

Ursus americanus. By Serge Larivière

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Ursus Linnaeus, 1758

- Ursus* Linnaeus, 1758:47. Type species *Ursus arctos* Linnaeus.
Melursus Meyer, 1793:155. Type species *Bradypus ursinus* Shaw.
Arceus Goldfuss, 1809:301. Type species *Arceus niger* Goldfuss.
Prochilus Illiger, 1811:109. Type species *Bradypus ursinus* Shaw.
Chondrorhynchus Fisher, 1814:142. Type species unspecified. Evidently a sloth bear from India.
Helarctos Horsfield, 1826:221. Type species *Helarctos eurypilus* Horsfield (= *Ursus malayanus* Phipps).
Danis Gray, 1825a:60. Type species *Ursus ferox* Desmarest (= *Ursus horribilis* Ord).
Thalarctos Gray, 1825a:62. Type species *Thalarctos polaris* Gray (= *Ursus maritimus* Phipps).
Thalassarctos Gray, 1825b:339. Emendation of *Thalarctos* Gray.
Myrmarctos Gray, 1864:694. Type species *Myrmarctos evermanni* Gray (= *Ursus arctos* Linnaeus).
Thalassiarctus Kobelt, 1896:93. Emendation of *Thalarctos* Gray.
Ursarctos Heude, 1898:17. Type species *Ursus arctos yesoensis* Lydekker (= *Ursus arctos lasiotus* Gray).
Melanarctos Heude, 1898:18. Type species *Melanarctos cavifrons* Heude (= *Ursus lasiotus* Gray).
Selenarctos Heude, 1901:2. Type species *Ursus thibetanus* Cuvier.
Arcticonus Pocock, 1917:129. Type species *Ursus thibetanus* Cuvier.
Vetularctos Merriam, 1918:131. Type species *Vetularctos inopinatus* Merriam.
Mylarctos Lönnerberg, 1923:91. Type species *Ursus pruinosus* Blyth.

CONTEXT AND CONTENT. Order Carnivora, family Ursidae, subfamily Ursinae. Seven recent forms in the subfamily Ursinae (*americanus*, *arctos*, *malayanus*, *maritimus*, *ornatus*, *thibetanus*, *ursinus*) have been split into as many as 5 genera (Corbet and Hill 1980) or lumped into 1 genus (Goldman et al. 1989; Talbot and Shields 1996; van Gelder 1977). Herein, I follow Wozencraft (1993) and consider 4 living species of *Ursus*: *americanus*, *arctos*, *maritimus*, and *thibetanus*. Other extant bears are considered under *Helarctos malayanus* (Malayan sun bear), *Melursus ursinus* (sloth bear), and *Tremarctos ornatus* (spectacled bear). A key (modified from Hall 1981; Nowak 1991) to the 4 extant *Ursus* species follows.

- 1 Always entirely white; combined length of M1 and M2 less than palatal width; primarily maritime *Ursus maritimus*
 Never entirely white; combined length of M1 and M2 never less than palatal width; never maritime 2
- 2 Claws on forefeet only slightly longer than those on hind feet and strongly curved; hump at shoulders lacking or only slightly developed 3
 Claws on forefeet ca. 2 times longer than those on hind feet and only slightly curved; hump on shoulders prominent *Ursus arctos*
- 3 Species present in North America; chin black; white markings on chest infrequent *Ursus americanus*
 Species absent from North America; chin white; typically with white V- or crescent-shaped mark on chest *Ursus thibetanus*

Ursus americanus Pallas, 1780

American Black Bear

- Ursus americanus* Pallas, 1780:5. Type locality “Eastern North America.”
Ursus luteolus Griffith, 1821:236. Type locality “Louisiana.”
Ursus amblyceps Baird, 1859:29. Type locality “Fort Webster (cop-

- per mines), on the Gila River, longitude 108°04'W, latitude 32°47'N, Grant County, New Mexico.”
Ursus floridanus Merriam, 1896:81. Type locality “Key Biscayne, Dade County, Florida.”
Ursus californiensis Miller, 1900:250. Type locality “California.”
Ursus carlottae Osgood, 1901:30. Type locality “Massett, Graham Island, Queen Charlotte Islands, British Columbia.” Canada.
Ursus altifrontalis Elliot, 1903:234. Type locality “Lake Crescent, Clallam County, Washington.”
Ursus machetes Elliot, 1903:235. Type locality “Casa Grande, Sierra Madre, Chihuahua, Mexico.”
Ursus kermodei Hornaday, 1905:82. Type locality “Gribble Island, British Columbia,” Canada.

CONTEXT AND CONTENT. Context as above. Currently, 16 subspecies of *U. americanus* are recognized (Hall 1981).

- U. a. altifrontalis* Elliot, 1903:234, see above.
U. a. amblyceps Baird, 1859:29, see above.
U. a. americanus Pallas, 1780:5, see above (*sunborgeri* Bangs and *schwenki* Shoemaker are synonyms).
U. a. californiensis Miller, 1900:250, see above.
U. a. carlottae Osgood, 1901:30, see above.
U. a. cinnamomum Audubon and Bachman, 1854:125. Type locality “Lower Clearwater River, Camp Chopunnish, near mouth Jim Ford Creek, Clearwater County, western Idaho.”
U. a. emmonsii Dall, 1895:87. Type locality “Saint Elias Alps, near Yakutat Bay, Alaska.”
U. a. eremicus Merriam, 1904:154. Type locality “Sierra Guadalupe, Coahuila,” Mexico.
U. a. floridanus Merriam, 1896:81, see above.
U. a. hamiltoni Cameron, 1957:538. Type locality “Big Falls, Humber River, Newfoundland,” Canada.
U. a. kermodei Hornaday, 1905:82, see above.
U. a. luteolus Griffith, 1821:236, see above.
U. a. machetes Elliot, 1903:235, see above.
U. a. penniger Allen, 1910:6. Type locality “Homer, Kenai Peninsula, Alaska” (*kenaiensis* Allen is a synonym).
U. a. pugnax Swarth, 1911:141. Type locality “Rocky Bay, now Bobs Bay, Dall Island, Alaska.”
U. a. vancouveri Hall, 1928:231. Type locality “King Solomon’s (sic) Basin, Vancouver Island, British Columbia,” Canada.

DIAGNOSIS. *Ursus americanus* (Fig. 1) is the smallest North American bear. Fur is usually black and darker than the



FIG. 1. Adult *Ursus americanus* in Minnesota. Photograph courtesy of Lynn L. Rogers.

brown or grizzled fur of the brown bear (*U. arctos*) or the white fur of the polar bear (*U. maritimus*). Cinnamon or brown color phases of *U. americanus* can be differentiated from *U. arctos* by lack of a prominent shoulder hump, claws on front feet similar in length to those of hind feet, and smaller size (usually <150 kg—Hall 1981; Nowak 1991). The Asiatic black bear (*U. thibetanus*) shares many morphological features with *U. americanus*, but the two species are not sympatric (Nowak 1991).

GENERAL CHARACTERS. *Ursus americanus* is a large, heavily built carnivore with a short tail, plantigrade feet, and non-retractile claws. Eyes are small, and ears are round and erect. Color of pelage is uniform and varies from black to blue, bluish gray, chocolate brown, cinnamon, and even beige. The color phase of an individual bear may change during consecutive molts (Rogers 1980). Most *U. americanus* in eastern North America are black, but the percentage of black individuals decreases from north to south in the Rocky Mountains and on the Pacific coast (Rounds 1987). Black color morphs occur most frequently in boreal forest and montane or temperate rain forests (Rounds 1987). Nonblack morphs are more common in open forests of the west and in desert ranges of the southwestern United States (Rogers 1980; Rounds 1987). White markings occasionally occur on the chest. A rare white phase of *U. americanus* occurs on the Kermode Islands off the Pacific coast of British Columbia (Hornaday 1905). Albinos are rare (Kolenosky and Strathearn 1987).

Males typically are 10% longer and 10–70% heavier than females (Bunnell and Tait 1981; Jackson 1961; McLean and Pelton 1990). Average measurements (in centimeters; *SD* and *n* in parentheses) of *U. americanus* from Smoky Mountains National Park, Tennessee (McLean and Pelton 1990), males and females, respectively, are as follows: total length, 157 (18, 311), 143 (14, 339); circumference of neck, 55 (10, 309), 46 (6, 335); circumference of chest, 86 (14, 308), 75 (9, 336); width of head, 28 (5, 239), 25 (4, 273); and length of head, 33 (4, 312), 31 (2, 341). Average body mass (*n* in parentheses) of males and females, respectively, was 86.0 kg (30) and 58.0 kg (11) in California (Piekielek and Burton 1975) and 67.3 kg (201) and 50.1 kg (352) in Tennessee and North Carolina (McLean and Pelton 1990). On the Atlantic coastal plain, males and females reach adult size at 5 and 3–4 years of age, respectively (Hellgren and Vaughan 1994).

Skull (Fig. 2) is massive with large cranium, strong sagittal crest and zygomatic arches, and broad frontal region. Auditory bullae are flat, depressed, and inconspicuous. Nares are large and expose well-developed turbinate bones. Average skull measurements (in mm; *n* and range in parentheses) of males and females, respectively, from Virginia (Graham 1991) are as follows: greatest length, 287 (25, 262–317), 255 (16, 243–271); condylobasal length, 277 (15, 250–304), 241 (13, 234–256); rostral breadth, 59 (27, 55–67), 52 (17, 49–56); and zygomatic breadth, 168 (16, 146–198), 147 (14, 130–159). Additional cranial measurements are available for *U. americanus* from Florida and Texas (Graham 1991).

DISTRIBUTION. *Ursus americanus* is the more widely distributed of the 2 North American bears. It is present in all Canadian provinces and territories except Prince Edward Island (Fig. 3). In the United States, American black bears are omnipresent except in arid areas of the Southwest (Kolenosky and Strathearn 1987). *U. americanus* also occurs in the Sierra Madre Occidental and Sierra Madre Oriental of Mexico.

FOSSIL RECORD. Ursine bears originated in the mid-Pleistocene (Kurtén and Anderson 1980). All species of Ursidae diverged from a common ancestor 4–8 × 10⁶ years ago (Goldman et al. 1989). Fossil records of *U. americanus* range from early Irvingtonian to Recent (Kurtén and Anderson 1980; Savage and Russell 1983). *U. americanus* was the most common ursid in the late Rancholabrean of North America (Kurtén and Anderson 1980).

