GUNNISON BASIN BEAR MANAGEMENT PLAN
DATA ANALYSIS UNIT B-12

GAME MANAGEMENT UNITS

54, 55, 551, 66, 67

PREPARED FOR

COLORADO PARKS AND WILDLIFE

BY

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on
March 10, 2022

EXECUTIVE SUMMARY

Gunnison Basin Bear Population (DAU B-12)	**GMUs: 54, 55, 66, 67, 551**
Landownership: USFS, BLM, Private, State, Other. Prior Population Objective: Provisional objective to hold bear population stable. Prior Mortality Objectives: Provisional of 25 bear harvest; 30 total bear mortalities. New Strategic Goal (Approved): Maintain a stable population trend with an adaptive management approach that adjust harvests according to three harvest composition metrics, a minimum harvest success threshold, and a maximum human-caused mortality threshold.	
Objectives (Approved): 1. % Adult Male Harvest of All Harvest = 25-35% 2. % Total Female Harvest in All Harvest = 30-40% 3. % Adult Female in Total Female harvest = 45-55% 4. 3-year average total human-caused mortality threshold maximum of up to 30 bears 5. 3-year average hunter harvest success rate threshold minimum of 1%.	

BACKGROUND

Black bear Data Analysis Unit (DAU) B-12 is located in Gunnison, Saguache, and Hinsdale Counties overlapping the Upper Gunnison River Basin. The Game Management Units (GMUs) in B-12 are 54, 55, 66, 67, and 551. Major towns include Gunnison, Crested Butte, and Lake City. B-12 covers approximately 9295 square km (2.30 million acres) of land, of which approximately 82% is public land.

From 2005 to 2020, an average of 17 bears (range: 7-31) were harvested annually. A range of 250 – 600 limited bear licenses were made available each fall in the same period. B-12 hunters experience very low success rates (per license numbers allocated) of ~3.4% annually. License allocations were gradually increased between 2006 and 2020 to meet growing demands for bear hunting opportunities, which contributed to a relatively commensurate increase in the number of bears harvested for the same time period. The B-12 black bear population size is currently estimated to have a relatively low abundance (213 bears) due to the lack of prime habitats in a DAU dominated by a sage-brush ecosystem in the center of the DAU, and relatively low quality bear forage in the primary habitats. Harvest composition metrics indicate that the current population trajectory is relatively stable to slightly decreasing (Exec Summary - Figures 1, 2, and 3).

SIGNIFICANT ISSUES

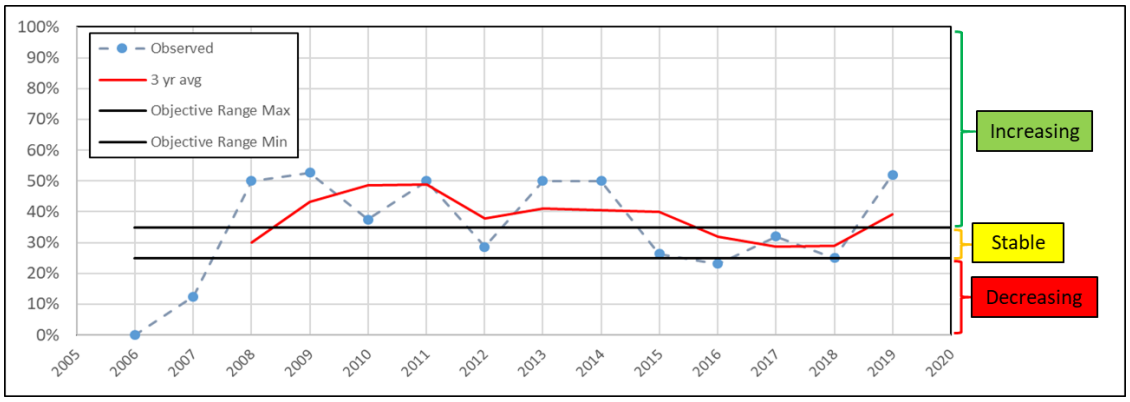
Aside for occasional conflicts between bears and humans in some known developed areas, no significant issues regarding bear management appear to exist in B-12 at this time or over the recorded history of B-12. Relative to the rest of Colorado's bear DAUs, B-12 managers are tasked with few bear-human conflicts. Annual conflict related bear mortalities are usually the lowest in Colorado. Bear-related damage corresponds to an annual average of less than $1000. An annual average of 2.75 conflict related bear mortalities occurred between 2007 and 2020.

MANAGEMENT ALTERNATIVES

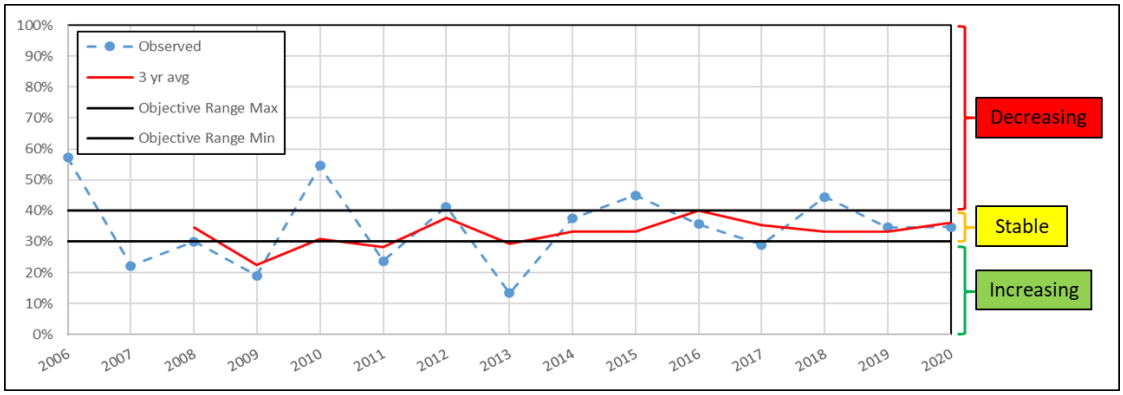
Alternative 1: Stable Population Trend (Approved). To manage for a stable population trend, bear license numbers will be adjusted annually to maintain the 3-year averages of

age/sex composition objective ranges, highlighted in yellow, in Exec Summary Figures 1, 2, and 3 below. A 3-year average total human-caused mortality (harvest, conflict related, and other human caused mortality sources combined) threshold maximum of up to 30 bears will also be incorporated. CPW will re-evaluate this strategy if the control kills (conflict related bear mortalities) exceeds a five year average of 10 bears annually.

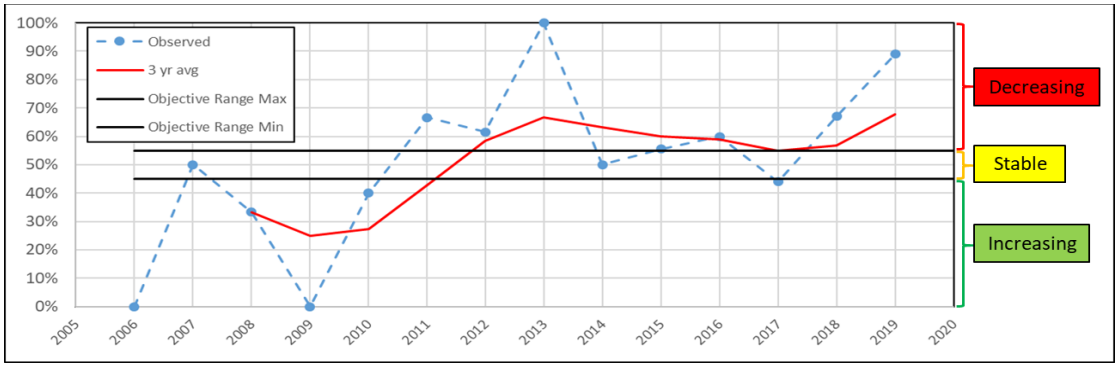
Alternative 2: Decreasing Population Trend
Alternative 3: Increasing Population Trend



Exec Summary - Figure 1. % of adult male harvests in all harvest with respect to stable population, 2007-2019.



Exec Summary - Figure 2. % of total female harvests in all harvest with respect to stable population, 2007-2020.



Exec Summary - Figure 3. % of adult female harvests in total female harvest with respect to stable population, 2007-2019.

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INTRODUCTION AND PURPOSE

Colorado Parks and Wildlife (CPW) manages big game for the use, benefit, and enjoyment of the people of the state in accordance with the CPW's Strategic Plan (2010-2020). Black bear management is also determined by mandates from the Colorado Parks and Wildlife Commission (PWC) and the Colorado Legislature. Colorado's wildlife species require careful and increasingly intensive management to accommodate the many and varied public demands and growing human impacts. The CPW uses a "Management by Objective" approach to manage the state's big game populations (Figure 1).

