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POPULATION DYNAMICS OF A HUNTED GRIZZLY BEAR POPULATION IN THE NORTHCENTRAL ALASKA RANGE

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SUMMARY

Population density and harvest rates for a grizzly bear (Ursus arctos) population in the northcentral Alaska Range were estimated during the years 1981 through 1986. Baseline population status and reproductive biology were determined during the years 1981 through 1985; the effects of increased harvest on this population will be the focus of investigations from 1986 through 1991.

In 1987 we observed only minor changes from past harvest rate, production, or survival rate patterns. All population estimates calculated during 1987 were adjusted for population closure. The estimated harvest rate for the minimum study area population was 10.2% in 1987, compared with the mean rate of 11.8% (1981-86). Minimum population size of grizzlies ≥2 years of age declined from an estimated 40.5 in 1986 to 31.4 in 1987; similarly, the decline is more evident from the 1981 estimate of 53.0 bears ≥2 years of age. Parameters of reproductive biology have remained stable: the age at 1st production of young was 5.5-7.5 years, the observed reproductive interval was 4.0 years, and the mean litter size was 2.0.

Key Words: density estimates, grizzly bear, Ursus arctos, harvest rates, Interior Alaska, population dynamics, reproductive biology.

CONTENTS

BACKGROUND

An understanding of the effects of hunter harvest on grizzly bear (Ursus arctos) population dynamics is necessary for effective management. To accomplish this, we need to determine (1) the effects of differing levels of harvest on population status, (2) the ways in which populations respond to hunter-caused mortality, and (3) whether the hunting harvest constitutes additive or compensatory mortality in grizzly bear populations.

Currently, most management decisions are based on the number, sex, and age of bears killed by hunters in a given area. These parameters may provide a general estimation of the status of grizzly bear populations under certain conditions,

but few data are available to use as a basis for establishing rates of harvest. Harvest data were used in making management decisions in the past, but analysis of computer simulations of this process indicates that this approach is inadequate in most situations (Harris and Metzgar 1987). More precise information is needed to make sound management responses to increased hunting demand on grizzly bear populations.

To address these problems, a 2-phase study was begun in the northcentral Alaska Range in 1981. Phase I was completed in 1985; it emphasized the gathering of baseline information on the population biology of northcentral Alaska Range grizzly bears, and most of the data necessary for an accurate baseline description and population modeling has been collected (Reynolds 1982; Reynolds and Hechtel 1983, 1984a,b, 1985, 1986; Reynolds et al. 1987). Harvest levels during the years 1965 through 1980 were generally low (i.e., about 3-5% of the estimated population); however, during the years 1981 through 1985 it increased to about 12%. By 1985, at the end of Phase I, the population had already begun to decline.

Initially, the study design called for low to moderate levels of harvest to occur during Phase I (i.e., when baseline data were collected). This was to be followed by higher harvest levels during Phase II (i.e., when data were collected on individuals and on population response to increased harvest). However, grizzly bear harvest by hunters, supplemented in part by capture mortality, resulted in a relatively high mean harvest level of 12% during Phase I. Even though this harvest was higher than the study design anticipated, it will strengthen rather than detract from the investigation. Most importantly, the early high harvest level will allow monitoring of the reproductive response over a longer period of time. This should be helpful because of the low productive rates of grizzly bears and the extended period required before females become reproductively mature.

Phase II, which started in 1986 and will continue through 1991, is designed to measure grizzly bear population response to human-caused mortality. During this period, harvest rates will continue at about 10-15% by manipulating hunting regulations and directing public hunting effort to the area. Changes in population size and productivity will be monitored, and the effects of increased harvest on population size and reproductive parameters will be analyzed. Changes in reproductive performance of adult females and survival rates of young bears will largely determine if population compensatory mechanisms operate as the harvest level is increased.

Natural-history studies of grizzly bears in Interior and northern Alaska have provided an adequate data base on some

aspects of reproductive biology, food habits, habitat use, and home range size (Dean 1976; Reynolds 1976, 1978, 1980, 1981; Murie 1981; Ballard et al. 1982; Miller and Ballard 1982; Miller and McAllister 1982; Reynolds and Hechtel 1982, 1983, 1984a,b, 1985; Miller 1983, 1984). These studies, however, were largely descriptive or of short duration (2-4 yrs). Because grizzlies do not mature until 4-10 years of age, observed (as opposed to extrapolated) measures of productivity, survival, and movement patterns must be obtained over a 4- to 10-year period for adequate accuracy and utility (Craighead et al. 1974, 1976; Reynolds 1976; Bunnell and Tait 1980, 1981; Knight and Eberhardt 1984, 1985). Though long-term studies are necessary for understanding and accurately predicting grizzly bear population dynamics and responses to changing patterns of human use, none have been completed and few are presently ongoing in Alaska.

Conservative harvest rates of 2-4% of the grizzly bear population have been proposed for areas in northwest Canada (Lortie, unpubl. data) and rates of 2-3% have been used as a basis for harvest in the Brooks Range (Reynolds 1976). Additional information is necessary before the effects of harvest in the Alaska Range can be understood. The following baseline information must be known to establish safe levels of harvest: (1) population density, (2) population structure, (3) movement patterns, (4) home range size, (5) mortality and survival rates, and (6) reproductive capacity, including age at 1st breeding, litter size, and interval between litters (Craighead et al. 1974, Reynolds 1976, Bunnell and Tait 1980).

OBJECTIVES

To quantitatively relate changes in the harvest rate of grizzly bears to their population dynamics, especially population size, structure, productivity, survival, emigration, and immigration; more specifically

1. To determine the size, density, and sex and age structure of the grizzly bear population.

2. To determine measures of reproductive biology, including the age at 1st production of young, reproductive interval, and mean litter size.

3. To determine natural mortality rates for sex and age classes within the population.

4. To determine harvest rates for sex and age classes within the population.

5. To determine movement patterns and home range sizes for grizzly bears of various sex and age classes within the population.

STUDY AREA

The 3,900-km² (1,500-mi²) study area is located in the mountains and foothills of the northcentral Alaska Range (Fig. 1) within Game Management Subunit 20A. The boundaries are the Gold King Creek and Wood River drainages downstream from Virginia Creek to the west, the crest of the Alaska Range to the south, the Delta Creek drainage to the east, and the southern edge of the Tanana Flats (approx. 64°N) to the north. It includes portions of 2 U.S. Army reservations: Ft. Wainwright and Ft. Greely.

Elevation in the area ranges from 500 to 3,700 m (1,500 to 12,000 ft). Most rivers flow through U-shaped, glacially formed valleys and are fed by active glaciers. Treeline occurs at approximately 900 m (3,000 ft). Dense patches of willow (Salix spp.) or alder (Alnus crispa), which bears use for cover, may be present up to an elevation of approximately 1,200 m (4,000 ft).

METHODS

We continued to use the same methods described in past reports to capture bears and measure population parameters (Reynolds 1982; Reynolds and Hechtel 1983, 1984a, 1985, 1986; Reynolds et al. 1987). All measurements, weights, and other routine data collections that were made during Phase I will be continued during Phase II (Appendix A). Beginning in 1986, however, we modified the way in which we estimated minimum population size (Reynolds et al. 1987). Also, in 1986 we conducted a census estimate based on marked-unmarked grizzly bear sightings (Reynolds et al. 1987) as described by Miller et al. (1987).

We emphasize that the method used to estimate population size during the years 1981 through 1985 (Reynolds 1982; Reynolds and Hechtel 1983, 1984b, 1985, 1986) was modified in 1986 and 1987 to account for lack of population closure. This modification resulted in lower estimated population sizes and, consequently, higher calculated harvest rates for all years (Reynolds et al. 1987).

Past estimates of minimum population size during the years 1981 through 1985 have included the sum of (1) those bears captured within the boundaries of the study area that would

have been alive in past years (e.g., a 14-year-old female captured in 1986 was assumed to be a resident of the study area during the years 1981 through 1985, but a 2-year-old male captured in 1986 was only counted as a member of the population from 1984 to 1986; those bears known to have emigrated were not included); (2) bears that were killed within the study area but which would have been alive in past years; and (3) bears that were observed in the area but could not be accounted for as captured or killed. In using this method, we assumed that the rates of unobserved emigration by young-aged bears equaled the rates of immigration; an assessment of this assumption was discussed in a previous report (Reynolds and Hechtel 1986). Based on the observed fidelity of adult bears to their home ranges in this study, we assumed that no adults emigrated or abandoned their established home ranges. Finally, we assumed that the bears we lost contact with (i.e., through collar shedding or malfuncting) remained in the study area. The degree to which this assumption is valid will become more evident as capture effort continues.

In addition to this method of calculating minimum population size, we derived "probable" population sizes by estimating that the 3,900-km² area included an additional 15-25 bears that were not captured, killed, or observed. This estimate was based on the availability of habitat in the area, given the known home range sizes and distribution of marked bears living in major drainages, and the fact that vegetative cover and rugged terrain can allow resident bears to escape detection for several years.

By 1986 we had enough baseline data on home range size and movement of Alaska Range grizzlies to "adjust" our estimates to more accurately account for lack of population closure (Reynolds et al. 1987). All estimates in this report were calculated using this method; also we have used it to recalculate population estimates for past years. Any differences between estimated population size or density reported here and those presented in past reports (Reynolds and Hechtel 1982, 1983, 1984a, 1985, 1986) are solely due to differences in the methods used.

Not all of the bears captured, killed, or observed within the boundaries of the study area maintain home ranges entirely within the study area; this factor results in an overestimation of population size. Bears living near the center of the study area are far more likely to remain entirely within the area than those living near the boundaries. To account for this bias, the approximate proportion of each home range lying outside the study area was estimated. These individual fractional home ranges were subtracted from total population estimates to more accurately

reflect numbers of bears in the study area, resulting in "adjusted" population estimates (Reynolds 1980). For bears killed by hunters, home range size and locations were assumed to be similar to those of radio-collared grizzlies of similar sex and age living in the same area. For example, if an unmarked 5-year-old female was killed on the Wood River at Mystic Creek, we would assume that 20% of her home range would lie outside the study area, since 20% of the home range of bear No. 1336, another 5-year-old female living along the Wood River, also lies outside the study area.

We believe we can account for most of the bears that use our study area. During the period 1985-87, only 7 of 35 bears captured in the study area were previously unmarked bears that were not offspring of marked bears; six of the seven were captured near the edges of the study area. Similarly, of 19 bears killed in the study area by hunters or by others in defense of life or property during 1985-87, only seven had not been captured; two were very likely the 2-year-old offspring of marked bears, and the other five were taken at the edges of the study area. For these reasons, we estimated that only 10-15 additional unmarked bears, instead of the previously estimated (Reynolds and Hechtel 1983, 1984a, 1985) 15-25 bears, remained in the study area. This proportion will decline as the capture program and hunting continue in the area.

During early June 1986, we used a modified capture-recapture method to estimate the density of bears in a portion of the northcentral Alaska Range study area. Miller et al. (1987) developed this modification in Southcentral Alaska in 1985, and it appeared to be a promising method of addressing geographic closure and providing a statistical variance for a bear population estimate. We tested the technique in our area under different conditions than those occurring in South-central Alaska, and we were able to compare density-estimated recapture techniques with those based on direct counts.

RESULTS AND DISCUSSION

Bears Captured and Radio-collared

In the study area, 82 individual bears were captured during the period 1981-87 (Table 1). In addition, 47 bears were recaptured so that radio collars could be replaced. During the period 1981-83, initial captures were made of bears of all sex and age classes; since then, most initial captures were of offspring of previously captured bears (Appendix B). Radio collars have been placed on 69 bears: 24 on young-age males ($\leq$5 years), 13 on adult males ($\geq$6 years), 13 on young-age females, and 19 on adult females. By fall 1987, 19 bears

carried functioning radio collars; 14 bears had shed collars; 29 bears were dead; and 7 bears could not be located, presumably because of long-range movements or collar failure (Appendix C, D).

Population Size and Density

Estimates Based on Population Closure:

Population density was calculated as a minimum value and adjusted for population closure during the years 1981 through 1987 (Table 2). Probable adjusted population size includes an estimate of those bears residing in the area that were not killed by hunters or captured during the study. Based on the home range size of marked bears and available habitat, we think the study area supports an additional 10-15 bears. Based on the mean proportions of cubs and yearlings in the 1987 population, we estimate that 9 to 11 of these undetected bears are $\geq$2 years of age. Therefore, the 1987 "probable adjusted" population size of bears in the area is 67-72, a decline from the 1982 probable adjusted population estimate of 78-83.

As the study continues, these estimated values will converge as unmarked, resident, breeding adults associating with radio-collared bears are captured and as monitoring of young-age bears born and weaned in the study area improves our understanding of dispersal and mortality rates. The minimum adjusted 1987 spring population was 56.7 grizzly bears, a density of 1.45 bears/100 km^2 (3.78 bears/100 mi^2), including (1) 34.1 marked bears adjusted from a total marked population of 39 bears whose home ranges included the study area, (2) 20.9 unmarked offspring of marked females adjusted from a total of 22 bears, and (3) 1.7 unmarked bears killed by hunters adjusted from a total of 5 bears.

A more useful measure of population size or density would include those members of the population $\geq$2 years of age for 2 reasons. First, cub and yearling cohorts constitute a relatively high percentage of the population--a mean of 28% in the 1981-87 adjusted population estimates (Reynolds and Hechtel 1986). These proportions can fluctuate widely, and point estimates may not be representative of the population trend or productive capacity. Second, because regulations do not allow legal harvest of cubs or yearlings, calculation of harvest rates is more accurate and useful if the population base only includes those bears $\geq$2 years of age.

