SOME ASPECTS OF BLACK BEAR ECOLOGY IN THE ARIZONA CHAPARRAL

ALBERT L. LeCOUNT, Arizona Game and Fish Department, 2222 West Greenway Road, Phoenix 85023

Abstract: A study of the black bear (*Ursus americanus*) on a 100-km^2 study area in the chaparral vegetation type of Arizona was initiated in 1973. During the subsequent 3.5-year period, 44 individual bears were captured and minimum density of 1 bear per 2 km^2 was estimated. Twenty-eight bears were radio-instrumented and more than 1,100 locations were recorded. The radio-locations indicated that subadult males have a home range averaging 42 km^2, adult males 29 km^2, adult females 18 km^2, and subadult females 13 km^2. There is considerable overlap of home ranges among adult males. A lesser degree of overlap was observed for adult females. Twenty-four dens were located. Most den sites were at elevations between 1,300 and 1,500 m. Some bears den by 1 November, the majority by 15 November. Emergence from dens begins about 15 March and all bears, except females with cubs, leave their dens by 15 April. Females with cubs remain at den sites approximately 30 days longer.

Until recently, Arizona black bears were of little interest to either hunters or wildlife biologists. The majority of bears taken in the state were shot incidental to the hunting of other big game. Few sportsmen hunted specifically for bears. Campers and picnickers also encountered bears on occasion, and livestock operators suffered varying degrees of livestock loss each year from bears.

As Arizona's population has increased, campers, picnickers, and summer home residents have increasingly encountered bears. Also, more hunters began to pursue the black bear as an interesting and unique trophy in itself, rather than something to be shot incidental to other hunting. The increased interest and awareness led to a statutory change in classification for the bear in 1968, when the state legislature changed the status of bears from small game to big game. This change led to an increased emphasis on bear management in Arizona and pointed up the need for more information. This study is an attempt to fill some of the gaps in our knowledge of the ecology of black bears in Arizona.

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STUDY AREA

This study was conducted in the vicinity of Four Peaks in the southern portion of the Mazatzal Mountains in central Arizona on an area of approximately 100 km^2 (Fig. 1). Only one major road traverses the area, but an extensive trail network allows access by horseback and foot. The elevation within the area

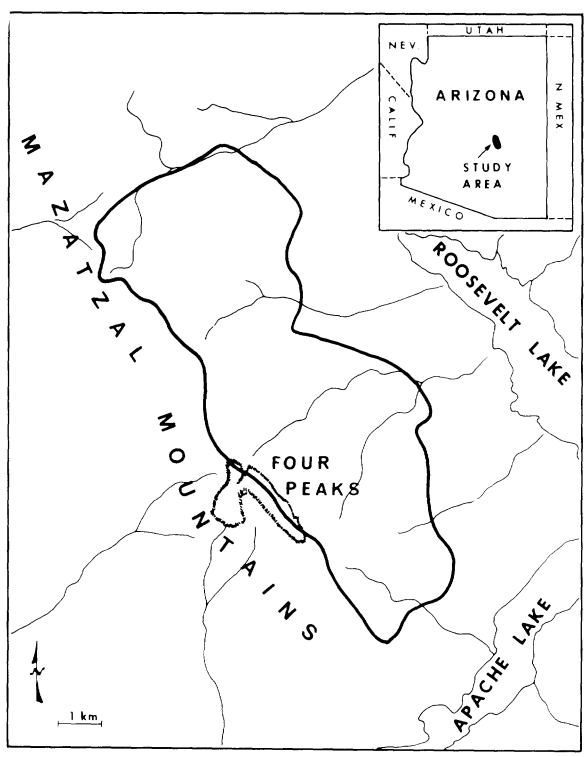

Fig. 1. Study area in the Mazatzal Mountains of Arizona.

ranges from 1,200 to 2,300 m. Topography is rocky and steep with many slopes exceeding 50 percent.

Annual precipitation averages about 63 cm. Summer rains (July-September) are usually in the form of thunderstorms. Winter precipitation (December-March) normally comes from major weather fronts of 1-3 days duration. Snow falls occasionally but seldom remains on the ground for more than a week. Midwinter dry periods are not uncommon. Average temperatures range from −5 C during midwinter to over 38 C in summer. Daytime temperatures of 10-15 C are not uncommon during the winter months.