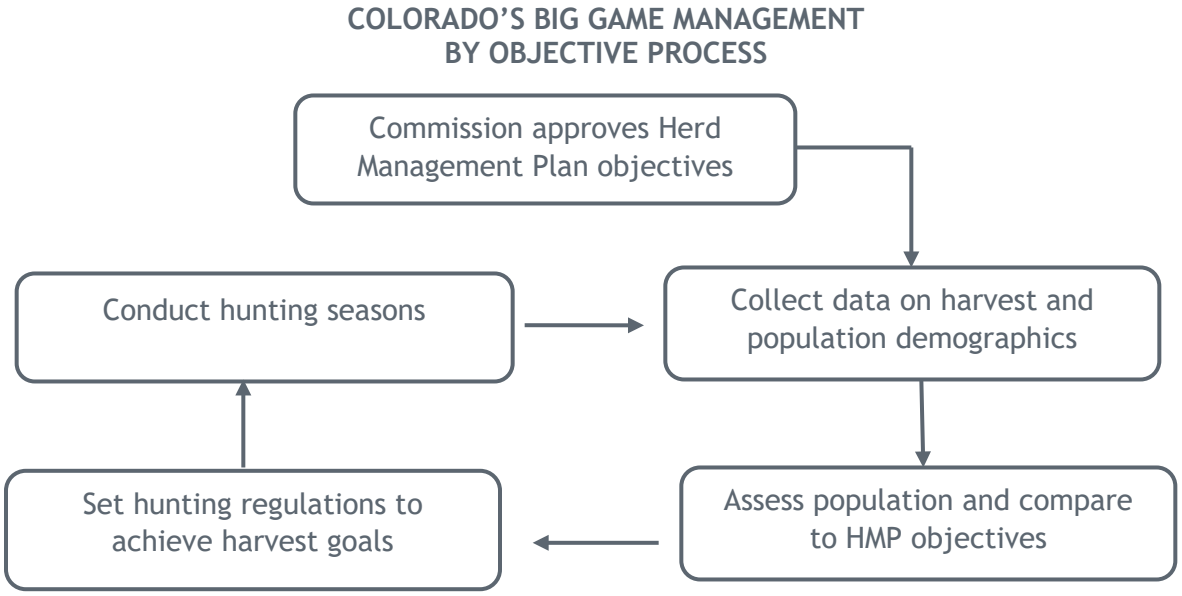

Figure 1. Management by Objective process used by Colorado Parks and Wildlife to manage big game populations by Data Analysis Unit (DAU).

Under this adaptive management approach (Figure 1). Big game populations are managed to achieve objectives established for Data Analysis Units (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 smaller scale, typically through hunting regulations.

The bear management planning 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 determining 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 Parks and 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 plan is a recommendation of objectives that will uphold the management strategy for the bear DAU. The plan also specifically outlines the management techniques that will be used to reach desired objectives. CPW intends to update these plans as new information and data become available, at least once every ten years.

Black bear management issues and what tools should be used to address them are particularly complex and multifaceted. Strategies in communities within B-12 and in other North American states and provinces involving attempts at bear behavioral change, community education, enforcement of ordinances requiring bear-proof garbage containers, the human dimensions component of human-bear conflicts, etc. have been reviewed elsewhere (e.g., Peine 2001; Gore 2004; Tavss 2005; Kiel 2007; Baruch-Mordo et al. 2009, 2011, 2013; Johnson et al. 2018).

The structure of a bear management plan focuses on one specific tool, primarily hunting, out of a suite of tools, including education, enforcement, and habitat modification, which also can be used to manage conflicts. This plan provides harvest-related monitoring structures along with strategic goal alternatives that will attempt to influence the bear population size in B-12. However, the types of conflicts that occur between people and bears often require more than simple changes in licensing or hunting structure in order to completely resolve the problem. Active involvement by residents and businesses in the communities, trash companies, HOAs, and local governments to reduce and ideally eliminate human food sources for bears are also critical to resolving bear management issues.

DATA ANALYSIS UNIT DESCRIPTION

LOCATION

The Gunnison Black Bear DAU B-12 is located in central-south west Colorado and comprised of Game Management Units (GMU's) 54, 55, 66, 67, and 551 (Figure 2). It lies within portions of Gunnison, Hinsdale, and Saguache Counties and is bounded by the Elk Mountains on the North, Continental Divide on the east and south, and approximately Blue Creek/Currecanti Creek/Ruby Range on the west. Major drainages in B-12 include: upper reaches of the Gunnison River, Lake Fork of the Gunnison, Tomichi Creek, East River, and Cochetopa Creek. Major towns include Gunnison, Crested Butte, and Lake City.

B-12 covers approximately 9295 square km (2.30 million acres) of land, of which approximately 82% is public land (Figure 2). The entire DAU is considered overall black bear range, although bear densities vary by habitat type. Within B-12, 36% is within black bear summer concentration range, 8% within fall concentration areas. Approximately 2% is mapped as human conflict area (Figure 2), and is focused around the towns of Crested Butte, Almont, Tincup, Pitkin, Ohio City, Lake City, Gunnison, and scattered exurban developments and camping areas such as Irwin, Ohio Creek, Taylor River, White Pine, Arrowhead, and Blue Mesa Estates. Bears concentrate in the fall during hyperphagia in areas with high mast crop production and/or accessible food sources.

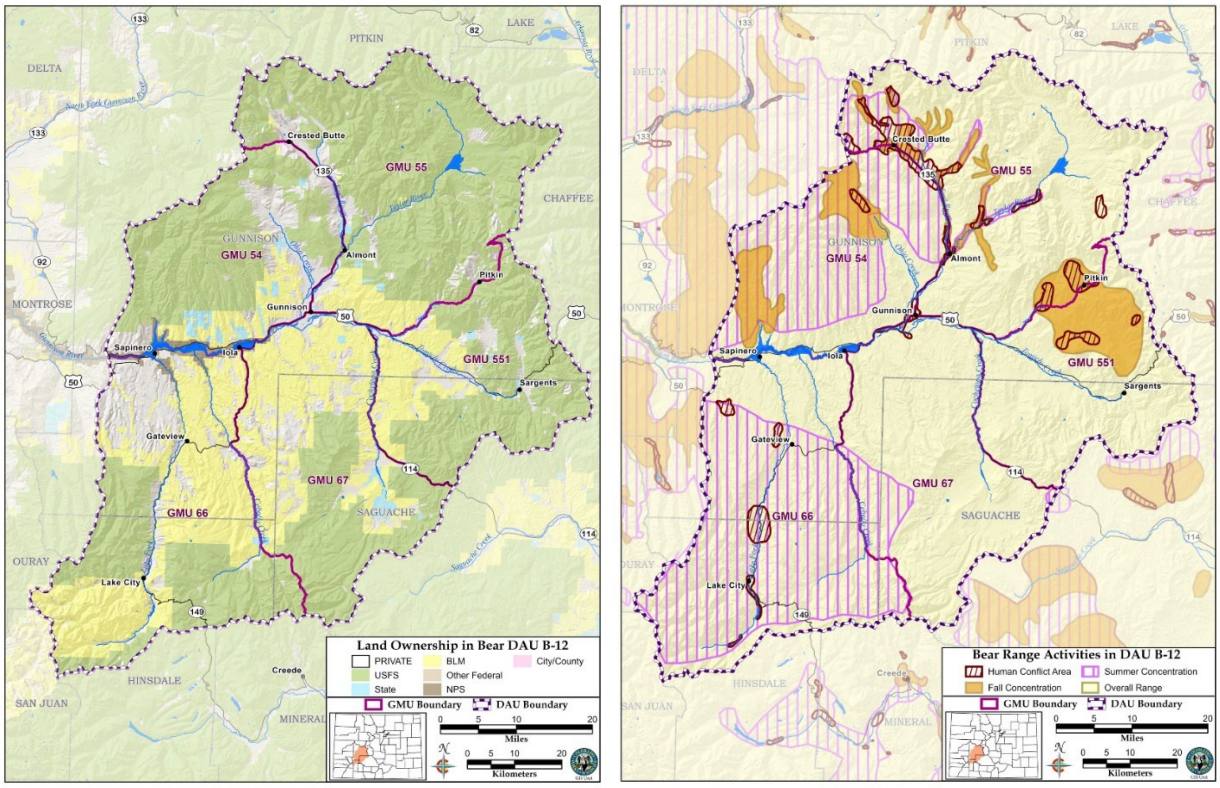

Figure 2. Land Ownership (left Pane) and seasonal black bear activities (right pane) in DAU B-12.

TOPOGRAPHY AND CLIMATE

Elevations in the DAU range from 7,100 ft at the lowest (west-central) reaches of the Gunnison river to 13,000 and 14,000 ft in all other directions on the periphery. All portions of the DAU are subject to long and cold winters, where January temperatures average 14 degrees F, with an average daily low and high of 1 and 29 degrees F respectively. Summer temperatures average 62 degrees F, with an average daily low and high of 46 and 78 degrees F respectively. Average annual rainfall precipitation is 10.5" in the low elevations (i.e., town of Gunnison), but high elevations (e.g., Irwin, Gothic) may experience >25" of rainfall. Snowfall precipitation ranges from 84" in the low elevations to >400" in high elevations.

