PROGRESS REPORT
1990 and 1991

Grizzly Bear Population Ecology in the Western Brooks Range, Alaska

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in cooperation with

U.S. National Park Service

October 1992

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SUMMARY

An intensive grizzly bear (*Ursus arctos horribilis*) research effort conducted during 1986-91 was designed to provide information on the role of unhunted productive population reservoirs in providing immigrants for adjacent populations. This central issue will be addressed using long-term data collections on changes in population structure and dynamics, productivity, mortality, movements, and fidelity to maternal home range. This grizzly bear population has been studied in the Utukok Uplands of the northwestern Brooks Range since 1977. Four hundred thirty-four captures of 225 individual bears have been made since the study began without capture-caused mortalities. Based on experience gained, a draft manual of capture procedures was prepared. During 1986-91 most captures were made to replace radio collars so that uninterrupted contact with individuals bears could be maintained. During 1990 and 1991, 100 captures included 58 recaptures, 31 initial captures that were offspring of radio-collared females, and 11 that were not offspring which were captured for the first time. Of the 83 bears that were originally captured during 1977-78, contact was maintained until at least 1986 for 21 bears and until the time of their deaths for another 25 bears. In addition, 16 bears have been monitored from the time they were first observed with their mothers; 11 of these have either produced their own cubs or been observed breeding. No pattern of emigration from the study area by adult females could be documented. An estimated annual mean of 41 adult females were present in the population during 1986-91, including 38 in 1990 and 37 in 1991. Mean litter size was 2.02 during both the 1986-91 ($\underline{n}$ = 58 litters) and 1977-85 periods ($\underline{n}$ = 48 litters); however, the observed production of cubs was 97 during the 9 years of the first period compared with 117 during the 6 years of the second period. The differences may be due to increased numbers of females or a decline in the age at first production of young. Variation in the rate of cub mortality was also observed; cub mortality rate was 44.1% during 1977-83,

60.4% during 1986-88, and 20.8% during 1989-91. Both the increase in total cub production and the decline in cub mortality may be related to increased availability of caribou as prey or carrion in the area. During 1989-91 genetic fingerprinting techniques were applied to blood and tissue samples collected from bears of both known and unknown familial relationships as a first step in measuring minimum effective viable population.

CONTENTS

I. BACKGROUND

During 1990 and 1991, research studies of the population ecology of grizzly bears (*Ursus arctos horribilis*) in the western Brooks Range of Alaska continued. The basic rationale and direction of the study remains the same as reported for the 1986-89 seasons and is included here from past reports for purposes of better understanding. This report describes progress made in data collection and updates the most important findings. References that have become available since 1986 will be included in the final report.

An understanding of the population biology of any species is crucial to maintenance and wise stewardship of that species, whether or not a particular population occurs in an area free from habitat destruction or heavy hunting pressure. Brown and grizzly bear populations throughout North America and the world have been particularly susceptible to loss of habitat and effects from human activities because of their low productive capacities, relatively sparse distribution, and wide-ranging movements.

Grizzly bears inhabiting Alaska's North Slope live at the northern limit of grizzly bear range. Winters are long and severe, summers short and cool, and the tundra vegetation is relatively unproductive. Bears have only 4 to 5 months to accumulate fat reserves for 7 to 8 months of hibernation. Study of bears in this area may reveal aspects of population dynamics that would be more difficult to analyze in more complex or diverse ecosystems.

The factors which affect the dynamics of the population in this study area are very likely related almost entirely to natural rather than human-related influences. In relative terms, human impact on this population of bears has been minimal, even compared with that which occurs in many national parks. Because of the remote and inaccessible nature of the area, no human-caused changes in habitat availability or composition have occurred. There are no roads or human developments in the study area, except for one unimproved airstrip (now unusable) and some seismic exploration trails that were used only during winter and that resulted in no discernible vegetative changes. Similarly, there has been little recorded human exploitation of wildlife populations within the area. There was only one record of a hunter-killed grizzly bear prior to 1985; since then, only 6 bears were killed by humans within the study area. No bears were known to have died from capture-related causes. Natural mortality of grizzly bears in the area is high enough so that this degree of human-caused mortality is negligible by comparison.

The Alaska Department of Fish and Game initiated a study of grizzly bears in the Utukok Uplands in 1977 as part of an assessment of natural resources for the National Petroleum Reserve-Alaska 105-C studies (Reynolds 1979). Grizzly bear population size and structure were described in 1978 after 2 years of an intensive capture and marking program. From 1979 to the present, we have continued to monitor marked animals in the area and have been able to maintain a reasonable sample of marked bears by recapturing bears in years when funds were available. We have collected data for 15 years on the movements, home ranges, survival, and reproduction of individual bears. During 1986, another period of intensive capture effort began that will be used for comparison with that which occurred during 1977 and 1978 (Reynolds 1980), and will provide additional information on the population dynamics of Brooks Range bears. The intensive capture effort and the monitoring of recently weaned young bears will provide insight into home range fidelity and how home ranges are established. This information will be helpful in determining how population reservoirs that occur in national parks influence grizzly bear abundance and population dynamics, both in and adjacent to these areas. Further, findings will address how management practices outside reservoirs may influence the populations inside reservoirs.

Natural history studies of grizzly bears in Alaska provide an adequate data base on some aspects of reproductive biology, food habits, habitat use, home range size, and management (Dean 1976, 1987; Reynolds 1976, 1980; Murie 1981; Miller and Ballard 1982; Miller and McAllister 1982; Miller 1984, 1987, 1990a,b; Reynolds and Hechtel 1984a,b, 1986; Reynolds and Boudreau, 1992). These studies, however, were largely descriptive and were of relatively short duration (2-3 years) or they described populations that were heavily harvested. Grizzly bears do not mature until 4 to 10 years of age, so observed (as opposed to extrapolated) measures of productivity, survival, and movement patterns must be collected over a 4- to 10-year period to be accurate and most useful (Craighead et al. 1974, 1976; Reynolds 1976; Reynolds and Hechtel 1984b; Bunnell and Tait 1980; Knight and Eberhardt 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.

Two problems that require long-term study and are important to managers of grizzly bear populations are: (1) how observed variations in productivity, survival, emigration, and immigration affect population increases or declines, and (2) whether population reservoirs exist and what effects increased mortality outside such reservoirs would have on the reservoir population. Population reservoirs are those populations characterized by high productivity or survival rates that provide immigrants to supplement adjacent populations; in other words, those populations that increase or remain stable even though emigration exceeds immigration. If reservoirs exist, it is important to determine if increased exploitation in adjacent areas constitutes compensatory or additive mortality in the reservoir population.

II. OBJECTIVES

1. Relate changes in grizzly bear population size and structure to long-term rates of, and variation in, productivity, survival, emigration, and immigration.

2. Determine the fidelity of grizzly bear offspring to their maternal home ranges.

3. Determine the relationship between fidelity to home range and productivity and survival.

4. Examine patterns of den selection by adult females in relation to production and survival of offspring.

III. STUDY AREA

The 5,200-km^2 study area lies in the mountains and foothills of the western Brooks Range. The approximate boundaries of the study area were: Archimedes Ridge (69°10'N latitude) on the north, the Kokolik River on the west, the crest of the Brooks Range on the south, and a line running from Thunder Mountain to the Utukok River (160°15'W longitude) on the east. The physiography of the southern one-fourth of the area is mountainous with elevations of about 600 m in river or creek valleys to 1,300 m for the highest peaks. The northern three-fourths of the area is characterized by a series of east/west-oriented rolling hills, ridges, and buttes of 600-900 m elevation that are cut through by 2 major north-south flowing rivers, the Utukok and the Kokolik. The lowest elevation on the northern edge of the area is 400 m.

Tussock tundra characterized by cottongrass (*Eriophorum* spp.) and sedges (*Carex* spp.) was the predominant vegetative type in the area. In addition, wet sedge meadow communities were found on poorest drained sites and *Dryas* spp. or fellfield communities on ridge slopes and mountains. Patches of willows (*Salix* spp.) are usually stunted but grow to heights of 0.5-2.5 m along broad-braided river channels (Spetzman 1959, Hechtel 1985).

IV. METHODS

I continued to use the same methods described in past progress reports to capture bears and describe population variables (Reynolds and Hechtel 1984a, Reynolds et al. 1987, Reynolds 1989). A draft of recommended capture procedures in included in Appendix A.

Bears were darted from helicopters with dart guns using immobilizing drugs Telazol (50% tiletamine and 50% zolazepam, A. H. Robins Co., Richmond, Va.), also known as Zoletil 100 (Reading Laboratories, L'Hay les Roses, France), Sernylan (phencyclidine hydrochloride, Bio-Ceutic Laboratories, St. Joseph, Mo.), or M-99 (etorphine hydrochloride, D-M Pharmaceuticals, Inc., Rockville, Md.). Acepromazine maleate (Ayerst Laboratories, New York, N.Y.) was used as a tranquilizer in conjunction with Sernylan injections. Ivermectin (22,23-dehydroavermectin Bl, Merck, Sharp, and Dohme, Rahway, N.J.) was used to treat lice infestations on 3 bears during 1988.

All bears captured were measured and weighed, marked with individually coded ear flags visible from the air, and in selected instances fitted with radiocollars (Telonics, Mesa, Ariz.). Offspring that accompanied their mothers were usually not collared until the year in which they were judged ready to be weaned (2- to 4-year-olds, depending on individual family group and year). Most bears were relocated from aircraft either by radio-tracking bears fitted with transmitters or observing bears during aerial searches. Relocations were used to construct minimum home range polygons, a standard method used in other grizzly bear studies (Craighead and Craighead 1972).

