandia Mountains were used to set harvest levels. The advancement and widespread acceptance of non-invasive sampling and mark-recapture methods, prompted the NMDGF to collaborate with the New Mexico Cooperative Fish and Wildlife Research Unit and New Mexico State University to update their density estimates for black bear populations in select mountain ranges across the state.

We established 5 study areas in 3 mountain ranges: the northern (NSC; sampled in 2012) and southern Sangre de Cristo Mountains (SSC; sampled in 2013), the Sandia Mountains (Sandias; sampled in 2014), and the northern (NSacs) and southern Sacramento Mountains (SSacs; both sampled in 2014). We collected hair samples from black bears using two concurrent non-invasive sampling methods, hair traps and bear rubs. We used a gender marker and a suite of microsatellite loci to determine the individual identification of hair samples that were suitable for genetic analysis. We used these data to generate mark-recapture encounter histories for each bear and estimated density in a spatially explicit capture-recapture framework (SECR). We constructed a suite of SECR candidate models using sex, elevation, land cover type, and time to model heterogeneity in detection probability and the spatial scale over which detection probability declines. We used Akaike's Information Criterion corrected for small sample size (AIC_c) to rank and select the most supported model from which we estimated density.

We set 554 hair traps, 117 bear rubs and collected 4,083 hair samples. We identified 725 (367 M, 358 F) individuals; the sex ratio for each study area was approximately equal. Our density estimates varied within and among mountain ranges with an estimated density of 21.86 bears/100 km^2 (95% CI: 17.83 – 26.80) for the NSC, 19.74 bears/100 km^2 (95% CI: 13.77 – 28.30) in the SSC, 25.75 bears/100 km^2 (95% CI: 13.22 – 50.14) in the Sandias, 21.86 bears/100 km^2 (95% CI: 17.83 – 26.80) in the NSacs, and 16.55 bears/100 km^2 (95% CI: 11.64 – 23.53) in the SSacs. Overall detection probability for hair traps and bear rubs, combined, was low across all study areas and ranged from 0.00001 to 0.02. We speculate that detection probabilities were affected by failure of some hair samples to produce a complete genotype due to UV degradation of DNA, and our inability to set and check some sampling devices due to wildfires in the SSC. Ultraviolet radiation levels are particularly high in New Mexico compared to other states where NGS methods have been used because New Mexico receives substantial amounts of sunshine, is relatively high in elevation (1,200 m – 4,000 m), and is at a lower latitude. Despite these sampling difficulties, we were able to produce density estimates for New Mexico black bear populations with levels of precision comparable to estimated black bear densities made elsewhere in the U.S.

Our ability to generate reliable black bear density estimates for 3 New Mexico mountain ranges is attributable to our use of a statistically robust study design and analytical method.

There are multiple factors that need to be considered when developing future SECR-based density estimation projects. First, the spatial extent of the population of interest and the smallest average home range size must be determined; these will dictate size of the trapping array and spacing necessary between hair traps. The number of technicians needed and access to the study areas will also influence configuration of the trapping array. We believe shorter sampling occasions could be implemented to reduce degradation of DNA due to UV radiation; this might help increase amplification rates and thereby increase both the number of unique individuals identified and the number of recaptures, improving the precision of the density estimates. A pilot study may be useful to determine the length of time hair samples can remain in the field prior to collection. In addition, researchers may consider setting hair traps and bear rubs in more shaded areas (e.g., north facing slopes) to help reduce exposure to UV radiation. To reduce the sampling interval it will be necessary to either hire more field personnel or decrease the number of hair traps per sampling session. Both of these will enhance detection of long-range movement events by individual bears, increase initial capture and recapture rates, and improve precision of the parameter estimates. We recognize that all studies are constrained by limited resources, however, increasing field personnel would also allow a larger study area to be sampled or enable higher trap density.

In conclusion, we estimated the density of black bears in 5 study areas within 3 mountains ranges of New Mexico. Our estimates will aid the NMDGF in setting sustainable harvest limits. Along with estimates of density, information on additional demographic rates (e.g., survival rates and reproduction) and the potential effects that climate change and future land use may have on the demography of black bears may also help inform management of black bears in New Mexico, and may be considered as future areas for research.

INTRODUCTION

Setting sustainable harvest limits for game species is one of the main duties of state wildlife management agencies. To this end, state agencies spend a large portion of their annual budget on population surveys to estimate abundance and population trends of game animals. Survey methodologies for large ungulates are well developed and can provide relatively robust estimates of common game species such as deer (*Odocoileus* spp.) and elk (*Cervus canadensis*). In contrast, estimating the abundance or density of large carnivores like American black bears (*Ursus americanus*), which are cryptic and occur at low densities is more difficult because their behavior makes the survey methods used for ungulates ineffective, e.g., assuming perfect detection probability (Miller 1990, Obbard et al. 2010). Historically, many state agencies set harvest limits for carnivores based on harvest data (Hristienko and McDonald 2007), including sex ratio and age structure of the harvested animals, which, along with other analytical approaches, can be used to infer harvest effects on a population (Garshelis 1990). Yet, hunter selectivity and sex-specific vulnerability may influence harvest composition (Miller 1990, Beston and Mace 2012). Thus, additional information provided by abundance and density estimates generated from robust statistical methods can aid in setting harvest limits for black bear populations.

New Mexico's most recent black bear density estimates were derived from a comprehensive, decade-long study on black bear ecology in the 1990s in which researchers estimated study area specific density using population reconstruction (Downing 1980), or backdating, to estimate the minimum population size during the study and then divided that estimate by the effective trapping area (ETA; Costello et al. 2001) to obtain a minimum density estimate. The ETA is an estimate of the actual area used by identified individuals to account for home ranges that straddle the study area boundary and may bias abundance estimates (Dice 1938, Wilson and Anderson 1985). Costello et al. (2001) estimated the ETA using the distribution of live-capture trap sites buffered by the mean activity radius of adult bears. Their minimum density estimate for the more northern, mesic, and presumably more productive Sangre de Cristo Mountains was 17.0 bears/100 km^2 (310 km^2 study area) while their estimate for the more southern, xeric, and presumably less productive Mogollon Mountains was 9.4 bears/100 km^2 (423 km^2 study area). It is important to note that backdating a population fails to account for undetected individuals or provide measures of uncertainty in estimates, thereby producing only a minimum population estimate. They extrapolated these minimum density estimates to similar black bear habitat throughout New Mexico assigning areas with habitat conditions in between the Sangre de Cristo Mountains and Mogollon Mountains a density equal to the mean of the two minimum density estimates (i.e., 13.2 bears/100 km^2). Costello et al. (2001) estimated the statewide minimum population by multiplying minimum density by the area of statewide primary habitat identified through their habitat suitability analysis, which introduces another source of uncertainty that was not quantified. Along with the density estimates, Costello et al. (2001) provided the NMDGF with a population model that incorporated the new density estimates, harvest data, mast survey data, and the relationship between mast production and reproductive success to model abundance and trend of black bear abundance in each Bear Management Zone (BMZ). These model-based abundance estimates, coupled with yearly harvest and mast survey data, have been the basis for establishing black bear harvest limits in New Mexico (Rick Winslow, NMDGF, personal communication). Although live-capture provides a wealth of information on age, dispersal, fecundity, health, home range size, and mortality rates, it is still inferentially limited due to small sample sizes. While Costello et al. (2001) was a progressive and highly informative study on New Mexico black bears, the capabilities of the technology at that time limited their ability to estimate abundance and density.

Capture-recapture (CR) is a common method for estimating abundance and density of animals and associated parameter uncertainty (Williams et al. 2002). Abundance estimates using CR are determined by comparing the ratio of uniquely marked individuals to unmarked individuals captured each sampling occasion in live capture studies (Pollock et al. 1990). Gould and Kendall (2013) summarize CR methodology and recent advances. Low capture probabilities and sample sizes inherent with species that typically reside at the low densities characteristic of carnivore populations hinders management agencies from utilizing traditional CR techniques for some species (Mills et al. 2000, Settlage et al. 2008). Noninvasive genetic sampling (NGS) revolutionized CR research by providing the ability to use remotely collected DNA samples to identify individuals (Waits and Paetkau 2005). Consequently, NGS enabled researchers to estimate population parameters for carnivores by increasing detection probability, increasing sample size of individuals detected, increasing the size of the study area, decreasing tag loss, and decreasing invasiveness compared to live capture studies (Woods et al. 1999, Mills et al. 2000). However, density estimators using traditional non-spatial CR methods are often less reliable because of the ad hoc and arbitrary estimate of the ETA, which introduces an unquantifiable error (Wilson and Anderson 1985, Parmenter et al. 2003).

Spatially explicit capture-recapture (SECR) models remedy this issue by estimating the number of home range centers within the study area, and subsequently density, directly, using a spatial point process (Efford 2004, Gopalaswamy 2013). By using SECR models, accounting for edge effects has been rooted in statistical theory and incorporated into the modeling process thereby eliminating the need to estimate ETA. Furthermore, integrating the distribution and location of sampling devices into the model eliminates individual heterogeneity related to unequal trap exposure (Borchers 2012). To date, SECR methods have shown improved parameter estimation compared to non-spatial methods with simulated datasets (Ivan et al. 2013, Whittington and Sawaya 2015) and similar or lower density estimates in empirical comparisons (Obbard et al. 2010, Stetz et al. 2014, Whittington and Sawaya 2015), particularly when distance to edge and sampling effort are not included in CR models. Although the accuracy of any density estimate is unknown, use of statistically robust estimation methods yields greater confidence in a management agency's ability to set defensible management objectives that will help ensure the long-term viability of harvested animal populations.

In light of advances in sampling (Woods et al. 1999) and statistical methods (Efford 2004), NMDGF began a collaborative project with the New Mexico Cooperative Fish and Wildlife Research Unit (NMCFWRU) and New Mexico State University (NMSU) to update their density estimates for New Mexico black bear populations. These estimates will then be used by NMDGF to set harvest limits in the respective study areas. Our (NMCFWRU and NMSU) objectives were to estimate the density of black bears ≥1 year of age in primary bear habitat within 7 of the 14 BMZs located within the Sangre de Cristo (BMZs 3, 4, and 5), Sandia (BMZ 8), and Sacramento Mountains (BMZs 11, 12, 13), New Mexico. We used non-invasive genetic samples from hair traps and bear rubs in combination with SECR models to estimate density for each study site.

STUDY AREA

We conducted our research in the Sangre de Cristo, Sandia, and Sacramento Mountains, New Mexico constituting 5 study areas: northern (NSC; 6,400 km^2) and southern Sangre de Cristo Mountains (SSC; 3,525 km^2), Sandia Mountains (300 km^2), and northern (NSacs; 925 km^2) and southern Sacramento Mountains (SSacs; 2,775 km^2). Interstate 25 and Interstate 40 separated the 3-mountain ranges. The sampling area for each study area was limited to primary habitat identified by Costello et al. (2001; Figure 1). Costello et al. (2001) used the New Mexico Gap Analysis land cover map (NMGAP, Thompson et al. 1996) to classify primary habitat as all closed-canopy forest and woodland types. All 5 study areas were managed as multiple-use forests encompassing portions of 4 National Forests (Carson, Cibola, Lincoln, and Santa Fe), 6 wilderness areas (Columbine-Hondo, Latir Peak, Pecos, Sandia Mountain, Wheeler Peak, and White Mountain), and 25 private landowners. Maximum elevation was 4,011 m, 3,254 m, and 3,649 m for the Sangre de Cristo, Sandia, and Sacramento Mountains and minimum elevations were approximately 1,900 m, 1,700 m, and 1,500 m, respectively. The Southern Rocky Mountains floristic district characterizes the Sangre de Cristo Mountains while the Sandia and Sacramento Mountains are characterized by the Mogollon floristic district (McLaughlin 1992). Dominant vegetation types in the study areas include: oak–mountain mahogany (*Quercus* spp. – *Cercocarpus* spp.) scrublands; piñon pine (*Pinus edulis*) - juniper (*Juniperus* spp.) woodlands; ponderosa pine (*P. ponderosa*), white pine (*P. monticola*), Douglas fir (*Pseudotsuga menziesii*), aspen (*Populus tremuloides*), Engleman spruce (*Picea engelmannii*) and subalpine fir (*Abies lasiocarpa*) mixed-forest, and bristlecone (*P. aristata*) and limber (*P. flexilis)* pine forests (Costello et al. 2001). Important mast-producing species include oak, piñon pine, juniper, algerita (*Berberis haematocarpa*), chokecherry (*Prunus virginiana*), gooseberry (*Ribes* spp.), bear corn/squawroot (*Conopholus alpina*), cactus fruits (*Opuntia* spp.) and sumac (*Rhus* spp.; Kaufmann et al. 1998, Costello et al 2001).

METHODS

Field Sampling

We used hair traps (Woods et al. 1999) and bear rubs (Kendall et al. 2008) concurrently to sample black bear populations (Sawaya et al. 2012, Stetz et al. 2014). We sampled the black bear populations by systematically distributing a grid of 5-km x 5-km cells, with a randomly determined origin, across the landscape. A 5-km x 5-km cell size allowed us to place 4 hair traps within the average fixed kernel female home range in the Sangre de Cristo Mountains (27.6 km^2; Costello et al. 2001). We then set hair traps across primary habitat in areas most likely to encounter bears (Figure 2, 3, 4; Costello et al. 2001). We chose trap site locations based on suspected travel routes, occurrence of seasonal forage (e.g., green grass and ripe soft and hard mast), and presence of bear sign. We set hair traps and bear rubs across 4 sampling occasions in the NSC (22 April – 5 September 2012) and SSC (29 April - 9 September 2013) and across 6 sampling occasions in the Sandias, NSacs, and SSacs (5 May – 6 August 2014). Due to logistical constraints, a sampling occasion in the NSC and SSC lasted 4 weeks whereas the sampling occasion for the Sandias, NSacs, and SSacs was 2 weeks.

A hair trap consisted of a single strand of barbed wire wrapped around ≥3 trees with a lure pile constructed from woody debris, rocks, pine needles, and leaves at the center (Woods et al. 1999). During each sampling occasion in the NSC and SSC, 1 of 4 non-consumable lures (cow blood/fish emulsion mixture, anise oil, fatty acid scent tablet, or skunk tincture/lanolin mixture) was randomly selected and applied to the lure pile to attract bears into the exclosure and increase the novelty of hair traps to increase recapture rates. In the Sandias, NSacs, and SSacs we randomly selected and applied 1 of 2 non-consumable lures (cow blood/fish emulsion mixture or skunk tincture/lanolin mixture) each occasion. Based on our judgement in the field, we eliminated anise oil and fatty acid scent tablets because their scent duration and dispersal distance was inferior compared to the other two lures. Therefore, we believe the cow blood/ fish emulsion and skunk tincture/lanolin mixtures provided a better opportunity to attract bears over a longer period of time and greater distance. When a bear passed over or under the wire to investigate the lure pile, a barb snagged a tuft of hair from the individual. We assumed that cubs of the year were too small to be sampled by the barbed wire based on the size of cubs photographed at hair traps by trail cameras. Thus, sub-adults and adults were our sampled population. A sample consisted of all hair caught in one barb, and we used our best judgement to define hair samples collected from the lure pile. We deposited each hair sample in a separate paper coin envelope. We sterilized the barbed wire with a propane torch to ensure we removed any remaining hair to prevent false recaptures during the next sampling occasion. Hair traps were moved (100 m – 2.5 km) each occasion to help increase novelty and recapture rates (Boulanger and McLellan 2001, Boulanger et al. 2004, Boulanger et al. 2008).

Bears rub on trees, power poles, barbed-wire fences, wooden signs, and road signposts (Burst and Pelton 1983, Green and Mattson 2003). We opportunistically identified and collected hair from bear rubs along trails used to navigate to hair traps. We identified bear rubs by evidence of rubbing behavior such as a smoothed surface and snagged hair on the surface (Kendall et al. 2008, 2009). We attached 3-short strands of barbed wire vertically to the rub structure in order to collect discrete, higher quality hair samples (Kendall et al. 2008, 2009, Stetz et al. 2014). Rubs were identified at varying time intervals across sampling occasions, however, once established they were checked concurrently with nearby hair traps. We collected hair samples only from the barbed wire to ensure that the samples collected were from individuals that visited the rub during the sampling occasion and we sterilized the barbed wire to prevent false recaptures (Kendall et al. 2009). All hair samples were stored in an airtight container on silica desiccant at room temperature.

Genetic Analysis

We identified individuals by comparing multilocus genotypes generated for hair samples using 8 polymorphic microsatellite loci (G1D, G10B, G10L, G10M [Paetkau et al. 1995]; G10H, G10J, G10U [Paetkau et al. 1998]; MU59 [Taberlet et al. 1997]). We used the amelogenin or ZFX/ZFY markers to identify the sex of the individual (Paetkau 2003, 2004; Yamamoto et al. 2002; Durin et al. 2007). We selected specific markers for individual identification by ensuring that the mean expected heterozygosity for each marker was between 0.70 and 0.80 (Paetkau 2003, 2004). These markers were determined from an initial subsample from the NSC population in 2012. Because NGS-collected samples may contain low quantity and quality DNA (e.g., hair vs. tissue), genotyping errors may create or delete individuals, which may bias estimates (Mills et al 2000, Lukacs and Burnham 2005). Paetkau (2003) suggested that the largest source of genotyping error resulted from human error when identifying alleles at a locus, which only training and experience could reduce. Therefore, we sent our genetic samples to Wildlife Genetics International (WGI), which is a genetics laboratory that specializes in strict laboratory and error-checking methods that reduce genotyping errors that may arise from poor quality or small quantities of DNA (Paetkau 2003, Kendall et al. 2009). The laboratory has conducted over

2,000 projects including successfully identifying 653 samples without error during a blind sample test (Kendall et al. 2009). Thus, WGI has established a reputation for integrity and high quality work.

First, we eliminated samples that contained insufficient genetic material for analysis (no root, ≤ 1 guard hair, or < 5 underfur hairs) or appeared to be from heterospecifics. Next, we used either the G10J or ZFX/ZFY marker as a prescreen to remove low quality hair samples that were likely to fail during the multilocus genotyping phase. After the prescreen, we amplified the 9 candidate markers for each sample. We eliminated samples that failed to amplify at ≥ 3 loci or that amplified ≥ 3 alleles at 1 marker because they indicated a mixed sample from 2 individuals. We reanalyzed the samples that failed at < 3 loci resulting in either a full 9-locus genotype or a discarded sample. We examined pairs of samples that were mismatched at 1 or 2 markers (1MM pairs or 2MM pairs) for evidence of amplification or human error. We then reamplified and resequenced the mismatched pair for these samples under the assumption that genotyping error may have created the similarity between the two samples (Paetkau 2003). If a 1MM or 2MM pair remained between samples, then we considered the two samples to be from separate individuals, otherwise, we identified and corrected the genotyping error and we concluded that the two samples were from the same individual. We assigned individual ID to each sample with a unique multilocus genotype based upon the first sample to identify the individual's genotype. We calculated the expected and observed heterozygosity for the Sangre de Cristo, Sandia, and Sacramento Mountains using program GENEPOP (Genepop on the Web, Raymond and Rousset, 1995). Detailed laboratory methods may be found in Paetkau (2003, 2004).

Density Estimation

We used genotypes of individual samples to generate capture-recapture encounter histories for each uniquely identified black bear. We then used these capture histories to estimate density using spatially explicit capture-recapture (SECR) models (Efford 2004, Efford et al. 2009a, Efford et al. 2013) with the R package "secr" (Efford 2013). We used SECR to estimate 3 parameters: density (D), detection probability (g0), and the spatial scale over which the detection probability declines (σ; Efford et al. 2004). We used a half-normal detection function for our observation model, which represents the probability of detecting an individual as a function of the individual's home range location relative to the detection device (Efford et al. 2009a). We then specified a homogeneous Poisson distribution as our state model to represent the spatial distribution of animals across the sampling grid. We only included primary habitat as identified by Costello et al. (2001) for black bears in New Mexico for our habitat mask. The habitat mask identifies the area of habitat/non-habitat within and buffered around the trapping grid. We estimated the state space (i.e., the trapping grid and all individuals potentially exposed to capture outside the trapping grid) using the secr function suggest.buffer for each study area. However, this buffer is not to be confused with the ad hoc method of identifying a buffer using the ETA. Instead, the suggested buffer is the area of integration and includes all animals with a non-zero probability of detection (Ivan et al. 2013). Habitat may extend beyond the mask but individuals outside the buffer have a negligible probability of encounter (Borchers and Efford 2008, Royle et al. 2014). Derived from the capture data using suggest.buffer, we set the habitat mask buffer for the NSC, SSC, Sandias, NSacs, and SSacs as 18.75 km, 25.40 km, 13.23 km, 14.84 km, and 11.03 km, respectively. Variability in sampling effort may negatively bias density estimates and reduce the ability to explain variation in detection probability (Efford et al. 2013). We accounted for variable sampling effort by using the number of days each hair trap and bear rub was active (Kendall et al 2009, Sawaya et al 2012, Efford et al. 2013).

We tested for variation due to time (t), sex, elevation (elev), detector type (type; hair trap versus bear rub), and land cover classification (veg) as predictors of g0, and σ. Elevation was standardized prior to analyses by subtracting the mean and dividing by the standard deviation (Gelman and Hill 2007). We did not consider behavioral models because we did not provide a food reward. We modeled D only using sex because we did not expect bear density to vary by time, land cover type, or elevation. We entered sex into our models as a session covariate. We modeled g0 and σ concurrently by fitting 4 models that varied by time, sex, land cover type, and elevation. We also included models that varied by temporal variation for g0 and land cover for σ, temporal variation for g0 and elevation for σ, land cover for g0 and temporal variation for σ, and elevation for g0 and temporal variation for σ. We chose temporal variation and sex as covariates because multiple studies have reported that detection probability and movement patterns fluctuate over the course of the sampling period and differ between males and females (Kendall et al. 2009, Sawaya et al. 2012, Stetz et al. 2014, Ciucci et al. 2015). We selected elevation and land cover to represent the spatial heterogeneity of food resources exploited by black bears. We hypothesized that this heterogeneity could influence g0 and σ depending on the presence or absence and distribution of food on the landscape. However, we did not include both land cover type and elevation in the same model due to concerns of multicollinearity. We also constructed models with temporal variation for g0 and σ in addition to additive variation with either elevation or land cover. We included additive effects because we hypothesized that g0 and σ are likely to vary because of the black bear mating season, hyperphagic foraging behavior during late summer and early fall, and the temporally variable distribution of food resources on the landscape.

We extracted the elevation for each detector using the National Elevation Dataset 30 m resolution digital elevation model. We extracted land cover using the Interagency Landfire Project (www.landfire.gov; Rollins 2009) land cover classification at 30 m spatial resolution. We combined 6 Landfire land cover classifications into 5 categories: aspen – conifer, mixed conifer (combination of Douglas fir and white pine), piñon pine – juniper, ponderosa pine, and spruce – fir. Variability in abundance and distribution of each land cover classification across study areas resulted in a different number of categories and, consequently, number of parameters in each model among study areas. Aspen-conifer and spruce-fir were only included in the NSC and SSC. Mixed-conifer was included in all study areas except the Sandia Mountains. Piñon-juniper and ponderosa pine were included in all study areas. We extracted elevation and assigned the dominant land cover classification surrounding the location of each detector using ArcGIS 10.2.1 (Environmental Systems Research Institute, Inc. [ESRI], Redlands, California, USA). Each model serves as a hypothesis modeling the heterogeneity in the data for each estimable parameter. We used Akaike's Information Criterion corrected for small sample size (AIC_c) to rank our final model set (Akaike 1973, Hurvich and Tsai 1989). We used the difference in AIC_c score (ΔAIC_c) between the top-ranked model and competing models to compare relative support, and we provide the AIC_c weights (w_i) to show the proportional support for each model (Burnham and Anderson 2002). We used model averaging to account for model selection uncertainty when the top ranked model in the final model set garnered less than 0.90 of the model weight (Burnham and Anderson 2002).

We conducted our study with authorization under Convention on International Trade in Endangered Species Export Permits 12US86417A/9, 13US19950B/9, and 14US43944B/9, and New Mexico Department of Game and Fish Authorization for Taking Protected Wildlife for Scientific and/or Education Purposes Permit 3504. All procedures were approved by the New Mexico State University Institutional Animal Care and Use Committee (Protocol number 2011-027).

RESULTS

Field Sampling

We set 557 hair traps that were open for 57,010 trap days and we collected 3,825 hair samples. In addition, we identified and sampled 112 bear rubs, which yielded 258 hair samples over 7,007 trap days (Figure 2, 3, and 4; Tables 1 and 2). Sampling effort varied across study areas and was dependent on the number of hair traps and bear rubs set, the length of a sampling occasion for each study area (4 weeks vs. 2 weeks), and the accessibility of areas due to stochastic weather events and wildfire. The number of hair traps that collected ≥1 hair sample ranged from 28% to 42% with most traps collecting a hair sample in 1 – 2 sampling occasions. The number of hair samples collected during a particular occasion increased over the course of the summer and decreased towards the conclusion of sampling with peak collection during June and July (Table 2).

Genetic Analysis

The mean observed heterozygosity for our suite of genetic markers was 0.73 (Table 3). The number of individuals that were mismatched at 1 or 2 markers was extremely low with 3, 0, 0, and 0 observed 1MM-pairs and 0, 4, 0, and 4 observed 2MM-pairs and 3, 0, 0, and 0 for the NSC, SSC, Sandias, and Sacramento Mountains, respectively. Excluding the NSC, the observed mismatched pairs fell within the expected mismatch distribution for each population (Paetkau 2003). The deviation from expectation observed in the NSC was likely due to chance (D. Paetkau, WGI, personal communication). From the 4,083 total hair samples collected, we eliminated 27.7% from the genotyping process. Reasons for excluding hair samples included: the sample contained insufficient genetic material for analysis (26.1%), was not of black bear origin (1.49%), or contained DNA from more than one individual (0.17%). We attempted to genotype 2,950 (72.3%) hair samples but were only able to generate a full 9-loci genotype for 49.6% of the eligible samples and identified 726 (368 M: 358 F) individuals (Table 4). The observed sex ratio for each study area was approximately equal. Genotyping success varied across study areas (43% - 60%), but overall, our success rates were lower than the 75% success rate observed in similar studies (D. Paetkau, WGI, personal communication). Contrary to our prediction, when we shortened the length of the sampling occasion from 4 weeks (NSC and SSC) to 2 weeks (Sandias, NSacs, and SSacs), we increased the percentage of successful genotypes by 4%.

Density Estimation

We detected the majority (61% – 85%) of individuals in each study area only once with similar average number of detections of males (1.19 – 1.67) and females (1.14 – 1.56; Table 5). The number of unique individuals detected during each occasion for the NSC, NSacs, and SSacs increased over the course of sampling, peaking mid-summer, and subsequently decreasing towards the end of the season (Figure 5); this pattern was similar to the total number of hair samples collected per sampling occasion (Table 3). However, the number of unique individuals detected continued to increase over the course of the summer reaching its highest point during the last sampling occasion for both the SSC and the Sandias. Mean maximum recapture distance for males ranged from 4.23 to 12.46 km with a maximum distance of 52 km by one individual in the NSC (n = 3 – 33). Mean maximum recapture distance for females ranged from 0.38 to 4.59 km with a maximum distance of 47 km by one individual, also in the NSC (n = 4 - 23; Table 5). Three individuals were detected in two study areas. The first two detections were males we detected in the NSC in 2012 and then again in the SSC in 2013, and the third was a female we detected in the SSC in 2013 and then again 90 km away in the Sandias in 2014.

The most supported model for the NSC received all model weight and suggested that time and land cover type were important covariates explaining both g0 and σ (Table 6). The top model (w_i = 0.87) for the SSC included time and elevation, whereas the second highest-ranking model (w_i = 0.13) included time and land cover type (Table 7). The top model (w_i = 0.96) for the Sandias indicated that both g0 and σ varied by sex (Table 8). The highest-ranking model (w_i = 0.96) for the NSacs included time and land cover type for both g0 and σ (Table 9). There was higher model selection uncertainty for the SSacs than any other site, but the most supported model (w_i = 0.50) included land cover type for both g0 and σ (Table 10). The second and third ranked models included time and land cover, and time and elevation, respectively; these three top-ranked models contained all of the model weight (Table 15). For the NSC, we were able to fit all models except when g0 and σ were modeled concurrently with elevation (i.e., g0 ~ elev, σ ~ elev), concurrently with time and elevation (i.e., g0 ~ t + elev, σ ~ t + elev), independently with elevation (i.e., either g0 ~ elev, σ ~ constant; or g0 ~ constant, σ ~ elev), independently with time and elevation (i.e., either g0 ~ t + elev, σ ~ constant; or g0 ~ constant, σ ~ t + elev), and with time and elevation for different parameters (i.e., either g0 ~ t, σ ~ elev; or g0 ~ elev, σ ~ t) because of computational limitations. For the NSacs, we did not fit a model using detector type to predict g0 and σ concurrently because only one bear rub was set.

Detection probability (g0) was highest for the Sandias (g0 = 0.02), but overall, g0 was low across all study areas (Table 11). The final model for all study areas, except the Sandias, did not support a sex effect. Despite having the highest g0 relative to the other study areas, the precision of the Sandias density estimate was the lowest; whereas, the NSC density estimate was the most precise despite a low g0 (Table 11). Mean density estimates varied within and between mountain ranges (range 16.55 to 21.86 bears/100 km^2) and were model averaged for the SSC and SSacs (Table 11).

DISCUSSION

Our study provided the most current density estimates for multiple New Mexico black bear populations in over a decade (Costello et al. 2001). Our results suggest that densities are similar (SSacs) to or higher (NSC, SSC, Sandia, and NSacs) than the previous estimates used by NMDGF (17 bears/100 km^2 and 13.2 bears/100 km^2) to manage New Mexico black bear populations. The differences in estimated density could be a result of an increasing black bear population, simple variation in population density due to time, a difference in the state of environmental conditions, or different sampling and analytical methods. For example, Costello et al. (2001) did not account for uncollared individuals in their density estimation approach and thus likely underestimated the density of the population by not accounting for imperfect detection. Furthermore, their abundance and density estimates provided no measure of uncertainty because their estimation technique was not statistically based and did not provide a measure of uncertainty. As a result, Costello et al. (2001) used minimum abundance to derive their density estimates, which may explain at least some of the difference in our density estimates given we estimated mean density. Regardless, unless populations are extremely stable, we would expect density of a population to vary across space and with time.

The relative importance of the covariates we selected for modeling parameters was similar across study areas. The top model for all study areas held density constant suggesting an equal sex ratio in each population. Time of the detection event and the land cover type or elevation at which the detector was deployed were helpful covariates in modeling heterogeneity in both g0 and σ for all study areas except the Sandia Mountains, which included sex of the individual detected as an important explanatory variable. The importance of temporal variability is likely a result of seasonal reproductive and foraging behaviors (Alt et al. 1980, Garshelis and Pelton 1981, Costello et al. 2003). Black bear mating season begins with den emergence, which can be as early as late March, peaks in June, and typically ends by July (Costello et al. 2001). During this period, males move more as they traverse their home range searching for receptive females (Young and Ruff 1982, Costello 2008, Lewis and Rachlow 2011). Mast season begins in July, with peak masting occurring during late summer and early fall (Costello 2008). At this time, bears begin to enter a hyperphagic state when they increase daily caloric intake from 8,000 kcal to 15,000 – 20,000 kcal to build up fat stores for hibernation and reproduction in females (Nelson et al. 1980). Bear home range size and distance between sequentially recorded movements increases as bears travel outside their core area to exploit the spatially and temporally variable mast (Ostfeld et al. 1996, Costello 2008), which is an important food source and highly correlated with black bear reproductive output in New Mexico (Costello et al. 2003). Increased movement rates and enlarged home range size during mating and hyperphagia would likely affect trap exposure rates on the landscape, thus affecting g0 and σ.