The closest living relative of *U. americanus* is either the Old World species *U. thibetanus* (Talbot and Shields 1996) or the sun bear (*Helarctos malayanus*—Zhang and Ryder 1994). *U. americanus* probably arose from a Holarctic population represented in North America by *U. abstrusus* (Savage and Russell 1983). Early forms were small but gradually increased in size through the late Irvingtonian and Rancholabrean (Kurtén and Anderson 1980; Nagorsen et al. 1995). Late Pleistocene American black bears gen-

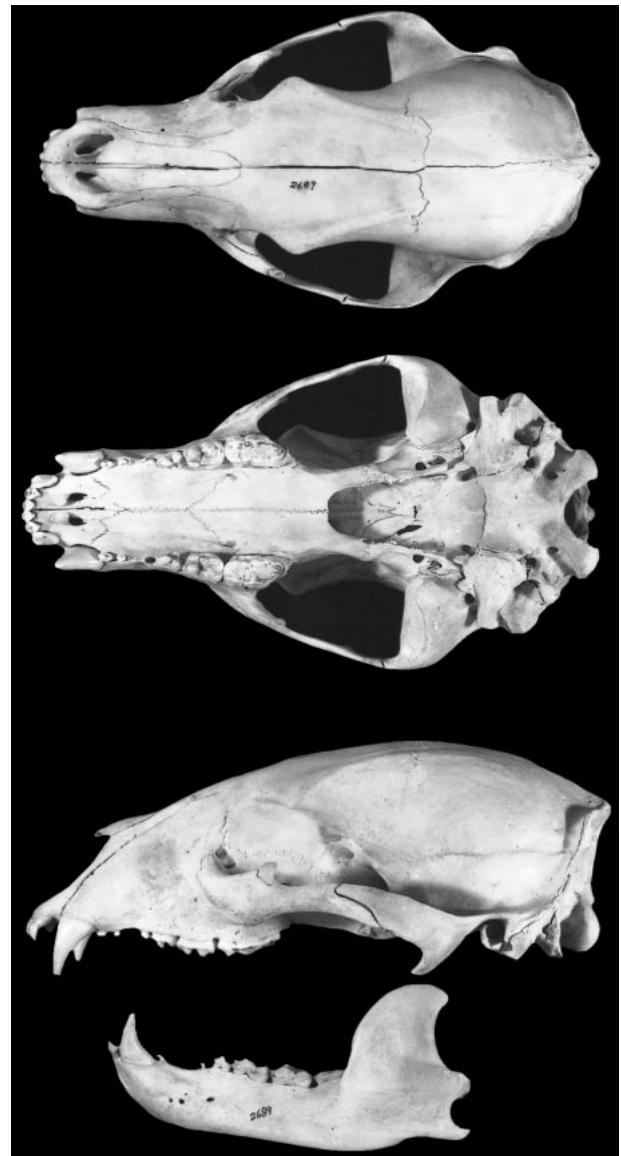


FIG. 2. Dorsal, ventral, and lateral views of cranium and lateral view of mandible of *Ursus americanus* from Chociceland, Saskatchewan (female, University of Saskatchewan Biology Museum 2689). Greatest length of cranium is 246 mm.

erally were larger than modern American black bears from the same area (Graham 1991).

FORM AND FUNCTION. In most areas, *U. americanus* is inactive during winter. Because American black bears undergo a specialized seasonal reduction of metabolism concurrent with low food availability and low environmental temperatures, they can be considered true hibernators (Watts et al. 1981). However, their large body size prevents a drop in temperature as occurs in smaller hibernating mammals. Thus, American black bears become active quickly when disturbed (Folk et al. 1976; Watts et al. 1981).

Ursus americanus accumulates fat reserves before entering dormancy, and its ability to assimilate fat and carbohydrates increases in autumn as an adaptation to gain weight (Brody and Pelton 1988; Hellgren et al. 1989). During hibernation, American black bears do not eat, drink, urinate, or defecate, yet they maintain a near-normal body temperature without food or water and with no accumulation of toxic waste. Loss of mass during hibernation averages 0.22–0.26 kg/day, or 23–30% of body mass (Hellgren et al. 1990b; Watts 1990). The rate of loss of mass of lactating females is 45% higher than that of nonlactating bears (Farley and Robbins 1995). After hibernation, low nutritional values of early spring food items may lead to additional loss of mass (Eagle and Pelton 1983).

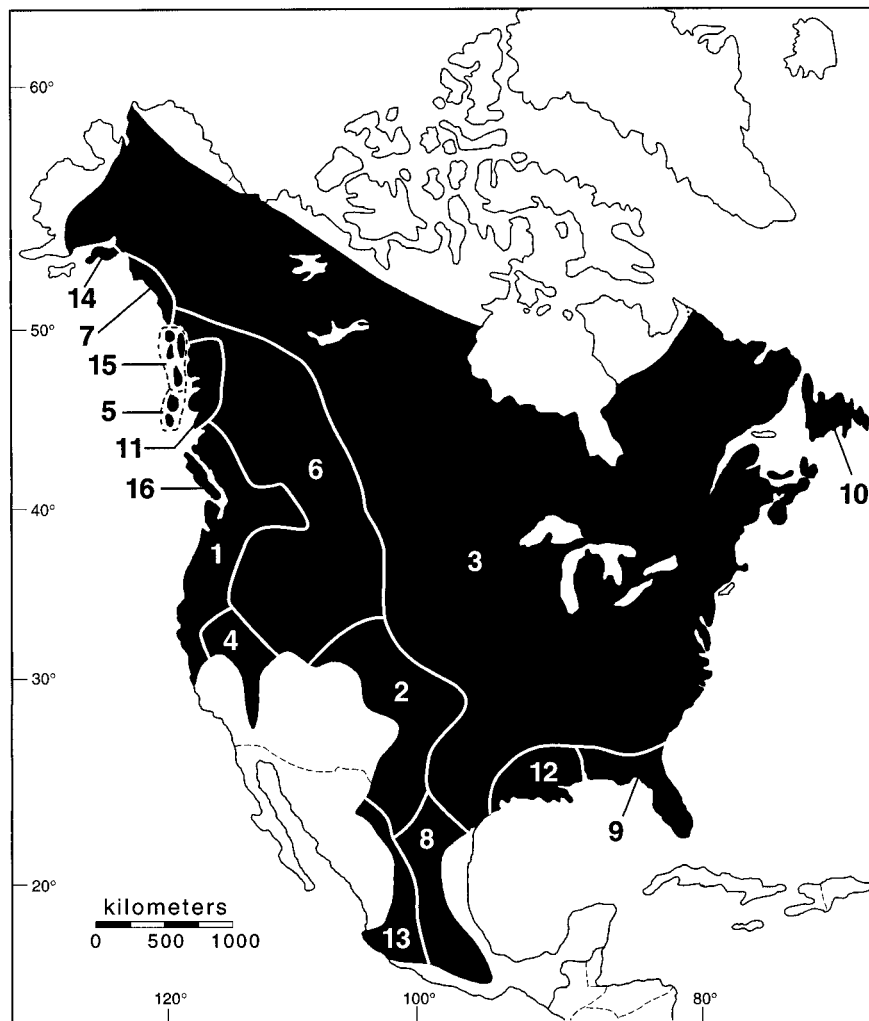


FIG. 3. Distribution of *Ursus americanus* in North America, modified from Hall (1981) and Kolenosky and Strathearn (1987). 1, *U. a. altifrontalis*; 2, *U. a. amblyceps*; 3, *U. a. americanus*; 4, *U. a. californiensis*; 5, *U. a. carlottae*; 6, *U. a. cinnamomum*; 7, *U. a. emmonsii*; 8, *U. a. eremicus*; 9, *U. a. floridanus*; 10, *U. a. hamiltoni*; 11, *U. a. kermodei*; 12, *U. a. luteolus*; 13, *U. a. machetes*; 14, *U. a. perniger*; 15, *U. a. pugnax*; and 16, *U. a. vancouveri*.

Numerous metabolic changes occur during hibernation. Hibernating bears maintain normal serum calcium concentration and do not develop osteoporosis (Floyd and Nelson 1990). They synthesize leucine, and their glucose use is reduced but lipolysis increases (Nelson and Jones 1987). Hibernation activates glyoxylate cycle enzymes that allow dormant *U. americanus* to convert brown adipose tissue to glucose (Davis et al. 1990). During hibernation, metabolic water is sufficient to maintain normal hydration (Nelson 1980), and nitrogen from recently formed urea is recycled into amino acids, thus minimizing protein loss and conserving mobility (Ahlquist et al. 1984; Barboza et al. 1997; Nelson 1978; Nelson et al. 1983). However, if protein catabolism occurs following depletion of fat reserves, then dehydration, rather than starvation, becomes life threatening (Maxwell et al. 1988). Details of the vascular anatomy and other physiological changes have been reported elsewhere (Anderson et al. 1989a, 1989b; Azizi et al. 1979; Foresman and Daniel 1983; Hock 1966; Watts et al. 1981).

Serum chemistry changes with age but remains relatively stable throughout winter hibernation (Storm et al. 1988). Levels of chloride, alkaline phosphatase, potassium, inorganic phosphorus, calcium, and serum urea nitrogen/creatinine are higher in cubs than in yearlings or adults, probably because of rapid bone development and dietary intake of calcium via nursing (Storm et al. 1988). In southern areas, *U. americanus* exhibits facultative hibernation, and changes in serum metabolites are reduced or absent (Graber 1990; Hellgren et al. 1997). Range of hematological values for females are as follows: mean white blood cell count, 3,900–

18,000; mean corpuscular volume, 51–75 fl; and mean hemoglobin, 15.7–19.3 g/dl (DelGiudice et al. 1991).

American black bears consuming fruits are constrained by intake rate, physiological capacity of the gastrointestinal tract, and the metabolic efficiency of gain in body mass. In captive *U. americanus*, maximum intake rates ranged from 30 g/min for 0.5-g berries to >200 g/min for 4.2-g fruits (Welch et al. 1997). Mean retention time was 13 h for hair and meat diet and 7 h for clover (Pritchard and Robbins 1990). Food intake can be predicted by turnover of exchangeable sodium (Farley and Robbins 1997).

American black bears have 2 inguinal and 4 pectoral nipples. Nipples are larger in parous than nulliparous females but do not differ in lactating and nonlactating parous females (Brooks and McRoberts 1997). Milk is high in fat (220 g/kg) and low in water (670 g/kg), enabling altricial cubs to gain weight rapidly during nursing (Ofstedal et al. 1993). Milk has low carbohydrate content (Ofstedal et al. 1993). Cubs retain ca. 30% of energy and 51% of nitrogen ingested.

Males possess a well-developed baculum, which in 6 bears >5 years of age averaged 10.4 g ($SD = 2.28$ g) in weight and 140 mm ($SD = 10$ mm) in length (Poelker and Hartwell 1973; Rausch 1961). Dental formula of deciduous teeth is i 3/3, c 1/1, p 3/3, total 28, and that of permanent teeth is i 3/3, c 1/1, p 4/4, m 2/3, total 42 (Rausch 1961).

ONTOGENY AND REPRODUCTION. Female *U. americanus* undergo estrus from June through September, but most mat-

ing occurs in June or July (Eiler et al. 1989; Wimsatt 1963). The reproductive cycle of males is triggered by photoperiod via increases in prolactin (Tsubota et al. 1995), and the testosterone cycle is independent of nutritional factors (McMillin et al. 1976). Adults (≥ 3 years old) remain in breeding condition longer than do yearlings and subadults (Garshelis and Hellgren 1994), and males in southern areas remain in breeding condition longer than do those in northern latitudes (Garshelis and Hellgren 1994).

Coitus may induce ovulation (Wimsatt 1963). Implantation is delayed (Wimsatt 1963) and occurs from mid-November to early December. Actual gestation lasts 60–70 days (Hellgren et al. 1990a; Kolenosky and Strathearn 1987), and parturition occurs during January or early February (Alt 1983). Lactation suppresses estrus; however, if nursing or lactation is interrupted, follicular maturation, estrus, mating, ovulation, and pregnancy may occur (Wimsatt 1963). Occasionally, females mate while raising cubs (LeCount 1983).