VEGETATION

Vegetation types in B-12 are largely determined by elevation and aspect (Figure 3). A sagebrush "sea" dominates the centrally located low elevations of the DAU, which gives way to a tree line interface of sage and mixed forests (conifers and aspens). Small forest patches are scattered throughout the sagebrush on north facing aspects. Spruce-fir forests dominate the 9,000 to 11,600 ft ranges in most of the DAU, but lodgepole pine forests dominate the eastern third of the DAU. Sparse juniper occur in rugged terrain of lower elevations. Oakbrush is restricted to a few sub-drainages of the western 1/5 of B-12. Riparian areas of the lower elevations are represented by cottonwood, willow, or irrigated hay fields. Scattered service berry, chokecherry, Gambel oak, wild rose, and raspberry make up bear forage in summer into fall. Overall, the B-12 habitat is considered relatively poor, where forage quantity varies depending on elevation and weather conditions. Food failures do occur, primarily due to late frosts. In addition to natural food sources, bears living near human communities have another

significant source of high-quality nutrition in the form of anthropogenic food (all sources associated with human activities including trash, pet food, barbeque grills, landscaping fruit trees, and bird feeders).

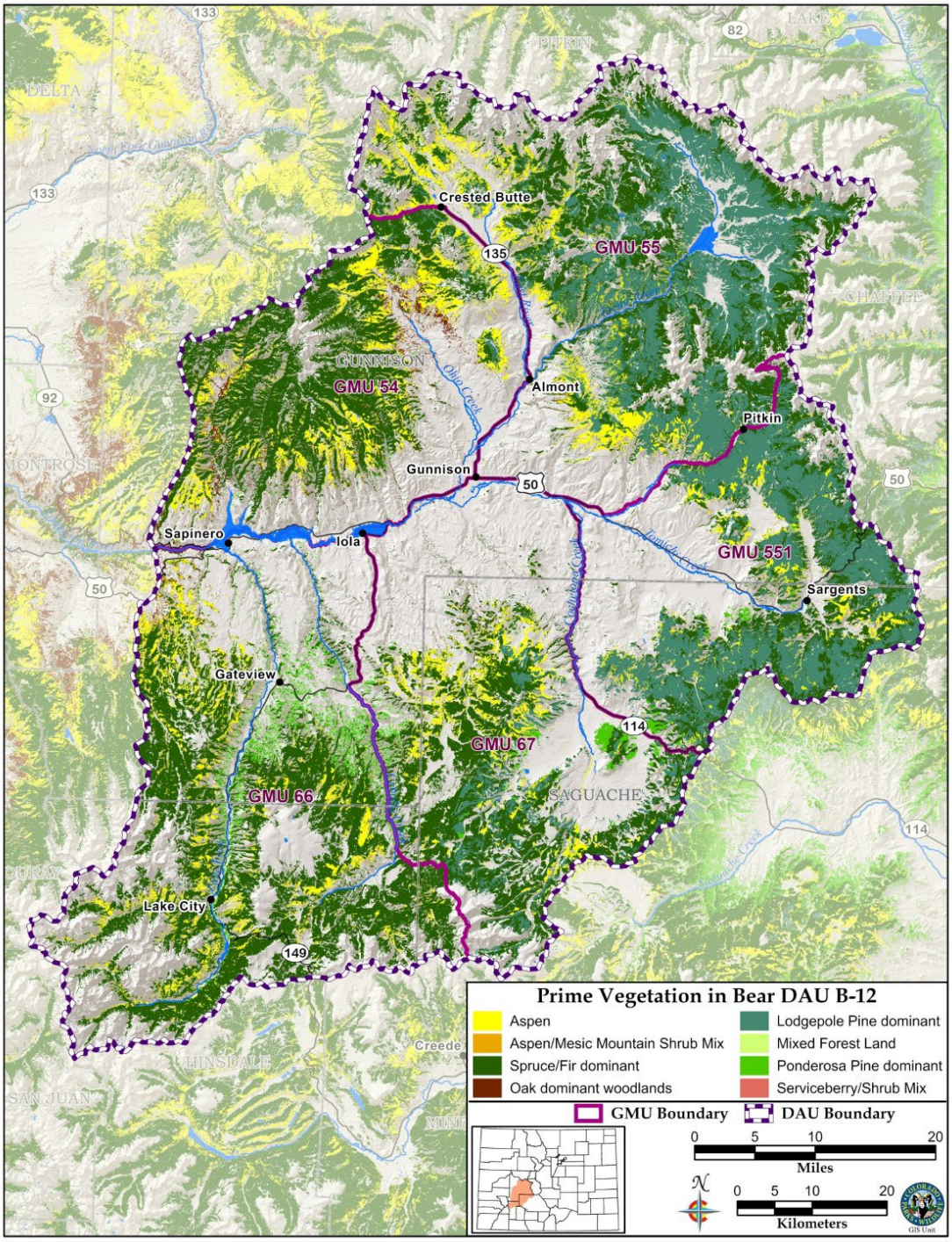

Figure 3. Primary black bear vegetation types in B-12.

Management History

Hunting Seasons and License Allocation History

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. In 1935, they were awarded some protection by being classified by the state legislature as a game animal. This regulation 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. 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 (Gill and Beck 1990). Hunters wishing to hunt bears during the established deer and elk rifle seasons had access to unlimited licenses until 2005 when license caps were established for these seasons. In 1992, a state ballot amendment was passed which changed bear hunting statutes within the state by prohibiting bear hunting prior to September 1st and banning the use of bait and dogs for pursuit. Since 1992, September 2nd has been the opening date of the earliest bear seasons in Colorado.

Since 2000, black bear hunting seasons have started with an early limited rifle season that runs from September 2nd through September 30th each year. An archery, muzzleloader, and later rifle season runs concurrently with deer/elk rifle seasons. In 2015, a single concurrent bear rifle season (valid for any concurrent deer/elk rifle season), replaced the individual 1st, 2nd, 3rd, and 4th concurrent rifle seasons. Private land specific bear seasons have never occurred in B-12.

Before 1999, bear licenses were valid statewide. Starting in 1999, all seasons became DAU-specific, and a license limit for B-12 was established for the September rifle season. In 2005, archery, muzzleloader, and concurrent rifle licenses also became license limited as well. Limited license numbers were initially relatively high in 2005, but was followed by a dramatic cut in licenses in 2006. Since this cut, license numbers gradually increased over the next six years, until 2012 (Figure 4). License numbers were then steady until 2019. Due to high license demand (Figure 5) and after not achieving the provisional harvest objective of 25 bears (15 year average harvest of 15.8 bears), additional hunting opportunity was added in 2020 by increasing archery and muzzleloader licenses (Figure 4). For the 2020 - 2024 big game season structure, bear licenses are completely limited under the stable population management strategy.

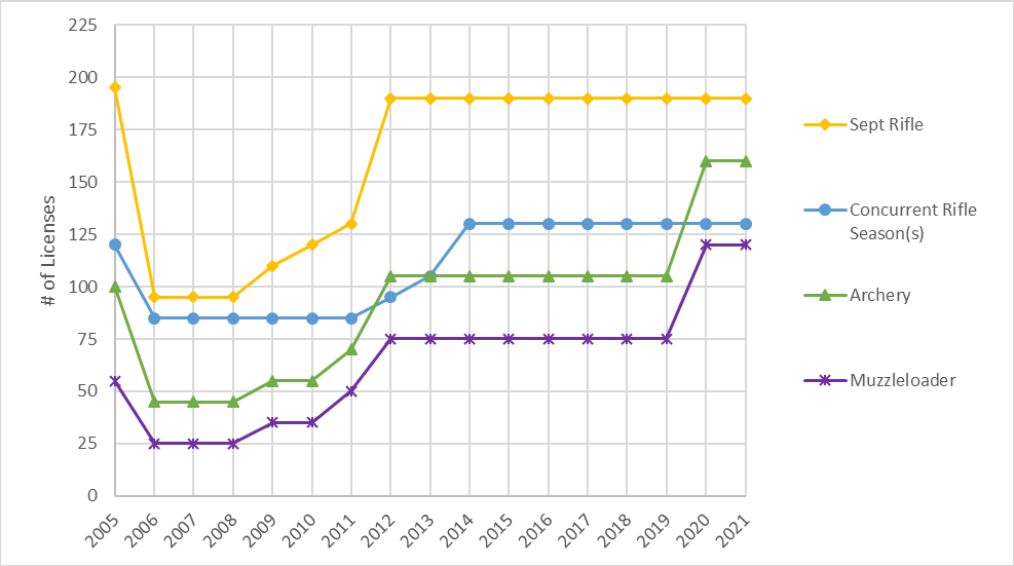

Figure 4: B-12 Limited license history (2005 -2021).

