MANAGEMENT AND BIOLOGY OF BLACK BEARS IN PENNSYLVANIA

Five Year Plan Revision
(2024-2029)

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EXECUTIVE SUMMARY

Many Pennsylvanians value the presence of bears even if they seldom see one. Bears are a source of recreation for hunters, wildlife photographers, and people who enjoy watching wildlife. Bears also can be an indicator of ecosystem health, a symbol of wilderness, and have economic impacts by damaging property, crops, or livestock. Black bears are a valuable resource in Pennsylvania that should be managed wisely.

At one time, bear populations were precariously low in Pennsylvania. However, their abundance and distribution has increased substantially during recent decades and bears now occur at record numbers throughout most of the state. Their recovery is a wildlife success story, but as bear populations increase and more people choose to live in areas occupied by bears, human-bear conflicts increase. A comprehensive plan for managing our bear resource was first approved in 2006 and is now being revised with this document.

The Mission Statement of the original Plan remains the same: to maintain healthy black bear populations in suitable habitats throughout the Commonwealth that provide hunting and recreational viewing opportunities without human-bear conflicts exceeding levels acceptable to citizens of Pennsylvania. The four goals of the original management plan have remained with some slight updates: (1) Ensure that black bear populations remain sustainable; (2) Maintain diverse forested habitats throughout the state for black bears; (3) Maintain human-bear conflicts at acceptable levels; and (4) Provide recreational opportunities that involve black bears. Additionally, a fifth goal was identified in the most recent stakeholder meeting in May of 2022: (5) Increase the public's knowledge about black bears. Necessary steps, referred to as objectives, and a list of strategies are provided for each goal.

A comprehensive review of what we know about the biology of bears in Pennsylvania, their history of population declines and recovery, economic impacts, public interest, and current population and habitat conditions also is provided. Twenty tables and figures are used to present information from more than 40 years of ongoing bear research and management. A comprehensive review of bear management techniques from across North America is provided as supporting documentation.

MISSION STATEMENT, GOALS, OBJECTIVES, AND STRATEGIES

Mission Statement for Bear Management in Pennsylvania

> *Maintain healthy black bear populations in suitable habitats throughout the Commonwealth that provide hunting and recreational viewing opportunities without human-bear conflicts exceeding levels acceptable to citizens of Pennsylvania.*

Five work areas are apparent in this mission statement: adequately manage and monitor bear populations, habitat, conflicts, recreational opportunity, and increase the public's knowledge about black bears. These work areas translate into five goals, which are listed below.

A course of action that contains objectives (major tasks) and strategies (how to accomplish a task) is outlined under each goal. Many of the objectives and strategies appearing here are identical to those in the original 2006-2016 Plan, which were based on input from a group of black bear stakeholders (see Appendix 1).

GOAL 1. ENSURE THAT BLACK BEAR POPULATIONS REMAIN SUSTAINABLE (Population Goal).

Objective 1.1 Maintain Wildlife Management Unit (WMU) bear populations in accordance with bear population objectives.

Strategies

1.1.1 Create a decision process to determine annual population objectives by WMU by June 2024.

1.1.2 Annually estimate population size at the state and WMU levels.

1.1.3 Determine feasibility of using Statistical Population Reconstruction or alternative method to monitor black bear population trends by June 2025.

1.1.4 As needed, design research to provide data to address population monitoring and management needs.

1.1.5 Evaluate bear check station operations and recommend changes to improve effectiveness and efficiency of monitoring annual bear harvest by January 2025.

Objective 1.2 Identify and address threats to black bear health.

Strategies

1.2.1 Annually monitor black bear health at captures and bear check stations.

1.2.2 Work with the Wildlife Futures program to identify black bear disease monitoring needs by January 2027.

1.2.3 Continuously identify regional and national partners to continue black bear disease and health concern research where needed.

GOAL 2. MAINTAIN DIVERSE FORESTED HABITATS THROUGHOUT THE STATE FOR BLACK BEARS (Habitat Goal).

Objective 2.1 Identify critical habitat characteristics used by black bears.

Strategies

2.1.1 Review literature and draft a guidance document on black bear habitat selection and habitat management techniques that provide preferred habitat types for black bears by January 2025.

2.1.2 Identify research needs to better understand habitat use by black bears in Pennsylvania and identify habitat manipulations that may help achieve other management objectives (i.e., mitigate conflict) by June 2027.

Objective 2.2 Increase agency staff and public consideration of black bear habitat needs when protecting, purchasing, and managing land.

Strategies

2.2.1 Continue participation in forest conservation programs, such as the Forest Stewardship Program, the Forest Wildlife Cooperator Program, and the Conservation Reserve Program (for forested riparian areas).

2.2.2 When possible, purchase forestlands in the primary bear range for addition to the State Game Lands system with a focus on connecting current public lands throughout the state.

2.2.3 Review habitat recommendations for black bears in the Wildlife Habitat Manual, and revise or add recommendations to incorporate treatments that are beneficial to black bears (e.g., promoting soft mast, herbaceous openings, and oak conservation).

Objective 2.3 Monitor abundance and productivity of hard and soft mast foods in each WMU.

Strategies

2.3.1 Annually measure wildlife food conditions using a qualitative survey of field employees.

2.3.2 Evaluate and identify mast survey data collection techniques to enhance efficiency of survey efforts and quality of data by June 2028.

GOAL 3. MAINTAIN HUMAN-BEAR CONFLICTS AT ACCEPTABLE LEVELS (Human-Bear Conflict Goal).

Objective 3.1 Identify social carrying capacity at the WMU level.

Strategies

3.1.1 Survey Pennsylvania residents to determine satisfaction with current bear populations every 5 years after the most recent survey done in 2023.

3.1.2 Annually document the type and number of human-bear conflicts in each WMU.

Objective 3.2 Develop or improve methods for reducing human-bear conflicts.

Strategies

3.2.1 In accordance with PGC policy and Standard Operating Procedures, remove any bear from the population that is deemed a chronic nuisance or public safety threat as needed.

3.2.2 In cooperation with the Bureau of Wildlife Protection and Regional staff, create an objective, categorical method to identify the severity level of a bear complaint and standardize responses to human-bear conflicts for consistency statewide by January 2028.

3.2.3 Conduct a resident survey to identify sociological factors affecting human-bear conflict by June 2025.

3.2.4 Review and revise PGC informational materials on how to avoid conflicts with bears as needed.

3.2.5 Create a BearWise™ community program and establish six BearWise™ communities withing the commonwealth by June 2029.

3.2.6 Evaluate new or emerging methods for reducing human-bear conflicts as needed.

3.2.7 Evaluate use of increased hunting opportunity to manage human-bear conflict within a WMU by January 2026.

GOAL 4. PROVIDE RECREATIONAL OPPORTUNITIES THAT INVOLVE BLACK BEARS (Recreation Goal).

Objective 4.1 Annually allow black bear hunting during a season that is compatible with all other objectives in this plan.

Strategies

4.1.1 Annually have a statewide firearms hunting season for black bear during the third week of November.

4.1.2 Annually establish harvest goals for each WMU to achieve population objectives (Strategy 1.1.1).

4.1.3 Annually identify WMUs where population trends and harvest are not meeting population goals and identify additional hunting opportunities beyond the statewide firearms season.

4.1.4 Continuously identify the recreational benefit (e.g., participation, approval rating, etc.) for additional hunting opportunities identified in Strategy 4.1.3.

4.1.5 Implement models for predicting population impacts to assist in evaluation or drafting of season proposals (after strategies 1.1.2 and 1.1.3) by January 2029.

Objective 4.2 Increase awareness and promotion of other recreational opportunities.

Strategies

4.2.1 Evaluate, and if possible, incorporate information about viewing and photographing free-ranging bears into education/outreach materials by December 2029.

GOAL 5. INCREASE THE PUBLIC'S KNOWLEDGE ABOUT BLACK BEARS (Education Goal).

Objective 5.1 Increase outreach opportunities throughout the state to increase overall knowledge about black bears and how to avoid human-bear conflict.

Strategies

5.1.1 Increase availability of informational materials on the PGC website and social media accounts by June 2025.

5.1.2 Continue ongoing black bear outreach opportunities and identify where new outreach opportunities should be established throughout the state.

5.1.3 Identify Game Commission staff and applicable external groups that can assist with outreach opportunities statewide by January 2027.

5.1.4 Create outreach opportunity goals that are commensurate with human-bear conflict levels and staff availability per region by January 2028.

5.1.5 Annually provide updated BearWise materials to outreach staff to maintain consistent human-bear conflict messaging.

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ACKNOWLEDGEMENTS

Many people including employees of the Pennsylvania Game Commission, Cooperative Wildlife Research Unit staff at Pennsylvania State University, graduate students and volunteers helped to collect the data discussed in this document. All data contained herein are subject to revision from corrections, improved analyses, and/or regrouping of data.

Cover drawing by Doug Pifer.

SECTION I. LIFE HISTORY

Life history traits of black bears in Pennsylvania are well documented. There are more than 250 articles published in popular magazines, scientific journals, books, conference proceedings, and agency reports that focus on some aspect of Pennsylvania black bears. Data are available on more than 153,000 bears handled since the mid-1970s, of which more than 20,000 were marked with ear tags. Few jurisdictions have such a wealth of information.

The life history of Pennsylvania black bears is summarized below. A review of life history is important because not all populations of black bears have identical biological characteristics, and some characteristics are notably different in Pennsylvania. Understanding the biology of Pennsylvania's black bear allows management strategies to be developed that are specific to our state.

Taxonomy

Bears are large-bodied members of the mammalian order Carnivora, family Ursidae that evolved from small tree-climbing ancestors (Miacids) almost 25 million years ago (Herrero 1999). There are eight species of bears worldwide occupying all continents, except Australia, Antarctica, and Africa.

Three species of bear occur in North America: the polar bear (*Ursus maritimus*), the brown or grizzly bear (*Ursus arctos*), and the American black bear (*Ursus americanus*). The American black bear is the only species living in Pennsylvania and the eastern United States (Pelton 1982, Servheen 1990). As many as 16 subspecies of the American black bear have been described based on differences in size, distribution and color (Hall 1981). The subspecies typically reported for Pennsylvania is *Ursus americanus americanus* (Whitaker and Hamilton 1998).

Distribution

The American black bear once occupied all forested regions in North America (Hall 1981, Pelton and Van Manen 1997, Scheick and McCown 2014), but habitat loss, overharvest, and predator control campaigns led to their disappearance from some areas. Today, black bears occur across most of Canada, in at least 40 U.S. states, and in northern Mexico (Scheick and McCown 2014).

In the eastern United States, black bears primarily live in a continuous band extending along the Appalachian Mountains from Maine to Georgia. Isolated populations also occur in some areas of Georgia, Florida, Mississippi, Alabama, and Louisiana (Fig. 1).

Bears in Pennsylvania are contiguous with populations in New York, New Jersey, West Virginia, and Maryland. Sightings are possible in all 67 counties; however, the primary range is limited to about three-quarters of the state. Areas currently outside the primary range include the southwest counties of Greene, Washington, Beaver and western Allegheny, and the southeast corner of the state from Adams County east, south of the Blue Mountains (Fig. 2). These areas lack large forested habitats and, instead, contain significant agricultural or urban development.

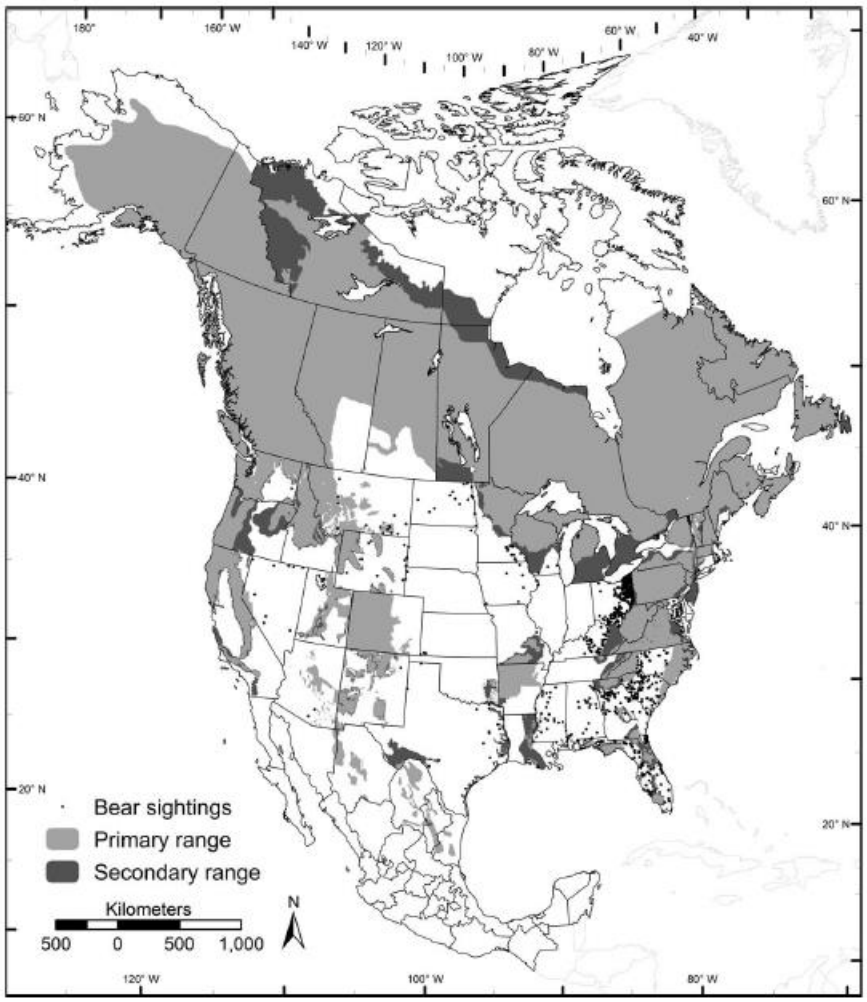

Figure 1. Estimated black bear range in North America (Scheick and McCown 2014).

Physical Characteristics

At birth, black bears in Pennsylvania weigh 10 to 16 ounces. They are 8 to 11 inches long and covered with fine (about one-tenth inch long) hair. Their ears are poorly developed buds less than one-half inch in length, and their eyes are closed for the first six weeks (Alt 1987). Newborn cubs are capable of crawling short distances and tend to be attracted toward warm objects, which may help them nurse in the den.

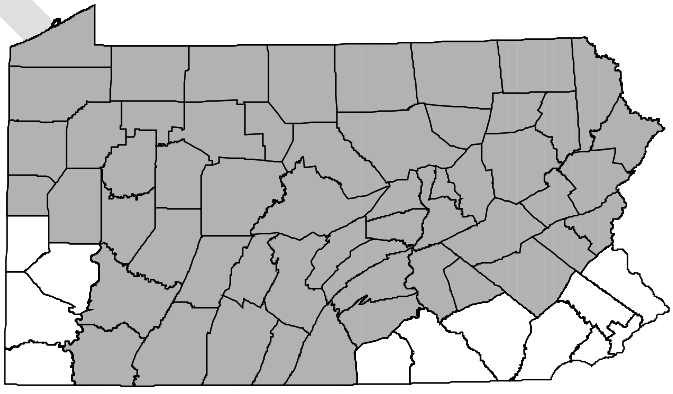

Figure 2. Primary bear range in Pennsylvania by County based on occurrence of forest habitats and frequency of bear sightings.

Growth is rapid during the first year. At two months, cubs typically weigh five pounds. By mid-November (11 months old), they average 80 pounds and may be as large as 140 pounds (Alt 1980*a*, unpublished PGC data). Interestingly, cubs of this age once averaged 20 to 30 pounds less in Pennsylvania during the early 1900s (Gerstell 1939).

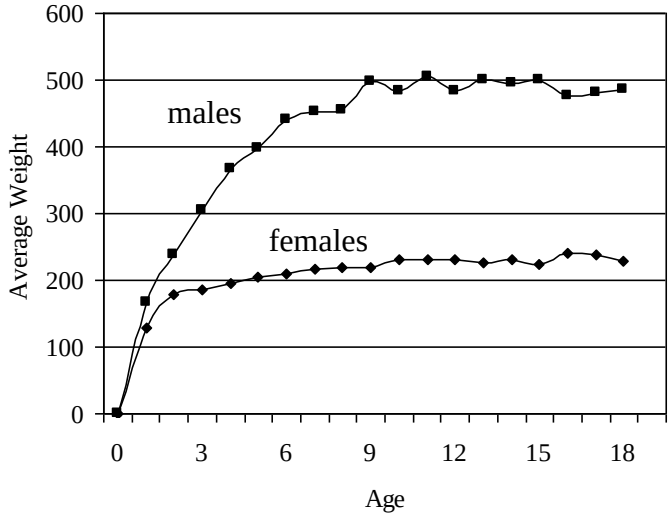

Figure 3. Average live weight (pounds) of black bears in Pennsylvania by sex and age. Scales were used to measure the weight of 53,535 whole or field-dressed (viscera removed) bears between 1969 and 2003. Field-dressed weights were assumed to be 82 percent of whole weight. Age was determined by cementum annuli analysis of collected teeth.

By age two, males in Pennsylvania average 240 pounds and females, 180 pounds. Full growth is usually reached by age five for females, or nine for males, and average adult weights stabilize near 250 and 500 pounds, respectively (Fig. 3). Adult males are 70 to 74 inches long and at least 30 inches high at the shoulder. Adult females are 59 to 62 inches long and rarely more than 30 inches at the shoulder (Eveland 1973, Alt 1980*b*). Black bears in parts of Pennsylvania appear to grow faster and larger than almost anywhere else in North America (Alt 1980*b*).

Subadult bears (i.e., less than three years old) of both sexes tend to gain weight throughout spring and summer. Adult males, on the other hand, generally lose weight or remain stable during this time. Spring-summer weights of adult females vary depending on whether they are with newborn cubs, one-year-old cubs, or solitary (Alt 1980*b*). All bears tend to gain weight in the fall and lose weight during winter hibernation. However, despite losing weight in the winter – sometimes as much as 30 percent – many bears in Pennsylvania emerge from dens in relatively good condition (Gerstell 1939, Alt 1980*b*), but additional weight loss in early spring is possible.

Black bears have a straight facial profile. The ears are rounded, and the eyes face forward. Eyes of adults are brown, and eyes of newborn cubs are blue. Eyesight is believed to be good only at short distances, but bears can distinguish some colors (Bacon and Burghardt 1976, Heyward et. al. 2020). Black bears also have a reflective lens in the back of their eye called the tapetum lucidum or third eyelid that increases their vision capabilities at night (Johnson 1901). The senses of smell and hearing are highly developed. Black bears possess 100 times greater an area of the sensitive olfactory membranes than humans do and can smell items (like potential food sources) from upwards of a mile away (Fair 1994). Black bears also have a vestigial vomeronasal organ (Jacobson's organ) on the roof of their mouth that also

enhances their olfactory abilities. Black bears have 42 teeth. Like most carnivores, the canine teeth are large and pointed, but cheek teeth are low-crowned, which is different from other carnivores that typically have scissor-like cheek teeth. The premolar teeth between the canine and cheek teeth are small and rudimentary.

Black bears have short, curved (1 to 1.5-inch) non-retractable claws on all four feet. Each foot has five toes. Bears walk with a shuffling gate because they walk on the soles of their feet. This differs from other carnivores, which typically place more weight on their toes. Bears can run up to 35 miles per hour over short distances (Kolenosky and Strathearn 1987), and they are strong swimmers and agile tree-climbers.

The tail is short and inconspicuous. Fur is uniform in color, except for a brown muzzle and an occasional white blaze on the chest. Fur color can vary. Black fur predominates in the eastern United States whereas brown, cinnamon, or blonde variations are common in western states (Rounds 1987). A white-phase (referred to as the Kermode bear), which is the result of a double recessive coloration gene and not albinism, exists on Gribble Island and neighboring coastal areas of British Columbia. A bluish-phase (called a glacier or blue bear) occurs in northern British Columbia and the Yukon (Pelton 1982, Kolenosky and Strathearn 1987).

In Pennsylvania most bears have black fur with less than one percent being brown/cinnamon. Sightings of brown-phase bears tend to be concentrated in northcentral counties (True 1882, Alt 1981*a*). Historical accounts of white (likely albino) and red-tinted black bears in Pennsylvania also exist (Blackman 1873, Rhoads 1903, Shoemaker and French 1921).

Food Habits

Black bears are opportunistic omnivores that tend to capitalize on whatever food is easiest to obtain. They have a varied diet including both plant and animal matter, but greater than 75 percent of the diet is typically vegetation. In early spring, bears feed on succulent new plant growth near wetlands, riparian habitats, and wet forest openings. Skunk cabbage (*Symplocarpus foetidus*), sedges (*Carex* spp.), grass, and squawroot (*Conopholis americana*) are important foods. Tree buds, catkins, and new leaves also are eaten, along with any acorns remaining from the previous year. Colonial insects (mostly ants and bees) are added to the diet as spring progresses.

Fruits and berries become increasingly important during summer and fall. Examples in Pennsylvania include blueberry (*Vaccinium* spp.), elderberry (*Sambucus* spp.), blackberry (*Rubus* spp.), juneberry (*Amelanchier* spp.), pokeberry (*Phytolacca* spp.), wild grapes (*Vitis* spp.), and fruits from chokecherry (*Prunus virginiana*), dogwood (*Cornus* spp.), hawthorn (*Crataegus* spp.), cucumber magnolia (*Magnolia acuminata*), and black cherry (*Prunus serotina*) trees (Bennett et al. 1943, Arner 1948). Agricultural crops (mostly corn), beehives and honey, and human-related foods (e.g., birdfeed, garbage, pet foods) are eaten, especially if they are readily available or when natural food supplies are poor. Bears also prey on mice, squirrels, groundhogs, beaver, and newborn white-tailed deer. In two studies of Pennsylvania fawn survival, bears killed 7 to 14 percent of very high frequency (VHF) and global

positioning system (GPS) collared fawns: 16 of 218 fawns in a 2001-2002 study (Vreeland 2002), and 23 of 165 fawns in a 2015-2017 study (Gingery 2018).