Females reach sexual maturity at 2–8 years of age (Hellgren and Vaughan 1989a; Poelker and Hartwell 1973; Rogers 1987a). Interbirth interval ranges from 1 to 4 years (Eiler et al. 1989; Kasworm and Thier 1994). Eastern populations may breed every 2 years, whereas western populations have a mean breeding interval ≥ 3 years (Bunnell and Tait 1981). Availability of food in autumn, especially hard mast, affects age at first reproduction, productivity, cub survival (Elowe and Dodge 1989; Kasbohm et al. 1995, 1996; Keay 1995b; McLaughlin et al. 1994; Miller 1994; Rogers 1976), and vulnerability to hunting (Beringer et al. 1998; Noyce and Garshelis 1997; Samson and Huot 1998).

Litter size ranges from 1 to 4 (Doan-Crider and Hellgren 1996; Kasworm and Thier 1994) and is influenced by maternal condition in early winter. Heavier or older females produce more offspring, and the former tend to produce more male offspring (Eiler et al. 1989; Kolenosky 1990; Samson and Huot 1995; Stringham 1990). Females in poor condition may abandon cubs (Fair 1978). Pseudopregnancy, implantation failure, and fetal resorption may occur (Hellgren et al. 1990a).

Neonates are blind, fully furred, and toothless. Cubs remain with their mother for ca. 16 months (Lindzey and Meslow 1977b). Sex ratio (M:F) of young at birth was 2.5:1 in Quebec (Samson and Huot 1995) and 1.1:1 in Ontario (Kolenosky 1990). In Minnesota, weight and growth of cubs was influenced by size of mother, but cub survival was affected only when the mother's mass 2 months postpartum was < 65 kg (Noyce and Garshelis 1994). With declining nutrition, life history parameters in Minnesota responded in the following sequence: litter size declined, age of first reproduction increased, juvenile survival decreased, 1st-year cub survival decreased, and litter frequency decreased (Noyce and Garshelis 1994). For these reasons, American black bears with access to human foods can reproduce nearly twice as often as those without such access (Rogers 1987a).

ECOLOGY. The American black bear requires a variety of habitats producing seasonal foods, as well as extensive and secluded areas for denning (Landers et al. 1979; Vander Heyden and Meslow 1999). Overall, habitat selection by *U. americanus* varies seasonally and is governed by presence of food (Clark et al. 1994; Fuller and Keith 1980; Hellgren et al. 1991; Schooley et al. 1994a). Disturbed habitats such as recently logged or burned forests are as important to American black bears as zones of high fruit and berry production (Costello and Sage 1994; Hellgren et al. 1991). Non-managed and mature hardwood forests can provide hard mast such as beechnuts (*Fagus grandifolia*) and acorns (*Quercus*—Costello and Sage 1994).

Ursus americanus has an omnivorous diet centered on vegetation. In spring, American black bears consume new vegetative growth and animal carcasses (Raine and Kansas 1990; Stubblefield 1993). During summer, herbaceous material and fruits are the primary food items. During autumn, bears feed mostly on berries and mast (Irwin and Hammond 1985; Landers et al. 1979; Raine and Kansas 1990). Preferred foods typically are low in terpenes and high in either protein or carbohydrates (Bacon and Burghardt 1983; Kimball et al. 1998).

Ursus americanus feeds opportunistically, and animal matter (e.g., mammals, reptiles, birds, and insects) is consistently part of the diet (Boileau et al. 1994; Maehr and Brady 1984; Noyce et al. 1997; Smith et al. 1994a). American black bears may kill moose (*Alces alces*) cows (Austin et al. 1994) and calves (Franzmann et

al. 1980; Schwartz and Franzmann 1991) and white-tailed deer (*Odocoileus virginianus*) fawns (Kunkel and Mech 1994; Ozoga and Verme 1982). In some areas, American black bears also kill livestock (Horstman and Gunson 1982). Where available, bears consume garbage (Stubblefield 1993) and bait set out by hunters (Landers et al. 1979).

Endoparasites infecting *U. americanus* include the protozoans *Eimeria albertensis*, *E. borealis*, and *Toxoplasma gondii* (Briscoe et al. 1993; Rogers and Rogers 1976). Also, they host the trematode *Nanophyetus salmincola*, the metacercariae of which harbor 2 rickettsia-like organisms, *Neorickettsia helminthoeca* to which American black bears are refractory and an unnamed form that causes Elokomin fluke fever (Rogers and Rogers 1976). Cestodes from American black bears include the cyclophyllidean tapeworms *Anacanthotaenia olseni*, *Mesocestoides krulli*, cf. *Multiceps serialis*, *Taenia hydatigena*, *T. krabbei*, *T. pisiformis*, and *T. saginata* and the pseudophyllidean tapeworms *Diphyllobothrium cordatum*, *D. cordiceps*, *D. latum*, and *D. ursi*. Intestinal nematodes from American black bears include the roundworms *Baylisascaris transfuga* and *B. multipapillata* and the hookworms *Uncinaria yukonensis* and *U. rauschi*. Extraintestinal nematodes include the lungworm *Crenosoma*, the eye worm *Thelazia californiensis*, the mosquito-transmitted filarial worm *Dirofilaria ursi*, *Trichinella spiralis* from muscles, and *Gongylonema pulchrum*, which usually occurs in the esophagus or rumen of ungulates but occurs in the tongue of American black bears (Rogers and Rogers 1976). Ectoparasites from American black bears include the louse *Trichodectes pinguis euarctidos*, the fleas *Chaetopsylla setosa*, *C. (Arctopsylla) tuberculiceps ursi*, *Pulex irritans*, and possibly *Orchopeas caedens*, and the ticks (Acarina) *Dermacentor albipictus*, *D. andersoni*, *D. variabilis*, and *Ixodes* (Rogers and Rogers 1976).

Diseases are uncommon in *U. americanus*, but dental cavities and periodontal diseases may be frequent and severe in some populations (Manville 1990). Diseases of the heart may occur (LeCount 1987).

Adult *U. americanus* have few natural predators, but smaller or younger animals may be killed by bobcats (*Lynx rufus*—LeCount 1987), brown bears (*Ursus arctos*—Schwartz and Franzmann 1991; Smith and Follmann 1993), coyotes (*Canis latrans*—Boyer 1949), wolves (*Canis lupus*—Rogers and Mech 1981), or other American black bears (Alt and Gruttadauria 1984; Garshelis and Pelton 1981; LeCount 1982). Flooding of natal dens may kill cubs (Alt 1984), but most mortality is human induced through hunting, trapping, poaching, and collision with vehicles (Burton et al. 1994; Hellgren and Vaughan 1989a; Kasworm and Thier 1994; Rogers 1987a; Wooding and Hardisky 1994).

Ursus americanus live up to 23 years in the wild (Keay 1995a) and up to 24 years in captivity (Marks and Erickson 1966). Average annual survival rates for males and females, respectively, were 0.88 and 0.84 in Florida (Wooding and Hardisky 1994), 0.73 and 0.79 in Montana (Kasworm and Thier 1994), and 0.59 and 0.87 in Virginia and North Carolina (Hellgren and Vaughan 1989a). In Alaska, ca. 14–17% of subadult males and 30–48% of subadult females survived to adulthood (Schwartz and Franzmann 1992). In Minnesota, overwinter mortality was $< 1\%$, but yearling starvation was observed following emergence from hibernation (Rogers 1987a).

American black bears are vulnerable to overharvest (Kolenosky 1986). Because the mating system is polygyny, an adequate number of females is needed to provide a sustainable harvest (Schwartz and Franzmann 1992). Hunting reduces population size and lowers the mean age of males (Kolenosky 1986). Sex ratio of the harvest may be controlled by allowing hunting when pregnant females inhabit their winter dens (Lindzey 1981).

American black bears are sympatric with brown bears in many areas. However, competition is limited through differential habitat usages for denning and foraging and through subtle differences in diet. In Montana, *U. americanus* used forested habitat more frequently, hibernated at lower elevation and on more gentle slopes, and consumed more insects and fewer roots, mammals, and pine nuts than did brown bears (Aune 1994).

Yearlings disperse from family groups in June, and litter size does not affect timing of dispersal (Clevenger and Pelton 1990; Rogers 1987a; Schwartz and Franzmann 1992). Typically, all males disperse and $> 95\%$ of females remain in the areas occupied by the mother (Elowe and Dodge 1989; Schwartz and Franzmann 1992). Dispersal distances vary from 13 to 219 km (Rogers 1987a),

and vulnerability to hunting increases during dispersal (Elowe and Dodge 1989).

Individual *U. americanus* exhibit little spatial or temporal avoidance of each other, and home ranges and core areas of both sexes often overlap (Horner and Powell 1990; Pacas and Paquet 1994; Powell et al. 1997; Wooding and Hardisky 1994). Typically, home ranges are larger in years or areas of low food abundance and are smaller in years or areas of high food abundance (Garshelis et al. 1983; Pelchat and Ruff 1986; Powell et al. 1997). Average home ranges (in square kilometers; n in parentheses) of males and females, respectively, were as follows: 119 (30), 20 (17) in Alberta, Canada (Young and Ruff 1982); 116 (6), 12 (6) in Arkansas (Smith and Pelton 1990); 170 (12), 28 (8) in Florida (Wooding and Hardisky 1994); 112 (2), 49 (7) in Idaho (Amstrup and Beecham 1976); 465 (14), 295 (21) in Manitoba, Canada (Pacas and Paquet 1994); 196 (5), 37 (8) in Pennsylvania (Alt et al. 1976); 42 (12), 15 (15) in Tennessee and North Carolina (Garshelis and Pelton 1981); and 5 (5), 2 (6) in Washington (Lindzey and Meslow 1977b).

Density of *U. americanus* averaged 1 bear in 3.5–11.2 km² in Alaska (Miller et al. 1997; Schwartz and Franzmann 1991), 3.0–4.2 km² in Arizona (LeCount 1982; Waddell and Brown 1984), 11.1–13.3 km² in Arkansas (Clark and Smith 1994), 1.3 km² in California (Piekielek and Burton 1975), 2.9 km² in Mexico (Doan-Crider and Hellgren 1996), 4.1–6.3 km² in Minnesota (Rogers 1987a), 2.0–4.4 km² in Montana (Jonkel and Cowan 1971), 2.9–11.1 km² in Tennessee and North Carolina (McLean and Pelton 1994), and 0.8–1.9 km² in Washington (Lindzey and Meslow 1977a; Poelker and Hartwell 1973). Populations of American black bears probably are not regulated by density-dependent phenomena (Garshelis 1994). However, exclusion from good food sources and predation on subadults by adult males may in part regulate some populations (Bunnell and Tait 1981; Kemp 1976; LeCount 1982).

Numerous short- and long-term studies have been done on this species (Pelton and van Manen 1996), especially concerning the changes in attributes of populations (Garshelis and Visser 1997; Patten 1997; Yodzis and Kolenosky 1986), models of habitat suitability (Rudis and Tansey 1995; van Manen and Pelton 1997), and effects of hunting on population dynamics and structure (Litvaitis and Kane 1994; Young and Ruff 1982). American black bears may be captured live with culvert traps or foot snares (Johnson and Pelton 1980b). They may be immobilized with oral administration of carfentanil citrate (Ramsay et al. 1995) or intramuscular administration of etorphine HCl (Beeman et al. 1974; Wathen et al. 1985), succinylcholine chloride (Rogers et al. 1976), or mixtures of tiletamine–zolazepam (Gibeau and Paquet 1991; White et al. 1996), medetomidine–zolazepam–tiletamine (Caulkett and Cattet 1997), or ketamine–xylazine (Addison and Kolenosky 1979) either alone or with yohimbine as an antagonist (Garshelis et al. 1987).