The adjusted population estimate of grizzly bears $\geq$2 years of age in the study area in 1987 was 31 bears, or 0.81

bears/100 km² (2.09 bears/100 mi²). This represents a decline from the adjusted 1981 population estimate of 51 or 1.30 bears/100 km² (3.39 bears/100 mi²) for bears ≥2 years old.

Population Structure

Analysis of the sex and age structure indicated there were more females than males <3 years of age in 1987. Males are more heavily harvested in the study area than females. The sex ratio of the bear harvest since 1979 is 70 males:30 females. During this period, the harvest included 32 males and 13 females in the 1- to 5-year-old age class and 22 males and 10 females for age classes ≥6 years old. Males have larger home ranges and travel more widely than females (see Movement section, p. 13) and thus are more likely to encounter hunters (Bunnell and Tait 1980). In addition, because regulations prohibit the taking of cubs (including yearlings) or females accompanied by cubs, productive females are less vulnerable to hunters. For those adult females whose reproductive status was known during the years 1981 through 1986, only 22% were vulnerable to hunters during spring hunting seasons and 51% were vulnerable during fall; all adult males were vulnerable during both seasons.

Offspring observed as cubs had an even sex ratio (i.e., 7 males:6 females:1 unknown sex), but we are hesitant to conclude that the sex ratio at birth is even. We rarely attempted to capture cubs, so our sample size was low. The sex ratios we observed in older juvenile age classes tend to be male dominant, but none are significantly different from the male:female ratio we observed for cubs. Yearlings had a sex ratio of 14 males:9 females:2 unknown sex; 2-year-olds, 13 males:7 females:1 unknown sex; 3-year-olds, 6 males:3 females. Of those 2- and 3-year-olds that were observed at weaning, 15 were males and 8 were females. If there is a real tendency toward greater male recruitment in the population, we believe it is more likely the result of initial production rather than a lower survival rate for females in litters. Of 17 litters, five were composed of all males, two were composed of all females, eight were composed of mixed-sex litters, and one each was composed of a male and a female with an unknown-sex litter mate. Similar patterns favoring males have been recorded in Yellowstone National Park; Craighead et al. (1974) found 57% of 74 cubs captured during the years 1959 through 1970 were males, and Knight and Eberhardt (1985) reported that 67% of 24 cubs captured during the years 1974 through 1982 were males.

Reproductive Biology

Age at 1st Production of Young:

The age at which females first produce cubs in this area ranged from 5.5 to 7.5 yr, but the age at which females produce cubs that are successfully reared may be 5.5-9.5 yr (Table 3). Only one of 8 females aged 4.5-5.5 yr was observed with cubs or showed evidence of suckling, although seven had been observed consorting with males. Of 8 females 6.5 years old, one produced a cub that survived, two had cubs that did not survive, three bred and produced cubs as 7.5-year-olds, one was not observed as a 6.5- or 7.5-year-old but produced surviving offspring at age 8.5 yrs, and one did not breed.

Reproductive Interval:

Reproductive interval, or reproductive cycle, is the period between weaning of 1 litter by an adult female and the successful rearing and weaning of her subsequent litter. For females producing cubs for the 1st time, intervals begin at the 1st breeding that results in offspring. Years in which a female breeds but fails to conceive or loses her litter are included in this definition of reproductive interval. Therefore, observations of the length of time offspring accompany females before weaning should be viewed as minimum values of reproductive intervals, since females may not always produce young subsequent to breeding efforts following weaning (Craighead et al. 1969, 1976; Reynolds 1974, 1976, 1978, 1980, in press; Glenn et al. 1976; Reynolds and Hechtel 1982). This definition differs from that used by others. Craighead et al. (1976) define a cycle as the interval from pregnancy to pregnancy.

Offspring were weaned as 2-year-olds (n = 8 litters) or 3-year-olds (n = 6 litters). Mean minimum reproductive interval, however, was 4.0 yr (n = 21), based on those cycles that we observed as well as those that were projected by assuming weaning of offspring as 2-year-olds (Table 4). Alternately, if we project minimum cycle length based upon observed proportions of those litters weaned as 2- and 3-year-olds, then the mean reproductive interval was 4.5 yr. All 8 intervals greater than 4 yr resulted from interruption of the breeding cycle because of mortality of litters or breeding that did not produce cubs the following year.

Factors resulting in females weaning their young as 2-year-olds or keeping them another year to wean as 3-year-olds have not been identified. Weight or nutritional status in mid- to late May at the time when offspring are usually weaned and the estrus cycle begins may be important, but with our small

sample sizes we were unable to detect any patterns. Nevertheless, conditions present in 1983 appear to have prolonged reproductive intervals. Not only were no surviving cubs produced during that year, but females with yearlings or 2-year-olds tended not to wean those offspring until they were 3 yrs of age. Of 3 females accompanied by 2-year-olds in 1983, all weaned their litters as 3-year-olds. Similarly, of 3 females with yearlings in 1983, one weaned her litter as 2-year-olds, but the other two weaned their litters as 3-year-olds. In contrast, of 6 litters produced in 1984 or 1985, five were weaned as 2-year-olds, and only 1 litter of 3-year-olds was weaned. Models of the effects of harvest on population dynamics should take these events into account.

Production Success:

The proportion of breeding activity by adult females that results in the production of cubs (success rate) was 75%. This rate was based on the outcome of 24 observations of breeding activity by 13 individual females $\geq$6 years of age during the years 1982 through 1987. In addition, 2 females bred at ages 4 and 5 yr before producing young as 6-year-olds. Production success is probably dependent upon an individual female reaching a critical weight, rather than a critical age, prior to ovulation or implantation. Weight gain and maintenance, in turn, must depend on weather conditions, food availability, or other unknown factors either in the year that breeding occurs or during the winter and spring following breeding. Only one of 3 adult females observed breeding in 1982 produced cubs in 1983. In addition, at least 3 other females that were later either captured or killed in the study area may have bred in 1982 but were not accompanied by surviving offspring in the spring of 1983. In comparison, six of 8 adult females that bred in 1983 were observed with cubs in 1984, all five that bred in 1984 produced cubs in 1985, four of 4 females that bred in 1985 were with cubs in 1986, and six of 8 females that bred in 1986 were seen with cubs in 1987 (Table 3).

Litter Size:

Mean litter size was 2.04 for 23 litters first observed as cubs, 1.92 for 12 litters first observed as yearlings, and 2.00 for 22 litters observed as yearlings regardless of when they were first observed. Mean cub litter size was small, especially compared with the 2.3 mean found in the Nelchina Basin (Miller and McAllister 1982); however, mean yearling litter size was only 1.6 for the Nelchina Basin. The number of females producing cubs varied from year to year, ranging from 1 female producing 1 cub in 1983 to 7 females producing 14 cubs in 1982 (Table 5). In 1987, 6 females produced 12

cubs. Poor cub production in 1983 may have been due to failure of berry crops in 1982 (Miller 1984) or to the weather patterns of the winter of 1982-83 when little snow fell and temperatures fluctuated widely.

Although the difference in mean litter size between cubs and yearlings is small, it is the result of mortality of entire litters rather than an indication of high survival rates. Similar patterns of loss of cub litters have been recorded in northwestern Alaska (Reynolds, unpubl. data).

The mean size of 11 litters weaned as 2- or 3-year-olds was 2.0. The annual number of adult females in the population since 1982 has ranged from 18 to 21 (Tables 3, 6), and the observed annual numbers of cub litters were 7, 1, 6, 5, 2, and 6 during the years 1982 through 1987, respectively. From 1982 to 1987, the observed annual numbers of weaned litters, however, were only 1-2, 0-1, 4, 2, 4, and 1, respectively. This pattern also reflects mortality of entire litters, mostly in cub or yearling age classes.

Mortality

From 1981 through 1987 at least 84 bears died in the study area: 14 in 1981, 11 in 1982, 11 in 1983, 18 in 1984, 11 in 1985, 9 in 1986, and 10 in 1987. These mortalities included 47 hunter kills, 2 illegal kills, 3 defense of life or property kills, 8 capture-related mortalities, 2 natural mortalities for which carcasses were found, and 22 offspring that were missing from family groups and presumed dead (Table 7, Appendix E). During 1987 mortality included 8 hunter kills, 2 missing offspring that were presumed dead, and 1 capture-related death.

The causes of mortality for cubs, yearlings, and 2-year-olds that disappeared while accompanying their mothers could not be determined. Cannibalism by adult males was suspected as the major cause and has been documented in Alaska in the Brooks Range (Reynolds 1976, 1980, 1984b; Reynolds and Hechtel 1982), Alaska Range (Dean et al. 1986), south of the Alaska Range (Troyer and Hensel 1962, Glenn et al. 1976, Miller 1984), and in Canada (Mundy and Flook 1973; Pearson 1975, 1976). Natural mortality rates (i.e., excluding those caused by humans) for offspring under maternal care were 27% for cubs (n = 44), 6% for yearlings (n = 33), and 8% for 2-year-olds (n = 25).

The mortality rates for 30 radio-collared females aged 2 to 25 yr (monitored for 77 bear-years) were 9% because of sport hunting, 3% from causes other than human, and 4% that were capture-related. Only two of the deaths were not human-

caused: 1 female was killed and eaten by an adult male, presumably as a result of defense of her single 2-year-old, and the other was found dead in her den.

Sport hunting is a major source of mortality in this population. Prior to 1981 the mean annual harvest ranged from one to 14; the mean take was 5.0 bears (Table 8). If the population remained relatively stable during the period 1961-80 and future research confirms a pre-1981 adjusted density estimate of 2.2 bears/100 km² (5.7/100 mi²), the average annual harvest rate was approximately 5.6-5.8% of the population (range of 1.1-16.5%). By comparison, during the years 1981 through 1987, the mean harvest rate for the minimum population, including all human-caused mortalities was 11.6% (Table 9). If these rates are based on adjusted population size, which accounts for the estimated number of bears that live in the study area but have not been captured, the mean mortality rate for the years 1981 through 1987 would be 9.3-9.9%. Alternately, if harvest rates are calculated for only those bears $\geq$2 years of age and based on probable population size (adjusted to account for lack of population closure and those bears living in the area that have not been detected), then the mean mortality rate for the years 1981 through 1987 would be 12.8-13.3%.

More than a simple calculation of harvest rate is necessary to evaluate the effect of harvest or to correlate harvest rates with population trend. Both Craighead et al. (1974) and Knight and Eberhardt (1984) emphasize that the number of productive females within a population is the most important factor in the rate of growth or decline in grizzly bear populations. Our data also indicate the importance of adult females to population dynamics. Since 1982 the harvest has not resulted in a decline in the number of adult females; there was only minor change from 21 females in 1982 to a projected total of 20 in 1988 (Table 6). However, the number of females in the 3- to 5-year-old age class, which acts as replacements when adults die, has declined from 10 in 1982 to 3 in 1987. At the same time, the population within the study area has declined from an adjusted minimum of 66 in 1981 to 57 in 1987, and this trend is expected to continue. Based on only those bears $\geq$2 years of age, the trend is similar but apparently more severe; minimum adjusted estimates were 51 bears in 1981 and 31 bears in 1987 (Table 9). Although compensatory changes in production or survival rates may occur in reduced populations, as suggested by Stringham (1983) and McCullough (1981), such mechanisms have yet to be documented. Evidence for compensatory mechanisms at the present level of exploitation in the study area will not be analyzed until more data are collected.

Movement

Some adult male bears moved outside the study area and returned after traveling as far as 40 km (25 mi) north of the study area. Female bears generally stayed within the drainage where they were captured (Reynolds and Hechtel 1986).

The fidelity of young-age bears to their maternal home ranges varied (Table 10), but based on our limited observations, we speculate that most females remain close to their maternal home ranges following weaning and less than half of the males remain. Of 17 males followed during the 1st year after they had been weaned, three moved from 44 to 74 km (27 to 46 mi) outside their maternal home ranges. Of those followed during the 2nd year after weaning, four more moved from their maternal home ranges but 4 others remained. Of those that stayed within their maternal home range for 1 or 2 years after they were weaned, one was only observed the year following weaning, six were killed during the year of weaning, one stayed for 2 yr following weaning, and three stayed for 3 yr. All 8 females that were monitored stayed within their maternal home ranges, three remained for 1 yr, one for 2 yr, and one for 3 yr. Siblings do not necessarily display similar patterns of movement. Of 6 sets of weaned offspring, 4 sets remained within their maternal home ranges; in the remaining 2 sets, 1 sibling emigrated while the other did not.

Conclusions and Recommendations:

Major findings of importance in the determination of the effects of harvest on the population for the 1981-87 period included the following:

1. Probable adjusted population size was 78-83 in 1982, but it declined to 62-67 by 1987. These estimates were based on the minimum numbers observed as well as the probable number that were present but not observed; the overall estimate was adjusted to account for lack of a closed population. The reduction in numbers resulted in fewer females in the 3- to 5-year-old age class that were available for recruitment.

2. Mean natural mortality rates observed during the years 1982 through 1987 were 27% for cubs-of-the-year, 6% for yearlings, 8% for 2-year-olds, and 3% for adult females.

3. Human-caused mortality (including hunting, defense of life or property, illegal, and capture-related) was 12.8-13.3% during the period; the range was 3.9-17.2%, based on probable adjusted population estimates. Harvest

rates of 10% were observed for adult radio-collared females.