Acorns (*Quercus* spp.), beechnuts (*Fagus grandifolia*), apples (*Malus* spp.), and occasionally hazelnuts (*Corylus* spp.) or fruit from black gum trees (*Nyssa sylvatica*) are typical fall foods for bears in Pennsylvania (Bennett et al. 1943, Arner 1948). Because black bears need to accumulate large fat reserves prior to hibernating, these foods, particularly acorns and beechnuts, are critical. When fall nut crops are poor, bears tend to den early, weigh less, and produce fewer and smaller cubs. Availability of fall foods also influences the number of bears struck by automobiles, nuisance activity, and hunter success rates.

Reproduction

Black bears breed during summer. Females may be in estrus as early as May 18 or as late as September 12, but the peak breeding period for females in Pennsylvania is June 15 to July 15 (Alt 1982, Alt 1989). Black bears are promiscuous. Males mate with multiple females during the course of a single breeding season, and although a male may stay with a receptive female for two or three days, some females mate with more than one male. Adult males will fight one another for the opportunity to breed.

Female black bears exhibit delayed implantation (Wimsatt 1963). Eggs are fertilized immediately, but development is suspended shortly afterward at the 16-cell stage (blastocyst). Dormant blastocysts float freely in the uterus for several months before implanting and resuming embryo development. In Pennsylvania, implantation occurs between mid-November and early December (Kordek and Lindzey 1980).

Delayed implantation is beneficial because it postpones investment of nutritional resources until after the critical fall foraging period. If fat reserves are poor because of an unexpected food shortage, pregnancy (dormant blastocysts) can be aborted without a large loss in nutritional investment, freeing the female to breed again next summer. If reproductive failure is widespread, cub production in the population becomes synchronized where all females including those that aborted pregnancies and those that did not breed (i.e., were with offspring) breed the following year. This leads to a cycle of high cub production one year followed by low cub production the next year. However, reproductive failure is uncommon in Pennsylvania and typically occurs in less than 9 percent of the breeding female population (Alt 1982), therefore, breeding synchronies are rare. In northcentral Pennsylvania, an average of 49.7 percent of adult female bears are with cubs annually (Ternent 2019).

Cubs in Pennsylvania are born during the first three weeks of January while females are in dens (Matson 1954, Alt 1983*a*, Alt 1989). Birth dates are not widespread despite a relatively long breeding season, which is probably caused by the synchronization of implantations. Cubs weigh 10 to 16 ounces at birth and develop quickly. Bear milk can have a fat content that approaches 30 percent and may be the highest of any land mammal (Hock and Larson 1966, Jenness et al. 1972). Bear milk also is high in calcium and iron, even though females have no dietary intake during hibernation. Serum blood analyses from hibernating bears have suggested that the source may be bone decomposition (Matula et al. 1980).

The average size of litters in Pennsylvania is 2.7 cubs, but they range between 1 and 5 (PGC unpublished data; Fig. 4). In northeast Pennsylvania, the average litter size is reported as 3.0 cubs, with litters of 2 being about as common as litters of 4 (Alt 1981*b*, Alt 1982, Alt 1989). In northcentral Pennsylvania, average litter size is slightly smaller at 2.7 cubs (Ternent 2019).

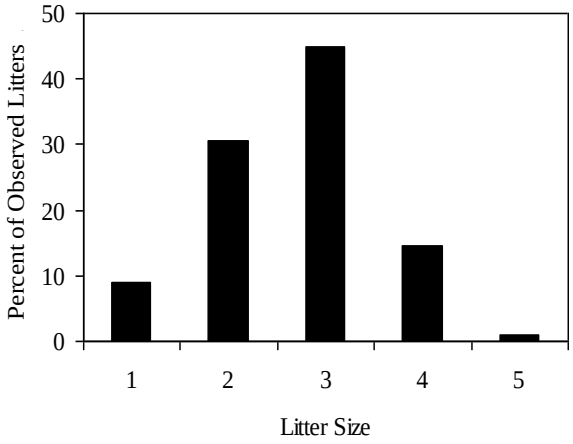

Figure 4. Prevalence of different-sized litters for black bears in Pennsylvania. Average litter size was 2.7 cubs. Values are based on 642 litters observed during capture or winter den visits of 473 bears between 1975 and 2003.

Older females produce larger litters. In a study of litter size in northeast Pennsylvania, average age of bears that produced litters of 1 was 4 years; litters of 2, 5.5 years; litters of 3, 6.2 years; litters of 4, 7.8 years, and litters of 5, 9.5 years (Alt 1982). Sex ratios within litters are typically equal, but the incidence of males may increase slightly in larger litters (Alt 1981*b*, Alt 1982). Cubs stay with their mother for 17 months, denning together the winter after birth and separating in late May the following spring. Adult females do not breed while with offspring; thus, breeding typically occurs every other year. In any given year, 47 to 49 percent of adult female bears in Pennsylvania are with cubs (Kordek and Lindzey 1980, Alt 1982, Ternent 2019).

Pennsylvania bears begin to produce cubs at an earlier age than almost anywhere else in North America (see Coy 1999 for a summary). Females typically give birth to their first litter at age 3 or 4, although bears as young as 2 have produced cubs (i.e., bred as a yearling the same summer they separated from their mother; Alt 1989; Fig. 5). Virtually all females are breeding by age three (Kordek and Lindzey 1980). In northcentral Pennsylvania, the average age of first reproduction is 3.6 years (Ternent 2019). Males are capable of breeding as yearlings, but they typically do not reach sexual maturity until several years later.

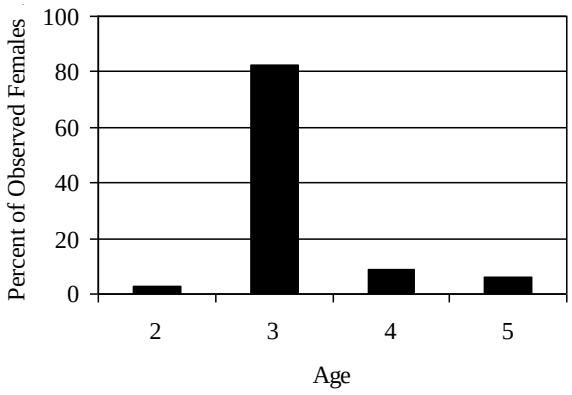

Figure 5. Age when female black bears produced their first surviving litter. Values are based on observations of 34 bears in winter dens during 1974–1989 in northeast Pennsylvania (Alt 1989).

Denning Behavior

Black bears hibernate during winter months to avoid food shortages. Their body temperature decreases from a normal range of 37–38° C to 31–36° C, which is different from almost all other hibernators with body temperatures that drop to near ambient conditions (Folk et al. 1972, Folk et al. 1976, Tøien et Al. 2011). Heart rate decreases from 40 beats per minute to 8–10 beats per minute, and metabolism may drop 50 percent (Tøien et Al. 2011). Although bears appear lethargic during hibernation, they are easily aroused and capable of fleeing. Bears do not eat, drink, defecate, or urinate while hibernating. Basic protein and water needs are partially met by (metabolically) recycling urea, and other adaptations hamper the loss of muscle tone and bone density.

The start of hibernation can vary from year to year depending on food availability, beginning later in years when food is plentiful and earlier in years when food is scarce. However, regardless of food conditions, pregnant females typically den first, followed by females with cubs from the previous winter and juveniles of both sexes. Adult males are the last group to den, sometimes remaining active into January. Pregnant females may begin denning in early November prior to Pennsylvania's bear-hunting season, which affords them added protection that males typically do not receive (Matson 1954, Alt 1980*c*). Den emergence occurs in reverse order of den entrance. Adult males begin to leave dens in late February–early March, whereas females with newborn cubs wait until April.

Black bears den in a variety of places. They utilize cavities in rocks, root masses and standing trees, crawl under fallen trees and brush piles, excavate dens, and build ground nests. Dens have been discovered in road culverts (Alt 1983*b*), under porches, and under houses. Den selection may vary from one year to the next, as does den location. Dens are seldom reused. In northeast Pennsylvania, only 4.8 percent of dens monitored over a 10-year period were used more than once, and they tended to be permanent dens such as rock cavities that were reused by closely related females (Alt and Gruttadauria 1984). Most dens, regardless of type, are lined with dry leaves, grass, broken twigs, or some other material collected by the bear.

Pregnant females tend to select sheltered dens more so than other bears. Seventy-nine percent of pregnant female dens studied in northeast Pennsylvania were rock cavities, brush piles, or excavations (Alt 1984*a*). From 2018 – 2022 in the Northcentral region 49% of sows with cubs or yearlings denned in ground nests, 22% in brush piles/downed trees, 22% in excavations, and the remaining 7% in rock cavities, hollowed trees or human structures (PGC, unpublished data). Den selection differences between regions by females may be due to differences in landscape and availability of den types within a female's home range (Martorello & Pelton 2003), or behaviors learned from their mother (Vitale et. Al. 2018). Ground nests and open brush piles are more typical of males, though some females do use them as noted previously. Although protective during the winter, sheltered dens can be susceptible to spring flooding. Between 1973 and 1983, 19 percent of dens with cubs studied in northeast Pennsylvania flooded and at least 15 cubs were known to have died (Alt 1984*a*).

Mortality and Disease

Bears are long-lived animals. Individuals in their mid-teens are part of the harvest each year. The oldest free-ranging bear confirmed in Pennsylvania was almost 37 years-old when euthanized in 2013 because of paralysis; a 30-year-old bear also was documented in 2001 (Rose 2001).

Age is determined by counting the number of concentric rings visible in a cross section of a tooth, analogous to the rings in wood that are used to determine age of trees. A microscope and staining process are required, but the resulting age determination can be very accurate (Harshyne et al. 1998).

Cub survival during the first year of life is estimated to be 80 percent. Cub mortality occurs more frequently in first-time litters than subsequent litters. Alt (1982) reported that 28 percent of litters in northeast Pennsylvania experience some level of mortality, and 9 percent lose their litter entirely. However, if a litter is lost early enough, the female can rebreed and produce a new litter that winter (Alt 1981*b*, Alt 1982). In northcentral Pennsylvania, mean annual recruitment was determined to be 0.7 yearlings per adult female age 4 or older (Ternent 2019).

Yearling (1½ year-old bears) mortality is not well documented, but it is probably greater than any other group because of aggression from older male bears, nutritional stress, a propensity to be involved with human-bear conflicts, and inexperience at avoiding vehicles or hunters. Alt (1980*c*) reported that yearlings in northeast Pennsylvania experienced more hunting mortality than any other group, averaging 36 percent. Annual mortality, including hunting and other factors, for two-year-old and older bears in Pennsylvania is reported to be 41 percent (females) to 48 percent (males; Diefenbach and Alt 1998).

Disease, predation, and starvation probably have little impact on adult survival. Bears have no natural predators; adult males may kill cubs to promote breeding opportunities or attack dispersing subadults to defend a home range, but neither is well documented (Garshelis 1994). Starvation is uncommon because people rarely report seeing emaciated bears in Pennsylvania, and none of the diseases or parasites that inflict bears are considered high mortality risks (Quinn 1981).

Intestinal roundworms (i.e., *Baylisascaris transfuga*) and tapeworms (*Taenia pisiformis* and *T. saginata*) are common in bears, but they rarely occur in numbers sufficient to interfere with digestion or nutrition (Quinn 1981), although hunters may be surprised to find them during field-dressing of animals. Likewise, tissue parasites such as *Toxoplasma gondii* (Briscoe et al. 1993, Dubey et al. 1995, Dubey et al. 2016) and *Trichinella spiralis* (Schad et al. 1986, Dubey et al. 2016), which may have human health implications, occur in Pennsylvania bears but are not thought to cause significant mortality.

Mange refers to a group of parasitic diseases of the skin in wild and domestic mammals caused by multiple species of mites. In black bears, mange has been reportedly associated with infection with *Demodex ursus*, *Ursicoptes americanus*, and *Sarcoptes scabiei*. In

Pennsylvania, only Ursicoptes and Sarcoptes mites have been identified in bears (Peltier et al. 2015).

Sarcoptic mange was previously considered to be rare in black bears. The disease was observed sporadically in the Midwestern and eastern United States between the 1980s and early 2000s (Schmitt et al. 1987; Fitzgerald et al. 2008). However, more recently, reports of sarcoptic mange in bears have become common and widespread, particularly in the mid-Atlantic states (Niedringhaus et al. 2019*a*).

In Pennsylvania, the first documented case of sarcoptic mange was in 1991 in Indiana County in an adult male black bear. A year later, three more bears were reported with the disease in Indiana and adjacent Clearfield County (Sommerer 2014). Over the subsequent 27 years, sarcoptic mange was reported in 55 out of 67 counties in Pennsylvania, and the number of cases continues to increase. In 2018, the number of suspected or confirmed cases reported in Pennsylvania was 277, which is a 296% increase from 2008 (70 cases; Niedringhaus et al. 2019*a*).

The cause for the emergence and expansion of sarcoptic mange in black bears is unknown. Black bear range in North America overlaps with many other mammalian hosts that are commonly affected by sarcoptic mange, including red fox and coyotes. Thus, the emergence of this disease in bears is likely due from spillover from some other host (Niedringhaus et al. 2019*a*). In fact, genetic analyses of Sarcoptes mites from bears in Pennsylvania and surrounding states were unable to identify a unique bear-specific variant (Peltier et al. 2017).

When diagnosing clinical mange in bears, skin scrapes appear to be the most sensitive method for mite detection and identification (Peltier et al. 2018). In 1996, skin samples were collected from harvested bears and 1.6 percent contained mites (PGC unpublished data). However, a prevalence survey has not been repeated, so it is currently unknown if the increase in cases is a result of an increasing infection rate or range expansion of the disease (same infection rate but over a larger area), a growing bear population (same infection rate but more bears), or changes in disease characteristics (same infection rate but symptoms more visible).

Mange can lead to severe hair loss, itching, lesions, and scabs on the surface of the skin, but the incidence of direct mortality is unknown. Recent research has shown around 80% of bears that are diagnosed with mild to moderate cases of mange recover within 1 year regardless if they receive a single injected dose of ivermectin or not, which is the typical treatment given to bears caught in Pennsylvania with symptoms of mange (i.e., itching, hair loss, crusted/thickened/scabbed skin, and secondary bacterial or fungal infections). In some cases, bears even had a complete recovery within several months (Tiffin et al. 2022). Bears with severe infections were more likely to not recover again regardless if they received one dose of injectable ivermectin or not. Only 64% of severely infected bears made a complete recovery, of which 71% of bears that received treatment completely recovered while 57% of bears that did not receive treatment completely recovered (Tiffin et al. 2022).

Additional research about mange in black bears is still needed. For example, how survival rates change for mange infected bears regarding other concerns like harvest vulnerability and vehicle collision likelihood is not fully understood. Additionally, bears, unlike many other mange-susceptible hosts, are not a social species for much of the year, and transmission dynamics and outbreak epidemiology between individual bears are likely different compared to other hosts. Additional research will help our understanding of mite adaptability, transmission, and host susceptibility (Niedringhaus et al. 2019*b*).

It is also unknown if mites consistently cause clinical disease in all infected bears or if some bears show no symptoms (Niedringhaus et al. 2019*b*), how treatment with anti-parasitic drugs affects survival or subsequent transmission of mites (Rowe et al. 2019), how many bears die from mange annually, or how many bears are currently infected in Pennsylvania. These questions and others are part of research projects currently underway in Pennsylvania, and mange in black bears is likely to become a primary disease research focus during the span of this Management Plan.

Most black bear mortality in Pennsylvania is caused by human activities. Hunting is the largest factor. Among bears two years old and older, hunting accounts for 48 percent (males) to 37 percent (females) of all deaths. About 23 percent of the male population and 16 percent of the female population is removed annually by hunting (Diefenbach and Alt 1998), yet hunting has not limited population growth. Other forms of mortality that are caused by people include vehicle collisions, being shot for crop damage, poaching, and removal of chronic nuisances.

Vulnerability to hunting varies depending on sex and age. Young bears (2 to 3 years old) tend to have almost twice the vulnerability of older bears. Young females are more vulnerable than young males, but female vulnerability decreases with age and becomes much less than males as adults. Male vulnerability, on the other hand, decreases very little over time (Alt 1980*c*). Vulnerability is measured by the percent of tagged bears that show up in the harvest.

Vehicle collisions are the second greatest human-caused mortality factor. They account for 10 percent of all documented deaths and may kill between 2 and 4 percent of the population annually (PGC unpublished data). State Game Wardens annually inspect 300 to 500 dead bears along roadways and the number is increasing (Fig. 6). Vehicle mortality rates are likely to increase as bears expand more into heavily populated areas, traffic volumes increase, rural roads improve to accommodate faster speeds, and new roads appear.

An average of 559 bears are reported dead annually from all other non-hunting causes. They typically include, on average, 97 bears dying of miscellaneous causes or accidents, 28 bears removed because of property or agriculture damage, and 16 bears killed illegally. Although documented poaching outside of a hunting season is relatively uncommon, examples of illegal trafficking in gall bladders, paws, and other bear parts have been documented in Pennsylvania, and poaching is known to be prevalent in other North American and Asian bear populations (Williamson 2002).

Population Dynamics

Bears have traditionally been labeled as one of the slowest reproducing terrestrial mammals in the world (Bunnell and Tait 1981). This assertion is because bears do not produce young until several years old, do not produce large litters, and have a relatively long interval between births (e.g., 2–3 years). However, longevity (many litters per lifetime) and high cub survival compensate for these shortcomings so that mortality, not reproduction, is really the limiting factor for most bear populations.

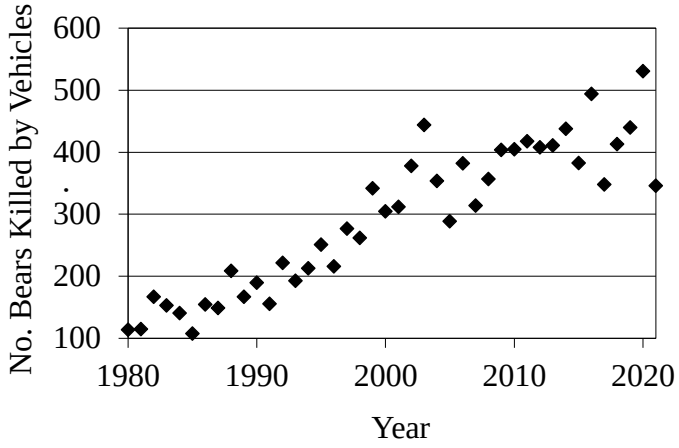

Figure 6. Number of bears killed annually in Pennsylvania by vehicles from 1980 - 2020. Values only include bears that were reported and located by Wildlife Conservation officers. In 2020, a record 531 bears were documented.

In Pennsylvania, limiting mortality enabled the bear population to dramatically increase from 1980 – 2000 and continue to grow through today, contrary to the assertion that bears are slow reproducers. Likewise, excessive mortality was the reason behind declining populations before 1980. During both periods (population decline and increase), reproductive traits remained mostly unchanged.

All wildlife populations have a threshold where increasing abundance begins to negatively impact habitats, reproduction, and survival. At this point populations are said to be approaching a biological carrying capacity (BCC). Once a population nears BCC, changes occur that slow or halt further population growth, preventing the population from significantly exceeding BCC. For bears, some of the changes may include smaller adult weights, smaller litters, later age of first reproduction, greater incidence of skipped litters (i.e., extended inter-birth interval), greater cub mortality, increased predation by large male bears on subadult bears, and others.

At present, these indicators do not appear to be occurring in Pennsylvania, which suggests that bear populations are not yet close to BCC. Some researchers have argued that there is little evidence of density-dependent regulation in any of the current North American black bear populations (Garshelis 1994). Thus, Pennsylvania's bear population appears to have the potential for additional growth.

Unfortunately, as bear populations grow, so does the likelihood that people and bears will come into conflict. Like BCC, which is an abundance threshold based on habitat conditions, there also is a cultural carrying capacity (CCC), which is an abundance threshold based on people's tolerance for human-bear conflicts. For bears, CCC is typically below BCC and, therefore, the focus of most bear management strategies. Ironically, CCC rarely remains constant, making it a difficult target for population management. Cultural carrying capacity is influenced by trends in nuisance bear activity, occurrence of highly emotional human-bear

conflicts (e.g., human fatality, pet predation, significant economic losses), effectiveness of bear awareness campaigns, and people's prior experiences with bears.

There are no formal estimates of CCC for bears in Pennsylvania, but the number of people reporting conflicts has increased. Furthermore, a large majority of Pennsylvania residents (62%) believe that the bear population where they live should stabilize and remain the same (Duda et al. 2019). But it also appears that most residents want some distance between themselves and black bears. Only 15 percent are comfortable with having black bears in their yard whereas 24 percent do not want them in their yard but are comfortable having them in their township; 40 percent want black bears in their county but not in their township, and 21 percent of residents are uncomfortable having black bears in their county (Duda et al. 2008).

Wildlife populations also can become too small where uncertainty about annual food crops, risk of disease outbreak, loss of genetic diversity, or insufficient reproduction can jeopardize their continued existence. The minimum viable population size (MVP) for bears is not well documented. If conditions are right, populations as small as 40 individuals are thought to be viable based on modeling done with black bears in Florida and grizzly bears in the Yellowstone Ecosystem. In Pennsylvania during the early 1970s, bears were estimated to number less than 2,000 and that population remained viable (Eveland 1973).

Habitat Requirements

Black bears prefer areas that have forest cover, but a variety of forest types may be used. Bears in the southwest U.S. live in chaparral or pinyon-juniper woodlands; in the north and west they live in coniferous forests, and in the south east they use cypress swamps and coastal flatwoods (Pelton et al. 1999). In Pennsylvania and the eastern U.S., bears primarily live in temperate deciduous forests.

A heterogeneous forest is preferred because it provides a greater diversity of foods. In poor food years, a diverse forest can still produce some food because not all crops may be affected the same, unlike a forest that has low food diversity. In Pennsylvania, the optimal habitat would include forest stands dominated by mature, hard-mast-producing trees interspersed with a diversity of soft-mast trees, understory shrubs and vines, punctuated with herbaceous and grass-covered openings.

Forest openings (e.g., closed roads, edges of wetlands, recent clear-cuts, and agricultural fields) are important for feeding on emerging grasses and herbaceous vegetation, and in mid-summer they provide insects and berries.