Age structure, age at first production of cubs, mean litter size, and reproductive interval were used as indicators of population productive potential. Ages were determined by examination of cementum annuli of premolar teeth (Mundy and Fuller 1964). In the discussion of age classes, "offspring" were defined as those bears in cub, yearling, and 2-year-old cohorts, composed of bears usually accompanied by their mothers; "young-age" bears, as those 3 to 5 years of age; and adults, as all cohorts 6 years of age and older. I used the term "cub" to describe a bear's age during its first year of life rather than to denote all offspring under maternal care from birth to 5-1/2 years of age. Reproductive status was estimated from (1) the size, coloration, and lactating condition of mammae; (2) observations of male-female pairing; (3) vulvar swelling; and (4) the number and age of offspring observed in family groups.

During 1989-91, blood samples and ear tissue samples from hole punches for ear tags were collected for genetic fingerprinting tests to be conducted by Dr. Ernie Vyse and Lance Craighead at Montana State University (Appendix B). Genetic sample material collected during 1988 for other studies will also be tested.

V. RESULTS AND DISCUSSION

Immobilization Drugs

During 1990 and 1991, I continued to use the drug Telazol for all capture efforts. Telazol continues to be far preferable to any other available drug used to immobilize bears (Taylor et al. 1989). Since 1977, 434 bears have been captured in this study area without any confirmed capture-related mortalities (Table 1; Appendix A). However, during 1987, in a separate cooperative study 130 km south of the study area, 1 bear immobilized with Telazol drowned.

Captures

During 1990, of 44 bears handled, 25 were captured for the first time and 19 were recaptures. Of the grizzly bears captured for the first time, 22 were offspring of marked females, 1 was an adult female, and 2 were adult males. The offspring included 2 male cubs, 9 male and 9 female yearlings, and 1 male and 1 female 2-year-olds. Of the recaptures, 2 were adult males, 16 were adult females, and 1 was a 5-year-old female.

During 1991, 56 bears were captured, including 17 initial captures and 39 recaptures. Of the first-time captures, 9 were offspring of marked females, 2 were adult males, 4 were subadult males, 1 was an adult female, and 1 was a subadult female. The offspring under maternal care that were captured for the first time included 2 female cubs, 1 male yearling, 2 male and 3 female 2-year-olds, and 1 3-year-old male. Of the 15 recaptures that were male, 4 were adults, 1 was a subadult, 2 were yearlings, and 8 were 2-year-olds. Of the 24 female recaptures, 12 were adults, 1 was a subadult, and 11 were 2-year-olds.

During 1986-91, 133 individual bears were captured in the study area a total of 210 times (Table 1; Appendix C). Of those, 69 were males and 64 were females; 102 had not been previously captured, but 51 were offspring of previously marked bears. Of the 83 bears that were originally captured in 1977-78, contact has been maintained until at least 1986 for 21 bears and until the time of their deaths for another 25 bears (Table 2; Appendix D). In addition, we have maintained contact with 16 bears from the time they were first observed with their mothers; 11 females that were originally captured with their mothers have either produced their own offspring or been observed consorting with adult males.

Since the study began in 1977, 225 individual bears have been captured. Of those, 120 were captured only once, 78 were captured 2-3 times, and 27 were captured ≥4 times, for a total of 434 captures (Appendix C). Bears that were captured during the last 4 years were much less likely to be captured more than once because collar replacement for adults is only necessary every 3-4 years. Of the 434 captures, no capture-related mortalities could be substantiated.

Population Size

During the 1977-79 period, population size in the study area was estimated at 119 using the direct count method (Reynolds 1980, Reynolds and Hechtel 1984b). The utility of the method is improved in areas like the western Brooks Range where there is a lack of cover. The direct count method requires an intensive marking effort over a period of at least 3 years and will be used to estimate the numbers of bears present in the annual population during the course of the study. For comparative purposes and to provide a statistically defensible control, both direct count (Reynolds 1980, Reynolds and Hechtel 1984b) and modified mark-recapture (Miller et al. 1987) methods will be used to estimate population size during 1992.

Population Structure

One hundred six individual males and 118 females have been captured in the study area since 1977 (Table 1). These figures probably do not reflect sexual structure of this unhunted population, but final analysis will not be completed until capture effort is completed. Sex and age structure of captured bears and of the population at the beginning and end points of the study will be presented in the final report. During tagging operations, bears were captured as they were encountered, so that, over time, structure based on occurrence in the capture sample should be representative of the population. The only exception to this practice occurred with offspring under maternal care; to avoid the effects of handling, those bears were usually not captured until just prior to weaning. Because of this practice, the sex of most offspring that died while under maternal care was unknown.

Genetics

Determining a means of establishing familial relationships of all grizzly bears within a population will constitute a far-reaching breakthrough in the understanding and management of populations. It will allow calculations of measures of biodiversity of ecosystems which must otherwise be based on theoretical or assumed values, including minimum viable population size, genetically effective minimum viable population, and behavior of population reservoirs.

Presently, the only means of determining familial relationships is by direct observation, a method that is usually impractical because it requires capture of all bears in a population and continued monitoring the entire population for at least 1 generation (8-10 years). Given the problems of continuity of funding and continued long-term contact with all members of a population, developing genetic fingerprinting techniques for grizzly bears is likely the only practical means of establishing familial relationships for population studies.

As the first step in determining familial relationships of individuals of unknown lineage or family background, tissues were collected during 1988 for genetic analysis from most bears except cubs. Genetic matrilineal relationships will be determined from electrophoretic analysis of mitochondrial DNA by Fred Allendorf and Kathy Knudsen of the University of Montana. Several sample sets from mother and offspring family groups were collected to serve as controls. Samples were also collected from grizzly bears in other areas of Alaska for comparative purposes (Knudsen et al., in prep.).

A more useful genetic technique, for purposes of this study, may be genetic fingerprinting. This technique utilizes both genomic and mitochondrial DNA to determine an individual genetic fingerprint and may allow determination of matrilineal, patrilineal, and sibling relationships within the population. Using this information, it should be possible to determine not only familial relationships within the population, but also measures of immigration, emigration, and the importance of reservoir populations. Because of the 14-year history of research in this area, this population can provide the background data that is not available elsewhere in the same detail and is needed to test and confirm the utility of genetic fingerprinting techniques. Observed intraspecific relationships, including membership in family groups and breeding partners, should help provide control data for these investigations (Appendix D). Genetic fingerprinting of bears in this population will be determined and analyzed by Dr. Ernest Vyse and Lance Craighead of Montana State University, using collections from both past and future samples (Appendix C).

Productivity

The minimum number of reproductively mature females ($\geq$6 years of age) present in the study area was 33 during 1990 and 31 during 1991 (Tables 3,4); however, if those observed 1 year before or after were assumed present in a given year, then 38 females were present during 1990 and 37 were present during 1991 (Table 5).

During 1990, 7 females were accompanied by cubs and 17 by older offspring; at least 9 others were either solitary before they were observed breeding during 1990 or accompanied by cubs during 1992. Breeding females included 4 that were not accompanied by offspring, 2 that weaned or lost offspring and then bred, and 5 that were observed with offspring during 1991 or 1992, and so were assumed present during 1990.

Similarly, during 1991, 7 females were accompanied by cubs and 19 by older offspring. Breeding females included 5 that were solitary, 4 that weaned offspring and then bred, and 1 that was observed during 1992 with cubs.

Since 1986, an average of 41 adult females were observed or assumed present in the study area (Table 5). The highest number observed was 47 in 1987, but 5 died that same year. Observed mortality of adult females in other years was only 0-3 annually ($\bar{x}$ = 1.2). The annual variation in observed presence probably does not reflect changes in the number of females in the population so much as failure or loss of radio collars. Because no emigration by adult females from their established home ranges has been documented in this study, it is reasonable to assume that the females that were not located in or adjacent to the study area during a specific year were either still present but not observed or they were dead. An analysis of these patterns will be included in the final report.

During 1989, 17 females were observed with 38 cubs. This is the highest number of females with cubs observed since the study began in 1977. Not only was the 1989 cohort a large one, but survival among its members was high. Of the minimum of 38 cubs that were produced, 27 (71%) survived until 1991 when they were 2-year-olds (Tables 3, 6). The ability to produce strong cohorts when conditions are favorable has important survival value to populations; cohorts that persist through weaning, as this one did, are especially advantageous to grizzly bear populations that exhibit low productive capacities.

The total production of cubs during any one year is dependent upon the number of adult females in the population, the proportions of those that are already accompanied by offspring or that were available to breed the previous year, reproductive interval, mean litter size, and annual variation in environmental conditions may affect any of the above factors. Persistence of a cohort can most logically be ascribed to its initial size and to environmental conditions, especially food availability. The effects of environmental conditions are probably most pronounced in an area such as northwestern Alaska where the vegetative growing season is short, diversity of micro-habitats and food items is relatively low, and availability of prey may be transitory and cyclic. Besides the 1989 cohort of 38 cubs, 8 cohorts with a minimum of 15-26 cubs have been observed since 1977; however, only 3 of these cohorts (produced in 1977, 1978, and 1990) have persisted long enough to result in 7 to 10 2-year-olds (Tables 3, 6). The second largest cohort, observed in 1986, began with a minimum of 26 cubs; by 1987, only 4 yearlings were observed from the cohort and only 2 were known to be alive the following year. For the 14 cohorts observed for at least 2 years, a total of 204 cubs were produced and 80 2-year-olds survived; the 1989 cohort accounted for 25% of the total number of cubs produced and 34% of the surviving 2-year-olds.

Although there may be several plausible explanations for this observation, it is most likely the result of the availability of microtines during a high population cycle in 1986, access to caribou (*Rangifer tarandus*) of the steadily increasing Western Arctic Caribou Herd, and moderate weather patterns. During 1983-85, 8, 13, and 18 adult females were observed in each respective year, but only 0, 2, and 9 young were produced. This pattern of low production was likely due to unseasonably cold and/or long winters, perhaps aggravated by declines in vegetative food production. Another explanation for the high cub production during 1986 is that following several years when cubs were not being produced fewer females were accompanied by older offspring and a larger proportion of adult females in the population bred in 1985.