The influence of land cover and elevation is likely a function of black bears responding to spatio-temporal changes in food abundance (Costello and Sage 1994, Costello et al. 2001, Mazur et al. 2013, McCall et al. 2013). Using scat surveys, Costello et al. (2001) reported that grasses, forbs, and ants tend to dominate bear diets during the pre-mast season (den emergence – 20 July). As the summer progresses, early mast season (21 July – 15 September) diets included soft mast species including chokecherry, squawroot (*Conopholis alpina*), and gooseberry as well as acorns (56% of scat volume). Diets during the late mast season (15 September – den entrance) are dominated by acorns (87% of scat volume) and supplemented with juniper berries (Costello et al. 2001). Mid-elevation land cover types (i.e., mixed conifer) are likely to contain a higher abundance of pre-mast species (grass and forbs) due to earlier snowmelt (compared to higher elevations) and moist conditions near riparian areas compared to dry, lower elevations. As snow melts, grasses and forbs will increase in abundance and distribution. With the arrival of monsoonal rains, soft mast will begin to ripen at lower elevations. Once oak acorns ripen in late summer/early fall, black bears begin to shift their attention towards vegetation types containing abundant acorns.

The main challenge we faced was genetic samples failing to produce a reliable genotype (i.e., not generating an individual ID for a particular hair sample). The inability to assign a reliable genotype to half of our genetic samples (44% - 61%) reduced the number of unique individuals and spatial recaptures (i.e., recapture of individuals at different traps) available for analysis. Consequently, this led to low detection probability and likely affected estimation of σ inducing larger standard errors and less precise density estimates (Efford et al. 2004, Sollmann et al. 2012, Sun et al. 2014). The relatively more precise NSC density estimate, despite a low g0, may be a result of a greater number of unique individuals and recaptures, which provided sufficient data for the model to predict unobserved movement distances (Table 5; Sollmann et al. 2012, Sun et al. 2014). Interestingly, despite having the highest estimated g0 among all study areas, the density estimate for the Sandias was the least precise, which may have been influenced by a low number of recaptures for both sexes, a low g0 for males, a large individual heterogeneity in male movement patterns, and/or an over-partitioning in data due to estimating sex specific detection parameters (i.e., g0 and σ). However, we believe the greatest factor affecting the density estimate is the number of individuals detected. Detecting fewer individuals results in less data to estimate the model parameters. Consequently, small sample size coupled with few recaptures can result in wider confidence intervals (Sun et al. 2014), which is likely the case for the Sandia density estimate. Our second highest-ranking model for the Sandias estimated density as 18.4 bears/100 km^2, which is still higher than the current density estimate used to manage the population (13.2 bears/100 km^2). Replicative sampling may help provide more information on the density of the Sandias.

In the SSC, we likely lost hair samples due to two forest fires, the Tres Lagunas and Jaroso Fires (Figure 6). The Tres Lagunas Fire started 30 May 2013 and burned 4,135 ha just below the southern boundary of the Pecos Wilderness. The Jaroso Fire started 10 June 2013 and burned 4,511 ha in the northwest corner of the Pecos Wilderness. We suspect these fires contributed to a less precise density estimate for the SSC. These fires affected 450 km^2 (12.7%) of the trapping grid and prevented us from checking hair traps located in close proximity to the fire primarily during the second and third sampling occasions (3–13% of total hair traps). Moreover, many of the fire-affected traps were in relatively high quality bear habitat where we would expect higher bear abundance. Anecdotally, post-fire these hair traps consistently yielded more hair samples than hair traps located in some areas that were unaffected by the fires. The inability to collect samples in this area may have reduced the number of new individuals detected, and, more importantly, most likely reduced the number of recaptures necessary for more precise parameter estimates. The limited access also prevented us from identifying more bear rubs across the SSC, restricting our ability to utilize multiple sampling methods and hindering our ability to minimize the impacts of capture heterogeneity (e.g., age, sex, reproductive status) caused by any one survey method (Boulanger et al. 2008). The use of hair traps and bears rubs concurrently has also been shown to increase the precision of parameter estimates compared to those generate by hair traps alone (Sawaya et a. 2012, Stetz et al. 2014), and likely aided our ability to generate more precise density estimates given our low amplification rates. We also hypothesize that the presence of fire on the landscape increased movements of individuals (Cunningham and Ballard 2004) as seen by our estimate of σ for the SSC, which is 3x – 24x larger than the other study areas.

Overall, a net loss in sampling occasions and hair samples reduced the amount of data available for the SSC analysis. The few individuals we recaptured in each occasion and the large number of unique bears identified in the last occasion, after the fires were extinguished or contained, support our argument that the fires in the SSC affected our model parameter estimates. Ideally, as a population is sampled the number of unique individuals captured declines over time (i.e., fewer unmarked individuals are encountered). Yet, in the SSC we captured 34% of all unique individuals during the last sampling occasion. While the number of individuals detected the last occasion in the NSC is still high (20%), it seems that the fires in the SSC influenced our ability to detect bears in this area as compared to the NSacs and SSacs (both 10%; Figure 5). Limited access to these hair traps during the fires led to longer sampling occasions and greater exposure to environmental conditions (i.e., exposure increased from 4 weeks to ≥8 weeks), subjecting hair samples to longer periods of environmental exposure, particularly to ultraviolet radiation (UV).

We suspect that for all study areas UV radiation is the main factor explaining failure of hair samples to produce a complete genotype (Stetz et al. 2015). Ultraviolet radiation causes DNA degradation by the formation of chemical compounds known as dimers. Dimers form by the binding of two adjacent, pyrimidine-nucleotide bases (cytosine and thymine) on a single strand of the double helix instead of binding between cross-strand partners (Jagger 1985). This fusion forms a bulge in the chemical structure of the DNA preventing DNA polymerase from progressing past the dimer and correctly duplicating the sequence, which prevents further amplification of the DNA molecule resulting in an incomplete genotype. Consequently, we suspect that the inability to assign an identity to a large portion of the genetic samples may have reduced the number of unique individuals and recaptures across all study areas. Multiple factors influence UV levels and, subsequently, its effects on DNA degradation including cloud cover, elevation, latitude, time of day, time of year, length of exposure, season, ozone depletion, and atmospheric turbidity (Piazena 1996, Stetz et al. 2015). For example, UV radiation increases with decreasing cloud cover, increases with elevation (9.0% – 11.0% per 1,000 m), and increases with lower latitude (Blumthaler et al. 1997). New Mexico receives substantial amounts of sunshine (Albuquerque 76% vs. U.S 58% average annual possible sunshine; NOAA 2004), is relatively high in elevation (1,200 m – 4,000 m), and is at a lower latitude than other geographic areas where NGS methods have been used to estimate bear abundance and density. Collectively, these factors result in UV radiation levels across much of New Mexico being higher than across most of the U.S. Further, we would expect UV radiation levels to be 1% – 26% higher in our study areas compared to those for Albuquerque, NM (Figure 7; NOAA 2015) because our study areas were typically located at higher elevations. Reducing sampling interval length should increase genotyping success, however, when we reduced our sampling interval from 4 to 2 weeks (which is a common time frame used by similar NGS studies), in the Sandias, NSacs, and SSacs we observed only a marginal improvement in genotyping success (4%). Surprisingly, the lowest genotyping success rate was in the SSacs (44%) given sampling occasions in the SSacs were 2 weeks shorter than the NSC and SSC. Thus, we suggest researchers consider conducting a pilot study to determine the optimal sampling interval for reducing UV degradation of DNA within hair samples particularly for study areas in the southwestern U.S.

Despite these sampling difficulties, we were able to produce density estimates with comparable levels of precision as those obtained in black bear studies conducted elsewhere in the U.S. (Table 12). We believe these estimates were possible due to the large extent of our study areas, which allowed us to detect a larger proportion of the population within each mountain range, increased the potential number of recaptures, and buffered the data from the low amplification success rates. In addition, we believe because there was no observable spatial pattern in the collection locations of samples that failed to amplify we were still able to gather an adequate representation of movement of individuals on the landscape due to our sampling intensity and use of multiple survey methods. This allowed us to model unobserved movement distances (Sollmann et al. 2012). However, a small data set affected the Sandias estimate resulting in larger confidence intervals than the other study areas, particularly the NSC. It is likely that precision for these two study areas was influenced by the number of individuals detected (NSC: n = 379 vs. Sandias: n = 18).

Black bears are naturally difficult to sample due to their cryptic behavior and large home ranges. Furthermore, spatially and temporally stochastic environmental (e.g., masting oak and wildfire; Cunningham et al. 2003, Mazur et al. 2013) and anthropogenic (e.g., recreation and roads; Boyle and Samson 1985, Kasworm and Manley 1988) factors confound black bear detection by influencing the distribution of individuals across the landscape. In New Mexico, the abundance and distribution of masting oak heavily influences black bear fitness and movement patterns as they accrue adequate fat reserves for hibernation and reproduction for females (Costello et al. 2001, Costello et al. 2003, Inman et al. 2007). Under the assumption of a count index, multiple years of low black bear harvest may indicate a declining population while multiple years of high black bear harvest may indicate an increasing population. While observed harvest numbers may be a function of a changing population, the observed changes in harvest could be a product of various factors unrelated to the number of animals harvested. In years with average or above average precipitation levels, acorn and soft mast abundance increases. During these times, black bear movement rates are smaller due to the high availability of food on the landscape. Smaller movement rates reduce black bear exposure to hunters resulting in hunters observing, and subsequently, harvesting fewer individuals (Costello et al. 2001, Fieberg et al. 2010). However, when food crops fail, particularly acorn crops, black bear home range size increases, along with hunter harvest rates, due to the increased movements of black bears searching for food (Costello et al. 2001, Fieberg et al. 2010).

In developing sampling designs for future SECR-based black bear density estimation projects, there are multiple considerations. First, the spatial extent of the population must be determined (Sun et al. 2014). Sollmann et al. (2012) suggested that trapping arrays could be smaller than an average male home range but 1.5x larger than the average female home range. Yet, they cautioned that a small trapping array might not provide an accurate representation of movement patterns necessary to inform σ. A larger trapping array may buffer against stochastic environmental events (e.g., mast crop failure) which may cause individuals to move larger distances (McCall et al. 2013). If trapping arrays are large, there is a reduced chance that individuals will move off of the study area and thus not be detected. Selecting study area boundaries is an important aspect to consider when trying to avoid violating geographic closure of the study area. The spacing between hair traps will also influence the spatial extent of the trapping array. Non-spatial CR literature has suggested a trapping density of 4 traps per individual home range, which we adhered to, however, recent simulation work has suggested only 2 hair traps per individual home range may be required when using SECR models (Sollmann et al. 2012, Sun et al. 2014). We stress that an accurate representation of the smallest average home range size is necessary to prevent traps from being spaced too far apart. When traps are spaced too widely, the number of unique individuals and recaptures declines causing a decrease in the precision of the parameter estimates (Sun et al. 2014). If hair traps can be spaced closer together, then a regular trapping array configuration may be used, however, if they cannot, then a cluster configuration may be preferred with clusters wider than the spacing between hair traps (Sun et al. 2014). Use of fewer traps has the benefit of decreasing the trapping array size, reducing the sampling occasion length reducing environmental exposure, or reducing the number of technicians required for the study potentially saving both time and money. However, depending on the extent of the population, the size of the study area, and available resources it may not be possible to sample all available black bear habitat. In that case, it may be more appropriate to distribute multiple, smaller trapping arrays randomly across the available sampling area instead of one large array (Wilton et al. 2014).

We suggest that future efforts to estimate the density of black bear populations in New Mexico may need to shorten the length of the sampling occasion to reduce DNA degradation via UV radiation, which will increase microsatellite amplification success helping to reduce genotyping errors and increase the number of individual genotypes identified (Stetz et al. 2015). When we decreased sampling occasion length from 4 weeks to 2 weeks the genotype success rate increased by only 4% (Sandia and Sacramento Mountains: 52% vs. SSC: 48%). Thus, a pilot study may be useful to determine the length of time hair samples can remain in the field prior to collection. In addition, researchers may consider setting hair traps and bear rubs in more shaded areas (e.g., north facing slopes) to help reduce exposure to UV radiation. This may help increase the amplification success for hair samples. Increasing the number of personnel would be preferable over fewer hair traps because it would allow for a larger study area or a denser trapping array to be sampled, which should increase detection of long-range movements helping to inform σ, increase recapture rates, and increase the precision of parameter estimates (Sollmann et al. 2012). A larger study area will also place density estimates at the spatial scale at which state agencies make management decisions (Dreher et al. 2007). Personnel should be able to check and reset, on average, 3 – 5 hair traps per day depending on road density. For example, we were able to check more traps in the Sacramento Mountains (n = 148) than the SSC (n = 141) in half the time (2 weeks vs. 4 weeks, respectively) due to the higher road density in the Sacramento Mountains. Increased seasonal personnel will certainly increase cost, but this cost will be offset by a reduction in total sampling time per season. The other option is to reduce the number of hair traps resulting in a smaller study area or an increased distance between hair traps. A small study area, relative to home range size, will increase the probability that individuals travel off the sampling grid and are unavailable for capture. Individuals will also be unavailable for capture when traps are widely spaced relative to home range size causing some home ranges to fall in between hair traps. Both scenarios will reduce the number of unique individuals identified, the number of recaptures, and ultimately the precision of the parameter estimates (Sollmann et al. 2012, Sun et al. 2014). Careful consideration of these factors must be taken into account when reducing the number of hair traps to ensure a reasonable tradeoff between study area size and the distance between hair traps.

To estimate density, we used SECR models. The SECR analysis may be performed using inverse prediction (Efford 2004), maximum likelihood (ML; Borchers and Efford 2008), or Bayesian based methods (Royle et al. 2009). Inverse prediction was the original constitution of SECR models, but it is applied only to single catch traps (e.g. Sherman-live traps), due to the lack of a ML based single-catch model. Inverse prediction is limited in regards to model selection and the inclusion of parameter covariates (Borchers and Efford 2008). The two prominent statistical paradigms in SECR-based analyses are ML and Bayesian with both methods providing similar density estimates (Borchers and Efford 2008, Royle et al. 2009). The ML framework is advantageous because these models require less computation time compared to Bayesian methods (Noss et al. 2012). Although, we note that larger study areas and finer discretization increases the necessary computation time for a model. Maximum likelihood methods may require less user knowledge compared to the Bayesian because the latter requires a prior distribution be specified and "model warnings" are often prompted if an error has occurred during model fitting (Noss et al. 2012, Efford 2013). However, users should evaluate model output carefully regardless of statistical paradigm chosen. Bayesian models may be preferred in cases where data sets with small sample size are expected (Noss et al. 2012) because ML models rely on asymptotic theory, which requires larger sample sizes in order to approach normality (Gerber and Parmenter 2015). Model output generated by a Bayesian approach may be difficult to decipher due to the mechanisms of the analysis. To interpret model output, a researcher must be able to understand the influence of model priors, the distribution of the MCMC chains, the posterior model output, and other results generated by the model (Noss et al. 2012). Inverse prediction and ML based SECR models may be fitted in either program DENSITY, which offers a Graphical User Interface (GUI), or the R package "secr" (Efford et al. 2004, Efford 2013). The secr package allows a wider range of analyses including modeling density surfaces and telemetry-integrated capture-recapture, and it provides the user greater flexibility in model optimization and processing. Bayesian estimation may be conducted in either program SPACECAP (Gopalaswamy et al. 2012), which offers a GUI, or in Program R using JAGS (Just Another Gibbs Sampler) in the BUGS (Bayesian inference Using Gibbs Sampling) language (Royle et al. 2014). For our study, we chose to estimate density using the ML based approach because the statistical knowledge and expertise of our research laboratory is rooted in ML theory.

In conclusion, we estimated the density of black bears in 5 study areas within 3 mountains ranges of New Mexico. Our estimates will aid the NMDGF in setting sustainable harvest limits. In addition to density estimates, information on demographic rates (e.g., survival rates and reproduction) and the potential effects that climate change and future land use may have on the demography of black bears may also help inform management of black bears in New Mexico, and may be considered as future areas for research.

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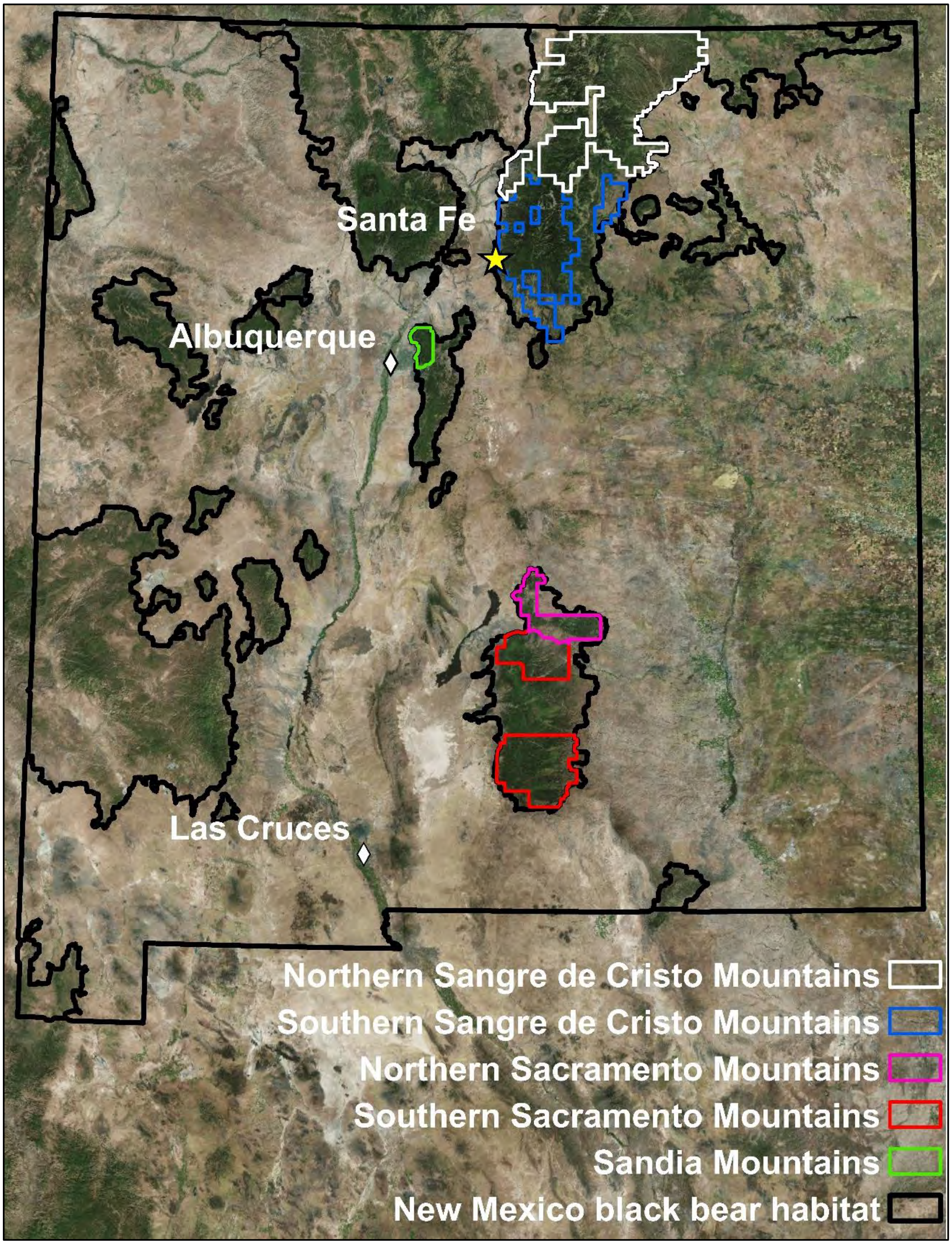

Figure 1. Aerial imagery of black bear habitat in New Mexico highlighting the study areas located within the Sangre de Cristo Mountains, Sandia Mountains, and Sacramento Mountains.

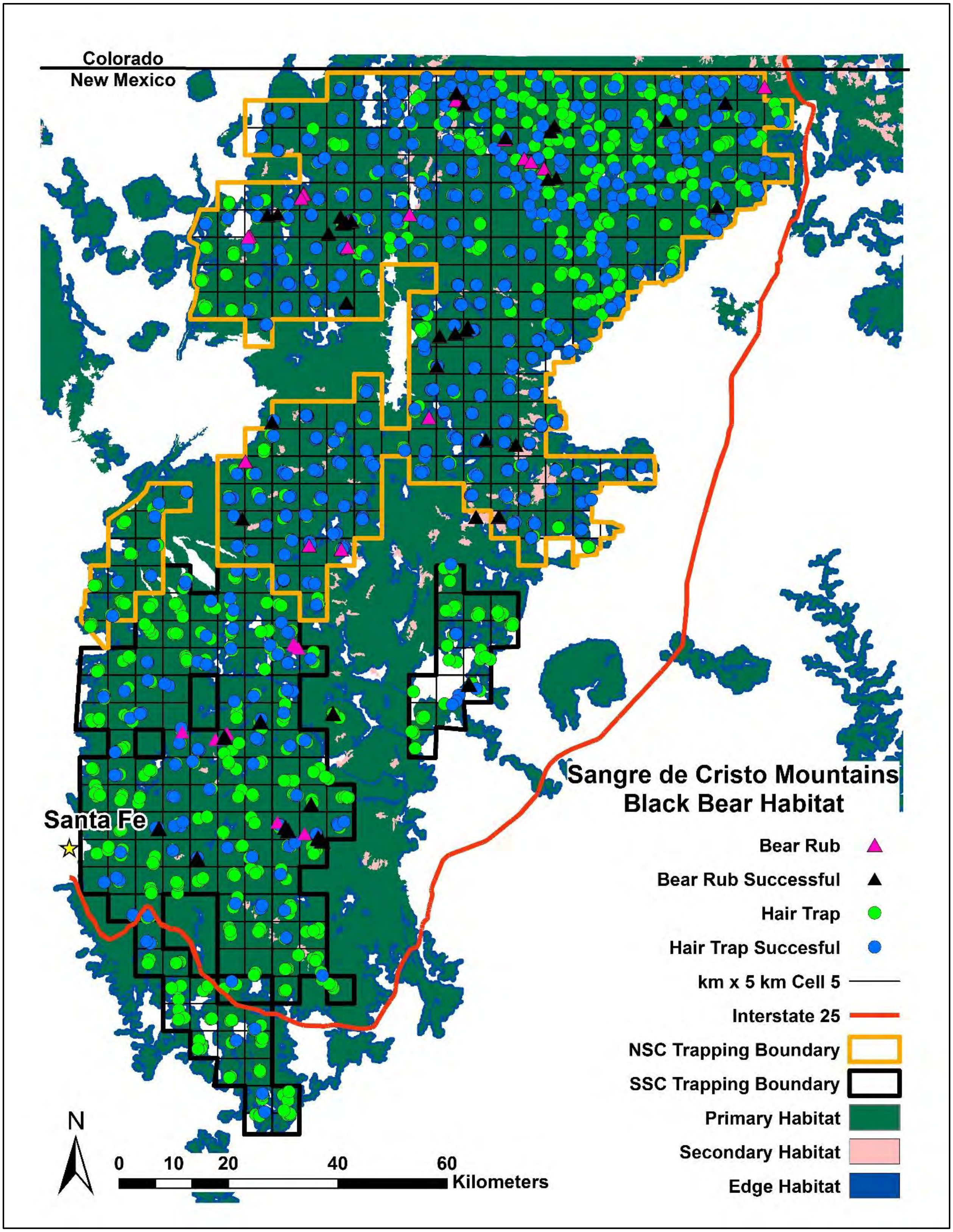

Figure 2. Black bear habitat identified by Costello et al. (2001) overlaid with hair traps and bear rubs set for the northern Sangre de Cristo Mountains, NM in 2012 and 2013.

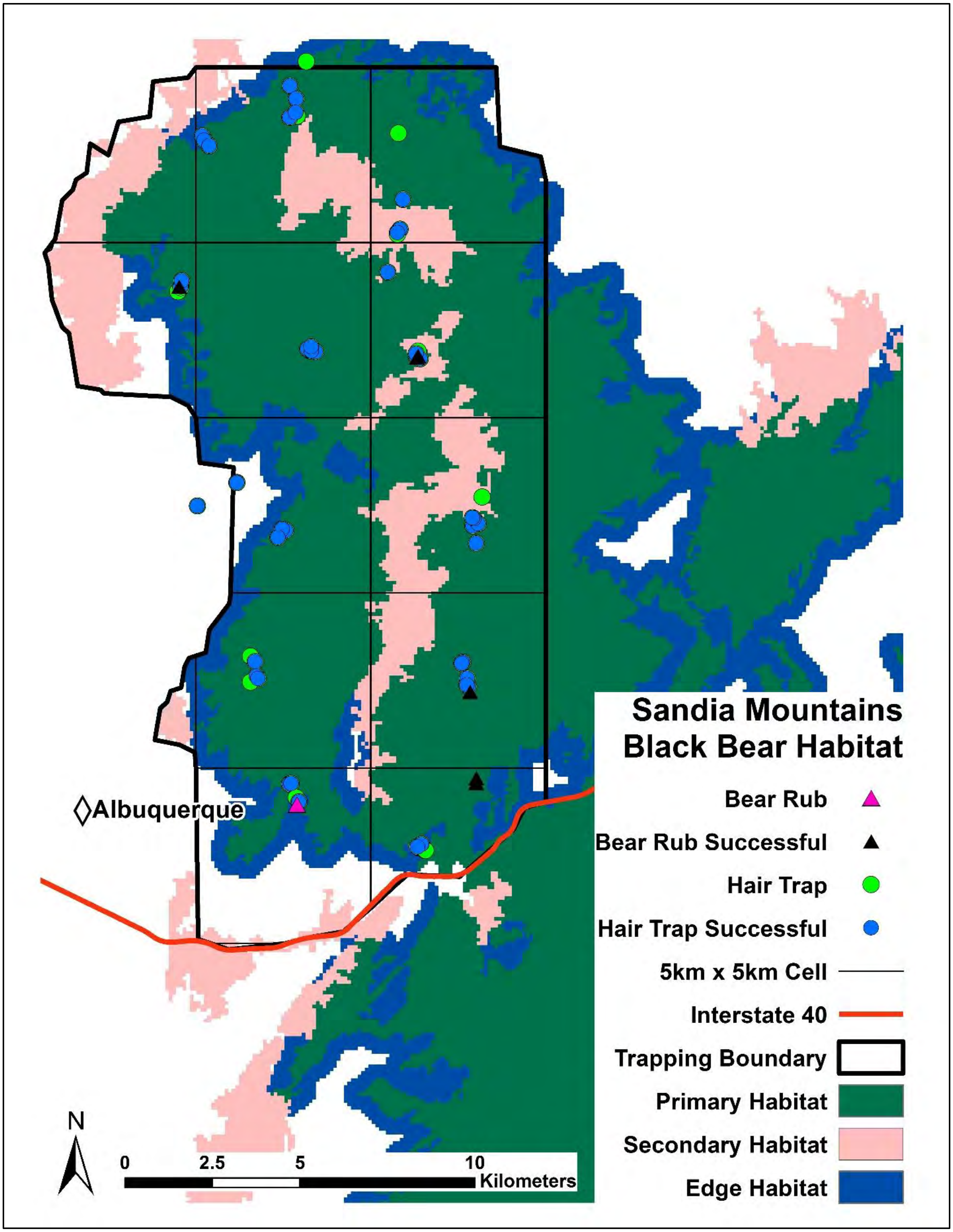

Figure 3. Black bear habitat identified by Costello et al. (2001) overlaid with hair traps and bear rubs set for the Sandia Mountains, NM in 2014.

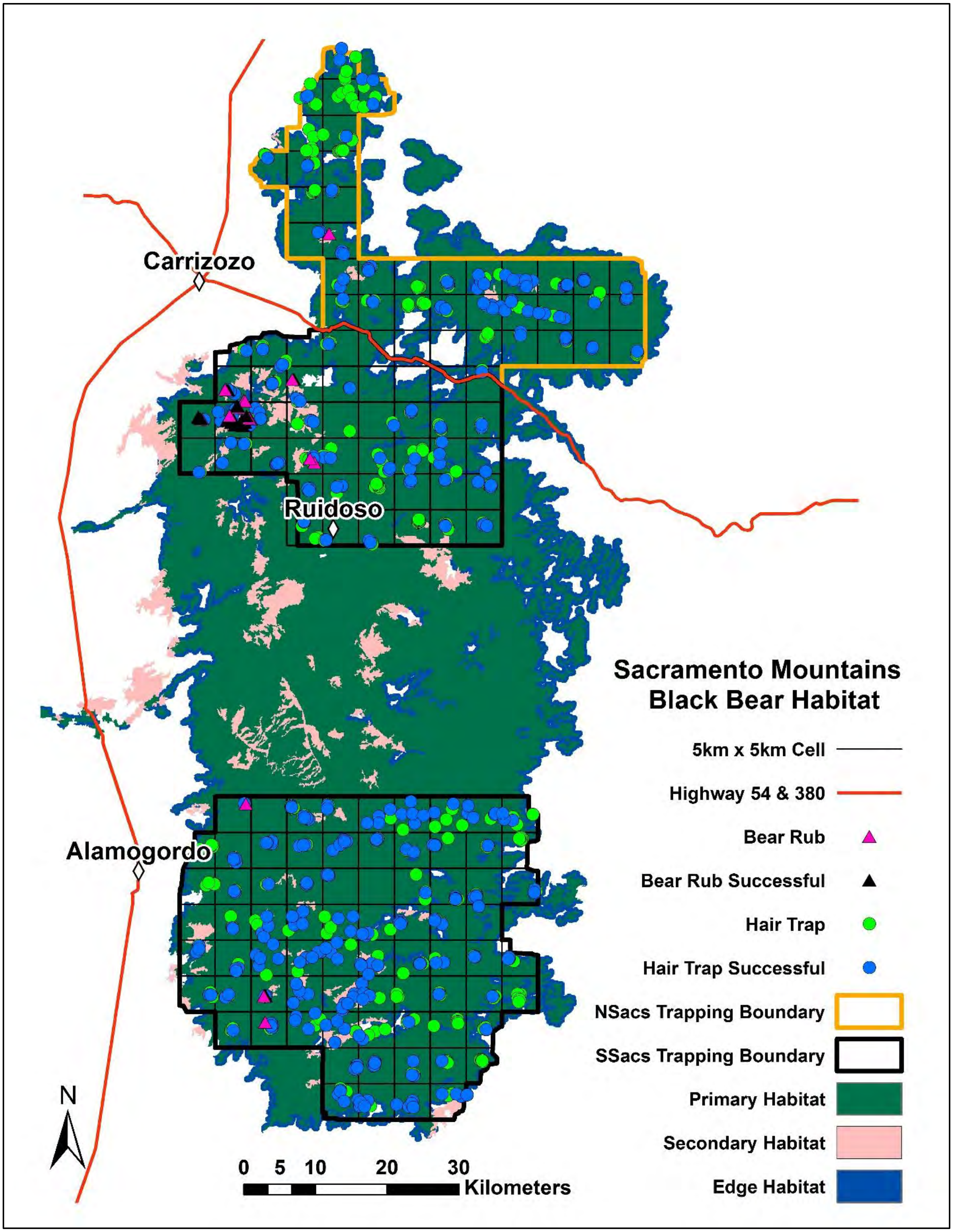

Figure 4. Black bear habitat identified by Costello et al. (2001) overlaid with hair traps and bear rubs set for the Sacramento Mountains, NM in 2014.