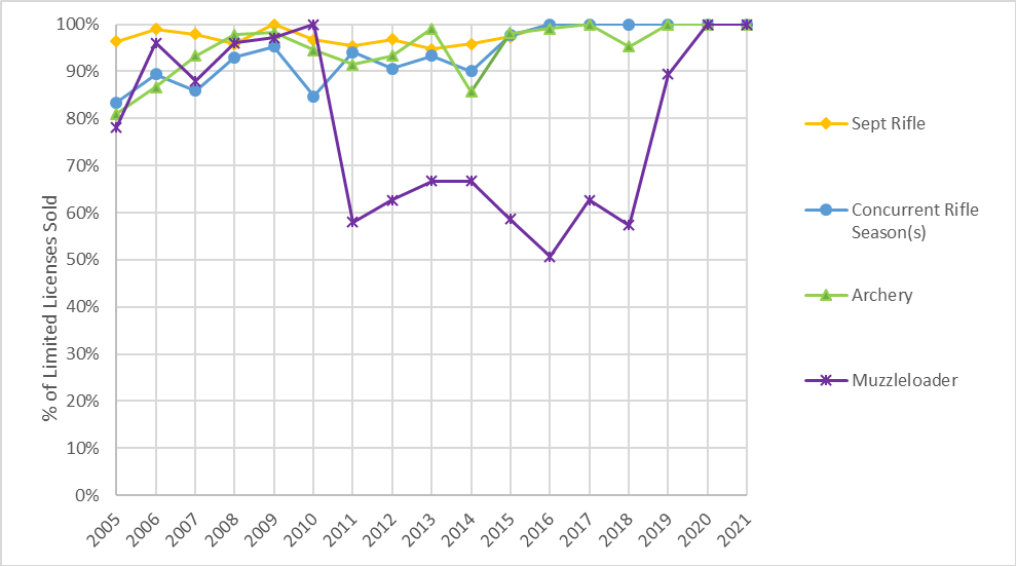

Figure 5: B-12 Limited license demand history (2005-2021).

MORTALITY – HARVEST AND NON-HARVEST

All known dead black bears, from both harvest and non-harvest sources, are checked by CPW staff to obtain biological information. Age structure in harvest and total mortality are derived from extraction of a premolar tooth from all dead bears.

From 1979 to 2020, an average of 17.2 bears (minimum = 1, maximum = 32) were harvested annually in B-12 (Figure 6). Specifically, from 1979 – 1989, an average of 23.9 bears were harvested annually. Then, from 1990 – 1999, harvest dropped to an average of 10.5 bears annually (Figure 6). This harvest decline started prior to the spring bear hunting ban in 1993. From 2000 to 2020, harvest rebounded to 17.6 bears annually, but has fluctuated (Figure 6).

The increasing harvest trend occurring from 2006 and 2020 (Figure 6) appears attributed to an overall increase in limited licenses (Figure 4).

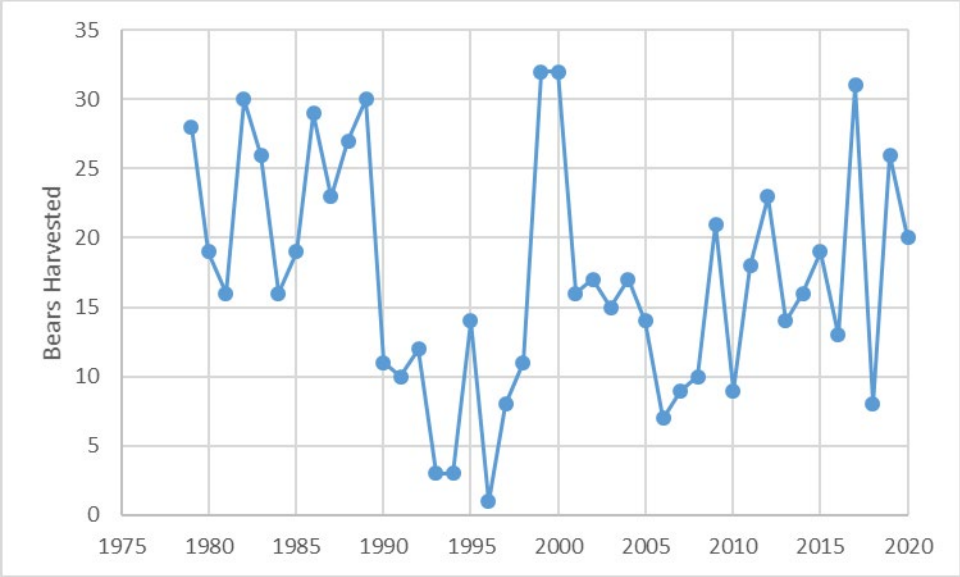

Figure 6. B-12 total hunter harvests (1979-2020).

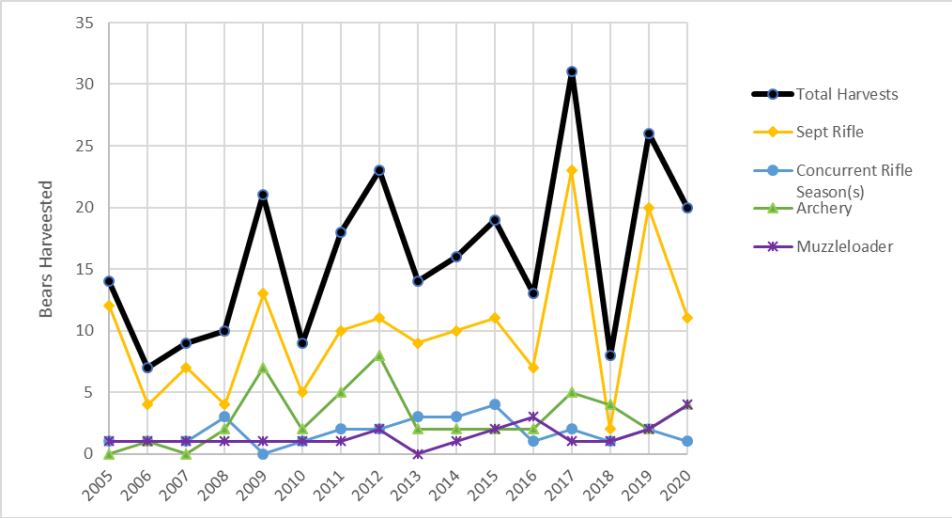

Figure 7. B-12 hunter harvests by season (2005-2020).

Most harvest has occurred within the September rifle seasons (Figure 7), which is due to higher limited license allocations (Figure 4) and higher hunter success rates (Figure 8). Overall harvest success rate (per licenses available) is 3.9%. Harvest success rates do vary by year, but there is no discernable long-term change in harvest success from 2005 – 2020 (Figure 8). Hunter success rates can vary annually depending on the quality of natural forage; in poor food years, bears are more mobile while in search of forage, and therefore their encounter rate with hunters is higher. Hunter success rates (per number of limited licensees available) averaged 6.3%, 3.6%, 2.6%, and 1.6% for the September, archery, muzzleloader, and concurrent rifle seasons respectively for the 2005 – 2020 period (Figure 8). Harvest (Figure 7)

and success rates (Figure 8) decline as hunting season dates progress (September rifle → archery → muzzleloader → concurrent rifle) through the fall months (September-November) due to bears transitioning from the hyperphagia to torpor periods.

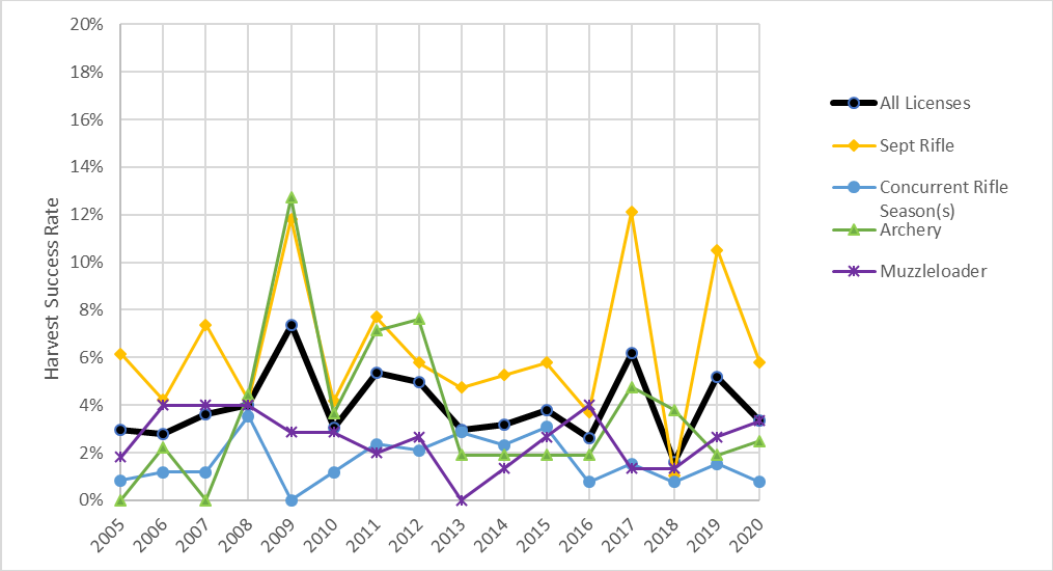

Figure 8. B-12 harvest success (per limited licenses allocated) by season (2005-2020). Note that Y-axis ranges 0-20%.

MORTALITY BY AGE AND GENDER

Beginning in 2006, a premolar tooth has been extracted from dead bears handled by CPW at mandatory check efforts, as a reliable means of determining ages of black bears (Harshyne et al. 1998, Costello et al. 2004). Teeth are collected and submitted annually for aging via cementum annuli sectioning at Matson's Lab in Montana. Tooth ages from 207 of the 262 bears harvested from 2006-2019 were determinable. There is no discernable trend in average age of harvest during this time period when examining the three year moving average (Figure 9). Harvests of old-aged bears (max age harvested = 15 - 30 years of age) occur almost every year in B-12 (Figure 9).

