BLACK BEAR DATA ANALYSIS UNIT
MANAGEMENT PLAN
UNCOMPAHGRE
DAU B-5

GAME MANAGEMENT UNITS
40, 60, 61, 62, 64, 65, and 70
SW/NW Regions

Prepared for:
Colorado Division of Wildlife

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Bear Data Analysis Unit Plan for B-5 (Uncompahgre)

EXECUTIVE SUMMARY

GMUs: 40, 60, 61, 62, 64, 65, & 70 (Montrose and Ouray counties and parts of Delta, Gunnison, Hinsdale, Mesa, and San Miguel Counties)

Land Ownership: 41% BLM, 31% Private, 25% USFS, 2% State, 1% National Park Service

Current Objective: Stable to increasing, no population objective for B-5

Current Mortality Objectives (2000 DAU plan): Harvest objective – 100 bears

New Strategic Goal: Stable management, with total mortality and harvest objectives focused on high end for approximately 3 years to decrease the bear population

Total annual mortality objective: 112-208

Total annual harvest objective: 92-188

Black bear Data Analysis Unit (DAU) B-5 is located in southwest Colorado and includes Game Management Units (GMUs) 40, 60, 61, 62, 64, 65, and 70. The DAU encompasses almost 3.7 million acres and includes all of Montrose and Ouray counties, as well as parts of Delta, Gunnison, Hinsdale, Mesa, and San Miguel counties which represent a human population base of almost 250,000. Only about 1/3 of the land is private throughout the DAU, with the majority of private land occurring in the low elevations valleys and the majority of the public land occurring in the elevations above 6,000 ft. B-5 represents some of the best bear habitat in the state with abundant mountain shrub and aspen communities at the higher elevations. Almost 100% of the land in B-5 is mapped as overall range with 19% of the DAU classified as summer range and 25% mapped as Primary habitat.

BACKGROUND

In general, reported black bear mortality in B-5 has increased over the last 25 years. Since 2000, total bear mortality in B-5 has ranged from a low of 47 in 2006 to a high of 174 in 2000, with an annual average of 109 bears. The 3-year average annual hunter harvest is 123 bears, while the 10 year average annual hunter harvest is 109 bears. The majority of harvest occurs during the 30 day Limited September rifle season (51% of annual harvest) with a 3-year average success rate of 21%. Archery and muzzleloader hunters harvest an average of 12 bears and 3 bears, respectively, with success rates of 12% and 8% on a 3 year average. Harvest success rates for the 4 concurrent rifle seasons are moderate, with total harvest across the 4 seasons averaging 22 bears per year over the last 3 years. The majority of the harvest occurs on the Uncompahgre Plateau in GMUs 61 and 62.

The highest mortality years occurred in the late 1990's through the early 2000's, and were probably related to severe drought conditions and catastrophic mast crop failures, causing bears to be mobile and in search of non-traditional food sources making them more susceptible to hunter harvest and control kills. As hunting licenses have stayed relatively stable to increasing over the last 3 years, hunter harvest and success, and other mortality has increased. The recent trends in mortality, as well as age and gender data collected from harvested bears over the last 3 years leads us to believe the population is increasing.

Game damage claims have averaged about 14 per year in B-5 since 2001, with 56% of the claims since 2001 being related to domestic sheep depredation. Conflicts between bears and humans are not uncommon in B-5, but are generally focused in a few specific locals within the DAU. Often these conflicts are the result of anthropogenic food sources being available around houses developed in high quality bear habitat.

A suite of habitat and population models have been developed as part of the revision of the B-5 DAU plan to provide estimates of the projected bear population in the unit. These include a general vegetation/bear density extrapolation, a use/occupancy surface extrapolation based on habitat classifications, and 2 model simulations with varying constraints (liberal and conservative).

SIGNIFICANT ISSUES

The most significant issue regarding bear management in B-5 is game damage and human conflicts.

Game damage claims and human conflicts have stayed relatively stable over the last 10 years. The peak years of conflicts and damage are generally those years when drought conditions or late spring frosts hindered mast crops. There has been a total of 125 game damage claims since 2001, with a total of $169, 675.30 paid out for primarily domestic sheep claims, as well as other livestock depredation, and beehives. Human conflicts generally occur in the Spring months as bears come out of hibernation and are looking for forage, as well as in late Summer and early Fall if higher elevation mast crops are not plentiful. Increased construction and housing development in quality bear habitat is probably the main cause for human conflicts with bears in B-5. Tools to manage conflicts are complex and multifaceted. The structure of a DAU plan focuses on one specific tool, primarily hunting, out of a suite of tools including education, enforcement, and habitat modification that are and will continue to be used to manage conflicts. Unfortunately, the types of conflicts that occur with bears and the landscapes they occur in, often preclude simple changes in licensing or hunting structure from completely resolving the problem.

In addition to managing human conflicts and game damage, managing a sustainable bear population in B-5 for hunting opportunity is a significant issue. B-5 is composed of a lot of high quality bear habitat on public land, allowing for significant opportunity to hunt bears. Limited September rifle licenses for all GMUs are highly sought after with most hunts requiring preference points to draw. In addition to managing the bear population for hunting opportunity, the GMUs encompassed by DAU B-5 are highly sought after for hunting deer and elk, which does create an issue in GMU 61 (managed for quality elk hunting) when trying to minimize conflict with elk hunters who have invested years in trying to draw an elk license.

MANAGEMENT ALTERNATIVES

Currently, B-5 is being managed for a stable to increasing population to maximize hunting opportunity and success. This new DAU plan revision outlines three strategic goal alternatives for bear management in B-5:

Increasing bear population: Total mortality, or off-take, as a proportion of the population should be less than 7%. Proportion of adult males in the harvest should be greater than 35%, with all females making up less than 30% of harvest. Additionally, adult females should comprise less than 45% of the females harvested. Not every management index must be in complete agreement, but most should point toward an upward trend.

Stable bear population: Total mortality, or off-take, as a proportion of the population should fall in the 7-13% range. Proportion of adult males in the harvest should be within 25-35%, with all females making up 30-40% of harvest. Additionally, adult females should comprise approximately 45-55% of the female harvest. Not every management index must be in complete agreement, but most should point toward a stable trend.

Decreasing bear population: Total mortality, or off-take, as a proportion of the population could increase to greater than 13%. Proportion of adult males in the harvest can be low, even below 25%, with total female harvest rates going over 40%. Additionally, adult female proportions in the female harvest can comprise over 55% of the female harvest. Not every management index must be in complete agreement, but most should point toward a population being held below biotic and defined human social tolerance thresholds.

Based on input from 2 public meetings and a 30-day comment period of the draft plan, the Wildlife Commission approved adoption of a strategic goal of **Stable bear management**. However, total and hunter harvest mortality objectives will be directed to the high end of the proportional harvest objective for approximately 3 years to decrease the population. If the population appears to have decreased, then total mortality and harvest objectives will be reduced. During the 3 years of higher mortality objectives, age and gender proportions will still be monitored to assess whether the population is increasing, stable, or decreasing.

Bear Data Analysis Unit Plan for B-5 (Uncompahgre)

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INTRODUCTION

The Colorado Division of Wildlife (CDOW) manages wildlife for the use, benefit and enjoyment of the people of the state in accordance with the CDOW's Strategic Plan and mandates from the Wildlife Commission and the Colorado Legislature. Colorado's wildlife resources require careful and increasingly intensive management to accommodate the many and varied public demands and growing impacts from people. CDOW is responsible for the maintenance of Colorado's big game at population levels that are established through a public review process and approved by the Colorado Wildlife Commission.

DAU PLANS AND WILDLIFE MANAGEMENT BY OBJECTIVES

To manage the state's big game populations, the CDOW uses a "management by objective" approach (Figure 1). Big game populations are managed to achieve objectives established for DAUs.

DAUs are geographic areas that typically contain an individual big game population. For large mobile carnivores like black bears DAUs are primarily administrative constructs with generally similar habitats and/or human social considerations. DAUs are composed of smaller areas designated as game management units (GMUs), which provide a more practical framework where the management goals can be refined and applied on a finer scale, typically through hunting regulations.

The DAU plan process is designed to balance public demands, habitat and big game populations into a management scheme for the individual DAU. The public, hunters, federal and local land use agencies, landowners and agricultural interests are involved in the determination of the plan objectives through input given during public meetings, the opportunity to comment on draft plans and when final review is undertaken by the Colorado Wildlife Commission.

The strategic goals and specific mortality objectives defined in the plan guide a long term cycle of annual information collection, information analysis and decision making. The end product of this process is a recommendation for numbers of hunting licenses for the DAU (Figure 1). The plan also specifically outlines the management techniques that will be used to reach desired objectives. CDOW intends to update these plans as new information and data become available, at least once every ten years.

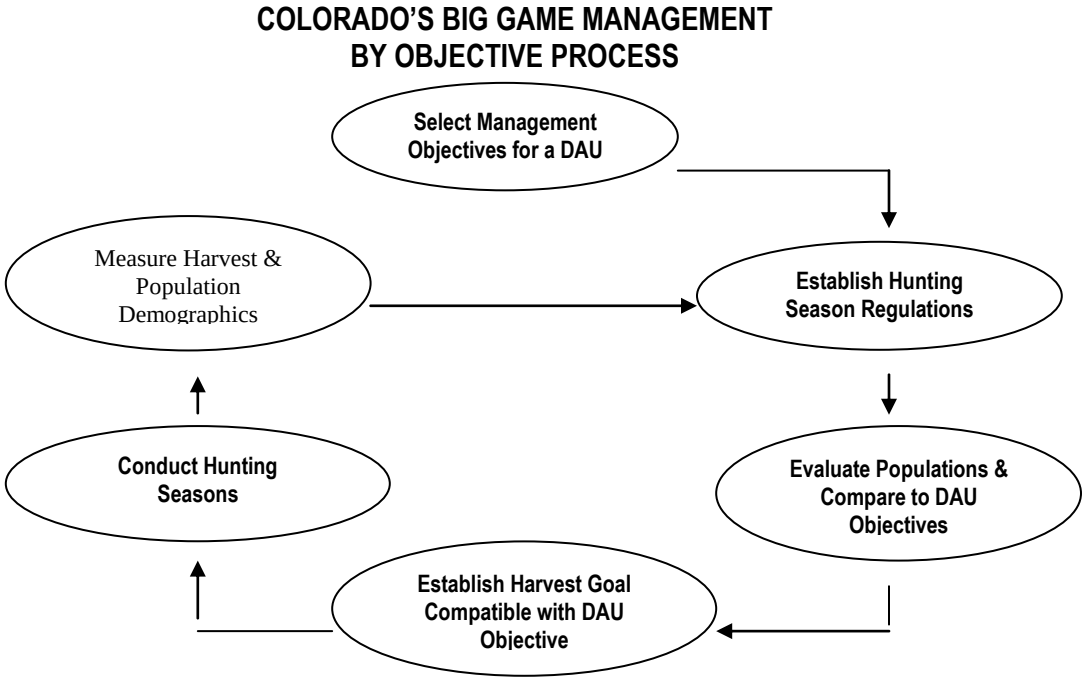

Figure 1. Management by objectives process used by the CDOW to manage big game populations on a DAU basis.

DATA ANALYSIS UNIT DESCRIPTION

Location

Data Analysis Unit B-5 encompasses almost 3.7 million acres (14,863 km^2) of land in southwestern Colorado and includes all of Montrose and Ouray counties and parts of Delta, Gunnison, Hinsdale, Mesa, and San Miguel counties (Figure 2). B-5 includes Game Management Units 40 (1,927 km^2), 60 (617 km^2), 61 (2,399 km^2), 62 (3,569 km^2), 64 (698 km^2), 65 (1,740 km^2), and 70 (3,914 km^2) and includes parts of the Uncompahgre, San Miguel, Gunnison, Dolores, and Colorado River drainages. The DAU is bounded on the north by the Colorado River; on the east by US Highway 50, Colorado Highway 92 to the Gunnison River, Big Blue Creek, Big Blue Creek-Cimarron Creek divide; on the south by the Ouray-San Miguel County line, San Miguel-San Juan County line, San Miguel Dolores County line, and on the west by Disappointment Creek, the Dolores River, Summit Canyon Creek and the Utah state line.

Thirty-one percent (~1.15 million acres) of the DAU is private, with the Bureau of Land Management (BLM) being the largest land manager at 41% (~1.5 million acres), the U.S. Forest Service manages 25% (~907,000 acres) of the DAU, the State (Colorado Division of Wildlife, State Land Board, State Parks) manages 2% (~66,700 acres), and the Nation Park Service manages 1% (~36,500 acres) of the DAU, as illustrated in Figure 2. Almost 100% of the DAU is mapped as overall bear range, with 19% identified as summer concentration habitat (Figure 3). The habitat in B-5 is ideal for bears with abundant mountain shrub communities for mast and berry forage, along with plentiful aspen communities and pinyon-juniper communities. B-5 is a very productive bear population drawing a lot of interest from hunters for bears and deer and elk as well. B-5 had the second highest bear harvest in the state in 2009 with 117 bears harvested through the hunting seasons.