Bears also require hiding cover, which they use for escape and resting. Examples in Pennsylvania are swamps, mountain laurel or rhododendron thickets, Eastern hemlock stands, regenerating clear cuts, riparian thickets, and wind-thrown areas. Two additional habitat components, denning cavities and water, are widely available and do not significantly influence abundance or distribution of bears.

Black bears can survive in forested habitats that are scattered among other land uses. Some uses, like agriculture and home sites, may be an enhancement because of added foraging opportunities if forest cover is nearby. However, placing more people among bears increases the opportunity for problems, which usually decreases CCC, despite the benefit to BCC. Landscape uses that restrict movements or remove substantial amounts of forest, such as roads with heavy traffic or urban development, are detrimental. Habitat loss and fragmentation are urgent issues today for many bear populations worldwide (Herrero 1999). Threats to oak and beech trees should also be considered important to habitat managers because of the importance of these species to bears as a hard mast food resource, especially regarding concerns like spongy moth infestations or beech bark and leaf disease. Additionally, over-browsing by deer, insect infestations, excessive cutting, and acidic precipitation, also are a concern in eastern U.S. forests (Vaughan 2002).

Home Range, Movements and Activity

Black bears travel with changes in food availability. The area that encompasses a bear's movements is called a home range. Home range size and shape can vary seasonally, annually, geographically, and between different sex and age groups.

Male home ranges are about four to five-times larger than female home ranges. In northeast Pennsylvania, male home ranges averaged 63 square miles (173 square kilometers) and were 8 to 16 miles across (13–26 kilometers), whereas female home ranges averaged 15 square miles (41 square kilometers) and were 3 to 8 miles wide (5–13 kilometers; Alt 1980*d*, Alt et al. 1980). Females with newborn cubs have small home ranges that gradually increase as cubs mature, which results in a fall home range that is larger than at any other time of the year. Conversely, adult males and solitary females have their largest home ranges during mid-summer when breeding activity is at a peak (Alt et al. 1976, Alt 1977, Alt 1980*d*, Alt et al. 1980).

Adjacent male home ranges may overlap some, but adjacent female home ranges generally overlap more. A home range for a single adult male may encompass several female home ranges. Young males disperse away from their mother's home range before establishing a territory whereas young females do not. Studies on male bear dispersal in the late 1970s found average dispersal distance is 14 miles (23 kilometers; Alt 1977, Alt 1978). Later study of dispersal distances indicated slightly larger distances for both males and females. Median distance dispersed by males statewide is 29 miles (47 km), and for females is 15 miles (25 km) (Vreeland 2015).

Black bears are most active at dusk and dawn, and only semi-active during midday. Nocturnal activity is uncommon unless they are avoiding daytime disturbances by people (Ayres et al. 1983, Lyons et al. 2005). Activity intensifies during the breeding season and again in the fall prior to hibernation. If fall food supplies are scarce, activity will be limited, and bears will den early. Conversely, an abundant nut crop will extend fall activity and postpone denning. In the spring, activity may be suppressed for a short time immediately after emerging from dens until food becomes more readily available.

Black bears can travel long distances to exploit food sources such as concentrated berry or nut crops, feeders, landfills, and agricultural fields (Garshelis and Pelton 1981, Rogers 1987). These movements typically occur in the fall when food is most critical. Evidence of long-distance movements can be seen in Pennsylvania's northern counties during years of poor beechnut production. These counties, where beech is more common than oak, typically harvest fewer bears when beech crops fail, but harvest will increase in southerly adjacent counties where oak is more abundant, which suggests that bears are moving from one area to the other.

Black bears can return home if relocated outside their home range. Homing tendencies are strongest for adult males. Subadult males, females relocated with offspring too young to travel, and bears moved greater than 40 air miles (Sauer and Free 1969, Alt et al. 1977, Rogers 1986, Shull et al. 1994) tend to return less. Bears relocated greater than 100 air miles rarely return (Alt et al. 1982).

Social Structure and Communication

Black bears are solitary except for females accompanied by young or adult pairs during the breeding season. Spacing is maintained through a dominance hierarchy (Rogers 1977). Large bears intimidate smaller bears by using threatening gestures: huffing sounds, jaw chomping, stamping feet, or charging. Actual fights are uncommon except by competing males during the breeding season or females protecting young.

Family groups communicate using a variety of sounds such as the pulsating "humming" of nursing young, squalling of scared cubs, and a low grunting sound by the female to assemble her cubs (Pelton et al. 1999). Tree marking, characterized by bears biting, clawing, and rubbing against trees, is another form of communication. Tree rubbing tends to peak during summer and normally occurs at the same or nearby tree year after year. Genetic analysis of hair left on rub trees suggests that multiple bears use the same sites. Thus, tree rubbing is assumed to be part of establishing social structure, but why black bears mark trees is still open to question (Pelton et al. 1999).

SECTION II. HISTORICAL AND CURRENT STATUS OF BEARS IN PENNSYLVANIA

Population Declines and Recovery

At the time of European settlement large numbers of black bears likely existed throughout Pennsylvania. Mature forests covered 95 percent of the state (Table 1) and mortality from people was minimal. However, conversion of forest lands to agriculture, overharvest for their hide, meat and grease, and misinformation about large carnivores that resulted in retaliatory killings resulted in black bear declines by the 1880s. Around 1900, prime black bear hides were worth $12 and meat, 8 cents per pound (Rhoads 1903), which suggests that killing bears was profitable. No regulations existed to protect bears from year-round or excessive killing.

Samuel Rhoads, author of The Mammals of Pennsylvania and New Jersey, described the abundance of bears in 1903 as, "Once uniformly and abundantly represented in every county of the two states. Now almost exterminated in N.J. …in the most densely populated counties of Pa. it is unknown, and in about half of those remaining it is found only as a straggler."

As agriculture and the demand for wood products grew, more forests were lost and indiscriminate killing by people who perceived bears as a threat to crops or livestock increased. Forests that were not converted to agriculture were cut for timber. By 1900, forest coverage had decreased to 32 percent of the state (Table 1), reducing habitat conditions for all forest-dwelling wildlife. A few years later the American chestnut, which was an important food for bears in the remaining forests, died because of disease. Before the chestnut blight of 1908–1913, it is estimated that 20 percent of the trees in Pennsylvania were chestnuts (DeCoster 1995). By 1920, bear numbers were significantly down across the state and their distribution was restricted to a handful of northcentral and northeast counties.

Table 1. Pennsylvania forestland trends during selected years, 1660–1995 (from DeCoster 1995).

Year	Forested Acres[a]	% of Total Land[b]
1688	27,400,000	95
1700	27,400,000	95
1800	25,000,000	87
1860	21,000,000	73
1900	9,100,000	32
1930	13,000,000	45
1960	16,200,000	56
1990	17,000,000	59
1995	17,000,000	59

[a]Land that is at least 10 percent stocked with trees of any size, or land from which trees have been removed to less than 10 percent stocking but remains undeveloped and available to regenerate trees, and land planted to trees.
[b]Based on 28.78 million acres total land area.

Bear populations began to improve once forests started to regenerate. By 1930, forests had reclaimed almost 4 million acres (Table 1). Regeneration was occurring where forests had been cut and on marginal agricultural lands that were being abandoned. Stricter hunting regulations and restocking efforts aided the recovery. Annual reports written by the Game Commission throughout the 1920s indicated that bear populations were increasing substantially.

From the 1940s to the 1970s, forested habitats continued to improve over most of the state (Table 1), but bear recovery stalled, and population declines reappeared in some areas. The reason was believed to be overharvest caused by increasing hunting pressure (Giles and Kordek 1979, Lindzey et al. 1979, Alt 1980*e*, Alt and Lindzey 1980, Lindzey et al. 1983). By the mid 1970s, an estimated 250,000 people were pursuing bears during the annual hunting season. Bear hunting was eventually closed 3 out of 10 years during the 1970s (1970, 1977, and 1978) because of concern for low bear numbers and heavy hunting pressure.

There are no quantitative estimates for how many bears lived in Pennsylvania during the mid-1900s, but there are harvest figures for every year since 1915. If the bear population was growing, a commensurate increase in harvest also should have occurred, especially because of the growing interest in bear hunting. But harvests remained stable to decreasing for decades and averaged 400 bears per year between 1937 and 1975 (Fig. 7). As a result, bears likely numbered between 2,000 and 4,000 statewide (i.e., 10 to 20 percent annual harvest

rate) for more than half of the 20th century, despite widespread forest regeneration and some restocking.

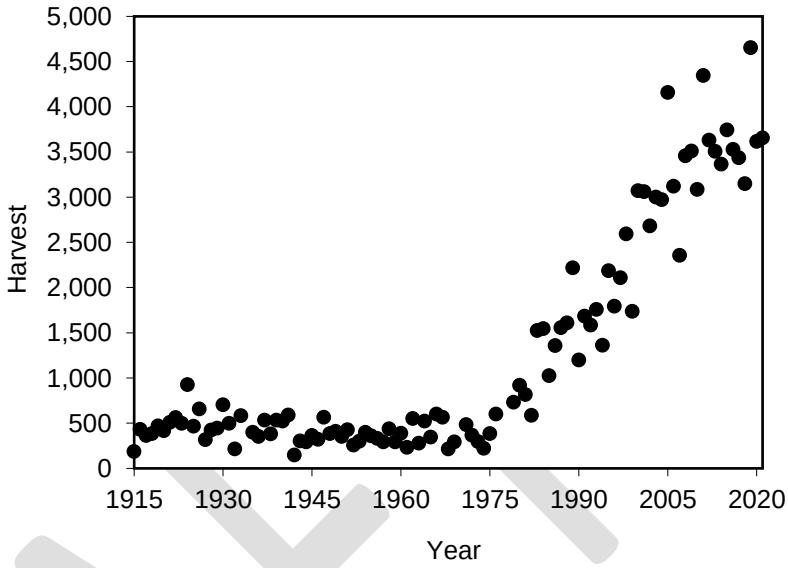

Figure 7. Annual black bear harvests in Pennsylvania, 1915–2021.

Following the back-to-back closed seasons in 1977 and 1978, the single-day hunting season in 1979 yielded a record 736 bears. Thereafter, the bear population entered a new era of recovery. Annual population estimates, harvest, hunter success, sightings, and vehicle collisions began to increase; later in the 1990s, human-bear conflicts increased. Today, there are an estimated 16,000 bears in Pennsylvania. Bears are more abundant than at any other time since European settlement, and about four times more abundant than 42 years ago when the trend began. The area occupied by bears likewise has increased to record levels.

Several factors are thought to be responsible for the growth in bear numbers during the past four decades. First, the two years of no hunting in 1977 and 1978 allowed recovery to begin. This was the only time in Pennsylvania's history to have two consecutive years of no bear hunting. Within three years of the closed seasons, a bear license was created that reduced the number of hunters by about 50 percent. Restocking efforts in the early 1980s and natural dispersal then began to repopulate peripheral areas of the bear range. Bear hunting was temporarily closed in peripheral areas to improve survival of newly arrived bears. Meanwhile, forests had matured and expanded to the point that annual food supplies were becoming reliable. Access to human-related foods also was increasing because of a growing human population (residential and recreational) in forested areas. A better availability of food would have aided bears to produce larger litters, starting at an earlier age, and with better cub survival. Hunting seasons throughout the recovery period also tended to protect females (i.e., they were short with opening dates occurring after the start of hibernation).

Hunting Regulations

Pennsylvania was one of the first states to establish a regulated hunting season for bear that eliminated year-round hunting. The season began in 1905 and many regulation changes followed during the next five decades.

The most noticeable trend was to shorten hunting seasons and move opening dates later into the fall. For example, bear hunting occurred during October 1–March 1 in 1905; October 1–January 1 in 1911; October 15–December 15 in 1915; and November 1–December 15 in 1930. By 1936, the season was less than two weeks long and completely within the month of November.

Once in 1934 and three times during the 1970s (1970, 1977, and 1978), bear season was closed entirely. By 1979, the season was a single day hunt in mid-December. Since then, seasons have steadily lengthened. In 1982 the statewide rifle season was extended to 2 days; in 1986, to 3 days; and in 2011, to 4 days. An extended season concurrent with part of the rifle white-tailed deer season was added in 2002 in 3 northeast counties and gradually expanded to over half of the state. An archery bear season was added in 2006, and a muzzleloader and special firearms bear seasons in 2019. While season dates were changing, the area open to hunting also changed, shrinking when the population was declining and expanding when numbers improved. Today, bear hunting is permitted statewide.

Increasingly restrictive regulations also occurred with method of take, number of animals that could be harvested (bag limit), and type of animal. There were no restrictions with the 1905 season, but steel-jawed traps and deadfalls were prohibited in 1911; log-pen traps were outlawed in 1915; ammunition was limited to single-projectile bullets in 1921; and use of dogs was banned in 1935. The use of bait to attract bears was prohibited about the same time. Bag limits were reduced to one bear per hunter in 1915, and cubs less than one-year-old were protected in 1925. All of these restrictions remain in place today except for the law protecting cubs, which was removed in 1980.

Starting in 1973, hunters were required to bring bears to an established check station. Check stations are still used although the number in operation has gradually expanded. Today there are 26 stations scattered across 25 counties (Lycoming County has two) that are manned by Game Commission employees during the opening weekend of the statewide firearms season. The extended season has 17 check stations manned by Game Commission staff that are open the first and second weekends of the season. During other seasons, bears are checked in the field by Game Commission staff. According to regulation, hunters have 24 hours from time of harvest to have their bear checked. Hunters are prohibited from selling edible parts of bears, which includes gall bladders, but they can sell non-edible parts within 90 days of the season after visiting a check station (see Appendix 5 for details).

In 1981, the State Legislature created a bear license that must be purchased in addition to a general hunting license before hunting bear. The annual allocation was set at 100,000. Allocation limits were removed in 1989, and today there is no limit on the number of bear licenses available. Bear licenses were only sold in the Harrisburg Headquarters building or regional Game Commission offices (six locations) at first but beginning in 1997 they were made available at all issuing agents statewide (greater than 1,000 locations).

<u>Relocation and Restoration Efforts</u>

Range expansion is limited in black bear populations because females rarely disperse far from where they are born. It may take several generations before female bears occupy new areas, even through contiguous suitable habitats. Consequently, the Game Commission has periodically trapped and transferred large numbers of bears to restock areas of the state where bears were absent or in low numbers.

For example, Executive Director Seth Gordon wrote in 1923, "during the last two seasons almost fifty black bears have been trapped and transferred to refuges in portions of the state where many years ago the timber was removed, forest fires followed, and the last bears were killed out. Through this effort five different sections of the state have been restocked with black bears, and all indications are that they are thriving splendidly" (Gordon 1923, p. 42). Most of these bears were captured in Potter County where they were plentiful but causing livestock depredations. By 1926, almost 100 bears had been trapped and transferred (Truman 1926).

Another large-scale trap and transfer effort occurred during 1979–1984. Seventy-two black bears (22 adult females with 25 cubs, 1 yearling, and 24 cubs that were born within 30 days of release) were relocated from northcentral and northeastern Pennsylvania to southwestern Pennsylvania (primarily Somerset County and eastern Westmoreland County). The objective was to bolster the bear population where habitat conditions were favorable but resident bear numbers low (Alt 1979, Alt 1980*f*). Subsequent monitoring revealed that many of the bears survived and went on to produce multiple litters in the new area. Thirteen bears produced a minimum of 20 litters, consisting of at least 54 offspring during 11 years following their release (Alt 1995). Bear harvests (Alt 1995) and population estimates (Diefenbach et al. 2004) have increased dramatically in southwest counties since the restocking.

Current Habitat Conditions

Pennsylvania is located along the Appalachian Mountain chain, which stretches from Maine to Georgia. Forests (about 17 million acres) cover 59 percent of Pennsylvania. Most (78 percent) are in private ownership with the remainder being publicly owned as State and National Forests (2.7 million acres), State Game Lands (1.5 million acres), and State Parks (300,000 acres). Almost all forested lands in Pennsylvania are potential bear habitat. Exceptions are small tracts of forest that are highly fragmented or isolated by urban development and agriculture, such as small woodlots in the southeast corner of the state.

Two different bear ranges exist in the state: one in the northeast and one in the northcentral. It is unclear if the two areas were ever totally isolated from one another, but when bear numbers were at their historic lows, these two areas served as cores for future expansion.

The northeast bear range is characterized by relatively flat, poorly drained, extensively forested land with numerous lakes and swamps that developed in depressions left by long-ago glacial activity (about 16,000 years ago during the Wisconsin Glacial Period). These swamps and lakes are now surrounded by berry-producing shrubs (mostly blueberry), which are a valued food source for bears, and contain dense hemlock and laurel cover. The northeast range is divided approximately midway east-to-west into two distinct forest types:

the oak-dominated mixed hardwoods that cover the southern half and beech/cherry-dominated northern hardwoods that cover the north with a peninsula extending south along the northern edge of the Pocono Mountains (Fig. 8).

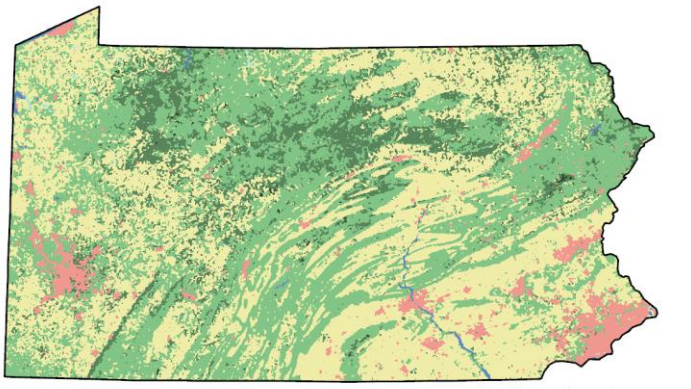

Figure 8. Generalized landcover classifications in Pennsylvania. The northern tier of the state consists mostly of mixed and evergreen forest types (i.e., Northern Hardwoods; dark greens), while the southern tier is predominantly deciduous forest (i.e., Mixed Oak Forests; light green). Yellow and red areas are classified are non-forested areas either due to agriculture or urban areas (source USGS National Land Cover Database for 2019).

Primary land uses in the northeast bear range include recreation, forestry, and some farming. Widespread development of residential areas that are interspersed among the swamps and lakes has occurred in the northeast during the past 2 decades. For example, the Monroe county human population grew by 22.4 percent from 2000 to 2010, respectively, but has remained relatively stable from 2010 to 2020. The Pike county human population grew by 23.9 percent from 2000-2010 and has only grown slightly from 2010-2020 with an increase of 4.5 percent, respectively (U.S. Census Bureau data). A large urban center also occurs in the Scranton-Wilkes Barre area. About 87 percent of the forestland is privately owned.

The northcentral bear range is characterized by large contiguous tracts of forest that are more rugged in terrain than the northeast with fewer swamps and lakes. It lies primarily on the Appalachian and Allegheny Plateaus, extending south into the Ridge and Valley Province. Soils along the narrow ridges and steep slopes are usually shallow and low in fertility. Two roughly parallel river systems, the Susquehanna and the Allegheny, traverse north-to-south through the range. Like the northeast range, two distinctive forest types are present: the oak-dominated mixed hardwoods that cover most of the area and beech/cherry-dominated northern hardwoods that cover a northern band of counties adjacent to New York (Fig. 8). Seventy-six percent of the forestland is privately owned. Recreation, timber cutting, and farming (particularly in the Ridge and Valley section) are common land uses with several large urban centers exist throughout the range (e.g., Erie, Pittsburgh, and Harrisburg).

Wildlife Management Units

Black bear numbers are not equal across Pennsylvania because availability of forest cover, food conditions, human population density, percent of land in public versus private ownership, and hunter density vary. As a result, bear population goals (e.g., increase, decrease, or stabilize) and management strategies are not likely to be uniform either.

The same scenario exists for most wildlife species managed by the Pennsylvania Game Commission, which is why management programs have historically dissected the state into smaller units. Traditional management units for different species rarely shared common boundaries, which was confusing, and they were based on political, instead of biological landscape features. To correct these problems, a system of 22 Wildlife Management Units that are based on biological features and delineated by easily recognizable roads and streams was developed in 2002, in 2022 there are 23 Wildlife Management Units (Figure 9). All species of game animals and furbearers managed by the Game Commission, excepting elk and waterfowl, are presently managed according to Wildlife Management Units (WMUs).

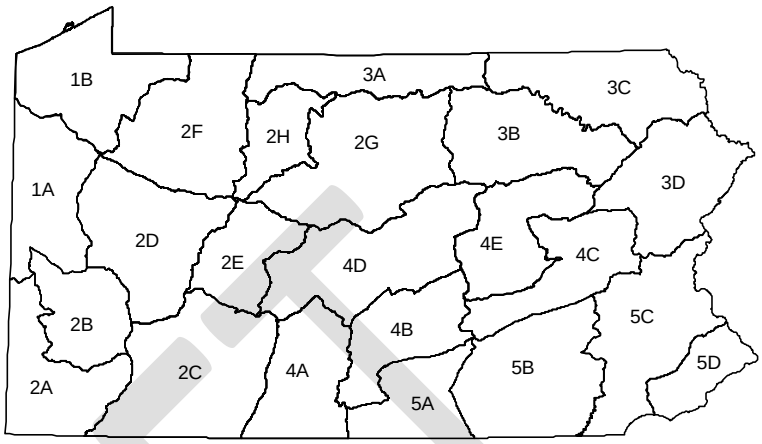

Figure 9. Wildlife Management Units in 2022.

Current Population Estimates

The Game Commission measures the size of Pennsylvania's bear population using mark-recapture data. Employees capture and ear-tag about 700 to 800 bears annually according to tagging quotas that are assigned to each county in the primary bear range. The proportion harvested is then noted at check stations during the hunting season and used to determine population size. For example, if 20 of 100 tagged bears are harvested and the total harvest is 1,000 bears, population size would be estimated to be 5,000 bears. In other words, if tagged bears experience a 20% harvest rate, we assume total harvest would represent 20% of the total population.

Mark-recapture population estimates do have some limitations. The two most problematic ones for Pennsylvania are (1) marking enough bears annually so that estimates are precise; and (2) assuming that all marked bears have an equal chance of being recaptured in the harvest. We are studying statistical variations of the mark-recapture method we use to address these questions (see *Current Research* section for more details). Thus, we may switch to another method of calculating population size in the future, but the trend should remain similar.