The ages of harvested bears are skewed toward younger age classes (Figure 10), with a median of 5 years of age (2006 – 2019). Among known-age harvested bears, 36% were subadult males; 13% were subadult females; 33% were adult males, and 18% were adult females (Figure 11). Data on the age and sex composition of harvested bears are used as indicators of population trajectory based on the relative vulnerability of each age-sex class being harvested (see elsewhere in this document).

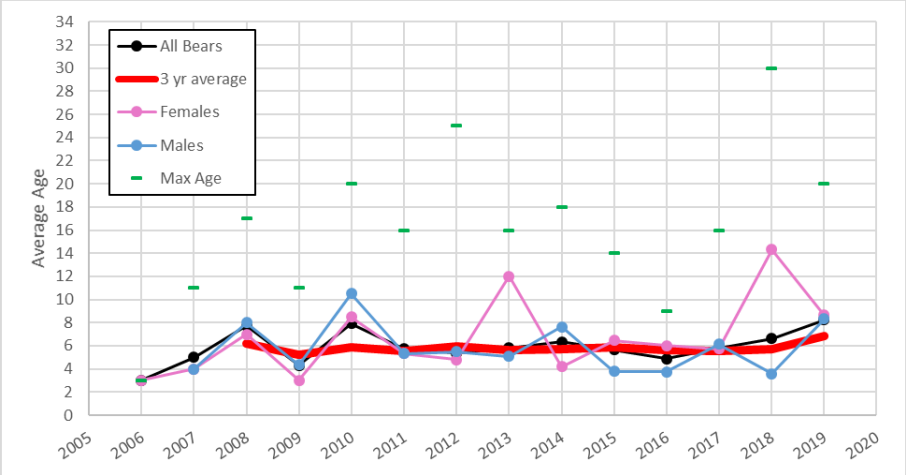

Figure 9. Average age of bears harvested in B-12 by year (black line), three year moving average (red), males (blue), females (pink), and max age (green) from 2006 – 2019.

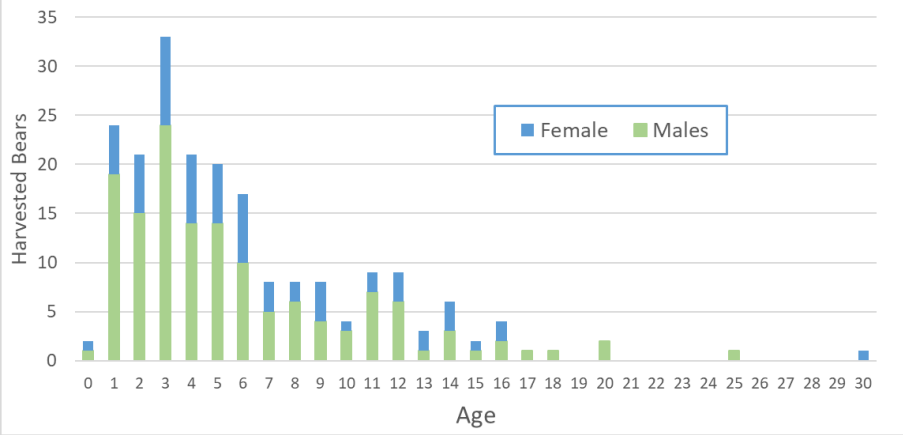

Figure 10. Age distribution of harvested bears in B-12, 2006 – 2019 (n = 207).

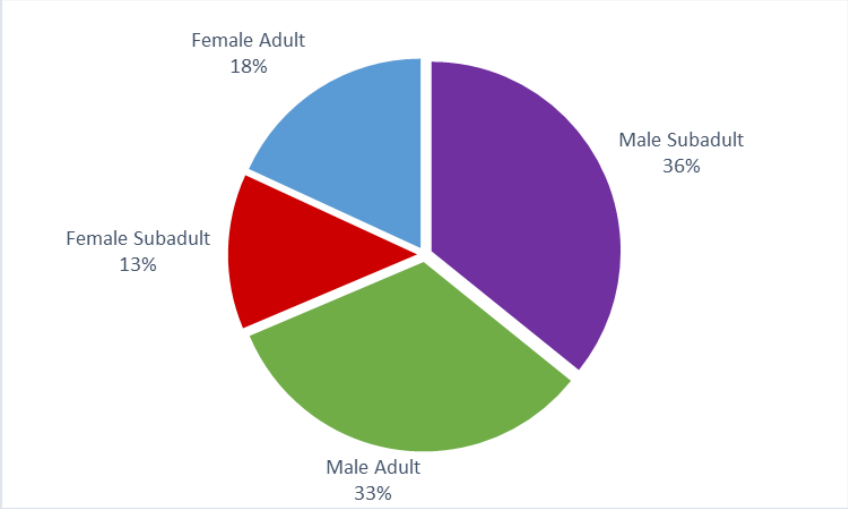

Figure 11. Age and sex composition of harvested bears in B-12, 2006-2019 (n= 207 bears).

BEAR CONFLICT MANAGEMENT

Human conflicts with black bears in B-12 irregularly occur, but are much more frequent during poor natural food years and in towns within bear habitat where human-related attractants remain high. Both bear and human populations have increased over the past several decades in Colorado, resulting in more chances of conflicts between bears and humans. In the 1970s through 1990s, development for residential housing encroached upon summer and fall habitats for bears, and over the past several decades, the human population has grown, leading to both an increased overlap between bears and humans and an increased availability of human food sources. The tourist-driven economy of B-12 supports a proportionately large transient/seasonal human population, so effective public education about securing garbage and keeping doors and windows closed and locked has been challenging to achieve.

However, human conflicts with bears in B-12 are relatively low compared to the rest of Colorado. Occasionally, conflicts result in control mortalities. These control mortalities are defined when a bear is killed by CPW, other authorized agency, landowner or individual when authorized to do so for human safety or livestock protection reasons. Across all of Colorado's 18 black bear DAUs, the current 5-year (2016-2020) median number of control mortalities is approximately 12 per year per DAU. However, B-12 averages only two bear control mortalities per year, and is thus the lowest ranking DAU in Colorado. From 2006-2019, CPW paid for 10 black bear claims in B-12, averaging $677 per claim. CPW began keeping track of human-bear encounters reported to CPW, county sheriff offices, and municipal police/animal control departments through an electronically recorded Wildlife Incidents database in 2019 (Table 1). Thus far, it is difficult to conclude any trends in conflicts from this new database. These incidents range from a report of a bear sighting in a residential or urban area to a physical interaction between a bear and a person. For the purposes of defining a "conflict" in this B-12 management plan, we categorized complaint incidents that involved an attack, aggressive behavior, food source property damage, or non-food property damage to be a conflict, and we classified incidents determined to be a simple sighting or unsubstantiated sighting or complaint as non-conflict (Table 1). With only two years of Wildlife Incidents App data so far (Table 1), it is difficult to conclude any trends at this point. Depending on the conflict severity, bears involved in conflicts are handled according to CPW policy at the discretion of the field officer or supervisor. At most, bears may be targeted for capture and then either translocated or euthanized.

Table 1. Number of conflict and non-conflict reports in B-12 documented in the Wildlife Incidents database, 2019-2020.

	Conflict					Non-conflict		
Year	Attack	Aggressive Behavior	Food Source Property Damage	Non-Food Property Damage	Conflict Total	Sighting	Unsubstantiated	Non-conflict total
2019	0	4	30	7	41	30	0	30
2020	0	2	38	8	48	44	4	48

CURRENT HARVEST AND MORTALITY OBJECTIVES

In 2005, a provisionary objective was established to maintain the B-12 population size as stable. The mortality objective was 25 harvested bears, with a total human-caused mortality objective of 30. It is unknown what the harvest and total human-caused mortality objective

was based on, but records indicate this mortality objective was likely derived by a harvest ranging from 1-30 bears during 1979 –2005. From 2005-2020, the average harvest mortality and DAU total mortality of 16.1 and 20.4 bears respectively is well below this period's objectives for provisional harvest and total mortality(Figure 12).