Mean litter size during 1977-91 was 2.02 cubs/litter ($\underline{n}$ = 106 litters; Table 6). Mean litter size was 1.85 ($\underline{n}$ = 27 litters) during 1986-88 and 2.16 ($\underline{n}$ = 31 litters) during 1989-91; annually, it ranged from 2.24 in 1989 to 1.63 in 1989 (Tables 3, 6). This compares with the mean of 2.02 cubs/litter for the 1977-85 period, and is within the range reported for that time of 1.67 to 2.50 cubs/litter. The relationship between long-term production rates for the population and for individual females will be discussed more fully as additional data are collected.

Mean litter size was 2.02 during both the 1986-91 (n = 58 litters) and 1977-85 periods (n = 48 litters); however, the observed production of cubs was 97 during the 9 years of the first period compared with 117 during the 6 years of the second period. The difference in total cub production between the 2 periods may be due to increased numbers of females in the study sample or to a decline in the age at which females first produce surviving litters.

The number of cubs observed emerging from natal dens represents potential production by the population of adult females (Table 4) because there is a high mortality rate among cubs. On the other hand, the number of offspring that are weaned by the adult female segment of the population represents realized productivity (Table 7). During the 1986-91 period, the observed potential production of the population was at least 117 cubs, but the observed realized production of weaned bears was only 26 offspring. However, during 1991, 23 of 27 2-year-old offspring and 3 of 5 3-year-old offspring were not weaned and will remain with their mothers for at least 1 additional year.

During 1977-91, 222 offspring were observed accompanying their mothers. By 1991, 77 of these were presumed or known dead, 67 lived at least until weaning, 27 may have lived until weaning but they had not been observed for ≥ 1 year, and 51 were still under maternal care (Table 3). By 1991, of the 67 that lived at least until weaning, 16 had died, 13 were alive (of which 7 were weaned during 1991), and the presence or absence from the study area was unknown for 38. Of the 38, 30 have not been observed since the year in which they were weaned, 2 were observed during the year following weaning, and 6 were observed in the area for at least 2 years following weaning.

The availability of calving caribou is related to the productivity of the grizzly bear population in this area (Reynolds and Garner 1987). The Western Arctic Caribou Herd continues to grow; it contained an estimated 240,000 caribou in 1971 but declined to 65,000 in 1976, primarily due to overharvest. Estimates of herd size were 340,000 caribou by 1987 and 440,000 by 1991 (ADF&G files). Although the location of the core calving grounds may shift from year to year, it is usually located north of the study area. Availability of calving caribou to bears varies annually and is difficult to quantify; however, as the herd grows, it is logical to expect that calving will take place over a wider area and availability will increase. Subjectively, it appeared that in 1986, 1987, and 1989 the presence of calving caribou in the area was about average. In 1988, caribou calved northeast of the study area, but the number of yearlings and adults that died during migration to the calving grounds seemed much higher than usual. In the past, it has been unusual to observe dead caribou unscavenged by grizzly bears, but during 1988 they were often seen. In addition to this food source, cyclic microtine populations were high in the study area in 1986 and 1987 and were heavily utilized by bears.

Survival and Mortality

During 1986-91, 70 mortalities or 11.7 annually were observed in or adjacent to the study area; 18 in 1986, 17 in 1987, 10 in 1988, 13 in 1989, 7 in 1990, and 5 in 1991. This compares with 43 or an average of 6.1 determined during the 1977-83 period (Reynolds and Hechtel 1984b). Seventeen of the 70 mortalities were adult bears. Observations or examination of mortality sites indicate that 4 adult females and 1 weaned yearling were killed and eaten by adult male grizzly bears; 1 very thin 2-year-old, which had been weaned as a yearling, was killed by another bear of unknown sex; 8 were eaten by other bears, but the causes of their deaths were unknown. Four bears from 2 litters that had been weaned as yearlings died in their dens, apparently from starvation. Hunters killed 5 bears and 1 apparently died in a rock-slide. At least 29 of the 48 cubs (60.4%) born in 1986-88 died during the period, an expected pattern because 44.1% of cubs died during the 1977-83 period (Reynolds and Hechtel 1984b). In 1989-91, however, only 16 of 77 cubs were known to have died, a mortality rate of 20.8% (Table 3).

VI. CONCLUSIONS AND RECOMMENDATIONS

During 1986, research was begun to relate demographic changes that have occurred in a western Brooks Range grizzly bear population since 1977-79 to long-term rates of productivity, survival, emigration, and immigration. These investigations should enhance insight into the population reservoir concept and provide the information necessary to improve current grizzly bear population dynamics models used throughout North America. Long-term data collection on productivity, mortality, survival, movements, denning, home range fidelity, and fate of offspring is providing important insights into grizzly bear population ecology that cannot be obtained in studies of less than 10 years duration. Future reports will present and analyze this information in greater detail. Population dynamics, fidelity to maternal home range, survival and movement patterns of young-aged bears, realized population productivity, and determination of genetic lineage investigations should be emphasized during the next 2 years. A mark-recapture density estimate should be conducted during 1992 to provide statistically defensible data for comparison with direct counts made during past years. In addition, more capture effort should be directed toward the eastern portions of the study area during 1992 so that the capture sample will be more representative of the entire area. Genetic "fingerprinting" of individual blood samples should be continued so that familial relationships of individuals of unknown lineage or family background within the population can be determined.

VII. ACKNOWLEDGMENTS

During 1986-91, the large majority of funding for this cooperative study was provided by the U.S. National Park Service and the Alaska Department of Fish and Game. I want to recognize the crucial contributions of Al Lovaas and Layne Adams, of the U.S. National Park Service Regional Office, in furthering the continuity of the research. They believed in the potential for this study to provide biological knowledge that could be broadly applied and translated that belief into conceptual, monetary, and field support when it was most needed. Additional funding for logistical support was provided by the Arctic District of the Bureau of Land Management during 1986-88. Data collected during 1986-89 built on a long-term grizzly research project begun in 1977, supported and funded over the years by the U.S. Bureau of Land Management, Alaska Department of Fish and Game, U.S. Fish and Wildlife Service, Office of Naval Research, Naval Arctic Research Laboratory, and the Craighead Wildlife-Wildlands Institute. Success of the field work was due in large part to the conscientious hard work and expertise of Layne Adams, John Hechtel, and Toby

Boudreau. Since 1986, many other biologists have assisted with field work, logistics, and data compilation, including Lee Anne Ayres, Derek Craighead, Lance Craighead, Bruce Dale, April Hudoff, Elizabeth Lenart, Al Lovaas, Charles Schwartz, James Silva, Ernie Vyse, and Clyde Wells. The success and safety of capture and tracking flights were due to the expert abilities of Super Cub pilot Jim Rood and helicopter pilot Ron Warbelow.

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Table 1. Capture and marking characteristics of 201 grizzly bears in the western Brooks Range, Alaska, 1977-91.

Bear No. and sex	Cem. age (yr)	Date of capture	Bear wt. (lb)	Location	Drug dosage[a]	Ear tags (left/right)	Marking[b]
1081M	5	5/24/77	175	Utukok R.	2.6/H	889/890	P/O
	7	9/17/79	430	N. Meat Mtn.	A/M	17827/17826	P/O
	8	7/7/80	380	Disappointment Cr.	2.8	504/503	P/O
		8/15/80	400	Utukok R.	3.0/L	504/503	P/O
	12	9/14/84	--	Utukok R.	1.8M99/L	504/503	P/O
		9/16/84	440	Utukok R.	4.0/M	338/339	1B/R
	15	6/19/87	360	Driftwood Cr.	6.0T/M	565/564	1B/R
	17	6/15/89	415	Elbow Cr.	6.5T/M	128/129	1B/R
	18	6/25/90	425	Utukok R.	9.9T/M	127/128	1B/R
1082M	13	5/25/77	370	Kokolik R.	2.0/M	892/893	O/G/O
		6/13/77	365	Kokolik R.	2.3/M	892/893	--
		6/25/77	380	Kokolik R.	2.7/M	892/893	--
		8/10/77	--	Kokolik R.	2.7/L	892/893	--
	14	6/27/78	425	Kokolik R.	2.8/L	892/893	Bk
	15	6/28/79	480	Kokolik R.	A/M	313/312	--
	16	8/17/80	520	Kokolik R.	5.0/L	538/539	dB/P
	23	6/18/87	370	Utukok R.	5.2T/H	554/555	W/R
1083M	7	5/25/77	265	Utukok R.	2.0/M	894/895	plaque
		6/2/77	--	Utukok R.	2.6/L	894/895	Bk
	8	7/2/78	360	Utukok R.	2.7/M	894/895	Bk
	9	6/30/79	355	Utukok R.	3.4/H	894/	--
	14	5/26/84	360[c]	Meat Mtn.	1.8M99/M	3350/3319	dB/1B
	15	6/4/85	345	Utukok R.	2.6/M	422/423	dB/1B
1084M	7	5/26/77	220	Utukok R.	A/L	897/896	P/P
		6/2/77	--	Driftwood Cr.	2.2/L	897/896	Bk/W
1085F	19	5/27/77	280	Meat Mtn.	A/L	899/898	--
1086F	16	5/29/77	205	Meat Mtn.	2.0/L	205/206	--
		6/24/77	235	Meat Mtn.	1.3/L	205/206	--
		8/8/77	265	Driftwood Cr.	1.9/M	205/206	--
	18	9/16/79	400[c]	N. Meat Mtn.	A/L	205/206	--
1087F	1	5/29/77	31	Meat Mtn.	0.13/M	207/208	/G
	3	6/30/79	170	Meat Mtn.	1.1/M+	314/208	Bk/
	4	7/7/80	205	Meat Mtn.	A/M	506/505	1B/Bk
	8	5/25/84	220[c]	Meat Mtn.	2.0M99/M	3195/3237	1B/Bk
	13	6/19/89	220	Seismo Cr.	3.5T/M	208/209	1B/Bk
	15	6/20/91	280	Meat Mtn.	4.6T/M	208/209	1B/Bk
1088M	4	5/31/77	270	Eskimo Hill	2.0/M	210/209	--
1089F	4	6/1/77	122	Adventure Cr.	A/M	214/213	--
		6/10/77	126	Adventure Cr.	1.7/M	243/240	W/W
	12	6/4/85	245	Adventure Cr.	2.0/M	401/402	W/W
	15	6/28/88	277	Tupik Mtn.	3.8T/M	416/415	W/W
	17	6/25/90	280	Ilingnorak Rg.	4.4T/M	321/320	W/W
1090F	18	6/1/77	220	Utukok R.	A/H	215/216	--
1091M	19	6/4/77	350	Utukok R.	3.0/H	217/218	--

Table 1. Continued.