4. Based on a limited number of observations, young, recently weaned females tend to remain within their maternal home range; in contrast, less than a third of the males observed stayed in their maternal home ranges.

5. No changes in trends of productive capacity, cub survival, or movement patterns were detected during the years 1982 through 1986.

Continuation of this study should place us in a position to learn what responses occur in the population as a result of high harvest levels, including answers to the following questions:

1. Will continued harvest at current levels result in further decline of population size;

2. Will changes in litter size, reproductive interval, or the age at which females first successfully produce cubs follow population reduction, and if changes do occur, how will they affect population productivity;

3. Will declines in the population size reduce natural mortality rates of adult females or their offspring; and

4. Will patterns of immigration and emigration of young-age bears affect population trend?

The answers to these questions should allow managers to better predict the effects of increased bear harvest and assess the impacts of various levels of harvest on grizzly populations. Therefore, we recommend that the increase in harvest rates that began during Phase I of this study be allowed to continue until 1991 when Phase II ends. Concurrently, research effort should continue to monitor population size changes, production, and the number of adult females and document any compensatory changes in production or survival of offspring. Emphasis should be directed toward determining the response by individual members of the population to high harvest levels and how individual responses affect the population as a whole. Further attention should be given to constructing and testing population dynamics models based on measurable productivity and harvest parameters.

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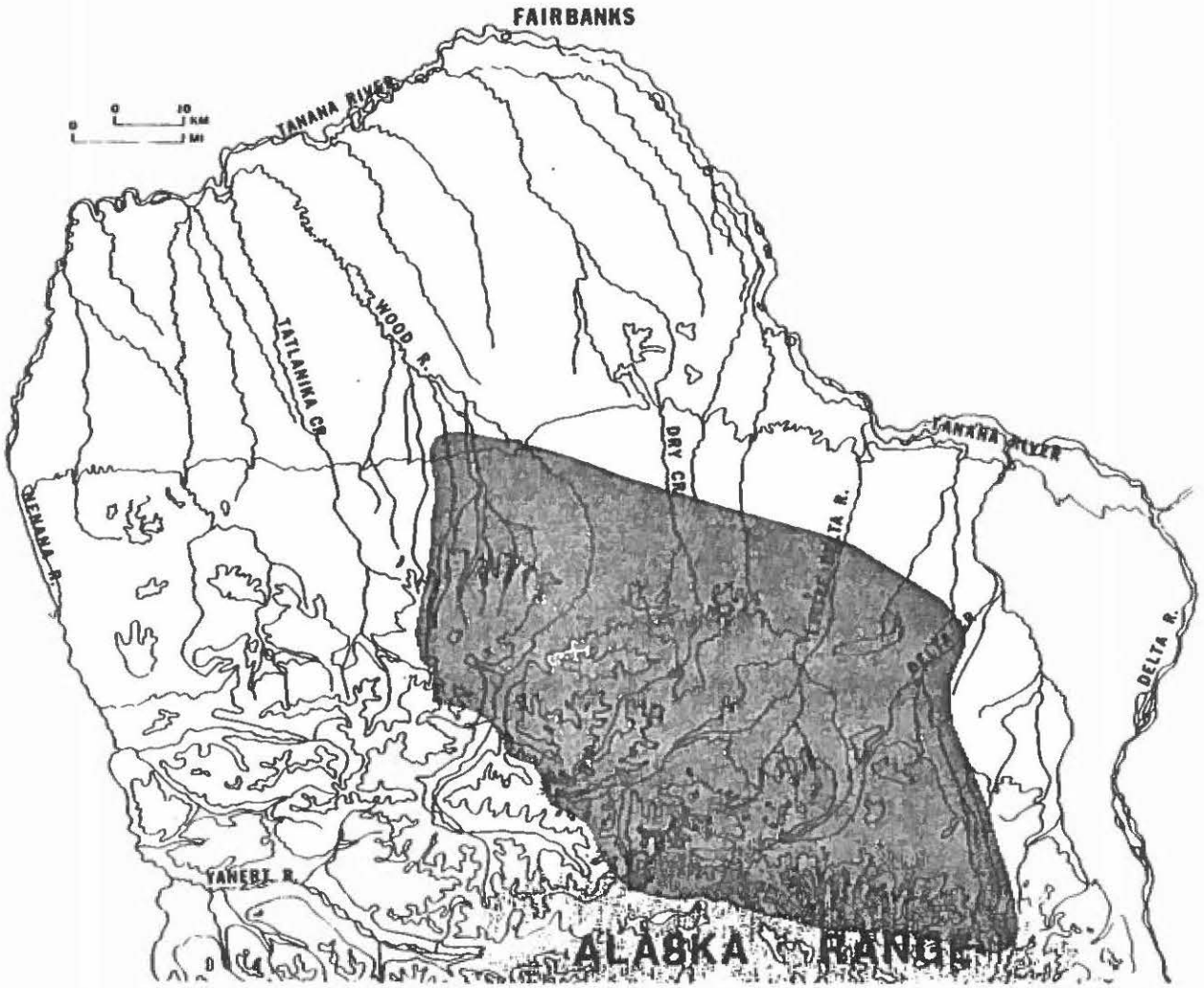

Fig. 1. Grizzly bear study area in northcentral Alaska Range.

Table 1. Capture and marking characteristics of 82 bears captured in the northcentral Alaska Range, 1981-87.

Bear No. and sex	Cem. age (yr)	Date of capture	Weight kg (lb)	Location	Drug dosage[a]	Ear tags[b]	Markers[c]
1301 M	6.5	5/18/81	120(265)	Buchanan Cr.	1.8/1.2 H	373/374	G/G
1302 F	3.5	5/19/81	75(165)	E. Fork Delta	1.0/1.0 M	368/367	R/G
	8.5	6/12/86	114(250)	E. Fork Delta	2.2 TEL M	280/281	O/1B
1303 F	2.5	6/17/81	57(125)	Mystic Mtn.	1.4/1.4 M	524/523	R/R
	4.5	6/27/83	82(180)	Hearst Cr.	5.0 M99 M	3227/3214	R/R
	6.5	6/14/85	73(160)	Upper Gold King	2.0/2.0 M	486/487	R/R
1304 M	5.5	6/19/81	136(300)	W. Fork Delta	2.4/2.0 M	451/452	1B/R
	11.5	5/21/87	255(560)	Threemile Cr.	8.1 TEL M	430/431	W/mG
1305 F	24.5	6/19/81	114(250)	Slate Cr.	A M	453/454	O/R
1306 M	2.5	5/24/82	44(97)	W. Fork Delta	1.0/1.0 L	3151/3086	G/1B
1307 M	2.5	5/24/82	44(98)	W. Fork Delta	1.0/1.0 H	3087/3152	1B/G
	5.5	6/17/85	114(250)[d]	Sheep Cr.	2.4/2.6 L	3087/3152	1B/G
1308 F	6.5	5/25/82	111(245)	Dry Cr.	-[e]	3001/3154	O/Pp
	8.5	6/20/84	120(265)	Dry Cr.	5.0 M99 M	3001/471	O/Pp
	11.5	6/8/87	123(270)	Dry Cr.	3.3 TEL M	528/529	O/Pp
1309 M	8.5	5/25/82	318(700)[d]	Dry Cr.	A L	3153/3101	dB/Bk
1310 M	13.5	5/25/82	250(550)[d]	Buchanan Cr.	2.0/2.0 M	No tags	
	15.5	6/20/84	241(530)	Molybdenum Rg.	4.0/2.0 M	467/473	O/W
	18.5	5/21/87	264(580)	Buchanan Cr.	9.0 TEL M	414/413	Y/W
1311 F	12.5	5/26/82	120(265)	Molybdenum Rg.	1.9/2.1 M	3106/3107	W/W
	14.5	6/21/84	116(255)	Molybdenum Rg.	2.0/2.2 M	466/455	W/W
	17.5	6/8/87	123(270)[d]	Molybdenum Rg.	3.4 TEL M	571/570	W/W_f
1312 F	0.5	5/26/82	12(26)	Molybdenum Rg.	0.1/0.1	3104/3155	O/W_f
1313 F	0.5	5/26/82	12(27)	Molybdenum Rg.	0.08/0.13	3156/3105	W/O_f
1314 M	6.5	5/27/82	116(255)	Iowa Rg.	2.1/1.9 H	3088/3002	dB/1B
1315 M	13.5	6/4/82	272(600)	Buchanan Cr.	1.9/2.1 L	3102/3157	Bk/O
	15.5	5/17/84	295(650)	Hayes Cr.	A H	3322/none	Bk/-

Table 1. Continued.

Bear No. and sex	Cem. age (yr)	Date of capture	Weight kg (lb)	Location	Drug dosage[a]	Ear tags[b]	Markers[c]
1316 M	11.5	6/7/82	236(520)	W. Fork Delta	3.8/0.0 H	3089/3090	O/1B
1317 F	3.5	6/8/82	36(80)	Forgotten Cr.	1.2/1.8 L	3091/3003	1B/O
	5.5	5/16/84	55(122)	Upper West Fk.	A L	3486/3239	1B/O
	6.5	5/23/85	59(130)	Upper Wood R.	7.0 M99	497/498	1B/O
1318 F	13.5	6/8/82	104(230)	Buchanan Cr.	A L	3004/3103	W/G
	15.5	6/22/84	118(260)[d]	Slate Cr.	A M	458/472	W/G
	18.5	6/2/87	105(230)[d]	Slate Cr.	3.3 TEL M	--	--
1319 M	0.5	6/8/82	12(26)	Buchanan Cr.	0.15/0 L	3005/3092	R/Y[f]
1320 F	17.5	6/8/82	102(225)	Trident Gl.	A M	3158/3093	G/B
	19.5	6/25/84	139(305)	E. Hayes Cr.	5.0 M99 M	463/461	G/B
	22.5	6/12/87	114(250)	Hayes Gl.	4.0 TEL M	517/518	mG/dB
1321 F	16.5	6/9/82	141(310)	Snow Mt. Glch.	2.1/1.9 M	3028/3108	G/W
	17.5	5/17/83	127(280)	Dry Cr.	1.8/2.2 M	3028/3427	G/W
	19.5	7/22/85	218(480)	N. VABM Wood	2.6/1.0 L	399/398	G/W
1322 F	8.5	6/9/82	91(200)	Sheep Cr.	1.9/2.1 M	3051/3159	W/1B
1323 F	11.5	6/10/82	95(210)	Mystic Mt.	1.9/2.1 M	3160/3030	G/G
	13.5	6/29/84	132(290)	VABM Wood	A M	579/582	G/G
1324 F	0.5	6/10/82	12(26)	Mystic Mt.	0.12/0 M	3027/3162	R/W[f]
1325 M	0.5	6/10/82	12(27)	Mystic Mt.	0.10/0 M	3161/3031	W/R[f]
	2.5	5/15/84	67(148)	Mystic Cr.	1.0 M99 M	3233/3394	R/W
1326 F	4.5	6/18/82	93(205)	Buchanan Cr.	2.2/1.8 M	3008/3163	W/R
	6.5	6/21/84	109(240)	Buchanan Cr.	1.8/2.2 M	468/462	W/R
	7.5	6/27/85	111(245)	Slate Cr.	2.4/1.6 L	426/427	W/W
1327 F	16.5	7/8/82	127(280)	Whistler Cr.	2.2/1.8 M	3134/3192	G/R
	18.5	6/23/84	125(275)	Whistler Cr.	A H	458/192	G/R
1328 F	1.5	7/8/82	43(95)	Whistler Cr.	0.9/1.1 M	3115/3014	dB/G
1329 F	13.5	7/9/82	120(265)	Buchanan Cr.	2.4/1.6 M	3026/3111	W/R
1330 M	1.5	7/9/82	48(106)	Buchanan Cr.	-- M	--/--	R/W
	3.5	6/28/84	102(225)	E. Fk. Delta	2.6/3.0 M	597/598	R/W

Table 1. Continued.