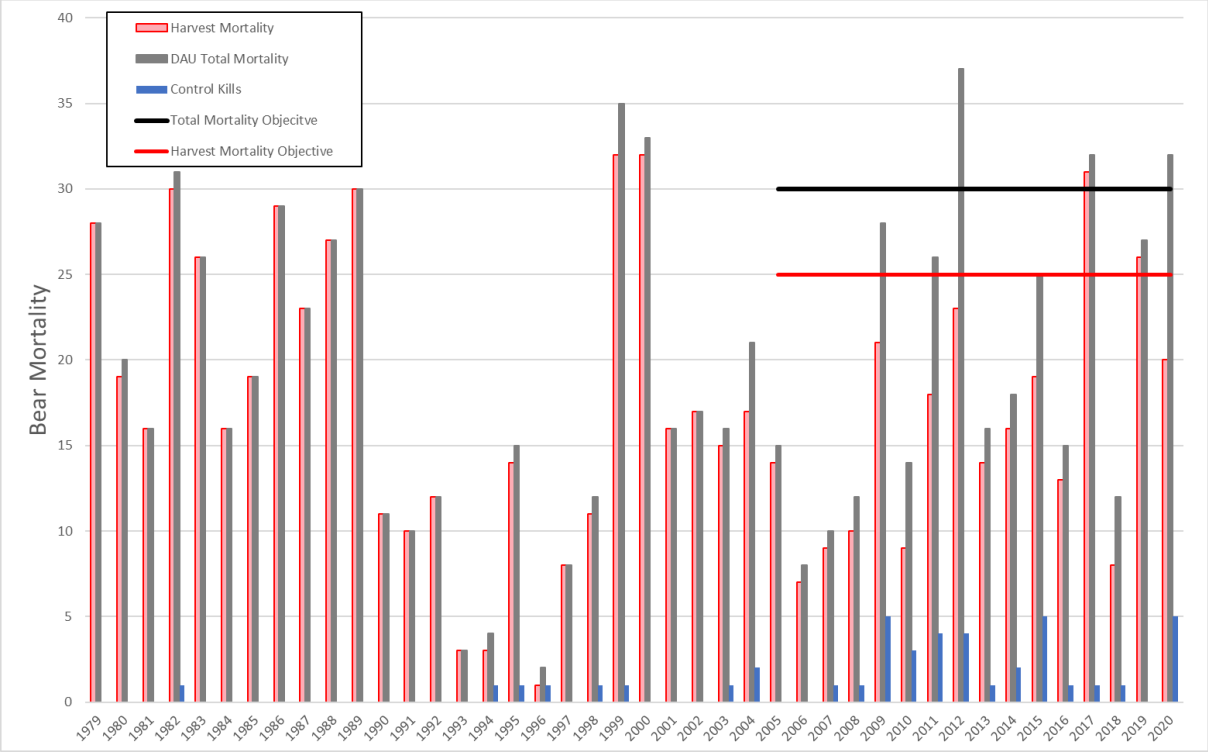

Figure 12. Annual harvest and DAU total mortality in B-12 in relation to the provisional total (black line) and harvest (red line) mortality objectives. Control kills (blue bars) are shown for comparison.

POPULATION MANAGEMENT CONSIDERATIONS

POPULATION SIZE ESTIMATES

Various bear population models have been developed over the years. However, some of these models (e.g., Integrated Population Models) lack parameter inputs specific to B-12's unique landscape. Integrated population models use a combination of field data and assumed values when field data is not available, and is therefore subject to the assumptions used. Because there are many unknowns about bear population demographic rates, there is wide variation among the population model estimates, highlighting the challenges of determining bear population size. The best available information informing bear population size in B-12 likely comes from spatial habitat models and harvest trends. The two spatial habitat models (referred to as Veg Model 1 and Veg Model 2 in this plan) are pixel based thematic maps, where varying presumed bear densities are assigned for various classes of vegetation cover types. Bear densities used in Veg Model 1 and Veg Model 2 are derived from the various black bear density estimation studies that have occurred across North America. Specifically, B-12 density estimates are derived from a combination of estimates from studies conducted in

habitats more similar to B-12's habitat in Colorado (Table 2). Other North American studies were also considered to help inform a biologically potential range of bear densities (Table 2).

Table 2: Black bear densities estimated in other North America studies. Studies utilized specifically for B-12 population size calculations are highlighted in yellow.

		Bears/100 km^2	
Study Area	Source	Midpoint	Range
Washington State	Lindzey 1977	130.5	112 - 149
Nevada - Urban Taho Basin	Bechmann & Berger 2003	120	
Wisconsin	Belant et al. 2005	57	50 - 64
Colorado - Piedra	Apker et al. 2014 Unpublished report	46	32.0 - 60.0
Idaho	Beecham 1980	45	43 - 47
Colorado - Divide Creek	Apker et al. 2015	43.5	40.0 - 47.0
Alberta	Kemp 1976	38	
Montana	Jonkel and Cowan 1971	38	
Colorado - Uncompahgre Plateau	Beck 1995 unpublished federal aid report	36	
Idaho	Rohlman 1989	34	
Arizona	LeCount 1982	33	
Colorado - Spanish Peaks	Apker et al. 2014 Unpublished report	33	11.0 - 44.0
Nevada - Sierra Range	Goodrich 1990	30	20 - 40
Colorado - Greenhorn Mountain	Apker et al. 2014 Unpublished report	29.5	26.0 - 33.0
Colorado - Durango	Apker et al. 2014 Unpublished report	29.5	21.0 - 38.0
Arizona	Waddel and Brown 1984	27.8	
Colorado - Aspen	Apker et al. 2014 Unpublished report	23.5	21.0 - 26.0
Colorado - Black Mesa Study Area	Beck 1991	17.9	
Colorado - Middle Park	Apker et al. 2014 Unpublished report	12.5	11.0 - 14.0
Colorado - Steamboat Springs	Apker et al. 2014 Unpublished report	10	
Colorado - Northern Front Range	Apker et al. 2014 Unpublished report	8.15	7.0 - 14.0
Colorado - Middle Park	Beck 1997 Unpublished Federal Aid Report	8.1	
Utah	Utah Division of Natural Resources 2000	7.7	
Wyoming - Snowy Range	Grogan and Lindzey 1999	2.55	2.1 - 3.0
Colorado - Rocky Mountain National Park	Baldwin & Bender 2007	1.35	

Veg Model 1 was developed by Gill and Beck (1990) in an unpublished report to the Colorado Wildlife Commission and was modified by Apker (2003) in an internal DOW report. This is sometimes referred to as the "General Vegetation/Bear Density Extrapolation". This model subjectively applies probable black bear densities for different vegetation types to the amount of land area of those vegetation types. The vegetation type amounts for this model were derived from Landsat GAP project coarse vegetation types. This vegetation/density model provides a snapshot extrapolation of possible bear population size (Table 2) in Colorado based on current vegetation classes and both measured and projected bear densities in those 1990 vegetation classes. This model and its subsequent extrapolation yields a projected bear population in B-12 of 484 black bears (Table 3).

Table 3: Black bear densities utilized in Veg Model 1 with classification of GAP land-cover vegetation map of B-12 and corresponding bear abundance.

DESCRIPTION	Bears/100 km2	Total Square km	Total Abundance by Habitat
Deciduous woodland (or tall shrubland) dominated by Gambel oak.	38.60	64.15	24.76
Deciduous forest dominated by Aspen.	38.60	611.75	236.13
Shrubland codominated by Big Sagebrush and Gambel Oak.	22.50	23.44	5.27
Codominate Pinon-Juniper and Oak, Mtn. Mahogany or other deciduous shrubs.	21.70	6.59	1.43
Oak dominant with sagebrush, snowberry, grass.	11.25	22.48	2.53
Mixed forest codominated by PIPO and Aspen.	6.40	9.71	0.62
Mixed forest codominated by Aspen and PICO.	6.40	140.54	8.99
Mixed coniferous/deciduous forest codom with PIEN, ABCO, PICO, and POTR.	6.40	92.39	5.91
High elevation shrubland dominated by willow and mixed shrubs.	6.40	220.91	14.14
Coniferous forest dominated by PIPO.	6.40	114.45	7.32
Mixed forest codominated by PIEN, ABLA, and Aspen.	6.40	520.67	33.32
Mixed forest codominated by PIPO and PSME.	5.60	5.59	0.31
Pinon-Juniper woodland with mixed understory.	4.80	7.59	0.36
Coniferous forest dominated by PSME.	4.80	291.46	13.99
Coniferous forest co-dominated by PSME, and PIEN.	4.35	0.74	0.03
Coniferous forest codominated by ABLA and PICO.	4.35	44.93	1.95
Coniferous forest dominated by PIFL.	3.90	2.39	0.09
Mixed forest codominated by PSME and Aspen.	3.90	148.66	5.80
Coniferous forest codominated by PIEN and ABLA.	3.90	1185.23	46.22
Coniferous forest dominated by PICO.	3.90	838.54	32.70
Harvested PIEN/ABLA sites, in regeneration.	3.90	15.85	0.62
Coniferous forest codominated by PICO and spruce.	3.90	167.19	6.52
Coniferous forest dominated by PIAR.	3.90	25.79	1.01
Coniferous forest co-dominated by PICO, PIEN, and ABCO.	3.90	211.36	8.24
Talus and scree slopes, nearly 100% rock.	3.90	151.82	5.92
7,000' to 11,500' tundra shrubs.	3.90	57.63	2.25
High elevation meadows co-dominated by grass and forbs (9,000 - 11,500).	3.90	201.67	7.87
Cottonwood, willow, sedges along waterways.	3.90	32.20	1.26
Wooded riparian areas dominated by cottonwood.	3.90	2.57	0.10
Shrub riparian areas consisting primarily of shrub willows.	3.90	0.01	0.00
Shrub riparian areas dominated by shrub willow species.	3.90	148.34	5.79
Non-woody riparian areas consisting primarily of sedges.	3.90	28.15	1.10
Herbaceous riparian areas dominated by sedges.	3.90	0.06	0.00
Codominate Pinon-Juniper and Sagebrush.	2.40	1.97	0.05
Codominate sagebrush/Mesic Mtn shrub mixed with grass/forb.	2.13	74.53	1.59
< 25% Pinon-Juniper with sagebrush and rock.	1.20	1.20	0.01
> 11,500' meadow dominated by alpine forbs.	0.00	0.27	0.00