Bear No. and sex	Cem. age (yr)	Date of capture	Bear wt. (lb)	Location	Drug dosage[a]	Ear tags (left/right)	Marking[b]
1092F	8	6/4/77	220	Ilingnorak Rg.	2.2/M	227/226	--
	11	8/19/80	320	Ilingnorak Rg.	4.0	549/548	O/G
	14	6/21/83	--	Ilingnorak Rg.	3.8M99/M	3389/3466	O/G
	16	9/6/85	375	Ilingnorak Rg.	A/L	356/357	O/G
1093F	Cub	6/4/77	38	Ilingnorak Rg.	0.1/M	228/229	lB/
1094M	4	6/5/77	175	Meat Mtn.	2.0/H	225/230	lB/dB
1095F	6	6/5/77	200	N. Meat Mtn.	1.5/M	231/233	O/W
	16	6/24/87	220	Thunder Cr.	3.6T/M	596/597	Y/Y
	18	6/15/89	245	Colville R.	4.5T/M	137/138	Y/Y
	20	6/24/91	242	Thunder Cr.	4.6T/M	137/138	Y/Y
1096M	7	6/5/77	325	Meat Mtn.	2.6/M	236/237	--
	8	6/28/78	395	Utukok R.	2.8/M	774/775	lB
	9	6/28/79	--	N. Meat Mtn.	A/H	774/893	/lB
	10	8/17/80	505	Meat Mtn.	4.2/L	536/537	O/lB
1097F	8	6/5/77	225	Meat Mtn.	1.8/M	235/234	--
		6/19/77	--	Utukok R.	1.4/M	235/234	--
	11	7/6/80	300	Utukok R.	1.8/M	510/511	Pp/P
		8/16/80	270	Utukok R.	A/L	510/511	Pp/P
	14	9/19/83	305	Utukok R.	5.0M99/M	3236/3480	Bk/P
	16	6/5/85	220	Colville R.	1.7/M	432/433	Bk/R
	18	5/25/87	240[c]	Utukok R.	3.2T/M	594/429	R/Bk
	20	6/23/89	310	Utukok R.	3.8T/M	371/429	R/Bk
	22	6/23/91	270	Utukok R.	4.6T/M	653/654	R/Bk
1098M	3	6/8/77	108	Utukok R.	1.2/H	238/239	O/lB
	14	6/23/89	500	Utukok R.	6.0T/M	-/-	O/O
1099M	10	6/11/77	365	Utukok R.	3.2/M	245/244	--
	11	6/27/78	450[c]	Kokolik R.	2.8/M	773/772	--
	12	6/26/79	450	Utukok R.	3.0/M	773/772	--
	16	9/20/83	495	Utukok R.	6.0M99/H	3238/3485	R/R
1100F	6	6/11/77	200	Meat Mtn.	2.4/M	247/246	--
	7	6/9/78	240[c]	Utukok R.	2.5/H	247/246	P
	8	7/1/79	220	Driftwood Cr.	1.9/M	247/246	P
1101M	2	6/12/77	145	Utukok R.	1.2/L	249/248	G/W
1102F	2	6/12/77	125	Utukok R.	1.2/L	251/250	W/G
	3	6/18/78	140	Utukok R.	1.4/M	251/250	--
	5	8/18/80	210	Kokolik R.	3.0	544/545	W/G
1103M	8	6/12/77	320	Utukok R.	2.6/H	253/252	--
	9	6/12/78	--	Utukok R.	A/H	253/252	--
	16	6/8/85	430	Utukok R.	2.4/L	202/201	O/mG
	21	6/29/88	556	Kokolik R.	6.0T/M	497/498	lB/R
1104F	9	6/12/77	215	Utukok R.	1.6/M	255/254	--
		6/17/77	--	Utukok R.	1.2/L	255/254	--
	12	7/10/80	250	Nimwutik Cr.	1.5/L	517/518	P/G
	15	6/22/83	190	Nimwutik Cr.	3.8M99/M	3468/3471	G/G
	17	6/10/85	240	Utukok R.	1.5/L	203/204	mG/mG
	18	6/26/86	245c	Utukok R.	2.5T/M	254/204	Y/mG

Table 1. Continued.

Bear No. and sex	Cem. age (yr)	Date of capture	Bear wt. (lb)	Location	Drug dosage[a]	Ear tags (left/right)	Marking[b]
1105F	7	6/13/77	225	Kokolik R.	1.5/M	257/256	--
		6/26/77	245	Tupikchak Mtn.	1.5/L	257/256	--
	8	6/28/78	285	Kokolik R.	1.7/L	257/301	--
	10	7/10/80	260	Iligluruk Cr.	1.8/M	522/521	W/O
	13	9/18/83	310	Tupikchak Mtn.	6.0M99/H	3309/3258	W/O
	15	6/7/85	185	Tupikchak Mtn.	2.0/M	209/210	W/O
1106F	11	6/14/77	210	Adventure Cr.	1.5/H	258/259	--
1107F	Cub	6/14/77	7	Adventure Cr.	None	None	None
1108F	Cub	6/14/77	20	Adventure Cr.	None	/260	/W
1109F	Cub	6/14/77	18	Adventure Cr.	None	261/	W/
1110F	24	6/15/77	245	Ilingnorak Rg.	A/H	262/263	1B/P/1B
	25	7/1/78	--	Ilingnorak Rg.	1.9/L	262/263	dB
	26	6/30/79	235	Ilingnorak Rg.	1.7/H	262/263	--
1111F	14	6/18/77	240	Colville R.	1.7/M	269/268	--
1112M	4	6/18/77	250	Colville R.	1.7/M	267/266	dB/G
1113F	4	6/18/77	150[c]	Colville R.	1.5/M	270/271	G/dB
1114M	16	6/19/77	450	Utukok R.	1.7/L	273/272	O/G/O
1115M	5	6/22/77	175	Meat Mtn.	1.5/H	275/274	dB/O
1116M	5	6/23/77	175	Utukok R.	1.5/M	276/277	O/dB
1117M	19	6/23/77	315	Driftwood Cr.	A/M	279/278	Pp/W/Pp
1118F	17	6/23/77	185	Driftwood Cr.	1.3/H	281/280	W/Pp
	24	9/14/84	275	Driftwood Cr.	AM99/M	321/322	W/Pp
1119F	6	6/24/77	190	N. Meat Mtn.	1.7/L	282/283	O/P
1120M	16	6/24/77	390	N. Meat Mtn.	2.6/M	284/285	Pp/1B/Pp
1121F	11	6/25/77	245	Kokolik R.	A/H	287/286	--
	18	9/17/84	320	Kokolik R.	A/L	383/384	R/Y
1122M	Cub	6/25/77	30	Kokolik R.	0.12/M	/288	/G
1123F	Cub	6/25/77	27	Kokolik R.	0.12/M	289/	G/
1124M	17	6/26/77	360	Tupikchak Mtn.	2.6/M	291/290	dB/W/dB
	24	9/17/84	390	Tupikchak Mtn.	4.0/L	385/386	Y/Y
1125F	3	6/27/77	145	Utukok R.	1.4/H	/292	/W
	17	6/24/91	230	Driftwood Cr.	4.6T/M	657/658	1B/O
1126M	13	6/28/77	345	Kokolik R.	2.7/M	293/294	O/W/O
1127F	26	6/28/77	295	Kokolik R.	1.5/L	295/	P/W/P
1128F	7	6/30/77	240[c]	Tupikchak Mtn.	1.8/M	297/296	P/P/P
1129F	1	6/30/77	90	Tupikchak Mtn.	0.5/M	299/298	P/P
1130F	21	6/30/77	255	Elbow Cr.	1.9/M	300/900	O/O/O
1131M	8	7/1/77	235	Driftwood Cr.	2.5/H	3085/3086	G/O
1132F	2	7/2/77	67	Archimedes Rg.	--	1498/3082	1B/P
1133M	2	7/2/77	80	Archimedes Rg.	--	3088/1499	P/1B
	4	6/27/79	150	Utukok R.	1.4/M	310/309	P/1B
1134F	14[c]	7/5/77	230[c]	Utukok R.	2.0/L	3089/3090	O
	17[c]	7/12/80	285	Utukok R.	2.8/H	526/527?	Bk/G
	20[c]	6/20/83	165	Utukok R.	A/H	--	--
1135M	1	7/5/77	57	Utukok R.	--	3091/3092	O/O

Table 1. Continued.