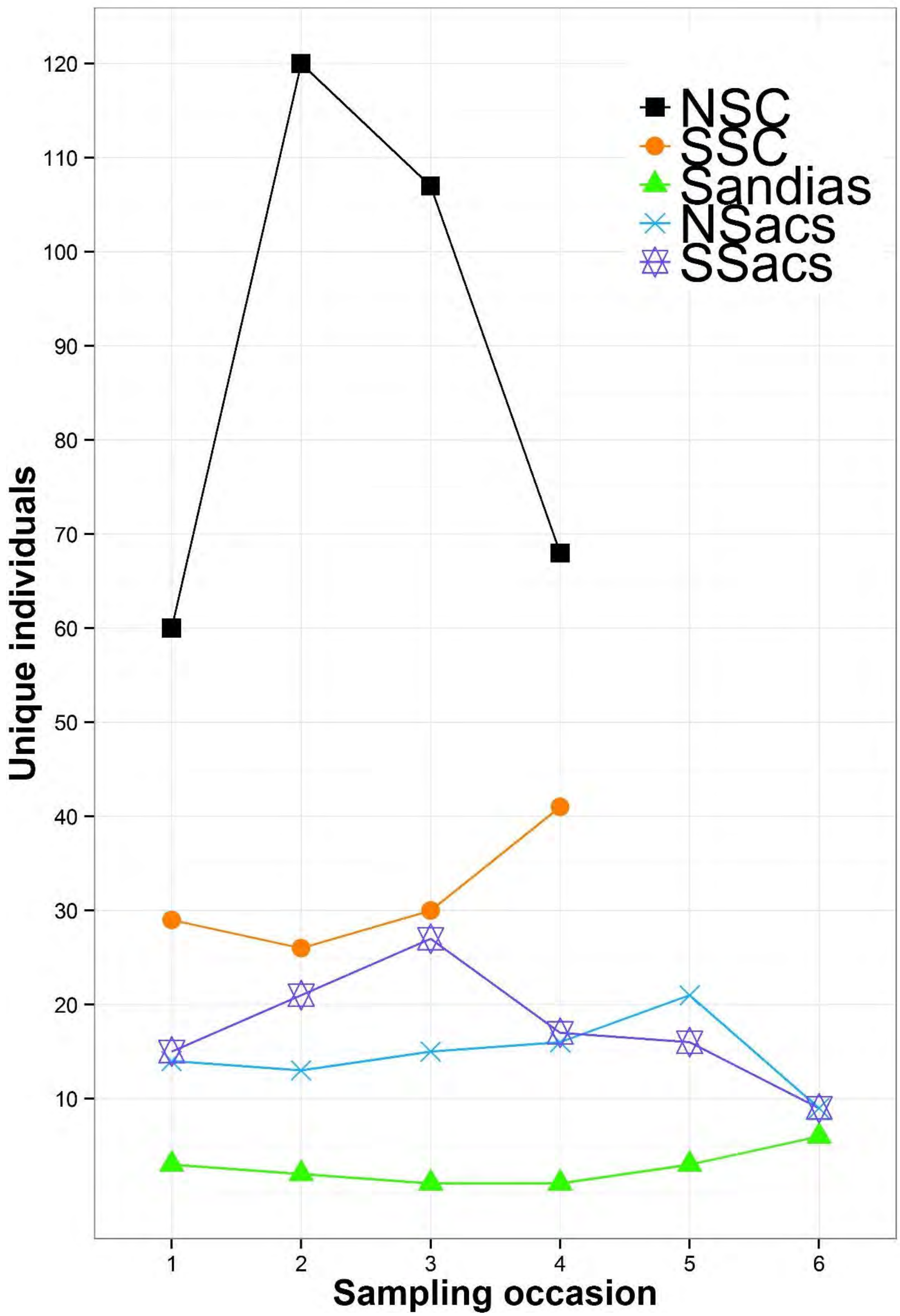

Figure 5. Number of unique individuals detected by hair traps and bear rubs combined for each sampling occasion in the Northern (NSC) and Southern (SSC) Sangre de Cristo, Sandia, and Northern (NSacs) and Southern (SSacs) Sacramento Mountains, NM.

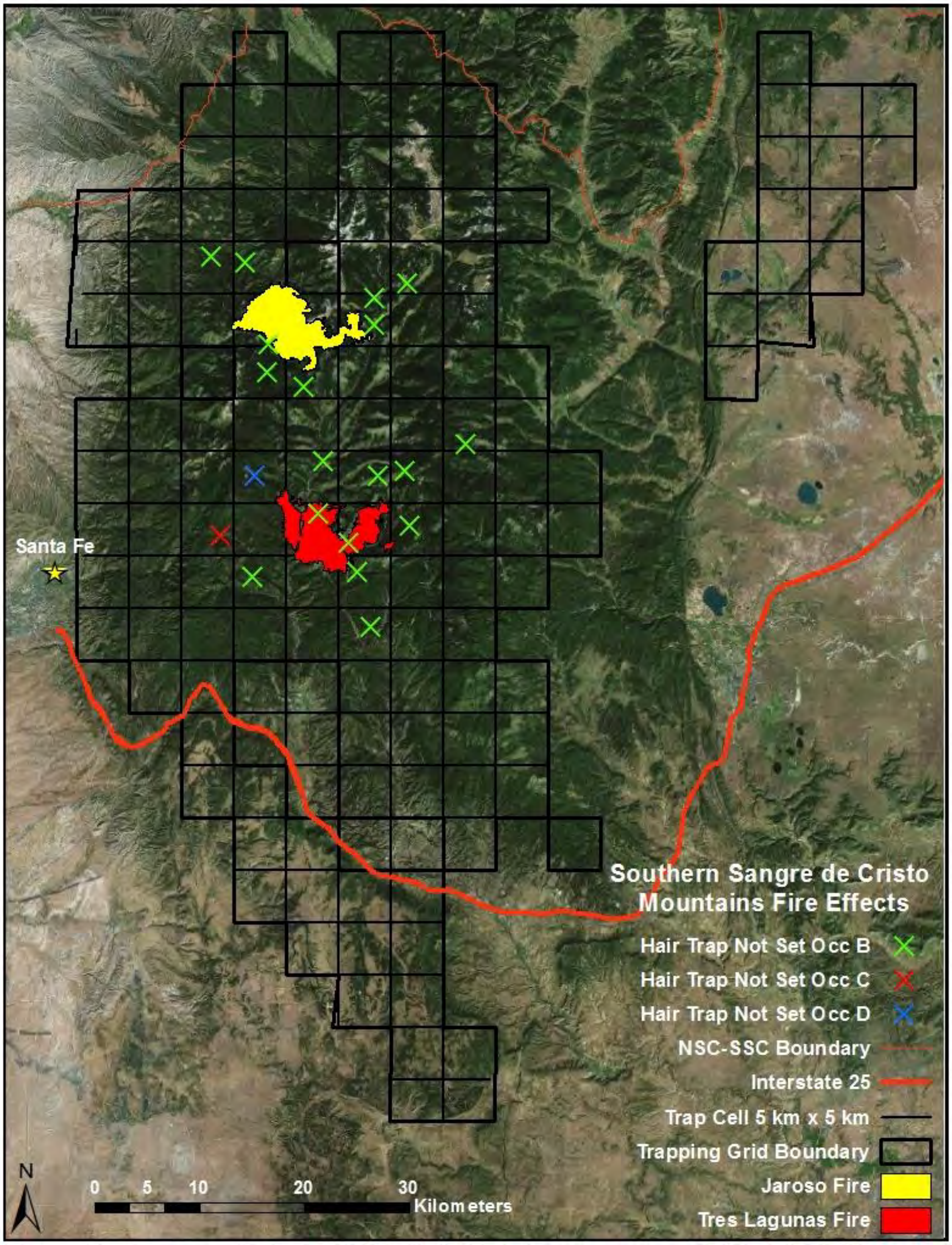

Figure 6. Map of hair traps not deployed due to the Jaroso and Tres Lagunas fires in the southern Sangre de Cristo Mountains, NM in 2013.

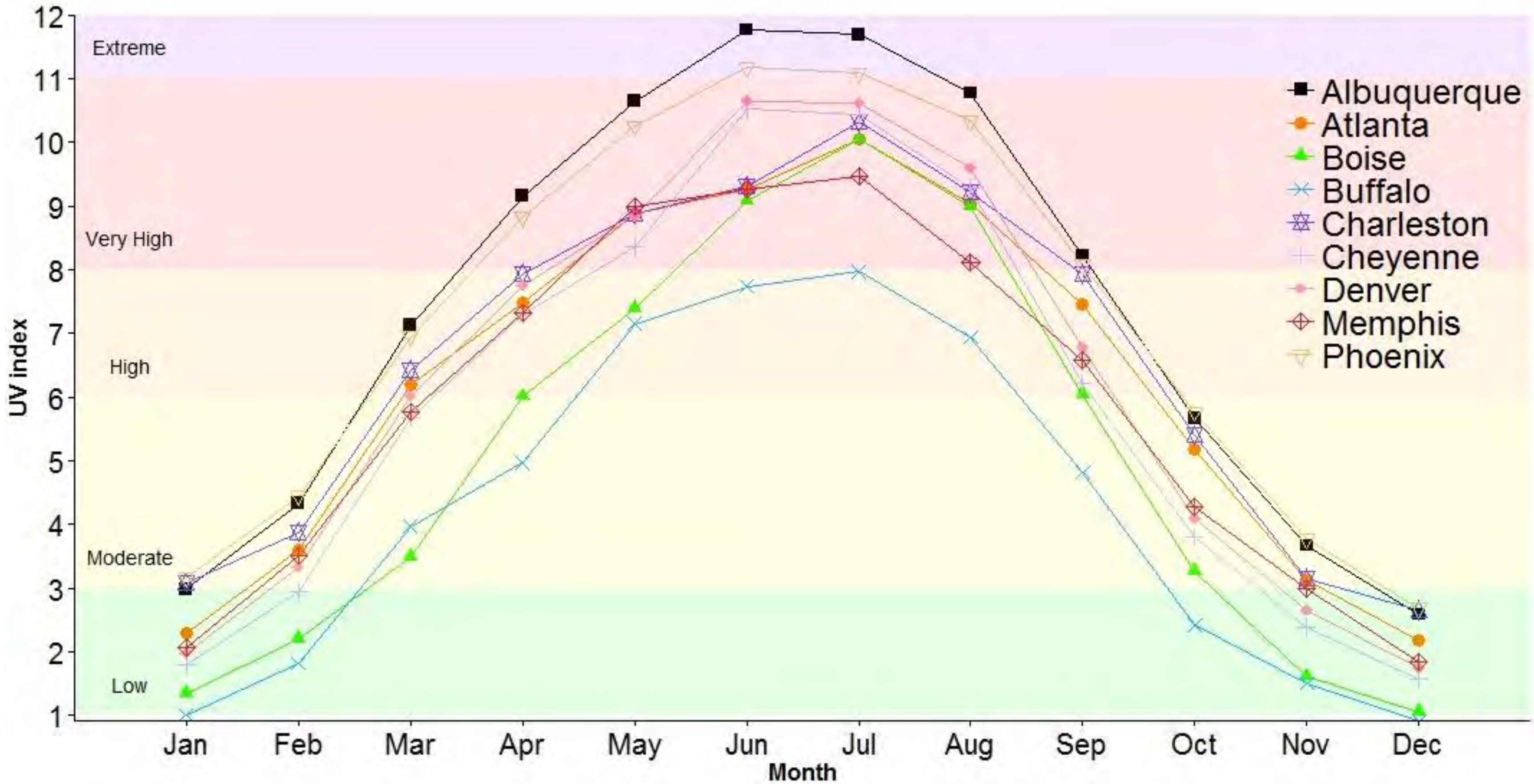

Figure 7. Mean montly ultraviolet index (UVI) generated by the National Oceanic and Atmospheric Administration showing estimated noontime intensity of ulatraviolet radiation coupled with the World Health Organization human health hazard UVI classification for Albuquerque, NM, Atlanta, GA, Boise, ID, Buffalo, NY, Charleston, SC, Cheyenne, WY, Denver, CO, Memphis, TN, and Phoenix, AZ, USA in 2012.

Table 1. Field sampling summary statistics allocated by number of detector types set (hair traps = HR & bear rub = BR), for the Northern (NSC) and Southern (SSC) Sangre de Cristo, Sandia, and Northern (NSacs) and Southern (SSacs) Sacramento Mountains, NM.

Study Area	HT[a]	HT Sites[b]	HT Hit[c]	HT Effort[d]	BR[a]	BR Effort[d]
NSC	256	1018	0.36	28,183	46	3,730
SSC	141	537	0.29	15,768	25	1,816
Sandias	12	69	0.42	979	7	293
NSacs	37	217	0.41	2,990	1	56
SSacs	111	656	0.29	9,090	33	1,112
Total	557	2497	0.33	57,010	112	7,007

[a] Number of sampling detectors set.
[b] Number of sampling detectors cumulatively summed across all sampling occasions.
[c] Number of traps which collected ≥1 hair sample over the all sampling occasions.
[d] Sampling effort represented by the number of days a sampling detector (hair trap & bear rub) was set summed across all detectors and all sampling occasions.

Table 2. The total number of hair samples collected across sampling occasions (1-6) and detector type (hair trap:bear rub) , and the overall total for the Northern (NSC) and Southern (SSC) Sangre de Cristo, Sandia, and Northern (NSacs) and Southern (SSacs) Sacramento Mountains, NM.

Study Area	1	2	3	4	5	6	Total
NSC	312 (299:13)	634 (582:52)	597 (571:26)	374 (339:35)	-	-	1917 (1791:126)
SSC	145 (141:4)	125 (124:1)	184 (183:1)	273 (246:27)	-	-	727 (694:33)
Sandias	8 (8:0)	30 (30:0)	23 (19:4)	28 (19:9)	51 (35:16)	37 (31:6)	177 (142:35)
NSacs	49 (49:0)	58 (58:0)	77 (73:4)	75 (73:2)	123 (118:5)	82 (79:3)	464 (450:14)
SSacs	93 (93:0)	143 (143:0)	183 (179:4)	135 (118:17)	129 (118:11)	115 (97:18)	798 (748:50)
Total	607 (590:17)	990 (937:53)	1064 (1025:39)	885 (795:90)	303 (271:32)	234 (207:27)	4083 (3825:258)

Table 3. Number of alleles, expected heterozygosity (H_E), and observed heterozygosity (H_O) for eight microsatellite markers used for individual identification of American black bears in the Sangre de Cristo Mountains, Sandia Mountains, and Sacramento Mountains, NM.

	No. Alleles			H_E			H_O		
Marker	**Sangres**	**Sandias**	**Sacramentos**	**Sangres**	**Sandias**	**Sacramentos**	**Sangres**	**Sandias**	**Sacramentos**
G10L	8.00	6.00	6.00	0.80	0.81	0.74	0.80	0.78	0.73
G1D	7.00	4.00	5.00	0.76	0.76	0.61	0.76	0.56	0.60
G10H	12.00	6.00	8.00	0.76	0.77	0.63	0.76	0.61	0.60
G10M	6.00	4.00	6.00	0.72	0.73	0.71	0.70	0.72	0.72
G10B	7.00	4.00	4.00	0.72	0.72	0.68	0.72	0.83	0.65
G10J	9.00	6.00	7.00	0.71	0.78	0.73	0.72	0.67	0.72
MU59	10.00	4.00	5.00	0.70	0.49	0.50	0.71	0.50	0.50
G10U	9.00	6.00	6.00	0.65	0.78	0.69	0.66	0.78	0.70
Mean	8.50	5.00	5.88	0.73	0.73	0.66	0.73	0.68	0.65

Table 4. Number of samples collected, number of samples that contained enough genetic material for analysis (samples analyzed), the proportion of samples that produced a successful genotype (Sample Success) and the number of unique individuals identified by each detector type (hair trap only = HT; bear rub only = BR; hair trap and bear rub = HTBR) for the Northern (NSC) and Southern (SSC) Sangre de Cristo, Sandia, and Northern (NSacs) and Southern (SSacs) Sacramento Mountains, NM.

				Unique Individuals		
Study Area	**Samples Collected**	**Samples Analyzed**	**Sample Success**	**M (HT:BR:HTBR)**	**F (HT:BR:HTBR)**	**Total (HT:BR:HTBR)**
NSC	1917	1416	0.49	190 (171:18:1)	189 (179:10:0)	379 (350:28:1)
SSC	727	517	0.48	67 (63:2:2)	64 (61:2:1)	131 (124:4:3)
Sandias	177	115	0.53	9 (5:1:3)	9 (8:1:0)	18 (13:2:3)
NSacs	464	360	0.61	49 (46:0:3)	39 (38:0:1)	88 (54:0:4)
SSacs	798	542	0.44	53 (50:2:1)	57 (53:3:1)	110 (103:5:2)
Total	4083	2950	0.50	368 (335:23:10)	358 (339:16:3)	726 (674:39:13)

Table 5. A summary of the capture history data for both male and female black bears identified by samples collected across the Northern (NSC) and Southern (SSC) Sangre de Cristo, Sandias, and Northern (NSacs) and Southern (SSacs) Sacramento Mountains, NM.

	Males								Females							
	N[a]	**Det[b]**	**Avg[c]**	**SD[d]**	**Max[e]**	**R[f]**	**MMR (km)[g]**	**MaxD (km)[h]**	**N[a]**	**Det[b]**	**Avg[c]**	**SD[d]**	**Max[e]**	**R[f]**	**MMR (km)[g]**	**MaxD (km)[h]**
NSC	190	239	1.26	0.43	3	33	7.57	52.03	189	216	1.14	0.35	3	23	3.98	47.41
SSC	67	80	1.19	0.38	3	8	12.46	29.33	64	77	1.20	0.39	2	12	2.53	20.33
Sandias	9	15	1.67	0.46	2	3	8.27	9.84	9	14	1.56	0.73	3	4	0.38	0.69
Nsacs	49	74	1.51	0.74	5	14	9.22	36.18	39	58	1.49	0.72	3	12	2.47	7.05
Ssacs	53	69	1.30	0.41	3	10	4.23	8.02	57	73	1.28	0.54	3	11	4.59	14.88
Total	368	477	1.39	0.48	5	68	8.35	27.08	358	438	1.33	0.55	3	62	2.79	18.07

[a] Number of animals detected.
[b] Total number of detections across all sampling occasions.
[c] Average number of detections per individual detected across all sampling occasions.
[d] Standard deviation for the average number of detections.
[e] Maximum number of detections of a single individual across all sampling occasions.
[f] Number of recaptured individuals across all sampling occasions.
[g] Mean maximum recapture distance.
[h] Maximum distance moved by an individual.

Table 6. The final set of *a priori* spatially explicit capture-recapture models for the Northern Sangre de Cristo Mountains, NM in 2012.

D[a]	**g0**[a]	**σ**[a]	**K**[b]	**AIC$_c$**[c]	**ΔAIC$_c$**[d]	***w_i***[e]	**Dev**[f]
constant	t + veg	t + veg	17	3149.15	0.00	1.00	3113.46
constant	t	t	9	3201.03	51.88	0.00	3182.54
constant	veg	veg	11	3216.43	67.28	0.00	3193.71
constant	t	veg	10	3221.75	72.59	0.00	3201.15
constant	veg	t	10	3236.73	87.58	0.00	3216.14
constant	type	type	5	3251.32	102.17	0.00	3241.16
constant	sex	sex	5	3271.17	122.02	0.00	3261.01
constant	constant	constant	3	3271.37	122.22	0.00	3265.31
sex	constant	constant	4	3273.42	124.26	0.00	3265.31

[a] Model parameters a function of: sex; t = time variation; type = detector type, veg = land cover type; + = additive effect; constant = no variation.
[b] Number of model parameters.
[c] Akaike's Information Criterion adjusted for small sample size.
[d] The difference between the top ranked model and the *i*th ranked model.
[e] Model weight.
[f] Model deviance = -2(log-likelihood).

Table 7. The final set of *a priori* spatially explicit capture-recapture models for the Southern Sangre de Cristo Mountains, NM in 2013.

D[a]	g0	σ	K[b]	AIC_c[c]	ΔAIC_c[d]	w_i[e]	Dev[f]
constant	t + elev	t + elev	11	1169.98	0.00	0.87	1145.76
constant	t + veg	t + veg	17	1173.85	3.87	0.13	1134.44
constant	veg	t	10	1195.99	26.01	0.00	1174.16
constant	elev	t	7	1197.67	27.69	0.00	1182.76
constant	t	veg	10	1199.07	29.09	0.00	1177.24
constant	t	elev	7	1199.91	29.93	0.00	1185.00
constant	veg	veg	11	1205.12	35.14	0.00	1180.90
constant	t	t	9	1210.10	40.12	0.00	1190.61
constant	elev	elev	5	1210.48	40.50	0.00	1200.00
constant	sex	sex	5	1214.90	44.92	0.00	1204.42
constant	type	type	5	1216.35	46.37	0.00	1205.87
constant	constant	constant	3	1223.86	53.88	0.00	1217.67
sex	constant	constant	4	1225.92	55.94	0.00	1217.60

[a] Model parameters a function of: elev = elevation; sex; t = time variation; type = detector type; veg = land cover type; + = additive effect; constant = no variation.
[b] Number of model parameters.
[c] Akaike's Information Criterion adjusted for small sample size.
[d] The difference between the top ranked model and the *i*th ranked model.
[e] Model weight.
[f] Model deviance = -2(log-likelihood).

Table 8. The final set of *a priori* spatially explicit capture-recapture models for the Sandia Mountains, NM in 2014.

D[a]	g0[a]	σ[a]	K[b]	AIC_c[c]	ΔAIC_c[d]	w_i[e]	Dev[f]
constant	sex	sex	5	209.23	0.00	0.96	194.23
constant	constant	constant	3	216.23	6.99	0.03	208.51
constant	elev	elev	5	219.20	9.97	0.01	204.20
sex	constant	constant	4	219.59	10.36	0.00	208.51
constant	type	type	5	219.84	10.60	0.00	204.84
constant	veg	veg	5	219.97	10.74	0.00	204.97
constant	t	elev	9	235.19	25.96	0.00	194.69
constant	t	veg	9	238.34	29.11	0.00	197.84
constant	elev	t	9	243.24	34.00	0.00	202.74
constant	veg	t	9	243.52	34.29	0.00	203.02
constant	t	t	13	311.75	102.52	0.00	194.75
constant	t + elev	t + elev	15	451.94	242.71	0.00	189.35
constant	t + veg	t + veg	15	461.61	252.38	0.00	191.61

[a] Model parameters a function of: elev = elevation; sex; t = time variation; type = detector type; veg = land cover type; + = additive effect; constant = no variation.
[b] Number of model parameters.
[c] Akaike's Information Criterion adjusted for small sample size.
[d] The difference between the top ranked model and the *i*th ranked model.
[e] Model weight.
[f] Model deviance = -2(log likelihood).

Table 9. The final set of *a prior*i spatially explicit capture-recapture models for the Northern Sacramento Mountains, NM in 2014.

D[a]	g0[a]	σ[a]	K[b]	AIC_c[c]	ΔAIC_c[d]	w_i[e]	Dev[f]
constant	t + veg	t + veg	17	868.31	0.00	0.96	825.57
constant	veg	t	10	874.86	6.55	0.04	852.01
constant	t	veg	10	880.74	12.44	0.00	857.89
constant	veg	veg	7	883.07	14.76	0.00	867.67
constant	t + elev	t + elev	15	910.39	42.08	0.00	873.72
constant	sex	sex	5	910.45	42.14	0.00	899.71
constant	t	t	13	922.95	54.65	0.00	892.04
constant	elev	elev	5	923.70	55.39	0.00	912.97
constant	t	elev	9	925.73	57.42	0.00	905.42
constant	elev	t	9	928.60	60.30	0.00	908.30
constant	constant	constant	3	951.19	82.88	0.00	944.91
sex	constant	constant	4	952.25	83.94	0.00	943.77

[a] Model parameters a function of: elev = elevation; sex; t = time variation; veg = land cover type; + = additive effect; constant = no variation.
[b] Number of model parameters.
[c] Akaike's Information Criterion adjusted for small sample size.
[d] The difference between the top ranked model and the *i*th ranked model.
[e] Model weight.
[f] Model deviance = -2(log-likelihood).

Table 10. The final set of *a priori* spatially explicit capture-recapture models for the Southern Sacramento Mountains, NM in 2014.

D[a]	g0[a]	σ[a]	K[b]	AIC_c[c]	ΔAIC_c[d]	w_i[e]	Dev[f]
constant	veg	veg	7	1168.68	0.00	0.50	1153.58
constant	t + veg	t + veg	17	1169.62	0.94	0.31	1128.97
constant	t + elev	t+ elev	15	1170.58	1.90	0.19	1135.47
constant	veg	t	10	1180.23	11.54	0.00	1158.00
constant	type	type	5	1182.05	13.37	0.00	1171.48
constant	elev	elev	5	1182.51	13.83	0.00	1171.93
constant	elev	t	9	1184.24	15.56	0.00	1164.44
constant	t	t	13	1186.59	17.91	0.00	1156.80
constant	t	elev	9	1191.22	22.54	0.00	1171.42
constant	t	veg	10	1193.33	24.65	0.00	1171.10
constant	constant	constant	3	1196.53	27.85	0.00	1190.31
constant	sex	sex	5	1198.08	29.40	0.00	1187.50
sex	constant	constant	4	1198.54	29.86	0.00	1190.16

[a] Model parameters a function of: elev = elevation; sex; t = time variation; type = detector type; veg = land cover type; + = additive effect; constant = no variation.
[b] Number of model parameters.
[c] Akaike's Information Criterion adjusted for small sample size.
[d] The difference between the top ranked model and the *i*th ranked model.
[e] Model weight.
[f] Model deviance = -2(log-likelihood).

Table 11. Density and model parameter estimates, coefficient of variation of the density estimate (CV), detection probability at the activity center (g0), spatial scale over which detection probability declines (σ; km), and their 95% confidence intervals for the Northern (NSC) and Southern (SSC) Sangre de Cristo, Sandia, and Northern (NSacs) and Southern (SSacs) Sacramento Mountains, NM. Competing models for the SSC and SSacs were model averaged. We performed all analyses within a spatially explicit capture-recapture framework.

Study Area	D[a]	g0[b]	σ[c]	$\hat{D}$[d]	CV($\hat{D}$)	$\widehat{g0}$[e]	$\hat{\sigma}$[f]
NSC	constant	t + veg	t + veg	21.86 (17.83 – 26.80)	0.10	0.00060 (0.000233 - 0.001528)	3.31 (2.09 – 5.25)
SSC	constant constant	t + elev t + veg	t + elev t + veg	19.74 (13.77 – 28.30)	0.18	0.00001 (0.000006 – 0.000052)	18.35 (12.73 – 26.46)
Sandias	constant	sex	sex	25.75 (13.22 – 50.14)	0.35	0.02941[g] (0.010779 – 0.077689) 0.00163[h] (0.000480 – 0.005488)	0.76[g] (0.49 – 1.15) 4.99[h] (2.46 – 10.09)
NSacs	constant	t + veg	t + veg	20.17 (15.35 – 26.52)	0.14	0.00266 (0.000580 – 0.012125)	5.42 (2.03 – 14.44)
SSacs	constant constant constant	veg t + veg t + elev	veg t + veg t + elev	16.55 (11.64 – 23.53)	0.18	0.00318 (0.001087 - 0.009279)	2.67 (1.69 – 4.21)

[a] Final model structure for the secr parameter, density (D).
[b] Final model structure for the secr parameter, detection probability (g0).
[c] Final model structure for the secr parameter, σ, the spatial scale over which detection probability declines.
[d] Black bear density estimate (bears/100 km^2) with the 95% confidence intervals in parentheses.
[e] Detection probability (g0) parameter estimate with the 95% confidence intervals in parentheses.
[f] σ (km) parameter estimate with the 95% confidence intervals in parentheses.
[g] Parameter estimate for female black bears.
[h] Parameter estimate for male black bears.

Table 12. Mean density estimates for black bears (bears/100 km^2) and 95% CIs in parentheses for noninvasive genetic sampling studies conducted in the United States that also used a spatially explicit capture-recapture framework.

State	$\widehat{D}$	Reference
Ozark Highlands, Missouri	1.7 (1.1 – 2.4)	Wilton et al. 2014
Carver Bay, South Carolina	4.6 (2.4 – 6.7)	Drewry et al. 2013
Southern Black Bear Range, New York	9.1 (7.6 – 11.3)	Sun et al. 2014
Picture Rocks National Lakeshore, Michigan	10.5 (8.5 – 12.7)	Sollmann et al. 2012
Glacier National Park, Montana[a]	12.0 (10.0 – 14.4)	Stetz et al. 2014[a]
Southern Sacramento Mountains, New Mexico	16.5 (11.6 – 23.5)	This Study
Southern Sangre de Cristo Mountains, New Mexico	19.7 (13.8 – 28.3)	This Study
Fort Drum Military Installation, New York	20.0 (15.0 – 26.0)	Gardner et al. 2010
Northern Sacramento Mountains, New Mexico	20.1 (15.3 – 26.5)	This Study
Northern Sangre de Cristo Mountains, New Mexico	21.8 (17.8 – 26.8)	This Study
Sandia Mountains, New Mexico	25.7 (13.2 – 50.1)	This Study
Spanish Peaks, Colorado	44.0 (32.1 – 55.8)	Apker et al. 2009
Lewis Ocean Bay, South Carolina	33.9 (22.9 – 44.8)	Drewry et al. 2013
Alligator River National Wildlife Refuge, North Carolina 2004	37.0 (30.7 – 43.2)	Tredick et al. 2009
Great Dismal Swamp National Wildlife Refuge, North Carolina and Virginia	46.0 (34.6 – 57.3)	Tredick et al. 2009
Alligator River National Wildlife Refuge, North Carolina 2003	57.0 (47.9 – 66.0)	Tredick et al. 2009
Pocosin Lakes National Wildlife Refuge, North Carolina 2002	58.0 (49.1 – 66.8)	Tredick et al. 2009
Pocosin Lakes National Wildlife Refuge, North Carolina 2003	77.0 (65.4 – 88.5)	Tredick et al. 2009

[a] Black bear population sympatric with grizzly bears (*Ursus arctos*).

PERFORMANCE REPORT

State: New Mexico **Grant Number**: W-93-R-57

Grant Title: Big Game Surveys, Inventories, and Management

Grant Period: From: July 1, 2016 to: June 30, 2017

Grant Objective: To survey New Mexico's big game populations and their hunters and to manage these big game species according to the mission, goals, and plans of the New Mexico State Game Commission and the Department of Game and Fish.

Project Number: 1 **Project Title**: Grant Administration and Coordination

Project Objective: To provide administrative support and coordination for New Mexico's Big Game Surveys, Inventories, and Management Grant.

I. Job Objectives and Summary of Progress:

Bear (*Ursus americanus*). Hunter harvest and other human-caused mortality were compiled and evaluated. Annual harvest statistics were compiled and analyzed for trends over the most recent 10 years to inform management. Simulations were conducted to develop a logistically feasible, cost-efficient clustered camera trapping survey in a spatial mark-resight framework to estimate bear density and abundance in BMZ 1

Cougar (*Puma concolor*). Annual harvest statistics were compiled and analyzed for trends over the most recent 10 years to inform management. A camera trapping survey in a spatial mark-resight framework was developed to estimate density, abundance, home range size, and resource selection.

PERFORMANCE REPORT

State: New Mexico **Grant Number**: W-93-R-57

Grant Title: Big Game Surveys, Inventories, and Management

Grant Period: **From**: July 1, 2016 **to:** June 30, 2017

Grant Objective: To survey New Mexico's big game populations and their hunters and to manage these big game species according to the mission, goals, and plans of the New Mexico State Game Commission and the Department of Game and Fish.

Project Number: 2 **Sections 2.A.1. and 2.2** **Project Title**: Population and Harvest Surveys, Inventories, and Big Game Management

Objective: To survey New Mexico big game populations and their hunters to develop hunt season recommendations, restore big game populations where biological, ecological and sociological information indicates it is feasible and ascertain health status of big game populations, identify the nature and extent of any disease affecting big game and understand the disease process.

II. Job Objectives and Summary of Progress:

2.A.1. and 2.2. Estimate big game population size and/or trend, sex and age composition, and geographical distribution. Evaluate survey techniques and develop new methods where appropriate.

Bear. Recently completed research suggests that bear densities in the management zones that were surveyed (3, 4, 5, 8, 12, and 13) are moderate compared to black bear populations elsewhere. Population estimates (Table 2.A.26) were produced by applying estimated densities to primary bear habitat. A Department objective is to estimate bear density and abundance for the majority of other management zones, and a clustered camera trapping survey in a spatial mark-resight framework will be conducted in Zone 1 during the upcoming reporting period.