The age of an individual *U. americanus* can be determined by sectioning first premolars (McLaughlin et al. 1990; Willey 1974) or canine teeth (Marks and Erickson 1966; Stoneberg and Jonkel 1966). Sex can be determined from the skull by using lower canine and lower molar measurements (Gordon and Morejohn 1975). DNA can be extracted from feces (Wasser et al. 1997), and relatedness may be established by genetic fingerprinting (Schenk and Kovacs 1996). Blood samples can be used to test for pregnancy (Foresman and Gagnon 1983) or to evaluate body condition (Franzmann and Schwartz 1988). Body condition also can be measured by electrical impedance analysis and isotopic water dilution (Farley and Robbins 1994). Stable isotopes can be used to estimate diet (Hilderbrand et al. 1996), and reproductive history can be estimated by use of dental cementum deposition (Coy and Garshelis 1992). Oocytes undergo nuclear maturation in vitro, thus black bears can be used as a model for gametic rescue techniques for endangered ursids (Johnston et al. 1994). They can be habituated to researchers for close-up behavioral or ecological work (Rogers and Wilker 1990). Other field methods have been reviewed elsewhere (LeCount 1986).

BEHAVIOR. *Ursus americanus* is mostly solitary, but aggregations may occur where food is superabundant, such as at garbage dumps or salmon streams (Rogers 1976). In natural habitats, they are diurnal, likely because of increased foraging efficiency for berries (Larivière et al. 1994). Mothers recognize their own offspring and avoid areas where their yearlings concentrate foraging activities (Rogers 1987a; Schwartz and Franzmann 1992).

Seasonally, daily activity increases following hibernation up to a peak in August–September, coinciding with the peak availability

of natural foods. Then, activity gradually declines until onset of hibernation in October–November (Larivière et al. 1994; Lindzey and Meslow 1976). Daily activity may be reduced by rain, snow, or extreme temperatures (Garshelis and Pelton 1980). American black bears become nocturnal and secretive in human-altered habitats such as orchards, campgrounds, garbage dumps, or urban areas (Ayres et al. 1986; McCutchen 1990; Waddell and Brown 1984).

Average daily movements (n in parentheses) of males and females, respectively, were 1.7 km (103) and 1.4 km (260) in Idaho (Amstrup and Beecham 1976). In Minnesota, 67% of males and 40% of females foraged >7 km from their regular range during autumn (Rogers 1987a). Daily movements change seasonally and yearly in response to changes in food supply. Adult males travel farther per day than do adult females, and juveniles travel more than do adults (Garshelis et al. 1983). American black bears seldom cross major highways, and crossing of smaller roads is inversely related to traffic volume (Beringer et al. 1990; Brody and Pelton 1989; Kasworm and Manley 1990).

Throughout most of its range, *U. americanus* becomes dormant during winter. Den entry and emergence occur from September to December and from March to May, respectively (Fuller and Keith 1980). Females with cubs typically enter dens earlier (Schooley et al. 1994b), stay in dens longer (Kasbohm et al. 1996; Oli et al. 1997), and emerge later than do single females (Hellgren and Vaughan 1989b; Kasbohm et al. 1996; Smith et al. 1994b). Similarly, adult females enter dens before adult males (Lindzey and Meslow 1976), and fat individuals enter winter dens earlier than do lean animals (Rogers 1987a). The stimulus to enter dens is related to food availability, weather, and snow accumulation (Schooley et al. 1994b; Schwartz et al. 1987) rather than temperature (Lindzey and Meslow 1976). Den entry occurs later in years of high mast abundance (Johnson and Pelton 1980a; Larivière et al. 1994; Schooley et al. 1994b). In southern latitudes, bears enter dens later (January–February) and emerge earlier (March–April) than in northern latitudes, resulting in a shorter hibernation period (Oli et al. 1997). However, not all American black bears in southern latitudes hibernate. In Mexico, pregnant females typically hibernate, whereas males remain active all winter; females with yearlings may or may not hibernate (Doan-Crider and Hellgren 1996). In the central Atlantic coastal plain, several individuals remained active throughout winter (Hamilton and Marchinton 1980; Hellgren and Vaughan 1989b). During winter sleep, American black bears curl up to minimize surface area, exposing the longest hair to ambient conditions (Moen and Rogers 1985).

Winter dens may be cavities in trees or rocks, brush piles, root excavations, underground burrows, or open-ground beds (Hayes and Pelton 1994; Kasbohm et al. 1996; Wooding and Hardisky 1992). Den chambers are lined with vegetation, and den entrances are completely or partially plugged (Fuller and Keith 1980). In southern areas, *U. americanus* uses more ground beds instead of underground burrows or cavities (Wooding and Hardisky 1992), and some individuals may change den locations up to 4 times during a single winter (Oli et al. 1997; Weaver and Pelton 1994). Security is a significant factor affecting choice of den sites, especially for females with cubs (Mack 1990). American black bears often abandon winter dens following disturbance (Goodrich and Berger 1994), and females may relocate their cubs. Winter dens may be reused from year to year by the same or different individuals (Alt and Gruttadauria 1984). In Louisiana, availability of den sites is not limiting for *U. americanus* (Weaver and Pelton 1994).

Ursus americanus uses sight and smell extensively for foraging. Initial orientation to food may be olfactory in the instance of an animal carcass or a small animal, but in close proximity to food, American black bears use vision (Bacon and Burghardt 1976a). Color vision enables animals feeding on berries to avoid leaves (Bacon and Burghardt 1976a, 1976b).

Ursus americanus is promiscuous. In captivity, males exhibit only limited courtship behavior prior to copulation. After initial mounting, the male uses its front paws to clasp the female around the waist and lifts himself up on his back legs. Bites to the neck of the female are frequent. Copulation lasts ca. 30 min and may occur several times during a single day or within a few days (Ludlow 1976). Individual females are visited periodically by males for 4–7 weeks during the breeding season, and multiple mating is practiced by both sexes (Schenk and Kovacs 1995). Most mating associations last only 0.25–2 h when the male is assessing the estrous

condition of the female. Actual breeding associations last 2–5 days, and >1 male may be present. Dominant males remain close to the female during this period (Barber and Lindzey 1986).

American black bears shuffle when walking but can move up to 56 km/h for short distances (Kolenosky and Strathearn 1987). They do not mark using scent glands, but instead mark trees by clawing and biting (Burst and Pelton 1983). Defensive behaviors include huffing, jaw popping, charging, slapping 1 or both front feet on the ground, stiff-leg walking, standing, and running away (Jordan 1976). Play behavior is common among bears up to 5 years of age around garbage dumps, but in natural areas this behavior is exhibited only by cubs (Rogers 1987a).

American black bears have no specific vocal calls, but animals may bellow or bawl when in pain and growl as a threat. A loud “woof” may be emitted as a threat or alarm call (Jackson 1961: 315).

American black bears have attacked humans, although infrequently (Herrero 1985; Herrero and Fleck 1990). Attacks can be classified into 3 categories: predatory attacks by single bears, cub defense by females with cubs, and defense of food (Herrero 1985; Herrero and Fleck 1990). *U. americanus* is much less dangerous than *U. arctos* or *U. maritimus* (Herrero and Fleck 1990). Coexistence of *U. americanus* and humans may lead to problems, especially when bears habituated to human foods lose their fear of humans (McCullough 1982). Relocation of *U. americanus* is rarely successful because they readily return to their initial home range, even without familiar landscape cues (Fies et al. 1987; McArthur 1981; Rogers 1986, 1987b). Aversive conditioning may be an answer where problems with American black bears are frequent (McCarthy and Seavoy 1994; McCullough 1982), but the best management strategy is to reduce availability of human foods and garbage (Gunther 1994).

GENETICS. *Ursus americanus* has $2n = 74$ chromosomes. Sixty-four autosomes are acrocentric or telocentric, and 8 autosomes are metacentric or submetacentric. The X chromosome is large and submetacentric, and the Y chromosome is small and acrocentric (Hsu and Benirschke 1967). Microsatellite analysis suggests that Newfoundland bears possess low levels of genetic variation (Paetkau and Strobeck 1994, 1996; Wathen et al. 1985). Hybridization between *U. americanus* and *U. arctos* has occurred in captivity (Gray 1971).

CONSERVATION STATUS. American black bears may be at risk because of international trade in gall bladders (Mills and Servheen 1994); however, only the subspecies *U. a. floridanus* and *U. a. luteolus* are threatened (Nowak 1991). *U. americanus* is listed in Appendix II of the Convention on the International Trade of Endangered Species. American black bears are “charismatic megafauna,” and hunting seasons and practices receive strong criticism from the public (Loker and Decker 1995). However, the biggest threat to *U. americanus* comes from habitat destruction and human alteration of spatiotemporal patterns of food production (Mattson 1990). Conflicts between humans and American black bears are likely to increase as urbanization encroaches on remaining natural areas used by *U. americanus* (Mattson 1990). To maintain viable populations in heavily hunted areas, sanctuaries must be large and roads must be limited to minimize human access (Powell et al. 1996).

REMARKS. *Ursus* is Latin for “bear” (Borrer 1960), and the specific name *americanus* refers to the type locality.