Bear No. and sex	Cem. age (yr)	Date of capture	Bear wt. (lb)	Location	Drug dosage[a]	Ear tags (left/right)	Marking[b]
1136F	1	7/5/77	48	Utukok R.	--	3093/	O/
	12	6/28/88	220	Elbow Cr.	3.8T/H	424/425	Y/O
	12	7/1/88	--	Elbow Cr.	4.2T/M	424/425	Y/O
1137F	1	7/5/77	58	Utukok R.	--	/3094	/O
1138F	23	8/10/77	250	Kantangnak Cr.	1.9/M	None	O
	24	6/16/78	265	Kantangnak Cr.	A/L	759/758	dB/dB/dB
1139F	11	6/7/78	200[c]	Utukok R.	1.3/M	651/654	W
	16	6/22/83	180	Utukok R.	3.6M99/M	3226/3229	mG/G
1140M	Cub	6/7/78	21	Utukok R.	None	/655	/O
1141F	Cub	6/7/78	16	Utukok R.	None	656/	O/
	2	7/13/80	165	Utukok R.	2.1	532/533	W/O
	6	9/16/84	260	Archimedes Rg.	2.6/L	397/398	W/O
	7	6/5/85	220	Archimedes Rg.	1.8/M	397/398	W/O
	9	5/25/87	190[c]	Disappointment Cr.	3.0T/M	491/492	W/Y
	10	6/25/88	230	Disappointment Cr.	4.4T/M	500/499	W/Y
	11	6/20/89	255	Utukok R.	3.8T/M	500/317	W/Y
1142F	14	6/9/78	250[c]	Utukok R.	A/H	658/657	Bk
1143F	9	6/9/78	210[c]	Utukok R.	1.8/H	704/705	1B/W
1144F	1	6/9/78	38	Utukok R.	0.4/H	717/718	Pp/G
	8	9/4/85	345	Elbow Cr.	A/H	260/261	mG/R
1145F	2	6/10/78	95	Elbow Cr.	1.7/H	720/719	1B/G
1146F	14	6/10/78	230[c]	Elbow Cr.	2.5/H	721/722	G/1B
1147M	3	6/10/78	205	Utukok R.	1.3/M	723/724	P/G
	5	7/10/80	305	Tupikchak Cr.	2.8/H	516/515	P/dB
	9	9/15/84	388	Utukok R.	4.0/L	327/328	R/dB
	11	6/30/86	395	Kokolik R.	3.2/M	242/243	R/1B
	13	6/27/88	375	Utukok R.	6.0T/M	471/472	Y/1B
	16	6/18/91	410	Nimwutik Cr.	9.4T/M	999/1000	Y/1B
1148M	6	6/10/78	205	Utukok R.	1.3/M	725/728	dB/W
1149F	4	6/11/78	180	Utukok R.	1.3/M	736/733	W/dB
	13	6/24/87	245	Utukok R.	5.4T/M	558/559	Y/Pp
	16	5/27/90	205	Nachralik	3.0T/M	797/798	1B/W
1150M	5	6/16/78	185	Utukok R.	1.2/M	751/747	Bk/P
1151F	3	6/16/78	112	Kantangnak Cr.	--	752/753	Bk/Bk
	8	6/22/83	165	Plunge Cr.	3.8M99/M	3469/	Bk/
1152M	3	6/16/78	142	Kantangnak Cr.	--	754/755	O/Bk
1153F	2	6/16/78	70	Kantangnak Cr.	--	756/757	Bk/O
	9	6/8/85	185	Utukok R.	1.8/M	215/216	R/O
1154F	12	6/21/78	220	Tupik Cr.	1.8/M	760/761	W/O/W
1155M	1	6/21/78	75	Tupik Cr.	0.50/M	763/762	G/W
1156F	6	6/21/78	205	Kogruk Cr.	2.0/M	765/764	P/Bk
	15	6/23/87	215	Elbow Cr.	3.4T/L	532/533	dB/Bk

Table 1. Continued.

Bear No. and sex	Cem. age (yr)	Date of capture	Bear wt. (lb)	Location	Drug dosage[a]	Ear tags (left/right)	Marking[b]
1157M	5	6/24/78	210	Driftwood Cr.	A/H	766/767	P/G/P
	6	6/30/79	275	Driftwood Cr.	2.4/H	766/767	Bk/P
	14	6/23/87	260	Elbow Cr.	5.6T/M	538/539	W/dB
	16	6/18/89	375	Utukok R.	7.0/M	221/220	W/dB
1158F	7	6/24/78	180	Elbow Cr.	1.4/M	769/768	P/W
	17	7/1/88	260	Elbow Cr.	4.2T/M	412/411	lB/mG
1159M	10	6/24/78	295	Driftwood Cr.	1.7/M	770/771	G/P
	12	8/16/80	--	Utukok R.	A/L	535/534	G/P
	15	9/16/83	--	Utukok R.	--	--	--
1160M	Cub	7/1/78	25	Ilingnorak Rg.	None	303/	dB/
1161M	Cub	7/1/78	21	Ilingnorak Rg.	None	/302	/dB
1162M	2	7/1/78	95	Iligluruk Cr.	1.1/M	304/305	lB/Bk
1163M	2	7/3/78	92	Iligluruk Cr.	A/H	306/307	Bk/lB
1164M	3	5/7/79	185	Meat Mtn.	1.3/M	308/311	G/Bk
	4	7/6/80	270	Meat Mtn.	1.9/M	512/311	Bk/G
	8	9/18/84	370	Meat Mtn.	4.0/L	584/419	lB/G
	10	7/1/86	350	Kokolik R.	2.8/M	510/509	lB/G
1165M	3	9/17/79	200[c]	N. Meat Mtn.	A/H	318/319	G/dB
	8	9/14/84	335	Meat Mtn.	AM99/M	332/333	R/W
	13	6/19/89	335	Colville R.	7.0/M	222/223	R/W
1166F	10	9/18/79	390	N. Meat Mtn.	A/L	284/317	dB/O
	11	7/7/80	265	Utukok R.	2.1/H	502/317	lB/O
	14	6/22/83	--	Utukok R.	3.6M99/H	3221/3228	mG/lB
	21	6/24/90	240	VABM Jean	4.4T/M	296/297	W/lG
1167F	7	9/18/79	235	N. Meat Mtn.	2.8/H	271/315	O/dB
	15	6/18/87	200	Seismo Cr.	2.6T/L	551/600	mG/dB
	18	6/24/90	245	Colville R.	3.6T/M	306/307	mG/Y
1168F	Cub	9/18/79	55	N. Meat Mtn.	0.60/M	274/296	None
1169F	11	7/5/80	290	Kokolik R.	2.2/L	513/514	Bk/dB
	14	6/21/83	--	Plunge Cr.	3.8M99/M	3467/3465	mG/Bk
	17	9/6/85	360	Kantangnak Cr.	A/M	259/255	mG/Bk
1170F	Cub	7/5/80	34	Kokolik R.	0.10	114/112	dB/
1171M	Cub	7/5/80	32	Kokolik R.	0.10	115/113	Bk/
1172M	11	7/6/80	360	Utukok R.	3.2/H	509/508	W/lB
	15	9/16/84	400	Archimedes Rg.	4.6/H	325/326	W/lB
1173M	Cub	7/10/80	32	Kokolik R.	0.14	525/101	/O
	4	5/25/84	120[c]	Tupikchak Mtn.	1.8M99/H	--	--
	5	6/7/85	143	Tupikchak Mtn.	1.5/M	495/496	W/mG
1174F	Cub	7/10/80	28	Kokolik R.	0.14	501/507	O/
	4	5/25/84	110[c]	Tupikchak Mtn.	1.8M99/H	--	--
	5	6/7/85	113	Tupikchak Mtn.	1.5/M	222/221	mG/W
	6	6/27/86	195	Tupikchak Mtn.	1.8/M	222/293	mG/W
	7	6/19/87	175	Tupikchak Mtn.	A,T/M	575/574	lG/
	10	6/23/90	236	Tupikchak Mtn.	4.0T/M	310/311	O/R
	11	6/22/91	225	Kokolik R.	4.8T/L	310/311	O/R
1175M	7	7/12/80	400	Iligluruk Cr.	2.6	528/529	lB/lB

Table 1. Continued.

Bear No. and sex	Cem. age (yr)	Date of capture	Bear wt. (lb)	Location	Drug dosage[a]	Ear tags (left/right)	Marking[b]
1176F	18	7/13/80	345	Utukok R.	2.0/M	531/530	G/G
	22	9/16/84	280	Archimedes Rg.	A/H	399/400	G/B
	25	6/22/87	260	Archimedes Rg.	3.1T/L	502/501	1G/1G
1177F	1	7/10/80	91	Nimwutik Cr.	0.38/L	520/519	G/G
	4	9/18/83	195	Utukok R.	4.0M99/M	3262/	O
	6	6/10/85	170	Avingak Cr.	1.6/M	233/234	R/1B
	7	6/30/86	220	Nimwutik Cr.	1.6/M	389/390	R/1B
	11	6/23/90	270	Nimwutik Cr.	4.4T/M	308/309	W/O
	12	6/18/91	260	Nimwutik Cr.	4.5T/M	308/309	W/O
1178F	13	8/18/80	250	Utukok R.	3.0	540/541	1B/Bk
1179F	2	8/18/80	135	Utukok R.	1.4/L	542/543	1B/O
	5	6/22/83	--	--	3.8M99/L	3230/3231	dB/mG
	7	6/10/85	200	Utukok R.	1.9/L	439/438	1B/mG
	9	6/22/87	265	Noatak R.	3.1T/L	515/516	1B/G
1180F	Cub	8/18/80	31	Kokolik R.	0.30/L	/547	/1B
1181F	Cub	8/18/80	34	Kokolik R.	0.40/M	546/	1B/
	3	9/15/83	225	Utukok R.	A/H	--	1B/dB
	4	5/26/84	145[c]	Nimwutik Cr.	1.8M99/H	546/-	1B/dB
	5	6/6/85	185	Meat Mtn.	A/M	3394/352	1B/dB
1232M	4[c]	9/18/83	190	Utukok R.	6.0M99/M	3399/3317	W/R
1233M	11[c]	9/18/83	430	Kokolik R.	6.0M99/M	3261/3395	dB/O
	13[c]	6/10/85	400	Utukok R.	A/L	207/208	dB/O
	16	6/30/88	435	Archimedes Rg.	6.0T/M	-/420	-/O
1234F	5[c]	9/18/83	280	Utukok R.	6.0M99/M	3253/3400	O/W
	7[c]	6/6/85	200	Utukok R.	2.0/M	3253/594	O/W
1261M	10	6/22/83	345	Utukok R.	5.0M99/M	3457/3470	mG/dB
1401M	11	5/25/84	370[c]	Tupikchak Mtn.	6.0M99/H	3042/3403	W/Bk
1402M	3	5/25/84	80[c]	N. Meat Mtn.	3.0M99/H	-- --	--
	4	6/5/85	115	Colville R.	1.2/H	218/217	Bk/dB
	5	6/29/86	180	Nuka R.	1.8/M	218/217	Bk/dB
1403F	3	5/25/84	95	N. Meat Mtn.	1.0M99/H	3475/3474	W/Bk
	4	6/5/85	125	Colville R.	1.2/L	206/205	W/Bk
	5	7/1/86	190	Utukok R.	2.6T/M	511/512	W/Bk
	6	5/25/87	170[c]	Amo Cr.	2.6T/M	484/485	W/Bk
1404M	3	5/25/84	90[c]	N. Meat Mtn.	1.0M99/H	3472/3487	Bk/W
	4	6/5/85	150	Colville R.	1.2/L	421/420	Bk/W
1405M	7	5/26/84	215[c]	N. Meat Mtn.	2.3M99/H	3047/3043	Bk/O
	10	6/20/87	330	Utukok R.	3.4T/M	478/479	R/Y
	13	6/21/90	370	VABM Boot	8.7T/H	199/198	Bk/O
1406F	10	9/13/84	275	Utukok R.	5.0M99/L	324/323	R/mG
1407F	10	9/14/84	275	E. Meat Mtn.	AM99/M	334/335	G/O
	13	6/18/87	240	Meat Mtn.	3.0T/M	542/543	mG/Y
	15	6/20/89	235	Meat Mtn.	4.0T/M	542/543	mG/Y
	17	6/20/91	290	Utukok R.	4.5T/M	986/987	mG/Y
1408M	10	9/15/84	300[c]	Utukok R.	AM99/M	382/381	O/R
1409M	Cub	9/16/84	31	Archimedes Rg.	0.3/H	329/330	O/O