Veg Model 2 is another density extrapolation model developed more recently as field methods to measure bear densities. This model has two components: an assessment of use/occupancy of various habitat types and a density estimate for each of three levels of use/occupancy. In 2008, using the Colorado Division of Widlife's Basinwide GIS Vegetation Classification project data, wildlife managers were asked to qualitatively rank each vegetation type for its utility as basic bear habitat (use/occupancy), taking into consideration the relative forage value and

the amount of seasonal use of each vegetation type. Use/occupancy was defined at 4 levels: primary, secondary, edge, and out (or not bear habitat) (Table 4). Much like model 1, model 2 uses apriori assumed bear densities (Table 2) in a matrix for assigning habitat quality and to extrapolate a potential population size (Table 4). However, model 2 incorporates broader bear density categories that the use/occupancy classes refer to (Table 4), which are lumped classes from the individual vegetation types of Veg Model 1 (Table 3). Veg Model 2 also uses a different underlying input vegetation dataset (Basinwide rather than GAP). Finally, Veg Model 2 provides a range of potential bear densities by specifying a low and high density for each use/occupancy class. B-12's density classes were derived from all neighboring DAUs (B-11, B-13, B-14, B-17) and studies of bear abundance of similar habitats as B-12, which include middle park (Beck 1997 Unpublished Federal Aid Report), Rocky Mountain National Park (Baldwin and Bender 2007) a neighboring Black Mesa study (Beck 1991), the Wyoming Snow Range (Grogan and Lindzey 1999), and more recent estimates from Aspen, Middle Park, Steamboat Springs, and the Northern Front Range (Apker et al. 2014). The abundance estimates of Veg Model 2 ranges from 176 bears (low density class) to 337 bears (high density class).

Table 4: Use/Occupancy Forage classes and corresponding high and low bear densities used in Veg Model 2 for B-12.

Use/ Occupancy Forage Class	Description	Measured Area (km^2) of B-12	Density Class	B12 Density Estimate (bears/100 km^2)	B12 Abundance Estimate
Primary	Cover types that bears typically and normally are found at various times of year	1405.4	High	12.5	175.7
			Low	8.15	114.5
Secondary	Cover types that bears occasionally use but is not preferred	4463.5	High	2.55	113.8
			Low	1.35	60.3
Edge	Cover types infrequently used, but bears may be found in when adjacent to Primary cover types	120.2	High	2.55	3.1
			Low	1.35	1.6
Out or Transit Habitat	Non-bear habitat (i.e., sagebrush)	3305.9	High	1.35	44.6
			Low	0	0.0
Total Bears			High		337
			Low		176

A coarse abundance estimate can also be made by back-calculating bear abundance from harvest information. This relies on two major assumptions: 1) A 10-15% annual harvest rate of the bear population results in a stable population size (Miller 1990, Beck and White unpublished data 1996), 2) the B-12 bear population is relatively stable based on the 2005-2020 trends in age and sex composition metrics of harvest (Fraser et al. 1982, Kolenskey 1986, Beecham and Rohlman 1994, Idaho Dept. of Fish and Game 1998, Costello et al. 2001, Woming Game and Fish Dept. 2007). Thus, with the 2005-2020 annual total mortality of 20.4 bears, a 10-15% total mortality rate under the stable population management strategy during the same time period, would correspond to a B-12 abundance of 136 - 204 bears. This corroborates the 176 bears estimated by the habitat model based estimate in Model 2's low density class.

A final B-12 abundance of 213 bears (range: 136 – 484) is estimated at this time. This estimate of 213 bears is specifically derived by averaging the above four most biologically reasonable estimates of 176 (Veg Model 2 low density class estimate), 337 (Veg Model 2 high density class estimate) 136 (from the 15% total mortality rate back-calculation), and 204 (from the 10% total mortality rate back-calculation. The minimum abundance (136 bears) is based on the

15% total mortality rate back-calculation. The maximum abundance (484 bears) is based on the value produced from Veg Model 1.

Total Mortality Rate

Mortality rate can be useful in standardizing mortality among DAUs with varying habitat suitability. Miller (1990) demonstrated that under optimal conditions of reproduction and survival, maximum sustainable total 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%. This range may be useful in gauging current human-caused mortality levels. The actual value of the mortality density thresholds will vary based upon the habitat quality within the DAU and results from the habitat model analysis, but the following guidelines could be used to develop threshold levels:

Increasing: 5% - 10% total mortality
Stable: 10% - 15% total mortality
Suppression: 15% – 20% total mortality

In B-12, the average DAU total human-caused mortality from 2005 - 2020 was 20.4 per year. This corresponds to a total mortality rate of 9.5% assuming a bear population of ~213 bears in B-12. As discussed in the population section above, this value is based on many assumptions to arrive at estimates of population size, but if accurate, it suggests that the population's trajectory is stable, to just slightly increasing, based on mortality rate from recent years.

Harvest 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 the fall hyperphagia period. 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 in poor food years compared to good food years.

Not all segments of a bear population are equally vulnerable. 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. Consequently, the adult male segment of a population is the first to be reduced under hunter pressure. As harvest rates increase, the proportion of subadult (< 5 years old) black bears in the harvest typically increases, whereas the proportion of adult males declines as the population's age structure changes. 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 (Table 8; from Wyoming Game and Fish Dept. 2007). 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 the most recent 3 years of available data on age of harvested bears in B-12 from 2017-2019, adult males comprised 39% of the total harvest (Table 9), suggesting a slightly increasing population size (Figure 1 from Executive Summary). The ten year average is slightly lower at 37.7%.

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 female are least vulnerable, especially if accompanied by cubs. The average percentage of 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 (Table 8; from Wyoming Game and Fish Dept. 2007). Proportions higher than 40% suggest that the population is being reduced through removal of female bears. 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 this indicator, B-12 is within the stable range with 36% of the harvest being females during the 2017-2019 seasons (Figure 2 from Executive Summary). This stable trend also holds for the 10 year average.

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 adult females within the overall female harvest should rise with harvest rates, increasing the 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 dual 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%. Thus, the percent of adults within the female harvest can be used to gauge the presumed population trajectory. Given the small harvest sample size from B-12, this measure of female harvest age structure is averaged over a three year period. 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 (Table 8; Wyoming Game and Fish Dept. 2007). In B-12 the adult proportion of female harvest has been 68% averaged over 2017-2019 (Executive Summary Figure 3) indicative of a slightly decreasing population size under this criterion.

Looking at these three indices of age/sex of harvest together, the bear population in B-12 is relatively stable over the long term (10 year average) under current management and harvest

levels. To better evaluate harvest data, we recommend that harvest objectives and attendant limited license allocations be set for a minimum of 3-year periods. This would allow for a more complete analysis of the effects of harvest by holding dates and quotas the same for each 3-year cycle. In order to increase the sample size of the harvest data and to reduce the influence of high or low annual harvest rates due to environmental or other factors, 3-year running averages should be used in harvest data analyses rather than analyzing annual data individually. While the evaluation of harvest criteria will be analyzed using a 3-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

As described in the Management History section, human-bear conflicts during years of natural food failures have been noticeable to wildlife managers, mostly involving bears in trash, or bears entering or attempting to enter a home, cabin, trailer or car. These conflicts are dealt with by CPW field staff individually depending on severity of the incident and other site-specific qualities, and whether the bear in question had been previously handled by the CPW. CPW's Administrative Directives provide 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. A major reason for these conflicts is that unsecured trash containers and other human food sources are available to bears (e.g., Lewis et al. 2015), despite the adoption of trash ordinances to prevent wildlife-human conflicts. As long as anthropogenic foods are available, they will continue to be an attractant for bears, leading to conflicts with humans and usually the removal of the bear. Under such scenarios, urban areas that draw in bears may function as population sinks, in which the mortality rate exceeds the recruitment rate of the population. At the population scale, mortality of adult females due to conflict removals could negate any improvement in their body condition and cub production gained from feeding on anthropogenic food sources (Lewis et al. 2014).

One social factor often overlooked is hunter crowding. This is sometimes thought to conflict with the quality of the ungulate hunting experience in the five deer and elk GMUs within B-12. Deer hunting opportunities in these early seasons are highly sought after in these five units. Hunter crowding issues during the early fall ungulate seasons (archery and muzzleloader deer /elk seasons) is discussed by CPW staff during every annual license setting session in the Gunnison Basin, and thus hunting pressure placed on bears is likewise considered. Given the low bear hunter success rate (3.9%) in B-12, a large number of bear licenses must be made available to achieve any reasonable harvest. Therefore, an increase in the number of available bear licenses is subject to scrutiny from some hunters exclusively seeking deer or elk, or for hunters seeking solitude. However, over the last five years, B-12 bear hunters are reported to expend an average of ~66.4 days afield (0.13 days/license allocated) annually from 2016 - 2020. At this current time, this number of bear hunters afield is not considered to be conflicting with ungulate hunting quality.