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LITERATURE CITED

- ADDISON, E. M., AND G. B. KOLENOSKY. 1979. Use of ketamine hydrochloride and xylazine hydrochloride to immobilize black bears (*Ursus americanus*). *Journal of Wildlife Diseases* 15: 253–258.
- AHLQUIST, D. A., R. A. NELSON, D. L. STEIGER, J. D. JONES, AND R. D. ELLEFSON. 1984. Glycerol metabolism in the hibernating black bear. *Journal of Comparative Physiology* 155B: 75–79.
- ALLEN, J. A. 1910. The black bear of Labrador. *Bulletin of the American Museum of Natural History* 28:1–6.
- ALT, G. L. 1983. Timing of parturition of black bears (*Ursus americanus*) in northeastern Pennsylvania. *Journal of Mammalogy* 64:305–307.
- ALT, G. L. 1984. Black bear cub mortality due to flooding of natal dens. *The Journal of Wildlife Management* 48:1432–1434.
- ALT, G. L., F. W. ALT, AND J. S. LINDZEY. 1976. Home range and activity patterns of black bears in northeastern Pennsylvania. *Transactions of the Northeast Section of the Wildlife Society* 33:45–56.
- ALT, G. L., AND J. M. GRUTTADAURIA. 1984. Reuse of black bear dens in northeastern Pennsylvania. *The Journal of Wildlife Management* 48:236–239.
- AMSTRUP, S. C., AND J. BEECHAM. 1976. Activity patterns of radio-collared black bears in Idaho. *The Journal of Wildlife Management* 40:340–348.
- ANDERSON, B. G., W. D. ANDERSON, AND R. J. SEGUIN. 1989a. Arterial supply and venous drainage of the brain of the black bear (*Ursus americanus*): II. Intracranial microvasculature. *Acta Anatomica* 135:285–288.
- ANDERSON, W. D., B. G. ANDERSON, AND R. J. SEGUIN. 1989b. Arterial supply and venous drainage of the brain of the black bear (*Ursus americanus*): I. Gross anatomical distribution. *Acta Anatomica* 135:281–284.
- AUDUBON, J. J., AND J. BACHMAN. 1854. The viviparous quadrupeds of North America. V. G. Audubon, New York 1:1–389.
- AUNE, K. E. 1994. Comparative ecology of black and grizzly bears on the Rocky Mountain Front, Montana. *International Conference on Bear Research and Management* 9:365–374.
- AUSTIN, M. A., M. E. OBBARD, AND G. B. KOLENOSKY. 1994. Evidence for a black bear, *Ursus americanus*, killing an adult moose, *Alces alces*. *The Canadian Field-Naturalist* 108:236–238.
- AYRES, L. A., L. S. CHOW, AND D. M. GRABER. 1986. Black bear activity patterns and human induced modifications in Sequoia National Park. *International Conference on Bear Research and Management* 6:151–154.
- AZIZI, F., J. E. MANNIX, D. HOWARD, AND R. A. NELSON. 1979. Effects of winter sleep on pituitary–thyroid axis in American black bear. *American Journal of Physiology* 237:E227–E230.
- BACON, E. S., AND G. M. BURGHARDT. 1976a. Ingestive behaviors of the American black bear. *International Conference on Bear Research and Management* 3:13–25.
- BACON, E. S., AND G. M. BURGHARDT. 1976b. Learning and color discrimination in the American black bear. *International Conference on Bear Research and Management* 3:27–36.
- BACON, E. S., AND G. M. BURGHARDT. 1983. Food preference testing of captive black bears. *International Conference on Bear Research and Management* 5:102–105.
- BAIRD, S. F. 1859. *Mammals of the boundary*. United States and Mexican Boundary Survey 2:1–62.
- BARBER, K. R., AND F. G. LINDZEY. 1986. Breeding behavior of black bears. *International Conference on Bear Research and Management* 6:129–136.
- BARBOZA, P. S., S. D. FARLEY, AND C. T. ROBBINS. 1997. Whole-body urea cycling and protein turnover during hyperphagia and dormancy in growing bears (*Ursus americanus* and *U. arctos*). *Canadian Journal of Zoology* 75:2129–2136.
- BEECHAN, L. E., M. R. PELTON, AND L. C. MARCUM. 1974. Use of M99 etorphine for immobilizing black bears. *The Journal of Wildlife Management* 38:568–569.
- BERINGER, J. J., S. G. SEIBERT, AND M. R. PELTON. 1990. Incidence of road crossing by black bears on Pisgah National Forest, North Carolina. *International Conference on Bear Research and Management* 8:85–92.
- BERINGER, J. J., S. G. SEIBERT, S. REAGAN, A. J. BRODY, M. R. PELTON, AND L. D. VANGILDER. 1998. The influence of a small sanctuary on survival rates of black bears in North Carolina. *The Journal of Wildlife Management* 62:727–734.
- BOILEAU, F., M. CRÉTE, AND J. HUOT. 1994. Food habits of the black bear, *Ursus americanus*, and habitat use in Gaspésie Park, eastern Québec. *The Canadian Field-Naturalist* 108: 162–169.
- BORROR, D. 1960. *Dictionary of word roots and combining forms*. National Press Books, Palo Alto, California.
- BOYER, R. H. 1949. Mountain coyotes kill yearling black bear in Sequoia National Park. *Journal of Mammalogy* 30:75.
- BRISCOE, N., J. G. HUMPHREYS, AND J. P. DUBEY. 1993. Preva-

- lence of *Toxoplasma gondii* infections in Pennsylvania black bears, *Ursus americanus*. *Journal of Wildlife Diseases* 29: 599–601.
- BRODY, A. J., AND M. R. PELTON. 1988. Seasonal changes in digestion in black bears. *Canadian Journal of Zoology* 66: 1482–1484.
- BRODY, A. J., AND M. R. PELTON. 1989. Effects of roads on black bear movements in western North Carolina. *Wildlife Society Bulletin* 17:5–10.
- BROOKS, R. T., AND R. MCROBERTS. 1997. Nipple dimensions and reproductive status of northeastern Minnesota female black bears (*Ursus americanus*). *The American Midland Naturalist* 137:178–182.
- BUNNELL, F. L., AND D. E. N. TAIT. 1981. Population dynamics of bears—implications. Pp. 75–98 in *Dynamics of large mammal populations* (C. W. Fowler and T. D. Smith, eds.). John Wiley & Sons, New York.
- BURST, T. L., AND M. R. PELTON. 1983. Black bear mark trees in the Smoky Mountains. *International Conference on Bear Research and Management* 5:45–53.
- BURTON, T., D. KOCH, D. UPDIKE, AND A. BRODY. 1994. Evaluation of the potential effects of sport hunting on California black bears. *International Conference on Bear Research and Management* 9:231–235.
- CAMERON, A. W. 1957. A new black bear from Newfoundland. *Journal of Mammalogy* 37:538–540.
- CAULKETT, N. A., AND M. R. L. CATTET. 1997. Physiological effects of medetomidine–zolazepam–tiletamine immobilization in black bears. *Journal of Wildlife Diseases* 33:618–622.
- CLARK, J. D., D. L. CLAPP, K. G. SMITH, AND B. EDERINGTON. 1994. Black bear habitat use in relation to food availability in the interior highlands of Arkansas. *International Conference on Bear Research and Management* 9:309–318.
- CLARK, J. D., AND K. G. SMITH. 1994. A demographic comparison of two black bear populations in the interior highlands of Arkansas. *Wildlife Society Bulletin* 22:593–603.
- CLEVENGER, A. P., AND M. R. PELTON. 1990. Pre and post break-up movements and space use of black bear family groups in Cherokee National Forest, Tennessee. *International Conference on Bear Research and Management* 8:289–295.
- CORBET, G. B., AND J. E. HILL. 1980. A world list of mammalian species. *British Museum of Natural History, Comstock Publishing, Cornell University Press, Ithaca, New York.*
- COSTELLO, C. M., AND R. W. SAGE. 1994. Predicting black bear habitat selection from food abundance under 3 forest management systems. *International Conference on Bear Research and Management* 9:375–387.
- COY, P. L., AND D. L. GARSHELIS. 1992. Reconstructing reproductive histories of black bears from the incremental layering in dental cementum. *Canadian Journal of Zoology* 70:2150–2160.
- DALL, W. H. 1895. The St. Elias bear. *Science* 2:87.
- DAVIS, W. L., D. B. P. GOODMAN, L. A. CRAWFORD, O. J. COOPER, AND J. L. MATTHEWS. 1990. Hibernation activates glyoxylate cycle and gluconeogenesis in black bear brown adipose tissue. *Biochimica et Biophysica Acta* 1051:276–278.
- DELGIUDICE, G. D., L. L. ROGERS, A. W. ALLEN, AND U. S. SEAL. 1991. Weights and hematology of wild black bears during hibernation. *Journal of Wildlife Diseases* 27:637–642.
- DOAN-CRIDER, D. L., AND E. C. HELLGREN. 1996. Population characteristics and winter ecology of black bears in Coahuila, Mexico. *The Journal of Wildlife Management* 60:398–407.
- EAGLE, T. C., AND M. R. PELTON. 1983. Seasonal nutrition of black bears in the Great Smoky Mountains National Park. *International Conference on Bear Research and Management* 5: 94–101.
- EILER, J. H., W. G. WATHEN, AND M. R. PELTON. 1989. Reproduction in black bears in the southern Appalachian Mountains. *The Journal of Wildlife Management* 53:353–360.
- ELLIOT, D. G. 1903. Descriptions of apparently new species of mammals of the genera *Heteromys* and *Ursus* from Mexico and Washington. *Field Columbian Museum Publications, Zoology Series* 3, 80:233–237.
- ELOWE, K. D., AND W. E. DODGE. 1989. Factors affecting black bear reproductive success and cub survival. *The Journal of Wildlife Management* 53:962–968.
- FAIR, J. S. 1978. Unusual dispersal of black bear cubs in Utah. *The Journal of Wildlife Management* 42:642–644.
- FARLEY, S. D., AND C. T. ROBBINS. 1994. Development of two methods to estimate body composition of bears. *Canadian Journal of Zoology* 72:220–226.
- FARLEY, S. D., AND C. T. ROBBINS. 1995. Lactation, hibernation, and mass dynamics of American black bears and grizzly bears. *Canadian Journal of Zoology* 73:2216–2222.
- FARLEY, S. D., AND C. T. ROBBINS. 1997. Validation of ²²sodium to estimate food intake of bears. *The Journal of Wildlife Management* 61:52–56.
- FIES, M. L., D. D. MARTIN, AND G. T. BLANK, JR. 1987. Movements and rates of return of translocated black bears in Virginia. *International Conference on Bear Research and Management* 7:369–372.
- FISHER, G. 1814. *Zoognosia tabulis synopticis illustrata. Quadrupedum reliquorum, cetorum et monotrymatum descriptionem continens. Typis Nicolai Sergeidis Vsevolozky, Moscow, Russia*, 3:1–605.
- FLOYD, T., AND R. A. NELSON. 1990. Bone metabolism in black bears. *International Conference on Bear Research and Management* 8:135–137.
- FOLK, G. E., A. LARSON, AND M. A. FOLK. 1976. Physiology of hibernating bears. *International Conference on Bear Research and Management* 3:373–380.
- FORESMAN, K. R., AND J. C. DANIEL, JR. 1983. Plasma progesterone concentrations in pregnant and non-pregnant black bears (*Ursus americanus*). *Journal of Reproduction and Fertility* 68:235–239.
- FORESMAN, K. R., AND P. M. GAGNON. 1983. Plasma protein profile as an index of pregnancy in the black bear. *International Conference on Bear Research and Management* 6:221–224.
- FRANZMANN, A. W., AND C. C. SCHWARTZ. 1988. Evaluating condition of Alaskan black bears with blood profiles. *The Journal of Wildlife Management* 52:63–70.
- FRANZMANN, A. W., C. C. SCHWARTZ, AND R. O. PETERSON. 1980. Moose calf mortality in summer on the Kenai Peninsula, Alaska. *The Journal of Wildlife Management* 44:764–768.
- FULLER, T. K., AND L. B. KEITH. 1980. Summer ranges, cover-type use, and denning of black bears near Fort McMurray, Alberta. *The Canadian Field-Naturalist* 94:80–83.
- GARSHELIS, D. L. 1994. Density-dependent population regulation of black bears. Pp. 3–14 in *Density-dependent population regulation in black, brown, and polar bears* (M. Taylor, ed.). *International Conference on Bear Research and Management Monograph Series* 3:1–43.
- GARSHELIS, D. L., AND E. C. HELLGREN. 1994. Variation in reproductive biology of male black bears. *Journal of Mammalogy* 75:175–188.
- GARSHELIS, D. L., K. V. NOYCE, AND P. D. KARNS. 1987. Yohimbine as an antagonist to ketamine–xylazine immobilization in black bears. *International Conference on Bear Research and Management* 7:323–327.
- GARSHELIS, D. L., AND M. R. PELTON. 1980. Activity of black bears in the Great Smoky Mountains National Park. *Journal of Mammalogy* 61:8–19.
- GARSHELIS, D. L., AND M. R. PELTON. 1981. Movements of black bears in the Great Smoky Mountains National Park. *The Journal of Wildlife Management* 45:912–925.
- GARSHELIS, D. L., H. B. QUIGLEY, C. R. VILLARUBIA, AND M. R. PELTON. 1983. Diel movements of black bears in the southern Appalachians. *International Conference on Bear Research and Management* 5:11–19.
- GARSHELIS, D. L., AND L. G. VISSER. 1997. Enumerating megapopulations of wild bears with an ingested biomarker. *The Journal of Wildlife Management* 61:466–480.
- GIBEAU, M. L., AND P. C. PAQUET. 1991. Evaluation of Telazol® for immobilization of black bears. *Wildlife Society Bulletin* 19: 400–402.
- GOLDFUSS, G. A. 1809. *Vergleichende Naturbeschreibung der Säugethiere. Erlandgen, Walterschen Kunst- und Buchhandlung* (not seen, cited in Hall 1981).
- GOLDMAN, D., P. R. GIRI, AND S. J. O'BRIEN. 1989. Molecular genetic-distance estimates among the Ursidae as indicated by one- and two-dimensional protein electrophoresis. *Evolution* 43:282–295.
- GOODRICH, J. M., AND J. BERGER. 1994. Winter recreation and