Table 1. Continued.

Bear No. and sex	Cem. age (yr)	Date of capture	Bear wt. (lb)	Location	Drug dosage[a]	Ear tags (left/right)	Marking[b]
1410F	20	9/16/84	265	Archimedes Rg.	A/H	336/337	G/O
1411M	7[c]	6/4/85	410	Plunge Cr.	2.4/M	424/425	G/R
	10	6/24/88	476	Iligluruk Cr.	6.0T/M	485/494	mG/R
	10	6/28/88	--	Utukok R.	6.0T/M	485/494	mG/R
1412M	15[c]	6/4/85	360	Ilingnorak Rg.	2.4/L	403/404	mG/1G
1413F	9	6/8/85	200	Archimedes Rg.	1.9/2.0	223/224	1B/1B
	12	6/25/88	270	Utukok R.	4.4T/L	452/451	1B/1B
1414F	2	6/8/85	105	Archimedes Rg.	1.4/1.0	213/214	dB/mG
1415F	14[c]	9/5/85	375	Utukok R.	A/L	244/245	1B/O
1416F	8[c]	9/5/85	405	Elbow Cr.	A/L	264/265	G/Bk
	12	6/28/88	255	Elbow Cr.	4.2T/M	462/461	1G/Bk
1417F	8[c]	9/6/85	355	Spike Cr.	A/L	266/267	mG/mG
	12	6/21/88	262	Spike Cr.	3.6T/M	389/390	mG/mG
1418M	17[c]	9/6/85	425[c]	Archimedes Rg.	A/M	263/262	R/G
1418F	15[c]	6/24/86	240	Squirrel R.	2.6T/M	377/376	Y/Y
1419M	9[c]	6/24/86	415	Squirrel R.	AT/M	--	--
1420M	7[c]	6/25/86	345	Kokolik R.	2.8/M	284/285	dB/W
	9	6/24/88	330	Kokolik R.	3.6T/L	491/492	dB/W
1421M	13[c]	6/25/86	475	Kokolik R.	3.2/L	347/346	O/1B
	16	6/19/89	440	Utukok R.	7.0T/M	-/-	O/1B
1422F	Cub	6/26/86	15	Utukok R.	0.15/L	-/283	-/Y
1423M	Cub	6/26/86	11	Utukok R.	0.15/M	282/-	Y/-
1424F	8[c]	6/27/86	285	Kokolik R.	2.2/L	270/271	R/R
	10	6/29/88	330	Kokolik R.	AT/L	489/490	Pk/Pk
	12	6/22/90	291	VABM Boot	4.0T/M	113/114	R/Bk
1425F	7[c]	6/29/86	200	Kokolik R.	2.5T/M	350/351	O/dB
	9	6/24/88	220	Kokolik R.	4.5T/M	477/478	O/dB
	11	6/26/90	250	Wolf Butte	4.4T/M	179/178	O/dB
	12	6/22/91	225	Wolf Butte	4.6T/M	179/178	O/dB
1426F	Cub	6/29/86	18	Kokolik R.	0.1/L	-/288	-/Y
1427M	Cub	6/29/86	22	Kokolik R.	0.25/M	289/-	Y/-
1428F	7[c]	6/30/86	240	Utukok R.	3.2T/M	290/291	dB/G
1429M	13[c]	7/2/86	380	Squirrel R.	5.0T/M	508/506	Bk/Bk
	14[c]	5/25/87	400[c]	Spruce Cr.	A,T/M	523/506	Bk/Bk
1430F	6[c]	5/22/87	190[c]	Kiana Hills	3.0T/M	547/546	R/R
1431F	8[c]	5/23/87	250[c]	Timber Cr.	A,T/L	540/541	mG/mG
1432M	9[c]	5/23/87	260[c]	Timber Cr.	3.2T/M	588/589	1B/1B
1433M	12[c]	5/23/87	400[c]	Timber Cr.	5.5T/M	552/553	Y/R
	14[c]	6/20/88	440[c]	Omar R.	7.0T/M	-/-	-/-
1434M	Cub	6/18/87	20	Seismo Cr.	0.14T/L	-/449	-/R
1435F	Cub	6/18/87	20	Seismo Cr.	0.14T/L	450/-	R/-
1436F	Cub	6/18/87	12	Seismo Cr.	0.8T/L	-/-	-/-
1437F	9[c]	6/19/87	160	Sulungatak Rg.	2.8T/H	563/562	dB/R
	12[c]	6/20/90	204	Sulungatak Rg.	3.5T/M	794/796	dB/R
1438F	Ad	6/20/87	220	Sulungatak Rg.	2.8T/L	586/587	dB/dB
1439F	14[c]	6/20/87	210	Sulungatak Rg.	4.0T/M	572/573	mG/dB

Table 1. Continued.

Bear No. and sex	Cem. age (yr)	Date of capture	Bear wt. (lb)	Location	Drug dosage[a]	Ear tags (left/right)	Marking[b]
1440F	14[c]	6/20/87	220	Sulungatak Rg.	3.0T/M	387/388	R/Bk
	15[c]	6/27/88	250	Spike Cr.	4.0T/M	387/388	O/Bk
	17[c]	6/25/90	260	Sulungatak Rg.	4.4T/M	372/123	R/Y
	18[c]	6/19/91	265	Ilingnorak Cr.	6.0T/M	372/123	R/Y
1441F	15[c]	6/20/87	270	Kokolik R.	3.0T/M	556/557	W/Pp
1442M	Cub	6/20/87	24	Kokolik R.	--	583/-	R/-
	1	6/24/88	60	Tupikchak Cr.	2.2T/M	365/366	lG/R
1443M	Cub	6/20/87	25	Kokolik R.	--	-/582	-/R
	1	6/24/88	50	Tupikchak Cr.	2.2T/M	483/484	W/R
1444M	Cub	6/20/87	24	Kokolik R.	--	588/589	-/-
	1	6/24/88	60	Tupikchak Cr.	2.2T/M	335/336	O/mG
1445F	1	6/20/87	60	Utukok R.	1.6T/M	568/569	dB/lB
1446M	15[c]	6/22/87	410	Utukok R.	5.0T/M	544/545	mG/O
1447M	4[c]	6/23/87	220	Utukok R.	3.4T/M	576/577	Bk/mG
1448M	8[c]	6/24/87	260	Spike Cr.	5.6T/M	434/435	dB/Pp
1449M	1	6/24/87	42	Spike Cr.	0.6T/M	578/579	lB/W
1450F	1	6/24/87	38	Spike Cr.	0.6T/M	592/593	R/W
1451F	14[c]	6/24/87	240	Utukok R.	3.2T/M	536/537	Y/R
1452F	5[c]	6/20/88	200	Omar R.	4.4T/M	-/-	-/-
1453M	18[c]	6/25/88	400	Disappointment Cr.	6.0T/M	475/476	R/R
1454F	10[c]	6/25/88	290	Disappointment Cr.	4.0T/M	488/487	lG/Bk
	12[c]	6/24/90	265	Colville R.	.4.T/L	488/487	lG/Bk
1455M	7[c]	6/25/88	345	Utukok R.	6.0T/M	370/369	B/B
1456M	10[c]	6/26/88	450	Kokolik R.	6.4T/M	360/359	mG/lG
1457F	10[c]	6/26/88	235	Kokolik R.	4.0T/M	496/495	R/Pk
1458F	7[c]	6/27/88	230	Spike Cr.	2.8T/M	469/470	R/Y
	9[c]	6/22/90	215	Spike Cr.	3.8T/M	469/470	R/Y
1459M	17[c]	6/27/88	380	Spike Cr.	6.0T/M	465/466	lG/lB
	21[c]	6/22/91	410	Spike Cr.	--T/M	661/652	lG/lB
1460F	8[c]	6/27/88	245	Spike Cr.	4.2T/M	468/467	R/mG
	10[c]	6/22/90	210	Sulungatak Rg.	3.6T/M	468/467	R/mG
1461F	--	6/27/88	--	--	3.0T/M	--	W/lB
1462M	4[c]	6/27/88	205	Adventure Cr.	2.6T/L	458/457	GY/lB
1463M	9[c]	6/28/88	325	Kidney Cr.	6.0T/H	463/464	lG/Bk
1464F	7[c]	6/29/88	290	Adventure Cr.	4.2T/M	480/479	Y/dB
	9[c]	5/27/90	205	1091 Cr.	2.6T/M	480/479	Y/dB
1465F	8[c]	6/29/88	280	Tupikchak Mtn.	4.2T/M	486/482	O/Y
	9[c]	6/14/89	255	Kokolik R.	5.0T/M	486/482	O/Y
	10[c]	6/20/90	265	Kokolik R.	3.6T/M	786/787	O/Y
1466M	1	6/29/88	135	Kokolik R.	2.6T/M	455/456	W/O
	2	6/19/89	174	Disappointment Cr.	3.0T/M	455/206	W/O
1467F	6[c]	6/29/88	270	Kokolik R.	4.2T/M	460/459	W/R
1468F	8[c]	6/30/88	300	Archimedes Rg.	4.0T/M	403/404	Bk/O

Table 1. Continued.