Bear No. and sex	Cem. age (yr)	Date of capture	Weight kg (lb)	Location	Drug dosage[a]	Ear tags[b]	Markers[c]
1331 F	4.5	7/10/82	77(170)[d]	Trident Gl.	2.4/1.6 M	3120/3194	Bk/O
	9.5	5/20/87	114(250)[d]	E. Hayes Cr.	3.0 TEL M	519/520	Bk/Y
1332 F	5.5	7/12/82	104(230)	Gillam Gl.	2.4/1.6 M	394/190	R/dB
1333 F	16.5	7/13/82	141(310)	Buchanan Cr.	A M	474/469	G/R
1334 M	1.5	7/13/82	49(108)	Buchanan Cr.	1.0/1.0 M	395/392	Y/G
	3.5	6/27/84	107(235)	McGinnis Cr.	A M	585/583	O/G
1335 F	1.5	7/13/82	38(84)	Buchanan Cr.	1.0/1.0 M	32/456	G/Y
	3.5	6/25/84	80(175)	Gilliam Gl.	1.5/3.0 M	465/464	dB/G
1336 F	2.5	5/16/83	48(105)	Kansas Cr.	1.0/1.0 M	3201/3204	Bk/mG
	3.5	6/26/84	89(195)	Copper Cr.	2.0/3.0 M	470/595	Bk/mG
	4.5	6/17/85	102(224)	Wood R.	A L	470/595	Bk/mG
	6.5	5/15/87	109(240)	Rogers Cr.	2.2/2.0 M	521/522	Bk/mG
1337 M	20.5	5/18/83	293(645)	Sheep Cr.	3.5/3.5	3209/3205	R/O
1338 M	6.5	5/20/83	111(245)	Molybdenum Rg.	A M	3203/3202	O/Bk
1339 M	6.5	5/23/83	120(265)	Trident Gl.	-- M	3286/3351	1B/W
	7.5	5/17/84	168(370)	E. Fk. Delta	6.0 M99 H	3254/3398	1B/W
1340 F	3.5	5/23/83	71(157)[d]	Hayes Cr.	1.2/0.8 H	3277/3208	G/O
	4.5	5/19/84	91(200)[d]	Molybdenum Rg.	4.0 M99 M	3277/3208	mG/O
	5.5	6/27/85	100(220)	W. Hayes Cr.	2.4/1.6 L	590/596	mG/mG
1341 F	10.5	5/23/83	107(235)[d]	NE Portage	1.5/1.5 H	3210/3428	R/dB
	12.5	6/13/85	107(235)[d]	E. Fk. Delta	2.0/2.0 M	442/none	O/-
1342 M	2.5	5/24/83	49(108)	Threemile Cr.	0.6/1.2 M	3354/3207	W/dB
1343 M	2.5	5/24/83	43(95)	Threemile Cr.	0.6/1.2 M	3426/3285	R/Bk
1344 M	2.5	5/24/83	56(123)	Threemile Cr.	0.6/1.2M	3361/3433	1B/Bk
	3.5	6/23/84	123(270)	Hayes Cr.	2.2/3.2 M	475/460	1B/Bk
1345 F	8.5	5/24/83	--	Upper W. Fork	1.2/1.8 L	3206/3352	O/O
	10.5	5/23/85	105(230)[d]	Upper W. Fork	7.0 M99	499/500	O/O
1346 M	5.5	5/25/83	114(250)	Hayes Gl.	A M	3359/3356	1B/1B
1347 M	6.5	5/31/83	189(415)	Coal Cr.	3.5 M99	None	Dead

Table 1. Continued.

Bear No. and sex	Cem. age (yr)	Date of capture	Weight kg (lb)	Location	Drug dosage[a]	Ear tags[b]	Markers[c]
1348 F	12.5	5/31/83	123(270)[d]	Mystic Mtn.	A M	3363/3372	W/O
	15.5	5/16/86	116(255)	Wood R.	2.4/1.6 M	235/236	W/O
1349 M	18.5	6/2/83	264(580)	O'Brien Cr.	3.8/1.2L	3364/3292	R/1B
1350 M	8.5	6/2/83	202(445)	Ptarmigan Cr.	3.0/2.0L	3432/3430	dB/R
	11.5	6/12/86	205(450)[d]	E. Fork Delta	3.5 TEL L	273/272	dB/R
1351 F	14.5	6/23/83	114(250)[d]	Dry Cr.	4.0 M99 M	3217/3390	dB/W
	16.5	6/10/85	111(245)	Little Delta R.	2.0/2.0 M	477/436	dB/W
	18.5	5/19/87	130(285)	Dry Cr.	AM	503/504	dB/W
1352 F	14.5	6/27/83	111(245)	W. Fork Delta	--	3215/3316	O/W
1353 M	1.5	6/27/83	27(60)	W. Fork Delta	--	3310/none	O/-
1354 F	1.5	6/27/83	12(27)	W. Fork Delta	--	None/3314	-/O
1355 M	3.5	6/30/83	60(133)	E. Fork Delta	4.0 M99 H	3232/3473	O/Bk
	5.5	6/3/85	70(155)	Whistler Cr.	2.2/1.8 H	586/587	O/Bk
1356 M	2.5	6/30/83	50(110)	Little Delta R.	2.0 M99 H	3234/3392	Bk/O
1357 M	2.5	5/15/84	63(138)	Dry Cr.	1.1 M99 M	3323/3235	W/Bk
	3.5	6/24/85	93(205)	Dry Cr.	1.5/1.5 M	447/448	W/Bk
1358 M	13.5	5/18/84	205(450)	Hayes Cr.	A L	3318/3447	1B/dB
	15.5	5/20/86	236(520)	Trident Gl.	3.4/2.0 L	297/296	1B/dB
1359 M	3.5	5/28/85	61(134)	Snow Mt. Glch.	4.0 M99 M	489/488	dB/O
1360 F	10.5	5/28/85	95(210)	Snow Mt. Glch.	7.0 M99 H	None	None
1361 F	3.5	5/28/85	63(138)	Dry Cr.	4.0 M99 M	482/483	mG/R
	4.5	5/19/86	100(220)	Rogers Cr.	1.7/2.0 L	274/275	G/Bk
1362 F	6.5	6/5/85	--	Glacier Cr.	2.0/2.0 L	None	None
	6.5	6/24/85	114(250)	Threemile Cr.	2.2/1.8 L	443/490	dB/dB
1363 M	3.5	6/5/85	55(120)	Slide Cr.	1.0/2.0 M	592/593	dB/1B
1364 M	0.5	6/14/85	7(15)	Gold King Cr.	0.7/- M	None	None
1365 M	5.5	6/19/85	118(260)	Wood R.	A M	476/441	1B/G
1366 M	8.5	7/22/85	234(515)	Tatlanika R.	3.2/1.0 M	390/391	mG/R
1367 M	2.5	5/19/86	61(134)	Threemile Cr.	1.4/2.0 M	400/241	1B/W

Table 1. Continued.

Bear No. and sex	Cem. age (yr)	Date of capture	Weight kg (lb)	Location	Drug dosage[a]	Ear tags[b]	Markers[c]
1368 F	2.5	5/19/86	48(106)	Threemile Cr.	1.4/2.0 M	257/256	1B/1B
1369 M	2.5	5/19/86	68(150)	Threemile Cr.	1.4/2.0 L	247/246	W/dB
1370 F	2.5	5/20/86	47(103)	Buchanan Cr.	1.4/2.0 H	253/252	dB/Bk
	3.5	5/20/87	69(151)	Buchanan Cr.	1.5/1.5	--	--
1371 M	2.5	5/20/86	57(126)	Buchanan Cr.	1.4/2.0 M	269/268	Bk/dB
1372 M	2.5	5/20/86	72(158)	Ptarmigan Cr.	1.4/2.0 M	387/386	1B/O
1373 M	7.5	5/21/86	193(425)	Delta Cr.	4.0/2.0 M	295/294	1B/R
1374 F	6.5	5/21/86	106(233)	Delta Cr.	2.0/2.0 M	249/248	R/G
1375 M	6.5	6/13/86	186(410)	Sheep Cr.	4.5 TEL L	276/277	Y/W
1376 F	14.5	6/13/86	130(285)	Hayes Cr.	3.0 TEL M	279/278	G/O
1377 M	2.5	8/28/86	132(290)[d]	Iowa Rg.	4.0 TEL L	505/507	Bk/R
1378 F[g]	2.5[d]	5/20/86	59(130)[d]	Ptarmigan Cr.	--	None	None
1379 F	2.5[d]	5/15/87	67(148)	Sheep Cr.	2.2/2.0 L	334/335	W/W
1380 M	2.5[d]	5/18/87	65(142)	W. Fork Delta	2.2 TEL H	513/514	W/R
1381 M	2.5[d]	5/21/87	73(160)	Dry Cr.	3.0 TEL M	481/480	1B/Bk
1383 M	2.5[d]	6/12/87	77(170)	Coal Cr.	AM	389/390	mG/dB

[a] Dosage in ml of phencyclidine hydrochloride/acepromazine maleate; use of M-99 is designated M99; use of Telezol is designated TEL; A denotes multiple injections with unknown effective dosage. Drug effects were as follows: L = light, M = optimum, H = heavy.

[b] Ear tag numbers, left/right.

[c] Marking designations:
Colors: R, red; G, light green; mG, medium green; O, orange; 1B, light blue; dB, dark blue; W, white; Bk, black; Pp, purple; Y, yellow.
Marker types: One or 2 color combinations were used for ear flags, e.g., O/W is orange in left ear, white in right ear; -/G is no flag, left; green, right.

Table 1. Continued.

[d] Estimated.

[e] Data collected but not recorded.

[f] Ear tags only and not ear flagging material were used to mark cubs of the year; therefore, for these bears only, marker colors indicate ear tags and not ear flags.

[g] Bear No. 1378, an offspring of No. 1311, was darted but not immobilized on 20 May 1986. We left her with her mother to recover from the darting chase, but she was killed by hunters before we returned. We include her in this table for ease of data analysis.

Table 2. Minimum grizzly bear population present in northcentral Alaska Range study area, 1981-87.[a]

Bears alive during spring of year[b]	1982			1983			1984			1985			1986			1987		
	N	Adj. N	Adj. N ≥ 2yrs	N	Adj. N	Adj. N ≥ 2yrs	N	Adj. N	Adj. N ≥ 2yrs	N	Adj. N	Adj. N ≥ 2yrs	N	Adj. N	Adj. N ≥ 2yrs	N	Adj. N	Adj. N ≥ 2yrs
Marked bears	65	56.8	39.1	59	50.2	43.1	62	53.3	35.4	50	42.8	34.4	45	39.3	39.3	39	34.1	30.1
Unmarked young with marked mothers	2	2	0	3	3	0	6	6	0	13	12.5	0	9	9	0	22	20.9	0
Unmarked bears killed by hunters	11	8.9	7.2	8	6.2	6.0	4	2.9	2.7	1	0.2	0.2	2	1.2	1.2	5	1.7	1.3
Minimum observed population	78	67.7	46.3	69	59.4	49.1	72	62.2	48.1	64	55.5	34.6	56	49.5	40.5	66	56.7	31.4

[a] Minimum populations are presented as: N, total number present; Adjusted N, which accounts for those bears which range outside the study area; and Adjusted N ≥2 years of age. To account for those bears whose home ranges extend beyond the study area boundaries, the proportion of each home range or estimated home range outside the study area was estimated. These individual fractional home ranges were subtracted from appropriate population figures to more accurately reflect the numbers of bears present.

[b] Number of bears alive during spring of year, N, includes bears that were later captured or killed by hunters but presumed to be present in preceding years.

Table 3. Reproductive status and litter sizes of potentially mature females in the northcentral Alaska Range, 1981-87.

Bear No.	Age in 1987[a] (yr)	Offspring No.	Reproductive status[b] 1981	1982	1983	1984	1985	1986	1987	Reproductive history
1302	9		NB	UN	UN	UN	UN	B	B	No offspring prior 1986
1303	8	1364, 1UM	NB	NB	B?	B	2cubs/B	UN	UN	No offspring prior 1981; lost cubs in 2 separate incidents 1985
1305	25	1306, 1307	2yrlg	2 2 yr/B/Dead						Hunter kill fall 1982
1308	11	2UM, 2UM		?/B	B	2cubs	2yrlg	1 2-yr/B	2cubs	Offspring 1982 or before; lost 1 yrlg 1985
1311	17	1312, 1313, 1372, 1378, 2UM	UN/B	2cubs	B	2cubs	2yrlg	2 2-yr/B	2cubs	Lost cubs August 1982;
1317	6			NB	NB?	NB	NB/Dead			Hunter kill fall 1985
1318	18	1319, 1380, 1UM	UN/B	1cub/B	B	B	2cubs	2yrlg	2 2-yr	Lost cub 1982
1320	22	1UM, 3UM, 2UM		?/B	1cub/B?	B	3cubs	B	2cubs	Weaned or lost offspring 1982; lost cub 1983; lost 3 cubs 1985, lost 1 cub 1987
1321	21	1342, 1343, 1344, 1UM, 1379,[c] 1381[c]	UN/3+cubs	3yrlg	3 2-yr	2 3-yr/B	3cubs	3yrlg	2 2-yr/B	1342 killed illegally fall 1983; lost 1 yrlg 1986
1322	13	1336	UN/1+cubs	1yrlg	1 2-yr	1 3-yr/B	UN	UN	UN	
1323	16	1324, 1325	UN/B	2 cubs	2yrlg	2 2-yr/B	UN	UN	UN	
1326	8	UM		NB	B	B	1cub	B/Dead		No offspring prior 1982; lost cub 1985; hunter kill 1986
1327	18	1328, 1UM, 3UM	UN/2+cubs	2yrlg	B	3cubs/ Dead				1UM yrlg capture mortality; lost 1328 in 1982; 1327 capture mortality? 1984
1329	14	1330	UN/1+cubs	1yrlg	1 2-yr/Dead					Killed by male May 1983
1331	9	1UM		NB	B	UN/B	UN	1+cubs	1yrlg	No offspring prior 1982; lost yrlg 1987
1332	6			NB?	Dead					No offspring prior 1982; died in den 1983

Table 3. Continued.