Annual population estimates were increasing an average of 394 bears per year between 1983 and 2000. Estimates during 2000–2007 were relatively stable, and then began to increase again through 2019. In 2020 and 2021 there were two consecutive decreases in the population (Figure 10). These decreases were after the introduction of new early seasons in 2019. Research began prior to these seasons to fully understand the effects of these early seasons with a specific focus on female harvest vulnerability (see *Current Research* section for more details). In 2021, Pennsylvania's black bear population was estimated to be 15,453 animals (95 percent confidence interval was 13,476–17,848).

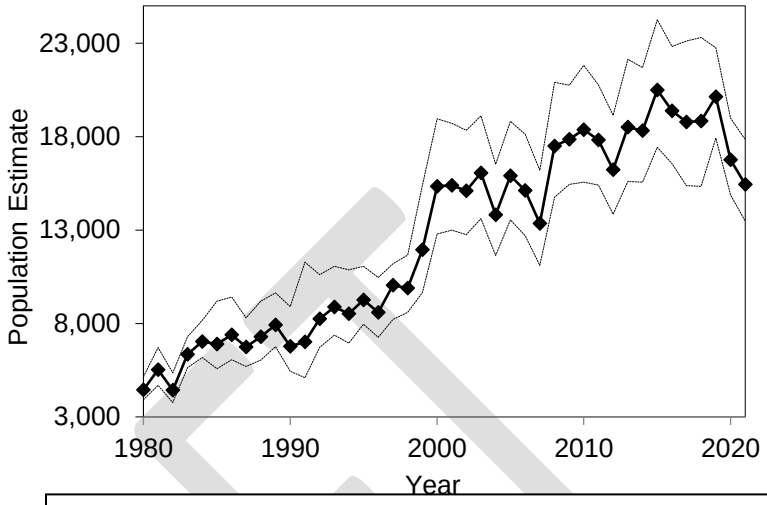

Figure 10. Mark-recapture population estimates for black bears in Pennsylvania. Thin, black lines indicate 95 percent confidence intervals or range of reliability surrounding each estimate.

Current Harvest Statistics

Pennsylvania's bear hunting seasons are currently managed to harvest 20 percent of the bear population annually (i.e., 20 percent harvest rate). Harvest rate is calculated as the proportion of tagged bears harvested and has averaged 20.2 percent since 1986 with relatively little variation (Table 2). The 20 percent harvest objective was initially adopted to stabilize the bear population at 10,000 animals, but current population estimates now exceed that level.

A general hunting license (resident $20.97; nonresident $101.97) and bear license (resident $16.97; nonresident $36.97) are required to hunt bear. In 2020, a record 220,471 bear licenses were sold, although license sales have been increasing steadily since about 1994 (Table 2). Nonresidents typically comprise 2-4% of bear license sales.

From 2010, about 2 percent, or 1 in 51 hunters, are successful at harvesting a bear, which is an increase from 1.7 percent (1 in 62 hunters) during the late 1980s to early 1990s (Table 2). Better success is most likely the result of increased bear abundance, but weather and food conditions greatly influence year-to-year variations. Harvest has also been steadily increasing over the past 35 years (Figure 7). Seven of the top 10 harvests have all occurred in the past 10 years, and annual harvests now average more than 3,500 bears (Table 2).

Equal numbers of males and females are typically harvested. However, males predominate in younger age classes (1 to 3 years old), while females increasingly outnumber males in older age classes. The average age of harvested bears is 2.2 years. Average live-weights of harvested bears are 82 pounds for cubs; 203 pounds for 1 to 3 year-old males; 160 pounds for 1 to 3 year-old females; 441 pounds for adult males; and 217 pounds for adult females. Large bears (i.e., more than 400 pounds) are harvested from a wide geographic area. In 2021, 41 of

the 59 counties where bears were harvested had at least one bear with a live weight over 400 pounds. There were 39 bears from 23 counties that had an estimated live weight greater than 500 pounds (PGC unpublished data).

Current Research

Annual Statewide Bear Tagging Effort

Ear-tag data are the foundation of our population estimates and harvest rate calculations (see discussion above). Bears also are tagged annually to monitor age structure, growth and development, reproduction, survival, dispersal, and distribution characteristics, as well as documenting histories for bears involved in nuisance situations. The annual statewide tagging effort is expected to continue.

Improving Population Estimates

As the bear population increases, a larger number of bears should be tagged each year to maintain reasonably accurate population estimates, but time and personnel resources are finite. Therefore, we are researching statistical variations of the Lincoln-Petersen mark-recapture estimator for alternative analyses. An important assumption when using mark-recapture data is that bears fitted with ear tags remain available for harvest (recapture) after they are marked. However, we have evidence that this assumption may be violated because some bears begin hibernation before hunting season, making them underrepresented in the harvest. The severity of underrepresentation varies from year to year based on changing food conditions, with more bears choosing to den early in poorer food years. By studying the timing of denning under different food conditions, we hope to better account for this variation and subsequently improve population estimates without tagging larger samples of bears.

Additionally, multiple new population models have been created in recent years to account for biological processes that may break assumptions associated with older population modeling efforts. Currently, the Game Commission is working with researchers at the Gavilan Group to create a population monitoring model that would better account for biological processes and other factors affecting wildlife populations and wildlife behavior that could then affect modeling efforts. Statistical population reconstruction (SPR) uses data regularly collected by wildlife agencies like age-at-harvest data or hunter effort among other data points that are used in the SPR population model that can estimate abundance, natural survival rates, harvest rates, and recruitment (Clawson et. al. 2017). Statistical population reconstruction also does not make certain assumptions about wildlife populations that in the past may have caused issues with other estimators. Additionally, using data that's already regularly collected can help make population monitoring efforts more economic and use personnel more efficiently for state agencies.

Orphan Cub Reintroductions

We currently maintain radio-collars on 10 to 20 adult female bears to use as surrogate mothers for orphaned cubs. Depending on the time of year and condition of the cub, orphans can be successfully added to a foster litter. Other alternatives are to temporarily hold cubs in captivity until they are believed to be self-sufficient and then release them without a mother, euthanasia, or permanent captivity (e.g., at a zoo or research facility).

Assessment of Factors Influencing Female Harvest Rates

Largely due to weather events on key hunting days, harvest was below objective in 2016, 2017, and 2018; as a result, the largest suite of bear season changes ever proposed in a single year was approved for 2019. These changes more than double the number of hunting days and begin bear hunting almost 2 weeks earlier. Yet, it is unclear how changes approved for 2019 will affect the bear resource. Factors influencing harvest are relatively well understood for the traditional bear hunting seasons, but we have little information on what influences harvest vulnerability during the earlier, new or expanded seasons. Although hunting season changes were warranted because of below-objective harvest, failing to fully understand their effect on female bear survival may lead to management challenges. Consequently, a 3-year study to assess the factors affecting female black bear harvest rates began in the fall of 2019.

Mange in Pennsylvania Black Bears

Mange in bears is usually a sporadic problem involving individuals or small numbers, but cases have steadily increased over the past two decades. Mange is a disease that tends to flare up in 'hot spots' and then decrease as other 'hot spots' develop. In Pennsylvania, we have now documented cases in three-quarters of the state, and bears with mange also have started appearing in several other eastern US states as well. We do not know if this trend is related to bear populations, human activities, or changes in the parasite that affect transmission. Yet, despite the current level of cases, we do not believe mange is having a population-level effect because bear numbers continue to be at record levels. In recent years we have partnered with researchers at Indiana University of Pennsylvania, University of Georgia, and most recently Penn State University (PSU) to study various aspects of this disease. The most recent PSU study focused on the effectiveness of treatment for free-ranging bears, survival with and without treatment, reinfection rates, the effect of disease on movement patterns, and occurrence of other host parasites. This current research is in the process of being published and implemented into Pennsylvania Game Commission standard operating procedures (SOPs). A regional study will begin in 2023 as well that will look to understand and create better regional cooperation in both data/biological sample collecting, public communication, and disease transmission work. This work is being managed by researchers at the University of Georgia and contributed to by multiple state agencies in the eastern United States.

SECTION III. RECREATION, ECONOMIC SIGNIFICANCE, AND PUBLIC INTEREST

Hunting

Black bear hunting for recreation, food, or clothing has a long tradition in North America. Currently, 32 states have a legal hunting season for black bears. A survey of all U.S. states and Canadian provinces was last conducted in 2001; at the time, there was an estimated 662,000 black bears in North America and about 373,000 bear hunters who harvest around 41,000 bears annually (Hristienko and McDonald 2007). In 2015 another range wide survey was conducted, and there were an estimated 735,000 bears in North America. Bear hunter numbers and bears harvested annually was not asked during this survey (R. A. Beausoleil and S. Dobey 2015, Washington Department of Fish and Wildlife and Kentucky Department of Fish and Wildlife, unpublished data).

Pennsylvania has some of the largest licensed bear hunter numbers in the U.S. Twelve to thirteen percent of Pennsylvania's hunters purchase a bear license and the number is steadily increasing; a record 220,471 hunters purchased a bear license in 2020 (Table 2).

Hunters come from all over North America to participate in Pennsylvania's bear season. Since 1980, hunters from 40 states and several Canadian provinces have traveled to Pennsylvania and been successful at harvesting a bear (i.e., were interviewed at a check station). Nonresident bear hunters represent about 4 percent of all bear licenses buyers; in 2021 there were 9,407 nonresident bear hunters.

More than two-thirds of Pennsylvania residents support the legal, regulated hunting of black bears (70%, Duda et al. 2008; 64% Duda et al. 2019). Common reasons Pennsylvania residents give for supporting bear hunting include hunting is the best way to control black bear populations (49% of those who support), population control is necessary with bears (34%), they are not opposed to hunting in general (18%), and hunting bears is a tradition (13%). The feeling that black bears threaten human safety is not an important reason – only 7% of those who support bear hunting give this reason (Duda et al. 2008).

Non-Hunting Use

Interest and admiration for bears has been a part of human culture for centuries. In North America, bears are a central figure in the spiritual beliefs of indigenous people (Rockwell 1991); they are common in folklore, children's stories, appear on state flags (California), and as icons for countries (e.g., Russia). To some, the bear is a symbol of wilderness or indicator of ecosystem health, and wildlife photographers and viewers prize them. Thus, many people value sustainable bear populations for reasons other than hunting. The most significant non-hunting use for bears in Pennsylvania is wildlife watching, which may include incidental observations or specifically seeking out bears for viewing and photography.

Table 2. Statewide black bear harvest statistics. Values represent all seasons (archery, muzzleloader, firearms, and extended) combined.

Year	Harvest	No. of Counties harvesting bear	Harvest rate[a]	No. of bear licenses sold	Hunter success[b] (%)
1986	1,362	37	18.1	94,700	1.4
1987	1,560	39	22.8	92,051	1.7
1988	1,614	39	21.9	91,604	1.8
1989	2,220	40	27.7	92,468	2.4
1990	1,200	40	17.4	93,348	1.3
1991	1,687	40	22.7	89,452	1.9
1992	1,589	42	18.9	91,165	1.7
1993	1,760	44	19.9	89,623	2.0
1994	1,365	44	15.8	89,408	1.5
1995	2,190	49	23.5	90,091	2.4
1996	1,796	48	20.7	93,893	1.9
1997	2,110	50	20.8	116,946	1.8
1998	2,598	49	26.1	114,767	2.3
1999	1,741	47	14.4	101,904	1.7
2000	3,075	50	20.1	104,279	2.9
2001	3,063	50	21.1	109,250	2.8
2002	2,686	49	19.5	122,046	2.2
2003	3,004	52	19.0	123,911	2.4
2004	2,973	51	20.3	132,181	2.2
2005	4,163	50	23.3	142,062	2.9
2006	3,124	51	17.1	139,371	2.2
2007	2,360	49	17.4	135,584	1.7
2008	3,460	52	19.3	145,795	2.4
2009	3,513	52	20.1	147,728	2.4
2010	3,090	53	17.0	161,119	1.9
2011	4,350	54	21.7	162,164	2.7
2012	3,632	56	19.9	160,839	2.3
2013	3,510	53	17.8	167,438	2.1
2014	3,368	56	17.5	173,523	1.9
2015	3,748	57	18.1	175,314	2.1
2016	3,530	56	17.2	173,580	2.0
2017	3,438	57	17.8	172,709	2.0
2018	3,153	60	15.8	174,869	1.8
2019	4,657	43	23.5	202,043	2.3
2020	3,621	61	21.5	220,471	1.6
2021	3,659	59	23.0	215,219	1.7
5-yr Averages					
1984-1988	1,512	38	20.9	92,785	1.6
1989-1993	1,691	41	21.3	91,211	1.9
1994-1998	2,012	48	21.4	101,021	2.0
1999-2003	2,714	50	18.8	112,278	2.4
2004-2008	3,216	51	19.5	138,999	2.3
2009-2013	3,619	54	19.3	159,858	2.3
2014-2018	3,447	57	17.3	173,999	2.0
*2019-2021	3,979	54	22.7	212,578	1.9

[a] Proportion of ear tagged bears harvested. Assumed to measure proportion of total population harvested.
[b] Percent of license buyers who harvested a bear (harvest divided by number of bear licenses sold).
[c] Percent of bear license buyers who harvested a bear (harvest / number of licenses sold).
*Only 3 years used for average.

Nearly 95 percent of Americans claim to be involved in some sort of outdoor recreation (Paige 2000). On a national survey, recreationists cited natural landscapes and seeing wild animals as important components of an outdoor activity (Duda and Young 1994). Sixty-three million Americans participate in wildlife viewing (Cordell et al. 1995). In Virginia, black bears were rated second only to eagles and hawks as the animal people were most interested in seeing (Virginia Dept. Game and Inland Fisheries 2003). It is not uncommon for people who have seen a bear in a natural setting to remember the circumstances for years and place a high value on the experience.

Economic Significance

Both hunting and non-hunting activities provide economic benefit. Roughly 11.5 million Americans, 16 years old or older, hunted in the United States during 2016. Collectively they spent more than $26.2 billion annually on licenses, equipment, lodging, and travel expenses (U.S. Fish and Wildlife Service 2016). Pennsylvania hunters spent $3.9 million in 2020 and 3.8 million in 2021 to purchase bear hunting licenses (Pennsylvania Game Commission 2022). In the 2002 U.S. Fish and Wildlife survey, people who hunt big game in Pennsylvania (bear, deer, elk, or turkey) also spend $82 million on food and lodging, $57 million on transportation, and $340 million on equipment (U.S. Fish and Wildlife Service 2003).

Nationwide, 86 million people enjoy watching wildlife. In 2016, wildlife-watchers throughout the U.S. spent $75.9 billion on equipment and travel. In the 2002 survey, people in Pennsylvania spent $901 million, which included $59 million for transportation, $101 million for food and lodging, and $729 million on equipment (U.S. Fish and Wildlife Service 2003), and this number has likely gone up since then.

Unfortunately, black bears also can cause economic hardships. Documented bear-vehicle collisions have been steadily increasing over the past two decades and now average 415 per year (Fig. 6, page 15) plus an unknown number that are not reported. In 2020, wildlife conservation officers examined a record 531 vehicle-killed bears. Colliding with a bear can be costly. Huijser et. al. performed a cost-benefit analyses of wildlife-vehicle collision mitigation techniques and found for the 10 sections of road studied the costs associated with a deer, elk, or moose collision ranged from $3,636 U.S. dollars (USD) to $46,155 USD (2009). The average vehicle repair bill for a deer collision is greater than $1500 USD (Conover et al. 1995), and adult bears are twice the size of adult deer in Pennsylvania. Bears also damage agricultural commodities, although the full cost is not known. In 2018-2019, the Game Commission paid $13,495 to people reporting damage caused by bears. However, only certain losses to livestock and beehives can qualify for compensation; the cost of crop damage, which is much more common, is not included.

Public Interest

Nuisance Bear Conflicts

Approximately 5% of Pennsylvania residents had problems with bears in the past 12 months (Duda et al. 2019), which was the same percentage 10 years ago (Duda et al. 2008). The most common problems are garbage cans raided and birdfeeders damaged.

Nuisance bear conflicts have economic and public safety consequences. They also impact other wildlife programs by diverting personnel resources, and they may decrease how people value bears. The Game Commission attempts to reduce conflicts by removing (translocating or euthanizing) problem bears, hazing or aversively conditioning bears from nuisance areas, asking people to remove food attractants, and regulating the abundance of bears by adjusting hunting seasons.

Conflict numbers can vary from year to year and seasonally. Conflicts tend to increase rapidly in April and May, peak in June, and then decline through mid-summer with a small increase in the fall. The post-June decline can be abrupt, as was the case in 2017, or prolonged, as in 2016 (Fig. 11). Conflict trends are influenced by a variety of factors that include seasonal changes in nutritional need, ripening dates of key foods, shifts in activity patterns, timing of breeding season, and timing of dispersal.

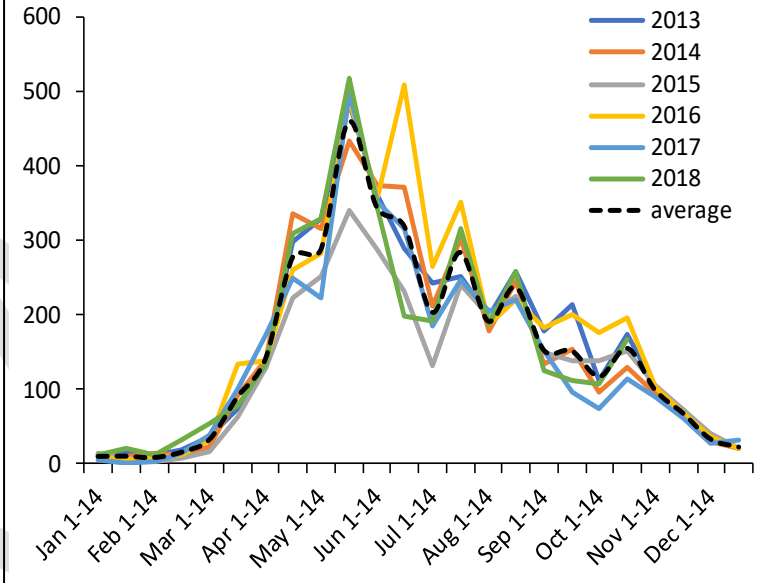

Figure 11. Distribution of reported human-bear conflicts during 2013–2018.

Conflict numbers also vary geographically. Although conflicts occur throughout the primary bear range, they are reported the most in Wildlife Management Unit 3D and adjoining portions of units 3B, 3C, 4C and 4E in the northeast region. Conflicts are also concentrated in unit 2H and 2F in the northwest part of the state, in 4D in the middle of the state, and in 2C in southwest part of the state (Fig. 12). In 2013 there were 3,918 reported human-bear conflicts; in 2014, 3,798 conflicts; in 2015, 3,187 conflicts; in 2016, 4,248 conflicts; in 2017, 3,480 conflicts, and in 2018, 3,505 conflicts. The average is 3,689 conflicts annually.

Figure 12. Average number of human-bear conflicts reported by township during 2013-2018 (n = 15,807). Conflicts with no township information are excluded (n = 6,329). Solid lines depict current Wildlife Management Unit boundaries. Light grey = 1 to 3 conflicts per township; medium grey = 4 to 8 conflicts per township, and dark grey = more than 8 conflicts per township.

Human-bear conflicts are more common and occur in more places today then during previous decades. There is a tendency to attribute the increase to increasing bear numbers, but studies have shown that nuisance bear conflicts correlate better with factors other than bear abundance (e.g., Shorger 1946, Piekielek and Burton 1975, Rogers 1987, Garshelis 1989, Garshelis and Noyce 2001). Although some relationship between bear density and number of conflicts must exist, part of the explanation may also be that opportunity for human-bear encounters is increasing. Range expansion is placing more bears near suburban areas, while at the same time more people are moving into areas traditionally occupied by bears. These changes can occur without significant growth in the bear population, but still lead to more conflicts. People today also may be less prepared to avoid conflicts because an increasing number of people who move into bear habitats or live where bears are expanding their range have little or no experience at coexisting with bears.

Regardless of why conflicts are increasing, the Pennsylvania Game Commission strives to reduce them. An increasing trend in human-bear conflicts is undesirable because it leads to larger property damage costs, greater risks of human injury, and increasing costs for the agency to adequately respond to complaints.

Property, Livestock and Agricultural Damage

Bears may destroy apiaries (beehive colonies), kill livestock, raid agricultural crops, or cause damage around homes to birdfeeders, outbuildings, or anything else containing food. Damage may be minimal or serious, infrequent or habitual, localized or over a wide geographic area.

When bears raid an apiary, they may eat honey or bees, destroy hives, reduce future production, damage equipment, and increase time and labor costs. In the eastern United States, apiary damage is probably the most economically significant of the different commodities damaged by bears (Jorgensen et al. 1978). The average cost of a bee damage claim submitted to the Game Commission for reimbursement is $408 (2017-2021). Total annual payments now average $5,114 (Table 3). In 2012, bee damage claims were a record $12,040, which was the highest amount paid in the past twenty-one years; in 2018, bee damage claims noticeably declined to less than $4,000 (Table 3).

It is estimated there are more than 6,000 registered beekeepers that manage more than 61,000 honey bee colonies throughout the state of Pennsylvania. The value of honey produced during 2001 was estimated to be $843,000 (Pennsylvania Department of Agriculture 2002).

The ideal location for an apiary tends to coincide with good bear habitat, which increases the likelihood of damage. In Pennsylvania, apiary damage is resolved by relocating problem bears, offering assistance with electric fencing, and, in some cases, permitting owners to shoot offending bears (see Appendix 5 for details). Elevating hives on stands that are inaccessible to bears also is recommended.

The Game Commission reimburses farmers for the value of livestock killed by bears (see Appendix 5). Predation on poultry and rabbits is the most common, but not always the most expensive (Table 4). Other livestock claims include predation on hogs, goats, sheep, horses, propagated deer, and cattle. Average annual cost for damage claims over the past 10 years is $12,243. Costs for unreported losses and non-qualifying claims are not available. Similarly, the Game Commission does not reimburse for bear-related damage to planted crops or orchards, which is more frequent and widespread than livestock losses. Thus, total value of agricultural damage caused by bears in Pennsylvania is probably much greater than currently documented.