Bear No. and sex	Cem. age (yr)	Date of capture	Bear wt. (lb)	Location	Drug dosage[a]	Ear tags (left/right)	Marking[b]
1469M	1	7/1/88	70	Elbow Cr.	2.2T/M	407/419	Y/G
1470M	1	7/1/88	70	Elbow Cr.	2.2T/M	410/409	W/1G
1471M	Cub	7/1/88	39	Elbow Cr.	0.6T/M	405/367	none
1472M	Cub	7/1/88	40	Elbow Cr.	0.6T/M	400/406	none
1473F	3[c]	6/14/89	155	Spike Cr.	4.0T/M	132/131	Bk/1B
1474F	3[c]	6/14/89	145	Iligluruk Cr.	4.0T/M	133/134	mG/Bk
	4[c]	5/27/90	190	Sulungatak Rg.	2.0T/L	133/134	mG/Bk
	5[c]	6/17/91	190	Iligluruk Cr.	4.4T/M	133/292	mG/Bk
	5[c]	6/21/91	--	Iligluruk Cr.	4.5T/M	133/292	mG/Bk
1475F	24[c]	6/15/89	245	Storm Cr.	6.5T/M	125/126	O/Y
1476M	8[c]	6/15/89	360	Nuka R.	7.0T/M	129/130	Bk/Y
1477M	10[c]	6/15/89	400	Colville R.	7.0T/M	782/783	Bk/Bk
	12[c]	6/23/91	485	Utukok R.	10.5T/M	673/672	Bk/Bk
1478M	10[c]	6/18/89	365	Kokolik R.	7.0T/M	779/212	1G/dB
	12[c]	6/24/91	445	Driftwood Cr.	4.2T/L	670/671	1G/dB
1479F	6[c]	6/18/89	230	Kokolik R.	4.6/M	214/215	1B/Y
	7[c]	6/21/90	280	VABM Boot	4.5T/M	124/215	1B/Y
	8[c]	6/18/91	240	Tupikchak Mtn.	4.5T/M	124/215	1B/Y
1480M	Cub	6/18/89	20	Seismo Cr.	0.25/M	None	None
1481F	Cub	6/18/89	15	Seismo Cr.	0.25/M	None	None
1482M	Cub	6/18/89	17	Seismo Cr.	0.25/M	None	None
1483F	Cub	6/18/89	24	Seismo Cr.	0.4T/M	None	None
	2	6/20/91	135	Meat Mtn.	3.0T/M	173/174	R/Bk
1484F	Cub	6/18/89	22	Seismo Cr.	0.4T/M	None	None
	2	6/20/91	135	Meat Mtn.	3.0T/M	173/174	R/Bk
1485M	Cub	6/20/89	36	Utukok R.	0.25/L	None	None
1486M	2	5/27/90	120	Nachralik Pass	1.4T/M	180/181	dG/mG
	3	6/23/91	210	Utukok R.	4.0T/M	180/181	dG/mG
1487F	2	5/27/90	115	Nachralik Pass	1.4T/M	194/195	O/1G
	3	6/20/91	200	Illingnorak Rg.	4.0T/M	194/195	O/1G
1488M	Cub	6/20/90	20	Sulungatak Rg.	0.3T/M	--	--
	1	6/21/91	80	Sulungatak Rg.	2.0T/M	666/667	Bk/O
1489M	Cub	6/20/90	24	Sulungatak Rg.	0.3T/M	--	--
	1	6/21/91	80	Sulungatak Rg.	2.0T/M	290/291	W/1G
1490M	6[c]	6/20/90	375	Tupikchak Mtn.	AT/M	182/183	mG/dB
1491M	17[c]	6/21/90	460	VABM Boot	8.7T/M	109/110	dB/mG
1492F	1	6/22/90	70	Sulungatak Rg.	1.0T/M	186/187	Y/dB
	2	6/18/91	102	Sulungatak Rg.	2.6T/M	186/187	Y/dB
1493F	1	6/22/90	60	Sulungatak Rg.	1.0T/M	115/116	dB/1B
	2	6/18/91	110	Sulungatak Rg.	2.6T/M	115/116	dB/1B
1494M	1	6/22/90	70	Spike Cr.	1.0T/M	177/176	O/mG
	2	6/21/91	130	Up. Kokolik R.	3.8T/M	145/176	O/mG
1495F	1	6/22/90	72	Spike Cr.	1.0T/M	136/135	W/Bk
	2	6/21/91	120	Up. Kokolik R.	3.8T/M	136/135	W/Bk
1496M	1	6/23/90	110	Nimwutik Cr.	2.2T/M	287/286	O/mG
	2	6/23/91	160	VABM N. Third	4.0T/M	287/286	O/mG

Table 1. Continued.

Bear No. and sex	Cem. age (yr)	Date of capture	Bear wt. (lb)	Location	Drug dosage[a]	Ear tags (left/right)	Marking[b]
1497M	1	6/23/90	110	Tupikchak Mtn.	2.0T/M	317/316	mG/W
1498F	1	6/24/90	80	Colville R.	1.2T/M	278/279	R/dB
	2	6/24/91	125	Disappointment Cr.	3.8T/M	278/278	R/dB
1499M	1	6/24/90	71	Colville R.	1.2T/M	322/323	O/1B
	2	6/24/91	120	Disappointment Cr.	3.8T/M	989/278	O/1B
1500F	1	6/24/90	70	Colville R.	1.2T/M	324/325	1B/R
	2	6/24/91	120	Disappointment Cr.	3.8T/M	324/325	1B/R
1701F	1	6/24/90	80	VABM Rain	2.4T/M	276/277	1B/dB
	2	6/20/91	130	Utukok R.	3.0T/M	276/277	1B/dB
1702F	1	6/24/90	71	VABM Rain	2.4T/M	280/281	dB/R
	2	6/20/91	130	Utukok R.	3.2T/M	280/281	dB/R
1703M	14[c]	6/24/90	--	Archimedes Rg.	7.5T/M	304/305	dB/mG
1704F	1	6/25/90	90	Ilingnorak Rg.	2.4T/M	312/313	1G/R
	2	6/21/91	142	Ilingnorak Rg.	3.2T/M	312/313	1G/R
1705M	1	6/25/90	100	Ilingnorak Rg.	2.4T/M	300/301	R/O
	2	6/21/91	160	Ilingnorak Rg.	3.2T/M	300/301	R/O
1706F	1	6/25/90	75	Ilingnorak Rg.	2.4T/M	102/101	W/mG
	2	6/21/91	120	Ilingnorak Rg.	3.2T/M	102/101	W/mG
1707M	1	6/25/90	80	Sulungatak Rg.	2.4T/M	294/295	1G/1G
	2	6/19/91	110	Up. Kokolik R.	3.0T/M	294/295	1G/1G
1708M	1	6/26/90	68	Wolf Butte	2.4T/M	283/282	Gy/mG
	2	6/22/91	120	Wolf Butte	3.2T/M	283/282	Gy/mG
1709M	1	6/26/90	80	Wolf Butte	2.4T/M	303/302	Bk/Gy
	2	6/22/91	125	Wolf Butte	3.2T/M	285/284	dB/Gy
1710M	1	6/26/90	80	Wolf Butte	2.4T/M	797/798	1B/W
	2	6/22/91	130	Wolf Butte	3.2T/M	303/651	Bk/W
1711F	4[c]	6/17/91	200	Poko Mtn.	4.0T/M	135/136	Y/R
1712M	17[c]	6/18/91	460	Tupikchak Mtn.	7.3T/M	169/170	1B/R
1713F	2	6/19/91	120	Up. Utukok R.	2.6T/M	167/168	1G/O
1714M	2	6/19/91	110	Up. Utukok R.	2.6T/M	978/979	1G/1B
1715F	2	6/19/91	130	Up. Utukok R.	2.6T/M	151/152	O/W
1716F	8[c]	6/19/91	260	Adventure Cr.	3.8T/M	165/166	dB/O
1717F	Cub	6/19/91	29	Adventure Cr.	0.3T/M	None	None
1718F	Cub	6/19/91	24	Adventure Cr.	0.3T/M	None	None
1719M	3[c]	6/20/91	230	Ilingnorak Rg.	4.0T/M	149/148	1G/Bk
1720M	16[c]	6/22/91	470	Kokolik R.	10.1T/M	161/162	Y/W
1721F	2	6/22/91	110	Spike Cr.	4.0T/M	153/154	1G/Y
1722M	2	6/22/91	110	Spike Cr.	4.0T/M	159/160	mG/O
1723M	3[c]	6/23/91	195	VABM Cache	4.0T/M	163/164	Gy/Y
1724M	4[c]	6/23/91	230	Driftwood Cr.	3.8T/M	982/983	1B/O
1725M	4[c]	6/23/91	210	Driftwood Cr.	4.2T/M	668/669	R/1B
1726M	3	6/24/91	175	Driftwood Cr.	3.8T/M	659/660	mG/1B
1727M	1	6/24/91	85	Storm Cr.	2.6T/M	155/156	Y/Bk

Table 1. Continued.