Table 2.A.26. Black Bear Population Estimates and Mortality Limits by Zones, NMDGF.

Zone	GMUs	Population point estimate	Total mortality limit	Female sub-limit
1	4-7, 51, 52	1,580	158	63
2	2	150	15	6
3	48, 49, 50, 53	544	65	26
4	45, 46, 48	1,093	109	43
5	54, 55	919	92	37

6	39, 40, 41, 42, 43, 47, 59	328	33	13
7	56, 57, 58	354	35	14
8	8	132	11	4
9	9, 10	356	36	14
10	12, 13, 15-18, 20-24, 26, 27	1,456	146	58
11	37, 38	360	36	14
12	34	325	33	13
13	36	159	16	6
14	14	233	19	7
Total		7,989	804	318

Cougar. Cougar population estimates and sustainable harvest levels were derived from a combination of available habitat, density extrapolated from a 1996 New Mexico cougar study and from other western states, and existing mortality and harvest data (Table 2.A.27). Two studies were initiated to evaluate non-invasive genetic and camera-trapping survey methods and spatial capture-recapture and spatial mark-resight models for estimating density and abundance of cougars in New Mexico.

Table 2.A.27. Cougar Population Estimates and Mortality Limits by Zones, NMDGF.

Zone	GMUs	Population Estimate	Total Mortality Limit	Female 25%Sub-limit
A	2, 7	207-285	42	13
B	5, 50, 51	142-192	28	8
C	43-46, 48, 49, 53-55	289-387	85	43
D	41, 42, 47, 59	76-106	23	12
E	9, 10	251-341	50	15
F	6	156-209	46	23
G	13 and 17	247-338	73	37
H	18, 19, 20	140-197	42	21
I	36-38	121-165	24	7
J	15, 16, 21, 25	445-603	89	27
K	22, 23, 24	225-305	66	33
L	26 and 27	64-91	19	10
M	31-33, 39, 40	146-215	31	9
N	4 and 52	76-102	15	5
O	12	103-141	21	6
P	56-58	49-66	14	7
Q	28-30 and 34	170-235	35	11
R	45 and 55	131-175	26	8
S	8 and 14	85-116	25	13
Totals:		3,123-4,269	749	303

PERFORMANCE REPORT

State: New Mexico **Grant Number**: W-93-R-56

Grant Title: Big Game Surveys, Inventories, and Management

Grant Period: **From**: July 1, 2015 **to:** June 30, 2016

Grant Objective: To survey New Mexico's big game populations and their hunters and to manage these big game species according to the mission, goals, and plans of the New Mexico State Game Commission and the Department of Game and Fish.

Project Number: 2 **Sections 2.B.1. and 2.3-2.10** **Project Title**: Population and Harvest Surveys, Inventories, and Big Game Management

Objective: To survey New Mexico big game populations and their hunters to develop hunt season recommendations, restore big game populations where biological, ecological and sociological information indicates it is feasible and ascertain health status of big game populations, identify the nature and extent of any disease affecting big game and understand the disease process.

II. Job Objectives and Summary of Progress:

2.1.B Estimate hunter numbers, harvest, effort, and success rates.

Bear. Harvest continued to be monitored by the harvest/total sustainable mortality system. During the season, each zone remains open to black bear hunting until the total number of harvested bears (determined by mandatory check-in for successful hunters) or the female portion of the harvest equals the total limit or the female sub-limit, respectively, whichever comes first. Only a maximum of 40% of the harvest can be female in all bear management zones. Total bear mortality from all human causes this grant segment remains comparable to license years prior to 2011-12 and post 2013-14. For 2011-2014, a relatively large number of bear mortalities occurred as a consequence of severe drought and associated reduced availability of natural foods resulting in increased bear movement and increased human contact (Table 2.B.4).

Table 2.B.4. Annual Bear Mortalities during 2001-2016/17, NMDGF.

License Year	Sport Harvest Female	Male	Unk.*	Sport Total	Depredation Kill Female	Male	Unk.	Depred. Total	Other (road kill, accident, etc.) Female	Male	Unk.	Other Total	All Total	Total % Female
2001-02	227	365	4	**596**	8	39	1	**48**	6	9	0	**15**	**659**	36.6%
2002-03	292	445	8	**745**	14	34	2	**50**	8	15	0	**23**	**818**	38.4%
2003-04	182	275	2	**459**	5	13	0	**18**	10	7	1	**18**	**495**	39.8%
2004-05	82	163	1	**246**	2	1	0	**3**	2	8	0	**10**	**259**	33.2%
2005-06	113	181	0	**294**	8	9	0	**17**	2	4	0	**6**	**317**	38.8%
2006-07	118	235	4	**357**	4	15	0	**19**	3	10	1	**14**	**390**	32.0%
2007-08	115	253	0	**368**	7	14	0	**21**	3	13	0	**16**	**405**	30.9%
2008-09	94	239	0	**333**	2	31	0	**33**	6	19	0	**25**	**391**	26.1%
2009-10	126	272	0	**398**	2	19	0	**21**	5	15	0	**20**	**439**	30.3%
2010-11	125	278	0	**403**	14	43	0	**57**	8	12	0	**20**	**480**	30.6%
2011-12	268	503	6	**777**	62	180	1	**243**	18	39	3	**60**	**1080**	32.2%
2012-13	268	440	6	**714**	30	60	2	**92**	20	36	4	**60**	**866**	36.7%
2013-14	293	479	6	**778**	47	126	1	**174**	29	31	4	**64**	**1016**	36.3%
2014-15	209	343	9	**561**	10	40	0	**50**	12	23	7	**42**	**653**	35.4%
2015-16	189	279	1	**469**	11	24	1	**36**	4	16	0	**20**	**525**	38.9%
2016-17	169	327	2	**498**	9	39	2	**50**	7	6	0	**13**	**561**	33.0%

Unk – Unknown, sometimes the sex is impossible to determine due to decomposition or physical damage.

Cougar. Harvest continued to be managed by the hunter harvest/total sustainable mortality system. During the hunting season, each zone remained open to mountain lion hunting from April 1 until March 31 or when the total number of hunter kills (as determined by mandatory check-in for successful hunters) equaled the total sustainable mortality limit for that zone, or the female sub-limit had been met, whichever came first. Only 30% of the harvest may be female in cougar management zones where the long term goal is stable cougar population, and 50% in cougar management zones where the goal is population reduction. Cougar harvest has remained relatively stable for the past 3 years (Table 2.B.5).

Table 2.B.5. Annual Cougar Mortality Statistics 2001-2016/17, NMDG

	Sport Harvest				Depredation Kill				Bighorn Sheep Protection				Other (road kill, accident, etc.)				TOTALS	
Cougar	Fem.	Male	Unk.*	**Total Sport**	Fem.	Male	Unk.	**Total Depred.**	Fem.	Male	Unk.	**Total BHS**	Fem.	Male	Unk.	**Total Other**	**Total**	% Female
2001-02	76	110	0	**186**	3	3	1	**7**	5	6	0	**11**	3	0	2	**5**	**209**	41.6%
2002-03	82	118	1	**201**	14	14	1	**29**	14	11	0	**25**	6	5	2	**13**	**268**	43.3%
2003-04	84	114	0	**198**	17	5	0	**22**	5	12	0	**17**	3	2	0	**5**	**242**	45.0%
2004-05	72	89	0	**161**	16	16	1	**33**	3	8	0	**11**	4	0	0	**4**	**209**	45.5%
2005-06	34	72	0	**106**	5	5	0	**10**	6	8	0	**14**	1	3	0	**4**	**134**	34.3%
2006-07	82	95	0	**177**	12	13	1	**26**	8	10	0	**18**	3	1	0	**4**	**225**	46.7%
2007-08	59	104	0	**163**	13	13	0	**26**	3	8	0	**11**	1	1	0	**2**	**202**	37.6%
2008-09	50	72	0	**122**	5	11	0	**16**	4	11	0	**15**	4	1	0	**5**	**158**	39.9%
2009-10	55	103	0	**158**	7	11	0	**18**	8	7	0	**15**	1	5	0	**6**	**197**	36.0%
2010-11	57	110	1	**168**	1	3	0	**4**	8	6	0	**14**	5	5	0	**10**	**196**	36.2%
2011-12	75	123	0	**198**	14	7	0	**21**	4	8	0	**12**	5	7	0	**12**	**243**	40.3%
2012-13	87	170	0	**257**	14	6	0	**20**	7	23	0	**30**	4	5	1	**10**	**317**	35.3%
2013-14	84	117	2	**203**	12	12	0	**24**	5	12	0	**17**	5	4	0	**9**	**255**	42.4%
2014-15	107	134	0	**241**	13	11	1	**25**	8	10	0	**18**	4	7	0	**11**	**295**	44.7%
2015-16	88	151	0	**239**	14	9	0	**23**	7	13	0	**20**	6	5	1	**12**	**294**	39.1%
2016-17	90	154	1	**245**	16	6	0	**22**	5	12	0	**17**	7	9	2	**18**	**302**	39.1%

*Unk – Unknown, sometimes the sex is impossible to determine due to decomposition or physical damage

2.4. Bear Demographics Research

The goal of this study is to provide bear demographic information in areas not recently surveyed to inform bear management in New Mexico. The objectives are to: 1) estimate bear survival and cause-specific mortality; 2) use a Bayesian modeling framework to estimate population growth rate; and 3) model the effects of currently prescribed harvest limits on estimated population growth and short-term viability (5 years). We focused efforts on Bear Management Zone 1 because radio-monitoring efforts of bears have been intensive in this Zone since 2012. A total of 23 female bears have been captured and radio-collared; we will use Cox proportional hazards models and the Kaplan-Meier method to estimate annual survival and cause-specific mortality rates. We will develop a stochastic population model augmented with ancillary demographic data to estimate population growth, viability, and harvest sustainability.

2.5. Cougar Demographics Research

Project #1: The goal of this study is to provide cougar demographic information to assist with directing cougar management in New Mexico. The objectives are to: 1) estimate cougar abundance and density in replicated 225 km^2 survey areas across habitat quality types; 2) compare density estimates to those used in the habitat model currently employed by NMDGF to develop harvest limits; and 3) test a remote camera-based method for estimating cougar abundance and density in the absence of marked individuals.

During the reporting period, from January through June 2017, 6 study areas were sampled using scat detection dogs; cougars were detected on 5 of those areas. A total of 70 scats were collected that were identified in the field as cougar; 88% (n = 62) were collected on the 3 areas predicted to have the highest quality habitat. An additional 77 samples were collected that were identified in the field as possible cougar samples. These scat samples were shipped to the University of Idaho for genetics analysis, the first stage of which is to test all samples for species identification. Camera photos collected during 2016 are in the final stages of preparation for data analysis. The sampling period was extended from six to eight weeks in 2017. One camera grid has been surveyed in 2017 during this segment (Appendix 2).

Project #2: The goal of this study is to provide cougar demographic and ecological information to inform cougar management in New Mexico, and is being implemented in concert with Project #1. The objectives are to: 1) develop a logistically feasible and cost-efficient survey design for estimating cougar density, abundance, and resource selection at a scale that population dynamics occur; 2) develop novel generalized spatial mark-resight models that incorporate multiple data types to improve density and abundance estimate accuracy and precision, and quantify ecological relationships between density and habitat/landscape characteristics; and 3) compare density estimates and resource selection to the habitat model that is currently employed by NMDGF for cougar management.

This project was initiated during the latter part of the reporting period. A total of 15 cougars (11M:4F) were live-captured and GPS-collared to constitute the marked portion of the population in the ~7,000 km^2 Cougar Management Zone F. Simulations were conducted in a spatial capture-recapture framework to develop a clustered camera trapping survey design that would estimate cougar density and abundance with nominal bias (Appendix 4). A total of 60 double camera trap stations (i.e., 120 total cameras) were established in 9 clusters across Zone F during July 2017, which simulations showed would produce unbiased estimates of cougar density (relative bias = 0.03; 95% CI = -0.04–0.10), pessimistically assuming that density is low (0.001/km^2), detection probability would be low (0.1), home range size is large (400 km^2), and if the survey is conducted for 12 sampling occasions. Thus, the camera traps will remain deployed through October 2017 to constitute 12 weeks of sampling, with 1 week serving as a sampling occasion.

PERFORMANCE REPORT

State: New Mexico **Grant Number**: W-93-R-56

Grant Title: Big Game Surveys, Inventories, and Management

Grant Period: From: July 1, 2015 **to:** June 30, 2016

Grant Objective: To survey New Mexico's big game populations and their hunters and to manage these big game species according to the mission, goals, and plans of the New Mexico State Game Commission and the Department of Game and Fish.

Bear (*Ursus americanus*). Data from hunter harvest and other human-caused mortality were compiled and evaluated. Annual harvest statistics were calculated and analyzed for trends over the most recent 10 years to inform management. Simulations were conducted to develop a logistically feasible, cost-efficient non-invasive genetic (utilizing bear hair traps) survey in a spatial capture-recapture framework to estimate bear density and abundance in BMZ 1 during the next segment.

Cougar (*Puma concolor*). Annual harvest statistics and other human-caused mortality were compiled and analyzed for trends over the most recent 10 years to inform management. A camera trapping survey in a spatial mark-resight framework was developed to estimate density, abundance, home range size, and resource selection. A pilot study was conducted during this segment to determine appropriate sampling design in regards camera placement to most accurately estimate density.

II. Job Objectives and Summary of Progress:

2.A.1. and 2.2. Estimate big game population size and/or trend, sex and age composition, and geographical distribution. Evaluate survey techniques and develop new methods where appropriate.

Bear. Recently completed research suggests that bear densities in the management zones that were surveyed (3, 4, 5, 8, 12, and 13) are comparable to black bear populations in similar habitats in neighboring states. Population estimates (Table 2.A.26) were produced by applying estimated densities to primary bear habitat. A Department objective is to estimate bear density and abundance for the majority of other management zones, and a clustered non-invasive genetic sample trapping survey in a spatial mark-resight framework is planned in Zone 1 during the upcoming reporting period.

Table 2.A.26. Black Bear Population Estimates and Mortality Limits by Zones, NMDGF.

Zone	GMUs	Population point estimate	Total mortality limit	Female sub-limit
1	4-7, 51, 52	1,580	158	63
2	2	150	15	6
3	48, 49, 50, 53	544	65	26
4	45, 46, 48	1,093	109	43
5	54, 55	919	92	37
6	39, 40, 41, 42, 43, 47, 59	328	33	13
7	56, 57, 58	354	35	14
8	8	132	11	4
9	9, 10	356	36	14
10	12, 13, 15-18, 20-24, 26, 27	1,456	146	58
11	37, 38	360	36	14
12	34	325	33	13
13	36	159	16	6
14	14	233	19	7
Total		7,989	804	318

Cougar. Cougar population estimates and sustainable harvest levels were derived from a combination of available habitat, density extrapolated from a 1996 New Mexico cougar study and from other western states, and existing mortality and harvest data (Table 2.A.27). Two studies were initiated to evaluate non-invasive genetic and camera-trapping survey methods and spatial capture-recapture and spatial mark-resight models for estimating density and abundance of cougars in New Mexico. It was determined that deploying GPS collars on cougars, combined with camera trap data, provides more accurate and precise population estimates than using scat detector dogs because the latter was not able to accrue enough data to run the models.

Table 2.A.27. Cougar Population Estimates and Mortality Limits by Zones, NMDGF.

Zone	GMUs	Population Estimate	Total Mortality Limit	Female 25%Sub-limit
A	2, 7	207-285	42	13
B	5, 50, 51	142-192	28	8
C	43-46, 48, 49, 53-55	289-387	85	43
D	41, 42, 47, 59	76-106	23	12
E	9, 10	251-341	50	15
F	6	156-209	46	23
G	13 and 17	247-338	73	37
H	18, 19, 20	140-197	42	21
I	36-38	121-165	24	7
J	15, 16, 21, 25	445-603	89	27
K	22, 23, 24	225-305	66	33
L	26 and 27	64-91	19	10
M	31-33, 39, 40	146-215	31	9
N	4 and 52	76-102	15	5
O	12	103-141	21	6
P	56-58	49-66	14	7
Q	28-30 and 34	170-235	35	11
R	45 and 55	131-175	26	8
S	8 and 14	85-116	25	13
Totals:		3,123-4,269	749	303

II. Job Objectives and Summary of Progress:

2.1.B Estimate hunter numbers, harvest, effort, and success rates.

Bear. Harvest continues to be monitored by the harvest/total sustainable mortality system. During the season, each zone remains open to black bear hunting until the total number of harvested bears (determined by mandatory check-in for successful hunters) or the female portion of the harvest equals the total limit or the female sub-limit, respectively, whichever comes first. Only a maximum of 40% of the harvest can be female in all bear management zones. Total bear mortality from all human causes this grant segment is somewhat comparable to 2011-14. For 2011-2014, a relatively large number of bear mortalities occurred as a consequence of severe drought and associated reduced availability of natural foods, resulting in increased bear movement and increased human contact, which was similar to this reporting period although with less intensity (Table 2.B.4).

Table 2.B.4. Annual Bear Mortalities during 2001-2017/18, NMDGF.

License Year	Sport Harvest Female	Male	Unk.*	Sport Total	Depredation Kill Female	Male	Unk.	Depred. Total	Other (road kill, accident, etc.) Female	Male	Unk.	Other Total	All Total	Total % Female
2001-02	227	365	4	**596**	8	39	1	**48**	6	9	0	**15**	**659**	36.6%
2002-03	292	445	8	**745**	14	34	2	**50**	8	15	0	**23**	**818**	38.4%
2003-04	182	275	2	**459**	5	13	0	**18**	10	7	1	**18**	**495**	39.8%
2004-05	82	163	1	**246**	2	1	0	**3**	2	8	0	**10**	**259**	33.2%
2005-06	113	181	0	**294**	8	9	0	**17**	2	4	0	**6**	**317**	38.8%
2006-07	118	235	4	**357**	4	15	0	**19**	3	10	1	**14**	**390**	32.0%
2007-08	115	253	0	**368**	7	14	0	**21**	3	13	0	**16**	**405**	30.9%
2008-09	94	239	0	**333**	2	31	0	**33**	6	19	0	**25**	**391**	26.1%
2009-10	126	272	0	**398**	2	19	0	**21**	5	15	0	**20**	**439**	30.3%
2010-11	125	278	0	**403**	14	43	0	**57**	8	12	0	**20**	**480**	30.6%
2011-12	268	503	6	**777**	62	180	1	**243**	18	39	3	**60**	**1080**	32.2%
2012-13	268	440	6	**714**	30	60	2	**92**	20	36	4	**60**	**866**	36.7%
2013-14	293	479	6	**778**	47	126	1	**174**	29	31	4	**64**	**1016**	36.3%
2014-15	209	343	9	**561**	10	40	0	**50**	12	23	7	**42**	**653**	35.4%
2015-16	189	279	1	**469**	11	24	1	**36**	4	16	0	**20**	**525**	38.9%
2016-17	169	327	2	**498**	9	39	2	**50**	7	6	0	**13**	**561**	33.9%
2017-18	178	305	2	**485**	23	60	2	**85**	16	35	3	**54**	**624**	34.8%

Unk – Unknown, sometimes the sex is impossible to determine due to decomposition or physical damage.

Cougar. Harvest continues to be managed by the hunter harvest/total sustainable mortality system. During the hunting season, each zone remained open to mountain lion hunting from April 1 until March 31 or when the total number of hunter kills (as determined by mandatory check-in for successful hunters) equaled the total sustainable mortality limit for that zone, or the female sub-limit had been met, whichever came first. Only 30% of the harvest may be female in cougar management zones where the long term goal is stable cougar population, and 50% in cougar management zones where the goal is population reduction. Cougar harvest has remained relatively stable for the past 3 years (Table 2.B.5).

Table 2.B.5. Annual Cougar Mortality Statistics 2001-2017/18, NMDG

	Sport Harvest				Depredation Kill				Bighorn Sheep Protection				Other (road kill, accident, etc.)			
Cougar	Fem.	Male	Unk. *	Total Sport	Fem.	Male	Unk.	Total Depred.	Fem.	Male	Unk.	Total BHS	Fem.	Male	Unk.	Total Other
2001-02	76	110	0	**186**	3	3	1	**7**	5	6	0	**11**	3	0	2	**5**
2002-03	82	118	1	**201**	14	14	1	**29**	14	11	0	**25**	6	5	2	**13**
2003-04	84	114	0	**198**	17	5	0	**22**	5	12	0	**17**	3	2	0	**5**
2004-05	72	89	0	**161**	16	16	1	**33**	3	8	0	**11**	4	0	0	**4**
2005-06	34	72	0	**106**	5	5	0	**10**	6	8	0	**14**	1	3	0	**4**
2006-07	82	95	0	**177**	12	13	1	**26**	8	10	0	**18**	3	1	0	**4**
2007-08	59	104	0	**163**	13	13	0	**26**	3	8	0	**11**	1	1	0	**2**
2008-09	50	72	0	**122**	5	11	0	**16**	4	11	0	**15**	4	1	0	**5**
2009-10	55	103	0	**158**	7	11	0	**18**	8	7	0	**15**	1	5	0	**6**
2010-11	57	110	1	**168**	1	3	0	**4**	8	6	0	**14**	5	5	0	**10**
2011-12	75	123	0	**198**	14	7	0	**21**	4	8	0	**12**	5	7	0	**12**
2012-13	87	170	0	**257**	14	6	0	**20**	7	23	0	**30**	4	5	1	**10**
2013-14	84	117	2	**203**	12	12	0	**24**	5	12	0	**17**	5	4	0	**9**
2014-15	107	134	0	**241**	13	11	1	**25**	8	10	0	**18**	4	7	0	**11**
2015-16	88	151	0	**239**	14	9	0	**23**	7	13	0	**20**	6	5	1	**12**
2016-17	90	154	1	**245**	16	6	0	**22**	5	12	0	**17**	7	9	2	**18**
2017-18	93	141	1	**235**	10	10	0	**20**	9	9	0	**18**	5	9	1	**15**

*Unk – Unknown, sometimes the sex is impossible to determine due to decomposition or physical damage

2.4. Bear Demographics Research

The goal of this study was to provide bear demographic information in areas not recently surveyed to inform bear management in New Mexico. Due to the Carnivore and Small Mammal Program Manager position being vacant from February through June, this project was not implemented during this segment. However, it is our intent to develop an implement the project in the spring of the following grant segment.

2.5. Cougar Demographics Research

Project #1: The goal of this study was to provide cougar demographic information using scat detector dogs to assist with directing cougar management in New Mexico. **During the previous reporting period** six study areas were sampled using scat detection dogs. Lab work performed during the current grant segment period revealed that cougars were detected on five of those areas. Of the 746 scat samples collected, only 65 of those were confirmed to be cougar by mitochondrial DNA amplification. Of those 65 cougar samples, only 30 amplified at enough microsatellite markers to identify individual cougars. Due to the low number (30/746) of scats identified to individual cougar, further analyses of individual detections and estimates of population numbers were not possible. Therefore, we chose to discontinue this method and focus resources on Project #2.

Project #2: The goal of this study is to provide cougar demographic and ecological information to inform cougar management in New Mexico using GPS collars and camera trap data. A total of 68 double camera trap stations (i.e., 136 total cameras) were established in nine clusters across Cougar Management Zone (CMZ) F during July 2017 and were maintained through October

2017 to constitute 17 weeks of sampling, with one week comprising a sampling occasion. Sufficient data were collected from the combination of GPS collaring and remote camera captures during this sampling period to produce a cougar density estimate of 1.02 cougars/100km2 (95% CI = 0.64─1.56). This camera trap configuration was maintained throughout the winter, until May 2018, and data will be reanalyzed for the extended sampling period.

In January 2018, the scope of this project was extended to include CMZs B and N, for a total survey area of ~16,500 km2. Five additional cougars (4M:1F) were live-captured and GPS-collared from January – March 2018. We will continue with the study during the next grant period.

GRANT STATEMENT

STATE: **New Mexico** **GRANT NUMBER:** W-93-R **SEGMENT NUMBER:** 59

GRANT TITLE: Big Game Surveys, Inventories and Management

GRANT PERIOD: July 1, 2018 to June 30 2019

A. **Need**: This grant is crucial in meeting Department mission and goals and to insure compliance with state and federal mandates. Through the Commission, the Department has the responsibility, mandated by statute, to protect New Mexico's game while providing and maintaining an adequate supply for recreational use. This includes developing recommendations for hunter opportunity, engaging landowners in big game management, conducting population surveys, and restoring populations when feasible.

B. **Purpose:** The information gathered under this grant will be used to prepare annual recommendations for big game and habitat management in accordance with the mission, goals and plans of the Commission and Department. This information may also be used by land management and other agencies and to provide the public with background biological information for their use.

OBJECTIVES:

Objective 5:
Conduct 15 investigations by June 30, 2019.
Activity Tag 1
Fish and wildlife species data acquisition and analysis
Unit of Measure: 15 investigations
Target Species : Deer, Elk, Pronghorn, Bear, Cougar, Bighorn, Oryx, Ibex

Approach

a. Collect, analyze, interpret, and report big game population and harvest data. Plan, prepare, and conduct surveys of big game populations and their hunters (Appendix I). These include composition, sightability, trend, and census surveys. Some of the specific techniques to be used are: ground population surveys, scat/scrapping transects, and mark-resight. This activity also includes surveys specific to young of the year (lamb, calf, fawn) and collecting (pulling) teeth for age determination. The data will be used to estimate big game population size and/or trend, sex and age composition, and geographical distribution. Methods are described in New Mexico Survey Standards and Guidelines.

Bear. Harvest continues to be monitored by the harvest/total sustainable mortality system. During the season, each zone remains open to black bear hunting until the total number of harvested bears (determined by mandatory check-in for successful hunters) or the female portion of the harvest equals the total limit or the female sub-limit, whichever comes first. Only a maximum of 40% of the harvest can be female in any bear management zone. Total bear mortality from all human causes this grant segment is similar to recent years. For 2014-2019, reasonably low numbers of non-sport harvest bear mortalities occurred as a consequence of moderate to good availability of natural foods, resulting in decreased bear movement and decreased human contact, and a shift in Department policy regarding depredation bears.

Table 3. Annual Bear Mortalities during 2001-2018/19, NMDGF.

	Sport Harvest				Depredation Kill				Other (road kill, accident, etc.)					
License Year	Female	Male	Unk.*	**Sport Total**	Female	Male	Unk.	**Depred. Total**	Female	Male	Unk.	**Other Total**	**All Total**	**Total % Female**
2001-02	227	365	4	**596**	8	39	1	**48**	6	9	0	**15**	**659**	36.6%
2002-03	292	445	8	**745**	14	34	2	**50**	8	15	0	**23**	**818**	38.4%
2003-04	182	275	2	**459**	5	13	0	**18**	10	7	1	**18**	**495**	39.8%
2004-05	82	163	1	**246**	2	1	0	**3**	2	8	0	**10**	**259**	33.2%
2005-06	113	181	0	**294**	8	9	0	**17**	2	4	0	**6**	**317**	38.8%
2006-07	118	235	4	**357**	4	15	0	**19**	3	10	1	**14**	**390**	32.0%
2007-08	115	253	0	**368**	7	14	0	**21**	3	13	0	**16**	**405**	30.9%
2008-09	94	239	0	**333**	2	31	0	**33**	6	19	0	**25**	**391**	26.1%
2009-10	126	272	0	**398**	2	19	0	**21**	5	15	0	**20**	**439**	30.3%
2010-11	125	278	0	**403**	14	43	0	**57**	8	12	0	**20**	**480**	30.6%
2011-12	268	503	6	**777**	62	180	1	**243**	18	39	3	**60**	**1080**	32.2%
2012-13	268	440	6	**714**	30	60	2	**92**	20	36	4	**60**	**866**	36.7%
2013-14	293	479	6	**778**	47	126	1	**174**	29	31	4	**64**	**1016**	36.3%
2014-15	209	343	9	**561**	10	40	0	**50**	12	23	7	**42**	**653**	35.4%
2015-16	189	279	1	**469**	11	24	1	**36**	4	16	0	**20**	**525**	38.9%
2016-17	169	327	2	**498**	9	39	2	**50**	7	6	0	**13**	**561**	33.9%
2017-18	178	305	2	**485**	23	60	2	**85**	16	35	3	**54**	**624**	34.8%
2018-19	188	308	0	**496**	14	54	0	**68**	11	23	2	**36**	**600**	35.5%

Unk – Unknown, sometimes the sex is impossible to determine due to decomposition or physical damage.

Cougar. Harvest continues to be managed by the hunter harvest/total sustainable mortality system. During the hunting season, each zone remained open to mountain lion hunting from April 1 until March 31 or when the total number of hunter kills (as determined by mandatory check-in for successful hunters) equaled the total sustainable mortality limit for that zone, or the female sub-limit had been met, whichever came first. Only 30% of the harvest may be female in cougar management zones where the long term goal is stable cougar population, and 50% in cougar management zones where the goal is population reduction. Cougar harvest and total mortality increased by over 25% during this grant period (Table 2.B.5). The primary reason for this increase was excellent snow conditions statewide that allowed harvest of cougars in areas that are usually difficult to harvest from because there is little snow there. Snow conditions and presence make it easier for hounds/houndsmen to locate and tree cougars, thereby making them available for harvest.

Table 4. Annual Cougar Mortality Statistics 2001-2017/18, NMDG

	Sport Harvest				Depredation Kill				Bighorn Sheep Protection				Other (road kill, accident, etc.)			
Cougar	Fem.	Male	Unk. *	**Total Sport**	Fem.	Male	Unk.	**Total Depred.**	Fem.	Male	Unk.	**Total BHS**	Fem.	Male	Unk.	**Total Other**
2001-02	76	110	0	**186**	3	3	1	**7**	5	6	0	**11**	3	0	2	**5**
2002-03	82	118	1	**201**	14	14	1	**29**	14	11	0	**25**	6	5	2	**13**
2003-04	84	114	0	**198**	17	5	0	**22**	5	12	0	**17**	3	2	0	**5**
2004-05	72	89	0	**161**	16	16	1	**33**	3	8	0	**11**	4	0	0	**4**
2005-06	34	72	0	**106**	5	5	0	**10**	6	8	0	**14**	1	3	0	**4**
2006-07	82	95	0	**177**	12	13	1	**26**	8	10	0	**18**	3	1	0	**4**
2007-08	59	104	0	**163**	13	13	0	**26**	3	8	0	**11**	1	1	0	**2**
2008-09	50	72	0	**122**	5	11	0	**16**	4	11	0	**15**	4	1	0	**5**
2009-10	55	103	0	**158**	7	11	0	**18**	8	7	0	**15**	1	5	0	**6**
2010-11	57	110	1	**168**	1	3	0	**4**	8	6	0	**14**	5	5	0	**10**
2011-12	75	123	0	**198**	14	7	0	**21**	4	8	0	**12**	5	7	0	**12**
2012-13	87	170	0	**257**	14	6	0	**20**	7	23	0	**30**	4	5	1	**10**
2013-14	84	117	2	**203**	12	12	0	**24**	5	12	0	**17**	5	4	0	**9**
2014-15	107	134	0	**241**	13	11	1	**25**	8	10	0	**18**	4	7	0	**11**
2015-16	88	151	0	**239**	14	9	0	**23**	7	13	0	**20**	6	5	1	**12**
2016-17	90	154	1	**245**	16	6	0	**22**	5	12	0	**17**	7	9	2	**18**
2017-18	93	141	1	**235**	10	10	0	**20**	9	9	0	**18**	5	9	1	**15**
2018-19	117	227	0	**344**	14	11	0	**25**	5	22	0	**27**	5	6	2	**13**

Survey Data

b. Cougar density estimation: Includes planning, implementing and assessment of a statewide cougar density estimation study

RESULTS:
The goal of this survey is to provide cougar demographic and ecological information to inform cougar management in New Mexico using GPS collars and camera trap data. A total of 128 double camera trap stations (i.e., 256 total cameras) were established in clusters across Cougar Management Zones (CMZ) B, F and N during July 2018 and were maintained through November 2018 to constitute 18 weeks of sampling, with one week comprising a sampling occasion. A total of 14 individual cougars fitted with GPS collars were included in the study. We detected cougars a total of 156 times across 48 sites, including 38 detections of previously marked cougars. Data collected from the combination of GPS collaring and remote camera captures during this sampling period are currently being analyzed to produce a cougar density estimate.