Some level of livestock or crop depredation should be anticipated annually, however, modification of herding or harvesting practices and feed storage can minimize conflicts (Will 1980). Electric fencing also may be used to protect small areas, but it is generally impractical for protecting large fields. Removal of problem bears may be the best solution but bears that have been caught before can be hard to recapture and confirming that the right bear has been caught is difficult. Moreover, crop damage may not be detected until harvesting time and after the problem bears have stopped using the area or bears that are in the area may have little interest in baits placed at traps because feeding is focused on the available crops. Lastly, relocating captured bears does not always prevent their return. Farmers in Pennsylvania are permitted to kill any bears they suspect of damaging crops (Appendix 5).

There are no data available on the cost of property damage at residences. However, residential damage is the most common type of complaint the Game Commission receives. Bears may damage birdfeeders, garbage cans, barbeque grills, screen doors and windows. Less common complaints involve damage to buildings and siding, swimming pools, ornamental trees, and parked vehicles. Most residential damage is preventable by removing or securing attractants and preventing bears from being rewarded with food in the first place. Depending on the circumstances, nuisance bears may be trapped and relocated, or occasionally destroyed. Homeowners are not permitted to kill bears in defense of residential property.

Table 3. Statistics associated with beehive damage claims submitted to the Game Commission for payment. See Appendix 2 for details on the type of claims that are approved.

Fiscal Year	No. of Hives Destroyed	No. of Claims Approved	Average Cost/ Hive	Total Cost Paid for Claims
1998	41	25	$93.41	$3,829.69
1999	81	37	$78.41	$6,350.87
2000	57	26	$65.77	$3,748.81
2001	42	27	$67.37	$2,829.34
2002	79	43	$97.75	$7,722.11
2003	72	33	$116.49	$8,387.23
2004	42	26	$103.50	$4,347.12
2005	42	17	$117.47	$4,933.81
2006	29	11	$108.45	$3,145.18
2007	44	13	$114.00	$5,016.20
2008	15	10	$160.59	$2,408.87
2009	46	18	$124.82	$5,741.57
2010	43	22	$134.13	$5,767.53
2011	75	29	$94.82	$7,111.58
2012	78	32	$154.36	$12,040.00
2013	80	27	$142.98	$11,438.78
2014	84	20	$140.22	$11,778.88
2015	75	19	$120.55	$9,041.42
2016	55	23	$209.53	$11,524.25
2017	81	18	$108.64	$8,800.08
2018	36	9	$95.04	$3,421.45
2019	102	20	$59.91	$6,110.85
2020	70	10	$83.05	$5,813.25
2021	21	5	$67.85	1,424.84
2017-2021 Average	62	12	$82.90	$5,114.09

Table 4. Statistics associated with verified claims of livestock depredation submitted to the Game Commission for reimbursement during 2006–2021[a]. See Appendix 2 for details on what constitutes a payable claim.

Number of Animals Lost

	Poultry	Rabbits	Hogs	Goats	Sheep	Horses	Deer[b]	Cattle	Other[c]
2006	56	20	7	2	1	3	0	2	0
2007	33	9	2	4	7	0	5	2	0
2008	45	28	1	7	2	1	0	1	7
2009	55	4	0	8	8	0	0	2	0
2010	47	8	0	5	1	0	0	4	0
2011	164	13	1	12	6	1	3	5	1
2012	51	0	1	2	5	1	0	2	0
2013	83	30	0	9	1	0	3	1	2
2014	6	1	0	10	1	0	2	0	1
2015	54	6	1	15	5	0	2	2	9
2016	76	3	0	2	0	0	0	0	0
2017	29	18	4	1	0	0	0	2	1
2018	121	1	0	9	0	0	1	0	0
2019	63	0	0	2	1	0	0	4	0
2020	100	0	0	5	1	0	0	0	0
2021	26	0	0	2	0	0	0	1	1
Avg.	63.1	8.8	1.1	5.9	2.4	0.4	1.0	1.8	1.4

Number of Claims Approved

	Poultry	Rabbits	Hogs	Goats	Sheep	Horses	Deer[b]	Cattle	Other[c]
2006	6	3	3	2	1	1	0	2	0
2007	2	3	1	3	2	0	2	2	0
2008	4	4	1	5	2	1	0	1	3
2009	6	1	0	3.5	5	0	0	1.5	0
2010	3	1	0	4	1	0	0	3	0
2011	11	3	1	5	3	1	1	4	1
2012	5	0	1	1	3	1	0	2	0
2013	7	3	0	6	1	0	1	1	1
2014	1	1	0	6	1	0	1	0	1
2015	5	2	1	7	2	0	1	1	1
2016	9	2	0	2	0	0	0	0	0
2017	3	2	3	1	0	0	0	2	1
2018	7	1	0	4	0	0	1	0	0
2019	9	0	0	2	1	0	0	2	0
2020	5	0	0	5	1	0	0	0	0
2021	1	0	0	2	0	0	0	1	1
Avg.	5.3	1.6	0.7	3.7	1.4	0.3	0.4	1.4	0.6

Total Cost of Claims

	Poultry	Rabbits	Hogs	Goats	Sheep	Horses	Deer[b]	Cattle	Other[c]
2006	$195	$329	$1,065	$140	$120	$3,000		$483	
2007	$144	$70	$80	$361	$587		$3,600	$415	
2008	$271	$243	$75	$1,180	$575	$250		$125	$4,413
2009	$246	$70		$1,285	$1,105			$195	
2010	$266	$52		$455	$250			$3,142	
2011	$1,192	$109	$113	$1,281	$990	$300	$1,900	$3,395	$200
2012	$215		$68	$150	$650	$500		$1,640	
2013	$595	$1,035		$1,430	$101		$225	$1,400	$50
2014	$85	$45		$1,580	$350		$1,300		$1,200
2015	$315	$160	$100	$2,245	$955		$600	$212	$252
2016	$425	$95		$530					
2017	$792	$239	$487	$125				$700	$800
2018	$1,461	$20		$1,230			$25		
2019	$622			$525	$220			$810	
2020	$1,500			$2,150	$440				
2021	$390			$950				$200	$1,000
Avg.	$545	$154	$124	$976	$396	$253	$478	$975	$495

[a]Fiscal year, e.g., July 1–June 30.
[b]Propagated.
[c]Includes 1 camel in 2004, 4 ducks and 3 alpaca in 2008, 1 alpaca in 2011, 2 ducks in 2013, 1 donkey in 2014, 9 pigeon in 2015, 1 donkey in 2017, and 1 alpaca in 2021.

Human Injuries

Between 1960 and 1980 more than 500 people were injured by black bears in North America. At least 90 percent of these injuries were minor and inflicted by bears that were conditioned to people's food (Herrero 1985). These types of injuries have declined, most noticeably in national and provincial parks, because of better garbage disposal and feeding regulations (Herrero and Fleck 1990, Gunther 1994). Black bears also can, on rare occasion, attempt to or even successfully attack people as prey. But given the large number of encounters that occur almost daily across North America between people and bears, it is extremely uncommon. At present, about 30 people are seriously attacked by black bears annually in the U.S. (more may receive minor injuries and not be reported), of which 2 to 3 usually results in death (Conover 2002, Herrero et al. 2011).

Accurate records on the number of people hurt by black bears in Pennsylvania do not exist, but there have been injuries. At present, the number of people injured by bears is believed to average 2 to 3 per year, and a fatality has never been documented. People are permitted to kill bears in self-defense (see Appendix 5 for details). The potential for injury is expected to increase as development and recreational activities expand further into traditional bear habitats (forested areas), bear numbers increase, and human-bear encounters become more frequent.

SECTION IV. BLACK BEAR MANAGEMENT OPTIONS

Regulatory Authority and Responsibility

The Game Commission has statutory responsibility for managing all wildlife in Pennsylvania, including black bears. Ideally, wildlife populations are to be managed so that they (1) provide ecological, aesthetic, recreational, and economic benefit to consumptive and non-consumptive users alike; (2) remain self-sustaining; and (3) result in as few human-wildlife conflicts as possible.

Options That Are Used to Manage Bear Populations

Hunting

Hunting is the most frequently used tool to manage black bear populations. Thirty-two states have a hunting season for bears. Population objectives are achieved by adjusting season length, timing, and method of take to alter the size and composition of the harvest. Key components for using regulated hunting as a management tool include: setting population objectives; determining where populations are relative to objectives; monitoring harvests and their effect on population levels; and adjusting season length, time, and methods of take to move populations (up or down) toward objectives.

Public opinion must be considered when implementing or maintaining black bear harvest seasons. Black bear hunting can garner a lot of attention from the public due to the species' popularity and cultural importance among both hunters and non-hunters. However, there is

often support for legal, regulated black bear hunts from the public. In a 2019 survey of Pennsylvania residents, 64% supported regulated hunting of black bears while 26% opposed it. The remainder of respondents had a neutral response (Duda et. al. 2019).

Bear populations can be overharvested. Depleted populations can be slow to recover because of poor dispersal by females and low reproductive potential (i.e., relatively long interval between births and delayed onset of first reproduction). However, because non-hunting mortality is often low, they do rebound if factors that allowed overexploitation are corrected. Closing the bear season in 1977 and 1978, maintaining short seasons thereafter, and creating a bear license in 1981 are examples of how overexploitation was corrected in Pennsylvania. Nonetheless, despite having the ability to reverse declining populations, conservative hunting seasons are preferred to avoid repeated cycles of overharvest and recovery.

High adult mortality, which leads to a population dominated by young animals, can alter productivity by reducing the number of females that are of reproductive age and average litter size, since young bears tend to produce smaller litters. Therefore, vulnerability of adult females is an important consideration when setting the length, timing, and methods of hunting. A high percentage or increasing trend in female harvest is indicative of overharvest. Social considerations, such as a desire for trophy-size animals, satisfaction with success rates, perceived quality of hunting experiences, cub orphaning, and disturbance of other recreationists or wildlife, also are important factors when determining season parameters.

If populations are below management objectives, hunting regulations can be adjusted to reduce female harvest. The simplest change is to shorten seasons or restrict the number of hunters. However, other alternatives that maintain hunting opportunity exist. For example, fall seasons can be opened after females start to den, which protects them from harvest. In Pennsylvania, the percent of solitary (pregnant) females denned during the traditional late November season may approach 50 percent some years (Alt et al. 1976, Alt 1980*c*). Likewise, spring seasons can be set to start before females emerge from dens, but after males and subadults are active. Some states also restrict the harvest of cubs, small bears, or bears visibly accompanied by cubs to protect females. However, the use of "cub laws" has been abandoned in Pennsylvania because cubs are indistinguishable from subadults under most hunting conditions (Alt 1980*a*).

If populations are above management objectives, regulations should be adjusted to increase harvest. Larger harvests can be achieved by making seasons longer, adding special seasons, allowing hunting methods that improve success (e.g., baiting, the use of hounds), and/or overlapping seasons with other hunting opportunities (e.g., deer hunting).

The most common black bear hunting method in Pennsylvania is organized drives. Hunting party size is restricted by regulation to 25 people or less. Still hunting, where hunters move through the woods alone or wait for game to come by, also is popular. Today, bears are harvested using multiple implement types such as archery equipment, crossbows, muzzleloaders, handguns, shotguns, and rifles, although rifles are the most commonly used implement. Below is a discussion of three additional hunting methods that are currently not permitted in Pennsylvania but are used elsewhere in North America. Additionally, an

overview of the archery season that was implemented during the last management plan period.

Hound Hunting

In hound hunting, bears are pursued by dogs and harvested after being treed or while passing another hunter. Fifty-six percent of states with open bear hunting seasons permit the use of dogs (see Appendix 7). Pennsylvania banned the use of dogs for bear hunting in 1935. Pursuit with hounds outside of the hunting season (i.e., training) also is prohibited.

Hound hunting is popular because it increases hunter success, allows hunters to be selective in what they kill, and provides a gratifying opportunity for dog owners to train and watch their animals. In many places where it is permitted, hound hunting has become a strong part of the bear hunting culture. In some areas, social hunts are the norm, with 10 or more hunters and twice that many hounds involved (DuBrock et al. 1978, Elowe 1990).

Hunting with hounds generally improves hunter success, but numerous variables are important, and success is not guaranteed. Experience of the hounds, bear behavior, terrain, weather, time of year, habitat conditions, and ability of houndsmen to locate fresh tracks for pursuit moderate success. An average to good pack of hounds with knowledgeable handlers may tree 30 percent of the bears they run (Elowe 1990). In Michigan, where hound hunting is popular, houndsmen had a success rate of 17 to 32 percent, depending on whether bait was used to initiate the chase, whereas still hunters had a success rate of 11 percent (Peyton 1989). In Virginia, between 11 percent and 20 percent of houndsmen are successful (Inman and Vaughan 2002), and a similar success rate was reported for New Hampshire (Litvaitis and Kane 1994).

Because much of Pennsylvania's bear habitat is extensively covered with roadways and composed of linear ridges with open understories, pursuit with hounds would significantly increase hunter success. The current success rate without hounds is between 1.5 – 3 percent, and at this rate 20 percent of the bear population is harvested. Steps would need to be taken to limit harvest if hound hunting was permitted; including possible changes to the existing season structure and license allocations.

There are several biological concerns related to hound hunting. Female black bears have smaller home ranges than males, which can make them more vulnerable to hound hunting in areas with dense roadway networks. Females with cubs are especially vulnerable because they are reluctant to leave cubs and repeatedly circle back or quickly tree (Allen 1984). However, houndsmen can be selective for males and release smaller bears that are typically female, although 40 percent of houndsmen in a Virginia survey did not or could not identify sex of treed bears (Inman and Vaughn 2002). Pursuit with hounds also may impose stress, disrupt reproduction, and alter foraging effectiveness of bears or other wildlife. Family groups may become separated, or cubs occasionally killed by hounds. However, several studies have concluded that most biological impacts from hound hunting are minimal (Allen 1984, Massopust and Anderson 1984*b*), and the issue of hound hunting is largely social.

Hunting bears with hounds has come under considerable public scrutiny (Elowe 1990). In the past, several states where the issue was brought to public ballot, bear hunting with hounds was closed (Inman and Vaughn 2002). Some people view it as unethical because of a perceived advantage over the bear. Chases may disturb recreationists, including other hunters, and cross private lands posted against trespass. Hound hunting can be highly visible. People may see or hear chases or see vehicles with packs of dogs searching for tracks. Finally, hound hunting is usually not well received by non-hound hunters. In a survey of Michigan bear hunters, a large majority of still hunters (those that did not use bait or hounds) believed using dogs was an unethical method of hunting that took an unfair number of bears, interfered with their own hunting, and should be stopped (Peyton 1989). In a 2008 survey of Pennsylvania residents, only 13% of respondents supported a legal black bear hunt with the use of hounds (Duda et Al. 2008).

Pursuit-only seasons are allowed in some jurisdictions to provide training opportunities. They have not been permitted in Pennsylvania to minimize disturbance of wildlife, recreationists, property owners, and to prevent illegal taking of bear or possible separation of bear families. More importantly, though, because hound hunting is not a legal hunting method in Pennsylvania, a training season has not been considered necessary. Supporters have suggested that training seasons could help reduce success rates (pursued bears become harder to harvest) or be useful for chasing nuisance bears from problem areas (e.g., cornfields). Additionally, the implementation of a legal training season for hounds did not have support among respondents in a 2008 survey done on black bear management in Pennsylvania. Only 18% of respondents supported a training season for hounds in the state (Duda et. Al. 2008).

Baiting

With bait hunting, a steady supply of food is used to attract bears closer to hunters or make them more visible. Bait site location and bait replenishment routines are designed to encourage visitation during daylight hours. Baits are usually placed prior to hunting, and several sites may be maintained simultaneously. Ten states that permit bear hunting allow baiting (31 percent; Appendix 7). Baiting is not allowed in Pennsylvania (Appendix 5).

Baiting is an effective harvest method with hunter success rates commonly ranging from 25 to 50 percent. However, success rates vary regionally and seasonally according to fluctuations in natural food crops, bear densities, habitat characteristics, and prevalence of commercial guides and outfitters (McLaughlin and Smith 1990). Like hound hunting, the legalization of bait in Pennsylvania would be a concern because of the potential for greater success rates, and steps would likely have to be taken to limit harvest.

Although baiting is widely practiced, it has received a considerable amount of public criticism over issues of fair chase and conflicts with other land uses (McLaughlin and Smith 1990). In a 2008 public opinion survey about bear management in Pennsylvania, only 12% of respondents supported using bait to harvest black bears while 84% opposed it (Duda et al. 2008). Some people consider the use of bait as unethical and an unfair advantage. Recreationists who encounter baits may consider them unsightly and littering from baits can occur. Baiting may condition bears to associate people with food and possibly lead to

increased nuisance bear problems or attract bears to areas where they have a greater chance of causing trouble. Baiting also may increase bear-vehicle collisions and the potential for disease transmission. Finally, baiting may invite more poaching activity because hunters see more bears. However, it is important to note that baiting conflicts are highly dependent on where and how bait is used.

Baiting can be a reliable method for increasing hunter selectivity. Bears that come to bait are usually visible for longer periods and provide better opportunity for judging size and sex than bears seen by still hunters. Baiting also may augment natural food supplies and mitigate the effects of poor food years. In some places across North America, harvest objectives are difficult to achieve without the use of bait because hunter numbers or success is too low, making it a necessary management tool. Baiting also may provide increased hunting success for handicapped people, increase the quality of hunting experiences by making more bears visible, and provide opportunities to photograph bears while hunting.

Regulations associated with baiting vary across North America. Most are designed to control the size and sex composition of the harvest and minimize conflicts with other land uses. Regulations often limit the number of baits allowed per hunter, the type and amount of bait that can be used, and the dates that baiting may occur. Registration of sites may be required, and number of sites per square mile may be restricted. Baiting near waterways, trails, roads, and campsites is usually prohibited to reduce nuisance bear problems or vehicle collisions, and bottles, cans, plastic, paper, or metal may be banned to avoid littering. Some jurisdictions require that baits be cleaned up after the close of the season (McLaughlin and Smith 1990).

Trapping

Trapping usually accounts for only a small proportion of the total harvest where it is permitted. In eastern North America, four providences in Canada (Quebec, Nova Scotia, Newfoundland, Ontario) and one state (Maine) allow bear trapping. Trapping is not permitted in Pennsylvania.

The advantages of trapping are increased recreational opportunity, better success among hunters, and increased opportunity to harvest wary bears that may only be active at night. The use of traps can allow a hunter to be successful when other commitments such as work or family prevent him or her from participating in a traditional firearms season. When used in combination with bait, trapping can result in high success, which would be a concern if permitted in Pennsylvania.

The disadvantages with bear trapping are primarily social. It may be viewed as unfair, lacking in fair-chase, inhumane, or a public safety risk. Where it is permitted, regulations often restrict the size, type, and number of traps that can be set to prevent capture of more than one bear. Signs and fencing may be required around the trap to alert people, and trap modifications may be required to prevent traps from closing on non-target animals like pets or small bears.

Archery Hunting

Archery hunting for bear is becoming increasingly popular. In Pennsylvania, archery hunting has steadily accounted for a larger percentage of the total bear harvest each year (Fig. 13). Interest in an archery bear season for Pennsylvania had been building for more than 20 years: In 1990, seven public hearings focusing on bear management were held throughout the state during January and February. Attendants were able to submit comments on proposed regulation changes, of which one dealt with creating an archery bear season. Forty-six percent of the comments supported the change (Alt 1990). In 1995, hunters receiving the annual Game Take Survey were asked if they supported a primitive-sporting arms season for bear that would be limited to archery and/or muzzleloading firearms. Thirty-eight percent supported the change (PGC unpublished data). Eventually a 2-day archery bear season was opened in 9 WMUs in 2006. In 2010, it was offered statewide and expanded to 5 days (Monday-Friday); in 2018, to 6 days (Monday-Saturday), in 2019 to 12 days (Monday-Saturday in 2 consecutive weeks), and in 2020 to 19 days (Monday-Saturday in 3 consecutive weeks; one Sunday hunting opportunity).

Archery bear seasons may occur separate from other big game seasons or be concurrent. Currently, archery bear hunting in Pennsylvania occurs concurrently with the third, fourth, and fifth weeks of the archery deer season.

Archery seasons increase recreational opportunity and may help meet management objectives. The current 10 and 5-year archery bear harvest averages in Pennsylvania are 619 and 416 bears respectively, which is up considerably from the 79 bears taken in the first (2006) season (Figure 13). Archery bear hunting currently accounts for 10-25% of the total harvest.

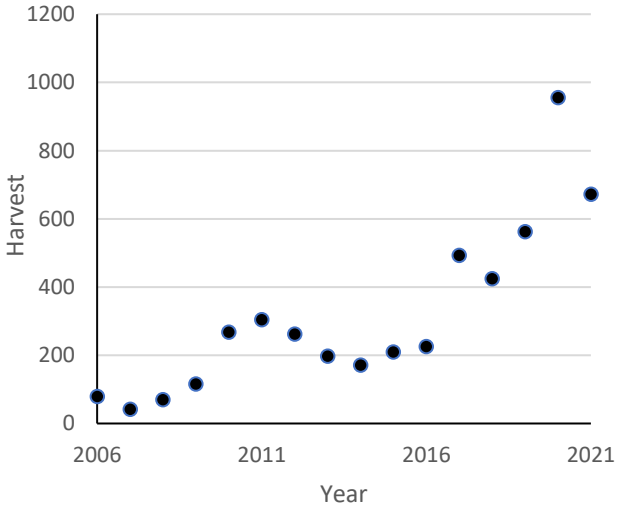

Figure 13. Annual archery black bear harvest totals from 2006 – 2021.

However, there are potential costs to further expanding archery bear hunting. If too many hunters participate or success rates are too high, steps would need to be taken to limit the total harvest. They may include restricting the number of licenses available, developing an allocation system that apportions licenses between multiple seasons, or adjusting season dates (shorter or later) to reduce hunter success. Checking requirements also increase with longer seasons or larger harvests, and some segments of the public oppose archery hunting because of concerns over wounding or illegal baiting activity. But little research has been done to confirm these problems.