The primary vegetative community on the study area is Interior Chaparral (upper Sonoran life zone) (Brown and Lowe 1974). This type intergrades with the Arizona Upland Desert Scrub (lower Sonoran zone) at the lower elevations (approximately 1,200 m) and with some species such as ponderosa pine (*Pinus ponderosa* Laws.) and Gambel oak (*Quercus gambelii* Nutt.) of the Montane Coniferous Forest (transition zone) at the highest portions of the study area.

The chaparral is a complex association of shrubs and low trees which, when well developed, create a cover so dense as to be nearly impenetrable. Variations in soils, elevations, and exposure produce differences in species composition and dominance. One or 2 species often dominate the type locally to give it a specific character, but some 50 species of plants having chaparral characteristics have been classified in the area. Manzanita (*Arctostaphylos* spp.), ceanothus (*Ceanothus* spp.), mountain mahogany (*Cercocarpus* spp.), garrya (*Garrya* spp.), and turbinella oak (*Q. turbinella* Greene) are dominante and comprise a crown density of 50-90 percent. Trees such as Arizona cypress (*Cupressus glabra* Sudw.), pinyon pine (*Pinus edulis* Engelm.), Emory oak (*Q. emoryi* Torr.), and sugar sumac (*Rhus ovata* S. Wats.) make up 5-15 percent of the cover. Major drainages contain riparian communities composed of Arizona sycamore (*Platanus wrightii* S. Wats.) and Fremont cottonwood (*Populus fremontii* S. Wats.).

Fruits produced by such chaparral species as serviceberry (*Amelanchier bakeri* Greene), manzanita, chokecherry (*Prunus serotina* Ehrh.), pigeonberry (*Rhamnus californica* Esch.), and the various species of oaks — as well as the prickly pear (*Opuntia* spp.) in the adjoining desert scrub type — provide an abundant food supply for bears.

The primary economic land use of the chaparral type in Arizona is cattle grazing. Allotment size and grazing intensities are established by the Forest Service. A portion of the study area is on the Three Bar Wildlife Area, where no livestock grazing has been permitted since the mid-1940s. Bear hunting is allowed on the entire study area in season (1 September-1 December).

MATERIALS AND METHODS

Bears were captured with foot snares and immobilized with Sernylan (phencyclidine hydrochloride) at a dosage rate of 1.10 mg/kg of body weight.

A first premolar was extracted from each captured bear and age was determined by the cementum layer technique (Stoneberg and Jonkel 1966).

Each bear was tagged with a numbered metal ear tag in each ear, and a numbered plastic ear tag in one ear, for subsequent identification. Radio-transmitter collars were attached to 28 randomly selected bears. Subsequent radiotracking was done from the ground and from aircraft, with over 1,100 radio-locations recorded.

Twenty-two bears were radiotracked to dens. Denning dates were noted and the exact location of each den was established in late December and January. Information on each den and denning site was gathered the following spring after the bears' emergence.

RESULTS AND DISCUSSION

Population Information

From June 1973 to September 1976, 44 individual bears were captured and marked. In addition to the animals captured, 2 cubs and 4 older unmarked bears were known to occupy the study area, for a total of 50 bears on approximately 100 km^2 (1 bear per 2.0 km^2). This total is considered to be a minimum population estimate. Similar densities have been found in Alberta (Kemp 1970), Montana (Jonkel and Cowan 1971), and Washington (Poelker and Hartwell 1973), and lower densities in Michigan (Erickson and Petrides 1964) and New York (McCaffrey et al. 1976).

Of the 22 adult bears captured, 55 percent were males. However, the actual sex ratio might be closer to the theoretical 1:1 because some bias undoubtedly occurred as a result of the selectivity of the capture technique. Males were more likely than females to encounter a trap because of their significantly larger home ranges.

We observed little evidence of mortality during the course of the study. Natural mortality is certain to occur but finding the evidence was extremely difficult in the dense chaparral.

The study area was open to bear hunting each autumn but no bears, marked or unmarked, were known to have been taken during the study. Bear hunting in the dense chaparral was evidently difficult and unproductive. Even hunters with bear hounds had low success rates because of the difficulty in following hounds in the heavy brush. The last known bear killed by a hunter on the study area was taken in 1971. One marked subadult male, however, was taken during the 1976 bear season about 100 km northwest of the study area. This was the only marked bear known to have been harvested since the study began.