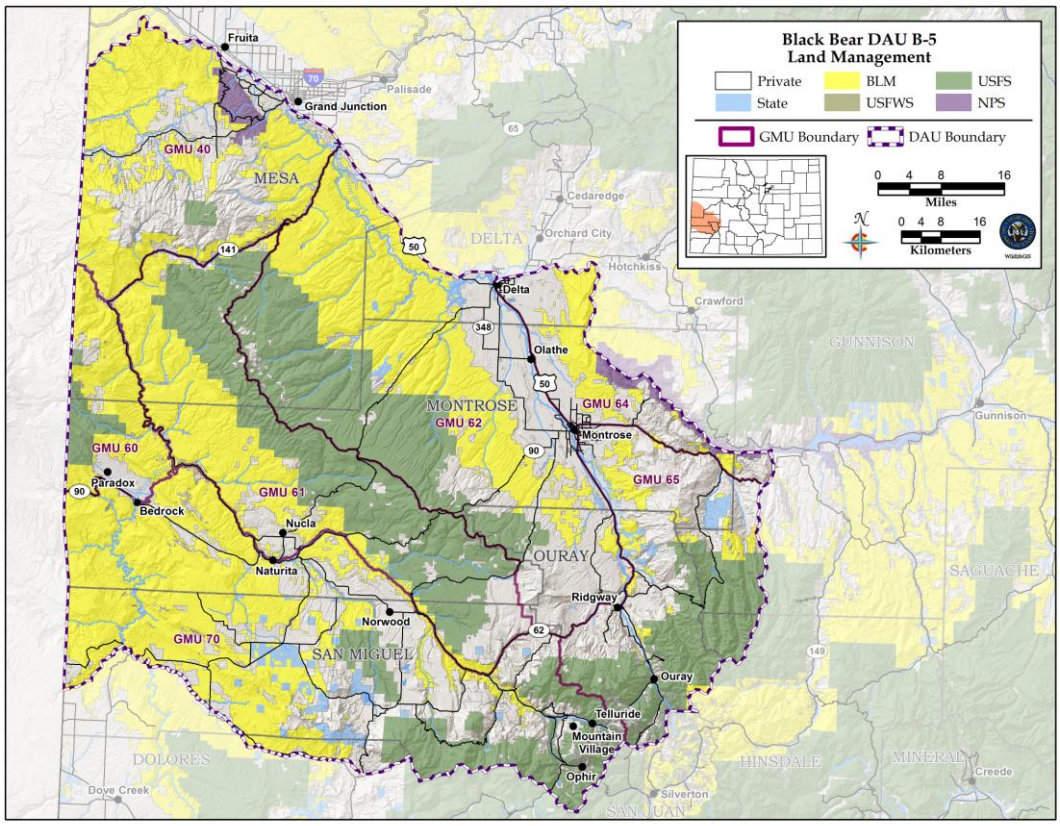

Figure 2. Location and land management status of DAU B-5.

Land Use And Land Status

The majority of the human population resides in Grand Junction (Mesa County), Delta (Delta County), and Montrose (Montrose County), which lie in the Uncompahgre and Grand Valleys where bear habitat is marginal, unless catastrophic forage failures occur in the higher elevations. The majority of human conflict with bears is in communities in natural bear habitat including Loghill Village, Ouray, Telluride, Mountain Village, Norwood, Nucla, and even Gateway, where peach orchards are the main attractant for bears. Most human conflict tends to be with bears hitting garbage cans and bird feeders, construction sites, livestock, and fruit orchards. Since 1960, the human population has increased by 260%, from 94,833 in 1960 to 247,168 in 2009 within the counties encompassed by B-5. Human encroachment into bear habitat is the primary cause for increasing human conflict.

Outdoor recreation is a significant past time for residents and tourists to the counties that encompass DAU B-5. Hunting and fishing generates $27,840,000 in Delta County, $53,140,000 in Gunnison County, $3,000,000 in Hinsdale County, $76,100,000 in Mesa County, $29,180,000 in Montrose County, $3,440,000 in Ouray County, and $17,380,000 in San Miguel County for a combined total of $210,080,000 (BBC Research & Consulting 2008).

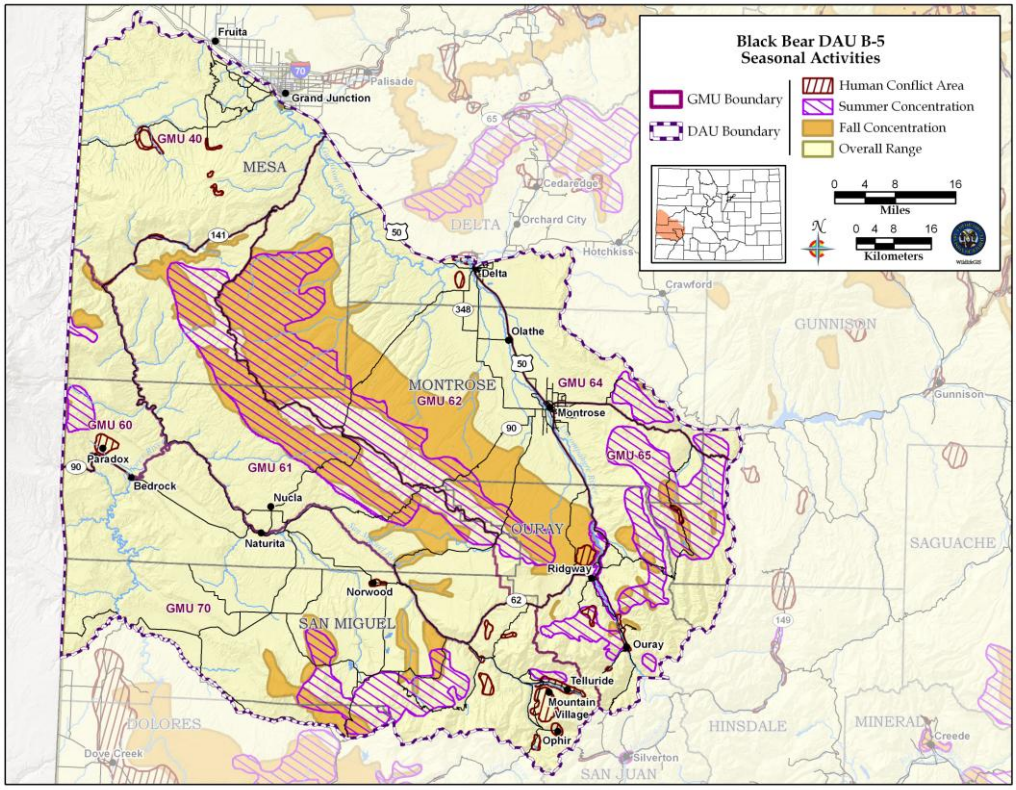

Figure 3. Black bear activity layers in B-5.

Topography And Climate

Elevations in the DAU range from approximately 4,600 ft along the Dolores River and the Colorado River near Utah on the western and northern boundary of the DAU to over 14,000 feet in the San Juan and San Miguel Mountains along the southern end of the DAU. The Uncompahgre Plateau (GMUs 61 and 62), in the middle of B-5, is the single biggest land feature within the DAU. The Plateau is a broad structural uplift that consists of a relatively flat 9,000-9,800 foot summit that runs northwest from Ridgway to the Unaweep Canyon. The lower elevations of the DAU below 6,500 ft are usually hot and dry during the summer and generally remain snow free during most of the winter. Precipitation in the lower elevations averages around 9-11 inches per year. Elevations 6,500-8,000 ft usually have persistent snow only between late November and March. Areas above 8,000 ft can receive heavy snowfall and from December through late April are generally inaccessible except by foot or snow

machine. Annual precipitation above 8,000 feet is usually 15 inches to 30 inches at the highest elevations. Monsoonal moisture between July and September is an important source of precipitation at all elevations and can be extremely important to berry and mast in the shrub communities.

Vegetation

Elevations below approximately 6,500 ft near the Dolores, Colorado, San Miguel, Uncompahgre and Gunnison Rivers, is where a high desert plant community is the predominant, extant vegetation type. Important plant species of this community include four-wing saltbush, shadscale saltbush, black sagebrush, winterfat, broom snakeweed, rabbit brush, greasewood, and, in the Gateway area, black brush. Elevations between approximately 6,000-7,500 ft are characterized by pinyon pine and Utah juniper woodlands and grassland/shrub (e.g., basin big sagebrush, black sagebrush, Wyoming/mountain big sagebrush, mountain mahogany, Indian ricegrass). From approximately 7,500 to 8,500 ft, ponderosa pine/mountain shrub (e.g., Gambel oak, serviceberry, mountain mahogany, mountain big sagebrush, silver sagebrush, snowberry, and manzanita) is the dominant vegetation type. Elevations above 8,500 ft are generally characterized by aspen forests and a mixed spruce-fir complex (aspen, Douglas fir, sub-alpine fir and Engleman spruce). Common plant species found in lowland riparian areas in the DAU include narrowleaf cottonwood, coyote willow, chokecherry, tamarisk, and boxelder. In higher elevation riparian areas characteristic species include thinleaf alder, birches, willows, and blue spruce.

Agricultural areas and cultivated croplands within the DAU occur primarily in the Uncompahgre and Grand Valley between Montrose, Delta, and Grand Junction, as well as on the west side of the Uncompahgre between Norwood to Nucla. Fruit orchards are plentiful throughout the valleys as well as in Gateway.

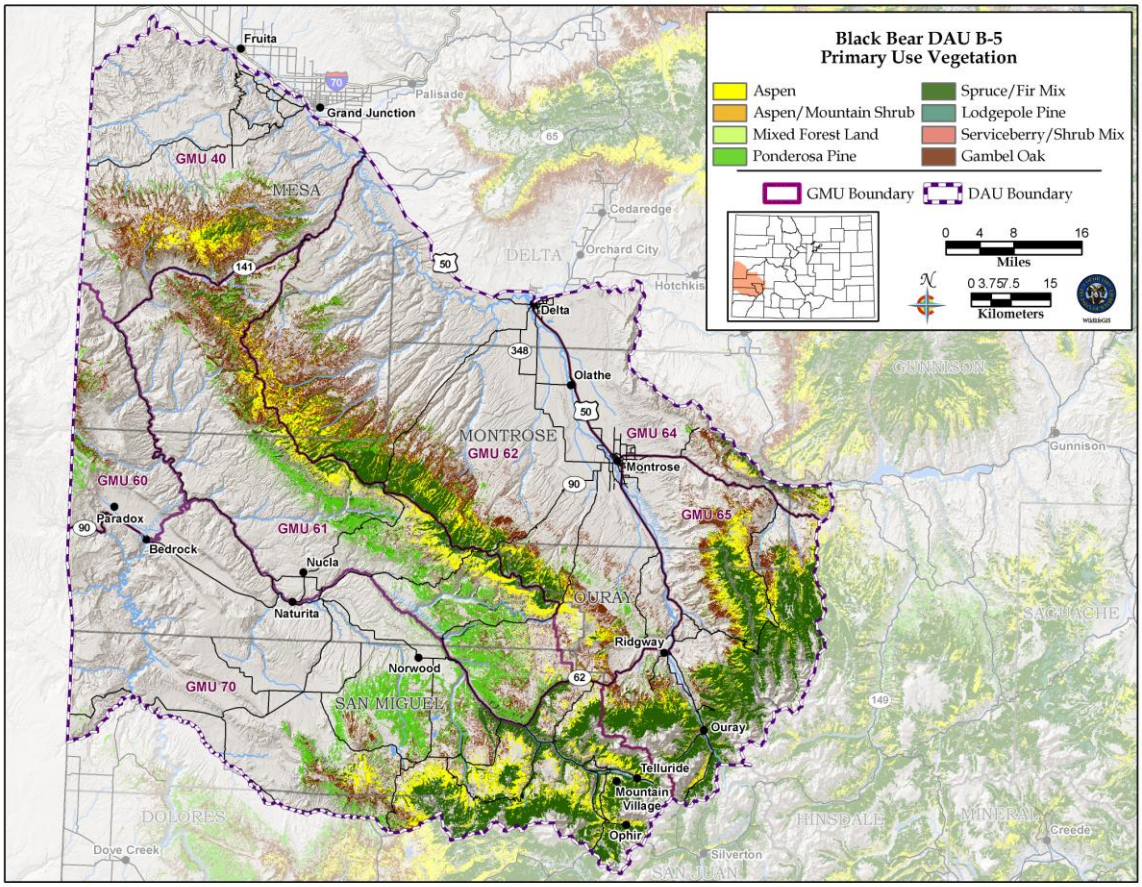

Figure 4. Vegetation classes in B-5.

MANAGEMENT HISTORY

Administrative

The current DAU boundary, including GMUs 40, 60, 61, 62, 64, 65, and 70, has been in place since 2003. Prior to 2003, GMU 66 was included in the B-5 DAU, but was removed and placed in DAU B-12 to manage bears throughout the Gunnison Basin more consistently.

Hunting Seasons

Prior to 1935, black bears were not considered a game animal, which afforded them no protection from being shot on sight if they were encountered, or preyed on livestock. In 1935, they were awarded some protection by being classified by the state legislature as a game animal. This established limits on the annual harvest and on the number of licenses that an individual could possess. From 1935 to 1963, bears were hunted in the fall usually concurrently with the annual deer and elk seasons. In 1964, a spring hunting season was established with unlimited licenses available. This continued until 1986, when licenses for the spring season were limited (Beck 1991). The fall hunting seasons occurred concurrently with the established deer and elk seasons and licenses were unlimited until the limited September rifle seasons were established in 1989. Hunters wishing to hunt bears during the established deer and elk season still had access to unlimited licenses until 2005 when license caps were established for these licenses (Appendix B).

In 1992, a constitutional amendment was passed and changed bear hunting within the state by preventing bear hunting prior to September 1st and outlawed the use of bait and dogs as aids for hunting black bears. Since 1992, the annual hunting seasons have begun on September 2nd annually.