Bear No.	Age in 1987[a] (yr)	Offspring No.	Reproductive status[b] 1981	1982	1983	1984	1985	1986	1987	Reproductive history
1333	18	1334, 1335	UN/2+cubs	2yrlg	2 2-yr	2 3-yr/ B/Dead				Hunter kill 1984
1336	6	2UM			NB	NB	B	B	2cubs	No offspring prior 1983
1340	7				NB	NB	B	UN	UN	No offspring prior 1983
1341	14	1UM, 1370, 1371		UN/1+cubs	1yrlg/B	2cubs	2yrlg	2 2-yr/B	B?	Lost yrlg 1983
1345	12	2UM, 2UM			B	2cubs	1yrlg/B	2cubs	2yrlg	Lost 1 cub 1984; lost 1 yrlg 1985
1348	16	1367, 1368, 1369, 2UM			?/B	3cubs	3yrlg	3 2-yr/B	2cubs	Probably weaned or lost offspring 1983
1351	18	1357, 1361, 1UM, 3UM	UN/B	UN/3+cubs	3yrlg	3 2-yr	2 3-yr/B	UN/3+cubs	3yrlg/Dead	Lost 1UM offspring 1984 Hunter kill 1987, 3UM yrlg orphaned?
1352	16	1353, 1354	UN/B	UN/2+cubs	2yrlg	2 2-yr/Dead				Hunter kill 1984; 1353, hunter kill 1984
1360	11	1359, 1363	UN/B	UN/2+cubs	UN/2+yrlg	UN/2+2-yr	2 3-yr/ Dead			Capture mortality 1985
1361	5					NB	NB	NB	UN	No offspring prior 1985
1362	8	2UM				UN	B	2cubs	2yrlg	No offspring prior 1985
1374	7	UM				UN/B	UN/2+cubs	2yrlg	?/B?	
1376	15	2UM					UN	?/B	2cubs	Offspring prior 1986

[a] Age in 1987 or last year in which bear was alive.

[b] Designations: NB, not observed in breeding condition; UN, not observed in that year; B, observed in breeding condition; ?, status unknown; UM, unmarked; cub, cub of year; ylg, yearling; 2-yr, 2-year-old; +, offspring first observed in subsequent year and therefore litter size may have been larger.

[c] Siblings 1379 and 1381 were captured separately after weaning within 1321's home range and were sighted together once during the summer. We assume that the siblings were those recently weaned by 1321.

Table 4. Observed and projected minimum reproductive intervals for adult female grizzly bears in the northern Alaska Range, 1981-87.

Bear No.	Maximum age at beginning of interval	Minimum cycle length[a]	Annual reproductive status for adult females[b]							
			Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8
1303	5	5	B	C/B	B	C	Y	2/B		
1305	22	3	W/B	C	Y	2/B				
1308	6	4,3	C?/B	B	C	Y	2/B	C	Y	2/B
1311	10	5	W/B	C	B	C	Y	2/B	C	
1318	12	7	W/B	C/B	B	B	C	Y		3/B
1320	17	7	W/B	C/B?	B	C	B	C	Y	2/B
1321	14	4,3	W/B	C	Y	2	3/B	C	Y	2/B
1322	6	4	B	C	Y	2	3/B			
1323	11	3	W/B	C	Y	2/B				
1326	6	5	B	C/B?	B/D	C	Y	2/B		
1329	11	3	W/B	C	Y	2/D				
1331	7	5	B	C	Y/B	C	Y	2/B		
1333	14	4	W/B	C	Y	2	3/B/D			
1336	5	3	B	C	Y	2B				
1341	10	5	W/B	C	Y/B	C	Y	2/B	B	
1345	8	5	B	C	Y/B	C	Y	2/B		
1348	12	3,3	W/B	C	Y	2/B	C	Y	2/B	
1351	12	4	W/B	C	Y	2	3/B	C	Y/D	
1352	13	3	W/B	C	Y	2/D				
1360	6	4	W/B	C	Y	2	3/D			
1362	6	3	B	C	Y	2/B				
1374	4	3	B	C	Y	2/B				
1376	14	3	W/B	C	Y	2/B				

[a] All reproductive cycles or intervals were minimum values because they were partially based on projections prior to or after years when actual observations were made. In addition, all projected calculations assume weaning of young as 2-year-olds; however, in weanings which were observed, 5 of 11 females weaned offspring as 3-year-olds.

[b] Underlining indicates reproductive status was projected to allow minimum cycle length calculation; status which was observed is not underlined. Designations are: B, bred; W/B, weaned offspring, then bred; C/B, lost cubs, then bred; Y/B, lost yearling, then bred; C, with cubs; Y, with yearlings; 2, with 2-year-olds; 3, with 3-year-olds; D, died.

Table 5. Observed litter size and number of offspring in cub, yearling, 2-year-old, and 3-year-old age classes, Alaska Range, 1982-87.

Age class	Observed no. of litters						Total		Mean litter size
	1982	1983	1984	1985	1986	1987	No. of litters	No. of offspring	
Cub									
litter size 1	1	1	0	1	0	0	3	3	
litter size 2	2	0	4	2	2	6	16	32	
litter size 3	0	0	2	2	0	0	4	12	
total	3	1	6	5	2	6	23	47	2.04
Yearling									
litter size 1	2	1	0	1	0	1	5	5	
litter size 2	2	2	0	3	2	2	12[a]	24[a]	
litter size 3	1	1	0	1	1	1	5	15	
total	5	4	0	5	3	4	22[a]	44[a]	2.00[a]
2-year-old									
litter size 1	0	2	0	0	1	0	3	3	
litter size 2	1	1	2	0	2	2	8	16	
litter size 3	0	1	1	0	1	0	3	9	
total	1	4	3	0	4	2	14	28	2.00
3-year-old									
litter size 1	0	0	1	0	0	0	1	1	
litter size 2	0	0	2	1	0	0	3	6	
litter size 3	0	0	0	1	0	0	1	3	
total	0	0	3	2	0	0	5	10	2.00

[a] One litter with 2 yearling offspring was first observed in 1981 and is included in these calculations.

Table 6. Minimum number of female grizzly bears present in the study population in northcentral Alaska, 1981-87.

	Minimum number of females in population								
		3-5 yrs old				≥6 yrs old			
			Change from previous year				Change from previous year		
Year	No. ≤2 yrs old[a]	No.	+	−	Net	No.	+	−	Net
1980	--[b]	--[c]				18[d]			
1981	--[b]	--[c]	--[c]	4	--[c]	20[d]	2	0	+2
1982	9-12	10	--[c]	5	--[c]	21	1	1	0
1983	6-8	9	1	2	-1	19	0	2	-2
1984	9-12	6	2	5	-3	20	3	2	+1
1985	8-11[e]	5	3	4	-1	19	3	4	-1
1986	7-8[e]	4	0	1	-1	18	1	2	-1
1987	9-10[e]	3	1	1	0	18	1	1	0
1988	--[b]	1-2	1-2	4	-2-3	20	3	1	+2

[a] No special effort was made to capture offspring of females until just prior to weaning; therefore, these figures are estimates based on sex ratios of captured offspring.

[b] Because cub production is so variable, no estimates were projected for years when observations were not made.

[c] Prior to 1982, production or survival was not observed; therefore, for bears less than 6 years of age, only known losses in these age categories are listed.

[d] Calculations of the number of adult females was based on those bears killed by hunters or captured during the study; therefore, figures for 1980-81 are likely underestimates because natural mortality is not accounted for. The probable number of adult females present during 1980-81 was more likely 21-24.

[e] Six adult females were not observed in 1985 (3) or 1986 (3 additional) but bred during the last year in which they were observed. It is very likely that these females produced offspring which these figures do not include.

Table 7. Mortality of grizzly bears in Alaska Range study area, 1981-87.

Bear No.[a]	Sex[b]	Age[c]	Date of initial capture	Date of death	Location	Cause of death
UM	F	3.5	--	5/16/81	Dry Creek	Hunter kill
UM	M	6.5	--	5/18/81	Buchanan Creek	Hunter kill
1301	M	6.5	5/18/81	5/18/81	Buchanan Creek	Capture mortality
UM	M	2.5	--	5/23/81	Wood River	Hunter kill
UM	M	3.5	--	5/25/81	W. Fk. Little Delta	Hunter kill
UM	M	2.5	--	9/4/81	Wood River	Hunter kill
UM	F	2.5	--	9/6/81	Iowa Ridge[d]	Hunter kill
UM	M	12.5	--	9/7/81	Wood River[d]	Hunter kill
UM	M	2.5	--	9/12/81	W. Fk. Little Delta[d]	Hunter kill
UM	F	3.5	--	9/28/81	Wood River[d]	Hunter kill
UM	M	7.5	--	10/2/81	E. Fk. Little Delta	Hunter kill
UM	M	Unk	--	10/8/81	Wood River[d]	Hunter kill
UM	F	5.5	--	10/9/81	Wood River[d]	Hunter kill
UM	M	8.5	--	10/17/81	Gold King	Hunter kill
UM	M	10.5	--	5/22/82	Gold King	Hunter kill
1319	M	Cub	6/8/82	6/18-7/2/82	W. Fk. Little Delta	Unk, offspring of 1318
UM	Unk	1.5	7/8/82	7/8/82	E. Fk. Little Delta	Capture mortality, offspring of 1327
1312	F	Cub	5/26/82	8/5-27/82	Molybdenum Ridge	Unk, offspring of 1311
1313	F	Cub	5/26/82	8/5-27/82	Molybdenum Ridge	Unk, offspring of 1311
1328	F	1.5	7/8/82	8/27-9/23/82	E. Fk. Little Delta	Unk, offspring of 1327
UM	F	5.5	--	9/15/82	W. Fk. Little Delta	Hunter kill
UM	M	2.5	--	9/15/82	Dry Creek	Hunter kill
1305	F	25.5	6/19/81	9/15/82	Dry Creek	Hunter kill
1314	M	6.5	5/27/82	9/15/82	Little Delta River	Hunter kill
UM	F	11.5	--	9/17/82	E. Fk. Little Delta	Hunter kill
1332	F	6.5	7/12/82	Winter 82/83	Buchanan Creek	Unk, den mortality
UM	F	4.5	--	5/1/83	Trident Glacier	Hunter kill

Table 7. Continued.

Bear No.[a]	Sex[b]	Age[c]	Date of initial capture	Date of death	Location	Cause of death
1329	F	14.5	7/9/82	5/15/83	Buchanan Creek	Killed and eaten by 1315M
1338	M	6.5	5/20/83	5/20/83	Molybdenum Ridge	Capture mortality
UM	F	5.5	--	5/24/83	W. Fk. Little Delta	Hunter kill
1347	M	6.5	5/31/83	5/31/83	Wood River	Capture mortality
UM	Unk	Cub	--	6/83	Delta Creek	Unk, offspring 1320
UM	Unk	1.5	--	5/23-8/21/83	Little Delta River	Unk, offspring 1341
UM	F	14.5	--	9/16/83	Kansas Creek	Hunter kill
UM	M	7.5	--	9/19/83	Little Delta River/ Tenmile Creek	Hunter kill
1342	M	2.5	5/24/83	10/83	Wood River	Nonsport illegal kill
1315	M	15.5	6/4/82	5/17/84	Delta Creek	Capture mortality
1306	M	4.5	5/24/82	5/20/84	W. Fk. Little Delta	Hunter kill
1356	M	3.5	6/30/83	5/20/84	Gerstle River	Hunter kill
1333	F	18.5	7/12/82	5/22/84	E Fk Little Delta	Hunter kill
1352	F	15.5	6/27/83	5/30/84	W Fk Little Delta	Hunter kill
1327	F	18.5	7/8/82	6/23/84	E Fk Little Delta	Capture mortality?
3UM	Unk	Cub	--	6/23/84	E Fk Little Delta	Unk, offspring of 1327
UM	Unk	Cub	--	6/84	Wood River	Unk, offspring of 1345
UM	Unk	2.5	--	8-9/84	Dry Creek	Unk, offspring of 1351
UM	F	Unk	--	9/2/84	Delta Creek	Hunter kill
1353	M	2.5	6/27/83	9/4/84	W Fk Little Delta	Hunter kill
UM	M	3.5	--	9/6/84	Dry Creek	Hunter kill
1344	M	3.5	5/24/83	9/7/84	Dry Creek	Hunter kill
1325	M	2.5	6/10/82	9/9/84	Gold King Creek	Defense of life and property kill
1335	F	3.5	7/13/82	9/14/84	E Fk Little Delta	Hunter kill
1309	M	10.5	5/25/82	9/15/84	Gold King	Hunter kill
UM	F	17.5	--	10/7/84	W Fk Little Delta	Hunter kill

Table 7. Continued.

Bear No.[a]	Sex[b]	Age[c]	Date of initial capture	Date of death	Location	Cause of death
3UM	Unk	Cub	--	5/85	Hayes Glacier	Unk, offspring of 1320
UM	Unk	1.5	--	5/12/85-5/15/86	Dry Creek	Unk, offspring of 1308
1360	F	10.5	5/28/85	5/28/85	Snow Mtn Gulch	Capture mortality
UM	Unk	Cub	--	5/23-6/5/85	Mystic Creek	Unk, offspring of 1303
UM	Unk	1.5	--	5/23-7/22/85	Upper Wood River	Unk, offspring of 1345
1364	M	Cub	--	6/14-24/85	Mystic Creek	Unk, offspring of 1303
UM	Unk	Cub	--	6/18-27/85	Buchanan Creek	Unk, offspring of 1326
1317	F	6.5	6/8/82	9/85	Wood R./Yanert R.	Illegal kill?[g]
1355	M	5.5	6/30/83	9/13/85	Iowa Ridge	Hunter kill
1378	F	2.5	--	5/25/86	Delta Creek	Hunter kill, offspring of 1311
1326	F	8.5	6/18/82	5/27/86	O'Brien Creek	Hunter kill
1358	M	15.5	5/18/84	5/31/86	Delta Creek	Hunter kill
1368	F	2.5	5/19/86	5/31/86	Bonnifield Creek	Defense of life or property kill, offspring of 1348
1367	M	2.5	5/19/86	6/28/86	Bonnifield Creek	Defense of life or property kill, offspring of 1348
UM	M	Unk	--	9/2/86	Wood River	Hunter kill
1373[e]	M	7.5[f]	5/20/86	9/2/86	McGinnis Creek	Hunter kill
UM	M	2.5[f]	--	9/3/86	W. Fk. Little Delta	Hunter kill, offspring of 1308?
1371	M	2.5	5/20/86	9/7/86	Little Delta River	Hunter kill, offspring of 1341
1357[e]	M	4.5	5/15/84	9/23/86	Tatlanika River	Hunter kill, offspring of 1351
UM	Unk	1.5	--	fall 1986	Dry Creek	Unk, offspring of 1321

Table 7. Continued.