On the grazed portion of the study area, bears could be taken legally any time of year by livestock

operators, under a depredation clause of the Arizona law. This clause allowed a cattleman to remove, at any time and by any means, any bear killing his livestock. However, since the study began, no depredating bears were reported taken under this law. This fact does not necessarily mean that no bear were taken by ranchers, however, since some ranchers were known to be reluctant to report the taking of bears because of criticism by protectionists. Some bears were killed on the study area by ranchers prior to the study but exact figures were unobtainable. Total mortality attributable to hunting by either sportsmen or ranchers, however, appears to be low at present.

The low harvest level probably accounts for the relatively high proportion (68 percent) of adults (3+ years of age) found in the population. In areas where bear populations have been exploited more heavily by hunters, investigators have reported subadult:adult ratios approaching 50:50 (Erickson and Petrides 1964, Kemp 1970, Jonkel and Cowan 1971). However, in relatively unexploited populations, as many as 70 percent of the animals have been found to be adults (Beecham 1980).

Home Range Sizes

Estimated home range sizes, as computed by the use of a minimum size polygon that calculated the area from the sum of the areas of interior triangles, for 11 adult and 8 subadult bears, are shown in Table 1.

Table 1. Home range data for 19 black bears on the Four Peaks, Arizona, study area, based on radio-locations.

Age-class	Number of bears	Number of radio-locations	Home range size (km^2)	
			Mean	Range
Adult male	6	327	29	15-69
Adult female	5	380	18	10-30
Subadult male	5	193	42	19-64
Subadult female	3	147	13	10-19

Sudadult males appeared to have the largest home ranges followed in descending order by adult males, adult females, and subadult females. Although there were marked differences in mean home range sizes between age-classes, there was considerable overlap among individuals.

Home range size for adult black bears has been determined by other investigators (Erickson and Petrides 1964, Jonkel and Cowan 1971, Poelker and Hartwell 1973, Amstrup and Beecham 1976). However, the variety of methods used to determine home range, differences in sample size, and the spread of home range size within any one age-class make direct comparisons difficult. Amstrup and Beecham (1976:345) suggest that the quantity, quality, and distribution of food, as influenced by climate and topography, probably determine minimum home range size. Our data appeared to support this hypothesis. The chaparral with its great diversity of berry- and mast-producing species produced a wide variety of foods available to bears from spring through fall. As a result, bears were able to meet all seasonal food requirements within relatively small areas.

Home Range Overlap

Radio-locations suggested considerable overlap in the home ranges of adult males (Fig. 2), a phenomenon

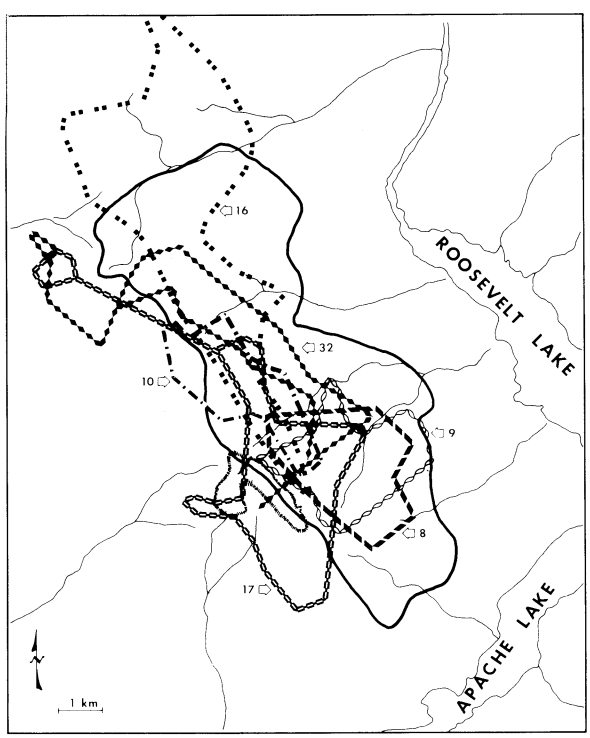

Fig. 2. Home range overlap of 6 adult male black bears on the Four Peaks, Arizona, study area.

also reported from Idaho by Amstrup and Beecham (1976:346). Overlap was less pronounced in Montana (Jonkel and Cowan 1971:35) and Washington (Poelker and Hartwell 1973:73). Adult females appeared to have more distinct home ranges than males (Fig. 3). Some degree of overlap occurred but on a lesser scale than among adult males.