In November 2018, the scope of this project was extended to CMZ Q, a survey area of ~17,800 km2. Seven cougars (3M:4F) were live-captured and GPS-collared from January – June 2019. A total of 101 double camera trap stations (i.e., 202 total cameras) were established in clusters across Cougar Management Zone Q during January 2019. We will continue with the survey during the next grant period to produce a population estimate.

c. Bear population density estimate in Bear Management Zone 1.

RESULTS
The goal of this study is to provide black bear demographic and ecological information to inform black bear management in New Mexico using non-invasive collection of hair samples for genetic analysis. Hair snare sites were set up beginning May 2019, and sample collection began June 2019 for the 171 established sites. Remote cameras were deployed at a portion of the sites to monitor visitation patterns and sample collection efficiency. We are currently processing and analyzing the hair samples, and working on population estimation and other demographic analyses.


NMDGF - BEAR AND
COUGAR RULE DEVELOPMENT 2019
- RECORD OF PUBLIC COMMENT -
STAPLES
CD-R
EXHIBIT
6
tabbies
52x speed
1x - 52x compatible
support-staples.com

From: [redacted]
To: DGF-Bear-Cougar-Rules
Subject: [EXT] August Bear Season
Date: Sunday, September 08, 2019 9:57:04 AM

I reside in California, and I purchased a house in Cliff for hunting bear and cougar. Each year I purchase non-resident bear and cougar licenses as do friends from several states. We hunt the August bear season, which is being considered for elimination. Let me make a suggestion that may appeal to people on both sides of this issue. I recommend making the August bear season a pursuit-only season like that in other states such as Utah. This would provide hunting opportunity for houndsmen without biological impact on the bear resource. Thank you for considering this recommendation.

Daniel Tichenor

From: [redacted]
To: DGF-Bear-Cougar-Rules
Cc: Comins III, James C., DGF
Subject: [EXT] B&C RULES—Letter—Karen Borch - Oct 10, 2019
Date: Thursday, October 10, 2019 3:37:59 PM
Attachments: B&C RULES—Letter—Karen Borch - Oct 10 2019 - 3-35 PM.pdf
ATT00001.txt

Last one for I have for now....

Scanned with TurboScan.

From:	[redacted]
To:	DGF-Bear-Cougar-Rules; Prukop, Joanna, DGF; Salazar-Henry, Roberta, DGF; Bates, Jimmy, DGF; Cramer, Gail, DGF; Lopez, Tirzio, DGF; Soules, David, DGF; Vesbach, Jeremy, DGF
Subject:	[EXT] Bear & Cougar Rule Development - APNM and HSUS Comments
Date:	Monday, September 16, 2019 4:12:59 PM
Attachments:	image002.png NM Cougar Rule Preproposal Comment 091619 FINAL.pdf

Dear Commissioners and New Mexico Department of Game & Fish,

Attached, please find initial written comments on the Bear & Cougar Rule development on behalf of Animal Protection of New Mexico and the Humane Society of the United States.

We thank you for your consideration and look forward to continuing to engage in this rulemaking process. Please don't hesitate to reach out if you have any questions about the comments we've provided here.

Sincerely,

Jessica Johnson
Chief Legislative Officer
Animal Protection of New Mexico and
Animal Protection Voters
[redacted]

Making Sure Animals Matter in Every New Mexican Community
Learn more by viewing our video!

From: [redacted]
To: DGF-Bear-Cougar-Rules
Subject: [EXT] Bear and Cougar Opinion
Date: Sunday, August 18, 2019 4:14:05 PM

Dear Fish and Game Dept.,
I'm a resident of Dona Ana county living in Las Cruces and I'm emailing to voice my opinion regarding bear and cougar rules.
I stand firm against ALL recreational trapping of cougars and a dramatically reduced annual cougar and bear kill limits. Preferably the only reason for killing would be a humane kill of an injured animal or one that proved an imminent danger to humans.
Thank you for allowing me to voice my opinion.
Nancy Fonde
[redacted]

Excellence is the Result of
Caring more than others think is *Wise*
Risking more than others think is *Safe*
Dreaming more than others think is *Practical*
and *Expecting* more than others think is *Possible*

From: [redacted]
To: DGF-Bear-Cougar-Rules
Subject: [EXT] Bear and Cougar Rule comments
Date: Thursday, August 29, 2019 3:22:50 PM

Thank you for the opportunity to comment on the Bear and Cougar Rule. Although we commented on the Rule during the July meeting of the Game Commission, please accept these as the official comments of the New Mexico Chapter of Backcountry Hunters & Anglers.

After consulting with our board, our allies in the trapping community and others, we have modified the position we previously stated at both our in-person meeting with Stewart Liley and Elise Goldstein and at the July 24 Game Commission meeting.

We support the changes proposed in season dates and harvest levels for both bear and cougar, but we respectfully disagree with the proposal to eliminate trapping as a sport harvest method. The current regulation has had an insignificant effect on the overall harvest of cougars and we see no reason to change it.

Thank you again.

Joel Gay, Chairman, NM BHA
Kevin Lockhart, Policy Coordinator, NM BHA
Katie DeLorenzo, Southwest Regional Coordinator, BHA

From: [redacted]
To: DGF-Bear-Cougar-Rules
Cc: Prukop, Joanna, DGF
Subject: [EXT] Bear and Cougar Rule
Date: Sunday, September 15, 2019 7:15:05 PM

There should be no trophy hunting of mountain lions (which the "bear and cougar rule" refers to as "sport harvesting") whatsoever. Although mountain lions *(Puma concolor,* also known as "cougars") are not legally classified as a federal endangered species, California, which has already banned mountain lion trophy hunting, is considering classifying *Puma concolor* as a state endangered species. The Humane Society of the United States (HSUS) calls for an end to mountain lion trophy hunting, which they have identified as the greatest threat to mountain lion populations. Their detailed report, State of the Mountain Lion can be found online at https://www.humanesociety.org/animals/mountain-lion.

HSUS bases its findings on reliable scientific studies of mountain lion populations throughout North America. The New Mexico Department of Game and Fish (NMDGF) does not have any accurate estimates of the statewide mountain lion population in New Mexico. While NMDGF has been able to collect some data from mountain lions fitted with GPS collars in areas where bighorn sheep are protected for hunters, mountain lions are far too elusive for GPS monitoring throughout their varied habitat in the state. At the August 13 public meeting in Albuquerque, NMDGF showed a slide claiming a population of 7,000, but they have never explained this figure, which does not appear in any of their online reports. Apparently it was calculated by "extrapolation," adopting a methodology developed for a bear population study. Perhaps the presenter was confused by NMDGF's insistence on lumping bear and mountain lion hunting together in one "bear and cougar" rule.

In any case, NMDGF does not seem to take its "public meetings" as seriously as its meetings with the special interest groups it refers to as "stakeholders." In email correspondence, NMDGF has acknowledged that there is no rule, regulation, or statute authorizing these stakeholder meetings, for which there are apparently no minutes kept.

If NMDGF were to finalize its "bear and cougar" rule based on dubious scientific methodology and closed-door stakeholder meetings, the rule could be the subject of legal action.

NMDGF has wisely decided to end mountain lion trapping. It should take the next logical step and end all mountain lion trophy hunting.

Marc Bedner
[redacted]

From: [redacted]
To: DGF-Bear-Cougar-Rules
Subject: [EXT] Bear and Cougar Rules Revisions
Date: Monday, August 19, 2019 8:51:05 AM

August 16, 2019

Dear New Mexico Department Game and Fish,

I am pleased to find out that the New Mexico Department of Game and Fish is proposing to revise the current Bear and Cougar Rule. I would like to express that as a long-time New Mexico resident, I approve of the elimination of all recreational cougar trapping, the reduction of annual cougar kill limits, undoing the double bag limit for cougars, and reduction of bear kill limits.
I am a wildlife photographer and avid outdoor person and oppose the killing of all wildlife, especially for commodity. It is a fact that bear and cougar populations are down and not just because of drought, loss of habitat or because of road kill.
I hope that the New Mexico Department of Game and Fish will take a humane and just approach and revise the current cougar and bear rules as stated above.

Sincerely,
Deanna M. Draudt
[redacted]

From: [redacted]
To: DGF-Bear-Cougar-Rules
Subject: [EXT] Bear and lion using hounds
Date: Wednesday, October 02, 2019 3:43:29 AM

Using hounds is an unfair advantage just like baiting and should be a shorter separate season all together

From: [redacted]
To: DGF-Bear-Cougar-Rules
Subject: [EXT] Bear Cougar Rules
Date: Sunday, August 18, 2019 10:49:40 PM

New Mexico Fish and Game:
Below are my comments on the Bear and Cougar Rules for the State of New Mexico:

1. I believe all recreational traps and snares to trap cougar should be prohibited in New Mexico.
2. I believe NMDGF should reduce annual cougar kill limits. Please use scientific studies to help determine the number that helps protect our cougar populations.
3. I believe NMDGF should reduce the annual bear kill limits. I believe the limits should reflect safe
   management of bear populations, but also allow bears to be part of our wildlife ecosystem.

Thank you,

Judy Larson
[redacted]

From: [redacted]
To: DGF-Bear-Cougar-Rules
Subject: [EXT] Bear- Cougar rules
Date: Monday, August 19, 2019 4:04:53 PM

I m totally against any recreational cougar & bear trapping on any state, private or federal land.
These animals are stressed out because of climate change & the drought among other things.
Therefore, there should be no trapping at all & a reduced number
of animal kill limits on hunting. Before we know it, these animal will be extinct.
I know you are a hunting organization but please have some respect for these magnificent animals.
Do the right thing for a change.
Thank you,
Olivia Solomon
[redacted]

From: [redacted]
To: DGF-Bear-Cougar-Rules
Subject: [EXT] Bear depredation
Date: Tuesday, September 17, 2019 10:38:53 AM

Stop the bear killing! Don't allow bear cops to be killed, still nursing on its mother! Karin Waldrop

Sent from my iPhone

From:	[redacted]
To:	DGF-Bear-Cougar-Rules
Subject:	[EXT] Bear hunting
Date:	Tuesday, September 17, 2019 12:48:12 PM

Dear Sirs:

It seems unsportsmanlike to kill any bears or cougars under any circumstances. Shooting them in dens or in trees where they are exposed by packs of dogs also seems unnecessary harassment. Using dogs is almost the opposite of "hunting", and there should be an age and sex limit. New Mexico should improve it's ethics in the field.

L. Bintz

Sent from my iPad

From: [redacted]
To: DGF-Bear-Cougar-Rules
Subject: [EXT] BEAR HUNTS
Date: Tuesday, September 17, 2019 10:33:59 PM

By now you are probably inundated with comments opposing current bear hunt rules. Let me add my voice to theirs.

There was an excellent letter to the editor of the Albuquerque Journal on Tuesday that speaks for many of us. Killing bears in instances of predation is something we have to live with. Otherwise, unless the bear is hunted for food, it should be off-limits. Sub-adults should always be off limits.

Sincerely,
Arlette MILLER
[redacted]
Sent from my iPad

From: [redacted]
To: DGF-Bear-Cougar-Rules
Subject: [EXT] Bear Killing Rules
Date: Tuesday, September 17, 2019 2:13:27 PM

Really!!?? New Mexico allows hunters to track down and kill bear cubs! I heard a hunter describe tearing into a bear den and letting his dogs kill the cubs while he took out the still sleeping mother. What sportsmanship! It made me sick and I told him so. His response was that it was perfectly legal in NM and that's the way he and his hounds always hunted. This is bear hunting in NM! No wonder our bear population has been so devastated in recent years.

These present bear killing rules are simply unacceptable. We would like to preserve the wildlife in this state so more folks can visit, hike, photograph and actually have a chance to SEE a Black Bear before they are so depleted that an ordinary person will never be able to see one in the wild.

I am a 5th generation New Mexican, and I believe I have the right to live in a state that values its wildlife for more than what they are worth dead to a single hunter. These rules will simply continue to devastate the bear population in New Mexico.

I will be lobbying my representative, senator and the governor to make some drastic and desperately needed change to the NM Game Commission and the rules and laws governing our dwindling wildlife in NM.

Kathryn and Ken Widger
[redacted]

From: [redacted]
To: DGF-Bear-Cougar-Rules
Subject: [EXT] Bear killing
Date: Wednesday, September 25, 2019 4:00:10 PM

The members of my household do NOT support the continued slaughter of our bears. If this was a ballot question, we would vote against this practice.

Jacqueline & Gerald Coryell
[redacted]

From: [redacted]
To: DGF-Bear-Cougar-Rules
Subject: [EXT] Bear killings
Date: Tuesday, September 17, 2019 3:54:44 PM

I read an opinion piece by Craig McClure. In it he questioned the high number of bear killings in NM. I would like you to consider his opinion. I do not believe in killing bears that haven't harmed anyone. I definitely do not want young bears killed, they should be relocated with their mother.

Thank you for reading my opinion.

Cathie Rutin

Sent from my Verizon, Samsung Galaxy Tablet

From: [redacted]
To: DGF-Bear-Cougar-Rules
Subject: [EXT] Bear rule
Date: Saturday, July 27, 2019 5:28:08 PM

What is the actual bear and Couger proposed fule

Sent from my iPhone

From: [redacted]
To: DGF-Bear-Cougar-Rules
Subject: [EXT] Bear rules comment
Date: Monday, September 09, 2019 3:39:15 PM
Attachments: Bear rules comment letter SC WEG APNM final.docx

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Please accept these comments submitted jointly by the Rio Grande Chapter Sierra Club, Animal Protection of New Mexico and WildEarth Guardians

Thank you,
Mary Katherine Ray
[redacted]

From: [redacted]
To: DGF-Bear-Cougar-Rules
Subject: [EXT] Bear
Date: Thursday, October 10, 2019 9:42:06 PM

I am a houndman my proposal is to cancel the august bear hunts due to many bear are harvested when summer food supply is at its best. Thanks JAMES lAY
Sent from Mail for Windows 10

From: [redacted]
To: DGF-Bear-Cougar-Rules
Subject: [EXT] Bear
Date: Friday, July 26, 2019 8:44:16 PM

We should have a bear spring pursuit season on bear It would help to keep them out of towns. I don't think we should harvest any at time of year.

Sent via the Samsung Galaxy, powered by Cricket Wireless

From: [redacted]
To: DGF-Bear-Cougar-Rules
Subject: [EXT] Bear/ cougar rule
Date: Monday, September 09, 2019 6:02:19 PM

I hate that politics play such a huge role in the rule making for the animal in New Mexico. It would be wonderful if we could get back to could get back to sound biology when making these rules. A prime example of this is there is no biology that indicates we need to decrease the cougar harvest limits but are going to do so to appease some of the public. There is however plenty of biology that indicates we need to increase the harvest limits on both bear and cougar in a few some units. I realize that the game and fish department is a government programs and is for the people but let's not forget that the mission statement is to conserve, regulate, propagate and protect the WILDLIFE and FISH within the state of New Mexico, unsung a flexible management system that ensures sustainable use for public food supply, recreation and safety- and to provide for off-highway motor vehicle recreation that recognizes cultural, historic and resource values while ensuring public safety.
Please look at increasing the harvest limits for bear in zone 7 and cougar in zone p not only to keep their number sustainable but the other wildlife in the area. These zones are some of the few that get closed every year in a very short amount of time. Thank you for your consideration!

Colby Kennedy

Sent from my iPhone

From: [redacted]
To: DGF-Bear-Cougar-Rules
Subject: [EXT] Bear-cougar rules
Date: Friday, September 27, 2019 9:57:09 AM

I am a registered NM voter and property owner of long standing. I AM AGAINST THE RULE CHANGES. They are barbaric and put NM back 250 years. We share the state with animals and plants. Let's celebrate this diversity instead of trying to ruin it. And besides whose bright idea was it to wipe out the State animal?

BC WEINER
[redacted]

[redacted]

From: [redacted]
To: DGF-Bear-Cougar-Rules
Subject: [EXT] Bears and Cougars
Date: Tuesday, November 05, 2019 11:14:14 AM

New Mexico Department of Game and Fish (NMDGF):

I would like to let you know what my public comment is on proposed revisions to the Bear and Cougar Rule.
Our wildlife is precious and should be conserved and respected. They deserve to live as much as human beings do. Invasive and cruel practices should be eliminated, these animals are sentient and should not suffer at the hands of hunters and trappers.
That's why I kindly ask you to please eliminate ALL "recreational" cougar trapping. Reverse the Game Commission's 2015 decision to allow the use of traps and snares as a method of cougar "sport harvesting" on both private and state trust lands!
The vast majority of New Mexicans oppose cougar trapping, consider it extremely cruel, and are concerned about the impacts on other species like endangered Mexican wolves.

And please reduce annual cougar kill limits. The latest data and scientific literature show that NMDGF has dangerously overestimated the number of cougars in New Mexico and applied inflated percentages of allowable kills (kill limits, or what NMDGF calls "harvest limits"), putting cougar populations at risk. NMDGF needs to rely on best available science to protect and conserve the notoriously hard-to-count cougar, and the killing is often unnoticed!

Undo the double bag limits for cougars. Reverse the Game Commission's 2015 decision to allow cougar hunters who kill their bag limit of two cougars to then kill up to two more in cougar management zones where current unjustifiably high kill limits are not met. This move has not yielded the results NMDGF sought, and a double bag limit violates the precautionary principles that should guide careful cougar management.

Reduce annual bear kill limits. Another species impacted by incorrect application of science, the annual number of bears killed in New Mexico never reach more than half of the current unjustifiably high kill limits. NMDGF should revise its approach to management of bears to ensure this important species is not decimated by irresponsible hunting allowances!

Please preserve and protect these precious animals for generations to come!

Sincerely:

sang

From:	[redacted]
To:	DGF-Bear-Cougar-Rules
Subject:	[EXT] Bears and cougars
Date:	Monday, November 04, 2019 4:55:45 PM

Subject: Bears and cougars

I would like to let you know what my public comment is on proposed revisions to the Bear and Cougar Rule.
Our wildlife is precious and should be conserved and respected. They deserve to live as much as human beings do. Invasive and cruel practices should be eliminated, these animals are sentient and should not suffer at the hands of hunters and trappers.
That's why I kindly ask you to please eliminate ALL "recreational" cougar trapping. Reverse the Game Commission's 2015 decision to allow the use of traps and snares as a method of cougar "sport harvesting" on both private and state trust lands!
The vast majority of New Mexicans oppose cougar trapping, consider it extremely cruel, and are concerned about the impacts on other species like endangered Mexican wolves.

And please reduce annual cougar kill limits. The latest data and scientific literature show that NMDGF has dangerously overestimated the number of cougars in New Mexico and applied inflated percentages of allowable kills (kill limits, or what NMDGF calls "harvest limits"), putting cougar populations at risk. NMDGF needs to rely on best available science to protect and conserve the notoriously hard-to-count cougar, and the killing is often unnoticed!

Undo the double bag limits for cougars. Reverse the Game Commission's 2015 decision to allow cougar hunters who kill their bag limit of two cougars to then kill up to two more in cougar management zones where current unjustifiably high kill limits are not met. This move has not yielded the results NMDGF sought, and a double bag limit violates the precautionary principles that should guide careful cougar management.

Reduce annual bear kill limits. Another species impacted by incorrect application of science, the annual number of bears killed in New Mexico never reach more than half of the current unjustifiably high kill limits. NMDGF should revise its approach to management of bears to ensure this important species is not decimated by irresponsible hunting allowances!

Please preserve and protect these precious animals for generations to come!

Sincerely:
Marian Giesbers

[redacted]

From: [redacted]
To: DGF-Bear-Cougar-Rules
Subject: [EXT] Bears and Cougars
Date: Monday, November 04, 2019 11:36:59 AM

New Mexico Department of Game and Fish (NMDGF):

I would like to let you know what my public comment is on proposed revisions to the Bear and Cougar Rule.
Our wildlife is precious and should be conserved and respected. They deserve to live as much as human beings do. Invasive and cruel practices should be eliminated, these animals are sentient and should not suffer at the hands of hunters and trappers.
That's why I kindly ask you to please eliminate ALL "recreational" cougar trapping. Reverse the Game Commission's 2015 decision to allow the use of traps and snares as a method of cougar "sport harvesting" on both private and state trust lands!
The vast majority of New Mexicans oppose cougar trapping, consider it extremely cruel, and are concerned about the impacts on other species like endangered Mexican wolves.

And please reduce annual cougar kill limits. The latest data and scientific literature show that NMDGF has dangerously overestimated the number of cougars in New Mexico and applied inflated percentages of allowable kills (kill limits, or what NMDGF calls "harvest limits"), putting cougar populations at risk. NMDGF needs to rely on best available science to protect and conserve the notoriously hard-to-count cougar, and the killing is often unnoticed!

Undo the double bag limits for cougars. Reverse the Game Commission's 2015 decision to allow cougar hunters who kill their bag limit of two cougars to then kill up to two more in cougar management zones where current unjustifiably high kill limits are not met. This move has not yielded the results NMDGF sought, and a double bag limit violates the precautionary principles that should guide careful cougar management.

Reduce annual bear kill limits. Another species impacted by incorrect application of science, the annual number of bears killed in New Mexico never reach more than half of the current unjustifiably high kill limits. NMDGF should revise its approach to management of bears to ensure this important species is not decimated by irresponsible hunting allowances!

Please preserve and protect these precious animals for generations to come!

Sincerely: Anna Brewer, Tina Beurtels, New Mexico; John Summers; Henry T.; Vickey Osborn; Teddy Miller , New York; Amanda Fields; Jurgen Sorens; Rita Suffolk; Mary Dalton; Joseph Pritchard; Kimberley Fields; Simon Sears; Beverly Woods; Anita Brewer; Daniel Russel; Petra Stafford; Kim Wright; Daphne Harlington, New Mexico; Kathy Stafford, Joan Butterfield, Kenneth Lawson, Myrthe Low, Diane Bremer, Texas, US

From: [redacted]
To: DGF-Bear-Cougar-Rules
Subject: [EXT] Bears
Date: Tuesday, September 17, 2019 8:41:19 PM

Please stop the killing(murder) of bears, especially the young bears that are less than four years old. It is unconscionable to kill very young bears still nursing as our laws allow. The law should be changed right away. The killing of adult bears should be stopped as well. Bears are a valuable predator that help keep deer and elk populations from overpopulating. It is a severe shame to kill such noble beasts like bears and mountain lions. The practice should end as soon as possible. There is no reason whatsoever in this day and age to kill animals like these. They are such a small population anyway. Bears can bring in tourist dollars. Much more money can be gained from tourists photographing and observing bears and such than hunting can. Our animals are under so much pressure and threat these days. They should be protected. Bear and mountain lion hunters are a very small minority in our state and in the west. The majority of New Mexican citizens want our state's animals protected. If bear and mountain lions become overpopulated please consider a draw hunt on occasion of older bears only. Thank you for your time.

Donald H Smith

From:	[redacted]
To:	DGF-Bear-Cougar-Rules
Subject:	[EXT] Black bear comments from the Humane Society of the United States
Date:	Friday, September 13, 2019 3:36:08 PM
Attachments:	HSUS-NMDGF-BB-Regulations-9-13-2019-Final.pdf

Dear New Mexico Wildlife Officials,

Attached please find comments by the Humane Society of the United States concerning black bear management in New Mexico.

Given the paucity of black bear data in New Mexico,, we request that the black bear quota revert to 335 from 804. The number 804 has no basis in sound science and is far greater than hunters, predator control agents and others achieve annually, according to the NMDGF's own mortality data.

Black bears cannot withstand heavy persecution – they are super slow to reproduce. A female black bear in New Mexico doesn't begin reproduction until she is almost six years old, and then she will produce only a few cubs in her lifetime – many of whom do not survive their first year.

The data show that bears are valued by most New Mexicans. Most appreciate bears' sentience and intrinsic values—their devotion to their cubs and ability to maintain the biological diversity of their forest ecosystems.

Please do not hesitate to reach out if you need access to studies we cited, or if you have questions or comments!

Thank you for reviewing these comments!

Sincerely yours,

Wendy Keefover
[redacted]

[redacted]

THE HUMANE SOCIETY OF THE UNITED STATES

From: [redacted]
To: DGF-Bear-Cougar-Rules
Subject: [EXT] Comment BEAR AND COUGAR RULE PROPOSED CHANGES,
Date: Saturday, September 07, 2019 8:48:54 PM

NMDGF,

I am supportive of NMDGF proposing to no longer allow leg hold traps or foot snares for cougars. These devices are dangerous and inhumane to both target and non-target species. I stepped on a buried leg hold trap near Santa Fe last year which has caused me to worry about every step I take when I go hiking on public lands, and made it less enjoyable for me. The less traps, and better yet NO traps the better for the recreating public and target and non-target species.

I am also happy to see you are incorporating recent research into determining cougar harvest limits and lowering some zones.

I am not supportive of NMDGF allowing hunting of cougar all year. This can result in the death of any kittens whose mother was killed by a hunter. This is inhumane. Cougar should have a season like most all other wildlife you manage.

I am not supportive of NMDGF not lowering bear harvest limits and not supportive of extended hunting seasons. Bears have been suffering from long term drought and need to be studied more thoroughly statewide to get an accurate population count. Research in the Jemez Mountains has found that in many recent years they have found no cubs. Please consider lower harvest limits for bears and supporting more research to better determine the actual bear population in NM.

Thank you,

Julie Luetzelschwab
[redacted]

From: [redacted]
To: DGF-Bear-Cougar-Rules
Subject: [EXT] comment cougar rule
Date: Monday, August 19, 2019 8:54:02 AM

From: David Heft
[redacted]

Retain trapping as a legal method of harvest for mountain lions on private lands. Current harvest levels are low using this method because it is used to address livestock depredation, ungulate enhancement, and human safety concerns. It is not being used to simply "sport" trap lions. Being used in this manner alleviates the necessity for Department action through direct intervention or administrative permissions. If trapping is not permitted on private lands statewide I suggest the following 2 additional options.

Retain trapping of mountain lions on private lands in those zones that have not met the quota for 2 of the last 3 years. OR

Retain trapping of mountain lions on private lands in those zones that overlap units with desert bighorn sheep herds.

Either of these options would more precisely target areas to use this tool for management purposes by license buying participants.

Eliminate the 10% closure limits as the proposal to make all zones management goal to maintain stable populations negates the need for this and simplifies the regulation.

David L. Heft

From:	[redacted]
To:	DGF-Bear-Cougar-Rules
Subject:	[EXT] Comment on Bear and Cougar Rule
Date:	Monday, September 23, 2019 3:03:24 PM

To Whom It May Concern,

I would like to thank you for considering my comments. I noticed that there are no proposed changes to the bear zone boundaries. I would like for you to consider giving GMU 4 its own boundary/zone for the following reasons.

1) Unit 4 is primarily all private land with the exception of the three WMA's (Sargent, Humphries, and Ro Chama).

2) Because it is private land it is hunted different than the surrounding public land in the surrounding units. Private landowners and the outfitters that lease the private lands typically have clients that would like to have more opportunities to hunt after October 1, while the elk hunters are in the field. At some times this can be difficult because the quota is filled by hunters on public land in surrounding units.

3) This would potentially increase harvest within the private lands and surrounding communities that would also decrease the need for trapping problem bears.

4) This should help the local law enforcement focus on other issues and spend less time trapping.

In the past it has at times proven to be difficult to plan a bear hunt with our elk hunters who come out in October. We are completing with the public land quota in the surrounding public lands and in some cases don't have options to plan ahead and book hunts that could provide an overlapping second hunt opportunity for bear.

I would also like to comment on the cougar trapping rule. As private landowners we would like to keep traps and foot snares in use. This is a valuable tool for many landowners that have issues with lion.   If the rule is changed it shouldn't include private lands.

Thank you for your consideration,

Aaron Jones
[redacted]

From: [redacted]
To: DGF-Bear-Cougar-Rules
Subject: [EXT] Comment on proposed changes.
Date: Friday, September 20, 2019 11:14:40 AM

I agree with most of the proposed changes. As a hound hunter myself I think that you need to keep the later starting date for bears in Zone 11 as well. If this is not done it is going to concentrate all hound hunters into a single zone in August which will negatively impact the hunt experience. I have also always disagreed with the August starting date for the hunts in the southern half of the state because it is still extremely hot, the skins on the bears are terrible, and the bears are small and not nearly as pretty as later in the fall.
Thanks for your consideration of my opinion.
Don Wenner III

From: [redacted]
To: DGF-Bear-Cougar-Rules
Subject: [EXT] Comment
Date: Wednesday, September 18, 2019 3:44:06 PM
Attachments: Comment Cougar Rule-1.pdf

Please see attached letter.
Guy Dicharry, [redacted]

From: [redacted]
To: DGF-Bear-Cougar-Rules
Subject: [EXT] Comment
Date: Friday, August 23, 2019 12:12:11 AM

The state of New Mexico has killed over 5,000 bears in 7 years. The state biologist in charge has lied to the commission about the data and numbers surrounding the proposal to continue with the high number of bear kills. The Commission is unwilling or unable to investigate the data presented to them. They refuse to bring in independent biologists to audit the plans of the NMDGF even though the commission is tasked with oversight of the DGF.

In New Mexico it is legal to shoot and kill a 12 month old cub still nursing on its mother. And we are the only state where phone calls are categorized as "depredations" and used to justify the ungodly high kill numbers of bears.

We've been battling the NMDGF through 6 directors and nothing ever changes. I am no stranger to wildlife management especially as it applies to bears. I worked for the US Fish and Wildlife in Alaska. Had we approached bear issues as NMDGF does, our officers and biologists would have done nothing all day but kill so called problem bears.

When the NMDGF decided to quadruple the number of bear kill tags in just two years, they then went in search of science to support a political decision already made. The answer was twofold. First, Create a new and very non-scientific description of "bear depredation" and that would be a phone call! Yes, a phone call. No self-respecting predator manager would dan to use it, but New Mexico does. Do you think that the citizens of this state would ever call the NMDGF about a bear if they knew that that call would create a Bear depredation record used to justify killing more bears? Second: do a limited hair sample over an area less than 1% of the state, send it to a fly by night lab in Canada and and then take great liberties with extrapolating bear populations based on that hair sampling.

By your own publications your bear population estimates have gone from there's no real solid way to know the population (Rick Winslow) to between 4 and 5 thousand to now, according to MR. Forman

7,989! Not bad considering his one and only bear biologist just a few years ago was quoted in one of your publications admitting to the fact that there was no real solid way of estimating a state's bear population, especially one this big. In short NMDGF has always said whatever is expedient at the time to stave off critical examination of their flawed management practices while being servile to a small disproportionally dominate group of cattle growers, trappers and trophy hunters. If you care about our state mammal you will increase the legal kill age from 12 months old, institute a wanton waste law since bear can now be killed and left to rot, and drop the "phone call as a depredation" crap.

Lastly an examination of the age of bears killed shows multiple red flags: In zones 1,2, and 14 the average age at kill is 3.5 years. This is sub-adult and means these females are killed before they can even reproduce. During the last Game Commission meeting in Santa Fe on 8-22-19 I watched as the Commission was lied to by DGF biologist S. Liley. The commission seemed more than willing to buy anything and everything he was selling with no questions of any depth or attention to critical review of the numbers.

I could go on for pages, but I doubt, after the arrogant and dismissive way the public was treated in the last commission meeting that science and data would make any difference. Supporting the continued kill numbers currently proposed by the DGF biologist Liley will end in damage to our bear population that will not be able to be corrected for years to come.

Hound hunting is not sport. It does irreparable damage and leaves countless orphan bears that die of slow starvation or get into trouble and are killed by DGF officers. It must be taken into account that hounds-men release up to 20+ dogs with telemetry collars and GPS satellite tracking devices. The hunters then get on their 4-wheelers drive to the tree and shoot the bear out of the tree, leaving the meat to rot and taking home their pathetic "trophy."