Bear No.[a]	Sex[b]	Age[c]	Date of initial capture	Date of death	Location	Cause of death
UM	Unk	1.5	--	5/20/87-7/3/87	E. Hayes Creek	Unk, offspring of 1331
UM	Unk	Cub	--	7/3/87-8/30/87	Hayes Glacier	Unk, offspring of 1320
UM	M		--	5/9/87	Slate Creek	Hunter kill
1370	F	3.5	5/20/86	5/20/87	Buchanan Creek	Capture mortality, offspring of 1341
1349[e]	M	22.5	6/2/83	5/22/87	Coal Creek (Healy)	Hunter kill
1369[e]	M	3.5	5/19/86	6/26/87	Lignite	Defense of life or property kill, offspring of 1348
UM	F	2.5	--	9/2/87	Delta Creek	Hunter kill, offspring of 1374?
UM	M	2.5	--	9/2/87	Wood River	Hunter kill
UM	M	8.5	--	9/2/87	Wood River	Hunter kill
UM	M	17.5	--	9/7/87	Virginia Creek	Hunter kill
1381	M	2.5	5/21/87	9/8/87	Dry Creek	Hunter kill
1351	F	18.5	6/23/83	9/11/87	Slide Creek	Hunter kill

[a] UM designates an unmarked bear.
[b] M, male; F, female; Unk, unknown sex.
[c] Age at death; Unk denotes unknown age.
[d] Hunter kills with location only listed as Wood River were counted in the study area.
[e] Killed outside study area.
[f] Estimate.
[g] Bear killed in September 1985, but not reported or sealed.

Table 8. Grizzly bear harvest[a] within the study area, 1961-87.

Year	Drainage of reported harvest				Total
	Delta Creek	Little Delta River	Dry Creek	Wood River[b]	
1961	0	2	2	3	7
1962	0	2	1	1	4
1963	0	1	1	5	7
1964	3	3	1	2	9
1965	0	0	1	1	2
1966	3	5	3	3	14
1967	0	1	0	0	1
1968	1	1	1	1	4
1969	0	1	0	1	2
1970	1	0	0	1	2
1971	0	1	0	1	2
1972	0	1	0	0	1
1973	1	1	1	5	8
1974	1	0	1	4	6
1975	1	0	0	1	2
1976	0	0	0	1	1
1977	1	1	2	1	5
1978	0	0	1	2	3
1979	1	3	0	6	10
1980	1	4	1	3	9
1981	0	5	1	7	13
1982	0	3[c]	2[c]	1[d]	6
1983	2	2	0	2[e]	6
1984	1	6[e]	2[e]	1[f]	11
1985	0	1[f]	0	1[g]	2
1986	2[g]	3[g]	0	3	8
1987	1	1	2[h]	3	7
Totals	20	48	23	61	152

[a] Includes hunter harvest, bears killed in defense of life or property, and bears killed illegally by hunters.

[b] The study area does not include the entire Wood River drainage. However, because many harvest records do not record specific portions of the drainage, all harvest records that designated Wood River as the location of kill are included.

[c] Single, marked bears were killed by hunters in the Little Delta River and Dry Creek drainages.

[d] One marked bear was killed illegally in the Wood River drainage in 1983.

[e] Seven marked bears (5 in drainages of the Little Delta River, 1 in Dry Creek, and 1 in Wood River) were killed by hunters in the study area during 1984; 1 was killed in defense of life or property along Gold King Creek.

[f] Both bears killed in 1985 were marked; one may have been taken illegally, either on the upper Wood River or Yanert River drainages.

[g] Six marked bears were killed in 1986; 4 marked bears were taken by hunters (2 in Delta Creek and 2 in the Little Delta River) and 2 were taken in defense of life or property in the Wood River drainage.

[h] Two marked bears were killed by hunters in Dry Creek during 1987.

Table 9. Human-caused mortality and mortality rates for a grizzly bear population in the northcentral Alaska Range, 1981-87.[a]

Year	Human-caused mortalities	Minimum population of all age classes		Minimum population ≥2 yrs of age		Adult females[b] ≥6 yrs of age		
		n	Mortality rate (%)	n	Mortality rate (%)	n	Deaths	Mortality rate (%)
1981	10.9	65.6	16.6	50.8	21.5	19.2	0	0
1982	5.2	67.7	7.2	46.3	11.2	20.2	2.0	9.9
1983	5.5	59.4	9.3	49.3	11.2	19.2	1.8	14.6
1984	12.4	62.2	19.9	48.3	25.7	18.9	4.0	21.2
1985	2.8	55.5	5.0	34.6	8.1	17.1	1.8	10.5
1986	5.7	49.5	11.5	40.5	14.1	16.3	1.0	6.1
1987	5.8	56.7	10.2	31.4	18.5	17.9	1.0	5.6
$\bar{x}$	6.9	59.5	11.6	43.0	16.0	18.4	1.7	9.0

[a] Human-caused mortality includes deaths from hunter harvest, defense of life or property, capture-related causes, and illegal take.

To account for those bears whose home ranges extend beyond the study area boundaries, the proportion of each home range or estimated home range outside the study area was estimated. These individual fractional home ranges were subtracted from appropriate mortality and population figures to more accurately reflect the numbers of bears included in each category. Note that mortality rates are based upon observed minimum populations, which do not include the 10-15 bears we estimate as present in the population but not captured or killed.

[b] Mortality of adult females is included here to provide perspective with changes in mortality rates and minimum population size. The only 2 cases of natural mortality of adult females were observed in 1983 and are included in calculations of adult female mortality rates for 1983 but not in human-caused mortality rates.

Table 10. Movement of young-age bears subsequent to weaning, Alaska Range, 1983-87.

Bear No. and sex	Maternal female No.	Age when weaned	Age/year during movement	Movement pattern
1306 M	1305	2.5	2.5/1982	Within maternal home range (MHR)
			3.5/1983	Within MHR
			4.5/1984	Killed by hunter 5/20/84 in MHR
1307 M	1305	2.5	2.5/1982	Within MHR
			3.5/1983	Within MHR
			4.5/1984	Sighted once within 15 km of MHR
			5.5/1985	Moved 12 km NW of MHR
			6.5/1986	Home range includes MHR
			7.5/1987	No radio contact
1372 M	1311	2.5	2.5/1986	Within MHR
			3.5/1987	Moved 40 km WNW of MHR, shed collar?
1378 F	1311	2.5	2.5/1986	Killed by hunter 5/25/86 prior to weaning
1344 M	1321	3.5	3.5/1984	Moved 44 km SE of MHR between 5/15 and 6/4/84, remained there through 6/23; killed in MHR by hunter 9/7/84
1379 F	1321	2.5	2.5/1987	Within MHR
1381 M	1321	2.5	2.5/1987	Killed by hunter 9/8/87 in MHR
1336 F	1322	3.5	3.5/1984	Within MHR
			4.5/1985	Within MHR, bred
			5.5/1986	Within MHR, collar nonfunctional
			6.5/1987	Within MHR, with 2 cubs
1324 F	1323	2.5	--/1984	Not radio-collared, status unknown
1325 M	1323	2.5	2.5/1984	Within MHR; killed in defense of life or property 9/9/84
1330 M	1329	2.5[a]	2.5/1983	Within MHR
			3.5/1984	Moved outside MHR?; no radio contact
			4.5/1985	No radio contact
			5.5/1986	No radio contact

Table 10. Continued.

Bear No. and sex	Maternal female No.	Age when weaned	Age/year during movement	Movement pattern
1334 M	1333	3.5	3.5/1984	Moved 48 km to SE between 6/4 and 6/25/84
			4.5/1985	No radio contact
			5.5/1986	No radio contact
			6.5/1987	No radio contact
1335 F	1333	3.5	3.5/1984	Killed by hunter 9/14/84 in MHR
1370 F	1341	2.5	2.5/1986	Within MHR
			3.5/1987	Within MHR; capture mortality
1371 M	1341	2.5	2.5/1986	Killed by hunter 9/7/86 in MHR
1367 M	1348	2.5	2.5/1986	Killed in defense of life or property 6/28/86 in MHR
1368 F	1348	2.5	2.5/1986	Killed in defense of life or property 5/31/86 in MHR
1369 M	1348	2.5	2.5/1986	Within MHR
			3.5/1987	Killed in defense of life or property 6/26/87 48 km WSW of MHR
1357 M	1351	3.5	3.5/1985	Moved 44 km NNW of MHR by 12/3/85
			4.5/1986	Killed by hunter 9/23/86 46 km WNW MHR
1361 F	1351	3.5	3.5/1985	Within MHR
			4.5/1986	Within MHR
			5.5/1987	Shed collar in den
1353 M	1352	2.5[b]	2.5/1984	Killed by hunter 9/4/84 in MHR
1354 F	1352	2.5[b]	2.5/1984	Not radio-collared, status unknown
1359 M	1360	3.5[c]	3.5/1985	Within MHR
			4.5/1986	Moved 62 km SE of MHR, shed collar
1363 M	1360	3.5[c]	3.5/1985	Within MHR
			4.5/1986	Shed collar between 4/28 and 5/16/86 within MHR

Table 10. Continued.

Bear No. and sex	Maternal female No.	Age when weaned	Age/year during movement	Movement pattern
1355 M	Unk	Unk	3.5/1983	Within established home range
			4.5/1984	Within established home range
			5.5/1985	Killed by hunter 9/13/85 12 km N of home range
1356 M	Unk	Unk	3.5/1984	Moved 74 km ESE of den area between 4/27 and 5/20/84 when killed by hunter
1302 F	Unk	2.5-3.5[d]	3.5/1981	Within established home range
			4.5-7.5	Shed collar 8/81, no contact until 1986 recapture
			8.5/1986	Within established home range
			9.5/1987	Within established home range

[a] Orphaned when 1329 was killed and eaten by No. 1315, adult male.

[b] Orphaned when 1352 was killed by hunter 5/30/84.

[c] Orphaned when 1360 died during capture.

[d] Captured as 3.5-year-old in 1981.

Appendix A. Physical attributes[a] of grizzly bears captured in the northcentral Alaska Range, 1981-87.

Bear No.	Date	Sex	Age (yr)[b]	Measured weight	Total length	Shoulder height	Hind foot	Neck	Girth	Body length	Head width	Head length	Left upper canine[c]	Left lower canine[c]
1301	5/18/81	M	6.5	120	180	119	31	61	114	101	21.0	36.8	3.4	3.0
1302	5/19/81	F	3.5	75	165	102	26	55	100	90	16.7	30.5	3.0	2.7
	6/12/86	F	8.5	114	180	--	--	61	106	--	19.2	33.1	--	--
1303	6/17/81	F	2.5	57	122	87	23	53	89	78	15.1	27.7	2.5	2.7
	6/27/83	F	4.5	82	159	97	26	55	91	79	18.4	32.3	3.0	2.9
	6/14/85	F	6.5	73	--	--	--	47	85	--	18.8	32.2	--	--
1304	6/19/81	M	5.5	136	196	121	30	63	108	109	20.0	36.0	3.9	3.5
	5/21/87	M	11.5	255	205	--	--	80	132	--	24.0	39.7	--	--
1305	6/19/81	F	24.5	114	174	103	28	60	100	96	20.1	32.6	3.0b	3.3b
1306	5/24/82	M	2.5	44	131	85	26	44	73	76	15.1	29.6	2.7	2.8
1307	5/24/82	M	2.5	44	148	84	28	46	74	83	15.4	27.3	2.6	2.5
	6/17/85	M	5.5	114[d]	--	--	--	55	94	--	19.2	34.8	--	--
1308	5/25/82	F	6.5	111	186	103	32	63	100	101	20.2	33.1	3.0	2.2b
	6/20/84	F	8.5	120	--	--	--	64	116	--	20.8	34.1	--	--
	6/8/87	F	11.5	123	183	--	--	56	106	--	21.5	34.9	--	--
1309	5/25/82	M	8.5	318[d]	238	150	36	89	152	128	25.0	39.1	4.0	3.5
1310	5/25/82	M	13.5	250[d]	--	--	--	--	--	--	--	--	b	--
	6/20/84	M	15.5	255	--	--	--	74	129	--	24.6	39.3	--	--
	5/21/87	M	18.5	264	212	--	--	80	143	--	25.5	39.1	--	--
1311	5/26/82	F	12.5	120	190	107	30	63	113	105	21.8	33.8	3.0	2.6
	6/21/84	F	14.5	116	--	--	--	59	100	--	20.0	34.2	--	--
	6/8/87	F	17.5	123[e]	188	--	--	62	115	--	21.2	34.1	--	--
1312	5/26/82	F	0.5	12	81	48	15	28	43	42	10.2	16.5	m	m
1313	5/26/82	F	0.5	12	76	50	15	30	48	45	11.1	16.8	m	m
1314	5/27/82	M	6.5	116	191	114	33	61	105	99	18.5	34.8	3.6	3.3
1315	6/4/82	M	13.5	273	197	126	36	96	154	122	26.4	38.2	3.5	3.3
	5/17/84	M	15.5	295	--	--	--	97	139	--	26.8	37.5	--	--
1316	6/7/82	M	11.5	236	211	133	33	81	133	135	24.0	40.7	3.8	3.7

Appendix A. Continued.