Since 2000, hunting seasons have started with an early, limited, rifle season that runs from September 2nd through September 30th each year, along with concurrent Archery, Muzzleloader, 1st, 2nd, 3rd and 4th rifle season licenses. Under the current season structure, the 4 concurrent seasons are 5 days, 9 days, 9 days and 5 days in length. In addition to the limited September rifle licenses, Private Land Only (PLO) limited September licenses and PLO Late season licenses were added to the whole DAU in 2009 (prior to 2009, only GMU 40 had PLO Sept. licenses). Harvest is concentrated in the limited September rifle season as it is concurrent with the initial phases of the bear hyperphagia period. Harvest and success rates decline as hunting seasons progress through the fall months (October-November) due to bears entering the initial stages of hibernation.

License Allocation History

License allocation in B-5 has been directed by season structure, as well as to manage hunter and harvest distribution across the DAU and to minimize disturbance to the quality elk hunting experience in GMU 61. Prior to 2006, all license holders were allowed to hunt any GMU within the DAU. However, since 2006, the huntcodes were broken up to better distribute hunters throughout the DAU, since GMUs 61 and 62 were being hunted disproportionately to the rest of the DAU. The GMUs were broken out with 40 by itself, 60 and 70 combined, 61 by itself, and GMUs 62, 64, and 65 combined. GMU 40 is relatively isolated from the rest of the DAU due to most access into the unit coming from the Grand Junction area and the fact that the majority of high quality bear habitat occurs on private land. GMUs 60 and 70 were combined due to their proximity to each other on the west side of the DAU, and to reflect minimal bear habitat in GMU 60 and a high amount of bear habitat in GMU 70. GMU 70 also has some areas where human conflict occur, primary around the Telluride and Mountain Village areas where human development occurs in high quality bear habitat. In addition to human conflict concerns in GMU 70, there is also some concern for bear conflict with depredation of livestock throughout the GMU. GMU 61 is being managed by itself due to the high quality of bear habitat available and the fact that GMU 61 has limited numbers of elk and deer hunters due to the quality management objectives in the unit. GMU 61 is managed for quality elk hunting and requires 6-12 preference points for residents and 13-17 preference points for non-residents to draw an elk license depending on the season. GMUs 62, 64, and 65 were combined due to their geographical distribution on the east side of the DAU and to spread out hunters and harvest into GMUs 64 and 65. Units 62, 64 and 65 also have some issues with

livestock depredation by bears, primarily on domestic sheep, in addition to some human conflict areas primarily between Ridgway and Ouray in GMU 65.

Due to the high quality of bear hunting in DAU B-5, September rifle licenses are in high demand across the DAU with limited licenses requiring preference points to draw, with residents needing 0-5 preference points and non-residents needing at least 1-7 preference points depending on the GMU of interest. Furthermore, archery and muzzleloader licenses that are currently allocated as OTC with a cap, have been limited to match prior limited license management of the seasons, which means that licenses are generally sold within minutes of being available for purchase. Bear licenses available during the regular rifle seasons are required to be used with a "like season, method of take, and unit" deer or elk license, which means those licenses are mostly used outside of GMUs 40 and 61 due to their limited licenses availability for deer and elk hunters. Figure 5 depicts the number of bear licenses sold in B-5 during the last 10 years.

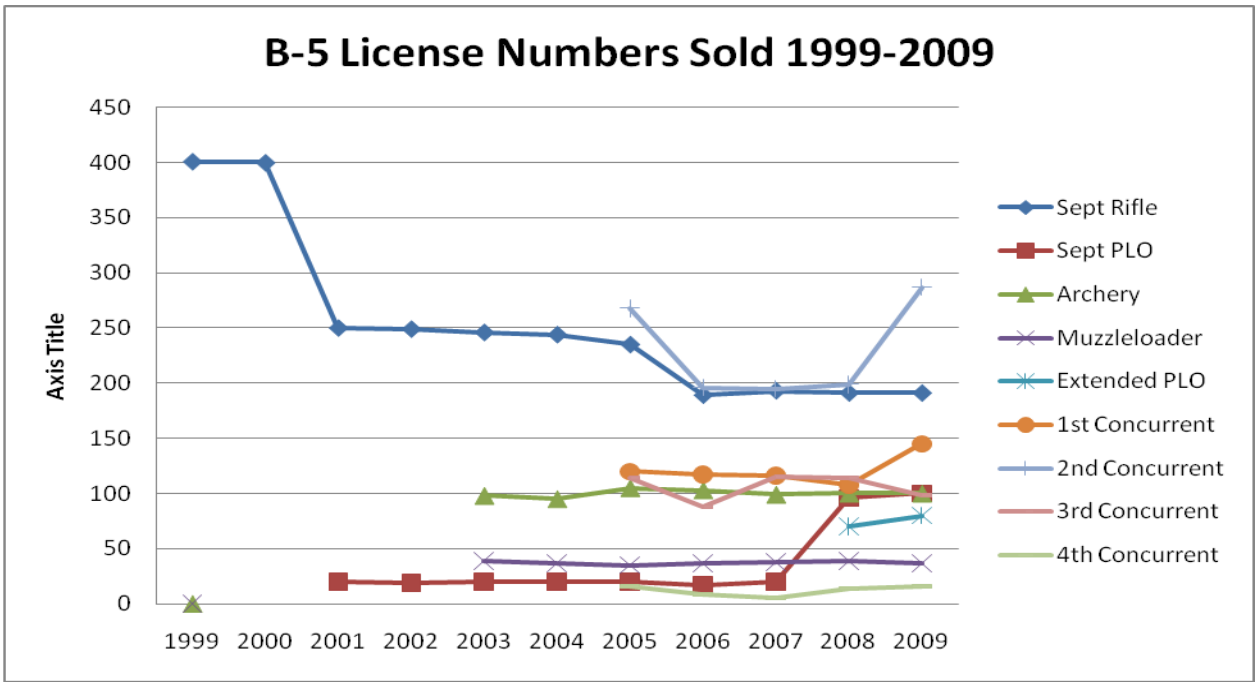

Figure 5. B-5 specific license numbers sold from 1999-2009 for all seasons and all GMUs (values missing during earlier dates mean they were unlimited and available statewide).

Mortality- Harvest and Non-Harvest

Annual hunter harvest in DAU B-5 is usually one of the highest in the state, with the 2009 harvest being the 2nd highest in the state at 117 bears. Figure 6 illustrates annual B-5 hunter harvest over the last 25 years broken out by male and female bears harvested. The proportion of female harvest over the last 10 years has been 36%, but over the last 3 years has only been 33%, which may be a factor of decreased hunting licenses being available during September from 2006-2009 and a subsequent increase in overall bear population. Licenses were slightly decreased from 2006-2009, following a decrease in hunter success, and a perceived decline in the bear population following the extremely high harvest years from 1999-2002 when drought and spring frost events were prevalent.

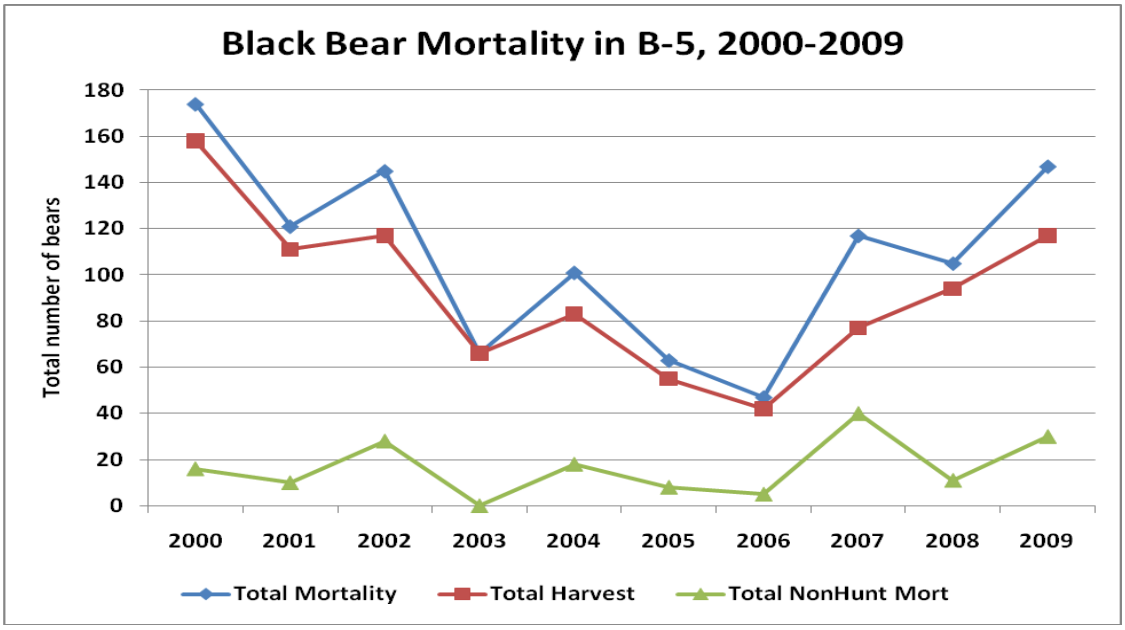

Figure 6. Total black bear mortality in B-5.

Bear harvest in B-5 occurs primarily in GMUs 61 and 62 on the Uncompahgre Plateau, due to the high quantity and quality of habitat the Plateau provides (Figure 7). The Uncompahgre Plateau is probably the source population for the surrounding GMUs with lower quality habitat. However, harvest rates of females in GMUs 61 and 62 are generally higher than the other GMUs, and may indicate that the Uncompahgre Plateau is acting as a sink.

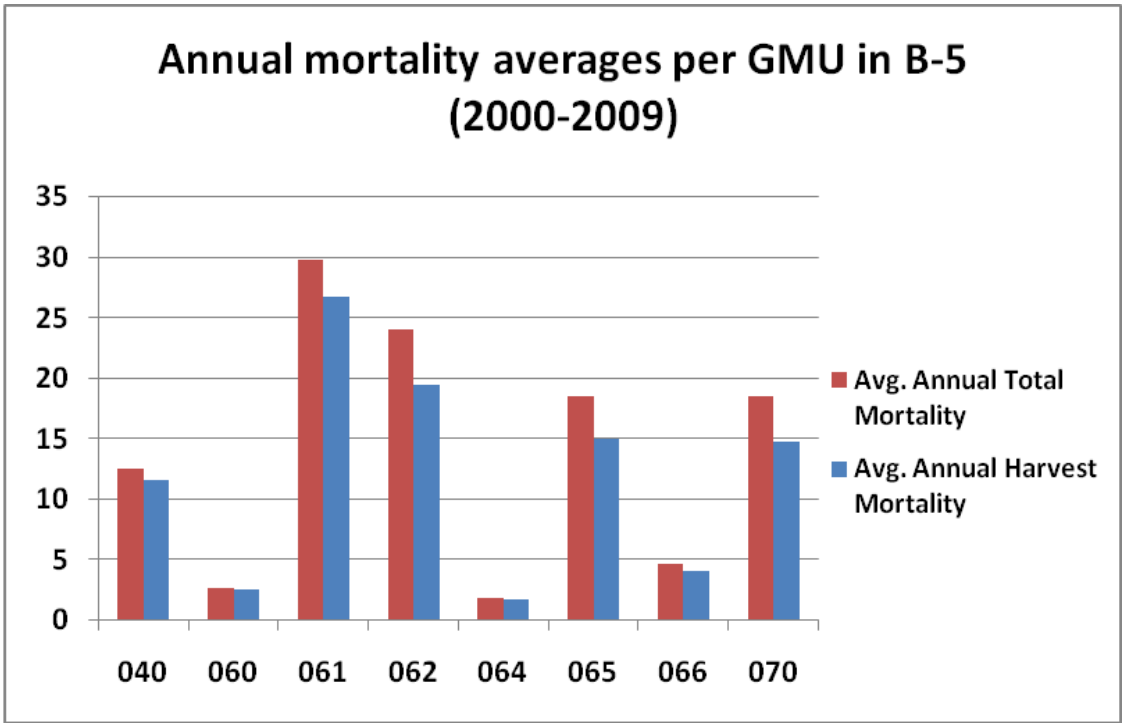

Figure 7. Annual average hunting and total mortality by GMU (2000-2009).

The proportion of females in the B-5 harvest has fluctuated over the last 20 years (Figure 8). Proportional harvest of females was highest during the late 1990's and early 2000's, however, over the last 3 years female harvest has decreased. The 3-year average proportion of females in the harvest

was 33%, while the 10-year average was 36% of females in the harvest. Non-harvest mortality is usually higher in the male population segment with females accounting for 24% and 35% of the non-hunt mortality over the 3-year and 10-year periods. Non-hunt mortality is generally focused on bears as they are bolder than females and typically kill more domestic livestock.