Archery bear harvests tend to correlate with fall mast (acorn) conditions. In years when mast conditions are poor, archery harvests go up, and vice versa in years when mast is abundant (Martin 2001, Igo 2001). This trend is opposite of what typically occurs in firearms bear seasons. Thus, a possible outcome from further expanding archery hunting may be fewer low-harvest years. However, the benefit of periodic low-harvest years is not well understood, and they could mitigate the negative effects of periodic high-harvest years.

Additional Management Practices

Reservoir Areas

Reservoir areas are places where bears are lightly hunted or not hunted at all and bear abundance is limited only by the capacity of the habitat. Reservoir areas help to replenish bear numbers in adjacent areas where hunting pressure may be high by providing a steady supply of dispersing bears. However, because female bears rarely disperse far, the opportunity to influence productivity (number of young produced) is limited. Most bears that disperse from reservoir areas are male. In Pennsylvania, 67 percent of males and 28 percent of females disperse from their natal area; median dispersal distance is 47.03 km for males and 25.84 km for females (Vreeland 2015).

Reservoir areas, known as Wildlife Refuge Areas, were an important part of game management history in Pennsylvania (Kosack 1995). Today, reservoir areas where hunting is purposefully restricted to propagate game are not used, but reservoir-like areas exist in places because poor road access, trespass postings, regulations (e.g., safety zones around buildings), private leasing of hunting rights that restrict access, or hunter behavior. For example, a study of bear and deer hunter movements in central Pennsylvania revealed that hunters were three times less likely to hunt in an area for each additional 0.5 km from the nearest road, and 1.46 times less likely to hunt for every 5° increase in slope (Diefenbach et al. 2005). Other similar scenarios are believed to exist throughout much of the northcentral bear range, and in neighboring states (e.g., Maryland; Jones et al. 2015).

Immunocontraception

Immunocontraception uses an animal's own immune system to disrupt reproduction. Vaccines are administered to the animal that fool the immune system into producing antibodies that interfere with sperm formation, egg development, fertilization, or implantation. Vaccines that target the egg's zona pellucida (ZP), the layer surrounding a mature mammalian egg, have received the most attention (Fagerstone et al. 2002). Injections of ZP proteins into the bloodstream cause the immune system to identify the proteins as foreign bodies and develop antibodies against them. This, in turn, interferes with sperm penetration of the ZP (Conover 2002). A common source of ZP protein is pig ovaries, and this type of ZP is referred to as porcine zona pellucida (PZP).

Current immunocontraceptive technology appears to be best suited for captive-animal studies with limited field applications (Miller et al 1998, Fagerstone et al. 2002). The greatest

drawbacks to using it on free-ranging wildlife are (1) vaccinating enough animals to produce a population effect, (2) recognizing which animals have been vaccinated, and (3) resolving possible human health effects from eating vaccinated animals. In some cases, re-dosing may be needed at multiple-year intervals to maintain contraception. More importantly, though, immunocontraception does not reduce the current population size, it only reduces recruitment of new animals, and other population reduction methods may still be required.

Some models have suggested that greater than 80 percent of the female bears in an area would need to be vaccinated before a population effect could be sustained. This would be a nearly impossible goal given that black bears are solitary, secretive, widely dispersed animals that live in relatively thick habitats. Presently, no ZP vaccines have been given FDA approval for use in bears.

A New Jersey study done in 2006 assessing the feasibility of immunocontraception in black bears found that this method would not be a feasible mean of managing the population. Their concerns were similar to what has been previously mentioned. Mainly, the difficulty of capturing and sterilizing enough bears to have a population level effect due to black bear densities and their large, variable movements, and that it is unknown if they FDA would approve the use of immunocontraception drugs in wild bears (Fraker et. al. 2006). Additionally, a study done on captive bears in New Jersey found that while male bears did develop testicular degenerative changes from immunocontraception treatments, sperm production was not completely eliminated and thus did not result in complete sterility. Five females were also treated in this study, and one gave birth to a lone cub after treatment. Female treatment was discontinued after 1 year of the study (Brito et. al. 2011).

Habitat Manipulations

Habitat condition influences the abundance and diversity of food, which can affect reproductive rates, survival, hunter success rates, nuisance bear activity, and the number of bear-vehicle collisions. Poor food availability usually reduces litter size, increases the age of sexual maturity, and encourages bears to travel more looking for food (i.e., more nuisance activity and vehicle collisions), whereas the opposite occurs when food is consistently abundant. Habitat diversity can help minimize the effects of key food crop failures by providing alternative foods, and it ensures that other habitat needs, such as adequate escape cover, are met (Hurst et. al. 2012, Lackey et. al. 2018).

Habitat manipulations that improve food availability, diversity, or provide escape cover can bolster bear populations, and may alleviate some human-bear conflicts. Improving the regeneration of hard mast trees (e.g., oaks), planting soft mast trees and shrubs, diversifying forests with multi-age stands, maintaining openings for berry-producing plants, and protecting patches of dense hemlock, mountain laurel, or swamps are all ways that forests can be improved for bears in Pennsylvania. Conversely, forest management practices that fragment bear habitat or remove key foods (e.g., overharvesting mature oak trees) are detrimental (Lackey et. al. 2018).

Habitat fragmentation, or the division of wild lands by human structures like roadways, urban landscapes, mining activity, etc., can have also negative impacts on bear and wildlife populations. Fragmentation and the increase of human sprawl on wild areas decreases available habitat for wildlife, can create genetic isolation in smaller bear populations (Murphy et. al. 2017) and can increase the likelihood of bears encountering conflict in communities adjacent to and in wild areas (Braunstein et al. 2020, Evans et al. 2014). Creation and maintenance of habitat and wildland corridors can help provide connection among different wildlife populations and their required habitat. Corridors can connect wildlife populations to decrease genetic diversity concerns and decrease negative interactions with wildlife species like bears (i.e., wildlife vehicle collisions, crop and livestock depredations, human-bear conflict, etc.). Creation of wildlife corridors should be considered in new construction of roadways and communities when economically feasible as these projects can range vastly in price depending on the project plan and materials needed. Maintenance of current man-made and natural corridors can often by more economically viable for local, state and federal agencies. Habitat corridors that provide movement pathways for wildlife species like black bears provides multiple benefits to both wildlife and people.

Forest insect pests and pathogens can impact bear populations if they kill or inhibit regeneration of mast-producing trees and shrubs. For example, Spongy moth (*Lymantria dispar*), beech scale, and dogwood anthracnose (*Discula* sp.) may eventually reduce the availability of important foods for bears in Pennsylvania. Likewise, over-browsing by white-tailed deer, acid rain, conversion of oak-dominated stands into maple/cherry-dominated stands after cutting, and excessive timber harvesting can reduce the abundance of oak trees through time. Management practices that mitigate or avoid these problems are beneficial to bears.

Costs associated with habitat manipulations or pest/pathogen control vary depending on the activity. But in many cases, adding bears into current forest planning should be inexpensive because most forest management practices and goals are compatible with bear management. Moreover, many wildlife species, in addition to bears, benefit from promoting mast-producing shrubs and trees. The real challenge with managing forests to improve habitat for bears is that 70 percent of Pennsylvania's forestlands (>12 million acres) are privately owned. Fortunately, the Game Commission owns over 1.5 million acres of State Game Lands where the primary land management goal is to improve habitat conditions for wildlife.

Orphan Cub Rehabilitation and Adoptions

Black bear cubs can become orphans if they are inadvertently separated from a litter or the mother is killed (e.g., hit by car, removed due to nuisance activity, shot in self-defense, or killed illegally). Once an orphan is reported to the Game Commission, there are five options: (1) return it immediately to the wild without a mother; (2) add it to another litter of cubs (adoption); (3) temporarily hold it in captivity and release without a mother once it develops more; (4) place it in permanent captivity; or (5) euthanasia. Returning orphaned cubs to the wild (options 1-3) has little biological significance because so few are handled each year, but it is preferred because public support for permanent captivity or euthanasia is lacking.

Several techniques for reintroducing orphans have been reported (Clarke et al. 1980, Alt 1984*b*, Alt and Beecham 1984, Carney and Vaughan 1987, Siebert et al. 1999, Clark et al. 2002*b*). Adoptions, where a cub is added to another bear's litter, can occur by dropping orphans into a den, adding them to a family of bears captured and immobilized in a culvert-style trap, or by treeing free-ranging cubs and sending the orphan up the tree with them. These techniques are primarily used if the orphan is less than 4 months old because older, free-ranging cubs are often hard to tree or capture. In Pennsylvania, we attempt to place healthy, normally developed cubs with an adoptive litter if it is orphaned before mid-May.

Cubs can be released without a mother when an adoptive litter is unavailable, but survival may be better if releases are timed when a natural food source is abundant. In Pennsylvania, we usually hold orphans for 1-2 months when an adoptive litter is unavailable and release them during August-September when soft mast crops are plentiful. Of 43 cubs we released in July without a mother, 22 or 51 percent were known to have survived because they were later recaptured or recovered in a hunting season (unpublished PGC data). Orphan cubs also can be held through the first denning period and released the following spring as one-year-old bears (Beecham et al. 2015). But this technique is not used in Pennsylvania because of the increased risk of habituating captive bears to people, which may encourage nuisance bear problems after they are released.

Releasing orphan cubs can be costly. An adequate sample of female bears must be fitted with radio-collars so that adoptive litters can be readily found if needed. Radio-collared bears should be located periodically, and they must be visited annually at den sites to maintenance radio-collars and determine if cubs are present. Orphans should be placed with an adoptive litter as soon as possible to prevent them from imprinting on people. Thus, personnel may need to work extra hours on short notice to transport cubs, locate a suitable litter, and carry out the release. If orphans are not going to be placed with an adoptive litter, a temporary holding facility must be maintained with personnel available for daily care of cubs and food purchased or collected. Nevertheless, despite these costs, orphan cub reintroductions are done because of social pressure to avoid euthanasia or permanent captivity, and they are likely to continue in Pennsylvania if adequately funded.

<u>Options That Are Used to Manage Nuisance Bears</u>

Information and Education

Disseminating information about bears is a common and potentially successful means of reducing human-bear conflicts. Information can be offered on how to deter unwanted bears from returning (reactive), or it can be distributed to help people prevent conflicts from developing (proactive). However, public education alone is not likely to be a sufficient way to decrease human-black bear conflict (Lacky et. al 2018).

People tend to view bears as intelligent, culturally significant, charismatic, and like humans (Kellert 1994). This contributes to human-bear conflicts because people are tempted to encourage, or at least not discourage, viewing opportunities around their homes. They may

feed bears or make no effort to keep bears from accessing garbage and other foods until significant property damage occurs. Furthermore, the number of people moving into bear habitats is growing. Many of these people come from urban centers that lack bears, so they have little knowledge about preventing human-bear conflicts. Bears also are recolonizing new areas where people have little knowledge about them. The result is that education and information needs are continuous and growing.

Informational materials may include advice on how to identify and remove attractants, build an electric fence, or why wildlife feeding is problematic. Guidance on how to interpret bear behavior, react in an encounter, and what to expect when living in bear country also are important. The role of managing bear populations and what the consequences are if bears are allowed to access food should be clear.

There are several ways to distribute advice and information. Game Commission employees routinely provide advice over the phone and in person when a person contacts the agency about a bear complaint. Unfortunately, though, this only educates people after they have had a problem and does not provide guidance to people who may experience a problem in the future. Therefore, information materials and outreach efforts should target the general public wherever bears are found, not just individuals reporting conflicts. Venues may include the Internet, social media, programs to school or civic groups, newspapers, radio, brochures, and videos. The Game Commission currently uses all these methods but improving large-audience outreach has been identified as a need (Ternent et al. 2001).

The need for large-audience outreach is not unique to Pennsylvania when it comes to human – black bear conflict. Recently, multiple state wildlife agencies have worked on creating black bear conflict outreach materials that can be consistently used throughout the black bear range to help prevent conflict. BearWise™ is an online resource created and managed by multiple state black bear biologists with the goal of providing consistent information to the public on how to safely live in and visit black bear country. Using consistent messaging helps the public have a clear message on how to safely navigate black bear interactions, and how to avoid negative outcomes (i.e., human-bear conflict). This resource is currently be used in Pennsylvania to educate the Pennsylvania public on a larger scale.

The costs associated with developing and circulating information and education materials can be significant. During the 2020-2021 fiscal year, expenditures in the Game Commission's Bureau of Information and Education totaled $6.8 million (5 percent of the agency's budget), although sales of printed materials and videos generated some revenue.

Food and Waste Management

Most human-bear conflicts occur because bears have discovered a food source near residential areas. These foods may be the result of intentional wildlife feeding (e.g., birdfeeders or other types of feeders), pets (e.g., unattended food dishes), gardens and fruit trees, compost piles, seasonal decorations (e.g., cornstalks or pumpkins in the fall), or garbage. Eliminating these attractants can discourage bears from frequenting an area and learning to associate people with food.

Once bears are rewarded with food, they become conditioned to expect similar rewards in other similar situations. Food-conditioned bears, in an attempt to exploit their newly discovered food resource, will approach people and homes to search for more food. They can lose their fear of people and become bold at acquiring food, leading to an increased risk of property damage or human injury.

Policies that reduce the availability of food and waste around homes have obvious benefits for reducing human-bear conflicts. The Game Commission adopted a regulation in January 2003 that prohibits the intentional and, in certain situations, unintentional feeding of bears statewide. Similar regulations exist in New York, Virginia, New Jersey, and other jurisdictions. Almost all national parks in the United States have laws that prohibit the feeding of wildlife, and nuisance bear conflicts have decreased substantially since their passage, despite increases in the number of visitors and bears (Gunther 1994). Thus, maintaining or improving no-feeding regulations should help to alleviate nuisance bear conflicts in Pennsylvania (Ternent et al. 2001).

Other activities that reduce food attractants around homes include: providing assistance to communities for purchase of bear-resistant garbage containers; changing municipal codes to require better handling of garbage, and intensifying efforts to inform people about how to identify and secure food attractants.

The cost of better food and waste management may be high depending on the activity. Cost is commonly cited as the reason for not replacing traditional dumpsters with bear-resistant models, and some people may perceive feeding bans as recreational or private-rights infringements. The benefits, however, from reducing human-bear conflicts can be significant. Lowering the number of human-bear conflicts reduces property damage caused by bears, lessens the potential for human injuries, and saves time and money used to resolve conflicts. Thus, food and waste management are applicable to bear management in Pennsylvania.

Aversive Conditioning

Animals can be conditioned to avoid nuisance behaviors by exposing them to uncomfortable (pain, noise, nausea, or harassing) stimuli whenever they occur. The learning paradigm is referred to as aversive conditioning and is frequently suggested as a tool for reducing nuisance bear problems. However, it is not widely used in Pennsylvania, and there have been few studies evaluating its effectiveness at altering long-term behaviors.

Common conditioning agents include red pepper capsaicin sprays (Hunt 1984, Rogers 1984, Hyngstrom 1994), rubber bullets (Gillin et al. 1994, Schirokauer and Boyd 1998), emetic compounds (Colvin 1975, Ternent and Garshelis 1999), and electric shock. The process of capturing and immobilizing a bear also has been suggested as aversive (Clark 1999).

A small number of wildlife agencies have also begun to use wildlife service dogs to harass bears that are involved with conflict and discourage unwanted behavior form the bear. The most common breeds used for bear harassment are Karelian Bear Dogs or Black Mouth Curs.

Both breeds have unique qualities and behaviors that can assist greatly when harassing black bears out of conflict areas or harassment after capture and handling. Successful wildlife service dog programs have been implemented in a few states, and the dogs are often used in multiple facets including wildlife harassment, outreach ambassadors, and search and rescue (Lackey 2018). However, agencies need to consider financial feasibility of caring for wildlife service dogs throughout their lifetime, training of both the dogs and handlers, agency liability if something were to happen involving the dog, private land incursions during harassment events, and public scrutiny if the harassment is deemed cruel to the bear or dog.

One advantage of aversive conditioning is that conflicts can be resolved without removing the animal. This would be important if management programs are trying to preserve or increase bear numbers, offending animals are highly valued, trap shy or too expensive to move, suitable relocation sites are limited, or public sentiment disapproves of removal. Some of these scenarios exist in Pennsylvania. If bears must be relocated, aversive conditioning can occur at the time of release.

Unfortunately, bears treated with aversive conditioning sometimes learn to only avoid a site rather than a behavior. They may avoid a backyard or campground where treated but continue to cause problems at a new location. Aversive conditioning also can be ineffective on strongly habituated bears (McCullough 1982), making it better suited for young or first-time offenders. Bears may also learn to avoid humans and human activity because of the aversive conditioning but continue the conflict behavior by becoming active during times when humans are less like to be around (Lackey et. al. 2018). Some techniques might also be perceived as cruel by the public, and create difficulty implementing them if community members don't want them applied to a bear. Aversive conditioning also can be labor- and time-intensive, or impractical because of safety conditions in the area.

Moreover, aversive conditioning addresses only the symptoms of nuisance activity (bears visiting a site) and not the cause (food availability). Thus, food attractants must be removed to maintain aversions or else treated bears will learn that negative stimuli are temporary, and new bears also may be attracted. Despite the shortcomings, aversive conditioning is becoming a popular component of bear management programs throughout North America and increasing its use in Pennsylvania has been discussed (Ternent et al. 2001).

The costs associated with aversive conditioning depend on the techniques used and how they are applied. Some techniques require training, special equipment, and supplies, and all are likely to increase the time spent handling a nuisance bear. Additional funding will therefore be needed if its use is expanded in Pennsylvania.

Repellents

Repellents are devices or substances that encourage a bear to leave an area. They are similar to aversive conditioning, except that pairing between stimuli and behavior may be less obvious and not lead to learned avoidance. Examples include ammonia, loud noises, motion-

activated lights or water-spraying devices, and red pepper (Capsaicin) sprays used to repel attacking bears.

Capsaicin, sprayed directly on mucus membranes of the mouth, nose, and eyes, is effective at repelling black bears (Hunt 1984, Rogers 1984); however, the odor of Capsaicin may attract bears if sprayed on other objects (Smith 1998). Capsaicin spray is primarily used to divert charging bears at close range (<30 feet) and is widely available to people recreating in bear habitats.

Bears have been successfully repelled from bait sites using ammonia (Hunt 1984), but some eventually ignore it. For example, bears that repeatedly raided garbage cans in Juneau, Alaska were not repelled when cans were treated with ammonia (McCarthy and Seavoy 1994). Ammonia is widely available and occasionally recommended by the Game Commission for repelling nuisance bears from backyards.

Motion sensor alarms that use sound and/or lights to deter bears can be helpful at discouraging bears from accessing specific locations. Multiple companies produce these motion sensor alarms, and they can be easily found in stores or online. They are also affordable to most property owners (25-75/unit). Bears can become conditioned to these devices though and continue unwanted behavior if they realize no harm comes from the sounds and/or lights.

Noise cannons, which use propane to generate a loud horn blast, have been used to repel bears from landfills and sheep herds. They are effective if bears are unfamiliar with them, but effectiveness tends to decline as bears become habituated to the sound. They also may be annoying to people. Noise cannons can be set to sound randomly, at intervals, or when remotely triggered by a passing animal. Noise repellents probably have little application as a broad-scale management tool in Pennsylvania, but they may be useful in specific situations. Standard noise cannons cost about $300.

Electric Fencing

Electric fencing is routinely used to protect beehives from bears. If properly constructed and maintained, it can be extremely effective at preventing bear damage (Storer et al. 1938, McAtee 1939, Robinson 1963, Brady and Maehr 1982, Maehr 1983, among others). Electric fencing also may be used to exclude bears from small agricultural fields, poultry coops, outbuildings, livestock,

Table 5. Number of fences provided and annual cost associated with the Game Commission's electric fence assistance program available to qualifying beehive owners, 1995-2021.

Fiscal Year	No. of Fences Provided	Total Cost For Fences
1995	13	$2,390.91
1996	32	$5,055.92
1997	15	$3,352.08
1998	9	$1,860.02
1999	7	$1,392.34
2000	5	$1,237.41
2001	4	$692.20
2002	4	$1,015.78
2003	6	$1,504.00
2004	1	$97.61
2005	0	$0
2006	0	$0
2007	0	$0
2008	0	$0
2009	0	$0
2010	0	$0
2011	0	$0
2012	0	$0
2013	0	$0
2014	1	$75.70
2015	0	$0
2016	0	$0
2017	1	$500.00
2018	0	$0
2019	0	$0
2020	0	$0
2021	0	$0

campgrounds, garbage collection areas, and municipal landfills. The Game Commission routinely recommends electric fencing to protect beehives (Alt 1980*g*).

People often support the use of electric fencing because it is nonlethal. However, electric fencing may be too costly or impractical for protecting large areas, such as cornfields (Calvert et al. 1992, Hygnstrom 1994, Jonker et al. 1998). Construction and maintenance costs are also a concern. Posts, wire, chargers, and power sources need to be periodically checked, and all vegetation growing near wires should be regularly cut to prevent grounding.

The Game Commission has an electric fence assistance program available to apiary owners (see Appendix 5 for a full description). However, the number of fencing requests and total expenditures has been steadily declining, and between 2005 and 2021, when only 2 claims were processed (Table 5). Ironically, while fencing applications have declined, the number of beehive damage claims has not (Table 3, page 30); the reason for low participation in the current fencing program is unclear.

Translocations

Translocating, or capturing and moving bears away from sites that are experiencing nuisance bear problems, is a widely used management practice (Warburton and Maddrey 1994), although in some jurisdictions it may be infrequent. In Pennsylvania, translocations had been steadily increasing until about 2003, after which numbers started stabilizing although spikes occurred in 2009, 2011, 2014, 2016, and 2020 (Fig. 14). In 2021, a decade-low 239 bears were translocated.

Translocations receive wide public support because they avert the euthanasia of bears and provide people with a sense of satisfaction that someone is responding to their problem. Translocations also have been used to successfully augment or reestablish bears in new areas (Shull et al. 1994, Clark et al. 2002*a*). In fact, the recovery of bear populations in Pennsylvania is partly the result of translocation work done in the early 1920s and again in the 1980s (see page 20, *Relocation and Restoration Efforts* for details). Most of the bears in the 1920 project and some of the bears in the 1980 project were captured as nuisances before being relocated.