- hibernating black bears *Ursus americanus*. *Biological Conservation* 67:105–110.
- GORDON, K. R., AND G. V. MOREJOHN. 1975. Sexing black bear skulls using lower canine and lower molar measurements. *The Journal of Wildlife Management* 39:40–44.
- GRABER, D. M. 1990. Winter behavior of black bears in the Sierra Nevada, California. *International Conference on Bear Research and Management* 8:269–272.
- GRAHAM, R. W. 1991. Variability in the size of North American Quaternary black bears (*Ursus americanus*) with the description of a fossil black bear from Bill Neff Cave, Virginia. Pp. 237–250 in Beamers, bobwhites, and blue-points: tributes to the career of Paul W. Parmalee (J. R. Purdue, W. E. Klippel, and B. W. Styles, eds.). *Illinois State Museum Scientific Papers* 23:1–436.
- GRAY, A. P. 1971. *Mammalian hybrids: a check-list with bibliography*. Second ed. Commonwealth Agriculture Bureaux, Farnham Royal, Slough, United Kingdom.
- GRAY, J. E. 1825a. On the genus *Ursus*, Cuvier, with its division into subgenera. *Thomson Annals of Philosophy* 10:59–62.
- GRAY, J. E. 1825b. An outline of an attempt at the disposition of Mammalia into tribes and families, with a list of the genera apparently appertaining to each tribe. *Thomson Annals of Philosophy* 10:337–344.
- GRAY, J. E. 1864. A revision of the genera and species of ursine animals (Ursidae), founded on the collection of the British Museum. *Proceedings of the Zoological Society of London* 1864:677–709.
- GRIFFITH, E. 1821. General and particular descriptions of the vertebrated animals, arranged conformably to the modern discoveries and improvements in zoology. . . . Order Carnivora. Baldwin, Cradock and Joy, Paternoster Row, London, United Kingdom (not seen, cited in Hall 1981).
- GUNTHER, K. A. 1994. Bear management in Yellowstone National Park, 1960–93. *International Conference on Bear Research and Management* 9:549–560.
- HALL, E. R. 1928. A new race of black bear from Vancouver Island, British Columbia, with remarks on other northwest coast forms of *Euarctos*. *University of California Publications of Zoology* 30:231–242.
- HALL, E. R. 1981. *The mammals of North America*. Second ed. John Wiley & Sons, New York 2:601–1181 + 90.
- HAMILTON, R. J., AND R. L. MARCHINTON. 1980. Denning and related activities of black bears in the coastal plain of North Carolina. *International Conference on Bear Research and Management* 4:121–126.
- HAYES, S. G., AND M. R. PELTON. 1994. Habitat characteristics of female black bear dens in northwestern Arkansas. *International Conference on Bear Research and Management* 9:411–418.
- HELLGREN, E. C., D. S. MAEHR, AND D. L. DOAN-CRIDER. 1997. Serum chemistry of southern populations of black bears (*Ursus americanus*). *The American Midland Naturalist* 137:95–105.
- HELLGREN, E. C., AND M. R. VAUGHAN. 1989a. Demographic analysis of a black bear population in the Great Dismal Swamp. *The Journal of Wildlife Management* 53:969–977.
- HELLGREN, E. C., AND M. R. VAUGHAN. 1989b. Denning ecology of black bears in a southeastern wetland. *The Journal of Wildlife Management* 53:347–353.
- HELLGREN, E. C., AND M. R. VAUGHAN. 1994. External morphometrics of black bears, *Ursus americanus* (Carnivora: Ursidae), in the Great Dismal Swamp of Virginia and North Carolina. *Brimleyana* 21:141–149.
- HELLGREN, E. C., M. R. VAUGHAN, F. C. GWAZDAUSKAS, B. WILLIAMS, P. F. SCANLON, AND R. L. KIRKPATRICK. 1990a. Endocrine and electrophoretic profiles during pregnancy and nonpregnancy in captive female black bears. *Canadian Journal of Zoology* 69:892–898.
- HELLGREN, E. C., M. R. VAUGHAN, AND R. L. KIRKPATRICK. 1989. Seasonal patterns in physiology and nutrition of black bears in Great Dismal Swamp, Virginia—North Carolina. *Canadian Journal of Zoology* 67:1837–1850.
- HELLGREN, E. C., M. R. VAUGHAN, R. L. KIRKPATRICK, AND P. F. SCANLON. 1990b. Serial changes in metabolic correlates of hibernation in female black bears. *Journal of Mammalogy* 71:291–300.
- HELLGREN, E. C., M. R. VAUGHAN, AND D. F. STAUFFER. 1991. Macrohabitat use by black bears in a southeastern wetland. *The Journal of Wildlife Management* 55:442–448.
- HERRERO, S. 1985. *Bear attacks: their causes and avoidance*. Winchester Press, Piscataway, New Jersey.
- HERRERO, S., AND S. FLECK. 1990. Injury to people inflicted by black, grizzly or polar bears: recent trends and new insights. *International Conference on Bear Research and Management* 8:25–32.
- HEUDE, M. 1898. Note sur l'ours et ses parents. *Mémoires Concernant l'Histoire Naturelle de l'Empire Chinois* 4:14–24.
- HEUDE, M. 1901. Notes sur quelques Ursidae peu ou point connus. *Mémoires Concernant l'Histoire Naturelle de l'Empire Chinois* 5:1–2.
- HILDERBRAND, G. V., S. D. FARLEY, C. T. ROBBINS, T. A. HANLEY, K. TITUS, AND C. SERVHEEN. 1996. Use of stable isotopes to determine diets of living and extinct bears. *Canadian Journal of Zoology* 74:2080–2088.
- HOCK, R. J. 1966. Analysis of the blood of American black bears. *Comparative Biochemistry and Physiology* 19:285–289.
- HORNADAY, W. T. 1905. A new white bear, from British Columbia. *Annual Report of the New York Zoological Society* 9:81–86.
- HORNER, M. A., AND R. A. POWELL. 1990. Internal structure of home ranges of black bears and analyses of home-range overlap. *Journal of Mammalogy* 71:402–410.
- HORSFIELD, T. 1826. Description of the *Helarctos euryspilus* exhibiting in the bear from the island of Borneo the type of a sub-genus of *Ursus*. *Zoological Journal* 2:221–234.
- HORSTMAN, L. P., AND J. R. GUNSON. 1982. Black bear predation on livestock in Alberta. *Wildlife Society Bulletin* 10:34–39.
- HSU, T. C., AND K. BENIRSCHKE. 1967. *Ursus americanus* (American black bear) 2n = 74. An atlas of mammalian chromosomes. Vol. 1, Folio 23. Springer-Verlag, New York.
- ILLIGER, J. K. W. 1811. *Prodromus systematis mammalium et avium additis terminis zoographicis utriusque classis, eorumque versione germanica*. C. Salfeld, Berlin, Germany.
- IRWIN, L. L., AND F. M. HAMMOND. 1985. Managing black bear habitats for food items in Wyoming. *Wildlife Society Bulletin* 13:477–483.
- JACKSON, H. H. T. 1961. *Mammals of Wisconsin*. The University of Wisconsin Press, Madison.
- JOHNSON, K. G., AND M. R. PELTON. 1980a. Environmental relationships and the denning period of black bears in Tennessee. *Journal of Mammalogy* 61:653–660.
- JOHNSON, K. G., AND M. R. PELTON. 1980b. Prebaiting and snaring techniques for black bears. *Wildlife Society Bulletin* 8:46–54.
- JOHNSTON, L. A., A. M. DONOGHUE, W. IGO, L. G. SIMMONS, D. E. WILDT, AND J. RIEFFENBERGER. 1994. Oocyte recovery and maturation in the American black bear (*Ursus americanus*): a model for endangered ursids. *The Journal of Experimental Zoology* 269:53–61.
- JONKEL, C. J., AND I. M. COWAN. 1971. The black bear in the spruce-fir forest. *Wildlife Monographs* 27:1–57.
- JORDAN, R. H. 1976. Threat behavior of the black bear (*Ursus americanus*). *International Conference on Bear Research and Management* 3:57–63.
- KASBOHM, J. W., M. R. VAUGHAN, AND J. G. KRAUS. 1995. Food habits and nutrition of black bears during a gypsy moth infestation. *Canadian Journal of Zoology* 73:1771–1775.
- KASBOHM, J. W., M. R. VAUGHAN, AND J. G. KRAUS. 1996. Effects of gypsy moth infestation on black bear reproduction and survival. *The Journal of Wildlife Management* 60:408–416.
- KASWORM, W. F., AND T. L. MANLEY. 1990. Road and trail influences on grizzly bears and black bears in northwest Montana. *International Conference on Bear Research and Management* 8:79–84.
- KASWORM, W. F., AND T. J. THIER. 1994. Adult black bear reproduction, survival, and mortality sources in northwest Montana. *International Conference on Bear Research and Management* 9:223–230.
- KEAY, J. A. 1995a. Accuracy of cementum age assignments for black bears. *California Fish and Game* 81:113–121.
- KEAY, J. A. 1995b. Black bear reproductive rates in Yosemite National Park. *California Fish and Game* 81:122–131.
- KEMP, G. A. 1976. The dynamics and regulation of black bear *Ursus americanus* populations in northern Alberta. *Internation-*