Bear No.	Date	Sex	Age (yr)[b]	Measured weight	Total length	Shoulder height	Hind foot	Neck	Girth	Body length	Head width	Head length	Left upper canine[c]	Left lower canine[c]
1317	6/8/82	F	3.5	36	142	91	24	38	62	72	14.2	27.9	2.9	2.9
	5/16/84	F	5.5	55	--	--	--	45	89	--	16.2	29.7	--	--
	5/23/85	F	6.5	59	--	--	--	43	77	--	16.4	30.3	--	--
1318	6/8/82	F	13.5	104	188	113	31	57		113	19.5	33.5	3.1	2.8
	6/22/84	F	15.5	118[d]	--	--	--	59	105	--	19.8	33.5	--	--
	6/2/87	F	18.5	105[e]	--	--	--	--	--	--	--	--	--	--
1319	6/8/82	M	0.5	12	85	52	14	26	34	44	10.8	17.2	d	d
1320	6/8/82	F	17.5	102	181	110	29	65	103	100	21.0	33.1	2.9w	2.7w
	6/25/84	F	19.5	139	--	--	--	62	106	--	21.0	33.0	--	--
	6/12/87	F	22.5	114	173	--	--	58	106	--	21.7	33.4	--	--
1321	6/9/82	F	16.5	141	199	107	34	69	105	115	22.1	35.8	3.5	3.1
	5/17/83	F	17.5	127	178	91	30	69	109	112	21.9	36.0	2.4b	3.2
	7/22/85	F	19.5	218	--	--	--	63	121	--	22.1	35.6	--	--
1322	6/9/82	F	8.5	91	169	100	29	62	97	97	18.9	32.8	3.2	3.0
1323	6/10/82	F	11.5	95	171	106	32	57	98	93	20.0	33.5	3.2	2.9
	6/29/84	F	13.5	132	--	--	--	61	109	--	20.9	33.6	--	--
1324	6/10/82	F	0.5	12	77	49	16	29	47	39	10.6	17.5	m	m
1325	6/10/82	M	0.5	12	86	54	15	26	48	42	11.5	18.0	m	m
	5/15/84	M	2.5	67	--	--	--	46	80	--	16.5	30.1	--	--
1326	6/18/82	F	4.5	93	172	102	27	54	88	98	17.9	31.4	3.1	2.9
	6/21/84	F	6.5	109	--	--	--	58	92	--	18.9	32.8	--	--
	6/27/85	F	7.5	111	--	--	--	52	95	--	20.1	33.3	--	--
1327	7/8/82	F	16.5	127	175	106	29	62	100	117	20.9	32.9	2.3	2.8
	6/23/84	F	18.5	125	--	--	--	61	109	--	21.0	33.5	--	--
1328	7/8/82	F	1.5	43	122	83	26	41	75	68	14.5	25.7	2.0	1.7
1329	7/9/82	F	13.5	120	186	112	30	59	106	104	19.8	34.2	3.3	3.0
1330	7/9/82	M	1.5	48	130	83	27	45	75	67	14.4	26.2	1.4	1.8
	6/28/84	M	3.5	102	--	--	--	50	99	--	17.5	32.9	--	--

Appendix A. Continued.

Bear No.	Date	Sex	Age (yr)[b]	Measured weight	Total length	Shoulder height	Hind foot	Neck	Girth	Body length	Head width	Head length	Left upper canine[c]	Left lower canine[c]
1331	7/10/82	F	4.5	77	161	102	28	50	96	98	17.0	30.5	--	--
	5/20/87	F	9.5	114[e]	175	--	--	56	104	--	19.8	33.4	--	--
1332	7/12/82	F	5.5	104	173	100	32	54	92	97	18.0	33.4	3.1	2.9
1333	7/13/82	F	16.5	141	175	112	33	65	117	124	21.0	34.0	3.1	2.6
1334	7/13/82	M	1.5	49	129	86	27	42	87	72	14.4	24.9	1.3	1.6
	6/27/84	M	3.5	107	--	--	--	52	104	--	18.1	31.3	--	--
1335	7/13/82	F	1.5	38	127	77	24	40	76	73	13.5	24.0	1.6	1.8
	6/25/84	F	3.5	80	--	--	--	47	90	--	16.8	30.0	--	--
1336	5/16/83	F	2.5	47	141	86	27	56	90	86	14.9	28.2	2.6	2.4
	6/26/84	F	3.5	89	--	--	--	49	101	--	16.9	31.7	--	--
	6/17/85	F	4.5	102	--	--	--	61	102	--	18.3	33.3	--	--
	5/15/87	F	6.5	109	160	--	--	67	103	--	18.8	34.6	--	--
1337	5/18/83	M	20.5	289	210	122	36	98	151	135	26.6	39.8	4.0b	b
1338	5/20/83	M	6.5	111	175	89	29	35	107	101	19.9	34.8	3.5	3.4
1339	5/20/83	M	6.5	120	174	103	29	37	109	100	19.7	34.4	3.6	3.1
	5/17/84	M	7.5	168	--	--	--	60	102	--	20.0	35.0	--	--
1340	5/23/83	F	3.5	71	159	86	27	58	95	91	15.7	30.2	3.2	3.2
	5/19/84	F	4.5	91[d]	--	--	--	51	95	--	17.3	31.8	--	--
	6/27/85	F	5.5	100	--	--	--	54	94	--	18.5	33.6	--	--
1341	5/23/83	F	10.5	107	171	110	31	63	125	110	20.7	33.2	3.2	3.1
	6/13/85	F	12.5	107	--	--	--	57	104	--	--	--	--	--
1342	5/24/83	M	2.5	49	133	85	27	52	91	67	15.6	27.2	2.5	2.8
1343	5/24/83	M	2.5	43	139	85	26	48	88	69	15.5	27.1	3.0	3.0
1344	5/24/83	M	2.5	56	151	79	--	49	93	--	14.9	28.5	2.5	2.5
	6/23/84	M	3.5	123	--	--	--	55	105	--	18.5	33.2	--	--
1345	5/24/83	F	8.5	--[d]	175	99	30	65	110	98	18.3	33.0	3.1	2.8
	5/23/85	F	10.5	105[d]	--	--	--	56	103	--	18.6	33.6	--	--
1346	5/25/83	M	5.5	114	145	98	30	71	110	94	19.7	25.1	3.2	3.0

Appendix A. Continued.

Bear No.	Date	Sex	Age (yr)[b]	Measured weight	Total length	Shoulder height	Hind foot	Neck	Girth	Body length	Head width	Head length	Left upper canine[c]	Left lower canine[c]
1347	5/31/83	M	6.5	189	188	119	23	71	144	114	22.0	37.5	3.7	3.4
1348	5/31/83	F	12.5	--	175	107	20	72	123	110	20.0	37.6	3.2	2.9
	5/16/86	F	15.5	116	180	--	--	58	100	--	20.2	32.8	--	--
1349	6/2/83	M	18.5	264	217	124	33	93	145	125	25.6	35.5	4.0b	3.4
1350	6/2/83	M	8.5	202	201	119	30	77	118	118	22.5	--	3.7	3.1
	6/12/86	M	11.5	205[d]	207	--	--	76	--	--	23.7	38.2	--	--
1351	6/23/83	F	14.5	114[d]	181	91	23	69	114	116	21.0	38.0	3.3	3.2
	6/10/85	F	16.5	111	--	--	--	56	98	--	21.3	35.5	--	--
	5/19/87	F	18.5	130	178	--	--	64	110	--	22.0	35.5	--	--
1352	6/27/83	F	14.5	111	175	102	29	59	103	108	19.5	34.1	3.1	2.8
1353	6/27/83	M	1.5	27	107	75	20	34	54	56	12.4	21.9	r	r
1354	6/27/83	F	1.5	12	87	60	17	24	41	43	11.0	18.4	r	r
1355	6/30/83	M	3.5	60	138	98	27	45	77	77	15.2	27.5	--	--
	6/3/85	M	5.5	70	--	--	--	49	84	--	17.4	31.6	--	--
1356	6/30/83	M	2.5	50	--	--	24	46	69	--	14.9	25.2	--	--
1357	5/15/84	M	2.5	63	--	--	--	53	90	--	14.7	27.5	--	--
	6/24/85	M	3.5	93[d]	--	--	--	50	88	--	18.5	31.1	--	--
1358	5/18/84	M	13.5	205[d]	--	--	--	86	--	--	--	38.4	--	--
	5/20/86	M	15.5	236	216	--	--	79	143	--	24.2	38.5	--	--
1359	5/28/85	M	3.5	61	--	--	--	44	--	--	14.4	29.1	--	--
1360	5/28/85	F	10.5	95	--	--	--	--	89	--	19.5	34.4	--	--
1361	5/28/85	F	3.5	63	--	--	--	44	81	--	17.3	30.0	--	--
	5/19/86	F	4.5	100	155	--	--	51	100	--	18.6	32.1	--	--
1362	6/5/85	F	6.5	--	--	--	--	--	--	--	--	--	--	--
	6/24/85	F	6.5	114	--	--	--	55	98	--	19.2	33.1	--	--
1363	6/5/85	M	3.5	55	128	--	--	50	86	--	16.0	28.3	--	--
1364	6/14/85	M	0.5	7	69	--	--	20	37	--	9.8	15.6	--	--
1365	6/19/85	M	5.5	118	--	--	--	57	97	--	18.9	34.9	--	--

Appendix A. Continued.

Bear No.	Date	Sex	Age (yr)[b]	Measured weight	Total length	Shoulder height	Hind foot	Neck	Girth	Body length	Head width	Head length	Left upper canine[c]	Left lower canine[c]
1366	7/22/85	M	8.5	234	--	--	--	83	130	--	23.2	36.3	--	--
1367	5/19/86	M	2.5	61	138	--	--	48	91	--	15.5	28.8	--	--
1368	5/19/86	F	2.5	48	140	--	--	51	82	--	15.0	27.0	--	--
1369	5/19/86	M	2.5	68	158	--	--	56	98	--	16.4	30.2	--	--
1370	5/20/86	F	2.5	47	136	--	--	41	81	--	14.9	25.5	--	--
	5/20/87	F	3.5	69	136	--	--	46	92	--	16.3	29.0	--	--
1371	5/20/86	M	2.5	57	150	--	--	51	83	--	16.5	28.2	--	--
1372	5/20/86	M	2.5	72	--	--	--	--	--	--	--	--	--	--
1373	5/21/86	M	7.5	193	190	--	--	69	119	--	22.6	37.1	--	--
1374	5/21/86	F	6.5	106	171	--	--	64	99	--	19.8	35.2	--	--
1375	6/13/86	M	6.5	186	208	--	--	67	117	--	21.0	36.6	--	--
1376	6/13/86	F	14.5[d]	130	171	--	--	64	103	--	21.8	34.2	--	--
1377	8/28/86	M	3.5[d]	132[d]	174	--	--	58	98	--	17.3	31.6	--	--
1378	5/20/86	F	2.5	130[d]	--	--	--	--	--	--	--	--	--	--
1379	5/15/87	F	2.5[e]	67	--	--	--	52	96	--	15.4	17.3	--	--
1380	5/18/87	M	2.5	65	153	--	--	49	84	--	16.6	30.3	--	--
1381	5/21/87	M	2.5[e]	73	158	--	--	45	83	--	16.3	29.6	--	--
1383	6/12/87	M	2.5[e]	77	146	--	--	52	88	--	17.4	30.9	--	--

[a] Weights in kg; measurements in cm.

[b] Age determined by cementum layering.

[c] Designations of tooth characteristics: b=broken, w=heavily worn; r=erupting; m=deciduous milk teeth.

[d] Estimate after close examination.

Appendix B. Grizzly bear captures, recaptures, and capture-related mortalities, Alaska Range, 1981-87.

Year	Bear No.		Total no. captured during year	Cumulative no. total captures	Capture mortalities		Percentage capture mortality	
					Yearly mortality			
	New captures	Recaptures			Total	Bear No.	Year	Cumulative
1981	1301-1305		5	5	1	1301	20	20
1982	1306-1335		31[a]	36[a]	1	UM yrlg[a]	3	6
1983	1336-1356	1303, 1321	23	59	2	1338, 1347	9	7
1984	1357, 1358	1308, 1310, 1311, 1315, 1317, 1318, 1320, 1323, 1325, 1326, 1327, 1330, 1334, 1335, 1336, 1339, 1340, 1344	20	79	2(5)	1315, 1327[b], 3UM[b]	10	8
1985	1359-1366	1303, 1307, 1317, 1321, 1326, 1336, 1340, 1341, 1345, 1351, 1355, 1357	20	99	1	1360	5	7
1986	1367-1378	1302, 1348, 1350, 1358, 1361	16	115	0	--	0	6

Appendix B. Continued.