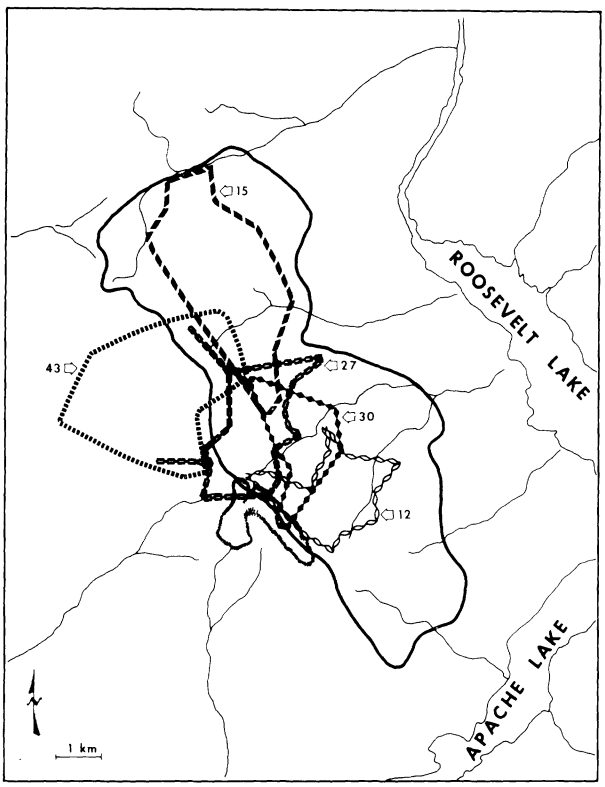

Fig. 3. Home range overlap of 5 adult female black bears on the Four Peaks, Arizona, study area.

Intraspecific tolerance among bears was observed in the course of radiotracking during the study. Two adult males were observed traveling together on 7 different occasions, and adult females were observed together in 2 instances. Although agonistic behavior was not observed, it probably occurred between males because many adult and subadult males carried the wounds and scars of battle.

Denning Behavior

Fifty percent of the 24 dens located were on north-facing slopes, 25 percent on west-facing slopes, 17 percent on south-facing slopes, and 8 percent on east-facing slopes. All dens were dug under large boulders surrounded by dense vegetation. Two instances of bears using multiple dens during 1 winter were also observed. Most den sites were at elevations of 1,300-1,500 m. However, 2 dens were located in the desert scrub type, 1 at approximately 1,200 m and the other at slightly less than 700 m.

Data from this study indicated that bears within this area began to enter dens approximately 1 November, with the majority of females denning before the males. Some bears remained active into early December but the majority of the population was denned by 15 November each year, regardless of presence or absence of snow. In late fall, the ground normally was free of snow, daily temperatures averaged 15 C, and night temperatures −2 C. Den sites at the higher elevations received several light snowfalls (12-15 cm) during the winter, but the snow usually melted within 2 weeks.

In February and early March, bears were frequently observed lying outside their dens during the warm (12-15 C) midday hours. However, these bears did not appear to leave the den sites at such times. By 15 March, most bears began to emerge from their dens on a daily basis, but movements were confined to within 100 m of the dens. Movements from the dens gradually increased in distance, and by 15 April, all bears, except females with cubs, had left their dens. Females with cubs remained at the den sites approximately 30 days longer, not leaving until about 15 May. These denning dates are similar to those determined by other investigators (Baily 1930, Gilbert 1952, Spencer 1955, Erickson 1965, Jonkel and Cowan 1971, Amstrup and Beecham 1976, Lindzey and Meslow 1976).

CONCLUSIONS

The black bear is normally thought of in association with a forest habitat. The Interior Chaparral in Arizona, however, is a scrubland vegetation type composed primarily of shrubs and low trees, interspersed with a few forest species along major drainages and at the higher elevations. It is composed of numerous mast- and fruit-producing species, and when well developed it creates cover so dense as to be nearly impenetrable.

These are the virtues that appear to make the chaparral excellent bear habitat. The diverse fruit- and mast-producing species not only provide an abundant food supply each year but also provide excellent cover. As a result, this type is capable of supporting a bear density of at least 1 per 2.0 km^2 while at the same time making it very difficult for hunters to overexploit the population.

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