- tional Conference on Bear Research and Management 3:191–197.
- KIMBALL, B. A., D. L. NOLTE, R. M. ENGEMAN, J. J. JOHNSTON, AND F. R. STERMITZ. 1998. Chemically mediated foraging preferences of black bears (*Ursus americanus*). *Journal of Mammalogy* 79:448–456.
- KOBELT, W. 1896. Katalog der aus dem paläarktischen Faunen-gebiet beschriebenen Säugetiere (einschliesslich der Grenzformen). Bericht Senckenberg Naturf Gesell, Berlin 1896:73–103.
- KOLENOSKY, G. B. 1986. The effects of hunting on an Ontario black bear population. *International Conference on Bear Research and Management* 6:45–55.
- KOLENOSKY, G. B. 1990. Reproductive biology of black bears in east-central Ontario. *International Conference on Bear Research and Management* 8:385–392.
- KOLENOSKY, G. B., AND S. M. STRATHEARN. 1987. Black bear. Pp. 443–454 in *Wild furbearer management and conservation in North America* (M. Nowak, J. A. Baker, M. E. Obbard, and B. Malloch, eds.). Ontario Ministry of Natural Resources, Toronto, Canada.
- KUNKEL, K. E., AND L. D. MECH. 1994. Wolf and bear predation on white-tailed deer fawns in northeastern Minnesota. *Canadian Journal of Zoology* 72:1557–1565.
- KURTÉN, B., AND E. ANDERSON. 1980. Pleistocene mammals of North America. Columbia University Press, New York.
- LANDERS, J. L., R. J. HAMILTON, A. S. JOHNSON, AND R. L. MARCHINTON. 1979. Foods and habitat of black bears in southeastern North Carolina. *The Journal of Wildlife Management* 43:143–153.
- LARIVIÈRE, S., J. HUOT, AND C. SAMSON. 1994. Daily activity patterns of female black bears in a northern mixed-forest environment. *Journal of Mammalogy* 75:613–620.
- LECOUNT, A. L. 1982. Characteristics of a central Arizona black bear population. *The Journal of Wildlife Management* 46:861–868.
- LECOUNT, A. L. 1983. Evidence of wild black bears breeding while raising cubs. *The Journal of Wildlife Management* 47:264–268.
- LECOUNT, A. L. 1986. The black bear field guide: a manager's manual. Arizona Game and Fish Department, Phoenix.
- LECOUNT, A. L. 1987. Causes of black bear cub mortality. *International Conference on Bear Research and Management* 7:75–82.
- LINDZEY, F. G. 1981. Denning dates and hunting seasons for black bears. *Wildlife Society Bulletin* 9:212–216.
- LINDZEY, F. G., AND E. C. MESLOW. 1976. Winter dormancy in black bears in southwestern Washington. *The Journal of Wildlife Management* 40:408–415.
- LINDZEY, F. G., AND E. C. MESLOW. 1977a. Population characteristics of black bears on an island in Washington. *The Journal of Wildlife Management* 41:408–412.
- LINDZEY, F. G., AND E. C. MESLOW. 1977b. Home range and habitat use by black bears in southwestern Washington. *The Journal of Wildlife Management* 41:413–425.
- LINNAEUS, C. 1758. *Systema naturae*. Tenth ed. Laurentii Salvii, Stockholm, Sweden 1:1–824.
- LITVAITIS, J. A., AND D. M. KANE. 1994. Relationship of hunting technique and hunter selectivity to composition of black bear harvest. *Wildlife Society Bulletin* 22:604–606.
- LOKER, C. A., AND D. J. DECKER. 1995. Colorado black bear hunting referendum: what was behind the vote? *Wildlife Society Bulletin* 23:370–376.
- LÖNNBERG, E. 1923. Remarks on some Palearctic bears. *Proceedings of the Zoological Society of London* 1923:85–95.
- LUDLOW, J. C. 1976. Observations on the breeding of captive black bears, *Ursus americanus*. *International Conference on Bear Research and Management* 3:65–69.
- MACK, J. A. 1990. Black bear dens in the Beartooth Face, south-central Montana. *International Conference on Bear Research and Management* 8:273–277.
- MAEHR, D. S., AND J. R. BRADY. 1984. Food habits of Florida black bears. *The Journal of Wildlife Management* 48:230–235.
- MANVILLE, R. M. 1990. Variability of dental diseases in two populations of Great Lakes black bears. *International Conference on Bear Research and Management* 8:129–134.
- MARKS, S. A., AND A. W. ERICKSON. 1966. Age determination in the black bear. *The Journal of Wildlife Management* 30:389–410.
- MATTSON, D. J. 1990. Human impacts on bear habitat use. *International Conference on Bear Research and Management* 8:33–56.
- MAXWELL, R. K., J. THORKELOSON, L. L. ROGERS, AND R. B. BRANDER. 1988. The field energetics of winter-dormant black bear (*Ursus americanus*) in northeastern Minnesota. *Canadian Journal of Zoology* 66:2095–2103.
- MCCARTHUR, K. L. 1981. Factors contributing to effectiveness of black bear transplants. *The Journal of Wildlife Management* 45:102–110.
- MCCARTHY, T. M., AND R. J. SEAVOY. 1994. Reducing nonsport losses attributable to food conditioning: human and bear behavior modification in an urban environment. *International Conference on Bear Research and Management* 9:75–84.
- MCCULLOUGH, D. R. 1982. Behavior, bears, and humans. *Wildlife Society Bulletin* 10:27–33.
- MCCUTCHEEN, H. E. 1990. Cryptic behavior of black bears (*Ursus americanus*) in Rocky Mountain National Park, Colorado. *International Conference on Bear Research and Management* 8:65–72.
- MCLAUGHLIN, C. R., G. J. MATULA, JR., R. A. CROSS, W. H. HALTEMAN, M. A. CARON, AND K. I. MORRIS. 1990. Precision and accuracy of estimating age of Maine black bears by cementum annuli. *International Conference on Bear Research and Management* 8:415–419.
- MCLAUGHLIN, C. R., G. J. MATULA, JR., AND R. J. O'CONNOR. 1994. Synchronous reproduction by Maine black bears. *International Conference on Bear Research and Management* 9:471–479.
- MCLEAN, P. K., AND M. R. PELTON. 1990. Some demographic comparisons of wild and panhandler bears in the Smoky Mountains. *International Conference on Bear Research and Management* 8:105–112.
- MCLEAN, P. K., AND M. R. PELTON. 1994. Estimates of population density and growth of black bears in the Smoky Mountains. *International Conference on Bear Research and Management* 9:253–261.
- McMILLIN, J. M., U. S. SEAL, L. ROGERS, AND A. W. ERICKSON. 1976. Annual testosterone rhythm in the black bear (*Ursus americanus*). *Biology of Reproduction* 15:163–167.
- MERRIAM, C. H. 1896. Preliminary synopsis of the American bears. *Proceedings of the Biological Society of Washington* 10:65–83.
- MERRIAM, C. H. 1904. Four new bears from North America. *Proceedings of the Biological Society of Washington* 17:153–156.
- MERRIAM, C. H. 1918. Review of the grizzly and big brown bears of North America (genus *Ursus*) with description of a new genus, *Vetularctos*. *North American Fauna* 41:1–136.
- MEYER, F. A. (ED.). 1793. *Zoologische Annalen*. Herausgegeben von Friedrich Albrecht Anton Meyer 1:1–412 (not seen, cited in Hall 1981).
- MILLER, J. 1900. *True bear stories*. Rand McNally and Company, Chicago, Illinois.
- MILLER, S. D. 1994. Black bear reproduction and cub survivorship in south-central Alaska. *International Conference on Bear Research and Management* 9:263–273.
- MILLER, S. D., ET AL. 1997. Brown and black bear density estimation in Alaska using radiotelemetry and replicated mark-resight techniques. *Wildlife Monographs* 133:1–55.
- MILLS, J., AND C. SERVHEEN. 1994. The Asian trade in bears and bear parts: impacts and conservation recommendations. *International Conference on Bear Research and Management* 9:161–167.
- MOEN, A. N., AND L. L. ROGERS. 1985. Radiant surface temperature and hair depths of a black bear, *Ursus americanus*. *The Canadian Field-Naturalist* 99:47–50.
- NAGORSEN, D. W., G. KEDDIE, AND R. J. HEBDA. 1995. Early Holocene black bears, *Ursus americanus*, from Vancouver Island. *The Canadian Field-Naturalist* 109:11–18.
- NELSON, R. A. 1978. Urea metabolism in the hibernating black bear. *Kidney International* 13:s177–s179.
- NELSON, R. A. 1980. Protein and fat metabolism in hibernating bears. *Federation Proceedings* 39:2955–2958.
- NELSON, R. A., AND J. D. JONES. 1987. Leucine metabolism in