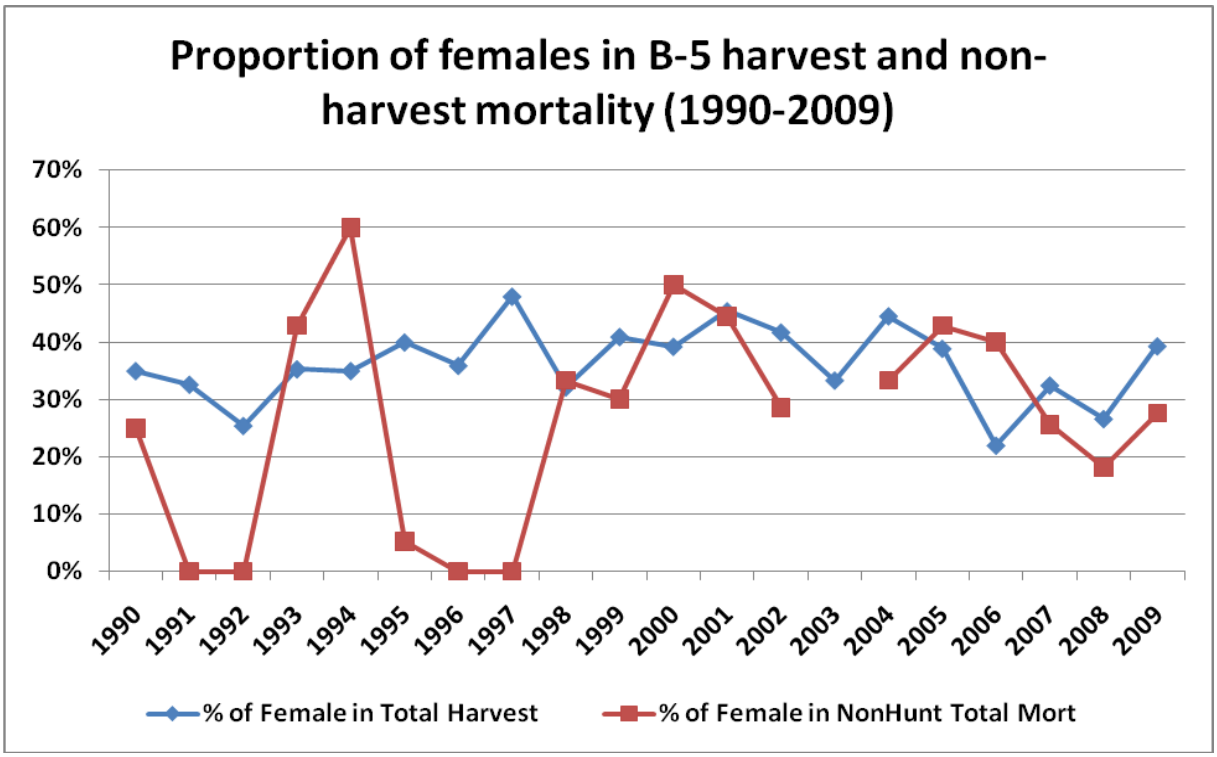

Figure 8. Proportion of females in B-5 harvest and non-hunt mortality.

Mortality- Method of Take

Over the last ten years, 52% of the bear harvest in B-5 has occurred during the 30 day limited September rifle (52%) season with a 3 year average success rate of 21% (Table 1). Archery and muzzleloader success rates tend to be good at 12% and 8%, respectively, and could contribute more to harvest, but license numbers are limited. The lowest success rates are generally during the regular rifle seasons, especially as the seasons progress with very few bears being harvested during the 3rd and 4th rifle seasons due to the onset of hibernation.

Table 1. Black bear harvest history, by method of take in B-5 (2000-2009).

YEAR	Archery Harvest	Muzzleloader Harvest	September Rifle Harvest	1st-4th Rifle Season Harvest	September PLO Rifle	Extended PLO Rifle
2000	32	13	109	4		
2001	32	16	48	11	4	
2002	33	10	57	12	5	
2003	6	3	32	20	6	
2004	9	6	60	5	3	
2005	6	1	22	24	2	
2006	3	3	23	11	0	
2007	15	2	44	10	6	
2008	8	1	33	33	11	9
2009	14	6	51	22	20	3
Avg	15.8	6.1	47.9	15.2	6.3	6

Mortality- Age and Gender

Beginning in 2007, a premolar was extracted from harvested bears and other deceased bears handled by CDOW. These teeth were collected and submitted annually for aging via cementum annuli sectioning. Since bear age data have only been collected for 3 years, the sample sizes particularly when broken into classes, can be small (total sample across 3 years in B-5 is 261 bears).

The technique of counting annual rings in cementum of bear teeth is a reliable method for determining ages of black bears (Harshyne et al. 1998, Costello et al. 2004). This is especially true for bears less than five years of age. For bears five years of age or older, errors increased with the age of the bear (McLaughlin et al. 1990, Harshyne et al. 1998, Costello et al. 2004). Since most female black bears in Colorado do not reproduce until their 5th year, classification of females into sub-adult (non-reproducing) and adult (reproducing) age classes using cementum annuli is quite reliable. Therefore, all female black bears age five and over are considered adults for the purposes of harvest data analyses. Cementum analysis of 12 female black bears indicated that the mean age of primiparity is 5 years and the mean birth interval is 2 years.

Below are figures showing the frequency of each bear year-class, by gender from the 2007-2009 dataset (Figure 9 & 10). Both harvest and non-harvest mortality sample sizes are greatly skewed towards the sub-adult age classes. In the case of males, the majority of black bear mortalities were in the 1.5-3.5-year old classes, however, multiple boars were harvested out to 17 years of age, indicating we have a healthy bear population. Further analysis of age and gender data indicate that the population is probably stable based on only 27% of the harvest coming from adult (5+ years of age) males and 35% of the harvest being female, and 47% of the harvested females being adult.

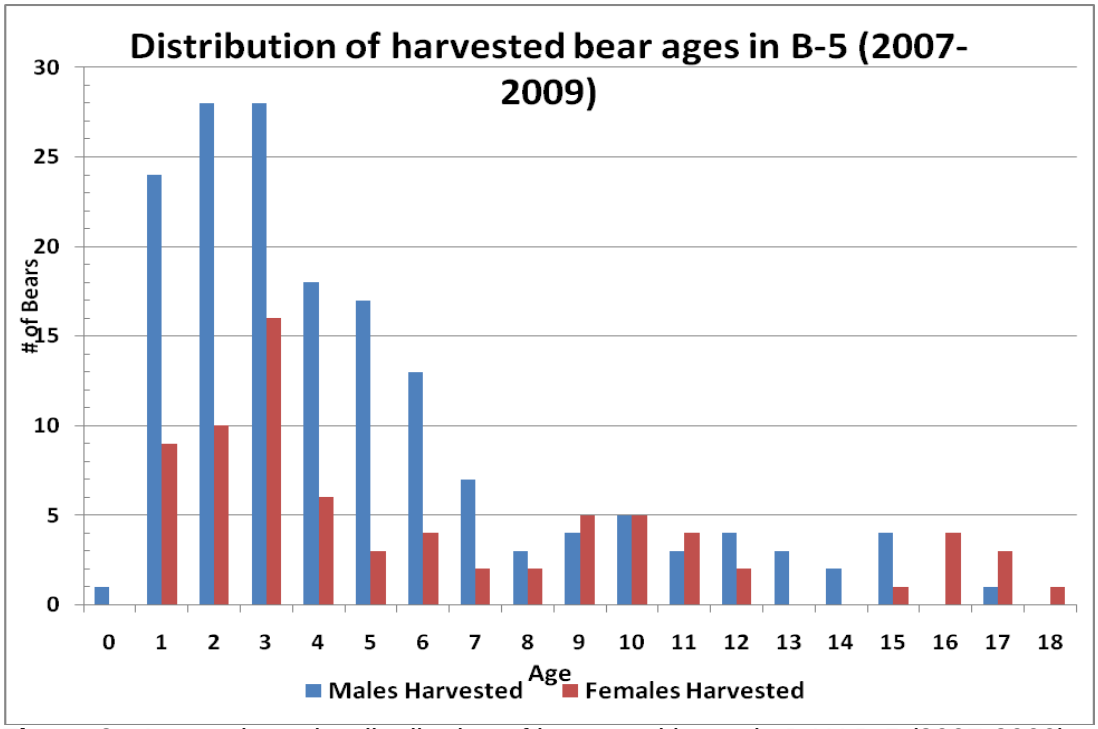

Figure 9. Age and gender distribution of harvested bears in DAU B-5 (2007-2009).

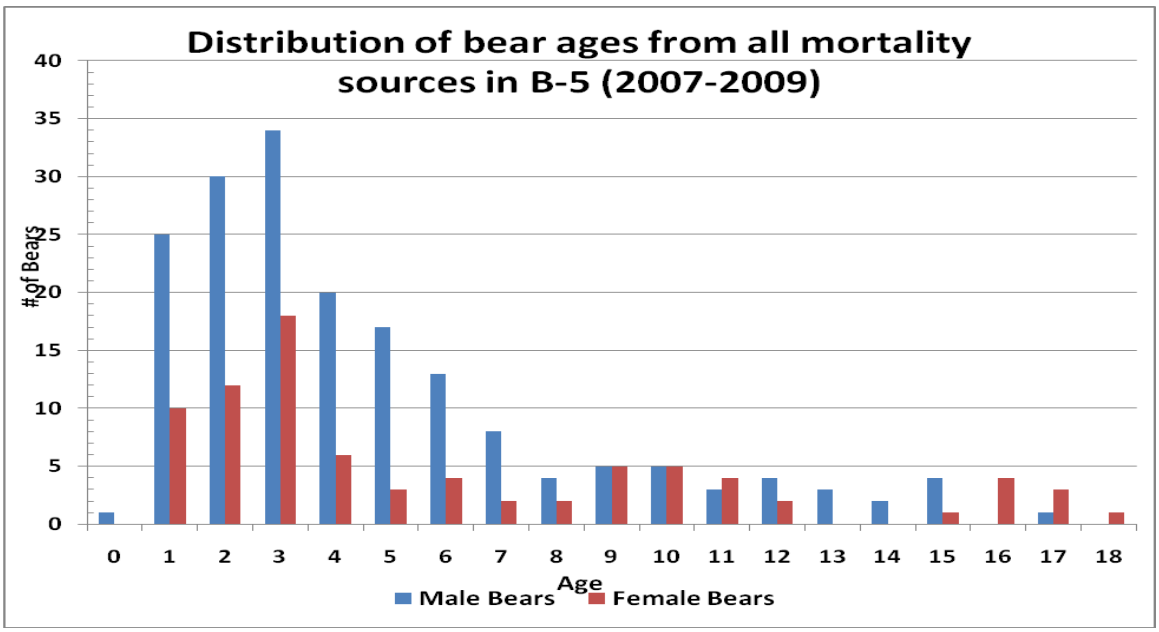

Figure 10. Age distribution of bears from all mortality sources in B-5 (2007-2009).

Mortality- Non-harvest

Non-harvest black bear mortality in DAU B-5 is primarily related to control kills related to human-conflict by Wildlife Services and CDOW, in addition to landowners killing bears to protect livestock and property, and even vehicle collisions. Non-harvest mortality seems to be increasing; however, a few key events have probably been the main cause for spikes in non-harvest mortality (Figure 11). During the years, 1999-2003, drought conditions and spring frost events persisted throughout the DAU, causing a decrease in available natural forage, and an increase in human and agricultural conflict as bears were moving to non-traditional, lower elevation areas to find forage. In addition, in 2007, bears appeared to be depredating on livestock at a higher than average rate, or at least control kills were being reported more than usual. Then, in 2009, multiple bears were killed in association with a person who had been feeding bears and that person being fatally attacked by a bear near Ouray. The majority of conflict mortality has been by males with an average of 35% of the non-hunt mortality coming from females over the last 10 years and only 24% coming from females on a 3-year average. GMU 62 has the highest amount of non-harvest mortality related to depredation on domestic sheep, while GMUs 65 and 70 also have a high amount of non-harvest mortality that is related to domestic sheep depredation and human conflict around the towns of Ouray and Telluride.

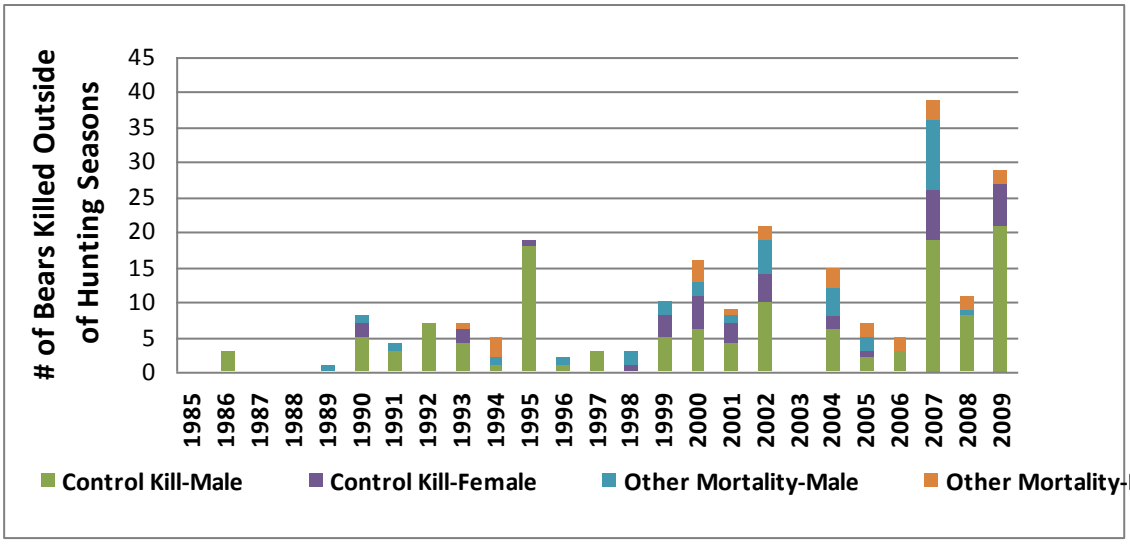

Figure 11. The number of bears killed annually in addition to hunter harvest in B-5 over the last 25 years, broken out by control kills and other mortality (usually vehicle collisions).