Predator-prey dynamics

Black bears can be highly effective predators upon newborn ungulates, and bear predation is often a major proximate cause of mortality for elk calves (e.g., grizzly and black bear: Singer et al. 1997, Barber-Meyer et al. 2008; black bear: Smith et al. 2006, White et al. 2010). However, the effects of predation on prey populations are complex and vary with predator and prey densities and species composition, habitat cover and forage conditions, weather,

body condition, and other biological and ecological factors (Singer et al. 1997, Smith et al. 2006, White et al. 2010, Griffin et al. 2011). Predator control is sometimes suggested by the public to improve ungulate populations, but its efficacy depends on a wide array of ecological interactions. Therefore, reducing the bear population in B-12 may, or may not, ultimately improve deer and elk populations. Based on deer fawn and elk calf production data collected in herds overlapping B-12 from 1980 - 2021, no apparent correlation between bear harvest (Figure 12) and ungulate recruitment exists.

STRATEGIC GOALS AND MANAGEMENT OBEJECTIVES

PROCESS FOR DEVELOPING STRATEGIC GOALS AND MANAGEMENT OBJECTIVES

The structure of a CPW bear management plan focuses primarily on one specific tool, hunting, out of a suite of tools such as education, enforcement, and habitat modification that can also be used to manage the bear population and human-bear conflicts. This plan provides harvest-related monitoring structures to assess the bear population, along with strategic goals that will attempt to influence the bear population size in B-12 and, ideally, to maintain the Gunnison Basin's low rate of human-bear conflicts.

In reality, human-bear conflicts require more than changes in licensing or hunting structure in order to resolve the problems. In addition to (and probably more effective than) bear population reduction, a drastic reduction in unsecured trash and other human food sources is also necessary to minimize the incentives for bears to forage in urban areas for anthropogenic foods. This will become even more important as the human population size increases throughout B-12.

Attempts in other North American states and provinces to reduce human-bear conflicts through hunting have been equivocal. Differences among these management attempts could be due to varying levels of bear harvest relative to bear population size, varying management responses to bear conflicts, and varying compliance with ordinances and recommendations to secure human-source foods and attractants; all of which highlight the complex and multi-faceted nature of human-bear conflict management. Some studies found that increasing bear harvest did lead to a reduction in complaints and conflicts (Raithel et al. 2017, Garshelis et al. 2020) and that following high levels of bear harvest, the reductions in both complaints and bear population size were sustained for multiple decades (Garshelis et al. 2020). However, other studies found that increasing bear harvest was not correlated with fewer conflicts (Obbard et al. 2014, Tavss 2005, Treves et al. 2010). Bears that were harvested may not have been the individuals involved in conflicts, or the level of harvest was not enough to reduce the population. More importantly, the underlying cause of the conflicts, namely unsecured trash and other human food sources, went unresolved in those studies.

Local CPW staff have developed three alternatives to consider for strategic goals for the B-12 bear population moving forward, which are as follows:

ALTERNATIVE 1: STABLE POPULATION TREND (APPROVED)

B-12 would be managed for a stable population trajectory, in which the 3-year average trend in age/sex composition of the harvest should be consistent with that of a stable population:

(a) proportion of adult males in all harvest within 25-35%,
(b) total females within 30-40% of all harvest,
(c) adult females within 45-55% of the female harvest.

The DAU total mortality rate as a proportion of the population should fall in the 10-15% range. However, the exact mortality rate is unknown in this population, given that the rate is dependent on the number of non-hunting bear mortalities and abundance estimates of the B-12 bear population size. Field based estimates of the B-12 population size have never been implemented, thus true estimates of population size, and by extension the mortality rate, are not obtainable at this time.

To maintain a stable population size, the three age and sex harvest composition metrics would be maintained within the stable parameters through annual adjustments in bear license numbers. Based on the long-term average and range of bear harvests and other human-caused mortalities reported, a 3-year average harvest and total human-caused mortality of 16 and 20 bears respectively would be expected under this strategy. As additional objectives for assuring the population does not decrease below a sustainable size, a commensurate decrease in licenses will happen in response to the following triggers: 1) the 3-year average total human-caused mortality exceeds a maximum threshold of 30 bears, 2) the 3-yr bear hunter harvest success falls below 1%.

Given the uncertainty in the population, age/sex harvest composition metrics, a B-12 bear management plan re-evaluation trigger will be implemented that calls for a HMP revision once the 5-year average number of bear control kills, from human-bear conflicts, exceeds 10 bears per year. 10 bears per year is just under the median (12 bears/year) number of control kills for all other Colorado bear DAUs in the last five years (2016 – 2020), and double the maximum number of control kills (5) ever recorded in B-12 (Figure 12).

ALTERNATIVE 2: DECREASING POPULATION TREND

B-12 would be managed for a decreasing population trajectory, in which the 3-year average trend in age/sex composition of the harvest should be consistent with that of a decreasing population:

a) proportion of adult males less than 25% of all harvest,
b) total females greater than 40% of all harvest,
c) adult females greater than 55% of the female harvest.

The total human-caused mortality rate as a proportion of the population should fall in the 15-20% range. However, the exact mortality rate is unknown in this population, given that the rate is dependent on the number of non-hunting bear mortalities measured and abundance estimates of the B-12 bear population size (see relevant discussion in Alternative 1).

To achieve a decreasing population size, the three age and sex harvest composition metrics would be maintained within the decreasing parameters through annual adjustments in bear license numbers. As additional objectives for assuring the population does not decrease below an unsustainable size, a commensurate decrease in licenses will be triggered in response to the 3-yr bear hunter harvest success falling below 1%.

Given the uncertainty in the population, age/sex harvest composition metrics, a B-12 HMP re-evaluation trigger will be used once the 5 year average number of bear control kills (via human-bear conflicts) drops to 0 bears per year.

Alternative 3: Increasing Population Trend

B-12 would be managed for an increasing population trajectory, in which the 3-year average trend in age/sex composition of the harvest should be consistent with that of an increasing population:

(a) proportion of adult males greater than 35% of all harvest,
(b) total females at less than 30% of all harvest,
(c) adult females at less than 45% of the female harvest.

The total human-caused mortality rate as a proportion of the population should fall in the 5-10% range. However, the exact mortality rate is unknown in this population, given that the rate is dependent on the number of non-hunting bear mortalities measured and abundance estimates of the B-12 bear population size (see relevant discussion in Alternative 1).

To achieve an increasing population size, the three age and sex harvest composition metrics would be maintained within the increasing parameters through annual adjustments in bear license numbers.

Given the uncertainty in the population, age/sex harvest composition metrics, a B-12 HMP re-evaluation trigger will be used where once the 5 year average number of control kills (via human-bear conflicts) for bears exceeds 10 bears per year. 10 bears per year is just under the median (12 bears/year) number of control kills across all other Colorado bear DAUs, and double the maximum number of control kills (5) ever recorded in B-12.

PUBLIC PROCESS

Public Meetings

Two public meetings were held to discuss the B-12 population and this bear management plan. Information summarized in this plan was presented, along with an opportunity to have an open discussion with all those interested. Attendance of these public meetings were relatively small and few comments were provided for feedback. A scoping meeting was held August 13, 2019, of which 11 people attended. A second meeting was held December 11, 2019 in the form of a general bear education event, where the presentation from the scoping meeting was provided. Approximately 50 people attended, and one comment was received regarding the future management strategy of black bears. This comment advocated for reducing the bear population.

30-day Public Comment Period

A draft of this plan, with the Alternative 1's stable population strategy identified as the preferred direction, was made available on the CPW website November 5, 20221 to December 5, 2021 to allow any members of the public, partner agencies (USFS, BLM, county commissioners), to express concerns or provide feedback. An announcement of this draft plan was provided in a CPW press release, where various local news outlets and social media channels could reach a wide audience. Only three comments from individuals were received, totaling approximately 200 words (Appendix A). All three comments advocated to cease bear hunting and/or reduce instances in which control mortalities would be allowed to occur.

PARKS AND WILDLIFE COMMISSION

A final draft of this plan was presented to the Colorado Parks and Wildlife Commission on January 13, 2022 for initial review, and on March 10, 2022 for a final vote. The CPW commission is a citizen board, appointed by the Governor, which sets regulations and policies for Colorado's state parks and wildlife programs. This 11 voting member board represents a cross-section of outdoor stakeholders, which includes three sportspersons, three agricultural producers, three recreationalists, and two at-large members.

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Appendix A: Comments Received From 30 Day Public Comment Period

Comments were received (via email) from three individuals during the 30 day public comment period. Names and contact information are removed.

11/9/2021:

Dear Mr. Blecha,

I know you have a difficult job of balancing wildlife vs. hunting. In my very humble opinion, I would have NO hunting of black bears - period!!!!!! If there are a few (if any) man-eating bears out there, please hire professional sharp shooters who have the skills to kill those "errant" bears effeciently. Killing for "fun" is disgusting and a stain on our moral integrity. Do you really want your children to enjoy taking an innocent life???????? Just for fun???????????

11/10/2021:

Mr Blecha,

I support increased public education safety/trash training and a sharp reduction of hunting quotas for bears. Since they are not a problem, their numbers should be allowed to increase. People should be fined for leaving trash out - and bears should not be killed unless in the act of attacking a human.

Sincerely,

11/14/2021:

I am a deer, duck and soon to be elk hunter in El Paso county. I vote to kill as few bears as possible. It s considered to be trophy hunting by the general public and that further gives hunting a bad image in the eyes of the general public. I would concentrate on removing problem bears and use funds for securing more habitat for wildlife and improve ecosystems in the state

thanks