- the black bear. *International Conference on Bear Research and Management* 7:329–331.
- NELSON, R. A., D. L. STEIGER, AND T. D. I. BECK. 1983. Neuroendocrine and metabolic interactions in the hibernating black bear. *Acta Zoologica Fennica* 174:137–141.
- NOWAK, R. M. 1991. *Walker's mammals of the world*. Fifth ed. The John Hopkins University Press, Baltimore, Maryland.
- NOYCE, K. V., AND D. L. GARSHELIS. 1994. Body size and blood characteristics as indicators of condition and reproductive performance in black bears. *International Conference on Bear Research and Management* 9:481–496.
- NOYCE, K. V., AND D. L. GARSHELIS. 1997. Influence of natural food abundance on black bear harvests in Minnesota. *The Journal of Wildlife Management* 61:1067–1074.
- NOYCE, K. V., P. B. KANNOVSKI, AND M. R. RIGGS. 1997. Black bears as ant-eaters: seasonal associations between bear myrmecophagy and ant ecology in north-central Minnesota. *Canadian Journal of Zoology* 75:1671–1686.
- OFTEDAL, O. T., G. L. ALT, E. M. WIDDOWSON, AND M. R. JAKUBASZ. 1993. Nutrition and growth of suckling black bears (*Ursus americanus*) during their mother's winter fast. *British Journal of Nutrition* 70:59–79.
- OLI, M. K., H. A. JACOBSON, AND B. D. LEOPOLD. 1997. Denning ecology of black bears in the White River National Wildlife refuge, Arkansas. *The Journal of Wildlife Management* 61:700–706.
- OSGOOD, W. H. 1901. Natural history of the Queen Charlotte Islands, British Columbia and natural history of the Cook Inlet region, Alaska. *North American Fauna* 21:1–87.
- OZOGA, J. J., AND L. J. VERME. 1982. Predation by black bears on newborn white-tailed deer. *Journal of Mammalogy* 63:695–696.
- PACAS, C. J., AND P. C. PAQUET. 1994. Analysis of black bear home range using a geographic information system. *International Conference on Bear Research and Management* 9:419–425.
- PAETKAU, D., AND C. STROBECK. 1994. Microsatellite analysis of genetic variation in black bear populations. *Molecular Ecology* 3:489–495.
- PAETKAU, D., AND C. STROBECK. 1996. Mitochondrial DNA and the phylogeography of Newfoundland black bears. *Canadian Journal of Zoology* 74:192–196.
- PALLAS, P. S. 1780. *Spicilegium Zoologica, quibus novae imprimis et obscurae animalium species iconibus*. Berolini, G. A. Lange, 1774–1780. Fascicle 14, p. 5 (not seen, cited in *Catalogue of the Library of the Museum of Comparative Zoology* 6:506).
- PATTEN, B. C. 1997. Synthesis of chaos and sustainability in a nonstationary linear dynamic model of the American black bear (*Ursus americanus* Pallas) in the Adirondack Mountains of New York. *Ecological Modelling* 100:11–42.
- PELCHAT, B. O., AND R. L. RUFF. 1986. Habitat and spatial relationships of black bears in boreal mixedwood forest of Alberta. *International Conference on Bear Research and Management* 6:81–92.
- PELTON, M. R., AND F. T. VAN MANEN. 1996. Benefits and pitfalls of long-term research: a case study of black bears in the Great Smoky Mountains National Park. *Wildlife Society Bulletin* 24:443–450.
- PIEKIELEK, W., AND T. S. BURTON. 1975. A black bear population study in northern California. *California Fish and Game* 61:4–25.
- POCOCK, R. I. 1917. A new genus of Ursidae. *Annals and Magazine of Natural History, Series 8*, 20:128–130.
- POELKER, R. J., AND H. D. HARTWELL. 1973. Black bear in Washington. Washington State Game Department, Biological Bulletin 14:1–180.
- POWELL, R. A., J. W. ZIMMERMAN, AND D. E. SEAMAN. 1997. Ecology and behaviour of North American black bears: home ranges, habitat and social organization. Chapman and Hall, New York.
- POWELL, R. A., J. W. ZIMMERMAN, D. E. SEAMAN, AND J. F. GILLIAM. 1996. Demographic analyses of a hunted black bear population with access to a refuge. *Conservation Biology* 10:224–234.
- PRITCHARD, G. T., AND C. T. ROBBINS. 1990. Digestive and metabolic efficiencies of grizzly and black bears. *Canadian Journal of Zoology* 68:1645–1651.
- RAINE, R. M., AND J. L. KANSAS. 1990. Black bear seasonal food habits and distribution by elevation in Banff National Park, Alberta. *International Conference on Bear Research and Management* 8:297–304.
- RAMSAY, E. C., J. M. SLEEMAN, AND V. L. CLYDE. 1995. Immobilization of black bears (*Ursus americanus*) with orally administered carfentanil citrate. *Journal of Wildlife Diseases* 31:391–393.
- RAUSCH, R. L. 1961. Notes on the black bear, *Ursus americanus*, in Alaska, with particular reference to dentition and growth. *Zeitschrift für Säugetierkunde* 26:77–107.
- ROGERS, L. L. 1976. Effects of mast and berry crop failures on survival, growth, and reproductive success of black bears. *Transactions of the North American Wildlife and Natural Resources Conference* 41:431–438.
- ROGERS, L. L. 1980. Inheritance of coat color and changes in pelage coloration in black bears in northeastern Minnesota. *Journal of Mammalogy* 61:324–327.
- ROGERS, L. L. 1986. Homing by radio-collared black bears, *Ursus americanus*, in Minnesota. *The Canadian Field-Naturalist* 100:350–353.
- ROGERS, L. L. 1987a. Effects of food supply and kinship on social behavior, movements, and population growth of black bears in northeastern Minnesota. *Wildlife Monographs* 97:1–72.
- ROGERS, L. L. 1987b. Navigation by adult black bears. *Journal of Mammalogy* 68:185–188.
- ROGERS, L. L., AND L. D. MECH. 1981. Interactions of wolves and black bears in northeastern Minnesota. *Journal of Mammalogy* 62:434–436.
- ROGERS, L. L., AND S. M. ROGERS. 1976. Parasites of bears: a review. *International Conference on Bear Research and Management* 3:411–430.
- ROGERS, L. L., C. M. STOWE, AND A. W. ERICKSON. 1976. Succinylcholine chloride immobilization of black bears. *International Conference on Bear Research and Management* 3:431–446.
- ROGERS, L. L., AND G. A. WILKER. 1990. How to obtain behavioral and ecological data from free-ranging, researcher-habituated black bears. *International Conference on Bear Research and Management* 8:321–327.
- ROUNDS, R. C. 1987. Distribution and analysis of colourmorphs of the black bear (*Ursus americanus*). *Journal of Biogeography* 14:521–538.
- RUDIS, V. A., AND J. B. TANSEY. 1995. Regional assessment of remote forests and black bear habitat from forest resource surveys. *The Journal of Wildlife Management* 59:170–180.
- SAMSON, C., AND J. HUOT. 1995. Reproductive biology of female black bears in relation to body mass in early winter. *Journal of Mammalogy* 76:68–77.
- SAMSON, C., AND J. HUOT. 1998. Movements of female black bears in relation to landscape vegetation type in southern Quebec. *The Journal of Wildlife Management* 62:718–727.
- SAVAGE, D. E., AND D. E. RUSSELL. 1983. *Mammalian paleofaunas of the world*. Addison-Wesley Publishing Company, Reading, Massachusetts.
- SCHENK, A., AND K. M. KOVACS. 1995. Multiple mating between black bears revealed by DNA fingerprinting. *Animal Behaviour* 50:1483–1490.
- SCHENK, A., AND K. M. KOVACS. 1996. Genetic variation in a population of black bears as revealed by DNA fingerprinting. *Journal of Mammalogy* 77:942–950.
- SCHOOLEY, R. L., C. R. MACLAUGHLIN, G., W. B. KROHN, AND G. J. MATULA, JR. 1994a. Spatiotemporal patterns of macrohabitat use by female black bears during fall. *International Conference on Bear Research and Management* 9:339–348.
- SCHOOLEY, R. L., C. R. MACLAUGHLIN, G. J. MATULA, JR., AND W. B. KROHN. 1994b. Denning chronology of female black bears: effects of food, weather, and reproduction. *Journal of Mammalogy* 75:466–477.
- SCHWARTZ, C. C., AND A. W. FRANZMANN. 1991. Interrelationship of black bears to moose and forest succession in the northern coniferous forest. *Wildlife Monographs* 113:1–58.
- SCHWARTZ, C. C., AND A. W. FRANZMANN. 1992. Dispersal and survival of subadult black bears from the Kenai Peninsula, Alaska. *The Journal of Wildlife Management* 56:426–431.
- SCHWARTZ, C. C., S. D. MILLER, AND A. W. FRANZMANN. 1987. Denning ecology of three black bear populations in Alaska.

- International Conference on Bear Research and Management 7:281–291.
- SMITH, D. W., D. R. TRAUBA, R. K. ANDERSON, AND R. O. PETERSON. 1994a. Black bear predation on beavers on an island in Lake Superior. *The American Midland Naturalist* 132:248–255.
- SMITH, M. E., AND E. H. FOLLMANN. 1993. Grizzly bear, *Ursus arctos*, predation of a denned adult black bear, *U. americanus*. *The Canadian Field-Naturalist* 107:97–99.
- SMITH, M. E., J. L. HECHTEL, AND E. H. FOLLMANN. 1994b. Black bear denning ecology in interior Alaska. *International Conference on Bear Research and Management* 9:513–522.
- SMITH, T. R., AND M. R. PELTON. 1990. Home ranges and movements of black bears in a bottomland hardwood forest in Arkansas. *International Conference on Bear Research and Management* 8:213–218.
- STONEBERG, R. P., AND C. J. JONKEL. 1966. Age determination of black bears by cementum layers. *The Journal of Wildlife Management* 30:411–414.
- STORM, G. L., G. L. ALT, G. J. MATULA, JR., AND R. A. NELSON. 1988. Blood chemistry of black bears from Pennsylvania during winter dormancy. *Journal of Wildlife Diseases* 24:515–521.
- STRINGHAM, S. F. 1990. Black bear reproductive rate relative to body weight in hunted populations. *International Conference on Bear Research and Management* 8:425–432.
- STUBBLEFIELD, C. H. 1993. Food habits of black bears in the San Gabriel Mountains of southern California. *The Southwestern Naturalist* 38:290–293.
- SWARTH, H. S. 1911. Birds and mammals of the 1909 Alexander Alaska Expedition. University of California Publications of Zoology 7:9–172.
- TALBOT, S. L., AND G. F. SHIELDS. 1996. A phylogeny of the bears (Ursidae) inferred from complete sequences of three mitochondrial genes. *Molecular Phylogenetics and Evolution* 5:567–575.
- TSUBOTA, T., R. A. NELSON, J. D. THULIN, L. HOWELL, AND J. M. BAHR. 1995. Annual changes in serum concentrations of prolactin in captive male black bears (*Ursus americanus*). *Journal of Reproduction and Fertility* 104:187–191.
- VANDER HEYDEN, M., AND E. C. MESLOW. 1999. Habitat selection by female black bears in the central Cascades of Oregon. *Northwest Science* 73:283–294.
- VAN GELDER, R. G. 1977. Mammalian hybrids and generic limits. *American Museum Novitates* 2635:1–25.
- VAN MANEN, F. T., AND M. R. PELTON. 1997. A GIS model to predict black bear habitat use. *Journal of Forestry* 95:6–12.
- WADDELL, T. E., AND D. E. BROWN. 1984. Exploitation of two subpopulations of black bears in an isolated mountain range. *The Journal of Wildlife Management* 48:933–938.
- WASSER, S. K., C. S. HOUSTON, G. M. KOEHLER, G. G. CADD, AND S. R. FAIN. 1997. Techniques for application of faecal DNA methods to field studies of ursids. *Molecular Ecology* 6:1091–1097.
- WATHEN, W. G., G. F. MCCracken, AND M. R. PELTON. 1985. Genetic variation in black bears from the Great Smoky Mountains National Park. *Journal of Mammalogy* 66:564–567.
- WATTS, P. D. 1990. Comparative weight loss in three species of ursids under simulated denning conditions. *International Conference on Bear Research and Management* 8:139–141.
- WATTS, P. D., N. A. ORITSLAND, C. JONKEL, AND K. RONALD. 1981. Mammalian hibernation and the oxygen consumption of a denning black bear (*Ursus americanus*). *Comparative Biochemistry and Physiology* 69A:121–123.
- WEAVER, K. M., AND M. R. PELTON. 1994. Denning ecology of black bears in the Tensas River Basin of Louisiana. *International Conference on Bear Research and Management* 9:427–433.
- WELCH, C. A., J. KEAY, K. C. KENDALL, AND C. T. ROBBINS. 1997. Constraints on frugivory by bears. *Ecology* 78:1105–1119.
- WHITE, T. H., JR., M. K. OLI, B. D. LEOPOLD, H. A. JACOBSON, AND J. W. KASBOHM. 1996. Field evaluation of Telazol® and ketamine-xylazine for immobilizing black bears. *Wildlife Society Bulletin* 24:521–527.
- WILLEY, C. H. 1974. Aging black bears from first premolar tooth sections. *The Journal of Wildlife Management* 38:97–100.
- WIMSATT, W. A. 1963. Delayed implantation in the Ursidae, with particular reference to the black bear (*Ursus americanus* Pallas). Pp. 49–76 in *Delayed implantation* (A. C. Enders, ed.). University of Chicago Press, Illinois.
- WOODING, J. B., AND T. S. HARDISKY. 1992. Denning by black bears in north-central Florida. *Journal of Mammalogy* 73:895–898.
- WOODING, J. B., AND T. S. HARDISKY. 1994. Home range, habitat use, and mortality of black bears in north-central Florida. *International Conference on Bear Research and Management* 9:349–356.
- WOZENCRAFT, W. C. 1993. Order Carnivora: Ursidae. Pp. 336–340 in *Mammal species of the world: a taxonomic and geographic reference*. Second ed. (D. E. Wilson and D. M. Reeder, eds.). Smithsonian Institution Press, Washington, D.C.
- YODZIS, P., AND G. B. KOLENOSKY. 1986. A population dynamics model of black bears in eastcentral Ontario. *The Journal of Wildlife Management* 50:602–612.
- YOUNG, B. F., AND R. L. RUFF. 1982. Population dynamics and movements of black bears in east central Alberta. *The Journal of Wildlife Management* 46:845–860.
- ZHANG, Y.-P., AND O. A. RYDER. 1994. Phylogenetic relationships of bears (the Ursidae) inferred from mitochondrial DNA sequences. *Molecular Phylogenetics and Evolution* 3:351–359.

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