Game Damage And Human Conflict Management

The state of Colorado is liable for damage to livestock and personal property used in the production of an agricultural product. Prior to 2001, the State paid damage to any personal property occurring damage. Since 2001, B-5 has had 127 game damage claims caused by black bears totaling $169,675.30. Domestic sheep claims represent the majority (56%) of claims filed and paid out across the DAU at $107,749.97 (Figure 12).

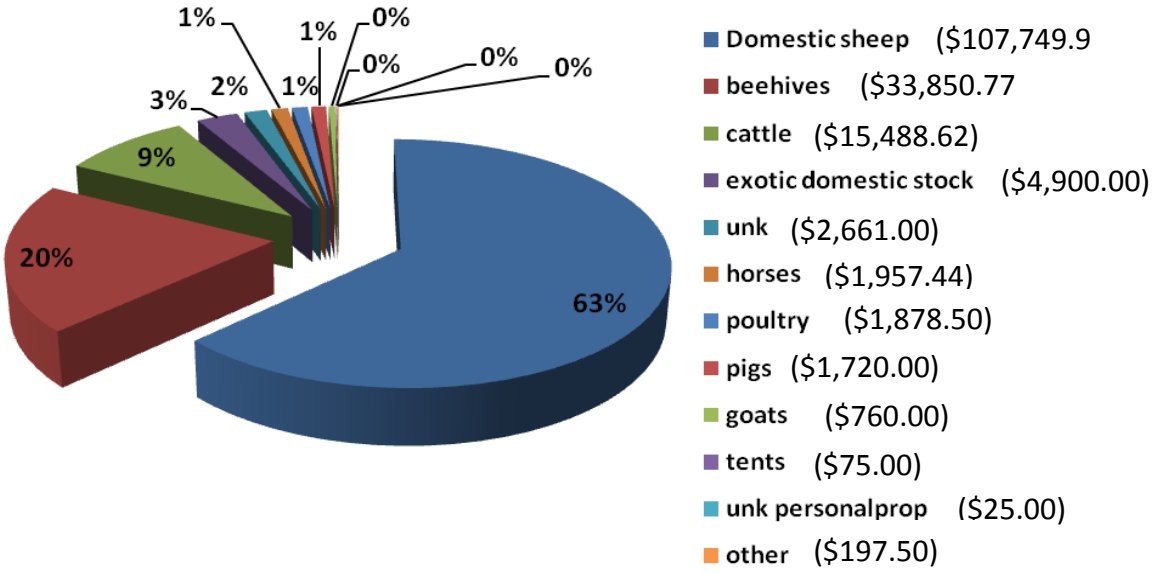

Figure 12. The proportion of game damage claimed in the DAU by type of claim from 2001- 2010.

Human conflicts with black bears in B-5 are not unusual occurrences. In many cases, human interactions with bears are reported to the CDOW call centers or field staff. This subset of conflicts is documented in written form by CDOW staff and range from a second hand report of a bear being seen in a town or suburb to a physical incident between a bear and a person. While these conflict reports provide a snapshot of individual incidents, lumping reports into categories or evaluating summary statistics can be misleading. There are a number of issues related to capturing the location of the incident versus the location the report was filed from, the reliability of some reports and the bias in reporting associated with increased media coverage on an event or location that can all significantly increase or decrease the number of conflict reports. The CDOW continues to document reported human conflicts with bears, and will continue to improve and refine the system and methods used for collecting and synthesizing those reports. Bears involved in conflicts will be handled per policy at the discretion of the field officer or supervisor.

Current Harvest And Non-Harvest Mortality Objectives

The current bear harvest objective identified in the 2000 B-5 Black Bear DAU (Watkins 2000) plan was to harvest a maximum of 100 bears per year. No non-harvest mortality objective was identified in the 2000 DAU plan, however, the harvest objective and the total mortality objective were used synonymously in setting annual license numbers. During the years 2003-2008, a reduced harvest objective was used to reflect a decrease in hunter success and a perceived decrease in the bear population following the severe drought conditions and mast failures of the early 2000's. In 2009, the harvest objective was returned to 100 to reflect a desire to harvest more bears with hunters than through control kills, as control kills spiked in 2008.

MANAGEMENT CONSIDERATIONS

Black bears have been classified as big game in Colorado since 1944. Yet the first black bear management plan was not developed until 1990, following seminal research in the Black Mesa area in western Colorado. Most of the fundamental aspects of black bear demographics, survival and reproductive strategies, physical characteristics, and behaviors described by Beck (1991) and by Gill and Beck (1990) hold true today.

Black bears live at relatively low densities compared to other big game species. They are relatively late maturing and slow reproducers. At high mortality levels, especially if the mortality is driven by poor natural forage conditions, the proportion of females in total mortality increases. When combined with poor reproduction and recruitment the high mortality levels may result in a population decline if a large area is affected or if there are no source areas nearby to produce dispersing sub-adult black bears. In source areas, black bear populations are limited by the capacity of the habitat to support black bears and their social structure. Some species compensate for excessive adult mortality by producing more young. However, black bears do not respond in this manner. High adult mortality tends to result in a younger age population and lower productivity (average number of young per litter). Young male black bears disperse from their mother's home range when they are 1.5 to 2.5 years old and often travel long distances to occupy vacant habitat. However, young female black bears rarely disperse far. As a result, black bear populations far from source areas are slow to recover from over-harvest.

Colorado has elected to adopt a form of source-sink management wherein DAUs will be managed with different overall management strategies. Sink areas will be geographically dispersed and should be allied with corresponding stable/increasing management areas in order to provide proximity to source areas. Other States and Provinces have followed a similar construct under varying names, including light, moderate, or heavy harvest regimes; population increase, stable, or reduction strategies; and population growth, maintenance, or suppressed strategies. Each term is relative because managers can't know with absolute certainty how many bears there are or what the precise population trajectory may be at the moment. Thus, by necessity harvest or population management strategies must choose a relative approach.

Bears are primarily solitary and their survival strategies do not lend themselves to easy or inexpensive inventory methods. Consequently, managers must rely upon indirect information and indices to monitor population status and trajectory. Although many States and Provinces have adopted similar gender and age class indices, in few circumstances have these indices been directly tested experimentally. Rather, they have resulted from relatively few observational studies within the then existing management frameworks. From these certain conclusions were arrived at based on the observed data and inferences made about the relative vulnerability of age classes and gender cohorts.

Certain age class and gender cohort indices have been shown to have the same values in both increasing and declining populations (Costello et al. 2001), and so caution is always advised to observe them over time rather than instantaneously. If total harvest or mortality in relation to the actual population size (absolute harvest or mortality rate) is quite small, then the relative proportions used by certain indices could have no real relationship to a population effect. Therefore, rather than relying on a few indices, it may be more appropriate to describe and use a suite of indices to inform management decisions. The following indices will be evaluated in relation to black bears in DAU B-5: habitat models and forage condition monitoring, mortality density, population modeling, hunter success rates, age class and gender composition in harvest, human-bear conflicts, and game damage.

Habitat Models

Habitat use by black bears primarily depends on the season and available forage. Most black bears in B-5 appear to use the lower elevation pinyon-juniper habitats only in early spring and late fall as they are free of snow and have juniper berry or pinyon nut crops. Primarily black bears in the DAU use higher elevation mountain shrub and aspen communities throughout the summer and fall as they have the most abundant and highest quality forage. However, in B-5 we do get higher than expected use of low elevation riparian areas by bears when berries are plentiful.

Two different habitat models have been developed to relate bear use, occupancy and forage value to bear densities to project population estimates. The population projections use densities derived from relevant Colorado data and from literature. Managers applied densities representative of similar habitats and vegetation types in Colorado to develop population projections and then select population ranges which best represent current conditions in the DAU,

General Vegetation/Bear Density Extrapolation

The first model, developed by Gill and Beck (1991) in an unpublished report to the Wildlife Commission was later updated by Apker (2003) in an internal CDOW report. This model applies subjective black bear densities for various vegetation types to the amount of land those vegetation types represent in a given DAU. The vegetation types were derived from the landsat GAP project coarse vegetation type analysis. This habitat model provides a single estimate of black bear population potential, based on habitat types derived in the GAP process, and doesn't account for change in habitat types over years or social factors affecting bear populations. Based on the vegetation types mapped in B-5 and the density estimates applied to the vegetation types, the projected B-5 population estimate was 1,246 (Table 2).

Table 2. B-5 projected bear population estimate based on a habitat model derived by Gill and Beck (1991) and modified by Apker (2003).

Common Name	Square Miles of Veg. Class in DAU	Acres of Veg. Class in DAU	Percent of DAU that is Veg. Class	Bear Density as 1 bear/X mi^2	Bear Numbers
Aspen	396.59	253816	6.91%	1	397
Douglas fir	36.89	23612	0.64%	8	5
Forest dominated wetland/riparian	12.10	7744	0.21%	10	1
Gambel oak	483.90	309698	8.43%	1	484
Juniper woodland	351.90	225217	6.13%	20	18
Mesic upland shrub	18.55	11873	0.32%	6	3
Pinyon Juniper	1853.81	1186440	32.29%	8	232
Ponderosa Pine	375.27	240173	6.54%	6	63
Shrub dominated wetland/riparian	2.78	1779	0.05%	10	0
Spruce fir	396.98	254066	6.91%	10	40
Subalpine meadow	45.32	29005	0.79%	10	5
TOTAL	**3974.10**	**2543423**	**69.22%**		**1,246**
Square miles in DAU = 5732.88					

Use / Occupancy Density Surface Analysis

The second habitat model was developed in 2008, using the DOW Basinwide GIS Vegetation Classification project data (Figure 4) and CDOW managers were asked to rank each vegetation type for its utility as basic bear habitat (use/occupancy) and then what its relative forage value was. This results in a two tiered habitat ranking system. Use/occupancy was defined at 4 levels; primary, secondary, edge, and out. Relative forage value was rated for primary, secondary, and edge habitat based upon the perceived potential of those habitats to provide forage for black bears. Use/occupancy terms are defined as follows:

Primary – cover types that bears typically and normally are found at various times of year.
Secondary – cover types that bears occasionally use but is not preferred.
Edge – cover types infrequently used, but bears may be found in when adjacent to Primary

cover types.

Out – cover types that are not black bear habitat or those in which bears would only travel through.

The result of this use/occupancy analysis provides tables of bear habitat in terms of its relative use and state of occupancy and their potential relative forage value. This resulted in a matrix for assigning habitat quality and subsequently for assigning bear densities to different habitat quality to extrapolate a potential population. Table 3 provides the results of the surface area analysis for B-5 and utilizes density values that will be discussed below. The population results for B-5 can be incorporated into modeling efforts or used as a comparison to independent population model runs.

Table 3. Results of habitat surface area analysis for use/occupancy population projection in B-5.

DAU	GMU	Out Acres	Primary Habitat Acres	Independent Bear Density	Secondary Habitat Acres	Independent Bear Density	Edge Habitat Acres	Independent Bear Density	Total Acres	Projected Population
B-5	40	926	319	36 bears / 100 Km^2	102	17.9 bears / 100 Km^2	580	17.9 bears / 100 Km^2	1,926	237
	60	256	48		82		231		617	73
	61	531	773		425		661		2,391	473
	62	1,444	847		357		922		3,569	534
	64	527	56		34		80		698	41
	65	503	781		196		259		1,740	363
	70	1,586	916		428		984		3,914	583
B-5 Total		**5,771**	**3,741**		**1,624**		**3,718**		**14,855**	**2,303**

Recent, 2009 Colorado mark-recapture surveys indicate higher densities than those found by most studies, analyses, or management reports in the western US (Table 4). Although density estimates are influenced by the size of the study area and the methods by which density estimates were derived, overall habitat quality in the two 2009 study areas in Colorado (SESA and NWSA) is probably better than that found in most other study areas (Apker et al. 2010). It should also be noted that both the Colorado 2009 survey areas were selected in large part because they were considered among the highest overall quality habitat in Colorado and the exact survey grid areas were structured to include mostly the highest quality cover and forage value habitat for the survey season. Although the density results are limited to one year, surveys will continue in these and several other locations to improve our understanding of bear densities in different habitats.

In addition to the 2 recent studies in Colorado, the CDOW also studied the black bear population on the Uncompahgre Plateau, GMUs 61 and 62 (Beck 1995) and on Black Mesa in nearby GMUs 53, 54, and 63 (Beck 1991). Beck (1995) determined the Uncompahgre Plateau had a density of 36/100 km^2 (1 bear/mi^2), which was considered to be very high. However, in recent years, based on increasing harvest success and more available anthropogenic food sources, it is plausible that densities in Primary quality bear habitat could be similar to that in the NWSA or SESA. To project a population estimate utilizing the use/occupancy surface density analysis, we utilized a density of 36 bears/100 km^2 for Primary habitat (same as Beck 1995), 17.9 bears/100 km^2 for Secondary (similar to Beck 1995), and 17.9 bears/100 km^2 for Edge habitat (similar to Beck 1995) to reflect that some Edge habitats are near high quality anthropogenic food sources. The projected independent bear population estimate for B-5 was 2,303 (Table 3).

Table 4. Reported black bear densities from research, analysis, or management reports in diverse locations and habitat types.