Year	Bear No.		Total no. captured during year	Cumulative no. total captures	Capture mortalities		Percentage capture mortality	
					Yearly mortality			
	New captures	Recaptures			Total	Bear No.	Year	Cumulative
1987	1379-1383[c]	1304, 1308, 1310, 1311, 1318, 1320, 1331, 1336, 1351	13	128	1	1370	8	6

[a] One unmarked (UM) yearling of female No. 1327 was not located after it was darted during a capture attempt and was assumed to have died.

[b] No. 1327 was found dead at the capture site and may have been killed by another bear before she recovered from immobilization drugs. We assume that her 3 cubs died without her care.

[c] No. 1382 was not used.

Appendix C. Current status of marked bears in the northcentral Alaska Range, 1987.

Bear No.	Sex	Initial capture Age	Initial capture Date	Date last location	Status as of fall 1987
1301	M	6.5	5/18/81	5/18/81	Dead, capture mortality
1302	F	3.5	5/19/81	9/19/87	Alive, functional collar
1303	F	2.5	6/17/81	7/22/85	Unk, shed collar by 12/3/85
1304	M	5.5	6/19/81	8/30/87	Alive, functional collar
1305	F	24.5	6/19/81	9/15/82	Dead, hunter kill
1306	M	2.5	5/24/82	5/20/84	Dead, hunter kill
1307	M	2.5	5/24/82	6/13/86	Alive? Not located during 1987
1308	F	6.5	5/25/82	9/19/87	Alive, functional collar; with 2 cubs
1309	M	8.5	5/25/82	9/15/84	Dead, hunter kill
1310	M	13.5	5/25/82	8/30/87	Alive, functional collar
1311	F	12.5	5/26/82	8/30/87	Alive, functional collar; with 2 cubs
1312	F	0.5	5/26/82	8/5/82	Dead, disappeared between 8/5 and 8/27/82
1313	F	0.5	5/26/82	8/5/82	Dead, disappeared between 8/5 and 8/27/82
1314	M	6.5	5/27/82	9/15/82	Dead, hunter kill
1315	M	13.5	6/4/82	5/17/84	Dead, capture mortality
1316	M	11.5	6/7/82	7/12/82	Unk, shed collar between 7/12 and 8/4/82
1317	F	3.5	6/8/82	7/22/85	Probable illegal kill
1318	F	13.5	6/8/82	9/19/87	Alive, collar functional; with 2 2-yr-olds
1319	M	0.5	6/8/82	6/18/82	Dead, disappeared between 6/18 and 7/2/82
1320	F	17.5	6/8/82	9/19/87	Alive, collar functional; with 2 cubs
1321	F	16.5	6/8/82	9/19/87	Alive, collar functional
1322	F	8.5	6/9/82	4/27/84	Unk, probably alive, collar nonfunctional
1323	F	11.5	6/10/82	6/29/84	Unk, unbolted collar recovered
1324	F	0.5	6/10/82	5/16/84	Unk, never radio-collared before weaning
1325	M	0.5	6/10/82	9/9/84	Dead, killed in defense of life or property
1326	F	4.5	6/18/82	5/27/86	Dead, hunter kill
1327	F	16.5	7/8/82	6/23/84	Dead, capture-related mortality
1328	F	1.5	7/8/82	8/27/82	Dead, disappeared between 8/27 and 9/23/82
1329	F	13.5	7/9/82	5/15/83	Dead, killed and eaten by bear No. 1315M
1330	M	1.5	7/9/82	8/14/84	Unk, probably emigrated
1331	F	4.5	7/10/82	8/30/87	Alive, functional collar or possibly shed
1332	F	5.5	7/12/82	10/31/82	Dead, died in den, winter 82/83
1333	F	16.5	7/12/82	5/22/84	Dead, hunter kill
1334	M	1.5	7/13/82	6/27/84	Unk, probably emigrated
1335	F	1.5	7/13/82	9/14/84	Dead, hunter kill
1336	F	2.5	5/16/83	9/19/87	Alive, functional collar; with 2 cubs
1337	M	20.5	5/18/83	5/19/84	Unk, tore collar off between 5/19 and 6/4/84, probably dead?
1338	M	6.5	5/20/83	5/20/83	Dead, capture mortality
1339	M	6.5	5/20/83	6/4/84	Unk, shed collar between 6/4 and 9/10/84
1340	F	3.5	5/23/83	6/27/85	Unk, collar shed between 6/27/85 and 4/28/86
1341	F	10.5	5/23/83	9/19/87	Alive, functional collar
1342	M	2.5	5/24/83	6/27/83	Dead, illegal kill, snared fall 1983

Appendix C. Continued.

Bear No.	Sex	Initial capture Age	Initial capture Date	Date last location	Status as of fall 1987
1343	M	2.5	5/24/83	5/15/84	Unk, collar nonfunctional or emigrated?
1344	M	2.5	5/24/83	9/7/84	Dead, hunter kill
1345	F	8.5	5/24/83	9/19/87	Alive, functional collar; with 2 yearlings
1346	M	5.5	5/25/83	8/19/83	Unk, shed collar? between 5/25/83 and 8/19/83
1347	M	6.5	5/31/83	5/31/83	Dead, capture mortality
1348	F	12.5	5/31/83	9/19/87	Alive, functional collar; with 2 cubs
1349	M	18.5	6/2/83	5/22/87	Dead, hunter kill
1350	M	8.5	6/2/83	6/13/86	Alive, shed collar between 6/13/86 and 5/11/87
1351	F	14.5	6/23/83	9/11/87	Dead, hunter kill
1352	F	14.5	6/27/83	5/30/84	Dead, hunter kill
1353	M	1.5	6/27/83	9/4/84	Dead, hunter kill
1354	F	1.5	6/27/83	5/18/84	Unk, never radio-collared
1355	M	3.5	6/30/83	9/13/85	Dead, hunter kill
1356	M	2.5	6/30/83	5/20/84	Dead, hunter kill
1357	M	2.5	5/15/84	9/23/86	Dead, hunter kill
1358	M	12.5	5/18/84	5/31/86	Dead, hunter kill
1359	M	3.5	5/28/85	11/6/86	Unk, shed collar between 4/28/86 and 11/6/86
1360	F	10.5	5/28/85	5/28/85	Dead, capture mortality
1361	F	3.5	5/28/85	11/6/86	Unk, shed collar in den
1362	F	6.5	6/5/85	9/19/87	Alive, functional collar; with 2 yearlings
1363	M	3.5	6/5/85	4/28/86	Unk, shed collar between 4/28/86 and 5/16/86
1364	M	0.5	6/14/85	6/14/85	Dead, disappeared between 6/14/85 and 6/24/85
1365	M	5.5	6/19/85	7/28/86	Unk, not located in 1987
1366	M	8.5	7/22/85	12/3/85	Unk, shed collar
1367	M	2.5	5/19/86	6/28/86	Dead, killed in defense of life or property
1368	F	2.5	5/19/86	5/31/86	Dead, killed in defense of life or property
1369	M	2.5	5/19/86	6/26/87	Dead, killed in defense of life or property
1370	F	2.5	5/20/86	5/20/87	Dead, capture mortality
1371	M	2.5	5/20/86	9/7/86	Dead, hunter kill
1372	M	2.5	5/20/86	6/11/86	Unk, shed collar between 6/11/86 and 5/11/87
1373	M	7.5	5/21/86	9/2/86	Dead, hunter kill
1374	F	6.5	5/21/86	8/30/87	Alive, functional collar, no offspring
1375	M	6.5	6/13/86	9/19/87	Alive, functional collar
1376	F	14.5[a]	6/13/86	9/19/87	Alive, functional collar; with 2 cubs
1377	M	3.5[a]	8/28/86	3/25/87	Unk, shed collar between 3/25/87 and 8/30/87
1378	F	2.5	6/20/86	6/20/86	Dead, hunter kill
1379	F	2.5[a]	5/15/87	9/19/87	Alive, functional collar
1380	M	2.5	5/18/87	9/19/87	Alive, functional collar
1381	M	2.5[a]	5/21/87	9/8/87	Dead, hunter kill
1383	M	2.5[a]	6/12/87	9/19/87	Alive, functional collar

[a] Estimate.

Appendix D. Status summary of marked bears in the northcentral Alaska Range, fall 1987.

Dead	Alive, active collar	Shed or nonfunctional collar unknown status			Never collared
		Alive in the area?	Dispersed?	Dead?	
1301	1302	1303	1330	1337	1324
1305	1304	1307	1334		1354
1306	1308	1316	1343		
1309	1310	1322	1359		
1312	1311	1323	1363		
1313	1318	1339	1372		
1314	1320	1340	1377		
1315	1321	1346			
1317	1331	1350			
1319	1336	1365			
1325	1341	1366			
1326	1345	1374			
1327	1348				
1328	1362				
1329	1375				
1332	1376				
1333	1379				
1335	1380				
1338	1383				
1342					
1344					
1347					
1349					
1351					
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1358					
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1364					
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1370					
1371					
1373					
1378					
1381					

Appendix E. Status of maternal grizzly bears and their offspring in the northcentral Alaska Range, 1981-87.

Maternal female			Offspring			
Bear No.	Age at capture (yrs)	Present status	Bear No. and sex[a]	Year of birth	Age at weaning (yrs)	Present status
1303	2.5	Last observed 1985	1364 M	1985	--	Assumed dead 1985
			UM	1985	--	Assumed dead 1985
1305	24.5	Hunter kill 1982	1306 M	1980	2.5	Hunter kill 1984
			1307 M	1980	2.5	Last observed 1986
1308	6.5	Alive	UM	1984	--	Assumed dead 1985
			UM	1984	2.5	Probable hunter kill 1986
			UM	1987	--	With mother 1987
			UM	1987	--	With mother 1987
1311	12.5	Alive	1312 F	1982	--	Assumed dead 1982
			1313 F	1982	--	Assumed dead 1982
			1372 M	1984	2.5	Alive 1986
			1378 F	1984	2.5	Hunter kill 1986
			UM	1987	--	With mother 1987
			UM	1987	--	With mother 1987
1318	13.5	Alive	1319 M	1982	--	Assumed dead 1982
			1380 M	1985	--	With mother 1987
			UM	1985	--	With mother 1987
1320	17.5	Alive	UM	1983	--	Assumed dead 1983
			UM	1985	--	Assumed dead 1985
			UM	1985	--	Assumed dead 1985
			UM	1985	--	Assumed dead 1985
			UM	1987	--	Assumed dead 1987
			UM	1987	--	With mother 1987
1321	16.5	Alive	1342 M	1981	--	Illegal kill 1983
			1343 M	1981	3.5	Last observed 1984
			1344 M	1981	3.5	Hunter kill 1984
			UM	1985	--	Assumed dead 1986
			1379 F	1985	2.5	Alive 1987
			1381 M	1985	2.5	Hunter kill 1987
1322	8.5	Last observed 1984	1336 F	1981	3.5	Had cubs 1987
1323	11.5	Last observed 1984	1324 F	1982	2.5	Last observed 1984
			1325 M	1982	2.5	Killed DLP[b] 1984
1326	4.5	Hunter kill 1986	UM	1985	--	Assumed dead 1985
1327	16.5	Dead 1984	1328 F	1981	--	Assumed dead 1982
			UM	1981	--	Capture death 1982
			UM	1984	--	Assumed dead 1984
			UM	1984	--	Assumed dead 1984
			UM	1984	--	Assumed dead 1984
1329	13.5	Dead 1983	1330 M	1981	2.5[c]	Last observed 1984
1333	16.5	Hunter kill 1984	1334 M	1981	3.5	Last observed 1984
			1335 F	1981	3.5	Hunter kill 1984
1331	4.5	Alive	UM	1986	--	Assumed dead 1987

Appendix E. Continued.

Maternal Female			Offspring			
Bear No.	Age at capture (yrs)	Present status	Bear No. and sex[a]	Year of birth	Age at weaning (yrs)	Present status
1341	10.5	Alive	UM	1982	--	Assumed dead 1983
			1370 F	1984	2.5	Capture death 1987
			1371 M	1984	2.5	Hunter kill 1986
1345	8.5	Alive	UM	1984	--	Assumed dead 1984
			UM	1984	--	Assumed dead 1985
			UM	1986	--	With mother 1987
			UM	1986	--	With mother 1987
1348	12.5	Alive	1367 M	1984	2.5	Killed DLP 1986
			1368 F	1984	2.5	Killed DLP 1986
			1369 M	1984	2.5	Killed DLP 1987
			UM	1987	--	With mother 1987
			UM	1987	--	With mother 1987
1351	14.5	Hunter kill 1987	UM	1982	--	Assumed dead 1984
			1357 M	1982	3.5	Hunter kill 1986
			1361 F	1982	3.5	Last observed 1986
			UM	1986	1.5[d]	Not marked
			UM	1986	1.5[d]	Not marked
			UM	1986	1.5[d]	Not marked
1352	14.5	Hunter kill 1984	1353 M	1982	--	Hunter kill 1984
			1354 F	1982	--	Last observed 1984
1360	11.5	Dead 1985	1359 M	1982	--	Last observed 1986
			1363 M	1982	--	Last observed 1986
1362	6.5	Alive	UM	1986	--	With mother 1987
			UM	1986	--	With mother 1987
1374	6.5	Alive	UM	1985	--	Not marked; mother alone 8/87
			UM	1985	--	Not marked; mother alone 8/87
1376		Alive	UM	1987	--	With mother 1987
			UM	1987	--	With mother 1987

[a] Unmarked.

[b] Killed legally in defense of life or property.

[c] Orphaned when 1329 was killed and eaten by adult male 1315.

[d] Probably orphaned when 1351 was killed by hunter, fall 1987.