This commission is no different than all those before it: twitter-patted by the DGF boys who beguile and mislead with false flattery and lies in order to do the bidding of the hunting guides, trappers, and ranchers. Say hello to the new boss, same as the old boss.

Cut the bear kill numbers in half and cut the female kill tags by 80%.

Capt. J. Craig McClure, Retired military & LEO

A VETERAN; Whether active duty, retired, national guard or reserve - is someone who, at one point in their life, wrote a blank check made payable to "The United States of America" for an amount "up to and including their life".

From: [redacted]
To: DGF-Bear-Cougar-Rules
Subject: [EXT] Comments on Bear Kills
Date: Thursday, September 19, 2019 8:08:01 AM

Greetings.

I'm writing concerning the current rules governing bear kills in the state of New Mexico.

My understanding is that current rules allow the use of dog packs to tree and kill bears as young as 12 months. I have been told that harvest data shows that, on average, female bears are being killed before they are old enough to give birth.

As I understand them, current rules concerning the killing of depredating bears do not actually require any evidence, beyond a verbal claim, that livestock has been killed or that the bears presented an immediate threat to humans.

Taken together, the current rules seem to risk a repeat of past mistakes – mistakes that required "transplanting" elk from Yellowstone and bighorn from Alberta after they had been extirpated from New Mexico.

I'm certainly no wildlife management expert. I don't even know whether NM Dept. of Game and Fish regularly reviews management policies of other states with significant black bear populations, in order to improve NM's own rules. But, if my understanding of the current rules is correct, I hope you will at least change them to increase the minimum harvest age and to encourage greater caution in killing of depredating bears.

Thank you for reading these comments.

--
Mitch

From:	[redacted]
To:	DGF-Bear-Cougar-Rules
Cc:	[redacted] Brian Turnbull
Subject:	[EXT] Comments on Proposed Bear and Cougar rules
Date:	Friday, September 20, 2019 8:49:20 AM

Comment reviewer(s), …………………I saw no name or other particular indication of who to address comments to.

I am writing to express my opposition to part of the proposed bear and cougar rule changes. Specifically, I am opposed to the Department's recommendation to no longer allow the use of traps and snares as a legal method for the harvest of cougars.

In attempting to understand why the Department would propose this rule change, I have reviewed the published Commission Meeting Agenda Briefing, titled "Subsequent Discussion on the Bear and Cougar Rule for 2020-2024 Hunting Seasons" and I also attended the Commission meeting at Cloudcroft, held on September 18th, 2019. Please forgive me if I have missed something but the only reason that I have been able to find for this proposed rule change, is in the Department's Briefing where it is stated:

"The Department recommends no longer allowing traps and snares as a legal method for sport harvest because it is only minimally being used by sportsmen and women. During each of the past three years, between 4 and 20 cougars were harvested with traps, representing between 1 and 7% of the total harvest."

In my opinion, "because it is only minimally used by sportsmen and women." seems to be an extremely weak rationale to disallow a practice that has been established to be an effective cougar management tool, especially when it is funded by individual trappers. I have seen no mention of administrative costs or other detriments to the Department. I do see that allowing the practice to continue has the potential to increase revenue for the Department by the sale of licenses. It also seems to me that 7% of a total annual harvest is a significant number for a practice that has only been allowed for a short time and in limited areas. I expect that expansion of the allowable trapping area, to include federal lands, would likely change the harvest numbers substantially.

Disallowing the use of traps and snares by the public also seems contradictory to the Department's mission statement, where it is stated; "using a flexible management system that ensures sustainable use for public food supply, recreation and safety"; specifically in regard to the recreation aspect.

Why the Department would forego potentially increased revenue, however minimal and instead prevent the public from assisting in a management practice that brings in revenue for an activity that the Department has historically expended funds to accomplish is not fiscally logical. As well, doing so is a restriction upon public freedom and is contrary to the principles on which our country was founded.

Above, I have expressed the primary points of my concern regarding the proposed rule change. Here, I would like to ask that this proposed rule change (No longer allow foothold traps and foot snares as a method of take for cougars) be deleted, in its entirety as well as ask that the Department work to expand the allowable public cougar trapping area to include federal lands within the state. Also, here; as I expect that time may be limited for those who review these comments, I would like to thank you for considering my views and requests. Below, I will offer my perspective (which does include speculation) on why the Department may have proposed this particular rule change and also explain my 'standing' regarding this matter….in case it matters and if time allows for these to be taken into account.

This is speculative on my part but it appears to me that the Department may have proposed the above discussed rule change as a concession to the "anti-trappers" as well as possibly other "animal rights, etc." types of groups and/or individuals. For that reason, I would like to explain my perspective in regard to what those types of folks seem to be on a mission to accomplish.

I would like to make it clear that I do understand compassion. I also understand that many, if not most, animals are beautiful and/or cute to look at. I enjoy seeing wildlife probably as much as anybody. I greatly prefer to see wildlife that is healthy as opposed to otherwise. I also understand that wildlife is a resource given to us, to be used and managed. I know that some folks will never come to terms with the concept of "humanely harvesting" or basically "humanely killing" something but there are several facts to be considered. Among those facts are: life is not fair; death is not fair; all living things will die; humans have for longer than I can attest to, relied upon the death of animals for subsistence (and in some cases vice versa); many animals rely on the death of other animals for subsistence; few of us humans and virtually no animals consciously choose when or how we will die. With these facts in mind, it simply stands to reason that life relies upon death. There is no way around it, on Earth. I and many others accept these facts, anyone who does not, does not accept reality.

Now as far as some perspective on 'humanely killing'; it seems to me that the most humane way to die would be to just cease to live….no pain….no suffering…no stress….etc. Some living beings are apparently afforded that ultimately humane type of death but probably not most. Do animals, specifically predatory animals consider humanely killing their prey? Seems doubtful, doesn't it? While one healthy deer fawn might be virtually killed instantly from a lion bite through the skull, never knowing that the lion was even in the area, an elk calf may have its ears and tail chewed off by coyotes that then begin feeding upon its entrails before it is dead. Then, let's consider how long and painful a disease, old age or other affliction might be in bringing about death. I think there is not much, in general, that we as humans can do to change the circumstances of death, short of possibly nuking the entire Earth, all at once.

Is attempting to kill an animal with a rifle shot to the brain, which is a relatively small target, more humane than with a shot through the lungs? Is trapping and dispatching an animal more humane than being killed by disease, old age, mange or a non-human predator? The answers to these questions and an infinite number of similar questions are obviously relative to the individual and the circumstances. So, as a hunter, a trapper, a harvester of wildlife and domestic animals, the best I can do is to be as humane as possible, within reason.

All who live for any significant length of time on Earth are dependent upon death. Some may claim to subsist entirely without relying upon the death of animals but have they considered the insect, rodent and possibly bird control utilized in the production of their grub? I accept these facts of life and death and have come to terms with participating in the respectful killing of animals, as humans have always done. For those who won't accept facts, my suggestion to you is; find something else, something that pleases you and is worthwhile to think about and let someone else the killing for your subsistence.

For those who actively seek to change, unnecessarily restricting our American way of life, as hunters, fishermen, trappers, owners and users of public land and resources; as well as our government representatives and their appointees, who make and modify laws and rules, I would like to offer the following comment: Please keep in mind that the Constitution of the United States was implemented to limit the government, not for the purpose of limiting the freedom of the people. To our government officials; I am well aware that our freedoms under the Constitution have already been compromised on many facets and I urge you to work to reduce the usurpation that has already taken place while not allowing further erosion of the people's freedom. To the "activists" who continually assault our freedom to do or be things that they don't like or agree with; Where will your assault on freedom end? Shall I actively seek to have the government mandate that you change the brick on your house because I don't like the color of it? To the man who commented at the Cloudcroft meeting that he loves to hunt but would like to see trapping banned; get ready bud, you're next.

In regard to my 'standing' regarding this matter: I am a lifelong New Mexico resident and for the last 49 consecutive years, I have bought various combinations of New Mexico hunting, fishing, trapping, bear, cougar and draw hunt licenses. As I approach a time in my life where it appears that I may be afforded some free time in the next few years, I decided that I would learn to trap, an activity that I have always been interested in but never had the time to pursue. A large part of my decision to get involved in trapping was due to having the potential of legally harvesting cougars. Just in the last few months, I have done a lot of studying, talking with experienced trappers and stocking up on the equipment needed. While I intend to learn to catch animals other than cougars as well, I probably would not have jumped off into the investment without the potential to legally set for and harvest cougars. I understand and accept that life is not fair but just so those of you who are making decisions regarding our wildlife laws and activities might more comprehensively understand the impact of your decisions, I'd like for you to know that I have invested well beyond a thousand dollars and I'm fairly certain that if I took the time to account for all of it, likely over two thousand dollars towards this endeavor and I assure you that this is no exaggeration. I have also spent many hours adjusting, dying and waxing traps, fabricating stakes and getting ready for the season. So to conclude; it is quite discouraging to see the Department and Commission consider shutting down something that I just made a significant investment into and was so looking forward to, especially with no more rationale than what has been presented.

Thank you for your time and consideration.

Brian Turnbull
[redacted]

Brian Turnbull | [redacted]

[redacted]

From: [redacted]
To: DGF-Bear-Cougar-Rules
Subject: [EXT] Comments on proposed Bear-Cougar-Rules
Date: Thursday, September 05, 2019 8:24:12 AM

All,

I do not agree on the 2 changes proposed for Cougar no longer allowing traps or foot snares for legal taking and no more additional tags after initial 2 tags are filled. I'm assuming that there has been a drastic decline in the Cougar population due to these Rules and this is the reason for their removal? If no documented and verifiable reduction in the Cougar population exists then there is no reason to remove these 2 Rules.

Thank you for your time and please reconsider in not taking a valuable tool from NM Sportsman.

Jose Carrasco
[redacted]

Sent from Mail for Windows 10

From: [redacted]
To: DGF-Bear-Cougar-Rules
Subject: [EXT] Comments on Proposed Revisions to the Cougar Rule
Date: Friday, September 13, 2019 2:28:47 PM
Attachments: Comments on Proposed Cougar Rule.pdf

Good Afternoon,

I have attached a PDF file of my comments and suggestions on the proposed revisions to the Cougar rule.

Please contact me if you have any questions.

Sincerely,
Elisabeth Dicharry, [redacted]

From: [redacted]
To: DGF-Bear-Cougar-Rules
Subject: [EXT] Cougar quota reduction in K
Date: Thursday, September 12, 2019 2:58:39 PM

Gentleman,

Please consider that the change proposed for Zone K is going to be detrimental to the deer and elk populations. Every rancher I have spoken with has suffered damage loss to livestock as well.

My son and I as well as our friends and family have purchased and hunted deer, elk, cougar, bear, as well as small game in your state. We are non residents. We would not return 2000 miles and/or spend any $ in your state if this is the direction the State of NM is taking.

Please carefully consider this position. Ours will not be the only loss of revenue.

Could you please provide me with sound biological evidence showing that less lions should be harvested?

Thank you,

Kevin Manning
--
[redacted]

[redacted]

From: [redacted]
To: DGF-Bear-Cougar-Rules
Subject: [EXT] Cougar Rules
Date: Tuesday, September 10, 2019 9:42:31 PM

I oppose the reduction in cougar harvest limits currently being considered by the Commission for Zone K. I have purchased non-resident cougar licenses each year for the past 9 years, and have been joined by friends from TX, TN, AZ, and CA, who have also purchased cougar licenses. In 2014 I purchased a house in Cliff to hunt Zone K. Due to difficulty of hunting in dry-ground conditions, the cougar harvest in Zone K is insufficient to control cougar predation on deer and bighorn sheep. In the field I met a NMDGF employee who was hired to snare cougars. He removed two cougars from the Big Dry Ranch, where I have permission to hunt. I also met a biologist who was hired to capture deer near Silver City, where they congregate to avoid predation by cougars, and relocate them elsewhere in Zone K, where cougars have decimated the deer herd. Under these conditions it makes no sense, biologically or economically, to reduce the sub-limit on female cougars. I urge you to reject this proposal and let us, your paying customers, help control cougar predation in Zone K.

Dan Tichenor

From: [redacted]
To: DGF-Bear-Cougar-Rules
Subject: [EXT] Cougar trapping
Date: Sunday, August 18, 2019 3:52:09 PM

I would like to comment on the cougar trapping rule.

I pursue cougars in unit N. I use the same traps for both cougars and coyotes on Private Land with no problems and with the whole-hearted support and at the request of landowners.

The proposal to eliminate cougar trapping makes no sense. Trapping is a legitimate method of "take" for many animals and is used to enhance and protect certain species, both wild and domestic.

I urge you to reconsider this ill-advised and discriminatory proposal.

Thank you.

Tom Fisher
[redacted]

From: [redacted]
To: DGF-Bear-Cougar-Rules
Subject: [EXT] Cougar trapping
Date: Monday, August 19, 2019 11:18:38 PM

First of all thank you for your time and efforts to make New Mexico a great place to live as a avid hunter and trapper. I want to take a minute and express my concern for the consideration to once again limit the active trappers of New Mexico by getting rid of cougar trapping and snaring. I understand that it is easy to be over whelmed with the demands of the anti Hunters and all I can do is ask you to do the right thing for sportsman in your state. Please don't let politics get in the way. I was in the meeting where your biologist agreed that trapping was an important management tool. I was also I the meeting when NMGF explained that there had been no issues with saftey or non targets. The current rules of only allowing cougar trapping and snaring on private and state land is extremely regulated and has no affect on others around the state, so let's keep it as a tool for the land owner! Thank you.

From: [redacted]
To: DGF-Bear-Cougar-Rules
Subject: [EXT] Cougar trapping
Date: Thursday, August 29, 2019 4:39:38 PM

As a past license holder to New Mexico I hope you keep trapping as one of the legal ways to harvest a mountain lion as I hope to get to trap there again and would like to have the opportunity to catch one of the big cats. As a nonresident we pay a premium price for license and having that animal on the list of available catches makes New Mexico a desired destination. Thank You
Mike Murray
[redacted]

From: [redacted]
To: DGF-Bear-Cougar-Rules
Subject: [EXT] Cougar trapping
Date: Tuesday, October 08, 2019 9:47:08 AM

Good Day,
By not allowing trapping of cougars, a important population management tool would be removed.

"and aligning harvest limits with recent biological data." (from summary) On the surface this sounds good, we all must make the assumption that the biological data is valid, and if the Department is gathering and compiling the data and not used a outside contractor, we should be able to assume it is good data.

One last note: I know that Farmington is in the ABQ district, but why don't we have more listening meetings and Department meetings in our area? Its a long dang way from here to there and back for all parties, a lot of people can't take the time off work to attend meetings in ABQ.

Tom King
[redacted]

From: [redacted]
To: DGF-Bear-Cougar-Rules
Subject: [EXT] Cougar trapping
Date: Wednesday, July 31, 2019 6:20:51 PM

Trapping is a crucial way to manage populations of wild animals. Without ethical trapping, cougars population will soar. This will cause more human encounters, some could be fatal. When populations rise more diseases come into play. This will cause slow painful death. As seen in Canada with lynx, populations will rise and the older weaker animals will not be able to hunt efficiently, this will cause the older animals to prey on any easy target. Please keep personal feelings out of the management of animals. Since human population has taken over the animals habitat, it now becomes our duty to manage safe and healthy populations.
Thank you for ready, any questions feel free to email me back at [redacted]
--
Rick Maga
[redacted]

From: [redacted]
To: DGF-Bear-Cougar-Rules
Subject: [EXT] Cougar
Date: Friday, August 16, 2019 8:02:30 PM

HI
I would like to comment on the Cougar bear rules.

1. I would like to see you eliminate all recreational cougar trapping. My concern is the poaching in the state which reduces populations of cougars. It would be difficult to know actual numbers.
2. Reduce annual cougar kills. I would like to see fewer numbers of cougars killed in the state.
3. Undo double bag limits on cougars. It is hard for me to imagine that these cats would be killed in double bag limits. My preference is to have less kill.
4. Reduce annual bear kills. We re one of the only sites with public lands that could sustain populations of these types of animals. Kansas, Oklahoma, and Texas have small or minor amounts of public land and habitat. There will be increasing human population pressure and habitat loss. My preference is to protect these populations.

thanks,

Candace Bogart

From: [redacted]
To: DGF-Bear-Cougar-Rules
Subject: [EXT] DGF-Bear-Cougar-Rules
Date: Monday, October 07, 2019 12:10:32 PM

To whom it may concern,

Hello, I am reaching out to put my two cents in. On the cougar rules removing the availability for the second set of tags. My first question is, are we filling all the tags in these zones now that the rule was implemented? If not, why change it back to two per person? I would also be interested in knowing why the Sandia and Monzano mountains have a shorter amount of time for bears? Also in those zones (8,14), why does the season close between the dates Sept 25 - Oct 14? In most zones across the state there is also a Aug time to hunt, why is this also not afforded to those of us that would like to hunt these two zones? By regulating the predators in these two specific zones could increase the number of deer and quality of those deer.

Thank you for listening,
Clinton King

From: [redacted]
To: DGF-Bear-Cougar-Rules
Subject: [EXT] Fwd: Ban commercial slaughter of bears and cougars
Date: Monday, September 23, 2019 3:18:31 PM

Begin forwarded message:

From: Chilton Gregory [redacted]
Subject: Ban commercial slaughter of bears and cougars
Date: September 23, 2019 at 3:14:54 PM MDT
To: DGF-Bear-Cougar-Rules@state.nm.us

I am sending this to support the banning of commercial bear and cougar hunting in New Mexico, with the exception of bear hunting by Native Amerians. Hunting of these animals has no value except to people who run commercial hunts.
Patricia K. Gregory; [redacted]

From:	[redacted]
To:	DGF-Bear-Cougar-Rules; Prukop, Joanna, DGF; Salazar-Henry, Roberta, DGF; Bates, Jimmy, DGF; Cramer, Gail, DGF; Lopez, Tirzio, DGF; Soules, David, DGF; Vesbach, Jeremy, DGF
Subject:	[EXT] HSUS / APNM Comments on Proposed Black Bear Rule
Date:	Tuesday, November 19, 2019 11:40:46 AM
Attachments:	NMDGF-Black Bear-Regulations-11.2019_HSUS_APNM.pdf

Dear Director Sloane and Commissioners,

Attached please find comments from the Humane Society of the United States and Animal Protection of New Mexico on the proposed Black Bear Rule changes.

Note that comments on the Cougar portion of the proposal have been submitted under separate cover.

Thank your for your consideration. Please feel free to contact me if you need a copy of any study cited in these comments.

Sincerely,

Nicholas Arrivo
[redacted]

From:	[redacted]
To:	DGF-Bear-Cougar-Rules; Prukop, Joanna, DGF; Salazar-Henry, Roberta, DGF; Bates, Jimmy, DGF; Cramer, Gail, DGF; Lopez, Tirzio, DGF; Soules, David, DGF; Vesbach, Jeremy, DGF
Subject:	[EXT] HSUS / APNM Comments on Proposed Cougar Rule
Date:	Tuesday, November 19, 2019 11:39:07 AM
Attachments:	NMDGF-Cougar-Regulations-11.2019_HSUS_APNM.pdf Attachment C.pdf Attachment A.pdf Attachment B.pdf

Dear Director Sloane and Commissioners,

Attached please find comments and associated attachments from the Humane Society of the United States and Animal Protection of New Mexico on the proposed Cougar Rule changes.

Note that comments on the Black Bear portion of the proposal will be submitted under separate cover.

Thank your for your consideration. Please feel free to contact me if you need a copy of any study cited in these comments.

Sincerely,

Nicholas Arrivo
[redacted]

THE HUMANE SOCIETY OF THE UNITED STATES

From: [redacted]
To: DGF-Bear-Cougar-Rules
Subject: [EXT] Killing bear cubs
Date: Wednesday, September 18, 2019 11:09:30 PM

Dear Game & Fish Commission;

I ask you, please do not allow or approve rules allowing the killing of cubs of very young age to be hunted and killed; shot in their den when they are young enough to still be nursing. Do not allow the hunting with hounds. Please do not allow these cruel proposals to pass.

Thank You,
Anita Walsh

From: [redacted]
To: DGF-Bear-Cougar-Rules
Subject: [EXT] Looking for the Bear/Cougar rule change
Date: Monday, July 29, 2019 3:40:58 PM

Hi,

I'm curious when you might post the rule change for bears and cougars? The first meeting is in a week and I'm sure folks are getting anxious.

Let me know.

Thanks.

From: [redacted]
To: DGF-Bear-Cougar-Rules
Subject: [EXT] New Mexico Wildlife Federation Comments
Date: Tuesday, October 01, 2019 3:07:34 PM
Attachments: Bear_Cougar Letter - Google Docs.pdf

Dear NMGF Personnel,
Attached please find comments from the New Mexico Wildlife Federation on the Bear and Cougar rules.

From:	[redacted]
To:	Prukop, Joanna, DGF; DGF-Bear-Cougar-Rules
Cc:	[redacted]
Subject:	[EXT] New Mexico: Proposed Cougar Rule Changes
Date:	Monday, September 16, 2019 1:45:00 PM
Attachments:	2019-09-16 NM New Mexico Comment Letter.pdf

Dear Chairman Prukop and Members of the Wildlife Board,

Please see the Mountain Lion Foundation's comment letter (attached) regarding the **Proposed Cougar Rule Changes**.

I have CCed our Executive Director, Lynn Cullens, to this email if you have any questions.

Thank you for your consideration. Please make this comment letter a part of the official record regarding this decision.

Korinna

Korinna Domingo, [redacted]

From: [redacted]
To: DGF-Bear-Cougar-Rules
Subject: [EXT] NMDGF Bear & Cougar Rule Comments
Date: Wednesday, August 21, 2019 10:33:27 AM
Attachments: image001.png
NMF&LB Position on Bear and Cougar Rule.pdf

Good Morning,

Attached is NMFLB's comments in regard to the Bear and Cougar rule proposals. Any questions or concerns can be directed to myself (Tanner Anderson) and my contact information is below.

Thank you,

Tanner Anderson
[redacted]

[redacted]

NEW MEXICO
FARM & LIVESTOCK BUREAU

From: [redacted]
To: Sonny; DGF-Bear-Cougar-Rules
Subject: [EXT] OPPOSITION to NMGF proposal to ban lion trapping
Date: Monday, August 26, 2019 8:32:57 AM

Good Morning NM State Game Commission,

I recently listened in (via webcast) to one of your public meetings. I was a bit un-impressed with the logic the NM Dept. of Game and Fish gave for proposing to remove trapping as a means of legal take of mountain lions. The logic and reasoning given in the meeting I witnessed was that only a few people participate in it. I saw no scientific reasons to justify the change. I do not trap lions myself, but believe that others should be able to do so if needed. Please consider the following points as you consider this proposed rule change.

- Lion Trapping has not negatively affected the population
- During public meeting NMGF stated Lion Trapping does not threaten public health or safety
- According to NMGF statistics, Lion numbers continue to rise yet harvest rates have not met the take limit.
- Lion trapping was only recently made legal (I believe since 2016). Few in the state currently have the knowledge to attempt it but there are many wanting to and beginning to learn. Participation will continue to increase with time, but remember too that lions are one of the hardest animals to successfully trap, and to do so takes a considerable amount of time and effort. I am confident that there is currently quite a bit of participation thought the harvest numbers may not suggest it yet. Our local sportsmen and women are still learning how to best go about it.
- Eliminating Lion trapping will further burden the NMGF department budget by requiring the department to contract with private individuals at an inflated rate for the removal of problematic Lions.
- With department statistics showing Lion numbers on the rise it would be irresponsible for NMGF to eliminate a method of harvest. This will potentially cause a negative impact to our wild ungulate herds as well as be a financial hardship to the department.
- Try to understand the motivations behind lion trapping. There is little to no value in their fur so I assure you it is not economics. Those I know who do try to trap lions do so to reduce livestock depredation and/or pressure on wild ungulate populations in areas of high lion density. Some are motivated by the extreme challenge and the opportunity to connect with the natural world in a way that cannot be understood by someone who has never participated in the activity themselves.
- **Bending to social pressure will only encourage for additional pressures to go against scientific biology and factual statistics**.

I would also like to encourage and respectfully ask you to focus on the following:

- Encourage NMGF to educate the public regarding trapping and all other forms of harvesting animals and its important contribution to the ecosystem.
- Improve the Trapping FACTS, information on the NMGF website to improve public perception and combat the falsehoods spread by media as a result of one sided reporting.
- Improve public understanding of the value of the North American Wildlife Management Model.

Thank you for your time and consideration,

Jayson L. Grover, P.E.

From: [redacted]
To: DGF-Bear-Cougar-Rules
Subject: [EXT] Opposition to Reduced Lion Harvest Lion Zone K
Date: Wednesday, September 11, 2019 6:31:04 AM

Dear Game Commission Representatives,

The proposed reduction in number of cougars to be harvested in lion zone K will have a detrimental affect on ranchers in this area. There is not a rancher in this area that I know of that has not suffered loss of live stock due to cougar predication.

The proposed reduction in number of cougars to be harvested in this zone will also have a detrimental affect on the deer heard population. One only has to look at California to see the results of reducing cougar harvest to see its affect on the deer heard. The deer heard in California has been decimated by the increase in number of mountain lions. Lion research projects by the University of California has clear evidence of female lions eating their cubs because of the lack of deer.

Clearly the reduction in the number of cougars to be harvested will have a severe impact on the local economy. Ranchers will experience a higher number of livestock loss to lion predication resulting in a loss of revenue and when the deer heard is decimated due to the increase number of lions there will be a loss of revenue to the State of New Mexico.

During the 2017 hunting season we found what appeared to be a male lion killed by another lion. During the 2018 hunting season we found a female lion that was recently killed by a large male lion. Now why would a male mountain lion kill a female mountain lion? Clearly this would indicate that there is an abundance of mountain lions in this zone.

Because of the dry conditions of hunting in this area, our research indicates that the average number of days to tree a lion in this area is approximately nine hunting days. This is approximately two days longer than the average hunter has available to lion hunt.

I respectfully request that you reconsider your proposed changes to the cougar harvest quota in lion zone K and recommend that you increase this quota instead of reducing it.

Respectfully submitted,
Donald Pengelly

From: [redacted]
To: DGF-Bear-Cougar-Rules
Subject: [EXT] Please save the bears and all wildlife in NM. Thank you, Anne Letherer
Date: Tuesday, September 17, 2019 9:04:04 AM

From: [redacted]
To: DGF-Bear-Cougar-Rules
Subject: [EXT] Please Stop the bear slaughter
Date: Wednesday, September 25, 2019 6:20:41 AM

To New Mexico Department of Game and Fish,

This letter is to protest the slaughter of black bears throughout New Mexico for the sport of hunters. I understand that under the auspices of NMDGF rules, as many as 5000 bears have been killed in New Mexico within the past six years. My husband and I moved back to New Mexico seven years ago because we love the state and especially the outdoor recreation - that includes enjoying the wildlife. Why are we (the citizens of the State of New Mexico through NMDGF) killing off all of the wildlife? I understand that a small number of bears occasionally become nuisance animals, but there is no reason for this wholesale slaughter of these large mammals - to the benefit of wealthy hunters who pay for the privilege of trophy hunting them. If one person calls to report a bear sighting, that is not "bear depredation", and I seriously doubt that most people who call in to report a bear know that that bear will likely be hunted down and killed. This slaughter for money must stop.

Stephanie Coxe
[redacted]

From: [redacted]
To: DGF-Bear-Cougar-Rules
Cc: [redacted]
Subject: [EXT] Please Stop the bear slaughter
Date: Monday, September 23, 2019 11:32:37 AM

To New Mexico Department of Game and Fish,

This letter is to protest the slaughter of black bears throughout New Mexico for the sport of hunters. I understand that under the auspices of NMDGF rules, as many as 5000 bears have been killed in New Mexico within the past six years. My wife and I moved back to New Mexico seven years ago because we love the state and especially the outdoor recreation - that includes enjoying the wildlife. Why are we (the citizens of the State of New Mexico through NMDGF) killing off all of the wildlife? I understand that a small number of bears occasionally become nuisance animals, but there is no reason for this wholesale slaughter of these large mammals - to the benefit of wealthy hunters who pay for the privilege of trophy hunting them. If one person calls about and reports a bear sighting, that is not "bear depredation", and I seriously doubt that most people who call in to report a bear know that that bear will likely be hunted down and killed. This slaughter for money must stop.

Bert Coxe
[redacted]

.cc - Rep. Daymon Ely; Sen. John Sapien; Gov. Michelle Lujan Grisham

From: [redacted]
To: DGF-Bear-Cougar-Rules
Subject: [EXT] Proposed Bear and Cougar rules
Date: Tuesday, September 10, 2019 11:41:24 AM

Greetings!

I have read the proposed Bear and Cougar rules. I thank you for eliminating the use of traps and snares and hunting dogs. These things are barbaric holdovers from unenlightened times and have no place whatever in modern society.

Best wishes to you.

Jan Novak
[redacted]

From: [redacted]
To: DGF-Bear-Cougar-Rules
Cc: Prukop, Joanna, DGF; Salazar-Henry, Roberta, DGF; Bates, Jimmy, DGF; Cramer, Gail, DGF; Lopez, Tirzio, DGF; Soules, David, DGF; Vesbach, Jeremy, DGF
Subject: [EXT] Proposed changes to Bear and cougar rules
Date: Sunday, September 22, 2019 2:41:26 PM

I hope that the members of the NMGFD/NMGFC will adopt a reasonable, conservative bear management program. Bears in New Mexico are one of the most vulnerable species in the state because of their low reproductive rates. I am asking you to review the current bear sow hunt limit and adjust the current number to a lower number.

The current sow limit is 318 for the next four years yet the harvest average for the last four years is 180. The average age of sows being killed is 6.5 years and in New Mexico sows normally have their first cub at 5.7 years. For a healthy bear population to survive in New Mexico, I propose that no more than 100 sows (including depredation) be killed statewide in future harvests until harvested sow ages show that they are rebounding to viable age ranges.

I was not aware until I read a letter to the editor (Abq Journal, 17 Sep 2019) from Craig McClure (Black Bear Bureau) that New Mexico allowed killing of bear cubs that are 1 year old or less. Also I did not realize that hunters were allowed to use dogs to hunt down and trap the bears or cougars and then use telemetry to locate and shoot them like they were in a carnival arcade. This is hunting ?? No, this blood sport and something that I believe most New Mexicans would not support. I urge you to prohibit the killing of bear cubs and the use of dogs to hunt bears or cougars.

Cal Jaeger
[redacted]

From: [redacted]
To: DGF-Bear-Cougar-Rules
Subject: [EXT] Proposed lion change
Date: Monday, August 19, 2019 7:04:01 PM

Roger DiCamillo

Nogal ranch
Chaunte canyon ranch
Spring canyon ranch

Thank you for coming down and explaining the upcoming changes in your department .
There is a big concern among ranch owners about this change. As I explained at the meeting it's not the sportsman that is snaring and trapping on private land, it's the landowner that is using this as a tool to help control the predation on his own lands. Your saying that it's a small amount contributing to the numbers needed to help sustain a healthy population.
Then your also proposing to decrease the harvest amount across the state.
But what happens when you remove the landowners out of the equation, does that mean to make up for that you will have to increase quotas.
You say we still have the right to protect our livestock if lions are a threat, but what I would like to make clear is this,
Sure we can snare if lion kills our live stock after we get an investigation and approval and a tag but what department needs to understand is a few facts.
We round up and brand our cows and calf's and turn them loose, six months later we round up and sale - we go from a 70-80% calf crop confirmed branded to 60-70% at round up, sure you can loose a few here and there, but what happened to the rest. As you know a lion can kill and bury and you will never know.
I removed 4 adult 130 plus # males last year in unit 17 on our property not 500 yrds from my back door, in a unit that your quotas were not even close to your harvest rate. This spring Ive notice more fawns from antelope and deer, our livestock calving numbers are up.
I would like for you to consider the facts from landowners and your biologist are telling you and make this decision based on that, rather than any outside influence.