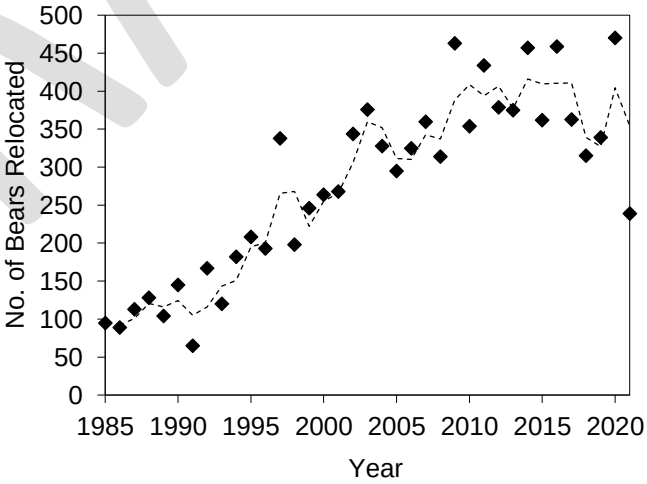

Figure 14. Number of bears relocated in Pennsylvania from 1985 - 2020. Bears captured and released in the same township were not considered to be relocated. A total of 10,274 bears have been relocated since 1985.

Unfortunately, a significant problem with translocating bears today is selecting a suitable release site. Release sites should contain enough forested habitat to be usable by bears, but lack large numbers of people, homes, roadways, or agriculture so problems do not redevelop. Release sites also should have relatively low numbers of bears to reduce stress and aggression between resident and translocated bears and be located far from capture sites to discourage homing. Because a growing number of people are choosing to live in rural places, and because nuisance bear problems are occurring over such a wide geographic area today, few places remain in Pennsylvania that meet these criteria. There are virtually no places left with suitable habitat where bears are understocked.

Age, sex, reproductive status, body condition score (BCS) and distance affect the likelihood of bears returning home after being translocated (Lackey et. al. 2018). Although adults return home more often than subadults, and solitary females more than females with cubs, return rates generally decrease if bears are moved >40 miles (Sauer and Free 1969, Alt et al. 1977, Massopust and Anderson 1984*a*, Rogers 1986, Shull et al. 1994). Bears that are moved more than 100 miles almost never return (Alt et al. 1982). Previous policies by the Game Commission encouraged translocations to be 40 miles or more for first-time offenders and greater than 100 miles thereafter. Today, however, availability of suitable release sites and administrative boundaries are the primary determinants of translocation distance, and most bears are released in the nearest public land, often in the same county.

Translocating bears can be costly and labor intensive. Portable traps, typically a culvert-style cage mounted on wheels, are needed to capture and transport bears, but new culvert-traps cost approximately $3,500. The time spent checking traps and transporting bears can be substantial, and it may reduce the time available for other duties. Cost of translocating an individual black bear was estimated to be $349 in Virginia (Comly 1993) and $2,000 in New Jersey (Kelcey Burgeus, personal communication). Individual estimates are not available for Pennsylvania, but Game Commission employees logged 7,884 hours during 2002 responding to nuisance bear complaints, which often resulted in the relocation of a bear.

Translocated bears can return to a conflict site depending on several factors as mentioned previously. Individuals capturing bears involved in nuisance activity should make property owners aware that moving the bear will only be a temporary solution and encourage property owners to contain the attractant that originally brought in the bear. Additionally, available food resources may attract other bears in the area, and translocation is not a final solution to bear conflict. Educated property owners that can contain attractants when the bear is translocated will greatly decrease the likelihood the original bear or other bears will find conflict on their property, and thus public outreach is essential when translocating nuisance bears.

Translocations can have short-term effects on reproduction. In Virginia, translocated females failed to produce cubs the first winter after being moved but reproduced normally thereafter (Comly 1993, Godfrey 1996). Opposition to translocations also may come from local hunters who fear that their chance of harvesting a bear will be reduced. Bears that are moved may experience greater mortality rates from vehicle collisions as they attempt to return home (Alt

et al. 1982), and translocations that require bears to be immobilized cannot be performed within 30 days of a hunting season to avoid residual drugs in harvested bears.

Lastly, disease spread should be considered when translocating a bear. Black bears can be susceptible to multiple infectious diseases (Alex et al. 2020, Cottrell et. al. 2021, Dubey et. al. 2016, Niedringhaus et. al. 2019). Although the black bears currently do not have any infectious diseases that would cause concern for the black bear population as a whole (i.e., cause large scale die-offs, decrease the bear population significantly on a local or regional scale, etc.), disease spread should always be mitigated when possible. Currently in Pennsylvania one of the largest diseases of concern is sarcoptic mange that is caused by the mite *Sarcoptes scabiei*. Sarcoptic mange can be found through much of the western two thirds of the state in the bear population, while the eastern third currently has few cases. Bears should not be translocated from areas of high mange prevalence to areas of low mange prevalence to avoid spread of the mite. Similar considerations should be made for other bear diseases when possible.

Despite the problems, translocations are effective at temporarily reducing nuisance bear activity (McArthur 1981, Fies et al. 1987), including in Pennsylvania (Alt et al. 1977, Alt 1980*h*, McLaughlin et al. 1981). Some bears are only a brief nuisance when dispersing or when poor natural food crops urge them closer to people, and an occasional translocation resolves the problem. Although adult bears frequently return after being moved, many avoid the location that led to their capture (Alt 1980*h*, McLaughlin et al. 1981). Translocations also provide time to secure/remove attractants, harvest crops that were being damaged, and avoid the destruction of bears until hunters have an opportunity to legally harvest them, which is considered a better use of the resource. Thus, translocations are a common management practice of the Game Commission that will likely continue if funding is adequate (see Appendix 6 for current policy).

Euthanasia

Euthanasia is a relatively uncommon management practice for black bears, except for animals that present an immediate threat to human safety or have repeatedly been involved in human-bear conflicts (Warburton and Maddrey 1994). In general, people tend to prefer non-lethal options for bears that are not chronic nuisances. The Game Commission typically euthanizes less than 15 nuisance bears a year.

Permanent removal guarantees that target animals will not repeat nuisance activity, which can be a problem with other non-lethal management options (e.g., translocations, aversive conditioning, public education). If a nuisance bear is a female, removing her also can prevent problems from perpetuating future offspring with the same behaviors.

Hunting can remove some problem bears from the landscape (Tri et al. 2013), but it can't be relied on. Hunting can control bear numbers, but it may not be selective for individual bears, particularly if they live in areas closed to hunting, such as safety zones or private communities. If problem bears are female, their small home ranges may preclude them from being harvested on adjacent lands. Consequently, nuisance activity in residential areas can

remain high because of one or two particularly bold bears despite high harvests. This problem is exacerbated if lands surrounding residential areas are closed to public hunting. Targeted removal may be the only way to eliminate these bears from the population.

Removing problem bears can improve public support for bear management. Support for greater bear densities or reoccupation of former range tends to decline if people perceive wildlife agencies as unwilling or ineffective at dealing with nuisance bears. Most troublesome are bears that cause frequent, expensive (e.g., killing large numbers of livestock), threatening (e.g., home-entries or aggressive behavior), or emotionally significant (e.g., killing pets) problems. Euthanizing these few individuals may have little impact on population parameters such as reproduction, abundance, or distribution, but failing to do so could significantly impact support for bear management goals. Removing chronic nuisances also may be a catalyst for people to improve how they live with bears (i.e., "a fed bear is a dead bear" slogans) or increase their tolerance of bears involved in less serious conflicts.

Pennsylvania residents generally support euthanizing problem bears, but it depends on the type of conflict. For instance, 39 percent and 35 percent of Pennsylvania residents believe a bear should not be euthanized for causing agricultural damage or for causing residential/campground damage, respectively, but only 27% believe a bear should not be killed for attempting to enter a building. The mean number of times residents believe the behavior should be documented before euthanizing a bear follows the same pattern: 3.31 times for agricultural damage, 2.93 times for residential/campground damage, and 1.73 times for entering buildings (Duda et al. 2008).

Unfortunately, bears that become chronic nuisances often continue the behavior until removed despite trying other non-lethal efforts, such as increasing public awareness and education, aversive conditioning, translocations, and repellents. Thus, permanent removal will likely continue to be used in Pennsylvania for specific bears and situations (see Appendix 6 for current policy).

Reimbursements

Reimbursement programs pay owners for losses caused by wildlife. Multiple states and provinces with black bear populations in North America offer reimbursement for damage caused by bears, although most only cover damage to crops, livestock, or bee keeping equipment (Wagner et al. 1997).

Compensation programs can increase public tolerance for nuisance activity and increase public acceptance of management programs intended to increase or expand bear populations. However, paying for damage fails to address the situations that led to the problem and may become costly for state wildlife agencies. Despite being an intuitively appealing alternative to removing animals, compensation programs are not universally well received (Wagner et al. 1997), and a preference among some producers for other management options has been reported (McIvor and Conover 1994). Criticisms typically include: unfair assessments, only partial payment for actual losses, high costs to administer programs, and a perception that agencies are unwilling to reduce human-bear conflicts.

Table 6. Number of bear damage claims approved for payment and total cost of payments per year, 1995-2021.

Fiscal Year	No. of Claims Approved	Total Cost of Approved Claims
1995	66	$14,041.19
1996	53	$9,332.81
1997	38	$5,545.88
1998	52	$10,379.11
1999	59	$15,621.92
2000	53	$12,615.61
2001	44	$4,688.26
2002	59	$10,790.30
2003	67	$17,196.14
2004	44	$6,666.02
2005	31	$8,206.37
2006	29	$8,673.14
2007	28	$10,273.45
2008	31	$9,540.72
2009	35	$8,688.95
2010	34	$9,932.05
2011	59	$18,632.13
2012	45	$15,761.89
2013	47	$16,274.28
2014	31	$16,338.88
2015	39	$13,880.42
2016	36	$12,576.40
2017	30	$11,943.27
2018	22	$13,495.23
2019	37	$13,644.61
2020	28	$12,869.02
2021	20	$10,480.24
Average 2017-2021	27	$12,486.47

Pennsylvania began a bear-damage compensation program in 1945 (See Appendix 5 for details). Payment is only provided for damage or loss to livestock, poultry, bees, and bee-keeping equipment, and the sum of payments cannot exceed $50,000 per year. Payments now average $12,500 annually although there is considerable variation from year to year (Table 6).

Supplemental Feeding

Supplemental feeding has two management applications. First, it can be used to improve nutritional condition, which results in greater cub production. Bears that have access to supplemental food typically produce larger litters at an earlier age and have better cub survival (Rogers 1987, McLean and Pelton 1990). Supplemental feeding for nutrition is usually supported by the public because of a sense of satisfaction in helping wildlife, and it may increase wildlife viewing opportunities. However, black bear populations in

Pennsylvania are not currently experiencing low reproductive rates or survival, so supplemental feeding for nutritional reasons is not justified.

Supplemental feeding also can be used to discourage damage caused by bears (diversion feeding). For example, commercial timber companies in the Pacific Northwest have successfully used feeders and large amounts of food to divert bears from debarking trees and eating the underlying sapwood. Similarly, supplemental food also can be used to divert nuisance bears out of areas where hunting is not permitted or practical, increasing their chance of harvest.

The use of diversion feeding is best suited for short-term problems or those that do not occur on a regular basis (Conover 2002). Diversion feeding can be expensive, labor intensive, and result in undesirable concentrations of animals which can have impacts on disease spread. Furthermore, it may result in worse damage by habituating animals to people, conditioning animals to expect food, and attracting animals that normally would not be there (Lackey et. al. 2018). Many jurisdictions, including Pennsylvania, have adopted policies that prohibit the feeding of bears to reduce nuisance bear problems. Because most bear conflicts in Pennsylvania occur in or near places where people live, supplemental feeding to divert damage is not practical. Diversion feeding in areas of minimal human use may have some situation-specific applications.

SECTION IV. LITERATURE CITED

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APPENDIX 1. Establishing the mission, goals, and objectives for Pennsylvania's 2023-2028 Bear Management Plan, many of which were also used in the current revision.

Introduction

Stakeholders from 6 areas of interest were invited to an all-day meeting to discuss what they value about Pennsylvania's black bear resource. Organizations that were contacted include:

PENNSYLVANIA STATE BEEKEEPERS' ASSOCIATION	PA STATE ASSOCIATION OF TOWNSHIP SUPERVISORS
PENNSYLVANIA FEDERATION OF SPORTSMEN'S CLUB, INC.	DEPARTMENT OF ECOSYSTEM SCIENCE AND MANAGEMENT
UNIFIED SPORTSMEN OF PENNSYLVANIA	US ARMY ENGINEER DISTRICT BALTIMORE
NATIONAL WILD TURKEY FEDERATION	PENNSYLVANIA DEPT OF TRANSPORTATION
PA CHAPTER QDMA	WESTERN PENNSYLVANIA CONSERVANCY
SAFARI CLUB INTERNATIONAL	DUCKS UNLIMITED
RUFFED GROUSE SOCIETY	PHEASANTS FOREVER
THE UNITED BOWHUNTERS OF PENNSYLVANIA	SENATOR LAUGHLIN
PENNSYLVANIA FARM BUREAU	REPRESENTATIVE GILLESPIE
PENNSYLVANIA VEGETABLE GROWERS' ASSOCIATION	GOVERNOR'S ADVISORY COUNCIL FOR HUNTING, FISHING, AND CONSERVATION
PENNSYLVANIA LANDSCAPE & NURSERY ASSOCIATION	THE HUMANE SOCIETY OF THE UNITED STATES
THE PENNSYLVANIA FORESTRY ASSOCIATION	EXECUTIVE ASSISTANT TLPOA ADMINISTRATIVE OFFICES
PENNSYLVANIA FOREST PRODUCTS ASSOCIATION	TROTTER FARM PLANNED COMMUNITY ASSOCIATION
HARDWOOD DEVELOPMENT COUNCIL, PA DEPT AGRICULTURE	LAKE NAOMI CLUB
PA STATE VETERINARIAN, PA DEPT AGRICULTURE	PROPERTY OWNERS' ASSOCIATION
PA STATE FORESTER	EMERALD LAKES ASSOCIATION
BUREAU OF STATE PARKS	HEMLOCK FARMS COMMUNITY ASSOCIATION
WILDLIFE SERVICES PENNSYLVANIA STATE DIRECTOR	SUNRISE LAKE PROPERTY OWNERS' ASSOCIATION
AUDUBON MID-ATLANTIC	FAWN LAKE FOREST ASSOCIATION
THE NATURE CONSERVANCY	THE GLEN AT TAMIMENT
COUNTY COMMISSIONERS' ASSOCIATION OF PENNSYLVANIA	SAW CREEK ESTATES
NATURAL RESOURCES EXTENSION	PENNSYLVANIA WILDLIFE FEDERATION
WECONSERVE PA	

An invitation letter was sent to each participant on April 14th, 2022. The meeting was held at the Pennsylvania Fish and Boat Commission on May 19th, 2022, from 10:00am to 3:00pm. Nicole Sturges, assistant director at Penn State Harrisburg's Center for Survey Research, facilitated the meeting.

The objective of the meeting was to gather input from groups that have an interest in how bear populations in Pennsylvania are managed. Specifically, we wanted participants to (1) provide feedback on the previous black bear management plan goals and identify if they were still relevant today; and (2) agree upon goals for the new management plan, and (3) list values they consider important, which we could use to develop objectives and strategies for achieving those goals.

The facilitators summarized notes collected during the meeting and provided a written report to the Game Commission. Flip-charts with comments recorded during the meeting also were provided.

Results

Activity 1: Feedback on Existing Goals

Participants were asked to work in small groups to discuss their impressions and opinions on the four goals of the Pennsylvania Game Commission's Black Bear Management Plan. The four goals were discussed during the initial presentation as well as projected on a screen as the groups worked. The participants were split into three groups of three and given sufficient time to discuss goals individually and prepare feedback. Once the facilitator determined each group was done working, there was a discussion for each goal.

Goal 1: Ensure the black bear populations remain healthy and self-sustaining (Population Goal)

The first goal of the Black Bear Management Plan focuses on black bear populations and is referred to as the "population goal." Participants noted that overall, the wording and the accompanying actions of the population goal were easy to understand. They did have several suggestions that they felt could strengthen and clarify the goal even further. One group mentioned clarifying the wording "self-sustaining," suggesting that while black bear populations may be self-sustaining, this does not necessarily mean that they are not above or below the ideal population. They suggested using the word "stable" instead, and the other groups supported this change.

Another group suggested adding "in balance with human population and land use" to further clarify the population goal. The other groups, similarly, wanted wording included in the goal that bears should not be overharvested, and that there should be a target population per wildlife management unit (WMU).

Overall, groups agreed that while this goal is acceptable as it is, it would be beneficial to clarify what self-sustaining populations entail, and if the populations are expected to differ by WMU. They agreed that the wording of the population goal might be changed to "Ensure the black bear populations remain healthy and stable in balance with human population and land use per Wildlife Management Unit." Participants wanted the goal to be specific about the population needs of black bears and believed that they would not be consistent across

WMUs. Therefore, the wording of the population goal addresses all the concerns brought up by the group.

Goal 2: Minimize loss of forested habitats and improve quality of existing forests for black bears (Habitat Goal)

The second goal related to black bear habitats and is considered the "habitat goal." Participants had mixed feelings about the second goal regarding habitat. Notably, one group suggested eliminating this goal altogether. The group noted that there are other agencies that work to maintain forests, generally, so the Black Bear Management Plan does not need to include a goal relating to habitats and forestry. However, other groups brought up several points, including that by protecting the existing habitats of black bears specifically, the state will be better able to maintain the health, wellness, and population of black bears in Pennsylvania. It was also noted that having a habitat-focused goal in the Black Bear Management Plan, specifically, would guarantee that the habitats of black bears would be looked after despite changes in the goals and focuses of other agencies.

After discussion, all three groups were in consensus that they would keep the goal the way it was, with some action items tweaked later, in activity two. The wording of the goal remained "Minimize loss of forested habitats and improve quality of existing forests for black bears".

Goal 3: Maintain human-bear conflicts at acceptable levels (Human-Bear Conflict Goal)

The third goal, named the "human-bear conflict goal," focused on human-bear conflicts, specifically. Participants agreed that this goal's language should be worded differently, but that it was an extremely important goal overall. All three groups were concerned about the word "maintain." Participants discussed using either "minimize" or "monitor" instead. After a lengthy discussion, groups agreed that minimize would be a more appropriate term, as it is unidirectional; however, they would be okay with using the word monitor if the deciding parties felt that it was more appropriate.

In addition, groups were unclear on "acceptable levels." Participants pointed out that they were unsure how much human-bear conflict was acceptable or appropriate. They all agreed that this phrase needed clarification. The new suggested wording was "Minimize human-bear conflicts," although groups were in consensus that they might be unclear on the "acceptable levels" part of the original goal wording and were open to the idea of the Pennsylvania Game Commission clarifying that aspect and including it in the goal if necessary.

Goal 4: Provide recreational opportunities that involve black bears (Recreation Goal)

Participants were enthusiastic about the recreation goal. The participants all had minor feedback, suggesting that the wording is very vague, and that the goal could be re-written to better communicate to the public what exactly is meant by "recreational opportunities." No specific wording suggestions were made, only a broad suggestion the Pennsylvania Game Commission think about how recreational activities could be further defined in the goal. The

consensus was that this goal could be re-written, but it was not as important as implementing the suggestions for the first three goals.

New Goal 5 Suggestion: Education, Outreach, and Research

All three groups suggested adding a goal focused on education, outreach, and research. Groups all indicated that this goal will probably overlap, in some way, with all four of the other goals. However, there was consensus that this should be a standalone goal, focusing specifically on educating the public about black bears. Participants were all concerned that, in the presentation, they were told that 73% of Pennsylvania residents reported knowing little to nothing about black bears. They hope this goal could help address that gap in knowledge. Although no wording for a new goal was suggested for outreach and research, participants agreed that outreach and research will be important action items that will aid in implementing this new goal. They agreed that these items would be a focus of the discussion for activity two.

After discussing amongst themselves, the three groups ended with a consensus on a new goal and how it should be worded. The group started off knowing that they wanted to "increase education" about black bears in Pennsylvania, but they did not like the goal worded in that way, as it could be interpreted differently by different individuals and organizations. They then moved onto thinking about using the word "improve" the education of Pennsylvania residents, but still were not settled. Finally, they came to an agreement on the goal wording being "Actively educate the people of the Commonwealth of Pennsylvania about Black Bears." However, the groups all agreed that this is just a starting-point, and ultimately trust that the Pennsylvania Game Commission will take their feedback and wording suggestions into account and create and implement an effective education goal in the newest Black Bear Management Plan.

<u>Activity 2: Suggested Actions for Stated Goals</u>

Following the initial activity regarding the feedback on goals within the Bear Management Plan, the stakeholders gathered back into their smaller groups of three to focus on actions accompanying the goal consensus. Each group utilized roughly 15 minutes of discussion time, per goal, to brainstorm different actions to strengthen the Bear Management Plan goals the group had previously discussed. Each featured action item is ordered from most to least important as noted by the groups during the session.

Goal 1: Population Goal

The first goal, focusing on black bear population, garnered several action items between the groups. Group one featured two specific action items: The Pennsylvania Game Commission will establish a target number of black bears within each Wildlife Management Unit (WMU), which would take specific action based on each WMU's population to match the target goal of black bears; moreover, avoidance of overharvesting black bears within each WMU rounds out group one's action items. Furthermore, group two offered several action items to strengthen the health and survival goal. Group two focused on risk identification including

issues such as connectivity, climate change, and invasive species impacting environments, the development of population objectives for black bears (similar to group one), and the monitoring of both the health and reproduction of black bears.

Lastly, group three offered the suggestion to document the number of human-bear conflicts, with documentation sent to the Pennsylvania Department of Transportation to mitigate the number of automobile issues in the context of human-bear conflicts.

Goal 2: Habitat Goal

The second goal focused on the minimization of forested habitat loss in conjunction with the improvement of existing forest quality for black bears. Within this capacity, group one primarily focused on land acquisition opportunities, particularly within mine reclamation areas. Furthermore, group two discussed the importance of ecosystem restoration; within their discussion, the group particularly emphasized the restoration and reclamation of lands that could be bear habitats, as well as garnering more public support to maintain habitats and bring awareness of what bear country looks like. Moreover, the third group agreed with the current strategies in place but stressed the importance of conservation efforts in support of habitat loss mitigation and quality of bear habitat. The group also suggested the use of an identifier (i.e., slogan, bear mascot or logo, etc.), for a visual cue to indicate the presence of black bears within their habitats and provide informative content when visitors are present in the habitats.