Location	Source	Per 100 km^2
Washington	Lindzey 1977	112 – 149
Nevada – Tahoe Basin (urban)	Beckmann and Berger 2003	120
Colorado – SESA	Apker et al. 2010 unpublished	47 – 52
Wisconsin	Belant et al. 2005	50 – 64
Idaho	Beecham and Rohlman 1994	31 – 77
Colorado – NWSA	Apker et al. 2010 unpublished	45 – 50
Idaho	Beecham 1980	43 – 47
Alberta	Kemp 1976	38
Montana	Jonkel and Cowan 1971	38
Colorado – Uncompahgre	Beck 1995 unpublished Fed Aid Rpt	36
Idaho	Rohlman 1989	34
Arizona	LeCount 1982	33
Nevada – Sierra Range	Goodrich 1990	20 – 40
Arizona	Waddel and Brown 1984	27.8
Colorado – BMSA	Beck 1991	17.9
New Mexico	Costello et al. 2001	9.4 – 17
Colorado – Middle Park	Beck 1997 unpublished Fed Aid Rpt	8.1
Utah	Utah Division of Wildlife Resources 2000	7.7
Arizona	LeCount 1987	6
Wyoming	Grogan and Lindzey 1999	2.1 – 3.0
Colorado - RMNP	Baldwin and Bender 2007	1.35

Several other correlates of bear habitat use/occupancy are also available to managers in B-5 including harvest density/locations, roadkill/highway crossings, and conflict hotspots. An evaluation of B-5 harvest locations superimposed on the basic categories of bear habitat use and occupancy indicates that most harvest, and presumably most of the bears, are being found (in the fall) in primary habitat or within edge habitat that very closely adjoins primary habitat (Figure 13). The significant exception to this would be the presence of bears, as documented through roadkill, harvest and conflicts, in high densities in some localized areas of edge habitat (those associated with human food sources).

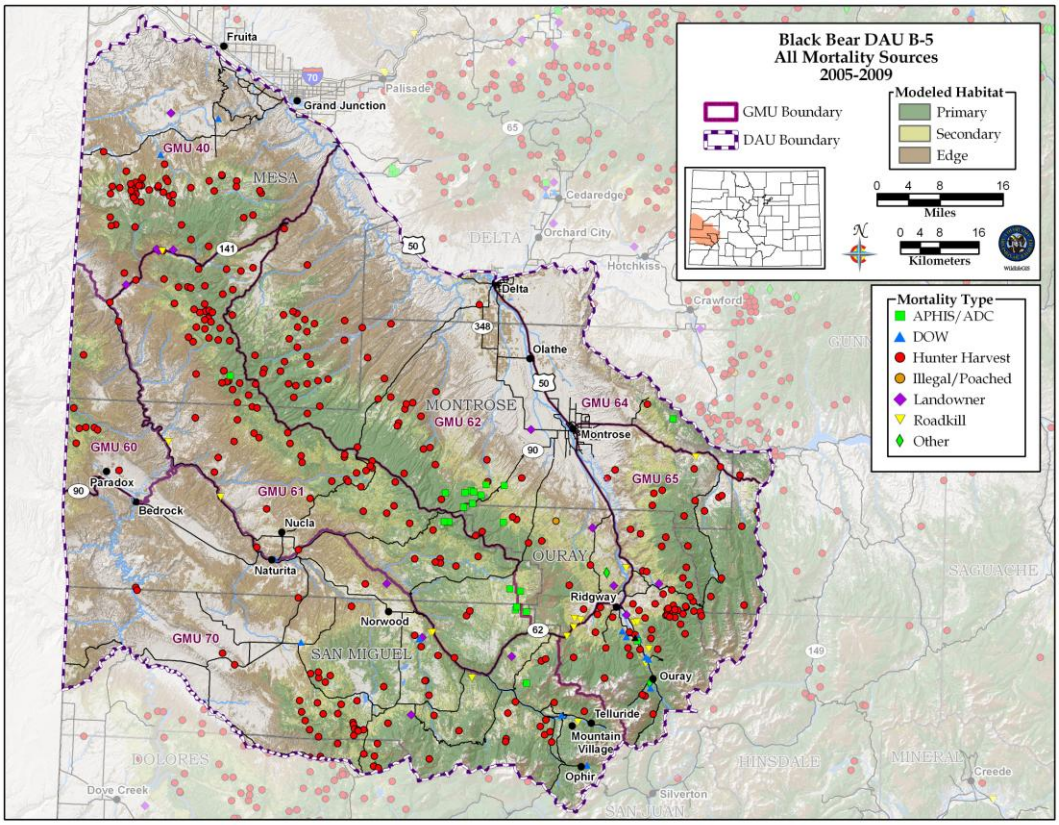

Figure 13. Black bear mortality from 2005-2009 overlaid on modeled Primary, Secondary, and Edge habitat classifications.

Mortality Density and Rates

The amount of human-caused mortality in relation to the amount of suitable habitat available can be another method to gauge impacts of human-caused mortality on black bear populations. This can be useful in illustrating impacts on a more local scale and standardizing mortality between DAUs with varying habitat suitability. The number of human-caused mortalities can be divided by the area of primary and secondary habitat.

Thus B-5 with 5,365 km2 of primary and secondary habitat and an average of about 109 bears killed per year over the past 10 years = a mortality density of 2.03 bears/100km2. Then assuming that the bear population is about 1600 bears, which is roughly the mid-point between the various habitat and population model projections, then the median bear population density in the DAU is about 29.8 bears/100km2. Using these figures to calculate a mortality rate yields 2.03/29.8 = 7%. It is likely that some human-caused non-harvest bear mortality occurs in B-5 that is undetected, however, it is unlikely that the average ten-year total mortality exceeds the 13% threshold to push the population into suppression.

While there are few reference values for human-caused mortality density in the literature, these values may be used to assess relative trends of harvest in each hunt area through time. Evaluating mortality density in relation to estimated population densities for black bears (Table 5) found in some other studies gives some context with which to interpret these data. Miller (1990) demonstrated that under optimal conditions of reproduction and survival, maximum sustainable mortality for black bears could be as high as 14.2%. Beck and White (1996 unpublished) conducted black bear population simulation analyses which, given their assumptions, produced stable bear populations with annual mortality at up to 15%.

It is unlikely that bears annually experience optimum reproduction and survival conditions due to environmental variation affecting forage conditions and black bear vulnerability to mortality factors. Therefore, we have formulated mortality rate thresholds associated with different management strategies which are somewhat lower than the foregoing:

Management Strategy	Mortality Rate Threshold
Increasing	< 7%
Stable	7% - 13%
Decreasing	> 13%

Forage Condition – Mast Production Surveys

Forage conditions influence bear reproductive success and certain gender and age specific survival rates due to changes in vulnerability to mortality (Beck 1991, Costello et al. 2001). Therefore, managers consider annual forage conditions when formulating annual management recommendations. In the fall of 2008, DOW began inventory of mast production conditions. Following survey protocols developed by Costello et al. (2001), we made only slight modifications to provide a basic 5 point matrix of fall mast fruit productions for gambel oak, juniper spp., chokecherry, and serviceberry. Forage condition results within DAUs can then be represented numerically to reflect annual forage conditions. These results can provide managers objective information about relative forage conditions over time and use that with their professional judgment to influence management recommendations. Taking it a step further, the results can be used as one of the many population model inputs as a factor influencing birth rates and cub survival in the population models.

Population Models

Another tool to estimate black bear populations is the development of deterministic population models utilizing annual harvest data and density data, where available, along with biological data from the literature. The starting population estimate for the models was derived from the vegetation/density model (Apker 2003) that estimated almost 1250 bears in B-5 (Table 2). We used plausible values from the literature for age-specific survival (Costello et al. 2001, Beck 1991, Beck 1997), number of cubs per litter, and estimated forage condition index values to account for changes in reproduction and mortality rates due to poor forage years. For 2008 and 2009, we used actual forage condition index values derived from CDOW assessing vegetation. For years prior to 2008-2009, non-hunt mortality was used to determine an index of forage conditions based on the assumption that if non-hunt mortality is higher than average, then forage conditions must have been poor and if non-hunt mortality was lower than average, then forage conditions were probably good. The models use mortality data with harvest as a direct model input and non-hunt mortality adjusted upward since we know records do not document all non-hunt mortality.

While the models do yield population estimates, these estimates are predicated on many plausible, yet assumed input values. The results do appear to conform to population extrapolations derived by the habitat models. Nonetheless, the value of the models is most worthwhile as an assessment of trends in population trajectories and responses to mortality and forage condition variability rather than the absolute population estimate produced.

Two models were developed for B-5, one liberal model with liberal, but plausible model parameters, and another more conservative model with more conservative, but plausible parameter values.

Assumptions Common to Both Models

The initial population size of 1250 bears and the starting age distributions for both models was derived from extrapolations of habitat quantity and known bear densities from the literature. Sex ratio at birth was assumed to be 50:50, with an average litter size of 2. Cementum analysis of 12 female black bears harvested between 2007-2009 indicated that the mean age of primiparity is 5 years and the mean birth interval is 2 years. Both models employ a non-harvest multiplier of 1.5 that increases the value of the reported non-harvest mortality.

Subadult and adult survival rates were largely midpoints of published ranges in New Mexico and Colorado (Costello et al. 2001, Beck 1991, Beck 1997), while cub survival fell within published ranges but was adjusted by a mast index that is intended to reflect documented forage conditions on a yearly basis. Predicted population and age structure levels beyond the current year (2010) relied upon the

continuation of assumptions used in the preceding years, as well as projected future mortality levels necessary to stability the population.

Liberal Model

The differences in assumptions between the liberal and conservative models are related to survival rates. Cub survival rates were variable according to forage conditions and the model utilized the following rates: 35% for poor food years, 63% for average food years, and 75% for good food years. In addition, to cub survival rates, the liberal model utilized the following survival rates for the other age and sex classes of bears: yearling female was 91%, sub-adult and adult female was 94%, yearling male was 90%, sub-adult male was 92%, and adult male was 91%. Modeling efforts utilizing the liberal inputs and assumptions produced a 2009 post-hunt population estimate of 3007 bears, with 1275 independent females and 699 independent males. The B-5 estimate for independent bears was 1,974 and total bears was 3,007.

Conservative Model

The conservative model used lower survival rates than the liberal model. Again, cub survival rates were variable according to forage conditions and the model utilized the following rates: 35% for poor forage conditions, 58% for average forage, and 72% for good forage conditions. The more conservative survival rates for the older bear ages classes were: 91% for yearling females, 93% for sub-adult and adult females, 90% for yearling males, 92% for sub-adult males, and 90% for adult males. Modeling efforts utilizing the conservative inputs and assumptions produced a 2009 post-hunt population estimate of 2352 bears with 1562 bears being 5+ years old.

Mortality Composition and Management Criteria

Black bear vulnerability to harvest and other mortality factors varies depending upon differences in habitat, hunter effort or pressure, access, and forage conditions. Bears are less vulnerable where cover is dense over large geographic areas. They are more vulnerable where vehicle access is good. The greatest influence in annual variation in bear vulnerability is forage conditions. When natural forage quality or availability is poor bears must become much more mobile in search of food, especially during fall hyperphagic periods. Increased mobility tends to result in bears being more visible to hunters, more likely to encounter human food sources, more frequently found along or crossing roads, and more concentrated in areas where there may be relatively more forage available. All of these tendencies can result in increased hunter harvest, increase human conflict mortality, more roadkills and other forms of mortality. However, not all segments of bear populations are equally vulnerable, regardless of other influences. Hunting pressure affects harvest rate, which affects age structure, sex ratios, and densities of black bear populations. Adult males are typically most vulnerable because they are bold (often use open areas) and have larger home ranges. Sub-adult males are slightly less vulnerable due to smaller home ranges and being less bold. Consequently, the adult male segment of a population is the first to be reduced under hunter pressure. As harvest rates increase, the proportion of sub-adult black bears (those less than 5 years old) in the harvest typically increases, whereas the proportion of adult males declines. **A low percentage of adult males (≥5 years old) in the harvest may be an indication of over-harvest.** This criterion is a more sensitive indicator of black bear population levels than median age (Idaho Dept. of Fish and Game 1998). The mean percent of adult males in the harvest in relatively stable populations in Idaho (Beecham and Rohlman 1994) and New Mexico (Costello et al. 2001) under moderate to high harvest levels was 30% and 28%, respectively. Studies of black bear populations in Alaska, Virginia, and Arizona showed similar relationships between lightly and heavily hunted populations. **Therefore, 25% to 35% adult males in the harvest could indicate a stable black bear population.** Levels lower than 25% may indicate a higher level of harvest, which has reduced the adult male segment of the population; whereas levels higher than 35% may indicate a much lighter harvest level. Based on 3 years of available age class data in B-5, it appears that current harvest levels may be maintaining a stable bear population, as adult male harvest comprises 26% of the total harvest (Figure 14).

As harvest levels increase and additional adult and sub-adult males are removed from an area, the proportion of females in the harvest begins to increase (Fraser et al. 1982, Kolenosky 1986, Beecham and Rohlman 1994), because females are least vulnerable, especially if accompanied by cubs. The average percent females in the harvest of black bear populations under moderate and high hunting pressure in Idaho (Beecham and Rohlman 1994) and New Mexico (Costello et al. 2001) was 35% and 40%, respectively. Beecham and Rohlman (1994) suggest a desired proportion of female harvest of 35% to maintain a stable population, whereas Beck (1991) suggested maintaining <40% females in harvest. **Therefore, a range of 30% to 40% females in the total harvest could indicate a stable black bear population.** Proportions higher than 40% may suggest reduction of the number of females in the population. Monitoring this criterion helps ensure a stable reproductive portion of the population and the ability of the population to rebound in the event of a decline. Based on B-5's female harvest of 30% over the last three years (Figure 14), the population appears to be maintaining a stable to increasing reproductive segment of the population.