Thank you for your time.

Roger DiCamillo
[redacted]

From: [redacted]
To: DGF-Bear-Cougar-Rules
Subject: [EXT] Proposed revisions to the Bear and Cougar Rule
Date: Wednesday, August 21, 2019 11:33:15 AM

Thank you for taking steps to walk back the damaging 2015 rule changes, but there are more protections for cougars and bears needed. I am writing to urge you to: eliminate ALL recreational cougar trapping, reduce annual cougar kill limits, undo the double bag limits for cougars, and reduce annual bear kill limits.

1. **Eliminate ALL recreational cougar trapping.** Reverse the Game Commission's 2015 decision to allow the use of traps and snares as a method of cougar "sport harvesting" on both private and state trust lands. The vast majority of New Mexicans oppose cougar trapping, consider it cruel, and are concerned about impacts on other species like endangered Mexican wolves.

2. **Reduce annual cougar kill limits.** The latest data and scientific literature show that the number of cougars in New Mexico has been dangerously overestimated, resulting in harvest limits that put cougar populations at risk. NMDGF needs to rely on the best available science to protect and conserve the notoriously hard-to-count cougar.

3. **Undo the double bag limits for cougars.** Reverse the Game Commission's 2015 decision to allow cougar hunters who kill their bag limit of two cougars to then kill up to two more in cougar management zones where current unjustifiably high kill limits are not met. This move has not yielded the results sought, and a double bag limit violates the precautionary principles that should guide careful cougar management.

4. **Reduce annual bear kill limits.** Another species impacted by incorrect application of science, the annual number of bears killed in New Mexico never reach more than half of the current unjustifiably high kill limits. NMDGF should revise its approach to management of bears to ensure this important species is not decimated by irresponsible hunting allowances.

Thank you.

Melissa Amarello [redacted]

"Sentiment without action is the ruin of the soul." — Edward Abbey

From: [redacted]
To: DGF-Bear-Cougar-Rules
Subject: [EXT] Proposed rules changes for cougar trapping
Date: Monday, October 07, 2019 5:45:46 PM

I support these changes.

Helen McGinnis
[redacted]

From: [redacted]
To: DGF-Bear-Cougar-Rules
Subject: [EXT] Public Comment - Bear Kills
Date: Monday, September 23, 2019 12:58:42 PM

Dear Sir/Madam: I recently read that close to 5,000 bears have been killed in NM in the past six years. The killing rules fall under the jurisdiction of NMDGF so for a department that has the emblem of a bear on the patches the employees wear, which typically should be to honor the animal, that seems like an excessive number. It's specially troubling because most of the killing seems to be for sport.

I understand a reasonable amount of management requires the killing of troublesome animals, but if the bear population was estimated by the NMGDF only ten years ago as 5,000-6,000, how could that number of kills be considered reasonable?

Please stop the slaughter of the bears. NM should be recognized as the wild life paradise that it truly is so we can grow our clean tourism industry and end killing for $$ that destroys something we can never replace.

Terry Eisenbart
[redacted]

From: [redacted]
To: DGF-Bear-Cougar-Rules
Subject: [EXT] Public comment on Bear Harvest
Date: Tuesday, September 17, 2019 7:27:05 AM

Dear commissioners,

As a lifelong resident of New Mexico and a 49+ year resident of Albuquerque, I respectfully request that we stand down with our stepped up harvest of bears in the state. Reasons are not about being touchy-feely for these animals that can be destructive and dangerous, but for the fact that is one of our state mammals and that we hold this animal as a tourist attraction.

Cougar and Bear habitats are being encroached upon. They have nowhere to go, humans have choices. Let's make the kind of choices that are humane and reflect our values and not just those of a small but loud faction.

Even when it is plain to see that human intervention works and that as humans we continue to get closer to them than safe, or do stupid things like camp with food in our tents in the middle of the forest or scare a mother and her cub, and continue to kill these animals - when taking them to safety and out of the way of harm of humans Is a more humane choice.

We are alone in this country and calling depredation by a bear with a simple phone call. Many times these humans have not maintained practices that will deter not only bears but other animals such as raccoons and not to mention mice and rats.

With the current loss of species daily we need to treasure these animals and help them survive rather than killing them willy-nilly and without good reason.

Please consider standing down on any further killing of these animals or "harvesting" of them other than during bear hunting season.

We successfully banned the sport – killing of coyotes in our state, now let's be another example for the country and environment and respecting their habitat and allowing them to live out their lives and peace.

More press is needed to teach the public how to avoid wild animals and with more and more People moving into the state without knowledge of its environment or the creatures that have lived here for millennia, education not predation is the answer for human animals

Thank you for listening.

Laura Casady
[redacted]

[redacted]

From: [redacted]
To: DGF-Bear-Cougar-Rules
Subject: [EXT] Public comment on killing of young bears/bears period
Date: Tuesday, September 17, 2019 3:56:05 PM

It's obvious that the use of dogs with GPS collars and "hunters" (?) with 4 wheeler-off road vehicles to expedite the killing of all bears, not just those that actually might be predators. It's a bit much to claim that there are 600 predators a year. Also a 12 month old cub or one that's still nursing as it's killed, really? Show me the evidence, of course there isn't any. I'm a hunter, these people are not, just Butchers of all kinds of wildlife. You want to hunt Bear in New Mexico, no firearms, just a 4 foot spear. I want to see how these hunters would do without their dogs, guns and 4 wheeler off road vehicles! Pathetic!!

Calla and Roger Elkins
[redacted]

From: [redacted]
To: DGF-Bear-Cougar-Rules
Subject: [EXT] public commentary
Date: Sunday, July 28, 2019 11:41:39 AM

Dave Hastings [redacted]

I would narrow my comments to a very few specific points, so as not to clutter up your process.

Most of the proposed changes find thier origin from a very small, but very well-funded segment of the country...those arguing for Animal Rights...which is not the same as Animal Welfare. This minority works off of huge, seemingly endless national funding (See tax reporting of Wild Earth Guardians of Santa Fe) and seems to tirelessly insist that all of society adhere to their scientifically unsupported values and beliefs...

It functions by manipulating any and all democratic processes; trying them all, searching for what will work. Ballot initiatives, billboards, petitions, lawsuits, influencing (financially and otherwise) government officials...it is an endless series of passionate efforts to force the world to comply with a small minority world view that apparently bases its data on the Disney model.

New Mexico Game and Fish has a century of proven track record of managing wildlife. The fact that the state has an abundance of healthy wildlife testifies to this. To have that success hijacked by a well funded group of zealots flies in the face of reason.

Don't manage wildlife in NM based on well funded zealot groups. Use science, data, wildlife experts, and the general benefit of all residents of New Mexico.

Dave Hastings, President [redacted]
[redacted]

From: [redacted]
To: DGF-Bear-Cougar-Rules
Subject: [EXT] Re. Bears and Cougars
Date: Monday, November 04, 2019 11:58:33 AM

New Mexico Department of Game and Fish (NMDGF):

I would like to let you know what my public comment is on proposed revisions to the Bear and Cougar Rule.
Our wildlife is precious and should be conserved and respected. They deserve to live as much as human beings do. Invasive and cruel practices should be eliminated, these animals are sentient and should not suffer at the hands of hunters and trappers.
That's why I kindly ask you to please eliminate ALL "recreational" cougar trapping. Reverse the Game Commission's 2015 decision to allow the use of traps and snares as a method of cougar "sport harvesting" on both private and state trust lands!
The vast majority of New Mexicans oppose cougar trapping, consider it extremely cruel, and are concerned about the impacts on other species like endangered Mexican wolves.

And please reduce annual cougar kill limits. The latest data and scientific literature show that NMDGF has dangerously overestimated the number of cougars in New Mexico and applied inflated percentages of allowable kills (kill limits, or what NMDGF calls "harvest limits"), putting cougar populations at risk. NMDGF needs to rely on best available science to protect and conserve the notoriously hard-to-count cougar, and the killing is often unnoticed!

Undo the double bag limits for cougars. Reverse the Game Commission's 2015 decision to allow cougar hunters who kill their bag limit of two cougars to then kill up to two more in cougar management zones where current unjustifiably high kill limits are not met. This move has not yielded the results NMDGF sought, and a double bag limit violates the precautionary principles that should guide careful cougar management.

Reduce annual bear kill limits. Another species impacted by incorrect application of science, the annual number of bears killed in New Mexico never reach more than half of the current unjustifiably high kill limits. NMDGF should revise its approach to management of bears to ensure this important species is not decimated by irresponsible hunting allowances!

Please preserve and protect these precious animals for generations to come!

Sincerely,
Andrea Sreiber
[redacted]

[redacted]

From:	[redacted]
To:	DGF-Bear-Cougar-Rules; jayson grover
Subject:	[EXT] Re: OPPOSE ban of mountain lion trapping
Date:	Monday, August 26, 2019 8:32:20 AM

Good Morning NM State Game Commission,

I recently listened in (via webcast) to one of your public meetings. I was a bit un-impressed with the logic the NM Dept. of Game and Fish gave for proposing to remove trapping as a means of legal take of mountain lions. The logic and reasoning given in the meeting I witnessed was that only a few people participate in it. I saw no scientific reasons to justify the change. I do not trap lions myself, but believe that others should be able to do so if needed. Please consider the following points as you consider this proposed rule change.

- Lion Trapping has not negatively affected the population
- During public meeting NMGF stated Lion Trapping does not threaten public health or safety
- According to NMGF statistics, Lion numbers continue to rise yet harvest rates have not met the take limit.
- Lion trapping was only recently made legal (I believe since 2016). Few in the state currently have the knowledge to attempt it but there are many wanting to and beginning to learn. Participation will continue to increase with time, but remember too that lions are one of the hardest animals to successfully trap, and to do so takes a considerable amount of time and effort. I am confident that there is currently quite a bit of participation thought the harvest numbers may not suggest it yet. Our local sportsmen and women are still learning how to best go about it.
- Eliminating Lion trapping will further burden the NMGF department budget by requiring the department to contract with private individuals at an inflated rate for the removal of problematic Lions.
- With department statistics showing Lion numbers on the rise it would be irresponsible for NMGF to eliminate a method of harvest. This will potentially cause a negative impact to our wild ungulate herds as well as be a financial hardship to the department.
- Try to understand the motivations behind lion trapping. There is little to no value in their fur so I assure you it is not economics. Those I know who do try to trap lions do so to reduce livestock depredation and/or pressure on wild ungulate populations in areas of high lion density. Some are motivated by the extreme challenge and the opportunity to connect with the natural world in a way that cannot be understood by someone who has never participated in the activity themselves.
- **Bending to social pressure will only encourage for additional pressures to go against scientific biology and factual statistics**.

I would also like to encourage and respectfully ask you to focus on the following:

- Encourage NMGF to educate the public regarding trapping and all other forms of harvesting animals and its important contribution to the ecosystem.
- Improve the Trapping FACTS, information on the NMGF website to improve public perception and combat the falsehoods spread by media as a result of one sided reporting.
- Improve public understanding of the value of the North American Wildlife Management Model.

Thank you for your time and consideration,

Jayson L. Grover, P.E.

From:	[redacted]
To:	Bert Coxe
Cc:	DGF-Bear-Cougar-Rules; Daymon Ely; Sapien, John M.
Subject:	[EXT] Re: Please Stop the bear slaughter
Date:	Monday, September 23, 2019 1:19:36 PM

I too wrote a letter today: To John Arthur Smith - State Senator, chair of the Senate Finance Committee:

Gary Sims [redacted]

12:52 PM (21 minutes ago)

to john.smith

Mr. Smith, I am disappointed with your reaction to the Governor's plan to provide free college education. Yes, I understand you are the chair of the Senate finance committee that is chartered to hold the state fiscally responsible. However, as a member of the Democratic Party I would expect the first words out of your mouth on the topic would have been more supportive of the plan, Later you can get to work to find ways to fund it.

Instead, you sound like you are in the Opposition Party putting up barriers and spreading doubt about the program on the same day of the announcement. The Republicans did not have to say a single thing in opposition. In their mind you handled it just fine.

As you know, the Democratic Party is pushing the legislature to pass an expansive set of new laws that will bring about significant change to the always being at the bottom of good lists and at the top of bad lists as a state. We will not be satisfied with Democrats who act more like Republicans on these important topics. Please adopt a "can-do" approach to funding these programs instead of having a committee where all good bills go to die.

Sincerely,

Gary L Sims

On Mon, Sep 23, 2019 at 11:32 AM Bert Coxe [redacted] wrote:

> To New Mexico Department of Game and Fish,
>
> This letter is to protest the slaughter of black bears throughout New Mexico for the sport of hunters. I understand that under the auspices of NMDGF rules, as many as 5000 bears have been killed in New Mexico within the past six years. My wife and I moved back to New Mexico seven years ago because we love the state and especially the outdoor recreation - that includes enjoying the wildlife. Why are we (the citizens of the State of New Mexico through NMDGF) killing off all of the wildlife? I understand that a small number of bears occasionally become nuisance animals, but there is no reason for this wholesale slaughter of these large mammals - to the benefit of wealthy hunters who pay for the privilege of trophy hunting them. If one person calls about and reports a bear sighting, that is not "bear depredation", and I seriously doubt that most people who call in to report a bear know that that bear will likely be hunted down and killed. This slaughter for money must stop.
>
> *Bert Coxe*
> [redacted]
>
> *.cc - Rep. Daymon Ely; Sen. John Sapien; Gov. Michelle Lujan Grisham*

From:	[redacted]
To:	[redacted]
Cc:	DGF-Bear-Cougar-Rules; Daymon Ely; Sapien, John M.
Subject:	[EXT] Re: Please Stop the bear slaughter
Date:	Monday, September 23, 2019 2:43:40 PM

Sent from my iPhone - Bert

On Sep 23, 2019, at 1:19 PM, Gary Sims <[redacted]> wrote:

I too wrote a letter today: To John Arthur Smith - State Senator, chair of the Senate Finance Committee:

Gary Sims [redacted]> 12:52 PM (21 minutes ago)

to john.smith

Mr. Smith, I am disappointed with your reaction to the Governor's plan to provide free college education. Yes, I understand you are the chair of the Senate finance committee that is chartered to hold the state fiscally responsible. However, as a member of the Democratic Party I would expect the first words out of your mouth on the topic would have been more supportive of the plan, Later you can get to work to find ways to fund it.

Instead, you sound like you are in the Opposition Party putting up barriers and spreading doubt about the program on the same day of the announcement. The Republicans did not have to say a single thing in opposition. In their mind you handled it just fine.

As you know, the Democratic Party is pushing the legislature to pass an expansive set of new laws that will bring about significant change to the always being at the bottom of good lists and at the top of bad lists as a state. We will not be satisfied with Democrats who act more like Republicans on these important topics. Please adopt a "can-do" approach to funding these programs instead of having a committee where all good bills go to die.

Sincerely,

Gary L Sims

On Mon, Sep 23, 2019 at 11:32 AM Bert Coxe <[redacted]> wrote:

> To New Mexico Department of Game and Fish,
>
> This letter is to protest the slaughter of black bears throughout New Mexico for the sport of hunters. I understand that under the auspices of NMDGF rules, as many as 5000 bears have been killed in New Mexico within the past six years. My wife and I moved back to New Mexico seven years ago because we love the state and especially the outdoor recreation - that includes enjoying the wildlife. Why are we (the citizens of the State of New Mexico through NMDGF) killing off all of the wildlife? I understand that a small number of bears occasionally become nuisance animals, but there is no reason for this wholesale slaughter of these large mammals - to the benefit of wealthy hunters who pay for the privilege of trophy hunting them. If one person calls about and reports a bear sighting, that is not "bear depredation", and I seriously doubt that most people who call in to report a bear know that that bear will likely be hunted down and killed. This slaughter for money must stop.
>
> *Bert Coxe*
>
> [redacted]
>
> *.cc - Rep. Daymon Ely; Sen. John Sapien; Gov. Michelle Lujan Grisham*

From:	[redacted]
To:	Goldstein, Elise J., DGF; DGF-Bear-Cougar-Rules; Prukop, Joanna, DGF; Salazar-Henry, Roberta, DGF; Bates, Jimmy, DGF; Cramer, Gail, DGF; Lopez, Tirzio, DGF; Soules, David, DGF; Vesbach, Jeremy, DGF
Subject:	[EXT] Re: seeking comment on proposed bear season dates
Date:	Saturday, August 31, 2019 9:41:22 AM

Hello Elise,

Thank you for letting us know about this proposed change to the bear hunting season. Given the heat in August, using dogs to run bears seems harsh on both bears and dogs. I wonder why BMZ's 11,14, 8 and 9 aren't also included in this season shift. Temperatures are only going to be rising. I am postulating that this proposed shift is being made for the more southern zones because of this as you did not offer a reason. But the latitude of zone 11 is equal to or south of the latitude of portions of zone 10. The same is mostly true of Zone 14. Zones 8 and 9 along with the other two have experienced temperatures in the past couple of weeks hovering close to or over 90 degrees. Perhaps there is another reason for this proposal and if so, I urge that the heat be a consideration too.

Also, here is an anecdotal example of an, I hope, unintended consequence of the heat. We live in BMZ 10 (game unit 17). About a week ago, a trailer full of baying hunting dogs went up our canyon onto the National Forest in late afternoon almost near sundown. It came out again at about 9:00 the next morning. The rules say that dogs hunting bears must be released during legal hunting hours which can be as late as 1/2 hour after sunset. I suspect that is when these dogs were released when it is much cooler, which is now legal, and treed the bear during the night. In the morning, the hunters killed the treed bear and they came out afterwards. The practice however most certainly comes very close to, if not outright crossing, the boundary of the prohibition of night hunting.

Whether or not the dates are shifted, there should be a better rule about releasing dogs so the hunt is effectively not happening at night.

Sincerely,
Mary Katherine Ray
[redacted]

On Fri, Aug 30, 2019 at 2:33 PM Goldstein, Elise J., DGF [redacted] wrote:

> As you may have seen at last week's Game Commission meeting, the Department is considering shifting the bear season dates in BMZs 10, 12, and 13 2-weeks later. The new dates would be Sept 1 – December 15. We are seeking public input on this proposal. If you would like to provide input, you may email it to me directly. Thank you.
>
> Elise Goldstein
>
> Assistant Chief - Wildlife
>
> New Mexico Department of Game and Fish

1 Wildlife Way

Santa Fe, NM 87507

(505)-476-8032 – office

(505) 231-1972-cell

CONSERVING NEW MEXICO'S WILDLIFE FOR FUTURE GENERATIONS

From: [redacted]
To: DGF-Bear-Cougar-Rules
Subject: [EXT] Reduce the hunting of bear and cougars, especially with trapping
Date: Wednesday, November 06, 2019 8:28:24 PM

Sir, Madam,

I am not sure who is supporting your recommendations…the hunters, but the general public is against this. They should be given first consideration.

Dale
Dale Houston
[redacted]

From: [redacted]
To: DGF-Bear-Cougar-Rules
Subject: [EXT] Retain cougar trapping
Date: Wednesday, August 21, 2019 2:31:10 PM

As a sportswoman and trapper, I strongly urge you to keep trapping cougars as a proven method of predator control. Being restricted to private land may affect the number of trappers choosing to trap cougar. "Sport trapping" is not the main focus of cougar trapping.

Please reconsider your proposal and allow ranchers, farmers and landowners to utilize traps as a means to protect livestock as well as wild animals.

Thank you.

Claudia Fisher
[redacted]

From: [redacted]
To: DGF-Bear-Cougar-Rules
Subject: [EXT] Slaughter of Bears
Date: Wednesday, September 18, 2019 4:11:57 PM
Importance: High

To Whom This May Concern:

I DO NOT SUPPORT the continued slaughter of our bears.

Diana Zelnio
[redacted]

From:	[redacted]
To:	DGF-Bear-Cougar-Rules
Subject:	[EXT] Stop Cougar and Bear Trapping and Killing
Date:	Wednesday, August 21, 2019 10:56:28 PM

I strongly urge you to:

1. **Eliminate ALL recreational cougar trapping.** Reverse the Game Commission's 2015 decision to allow the use of traps and snares as a method of cougar "sport harvesting" on both private and state trust lands. The vast majority of New Mexicans oppose cougar trapping, consider it cruel, and are concerned about impacts on other species like endangered Mexican wolves.

2. **Reduce annual cougar kill limits.** The latest data and scientific literature show that NMDGF has dangerously overestimated the number of cougars in New Mexico and applied inflated percentages of allowable kills (kill limits, or what NMDGF calls "harvest limits"), putting cougar populations at risk. NMDGF needs to rely on best available science to protect and conserve the notoriously hard-to-count cougar.

3. **Undo the double bag limits for cougars.** Reverse the Game Commission's 2015 decision to allow cougar hunters who kill their bag limit of two cougars to then kill up to two more in cougar management zones where current unjustifiably high kill limits are not met. This move has not yielded the results NMDGF sought, and a double bag limit violates the precautionary principles that should guide careful cougar management.

4. **Reduce annual bear kill limits.** Another species impacted by incorrect application of science, the annual number of bears killed in New Mexico never reach more than half of the current unjustifiably high kill limits. NMDGF should revise its approach to management of bears to ensure this important species is not decimated by irresponsible hunting allowances.

From: [redacted]
To: DGF-Bear-Cougar-Rules
Subject: [EXT] STOP KILLING BEARS
Date: Thursday, September 19, 2019 11:28:13 AM

Please stop the hunting and killing of all wild animals. It’s cruel and insane.

Nancy O'Donohue
[redacted]

From: [redacted]
To: DGF-Bear-Cougar-Rules
Subject: [EXT] Stop Legal Bear Cub Killings
Date: Thursday, September 19, 2019 6:14:55 AM

I am horrified to learn that the state of New Mexico actually allows people to shoot and kill innocent bears. We are the only state that allows this and it’s unconscionable. Please stop!

Patricia Kuning
[redacted]

From: [redacted]
To: DGF-Bear-Cougar-Rules
Subject: [EXT] thousands of bears in six years?
Date: Friday, September 27, 2019 2:49:05 AM

Why are you killing bears? What on earth are you thinking?

Maureen Doll,[redacted]

From: [redacted]
To: DGF-Bear-Cougar-Rules
Subject: [EXT] Too many bear killings in New Mexico
Date: Tuesday, September 17, 2019 6:43:39 PM

To New Mexico Game Commission members:

It has been called to my attention that too many bears are being killed in New Mexico. We need to cut that number in order to have a sustainable numbers of bears here. An Albuquerque Journal letter to the editor by Craig McClure, President of the Black Bear Bureau, stated that there were just under 5,000 bears killed in the past 6 years. That sounds like too many bears killed to me. I am not against hunting but believe we have to always consider how to preserve the species and make sure not too many bears are killed. Pleas do what you can to preserve our black bears in New Mexico.

Thank you. Sincerely, Ms. Pat Manaster

From: [redacted]
To: DGF-Bear-Cougar-Rules
Subject: [EXT] Trapping regulations
Date: Tuesday, October 08, 2019 12:10:16 PM

To who It May concern:
We can’t get enough regulations when it comes to trapping but the more the better. Trapping is hazardous to children, pets and wildlife. Both bears and cougars also are essential to the ecosystem

From: [redacted]
To: DGF-Furbearer-Rules
Subject: [EXT] Trapping rules
Date: Monday, September 16, 2019 9:27:54 AM

There are no rules that will end the cruel, inhumane deaths caused by trapping. The vast majority of New Mexicans oppose this barbaric and outdated practice. The DGF knows all of the specious arguments in defense of a practice that nearly all other states have banned so I won't repeat them here. Trapping is not a sport like hunting or fishing and shouldn't be treated like it is. A small minority should not determine whether we allow trapping when the general public is opposed. Preservation of our wildlife should take precedence over a for profit practice.

Maurice Mackey

[redacted]

From: [redacted]
To: DGF-Bear-Cougar-Rules
Subject: [EXT] Unnecessary bear killings
Date: Tuesday, September 17, 2019 9:43:02 AM

I am a fairly new resident in NM. I lived for 22 years in Asheville, NC where we lived in harmony with bears: they lived among our houses in developments, they wandered around the city looking for food, and of course were often sighted crossing the Blue Ridge Parkway and in our mountains. Our community did not see the bears as unwelcome. I have seen many photos of a bear on mountain home porches and snacking on bird feeder contents. One bear tried to open the garage door entrance which was a door, most likely smelling the dog food in the garage. They even opened car doors looking for food. This was cause for locking your car, not killing the bear! I guess I come from a peaceful, caring community!

We adapted to their presence as they adapted to our presence in their territory. It is very wrong to kill native species, just because we are encroaching on their territory. They have as much, if not more right to live peacefully and raise their young. Why do people think thay have the right to kill????and maim??? Why has their mroal compass gone astray? If they were hungry and looking to feed themselves or their family, it could be understood on a one animal killing. For sport.....never.

Please adjust your understanding of what bear depredation means. Look at Asheville and other mountain communities to re-evaluate your thinking.

With regards,

Debra Benjamin
[redacted]

From: [redacted]
To: DGF-Bear-Cougar-Rules
Subject: [EXT] Wild animal killings
Date: Tuesday, September 17, 2019 10:41:11 AM

The slaughter of our bears, cougars & various wild animals, needs to be stopped or better controlled i.e. no killing baby animals or the mothers until they are old enough to be on their own. The number of animals trapped, killed is outrageous. Don't do it--have better controls on the number that are "harvested"(sickening term) & which ones are can't be sport.
Barbara Douglas
[redacted]

From: [redacted]
To: DGF-Bear-Cougar-Rules
Subject: [SPAM] [EXT] [io-2] DGF-Bear-Cougar-Rules@state.nm.us, you have one new system message.
Date: Wednesday, November 13, 2019 2:07:02 PM

Your **ebay**

Hello DGF-Bear-Cougar-Rules@state.nm.us,

You have one new important system message . Click below to proceed.

Thanks,

The ebay Team

Read message

This message was sent to: DGF-Bear-Cougar-Rules@state.nm.us

From: [redacted]
To: DGF-Bear-Cougar-Rules
Subject: Attn: Bear and Cougar Rule Development
Date: Wednesday, August 07, 2019 3:30:31 PM

I strongly urge you to:

1. **Eliminate ALL recreational cougar trapping.** Reverse the Game Commission's 2015 decision to allow the use of traps and snares as a method of cougar "sport harvesting" on both private and state trust lands. The vast majority of New Mexicans oppose cougar trapping, consider it cruel, and are concerned about impacts on other species like endangered Mexican wolves.

2. **Reduce annual cougar kill limits.** The latest data and scientific literature show that NMDGF has dangerously overestimated the number of cougars in New Mexico and applied inflated percentages of allowable kills (kill limits, or what NMDGF calls "harvest limits"), putting cougar populations at risk. NMDGF needs to rely on best available science to protect and conserve the notoriously hard-to-count cougar.

3. **Undo the double bag limits for cougars.** Reverse the Game Commission's 2015 decision to allow cougar hunters who kill their bag limit of two cougars to then kill up to two more in cougar management zones where current unjustifiably high kill limits are not met. This move has not yielded the results NMDGF sought, and a double bag limit violates the precautionary principles that should guide careful cougar management.

4. **Reduce annual bear kill limits.** Another species impacted by incorrect application of science, the annual number of bears killed in New Mexico never reach more than half of the current unjustifiably high kill limits. NMDGF should revise its approach to management of bears to ensure this important species is not decimated by irresponsible hunting allowances.

Thank you,
Shannon Patrick
[redacted]

From: [redacted]
To: DGF-Bear-Cougar-Rules; Comins III, James C., DGF; Salazar-Henry, Roberta, DGF; Vesbach, Jeremy, DGF; Lopez, Tirzio, DGF; Soules, David, DGF; Bates, Jimmy, DGF; Cramer, Gail, DGF
Subject: B&C RULES—Letter—Carson Forest Watch - Oct 10, 2019
Date: Thursday, October 10, 2019 3:32:42 PM

Hi. For the record and the letter asks me to share it with other Commissioners....jp

Scanned with TurboScan

Sent from my iPhone

From: [redacted]
To: DGF-Bear-Cougar-Rules
Cc: [redacted]
Subject: Bear & Cougar rule revsision
Date: Sunday, August 11, 2019 6:51:20 PM

Submitting Public Comment: Bear & Cougar Rule Revisions.

I would like to recommend changes be applied to the current rulings managing both cougar & bear in New Mexico.

1. No trapping of cougar be lawful throughout the State period. It is an extremely cruel and indiscriminate practice.

2. No hunting of cougar by any means, it is an unnecessary practice, and does not reflect the best way to manage puma con-color. Science has shown (evolution in fact has shown) that this species is capable of self regulation. A species, which if allowed to fulfill its roll within an eco system, will not only contribute to it, but enhance its health and vitality. Current human hunting allowances of the cougar put not only the species in jeopardy, but the well being of the wilderness as a whole.

3. Limit the killing of Bears: humans hunting tends to disturb bruin communities and pummel their populations, again, affecting the health of the wilderness. Killing native species really should be used as a last resort, in cases were human safety is an issue, or numbers are severely impacting another species in a negative way . Otherwise there are no legitimate reasons to hunt bear, or cougar. Hunting for food should be applied to species with higher population thresh holds.

There is beauty in New Mexico - its wild places, people from all over the world travel to see it. Its native populations are what have helped shape it, and will help to restore it where we have failed.

Thank you for the opportunity to speak on behalf of these species.

Sincerely

Carmel Marie Severson.

Sent from Mail for Windows 10

From:	[redacted]
To:	DGF-Bear-Cougar-Rules
Subject:	Bear & Cougar Rule
Date:	Friday, August 09, 2019 2:21:59 PM

Instead of providing two tags with the purchase of a cougar license there should only be one. If hunters want additional tags they should have to pay for each additional tag.

Also, the bear harvest limit should be decreased since we don’t come close to reaching it anyways.

Thanks for your consideration.

Sent from my iPhone

From: [redacted]
To: DGF-Bear-Cougar-Rules
Subject: Bear & Cougar Rule
Date: Friday, August 09, 2019 1:44:23 PM

Regarding your proposed revisions to the Bear & Cougar Rule:

I encourage the elimination of all recreational cougar trapping!
I encourage the reduction of cougar kill limits
I encourage the reversal of the double bag limits for cougars.
I encourage the reduction of annual bear kill limits.

Please rely on only the best available science.
Please provide better protection of our top predator species, recognizing their role in the ecosystem.

Respectfully,

Victoria Linehan
[redacted]

From:	[redacted]
To:	DGF-Bear-Cougar-Rules
Subject:	Bear and Cougar Rule Development
Date:	Sunday, August 11, 2019 4:31:31 PM

Hello,

Please see below. Please do the right thing for these animals and for our environment. Thank you.

1. **Eliminate ALL recreational cougar trapping.** Reverse the Game Commission's 2015 decision to allow the use of traps and snares as a method of cougar "sport harvesting" on both private and state trust lands. The vast majority of New Mexicans oppose cougar trapping, consider it cruel, and are concerned about impacts on other species like endangered Mexican wolves.

2. **Reduce annual cougar kill limits.** The latest data and scientific literature show that NMDGF has dangerously overestimated the number of cougars in New Mexico and applied inflated percentages of allowable kills (kill limits, or what NMDGF calls "harvest limits"), putting cougar populations at risk. NMDGF needs to rely on best available science to protect and conserve the notoriously hard-to-count cougar.

3. **Undo the double bag limits for cougars.** Reverse the Game Commission's 2015 decision to allow cougar hunters who kill their bag limit of two cougars to then kill up to two more in cougar management zones where current unjustifiably high kill limits are not met. This move has not yielded the results NMDGF sought, and a double bag limit violates the precautionary principles that should guide careful cougar management.

4. **Reduce annual bear kill limits.** Another species impacted by incorrect application of science, the annual number of bears killed in New Mexico never reach more than half of the current unjustifiably high kill limits. NMDGF should revise its approach to management of bears to ensure this important species is not decimated by irresponsible hunting allowances.