Goal 3: Human-Bear Conflict Goal

The third goal focused on the change from maintaining the number of human-bear conflicts to the minimization of human-bear conflicts. To support this language change, the three groups offered suggestions to support minimization of human-bear conflicts. Group one focused on an educational component for areas within the Commonwealth that have high black bear populations. An additional suggestion from group one is the establishment of bear population targets per WMU. Group two contributed a variety of research capabilities; succinctly, there would be a categorization and prioritization of the causes of conflict. From there, information would be disseminated accordingly to those most vulnerable to conflict regarding best steps to avoid and mitigate conflict if/when it occurs. Additionally, group two provided input regarding resource provision about how best to "bear proof" trash receptacles. Group three provided alternative research capabilities, including auditory deterrents to prevent interactions. Additionally, group three provided suggestions such as partnering with departments within the state to decrease human-bear conflict, including PennDOT and the PA Department of Agriculture to determine the levels of damage and mitigation strategies for collisions and crop damage, respectively.

Goal 4: Recreation Goal

The fourth goal focused on strengthening recreational activities involving black bears within the Commonwealth. A common action item in this capacity is a focus on R3's, otherwise known as recruitment, retention, and reactivation. Groups one and two proposed the focus on

this concept to reduce over harvest while increasing hunter numbers, as well as saving and cultivating the tribal and cultural facets of hunting in the Commonwealth of Pennsylvania through means of mentorship and training. Consequently, keeping the R3 mission as the foundation would allow for recreational activities to come forward naturally. Group three believed that the existing objectives and strategies in place were beneficial but offered suggestions to further increase recreational activities pertaining to black bears in the Commonwealth. Subsequently, group three offered suggestions such as a bear den camera to engage with black bear habitats virtually, increasing signage to include information and safe interaction with bear habitats, and increasing educational opportunities which in turn tie together all the proposed goals.

Proposed Goal 5: Education, Outreach, and Research

Lastly, action items were formulated in support of a proposed fifth goal, centered around education, outreach, and research outlets in relation to black bears in Pennsylvania. Group one focused primarily on the outreach component: suggestions included outreach to youth through extracurricular involvement within school districts, publications through news channels, information dissemination through kiosks in outdoor areas (i.e., campgrounds, trails, and outdoor recreation areas) other informational dissemination methods through state and municipal agencies. Group two offered several suggestions: an initial baseline of human knowledge of black bears in their WMU (essentially documenting who knows what in which region), holding events that incorporate stakeholders in the agricultural, sportsman, and other sectors together for community gathering around the topic of black bears, and a multi-media campaign to garner awareness "where the people are." Lastly, group three focused on education on black bears and their relationship to the different sectors within the Commonwealth of Pennsylvania. Utilizing the example of beekeepers, group three mentioned the idea of creating websites and an overall media presence. Essentially in this action item, checklists would be created to assist beekeepers in decision-making if a representative from the Pennsylvania Game Commission is unavailable, as well as proper times that euthanasia is a viable option with accessible methods implemented for those who are less technologically inclined. Additionally, outlets including media (such as educational videos), partnerships with Penn State University's bee database, BeeScape; mobile AgLabs for students; fieldtrips; and utilizing a black bear mascot were mentioned to increase education.

Miscellaneous Feedback

The meeting participants also provided feedback unrelated to the aforementioned goals. Stakeholders were asked to provide suggestions regarding the best ways to release information on new research in a relatable capacity to the general public.
Overall, the participants compiled several suggestions, including a summarization of the project in laymen's terms with a link to the full research paper if the viewer is interested in further exploring the topic, utilizing a podcast format to explain the research findings in an audible format, and utilizing a "landing page" or "media database" for the Commonwealth (including press releases, radio interviews, magazine releases, etc.) for a collection of research discussions throughout the state.

Conclusion

This report includes summaries of two activities facilitated at the Pennsylvania Bear Management Stakeholder Engagement Meeting. Suggested wording changes of the existing goals, along with suggestions for the accompanying action-items, are included in this report. Participants in the Pennsylvania Bear Management Stakeholder Engagement Meeting were excited and enthusiastic to be contributing to the new Pennsylvania Bear Management Plan and requested to be informed when the new plan was released.

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APPENDIX 3. Highlights of the Pennsylvania Game Code that involve black bears.

Buying and Selling of Bear Parts

- Unless otherwise provided, it is unlawful for anyone to buy or sell any part of a game animal (§ 2312.a).
- However, § 2312.c2 authorizes the Game Commission to establish by regulation exceptions for the buying and selling of inedible wildlife parts.
- The current regulation for bear allows non-edible parts to be sold only by the hunter harvesting the bear, provided the sale occurs within 90 days of the end of the hunting season when the bears was harvested.
- Non-edible parts include the hide, skull, bones, and claws. Gall bladders are considered an edible part, and therefore cannot be sold or bought under this exception.
- Taxidermists are permitted to sell finished products (tanned skins, mounts, etc) to recoup expenses associated with work not claimed or paid for by a hunter only after notifying the hunter 30 days after receipt of a registered letter. T-58 147.146 (3)(4)

Killing Bears in Self-Defense

- Bears can be killed in self-defense only when it is clearly evident that a human is about to be injured and there is no other course of action (§ 2141.a). Simply perceiving that there is a threat of injury is not sufficient; the facts must corroborate that injury was actually going to occur.
- The incident must be reported as soon as possible and within 24 hours (§ 2141.b).
- The bear cannot be retained by the person killing it (§ 2141.c).

Killing Bears to Protect Property

- Farmers may kill any bear perceived as a threat to cultivated crops, fruit trees, vegetables, livestock, poultry, or beehives (§ 2121.a.1-3). A farmer is anyone cultivating land as a primary means of income, or lessees and employees of the farmer or family living on the property that regularly assist with cultivation (§ 2121.c).
- Bears cannot be killed by anyone other than a farmer, family, lessees, or employees even if agricultural damage is occurring on their property, or to protect any property other than cultivated crops, fruit trees, vegetables, livestock, poultry, or beehives even if the damage is occurring on a farm.
- Bears that are killed to protect agricultural items must be reported within 24 hours (§ 2122) and cared for to prevent spoilage unless otherwise directed (§ 2123).
- The person killing a bear can retain the carcass for consumption if it was not killed at a site where deterrent fencing had been provided and if the property is open to public hunting. Only one carcass can be in possession at any given time (§ 2124).

Damage Compensation Payments

- Payment is only provided for damage or loss to livestock, poultry, bees, and bee-keeping equipment (§ 551.a).
- Damage must be reported by sworn written statement within 10 days and the land where the damage occurred open to public hunting (§ 551.a).
- Only Pennsylvania residents can receive damage payments (§ 551.c).
- Payments represent the true value of damage sustained, not projected losses (§ 553). If the value of damages cannot be mutually agreed upon, claimants can request a hearing to resolve the matter (§ 554).
- The sum of all bear-related damage payments in any year cannot exceed $50,000 (§ 555).
- When paying for bees or bee-keeping equipment, a bear must not have been killed at the site; affected hives must be within 300 yards of the owner's residence or the residence of a person overseeing the hives; and the claim cannot be a second or subsequent claim unless a Commission-approved electric fence was erected and maintained (§ 551.b.1-3).

Applying to Receive Commission-Purchased Electric Fencing

- Anyone who has 10 or more beehives in one location, allows public hunting on their land, and is experiencing or anticipating bear damage to their hives can request electric fencing materials from the Game Commission (§ 541(b)). Unsuccessful applicants may request a hearing to resolve the matter (§ 545).
- There is no cost to the recipients, but they are responsible for erecting and maintaining the fence (§ 544).
- The Commission-approved fence design includes 3 strands of 12 gauge, 4-point barbed wire suspended at 10, 20, and 30 inches above the ground between insulated posts that are a maximum of 10 feet apart. Fences operate on either a 12-volt DC (battery) system or AC current. Solar-charging systems are not provided. Recipients are encouraged to "bait" the wire by hanging bacon over the wire at several locations.
- Fences are expected to last 10 years. If the recipient no longer needs a fence (e.g., stops producing honey) before 10 years have passed, they are required to repay the cost of fencing materials prorated at a 10% annual depreciation rate.
- Annual expenses for supplying fencing materials cannot exceed $300,000, excluding fences erected on commercial forestlands (§ 546).

Prohibiting The Feeding of Bears

- Feeding of certain wildlife can be prohibited by the Game Commission (Title 58, § 137.33). "It is unlawful to, except for normal or accepted farming, habitat management practices, oil and gas drilling, mining, forest management activities or other legitimate commercial or industrial practices, intentionally lay or place food, fruit, hay, grain, chemical, salt or other minerals anywhere in this Commonwealth for the purpose of feeding bear or elk, or to intentionally lay or place food, fruit, hay, grain, chemical, salt or other minerals that may cause bear or elk to congregate or habituate an area. If otherwise lawful feeding is attracting bear or elk, the Commission may provide written notice prohibiting the activity."

- Regulation given final approval at April 2003 Board of Game Commissioners meeting.
- Expiration (sunset) date of October 2004 removed from regulation in July 2004.

Hunting Restrictions

- Only manually operated centerfire rifles, handguns and shotguns; muzzleloading firearms of any caliber; long, recurve, and compound bows; or crossbows can be used.
- Bullets must be designed to expand on impact, and bullets or balls must be all-lead. Buckshot is illegal. Arrows must be fitted with broadheads of cutting edge design.
- Hunters cannot use electronic devices to locate bears fitted with radio-transmitters or alert other hunters to the presence of game. Electronic calls, and any device that emits a beam of light onto the animal also are prohibited.
- Hunting near bait or areas baited within the past 30 days is prohibited (Title 34, § 2308.a8). Lures or scents are considered bait and cannot be used.
- Bears in dens cannot be killed or harassed.
- Organized parties of hunters cannot exceed 25 people. (Title 58, § 141.42)
- It is unlawful to hunt, disturb, or chase bears within 150 yards of any building (i.e., Safety Zone) without the permission of the occupants.
- It is unlawful to hunt from a vehicle, have a loaded firearm in a vehicle, or exit a vehicle and shoot at bears unless the hunter has moved at least 25 yards from the roadway. Shooting at bears on roads open to public travel, and shooting over a road is prohibited unless the bullet trajectory is high enough to not be a danger.
- At least 250 square inches of fluorescent orange on the head, chest and back combined so as to be visible 360 degrees is required while hunting bear.
- Hunters are required to make a reasonable effort to retrieve any bears injured or killed.
- Bears must be tagged by the successful hunter before being moved.
- Harvested bears must be taken to an established check station within 24 hours of harvest. Hunters must bring their hunting license, bear license, and proof of identification with them to the check station (Title 34, § 2323.a2).
- Bears cannot be hunted on Sunday except when a legal bear season occurs over one of the three “PGC choice” Sunday hunting opportunities.

Possession of Vehicle-Killed Bears

- Individuals that kill a bear with a vehicle can keep the carcass for the meat only if they report it to the Game Commission and get approval to do so before moving the carcass (Title 34, § 2307; SOP 50.15).
- However, carcasses of vehicle-killed bears that are salvageable and where the finder wants to keep the head, hide, and/or skull, they have to purchase the bear from the Game Commission, including to the individuals who struck the bear (Title 58 §147.141).

APPENDIX 4. Pennsylvania Nuisance Black Bear Policy (SOP 50.33) approved by Board of Game Commissioners, July 20, 2020.

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BUREAU OF WILDLIFE MANAGEMENT

Policy Item – A request to approve an agency policy concerning the handling of black bear conflicts.

Commentary: Pennsylvania's black bear population has increased and expanded in range since the late 1970s. From two core areas in the northcentral and northeast regions, the population has grown to approximately 20,000 animals distributed across most of the state. Expansion of human development and residential areas into occupied bear habitats has also occurred. Unsurprisingly, the number of human-bear conflicts has increased, and responding to bear incidents is now a common duty for many Pennsylvania Game Commission personnel in all regions of the state. Teaching people about bears resolves many of the conflicts encountered and information/education efforts are currently used by all regions, but some incidents require additional action. All PGC Communication Centers shall create an incident in the Computer Aided Dispatch (CAD) system involving all bear complaints received from the public. It is imperative that incidents involving threats to public are well documented and dispatched to the appropriate Warden as soon as possible. If a Warden is not available, the Duty Supervisor for the receiving region should be contacted to determine if an immediate response is required. It is important for agency Game Wardens to respond to, preferably in person, all incidents involving bears posing a threat to the public. Wardens shall document incidents of bears posing a threat to humans by entering specific facts and circumstances into the agency Incident Management System (IMS)(CAD) narrative. Incidents involving human contact or aggression, shall be treated very seriously. All necessary action or mitigation must be deployed to ensure public safety. The Board of Game Commissioners adopted a policy in January 2001 concerning Nuisance Black Bears. However, this policy was not incorporated in the subsequent revision of the agency Policy Manual. To provide direction to our staff and protection to the public, the following guidance is provided in handling these conflict situations.

Standard Operating Policy (SOP) 50.33: Guidelines for Handling Nuisance Bear Conflicts

1. BEAR IN BOROUGHS, TOWNS AND CITIES

Public Education, Hazing, and Coordination with Local Authorities Transient bears pose minimal threat to public safety under most circumstances and educating the public about bears may be the only required intervention. However, if a Pennsylvania Game Commission Game Warden, Deputy Game Warden or authorized Wildlife Management Staff considers it unlikely that a bear will leave an area on its own, he or she will work with local authorities to haze the bear away from the borough, town or city. Hazing includes any activity intended to move or lure a black bear in a desired direction, such as crowd control, traffic control, noise (eg, cracker shells) or rubber buckshot/slugs. SOP 40.8 2

Immobilization and Relocation is authorized when it has been determined that a bear cannot leave an area on its own, creates a traffic or other hazard, or is in imminent danger. The bear will be relocated to the nearest suitable habitat.

Destruction is authorized when a bear presents an imminent threat to public health or safety and immobilization is not feasible, or when a bear is deemed a human-habituated nuisance and previous relocation efforts have failed to resolve the problem.

2. BEAR EXHIBITING AGGRESSIVE BEHAVIOR

Reducing Attractants, Hazing, Aversive Conditioning, or Tranquilization and Relocation Foods that encourage bears to approach humans should be discouraged or removed. Bears exhibiting aggressive behavior may be hazed, subjected to aversive conditioning, or immobilized and relocated to the nearest suitable, non-conflict area depending on the situation. Aversive conditioning may include the use of rubber bullets, pepper spray, water, loud noises or other devices and activities that associate a negative stimulus with the unwanted bear behavior. Aggression due to defense of young outside of residential areas will not be interpreted as unnatural or unprovoked behavior.

Destruction is authorized if a bear exhibits aggression that presents an imminent threat to public health or safety. This includes bears that enter, or attempt to enter, any dwelling or living space especially if done by breaking into or forcing doors or windows or cause any damage which would indicate the attempt to enter a living area. Any Pennsylvania Game Commission Game Warden, Deputy Game Warden, Dispatcher or authorized Wildlife Management Staff may make this emergency determination and act or authorize a resident or another Law Enforcement Agency to act without consent from the Region Director or his designee. In those instances where action must precede regional notification, a full report will be made to the Region Director immediately after the animal is destroyed and the scene controlled.

3. PROPERTY DAMAGE

Preventative Measures Taken by Landowner Pennsylvania Game Commission Game Wardens, Deputy Game Wardens or authorized Wildlife Management Staff will work with SOP 50.33 3 landowners and homeowners to prevent or minimize bear-related conflicts on their properties by providing technical advice (e.g., on the use of bird and other wildlife feeders, securing food sources, etc.) or assistance (e.g., permanent fencing as provided under Title 34, temporary fencing, repellent, equipment for hazing bear, etc.).

Hazing and Aversive Conditioning is authorized if preventative measures fail to adequately reduce damage. SOP 40.8 3

Immobilization and Relocation is authorized if preventative measures, hazing, or aversive conditioning fail to reduce damage or are impractical. Relocation should be to the nearest suitable, non-conflict area as but far as possible from the site of damage. Bears exhibiting signs of mange should be treated and released in proximity of the capture site to reduce the spread of the parasite.

Destruction is authorized if the responsible bear is identifiable, a clear history of persistent property damage is apparent, and previous relocation efforts have failed to resolve the problem. In accordance with SOP's 40.4 and/ or 40.9, when feasible, bears should be properly sedated and immobilized prior to euthanasia as the most humane method.

4. INJURED OR ORPHANED BEARS

Immobilization and Relocation Bears are resilient and can recover from most injuries without assistance. However, bears that threaten public safety or appear to require treatment for recovery may be immobilized and relocated to the nearest suitable habitat. Orphaned bears cubs will be placed with an adoptive female bear. If adoption is not possible, orphaned cubs may be rehabilitated and released to the wild if human habituation did not occur during captivity. Prior to any bear or bear cubs being moved from one region to another, the Region Director or his designee from the receiving region shall be notified. This includes any bear or bear cub that is being transported to a rehabilitation center authorized to receive orphaned/injured bears or any bear or cub exhibiting signs of mange whether treated or not. Bear cubs shall be ear tagged in the region or origin prior to being transported to the rehabilitation center.

Destruction is authorized when chance of recovery from injury is deemed unlikely or impractical, or if human habituation precludes release into the wild.

5. GENERAL COMMENTS

Any bear that is immobilized will be inspected for ear-tags or tattoos and tagged in both ears prior to release. Bears released within 30 days prior to an open season for harvesting bears, or during any open season for harvesting bears, shall also be tagged with DO NOT EAT tags in addition to numbered ear tags which uniquely identify the bear. SOP 50.33 4 Any carcass that results from destruction of a black bear will be utilized in accordance with SOP 50.15. Before any destroyed bear is permitted out for consumption, it shall be determined whether the bear has been immobilized at least 30 days prior to the date of destruction to safeguard the public. Personnel that destroyed any bears due to unknown illness or severe mange, shall contact the region Wildlife Management Supervisor to determine if examination or necropsy is required before disposal. If feasible, bears that have been injected with immobilizing pharmaceuticals prior to destruction must be disposed in a manner that will prevent scavenging from other wildlife or birds of prey. It is recommended such carcass be buried, incinerated or placed in a location to limit access by other wildlife.

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<u>Additional SOPs relating to Black Bears:</u>

- 40.4 Wildlife Disease Surveillance, Management, and Response
- 40.11 Treatment and Disposal of Mange-Infected Bears
- 50.7 Payment of Bear Damage Claims
- 50.15 Disposal of Big Game Accidentally Killed on the Highway, Illegally Killed and Killed for Crop Damage

APPENDIX 5. Summary of black bear hunting regulations in the U.S. (modified from Scheick 2002, and data collected from the 2018 Western Black Bear Workshop and 2019 Eastern Black Bear Workshop).

State or Province	Listed Status	Any Bear Season	Dog Hunting Season	Baiting	Comments
Alabama	Protected	No	No	No	
Alaska	Game	Yes	Yes	Yes	Has a spring harvest season; dogs and bait require registration with state authorities; use of dogs is very rare.
Arizona	Game	Yes	Yes	No	Has a spring harvest season.
Arkansas	Game	Yes	No	Yes	
California	Game	Yes	No	No	
Colorado	Game	Yes	No	No	
Connecticut	Protected	No	No	No	
Delaware	Extirpated	No	No	No	No wild bear population since colonial times; only occasional transient sightings.
Florida	Game*	No**	No	No	*Was previously listed as threatened until 2012; **Had one harvest season in 2015; no season since then.
Georgia	Game	Yes	Yes	No	
Hawaii	Unclassified*	No	No	No	*Not part of historic or current bear range.
Idaho	Game	Yes	Yes	Yes	Has a spring harvest season.
Illinois	Extirpated	No	No	No	No wild bear population, may be some transients.
Indiana	Extirpated	No	No	No	
Iowa	Game	No	No	No	No wild bear population, occasional transients; there are currently no protections for bears in the state.
Kansas	Extirpated	No	No	No	No wild bear population, incidental sightings in extreme southeast and far west.
Kentucky	Game	Yes	Yes	No	
Louisiana	Protected	No	No	No	
Maine	Game	Yes	Yes	Yes	Trapping also permitted.
Maryland	Game	Yes	No	No	
Massachusetts	Game	Yes	No	No	
Michigan	Game	Yes	Yes	Yes	
Minnesota	Game	Yes	No	Yes	
Mississippi	Protected	No	No	No	
Missouri	Game	Yes*	No	No	*First season since recovery in 2021.
Montana	Game	Yes	No	No	Has a spring harvest season.
Nebraska	Game	No	No	No	No population, occasional transient.
Nevada	Game	Yes	Yes	No	
New Hampshire	Game	Yes	Yes	Yes	
New Jersey	Game	No*	No	No	*Has historically had a season; in 2021 the season was suspended.

APPENDIX 5, continued.

State or Province	Listed Status	Any Bear Season	Dog Hunting Season	Baiting	Comments
New Mexico	Game	Yes	Yes	No	
New York	Game	Yes	No	No	
North Carolina	Game	Yes	Yes	No	
North Dakota	Protected	No	No	No	No wild bear population, occasional transients.
Ohio	Protected*	No	No	No	*State endangered designation.
Oklahoma	Game	Yes	No	No	
Oregon	Game	Yes	No	No	Has a spring harvest season.
Pennsylvania	Game	Yes	No	No	
Rhode Island	Protected	No	No	No	Mostly transients, possibly a few resident bears.
South Carolina	Game	Yes	Yes	No	
South Dakota	Protected	No	No	No	Sightings mostly occur in the SW corner of the state.
Tennessee	Game	Yes	Yes	No	
Texas	Protected*	No	No	No	*State endangered designation.
Utah	Game	Yes	Yes	Yes	Has a spring harvest season.
Vermont	Game	Yes	Yes*	No	*6 dog max, with permit.
Virginia	Game	Yes	Yes	No	
Washington	Game	Yes	No	No	
West Virginia	Game	Yes	Yes	No	
Wisconsin	Game	Yes	Yes	Yes	
Wyoming	Game	Yes	No	Yes*	Has a spring harvest season. *Except within grizzly areas.

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