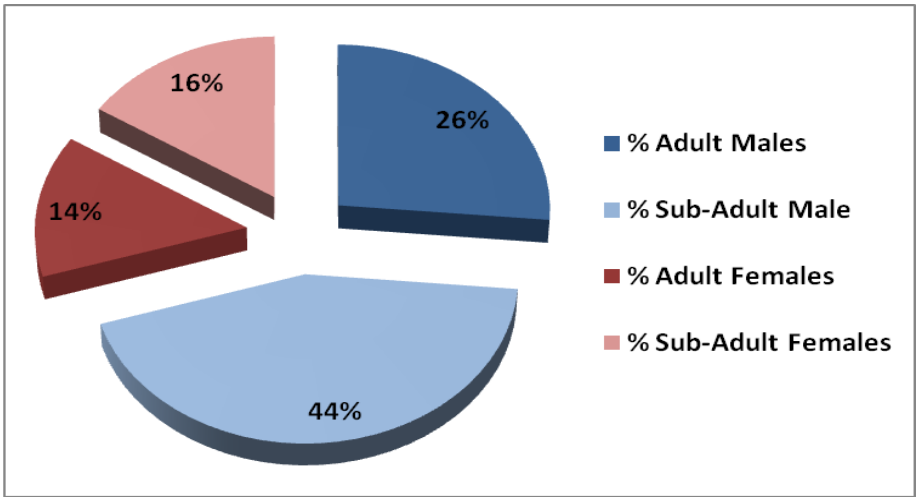

Figure 14. Bear harvest in B-5 by proportion of age class and gender from 2007-2009.

With increasing harvest of a black bear population, younger females are removed and older females become more common in the harvest. **Thus, the proportion of adults in the female harvest should rise with harvest rates, increasing mean age of females in the harvest** (Kolenosky 1986, Beecham and Rohlman 1994). This phenomenon is especially important with late-reproducing species like bears, since removing adult females has the enhanced effect of not only reducing the number of bears in the population, but also decreasing reproductive potential of the population and, thus, its ability to respond to declines. The delayed response of slow reproducing populations to reductions was noted by Harris (1984) and was demonstrated in modeling efforts by Miller (1990), who predicted black bear populations reduced by 50% would take an average of 17 years to recover if hunting pressure was reduced by 25%.

The percent of adults in the female harvest, rather than mean or median age of the females in the harvest, can be used to gauge the overall age of harvested females and thus the presumed population trajectory. Averaged over a three-year period, this criterion provides a more meaningful measurement of female harvest age structure, especially in areas with small sample sizes. The mean percent of adult females in the harvest of two New Mexico black bear populations under moderate and high harvest pressure was 55% and 70%, respectively (Costello et al. 2001). The mean percent adult females in the Wyoming statewide female black bear harvest from 1994-2005 was 47%, with a range of 32% – 57%, **suggesting that 45 – 55% adult female harvest provides a stable proportion of adult females** (Wyoming Game and Fish Dept. 2007). In B-5, adult female bear harvest was 47% of all females harvested from 2007-2009 (Figure 15), which leads us to believe the population is steady.

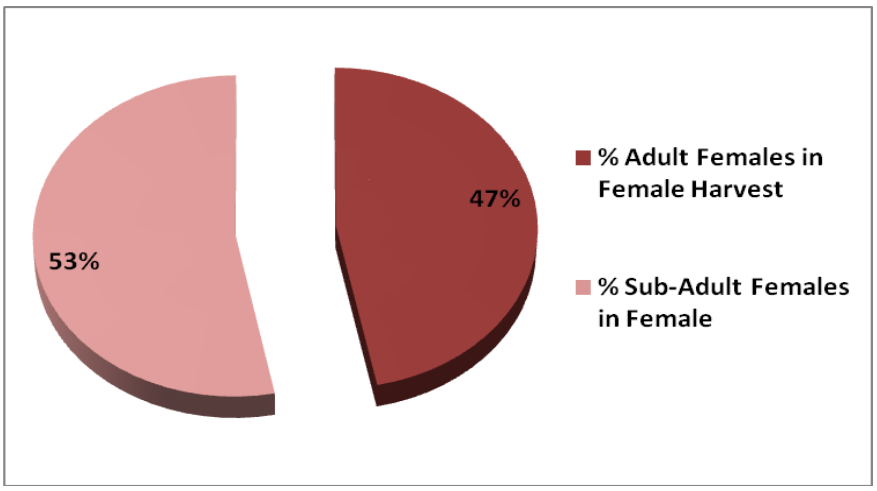

Figure 15. Proportion of female bear harvest in B-5 by age class from 2007-2009.

Looking at criterion independently could give very different results than when considering them together. For instance, looking only at a reduced percentage of adult males in the harvest may indicate a population is moving from light to moderate harvest. However, evaluating the other criteria may show an increased proportion of females and higher proportion of adult females in the harvest, indicating a much higher level of harvest than looking at males alone. Alternatively, a high percentage of adults in the female harvest, assessed independently, would indicate population reduction. However, when the percent adult males and percent females in the harvest are both in the population increase or stable range, the population might actually be thriving. This situation might occur when the DAU is adjacent to, or has an area providing, a source of immigrating black bears. Source areas can be defined as areas of suitable habitat with little to no human-caused mortality that may provide dispersing bears to surrounding areas (Beecham and Rohlman 1994, Powell et al. 1996). Areas adjacent to sources may have a lower proportion of adults in the harvest due to sub-adults dispersing to occupy vacant home ranges of harvested bears. These areas may also be able to rebound more quickly from overharvest (Beecham and Rohlman 1994). Dispersing sub-adult males may also supplement surrounding populations and absorb much of the harvest to the point where female harvest remains low and adult females comprise a higher proportion of the population.

To better evaluate harvest data, black bear seasons are set for a five year period as with most other big game species. We encourage, but cannot require, that harvest objectives and attendant license allocations be set for three-year periods. This would allow for a more complete analysis of the effects of harvest by holding dates and quotas the same for a three-year evaluation cycle. In addition, in order to increase harvest data sample sizes and reduce the influence of abnormally high or low harvest rates due to environmental or other factors, three-year running averages will be used in harvest data analyses rather than analyzing annual data independently. While the evaluation of harvest criteria will occur every three years and will be analyzed on a three-year average, data from the previous 10 years (two black bear generations) or longer should be analyzed to illustrate longer-term trends in harvest and related population trends.

Social Factors

The social factors that influence management of black bears in DAU B-5 include game damage, human conflicts, and hunting opportunity. As mentioned in previous sections, depredation on domestic sheep makes up the majority of damage claims and dollars paid to mitigate damage. The average number of game damage claims over the last 10 years is 12.5 (SE 2.2); however, during the years of natural forage failures, damage claims increase. Monitoring trends in game damage may be another index to monitor bear populations. If game damage claims appear to be increasing over the 12.5/year average and associated 95% confidence intervals, outside of poor natural forage years, then that may

mean the population is increasing and looking for alternative food resources. In addition to domestic livestock depredation and beehives, human conflicts occur when bears are utilizing garbage cans, bird feeders, and potentially entering cars or houses when access is easy and attractants are present. Increasing human conflicts can be an indicator of increasing bear populations, but locally is believed to be more of a factor of increasing human population and development in prime bear habitat. Increasing human conflicts usually generate more outreach to address minimizing bear attractants.

Direct, significant human conflicts with black bears in B-5 typically involve a bear entering or attempting to enter a home, cabin, trailer or car. These conflicts are dealt with by CDOW field staff differently depending on severity of the incident, other site-specific qualities and whether the bear in question had been previously handled by the CDOW. There is a CDOW policy on handling bears that have already received a first "strike", as well as procedures to follow if a bear makes physical contact with a person.

In addition to managing game damage and human conflicts, we are also concerned with maintaining hunting opportunity. Bear hunting in B-5 is very good, with competition for limited September rifle licenses taking multiple preference points to draw, as well as archery and muzzleloader licenses selling out within minutes of being available to purchase. Managing the B-5 bear population for a stable population ensures license availability at current levels with similar success rates. Managing B-5 for increasing populations may limit license availability, yet increase success rates. However, managing bears in B-5 for a suppressed population may increase licenses yet decrease success rates.

Hunter Success Rates

Just as bear vulnerability to harvest changes with hunter effort or pressure, hunter success rates generally vary depending upon bear vulnerability due to natural forage failures. Colorado data show direct correlation of increases in hunter success rates in years when there is some form of natural food failure. If one can account for variation due to food failure, then in average to good forage years increases in hunter success may be due, in part, to increases or decreases in either bear densities or changes in hunter effort. Averaged over time and within the range of hunter ability, knowledge, and hunting competence, overall hunter effort should be relatively static and the remaining annual change in hunter success should have a crude correlation to bear density, excluding food failure years.

September hunting seasons and Fall concurrent seasons have been relatively constant over the past 15 years. With success rates in food failure years censored the 10 year mean September season success rate for B-5 is 15.5%, which will serve as a baseline to measure future success rates against. As a subjective benchmark, we consider the standard error (SE) of 2.2 from the foregoing DAU baseline mean should establish the range within which hunter success would tend to indicate a more or less stable population. Success above the range of SE may indicate an increasing bear population, whereas success below the SE may indicate a decreasing bear population. Comparing B-5's September limited success rate baseline of 15.5% to recent years higher success rates, indicates that we probably have a growing population in B-5. Because this is a very crude index it should not be considered independent of other indices. Moreover, it should be noted that rapid changes in license amounts and/or hunter numbers can also affect hunting success rates and thus the applicability of this index. Success rates should be evaluated on a 3-year average.

STRATEGIC GOALS AND MANAGEMENT OBJECTIVES

Process For Developing Strategic Goals And Management Objectives

Public Process

Through the DAU planning process, ample opportunity has be given for the general public to provide input on bear populations and management. In October of 2010, two public meetings were advertised and held to discuss bear biology and management in B-5. One meeting was held in Grand Junction, where 3 people attended. The other meeting was held in Montrose, where 5 people attended. In addition, 9 people responded with comments via email, written letter, or survey. The meeting attendees and any public that stopped by the office were provided a survey form, Appendix A. The results from the 7 filled out surveys, and individuals who responded via email or letter, are provided in Table 5. Essentially, the majority of respondents were hunters, landowners, and livestock producers that would like to see a stable to decreasing population. The majority of experience with bear conflict was related to livestock depredation or facilities that hold livestock being damaged. Other suggestions to manage the bear population were as followed with the number of respondents in (): don't transplant bears (5), earlier/summer hunting season dates (4), spring hunting season (3), baiting allowable (2), quota system for bears like lions (1), extend Limited September rifle season to weekend before 1st Rifle (1), unfilled limited rifle tags to be useable in regular rifle seasons (1), all licenses to be over-the-counter, except in quality deer and elk units (1).

Table 5. Responses from survey respondents, email, and written letters in October of 2010.

Stakeholder	Hunter	Landowner	Livestock Producer	Homeowner	Recreationist			
	10	7	6	4	2			
GMU of Interested	**40**	**60**	**61**	**62**	**64**	**65**	**70**	**Other**
	4	3	6	3	0	0	0	1
What Mgnt Strategy?	**Increasing**	**Stable**	**Decreasing**					
	0	2	9					
Experience w/ conflict?	**Ag**	**Personal Property**	**Physical**	**Other**	**None**			
	6	5	2		1			

In addition to the initial public input meetings held in October 2010, the plan was posted on our website at www.wildlife.state.co.us for a 30 day public comment period in March 2011. Furthermore, a notice to comment on the plan was sent to local city, county, and federal government organizations during the comment period. Table 6 summarizes responses from the 5 individuals, municipalities, and county that responded during the 30-day comment period. Four of 5 respondents indicated that we should manage black bears with a stable management strategy. All respondents described the value of outreach and education on living with bears in the area. In addition to the public meetings and comment period, the public will also have the opportunity to comment on the plan at the Wildlife Commission meeting in July.

Table 6. Responses from 30-day public comment period, including local city and county respondents.

Stakeholder	Hunter	Landowner	Livestock Producer	Homeowner	Recreationist	Municipality	
		2		2	3	3	
GMU of Interested	**40**	**60**	**61**	**62**	**64**	**65**	**70**
				1		2	3

What Mgnt Strategy?	Increasing	Stable	Decreasing
		4	

Experience w/ conflict?	Ag	Personal Property	Physical (threat)	Other	None
	1	4	1		

Strategic Goals

Subsequent total mortality and harvest objectives are presented as a range of probable amounts necessary to achieve the strategic goal of the DAU. Annual monitoring of mortality amounts, gender and age structure, Colorado black bear density study, and annual forage condition survey results are all incorporated into determining annual mortality objectives. However, the models and their results have not been validated with demographic data from Colorado bear populations. Moreover, the data that has been collected and used for model inputs result from relatively new efforts. We anticipate that the models will change and be improved over time and thus should be viewed as **presumptive** estimates. Therefore, although the plan identifies mortality and age and gender objectives, these are initial values. Modeling will be conducted every other to every third year, while other mortality data and demographics are collected and analyzed annually. Population extrapolations based on predicted densities, range-wide or within vegetation associations, will be re-evaluated as new data is gathered via research and mark-recapture surveys. While unlikely, objectives may be periodically adjusted in order to achieve the DAU strategic goals based on changes in the information sources above. Specific objectives will be documented in annual objective sheets approved by the Wildlife Commission. These objective sheets will also govern annual license levels to achieve the DAU strategic goals.

Three Alternative Strategic Goals in B-5 were considered:

Increasing the bear population: To a achieve a strategic goal of increasing the bear population in B-5 management criteria applied to determining harvest and total mortality objectives would be in the conservative range. Total mortality, or off-take, as a proportion of the population should be less than 7%. Proportion of adult males in the harvest should be greater than 35%, with all females making up less than 30% of harvest. Additionally, adult females should comprise less than 45% of the females harvested. Not every management index must be in complete agreement, but most should point toward an upward trend.