Dylan Shaw
[redacted]

"I would like for my life to be a statement of love and compassion-and where it isn't, that is where my work lies." **- Ram Dass**

From:	[redacted]
To:	DGF-Bear-Cougar-Rules
Subject:	BEAR AND COUGAR RULE PROPOSED CHANGES, 2020-2024
Date:	Wednesday, August 07, 2019 5:56:42 PM

I am unable to attend the meeting regarding Bear and Cougar Rule Proposed Changes, 2020-2024. Therefore, I ask that you accept my comments on the proposed revisions to the Bear and Cougar Rule via this email and as follows. Thank you.

I urge the New Mexico Game & Fish to implement the following:

1. Eliminate ALL recreational cougar trapping. Reverse the Game Commission's 2015 decision to allow the use of traps and snares as a method of cougar "sport harvesting" on both private and state trust lands. The vast majority of New Mexicans oppose cougar trapping, consider it cruel, and are concerned about impacts on other species like endangered Mexican wolves.
2. Reduce annual cougar kill limits. The latest data and scientific literature show that NMDGF has dangerously overestimated the number of cougars in New Mexico and applied inflated percentages of allowable kills (kill limits, or what NMDGF calls "harvest limits"), putting cougar populations at risk. NMDGF needs to rely on best available science to protect and conserve the notoriously hard-to-count cougar.
3. Undo the double bag limits for cougars. Reverse the Game Commission's 2015 decision to allow cougar hunters who kill their bag limit of two cougars to then kill up to two more in cougar management zones where current unjustifiably high kill limits are not met. This move has not yielded the results NMDGF sought, and a double bag limit violates the precautionary principles that should guide careful cougar management.
4. Reduce annual bear kill limits. Another species impacted by incorrect application of science, the annual number of bears killed in New Mexico never reach more than half of the current unjustifiably high kill limits. NMDGF should revise its approach to management of bears to ensure this important species is not decimated by irresponsible hunting allowances.

Taking steps to “walk back” the incredibly damaging NMDGF 2015 rule changes isn’t enough. Further protections for our vulnerable, over hunted, and maltreated cougars and bears are required. There must be a commitment to compassion, to public safety, and to ending the suffering and exploitation of our wildlife. The fight to stop dangerous, cruel, commercialized, recreational trapping, and hunting in New Mexico must continue and come to fruition. Supporting the lethal exploitation of native species on behalf of special interests must stop.

Thank you for accepting my comments for this issue.

Yolanda Garcia
[redacted]

From: [redacted]
To: DGF-Bear-Cougar-Rules
Subject: Bear and Cougar Rule Proposed Changes
Date: Tuesday, August 13, 2019 8:42:55 AM

Hello,

I was wondering if you could please tell me when comment letters are due for the comment period regarding the proposed changes to the Bear and Cougar Rule? Also, is there anyone in particular that my comment letter will need to be addressed to?

Kindest regards,

Denise M. Peterson
[redacted]

From: [redacted]
To: DGF-Bear-Cougar-Rules
Subject: Bear and Cougar rule public comment
Date: Friday, August 09, 2019 3:29:02 PM

I urge you to do the following concerning the proposed revisions to the Bear and Cougar Rule:

1. **Eliminate ALL recreational cougar trapping.** Reverse the Game Commission's 2015 decision to allow the use of traps and snares as a method of cougar "sport harvesting" on both private and state trust lands. The vast majority of New Mexicans oppose cougar trapping, consider it cruel, and are concerned about impacts on other species like endangered Mexican wolves.

2. **Reduce annual cougar kill limits.** The latest data and scientific literature show that NMDGF has dangerously overestimated the number of cougars in New Mexico and applied inflated percentages of allowable kills (kill limits, or what NMDGF calls "harvest limits"), putting cougar populations at risk. NMDGF needs to rely on best available science to protect and conserve the notoriously hard-to-count cougar.

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4. **Reduce annual bear kill limits.** Another species impacted by incorrect application of science, the annual number of bears killed in New Mexico never reach more than half of the current unjustifiably high kill limits. NMDGF should revise its approach to management of bears to ensure this important species is not decimated by irresponsible hunting allowances.

Please base your rule changes on what MOST new Mexicans want, not just a vocal minority of ranchers and hunters!!

Respectfully,

Mike Hasson
[redacted]

From: [redacted]
To: DGF-Bear-Cougar-Rules
Subject: Bear and Cougar Rule
Date: Wednesday, August 07, 2019 7:34:12 PM

1. **Eliminate ALL recreational cougar trapping.** Reverse the Game Commission's 2015 decision to allow the use of traps and snares as a method of cougar "sport harvesting" on both private and state trust lands. The vast majority of New Mexicans oppose cougar trapping, consider it cruel, and are concerned about impacts on other species like endangered Mexican wolves.

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4. **Reduce annual bear kill limits.** Another species impacted by incorrect application of science, the annual number of bears killed in New Mexico never reach more than half of the current unjustifiably high kill limits. NMDGF should revise its approach to management of bears to ensure this important species is not decimated by irresponsible hunting allowances.

Jim (JC) Corcoran

"Any great change must expect opposition because it shakes the very foundation of privilege."
~ Lucretia Coffin Mott, 1793-1880, minister, women's rights leader, abolitionist, peace activist, humanitarian ~

From: [redacted]
To: DGF-Bear-Cougar-Rules
Subject: Bear and Cougar Rules
Date: Wednesday, August 07, 2019 8:20:38 PM

Again with the murdering of animals that you deem necessary, "Sports harvesting" You mean Trophy Hunting, you want to bring more people in and let them PAY to KILL and murder the wildlife throughout the state. Let me tell you something, you need both prey and predator animals to survive, but I have hollared at many an official before trying to get this point across, but it's like talking to someone who is deaf. They do not want to hear it. When MAN takes over the land, they push out the animals living on it, so they either don't seem to care, or don't want to understand where the wild animals go, basically they have no place to call home, because it was taken away from them. This is happening all across the country, so MAN in his infinite wisdom seems and deems fit to MURDER them all because they can't be running all over the place. Little do they realize that you can not have it both ways. You need to have both prey and predator animals, and that DOES not mean MAN, of course MAN is the MOST Dangerous Predator on the Face of this Earth and always Has Been and Always Will Be, As long as Man is Allowed to Trophy Hunt and Harvest at Will. Animals will never stand a chance against a bullet or an arrow. This is a new age of extinction for these animals, and once they are gone, it is forever. I hope all of you Trophy Hunters are Happy!!!

These types of harvesting have consequences that will ripple throughout all each leaf of Nature, including us. But you may not understand it until it actually hits home, and by then it will be too late, and then there are No take backs, because by then the damage is done, permanently, there are no do-overs.

You ARE NOT OUT to manage them, you are OUT to take them out permanently, if you look at the data, there are NOT that many cougars throughout this country, they have a very hard life, they already get shot at. And now you want to double kill them, some of them can't even raise one of their babies past it's first or second year, if they are lucky. But you still want to take them out, really? They live in the harshest of environments and you want them gone, SHAME on you!! Same with the Mexican Wolf, Shame on You!!! Is this Earth only Meant to be inhabited by Humans, you will find that every single animal that lives and breathes on this Earth, has a purpose in the circle of life, including in OUR life!! Believe it or NOT, they do!! Just ask Leonardo De Caprio he will tell you all about that.

Each animal's purpose intertwines with another's somehow, and so on and so forth, this is the circle of life, until it effects ours, which it eventually does, very fast. So before you start murdering vast amounts of certain species of animals, think back to what happened when the soldiers sped across the country on the early trains murdering the buffalo, so the Indians were not able to have them there. They murdered hundreds of thousands of them, and left them on the plains to rot. Guess what? It took forever for them to make a comeback, yet they have not made without a cost to themself. Yes, a few hundred are alive on the plains of Yellowstone but not like they were, they will never be like that again, because of what someone thought was a way to take them out. And because of that other animals suffered.

DON'T BECOME TROPHY HUNTERS, OR START "SPORT HARVESTING" IN ANYONE'S EYES IT'S THE SAME THING, BECAUSE YOU ARE PAYING TO DO IT, SHAME ON YOU!

1. **Eliminate ALL recreational cougar trapping.** Reverse the Game Commission's 2015 decision to **allow the use of traps and snares as a method of cougar "sport harvesting" on both private and state trust lands**. **The vast majority of New Mexicans oppose cougar trapping, consider it cruel, and are concerned about impacts on other species like endangered Mexican wolves.**

2. **Reduce annual cougar kill limits.** The latest data and scientific literature show that NMDGF has dangerously overestimated the number of cougars in New Mexico and applied inflated percentages of allowable kills (**kill limits, or what NMDGF calls "harvest limits"), putting cougar populations at ris**k. NMDGF needs to rely on best available science to protect and conserve the notoriously hard-to-count cougar.

3. **Undo the double bag limits for cougars.** Reverse the Game Commission's 2015 decision to allow cougar hunters who kill their bag limit of two cougars to **then kill up to two more in cougar** management zones where current unjustifiably high kill limits are not met. This move has not yielded the results NMDGF sought, **and a double bag limit violates the precautionary principles that should guide careful cougar management.**

4. **Reduce annual bear kill limits.** Another species impacted by incorrect application of science, the annual number of bears killed in New Mexico never reach more than half of the current unjustifiably high kill limits. **NMDGF should revise its approach to management of bears to ensure this important species is not decimated by irresponsible hunting allowances**.

Sincerely
Victoria Parisio

From:	[redacted]
To:	DGF-Bear-Cougar-Rules
Subject:	Bear and Cougar
Date:	Wednesday, August 07, 2019 7:54:21 AM

To whom it may concern
I am a rancher and conservationist, I own 3,500 acres and a forest permit on the Capitan mountain. Over the last several years we have seen a depletion in our deer (not due to hunting) as we have not allowed any hunters to kill deer but we find deer carcasses all over our deeded property as well as public property. This is a lion problem and I feel like the department will be headed in the wrong direction if you cut lion harvest numbers.
Paul Turney
[redacted]

Sent from my iPhone

From: [redacted]
To: Forman, Nicholas, DGF
Subject: bear/cougar rule
Date: Friday, August 09, 2019 8:46:16 AM

I think we should try to add something to the bear/cougar rule that would make it illegal to kill a bear/cougar over someone else's dogs unless you are in their hunting party or have their permission. This has for sure happened in NM (friend of mine) - guide's dogs treed a lion and someone else came from the opposite direction (without dogs I believe) and shot the cat and left with it before they could get to the tree. As it stands now, I believe this was not illegal in NM, just a real unsportsmanlike move. I know this rule is in place in Maine, not sure of any other states. Something to think about.

From Maine IFW:

"It is unlawful to:

- kill or wound a bear that is treed or held at bay by another person's dog or dogs unless you have permission from the person conducting the hunt"

David Wilckens
[redacted]

From: [redacted]
To: DGF-Bear-Cougar-Rules
Subject: Bear/Couger rule
Date: Tuesday, August 06, 2019 1:37:25 PM

My name is Bill Ritchey owner of out on a limb guides&outfitter
I live in Aztec nm we specialize in predator hunts bear,Couger,bobcat with the use of our hounds and have over 20 years studying and harvesting these predictorsI
listened to the pod cast in July 24 as I was unable to attend
I herd a few comments I'd like to address
1) I have no issue with removal of bear of Couger meat from the field we do it anyway once our hunter harvests a Couger/bear we always carry out the meat and cut it up for transportation
2) there was someone at the pod cast who mentioned (self management of Couger said see they manage their selves so we don't need to)
Self management of Couger doesn't mean that if there is to many cougars in an area the other cougars wave your magic wand and Poof disappear
it means that if there are too many cougars in an area the maturest cat will fight with the other cats until one or both or all have killed each other this is a long drawn out grueling pain of months of agony and disease setting in
it's way more ethical to let our sportsman harvest a big mature cat then it is to let them suffer in pain from the wounds they've received from another
I have seen the after math of self management it's not Pretty at all
Thanks for you're time
Bill Ritchey
[redacted]
Sent from my iPhone

From: [redacted]
To: DGF-Bear-Cougar-Rules
Subject: Bears and cougars
Date: Friday, August 09, 2019 12:36:25 PM

As a New Mexico resident I urge you to please consider the following:
Eliminate all recreational cougar trapping.
Reduce annual cougar kill limits.
Undo double bag limits for cougars.
Reduce annual bear kill limits.
I thank you for your time to think these things through in a scientific and responsible way.

Sent from my iPhone

From: [redacted]
To: DGF-Bear-Cougar-Rules
Subject: bears and cougars
Date: Wednesday, August 07, 2019 6:16:51 PM

I am raising my voice to stand up for bears and cougars in our state. Thank you.
barb glover
[redacted]

From: [redacted]
To: DGF-Bear-Cougar-Rules
Subject: Bears and Cougars
Date: Thursday, August 08, 2019 5:24:19 AM

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1. **Eliminate ALL recreational cougar trapping.** Reverse the Game Commission's 2015 decision to allow the use of traps and snares as a method of cougar "sport harvesting" on both private and state trust lands. The vast majority of New Mexicans oppose cougar trapping, consider it cruel, and are concerned about impacts on other species like endangered Mexican wolves.

2. **Reduce annual cougar kill limits.** The latest data and scientific literature show that NMDGF has dangerously overestimated the number of cougars in New Mexico and applied inflated percentages of allowable kills (kill limits, or what NMDGF calls "harvest limits"), putting cougar populations at risk. NMDGF needs to rely on best available science to protect and conserve the notoriously hard-to-count cougar.

3. **Undo the double bag limits for cougars.** Reverse the Game Commission's 2015 decision to allow cougar hunters who kill their bag limit of two cougars to then kill up to two more in cougar management zones where current unjustifiably high kill limits are not met. This move has not yielded the results NMDGF sought, and a double bag limit violates the precautionary principles that should guide careful cougar management.

4. **Reduce annual bear kill limits.** Another species impacted by incorrect application of science, the annual number of bears killed in New Mexico never reach more than half of the current unjustifiably high kill limits. NMDGF should revise its approach to management of bears to ensure this important species is not decimated by irresponsible hunting allowances.

From: [redacted]
To: DGF-Bear-Cougar-Rules
Subject: Bears and Mountain Lions.
Date: Friday, August 09, 2019 2:10:27 PM

Dear Sirs,
My name is Steve Hughes and I live in Wrexham North Wales UK.
I have one question for you and your colleagues. And that is : What gives you the God given right to kill these beautiful animals in the most brutal ways possible?
No doubt you are pandering to the farmers and ranchers
People are encroaching on THEIR land. I just wish you had the backbone to stand up to these people instead of caving in to them.
Your actions against Wolves are just the same.
All these animals are an absolute necessity to the ecosystem. They keep their prey animals in check, and keep the various herds healthy.
Please listen to the experts and scientists who know better than you. Your government "experts" only tow the line, and are of no use whatsoever.
I urge you to help these beautiful animals. They are far more beneficial than you know.
Yours sincerely,
Steve Hughes.

[redacted]

From: [redacted]
To: DGF-Bear-Cougar-Rules
Subject: Chinese-like preying
Date: Thursday, August 08, 2019 5:42:04 AM

Dear people at the Department of Game&Fish
On the twenty one century, after all the destruction fell on wildlife in your state, it must be stopped the Chinese-like way of degrading territories and lands by abandoning wildlife protection. Ethical reasons as well should be taken seriously, too. So, please

Eliminate ALL recreational cougar trapping. Reverse the Game Commission's 2015 decision to allow the use of traps and snares as a method of cougar "sport harvesting" on both private and state trust lands. The vast majority of New Mexicans oppose cougar trapping, consider it cruel, and are concerned about impacts on other species like endangered Mexican wolves.
Reduce annual cougar kill limits. The latest data and scientific literature show that NMDGF has dangerously overestimated the number of cougars in New Mexico and applied inflated percentages of allowable kills (kill limits, or what NMDGF calls "harvest limits"), putting cougar populations at risk. NMDGF needs to rely on best available science to protect and conserve the notoriously hard-to-count cougar.
Undo the double bag limits for cougars. Reverse the Game Commission's 2015 decision to allow cougar hunters who kill their bag limit of two cougars to then kill up to two more in cougar management zones where current unjustifiably high kill limits are not met. This move has not yielded the results NMDGF sought, and a double bag limit violates the precautionary principles that should guide careful cougar management.
Reduce annual bear kill limits. Another species impacted by incorrect application of science, the annual number of bears killed in New Mexico never reach more than half of the current unjustifiably high kill limits. NMDGF should revise its approach to management of bears to ensure this important species is not decimated by irresponsible hunting allowances.

New Mexico´s lobbies working to prey on wildlife should not get the D of G&F help. Quite on the contrary.

Thank you

Marina Sagardua

[redacted]

From: [redacted]
To: DGF-Bear-Cougar-Rules
Subject: Comment on Rules
Date: Wednesday, August 07, 2019 7:38:10 AM

Hello,

I would like to comment that there needs to be stricter rules for out of state bear hunters, every season it seems that us residents get over run by out of state bear hunters. They come into our state and kill just about everything they catch.

Also, there needs to be something done about the population of bears, there seems to be a very high number of bears in the state of New Mexico, we could possibly use a spring season for bears just like our neighbor state of Utah, they have a spring season to hunt the bears. I think that this would be beneficial to our population management of bears.

Thank you,
Michael Martinez

From: [redacted]
To: DGF-Bear-Cougar-Rules
Subject: Comments Bear-Cougar-Rules Change
Date: Friday, August 02, 2019 9:43:01 PM

New Mexico Department of Game and Fish,

I recently was informed of the proposed changes to the rules for the harvest of Cougar for 2020. After reviewing the presentation from the commission meeting on 24, July 2019, I was disappointed to see that the proposed manner and method requirements would no longer allow for the sport harvest of Cougar utilizing traps and foot snares. What is most disappointing is that this decision appears to have been reached based on that fact that trapping and snaring is an infrequently used method of take. This reason is obviously not one that is based on sound wildlife management (i.e. potential over-harvest), but rather one based on social pressures, political pressures, or both.

I strongly oppose the proposed rule to not allow the use of traps and foot snares for the harvest of Cougar based on the reasons given. In addition, I am strongly in favor of managing wildlife based on the best available science and feel that it would be in the best interest of New Mexico's sportspersons, non-resident sportspersons, and stakeholders that may have to interact with Cougar to manage this species and the rules and tools of take based on such best available science rather than social or political reasons.

Sincerely,

Jason Wisniewski

From: [redacted]
To: DGF-Bear-Cougar-Rules
Subject: Consider adding spring bear hunt
Date: Tuesday, August 13, 2019 8:07:26 AM

Consider adding a state wide spring bear hunt.

Ray Vigil
[redacted]

From: [redacted]
To: DGF-Bear-Cougar-Rules
Subject: Cougar and Bear hunting
Date: Friday, August 09, 2019 12:47:46 PM

Hello,

I would like to express my opinion in favor of protecting bears and cougars, not hunting them. They are a vital part of our ecosystem, and "kill limits" should be drastically reduced. All trapping of cougars and bears should be eliminated.

I moved to NM, and support our economy here, because of our varied wildlife. Please follow what the science says should happen, not special interests groups representing hunters or ranchers.

Thank you,
Budd Berkman
[redacted]

From:	[redacted]
To:	DGF-Bear-Cougar-Rules
Subject:	Cougar and Bears in NM
Date:	Thursday, August 15, 2019 3:47:56 PM

I am unable to attend the meeting this evening and wish to express my opinion of the trapping of cougars and bears in NM in this email.

1. **Eliminate ALL recreational cougar trapping.** Reverse the Game Commission's 2015 decision to allow the use of traps and snares as a method of cougar "sport harvesting" on both private and state trust lands.

2. **Reduce annual cougar and bear kill limits.** The latest data and scientific literature show that NMDGF **has dangerously overestimated the number of cougars and bears in New Mexico and applied inflated percentages of allowable kills, putting populations at risk**.

3. **Undo the double bag limits for cougars.** Reverse the Game Commission's 2015 decision to allow cougar hunters who kill their bag limit of two cougars to then kill up to two more in cougar management zones where current unjustifiably high kill limits are not met.

These changes, I believe, will increase tourism in our state. One of the biggest economic drivers we have! As one of the poorest and least well educated in the nation it behooves us to capitalize on our natural resources, of which these marvelous creatures are a part, and FORBID the use of traps EVERYWHERE. These traps are a danger to hikers, horses and dogs…..and TOURISTS.

And tell me, to hunters eat cougar? Bear? Or just hang the heads on the wall?

Nancy C. Sharp

May your trails be crooked, winding, lonesome, dangerous, leading to the most amazing view
-Edward Abbey

From:	[redacted]
To:	DGF-StateGameCommission; DGF-Bear-Cougar-Rules
Subject:	Cougar comment, Mr. Goodart
Date:	Monday, September 30, 2019 8:15:08 AM
Attachments:	Comment_Cougar_Rule_Goodart_093019.pdf

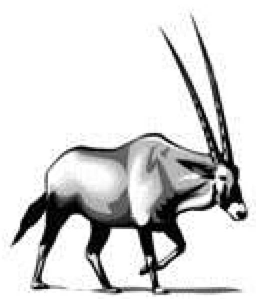
Hello, Commissioners –

Good morning. I am attaching a comment on the Cougar Rule that was delivered via USPS. I am copying the Cougar Rule email so that it is included in the rule making record.

Have a great week. Thank you.

Sandra C. DuCharme

[redacted]



CONSERVING NEW MEXICO'S WILDLIFE FOR FUTURE GENERATIONS

From: [redacted]
To: [redacted]
Cc: DGF-Bear-Cougar-Rules; Comins III, James C., DGF
Subject: Cougar harvest limit in Zone K
Date: Thursday, October 10, 2019 3:08:12 PM

Dear, Mr. Tichenor,

Thank you for the comment letter, including photos, you sent to express your opposition to the Department's proposed reduction in the cougar harvest in Zone K. I will make certain your letter becomes a part of the official record in our rule making process, and I will discuss it with Department staff.

Thank you again,

Joanna Prukop, [redacted]

Sent from my iPad

From: [redacted]
To: DGF-Bear-Cougar-Rules
Subject: Cougar Rules - Reconsider
Date: Thursday, August 01, 2019 1:10:22 PM

Please reconsider changing the rules to cougar trapping in NM. These methods of trapping are ***Agreement on International Humane Trapping Standards (AIHTS)*** approved. Foothold traps especially should remain legal as a control device. These traps are humane, and do not harm the animal and allow the trapper to identify sex of the animal and ascertain if a female has cubs and allows the option of releasing the animal. Traps are checked regularly to minimize impact on the animal and are an important tool in game management across North America.

If no other argument here remains please consider this would be an unfortunate loss of the privileges of the citizens of the State.

Thank you.

Ben Roundell

From: [redacted]
To: DGF-Bear-Cougar-Rules
Subject: Cougar trapping ban
Date: Thursday, August 08, 2019 7:37:48 AM

I would highly encourage you guys to look deeper into the ban on cougar trapping as it directly impacts the livelihood of many people who deal with them on a daily basis. Farmers and ranchers who make a living from their animals, who also provide food for each and every one of your residents, are being put at a huge disadvantage due to predation from mountain lions. Putting these people in this position not only affects them and their family, but your entire economy as well. Mountain lion quotas (set by the government) are very rarely met within the last several years, trapping on these lands only help meet the regulations set by the state.

All of this hasn’t even gotten started on the effects of the local wildlife that call NM home. The management of lions and wolves is absolutely critical for all other forms of wildlife. They are an apex predator, they have no other form of regulations, besides us. No one wants to kill them all, they are crucial for the environment, but it is our job to manage the numbers of these types of predators. If these predators continue to grow out of control, they will continue to encroach on the urban areas where people’s lives are at stake. This is completely preventable, and I encourage everyone to look at the facts.

Thanks for your time,
Drew Reed

Sent from my iPhone

From:	[redacted]
To:	DGF-Bear-Cougar-Rules
Subject:	Cougar-Bear Rules
Date:	Friday, August 16, 2019 6:19:37 AM

DGF:
As a New Mexican resident and a state taxpayer, I support elimination of ALL recreational cougar trappings, the reduction of cougar kills and the undoing of double bag limits allowing hunters to kill numerous cougars.
There has been no solid cougar counts and since the sightings are nil, I oppose cougar killings.
The ecosystem must be balanced!!
As a gun owner, I also oppose any extension in bear hunting rules. In fact, I oppose any extensions into the bear hunting season.

Thank you
Diane Baptista
[redacted]

From: [redacted]
To: DGF-Bear-Cougar-Rules
Subject: Cougars and Bears
Date: Thursday, August 15, 2019 3:31:25 PM

Nancy C. Sharp

May your trails be crooked, winding, lonesome, dangerous, leading to the most amazing view
-Edward Abbey

From: [redacted]
To: DGF-Bear-Cougar-Rules
Subject: Cougars and Bears
Date: Saturday, August 10, 2019 2:33:38 PM

I implore you to immediately enact any and all protections for New Mexico's wildlife, especially for cougars and bars. Specifically:

1. **Eliminate ALL cougar trapping.** Reverse the Game Commission's 2015 decision to allow the use of traps and snares as a method of cougar "sport harvesting" on both private and state trust lands. The vast majority of humans oppose cougar trapping, consider it cruel, and are concerned about impacts on other species like endangered Mexican wolves.

2. **Eliminate annual cougar kill limits.** The latest data and scientific literature show that NMDGF has dangerously overestimated the number of cougars in New Mexico and applied inflated percentages of allowable kills (kill limits, or what NMDGF calls "harvest limits"), putting cougar populations at risk. NMDGF needs to rely on best available science to protect and conserve the notoriously hard-to-count cougar.

3. **Ban cougar and bear hunting.** Reverse the Game Commission's 2015 decision to allow cougar hunters who kill their bag limit of two cougars to then kill up to two more in cougar management zones where current unjustifiably high kill limits are not met. This move has not yielded the results NMDGF sought, and a double bag limit violates the precautionary principles that should guide careful cougar management.

4. **Bears are also** impacted by incorrect application of science, You must ensure this important species is not decimated by irresponsible hunting allowances.

Debra Curci
[redacted]

From: [redacted]
To: DGF-Bear-Cougar-Rules
Subject: Dear NMDGF-- RE: BEAR AND COUGAR RULE PROPOSED CHANGES, 2020-2024
Date: Wednesday, August 07, 2019 4:45:42 PM

Dear New Mexico Department of Game and Fish:

PLEASE:

1. **Eliminate ALL recreational cougar trapping.** Reverse the Game Commission's 2015 decision to allow the use of traps and snares as a method of cougar "sport harvesting" on both private and state trust lands. The vast majority of New Mexicans oppose cougar trapping, consider it cruel, and are concerned about impacts on other species like endangered Mexican wolves.

2. **Reduce annual cougar kill limits.** The latest data and scientific literature show that NMDGF has dangerously overestimated the number of cougars in New Mexico and applied inflated percentages of allowable kills (kill limits, or what NMDGF calls "harvest limits"), putting cougar populations at risk. NMDGF needs to rely on best available science to protect and conserve the notoriously hard-to-count cougar.

3. **Undo the double bag limits for cougars.** Reverse the Game Commission's 2015 decision to allow cougar hunters who kill their bag limit of two cougars to then kill up to two more in cougar management zones where current unjustifiably high kill limits are not met. This move has not yielded the results NMDGF sought, and a double bag limit violates the precautionary principles that should guide careful cougar management.

4. **Reduce annual bear kill limits.** Another species impacted by incorrect application of science, the annual number of bears killed in New Mexico never reach more than half of the current unjustifiably high kill limits. NMDGF should revise its approach to management of bears to ensure this important species is not decimated by irresponsible hunting allowances.

Thank You for allowing public comments on this issue!

Sincerely,

Cathy ELizabeth Levin

[redacted]

From:	[redacted]
To:	DGF-Bear-Cougar-Rules
Subject:	Don"t Ban Mountain Lion Trapping.
Date:	Monday, August 05, 2019 6:28:33 PM

It's illogical to ban any current harvest method for mountain lions. Especially when their population is only increasing, and quotas are rarely met in high lion population areas.

Slippery slope if these changes get passed.

From: [redacted]
To: DGF-Bear-Cougar-Rules
Subject: Fw: [EXT] An open letter to the State of New Mexico Game Commissioners
Date: Friday, October 11, 2019 6:36:42 AM

Please see comments below.

From: Soules, David, DGF
Sent: Monday, September 9, 2019 12:26 PM
To: Stephan Helgesen
Subject: Re: [EXT] An open letter to the State of New Mexico Game Commissioners

Mr. Helgesen:

I agree with your position that Game and Fish Department studies should be conducted using best available science. In my opinion, the study I attached to my last email fits that description. It included several wildlife scientists from NM State University as co-authors, was published in a peer-reviewed journal, included a statistically significant sample size (roughly 4000 samples, of which roughly 3000 provided useful genetic data), included a large portion of available bear habitat in NM, and was published recently (2018). That is exactly the type of study that I believe should be used by our game department to inform our wildlife management policies.

I appreciate the critical importance of sows to healthy bear populations, and I believe the remainder of the commission and the department recognize this too.

Thanks again,
David Soules

From: Stephan Helgesen [redacted]
Sent: Monday, September 9, 2019 6:07 AM
To: Soules, David, DGF
Subject: Re: [EXT] An open letter to the State of New Mexico Game Commissioners

Mr. Soules,

Thanks for you response. It's not the newness of the study that matters as much as who does it. The previous study was done by a non-professional and based on many metrics and methods that were not universally used in such studies. We should be looking to our neighbor to the north in Colorado for some cooperation and maybe guidance when it comes to Black Bear population management.

Here in New Mexico we need to reduce the number of sow kills, plain and simple, otherwise we will severely harm future populations of Black Bears. Please try to sensitize your colleagues and the NM Fish and Game people to this reality. Also, please try to focus on the problems I outlined on page two of my Open Letter to the Game Commissioners (I'm attaching another copy with this email). Thank you for your concern for our State Animal.

Regards,
Stephan Helgesen
[redacted]

On 9/8/2019 9:04 PM, Soules, David, DGF wrote:

Dear Stephan:

Thank you for your thoughtful letter. I agree with most of the points you make, particularly with regard to the need to transplant more bears with regard to depredation, rather than killing them.

If you are not aware of it, the department is actually basing their current population estimates on a very significant study. I have attached it for your review.

I would also point out that in some areas (the Sandias in particular, see the data below), bears are being killed on our roads in very significant numbers. Unfortunately, I don't have an answer for how to address that.

Bear Management Zone 8 Black Bear Sow Mortality

Year	Hunting	Depredation	Road Kill-Other
2012	1	1	2
2013	1	6	9
2014	0	0	1
2015	1	0	0
2016	0	0	0
2017	0	0	1
2018	0	0	1
Total	3	7	14

Thank you again for expressing your concerns,
Best regards,
David Soules

From: Stephan Helgesen [redacted]
Sent: Friday, September 6
To: [redacted]; Salazar-Henry, Roberta, DGF; Bates, Jimmy, DGF; Cramer, Gail, DGF; Lopez, Tirzio, DGF; Soules, David, DGF; Vesbach, Jeremy, DGF
Subject: [EXT] An open letter to the State of New Mexico Game Commissioners

Please see the two-page attachment. If you have any questions, please feel free to contact me.
Thank you for your service to our animals and their habitats.

Regards,

[redacted]

From:	[redacted]
To:	DGF-Bear-Cougar-Rules
Subject:	Fw: [EXT] An open letter to the State of New Mexico Game Commissioners
Date:	Wednesday, September 18, 2019 6:05:22 AM
Attachments:	An open letter to the NM Game Commissioners Sept 5 2019.pdf

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From: Stephan Helgesen [redacted]
Sent: Friday, September 6, 2019 5:49 PM
To: joanna.prukp@state.nm.us; Salazar-Henry, Roberta, DGF; Bates, Jimmy, DGF; Cramer, Gail, DGF; Lopez, Tirzio, DGF; Soules, David, DGF; Vesbach, Jeremy, DGF
Subject: [EXT] An open letter to the State of New Mexico Game Commissioners

Please see the two-page attachment. If you have any questions, please
feel free to contact me.
Thank you for your service to our animals and their habitats.

Regards,

Stephan Helgesen
[redacted]