Stable bear population: To achieve a strategic goal of maintaining a stable bear population in B-5 management criteria applied to determining harvest and total mortality rates should fall in an intermediate range. Total mortality, or off-take, as a proportion of the population should fall in the 7-13% range. Proportion of adult males in the harvest should be within 25-35%, with all females making up 30-40% of harvest. Additionally, adult females should comprise approximately 45-55% of the female harvest. Not every management index must be in complete agreement, but most should point toward a stable trend.

Decreasing the bear population: To achieve a strategic goal of decreasing the bear population in B-5 management criteria applied to determining harvest and totally mortality rates would be in the liberal range. Total mortality, or off-take, as a proportion of the population could increase to greater than 13%. Proportion of adult males in the harvest can be low, even below 25%, with total female harvest rates going over 40%. Additionally, adult female proportions in the female harvest can comprise over 55% of the female harvest. Not every management index must be in complete agreement, but most should point toward a population being held below biotic and defined human social tolerance thresholds.

Monitored Data To Inform Management

All known dead black bear, from both harvest and non-harvest sources, are checked by CDOW staff to obtain biological information. The proportion in total mortality of each gender will continue to be closely monitored on an annual basis to assure that female mortality rates are not contrary to the DAU strategic goals. Age structure in total mortality and reproductive history are derived from extraction of a premolar tooth from bears when bear harvest and non-hunt mortality is reported through the mandatory check.

In 2009 and 2010, hair snag surveys were conducted in two locations in Colorado. Additional hair snag survey areas may be established in the future during the term of this DAU plan. Results about bear density, gender, and possibly age structure from these surveys may be incorporated into the habitat model/density extrapolations.

Because of low reproductive rates, black bear populations cannot sustain high harvest levels over prolonged periods. Research has shown that high harvest levels can quickly reduce black bear populations to levels where severe reductions in harvest quotas and season lengths may be necessary for greater than 10 years for full recovery of a population (Miller 1990, Beecham and Rohlman 1994). Therefore, the following harvest criteria will be assessed at the DAU level, with each DAU strategic goal set to achieve the criteria for reduced, stable, or increasing black bear numbers.

Total mortality

Monitoring harvest and overall mortality totals in relation to projected population size will be important in interpreting mean age and relative proportions of age/gender classes as indices. Based upon the selected strategic goal of a **stable bear population** the total mortality off-take range that would allow managers to reach that goal is **7-13%**.

Proportion of mortality by age and gender

The following 3 harvest criteria will be monitored annually, using a 3-year average in B-5 to manage for a stable bear population.

	Population Trend
	Stable
% of Adult Males in Total Harvest	**25 - 35%**
% of All Females in Total Harvest	**30 - 40%**
% of Adult Females in Total Female Harvest	**45 - 55%**

Forage condition monitoring

Collected annually this data can be used when projecting reproductive rates, cub survival, vulnerability to harvest and other factors related to modeling and predicting population trends for the upcoming year. Annual forage condition/mast production surveys are conducted in representative GMUs in DAU B-5. Results of these surveys are incorporated into population modeling efforts, as are mortality, age and gender structure data.

Game Damage & Human Conflict

Number and type of damage claims associated with bears will be monitored annually. In

addition, documented human conflicts will be monitored annually. The general trend in damage claims and conflicts will be evaluated to determine if they are increasing or decreasing, but no specific trigger or action is being identified. In most cases, management efforts will be taken to address an individual bear causing conflict. Management efforts may include public outreach to trap and transplant or even harvest, following protocols identified in CDOW Administrative Directive W-2.

Hunter Success

Hunter success rates will be monitored annually to look for general trends in success in relation to license allocation. If license numbers remain stable, but success rates increase then the population may be increasing. Alternatively, if license numbers remain stable, but success rates decrease then the population may be decreasing. No hunter success trigger is being identified, but hunter success will be monitored for trends.

Management Objectives

Strategic Goal

The preferred alternative for a strategic goal in B-5 is to manage for a ***stable bear population***. To achieve a strategic goal of maintaining a stable bear population in B-5, management criteria applied to determining harvest and total mortality rates should fall in an intermediate range. Total mortality, or off-take, as a proportion of the population should fall in the 7-13% range. Proportion of adult males in the harvest should be within 25-35%, with all females making up 30-40% of harvest. Additionally, adult females should comprise approximately 45-55% of the female harvest. Not every management index must be in complete agreement, but most should point toward a stable trend.

Furthermore, total and hunter harvest mortality objectives will be directed to the high end of the proportional harvest objective from 2012-2014 to decrease the population slightly. If the population appears to have decreased, then total mortality and harvest objectives will be reduced. During the 3 years of higher mortality objectives, age and gender proportions will still be monitored to assess whether the population is increasing, stable, or decreasing.

The specific total mortality and harvest objectives are based on present information and assumptions about population status and trajectory. These represent starting points in an ongoing process. Annual changes to mortality and harvest objectives are anticipated based on new information and evaluation of monitored data. Annual quantitative objectives will be documented in DAU objective sheets approved by the Wildlife Commission during annual regulation cycles.

Using the 4 different models/techniques to predict bear population estimates in B-5 yields the following:

Vegetation / bear density extrapolation = 1,246 independent bears
Use/occupancy density model population extrapolation = 2,303 independent bears
Liberal population model estimate posthunt 2009 = 3,007 (1,974 independent bears)
Conservative population model estimate posthunt 2009 = 2,352 (1,562 independent bears)

For purposes of calculating mortality objectives to correspond with the strategic goal in the DAU a 2009 posthunt population of 1600 independent bears will be used. This estimate is based on the conservative model estimate which utilizes survival rates below the highest rates, which is probably closer to recent year survival estimates based on the number of forage failures over the last 10 years as well as the drought conditions present through much of the last decade. Harvest and total mortality objectives are based on the population of independent bears since cubs are not legal for harvest in Colorado. If a hair snare survey to estimate black bear densities in B-5 is conducted over the next 10 years, then new population estimates will be developed and utilized.

Mortality Objectives – 3 year running average

Total Mortality Objective

In order to achieve the DAU strategic goal of a **stable bear population** , it is estimated that the average total mortality should be **112-208** .

Hunter Harvest Objective

Annual hunter harvest objectives are determined by deducting the 3-year running average amount of non-hunter mortality from the total mortality objective. If the strategic goal is to manage for a **stable bear population**, then hunter harvest objectives could be adjusted up or down to increase or decrease the rate population growth or decline. Based on a total mortality objective of **112-208**, the hunter harvest objective will be **92-188**.

Age and Gender Composition in Hunter Harvest Objective

The 3-year running average proportion of age and gender structure in hunter harvest should meet the following criteria:

	Population Trend
	Stable
% of Adult Males in Total Harvest	**25 - 35%**
% of All Females in Total Harvest	**30 - 40%**
% of Adult Females in Total Female Harvest	**45 - 55%**

Game Damage and Human Conflict Objectives

Standard CDOW management techniques will be employed in B-5 to reduce game damage and human conflicts with bears. Other methods of non-lethal intervention will be used when the conditions and individual situation warrant it.

Conclusion

The Wildlife Commission has approved a **stable bear management strategic goal** in DAU B-5 based on habitat availability, human and agricultural conflict potential, and input from the public during 2 public meetings and a 30-day comment period. The **total mortality objective** for the stable management goal is **112-208** bears per year, with a **hunter harvest objective of 92-188** per year. Furthermore, total and hunter harvest mortality objectives will be directed to the high end of the proportional harvest objective for approximately 3 years to decrease the population. If the population appears to have decreased, then total mortality and harvest objectives will be reduced. During the 3 years of higher mortality objectives, age and gender proportions will still be monitored to assess whether the population is increasing, stable, or decreasing. Total mortality, or off-take, as a proportion of the population should fall in the 7-13% range. Proportion of **adult males** in the annual harvest should be within **25-35%**, with **all females** making up **30-40%** of harvest. Additionally, **adult females** should comprise approximately **45-55%** of the annual female harvest. Not every management index must be in complete agreement, but most should point toward a stable trend.

The specific total mortality and harvest objectives are based on present information and assumptions about population status and trajectory. These represent starting points in an ongoing process. Annual changes to mortality and harvest objectives are anticipated based on new information and evaluation of monitored data. Annual quantitative objectives will be documented in DAU objective sheets approved by the Wildlife Commission during annual regulation cycles.

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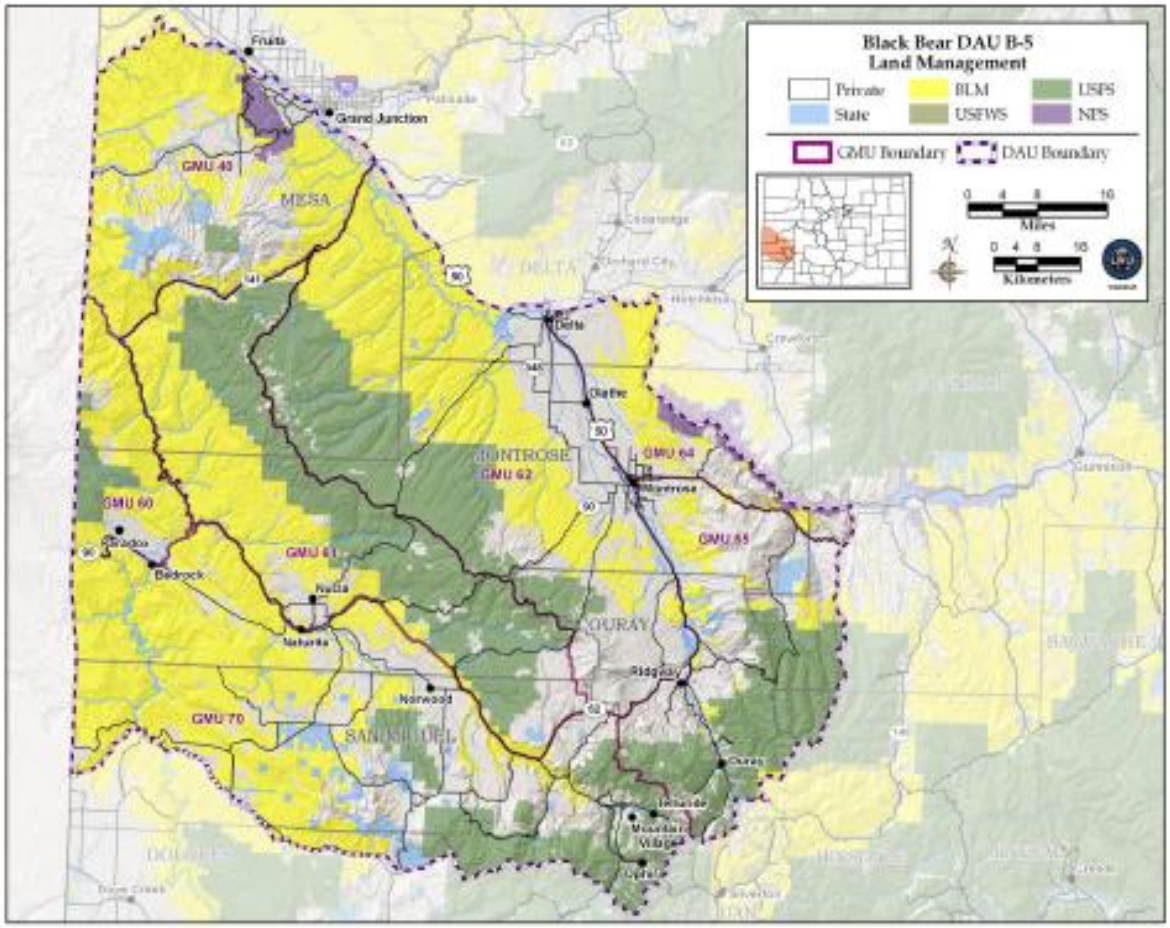
APPENDIX A

Uncompahgre Black Bear Management Plan Public Input Survey

(Please return the survey by November 1, 2010)

Montrose Service Center
2300 S. Townsend Ave.
Montrose, CO 81401
(970)252-6000



The Colorado Division of Wildlife would like to hear your input regarding how black bears should be managed on and around the Uncompahgre Plateau in Game Management Units (GMUs) 40, 60, 61, 62, 64, 65, and 70. Your input will be used to help us develop a black bear management plan to best manage bear populations to provide recreation and enjoyment within the bear population's biological capability to allow for such use, while minimizing conflict. Please answer the questions on the back and feel free to add additional comments.

WHAT BEST DESCRIBES YOU AS A STAKEHOLDER? (Please circle all that apply)

Hunter **Landowner** **Livestock operator** **Homeowner**

Recreationist **Other:**_____

WHAT GAME MANAGEMENT UNIT(S) IS/ARE OF GREATEST CONCERN TO YOU? (Please circle all that apply)

40 **60** **61** **62** **64** **65** **70**

WHAT STRATEGY SHOULD WE USE TO MANAGE BEAR POPULATIONS IN THE UNCOMPAHGRE DAU? (Please circle one)

Increasing **Stable** **Decreasing**

WHY?

_____

_____

_____

_____

HAVE YOU EXPERIENCED CONFLICT WITH BEARS? **Yes** **No**

IF SO, WHAT KIND OF CONFLICT (e.g., LIVESTOCK DEPREDATION, PERSONAL PROPERTY, PHYSICAL)?

_____

_____

_____

ADDITIONAL COMMENTS:

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____