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a Dosage in ml of sernylan, Telazol, or M99; no designation indicates use of Sernylan, T of Telazol, and M99 of M99. A denotes multiple injections with unknown effective dosage. Drug effects were as follows: L = light, M = optimum, H = heavy.

b Marker designations:

Colors: P, pink; W, white; G, light green; mG, medium green; O, orange; dB, dark blue; lB, light blue; Bk, black; Pp, purple.

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. Three flag combinations were used in nylon rope collars; e.g., OOW is 2 identical clusters of OOW flags on opposite sides of the collar.

c Estimate after close examination.

Table 2. History and status of grizzly bears marked in the western Brooks Range, Alaska study area 1977-91.

Bear no./sex	Initial capture Age	Initial capture Date	Recaptures	Date of last location	Locations/ year	Status, fall 1991
1081 M	5	5/24/77	9/17/79	8/24/91	2/1977	Functional collar
			7/7/80		3/1979	
			8/15/80		14/1980	
			9/14/84		13/1981	
			9/16/84		5/1982	
			6/19/87		2/1983	
			6/15/89		1/1984	
			6/25/90		4/1985	
					2/1986	
					2/1987	
					4/1988	
					3/1989	
					2/1990	
					4/1991	
1082 M	13	5/25/77	6/13/77	6/1/89	24/1977	Dead
			6/25/77		20/1978	
			8/10/77		18/1979	
			6/27/78		3/1980	
			6/28/79		4/1981	
			8/17/80		2/1987	
			6/18/87		1/1988	
					1/1989	
1083 M	7	5/25/77	6/2/77	6/18/87	24/1977	Unknown
			7/2/78		15/1978	
			6/30/79		6/1979	
			5/20/84		16/1980	
			6/4/85		1/1981	
					2/1984	
					5/1985	
					2/1986	
					1/1987	
1084 M	7	5/26/77	6/2/77	9/1/84	4/1977	Dead, hunter kill
1085 F	19	5/27/77	--	8/20/80	20/1977	Presumed dead
					14/1978	
					9/1979	
					14/1980	
1086 F	16	5/29/77	6/24/77	7/19/80	33/1977	Presumed dead
			8/8/77		28/1978	
			9/16/79		25/1979	
					13/1980	

Table 2. Continued.

Bear no./sex	Initial capture Age	Date	Recaptures	Date of last location	Locations/ year	Status, fall 1991
1087 F	1	5/29/77	6/30/79 7/7/80 5/25/84 6/20/91	8/24/91	10/1979 1/1980 3/1984 6/1985 5/1986 6/1987 2/1988 4/1989 4/1990 4/1991	Functional collar
1088 M	4	5/31/77	--	6/3/79	8/1977 1/1978 2/1979	Dead, hunter kill
1089 F	4	6/1/77	6/10/77 6/4/85 6/28/88 6/25/90	8/24/91	10/1977 5/1978 1/1979 3/1986 4/1987 2/1988 4/1989 2/1990 4/1991	Functional collar
1090 F	18	6/1/77	--	10/12/78	20/1977 17/1978	Presumed dead
1091 M	19	6/4/77	--	10/12/78	19/1977 11/1978	Presumed dead
1092 F	8	6/4/77	8/19/80 6/21/83 9/6/85	9/20/87	20/1977 20/1978 2/1980 5/1981 5/1982 3/1983 1/1984 3/1985 3/1986 4/1987	Dead, hunter kill
1093 F	Cub	6/4/77	--	9/19/78	20/1977 20/1978	Unknown
1094 M	4	6/5/77	--	9/3/83	4/1977	Dead, hunter kill

Table 2. Continued.

Bear no./sex	Initial capture Age	Initial capture Date	Recaptures	Date of last location	Locations/ year	Status, fall 1991
1095 F	6	6/5/77	6/24/87 6/15/89 6/24/91	8/23/91	1/1977 1/1978 2/1987 2/1989 1/1990 4/1991	Functional collar
1096 M	7	6/5/77	6/28/78 6/28/79 8/17/80	9/19/81	23/1977 25/1978 4/1979 7/1980 15/1981	Probable hunter kill
1097 F	8	6/5/77	6/19/77 7/6/80 8/16/80 9/19/83 6/5/85 5/25/87 6/23/89 6/23/91	8/24/91	22/1977 20/1978 15/1979 19/1980 23/1981 13/1982 3/1984 4/1985 5/1986 9/1987 1/1988 3/1989 3/1990 5/1991	Functional collar
1098 M	3	6/8/77	6/23/89	6/21/90	2/1977 1/1978 2/1988 1/1989 1/1990	Unknown
1099 M	10	6/11/77	6/27/78 6/26/79 9/20/83	10/26/84	20/1977 31/1978 11/1979 1/1980 1/1983 1/1984	Killed, DLP
1100 F	6	6/11/77	6/9/78 7/1/79	8/20/80	18/1977 13/1978 9/1979 12/1980	Unknown

Table 2. Continued.

Bear no./sex	Initial capture Age	Initial capture Date	Recaptures	Date of last location	Locations/ year	Status, fall 1991
1101 M	2	6/12/77	--	10/7/77	3/1977	Dead, killed by 1099
1102 F	2	6/12/77	6/18/78	6/14/82	3/1977 12/1978 2/1979 2/1980 6/1981 22/1982	Unknown
1103 M	8	6/12/77	6/12/78 5/8/85 6/29/88	6/18/89	20/1977 6/1978 1/1985 1/1986 1/1988 3/1989	Presumed dead
1104 F	9	6/12/77	6/17/77 7/10/80 6/22/83 6/10/85 5/26/86	9/23/87	23/1977 17/1978 2/1979 9/1981 24/1982 2/1983 3/1984 7/1985 4/1986 4/1987	Dead, killed by adult male
1105 F	7	6/13/77	6/17/77 7/10/80 6/22/83 6/7/85	9/9/87	23/1977 21/1978 10/1979 5/1980 6/1981 13/1982 2/1984 3/1985 4/1986 4/1987	Hunter kill 1987
1106 F	11	6/14/77	--	5/4/79	23/1977 17/1978 1/1979	Killed by bear no. 1099?
1107 F	Cub	6/14/77	--	4/20/78	23/1977 1/1978	Dead, spring 1978

Table 2. Continued.

Bear no./sex	Initial capture Age	Date	Recaptures	Date of last location	Locations/ year	Status, fall 1991
1108 F	Cub	6/14/77	--	5/4/79	23/1977 17/1978 1/1979	Presumed killed by bear no. 1099
1109 F	Cub	6/14/77	--	5/4/79	23/1977 17/1978 1/1979	Presumed killed by bear no. 1099
1110 F	24	6/15/77	7/1/78 6/30/79	5/7/81	2/1977 14/1978 3/1979 11/1980 2/1981	Presumed dead
1111 F	14	6/18/77	--	7/11/79	19/1977 14/1978 2/1979	Unknown
1112 M	4	6/18/77	--	6/24/78	10/1977 1/1978	Unknown
1113 F	4	6/18/77	--	10/5/77	9/1977	Unknown
1114 M	16	6/19/77	--	5/31/79	3/1977 3/1978 1/1979	Unknown
1115 M	5	6/22/77	--	6/27/77	3/1977	Unknown
1116 M	5	6/23/77	--	10/12/78	2/1977	Unknown
1117 M	19	6/23/77	--	6/23/77	1/1977	Presumed dead
1118 F	17	6/23/77	9/14/84	6/29/86	3/1977 1/1978 2/1984 3/1985 1/1986	Presumed dead
1119 F	6	6/24/77	--	6/9/78	1/1977 1/1978	Unknown
1120 M	16	6/24/77	--	9/18/78	1/1977 1/1978	Unknown

Table 2. Continued.

Bear no./sex	Initial capture Age	Date	Recaptures	Date of last location	Locations/ year	Status, fall 1991
1121 F	11	6/25/77	9/17/84	11/8/86	21/1977 11/1978 1/1980 1/1984 3/1985 3/1986	Dead; killed?, eaten by other bear fall 1986
1122 M	Cub	6/25/77	--	8/25/78	21/1977 11/1978	Unknown
1123 F	Cub	6/25/77	--	8/25/78	21/1977 11/1978	Unknown
1124 M	17	6/26/77	9/17/84	6/9/85	7/1977 1/1984 2/1985	Unknown
1125 F	3	6/27/77	6/24/91	8/23/91	2/1977 0/1978-90 2/1991	Functional collar
1126 M	13	6/28/77	--	6/28/77	1/1977	Unknown
1127 F	26	6/28/77	--	7/14/77	2/1977	Presumed dead
1128 F	7	6/30/77	--	8/31/78	3/1977	Unknown
1129 F	1	6/30/77	--	7/27/77	3/1977	Unknown
1130 F	21	6/30/77	--	8/2/78	1/1977 1/1978	Presumed dead
1131 M	8	7/1/77	--	8/16/78	1/1977 2/1978	Unknown
1132 F	2	7/2/77	--	7/2/77	2/1977	Unknown
1133 M	2	7/2/77	6/27/79	6/2/83	2/1977 1/1978 1/1979	Dead, hunter kill

Table 2. Continued.

Bear no./sex	Initial capture Age	Initial capture Date	Recaptures	Date of last location	Locations/ year	Status, fall 1991
1134 F	14	7/5/77	7/12/80 6/20/83	6/20/83	18/1977 15/1978 1/1979 3/1980 1/1981 6/1982 3/1983	Dead, starved?; eaten by other bear
1135 M	1	7/5/77	--	5/5/79	18/1977	Presumed dead
1136 F	1	7/5/77	6/28/88 7/1/88	7/1/88	18/1977 15/1978 1/1979 2/1988	Unknown
1137 F	1	7/5/77	--	5/5/79	18/1977 15/1978 1/1979	Unknown
1138 F	23	8/10/77	6/16/78	10/27/78	2/1977 5/1978	Presumed dead
1139 F	11	6/7/78	6/22/83	5/25/85	16/1978 13/1979 1/1980 2/1984 1/1985	Dead
1140 M	Cub	6/7/78	--	7/11/79	16/1978 13/1979	Unknown
1141 F	Cub	6/7/78	7/13/80 9/16/84 6/5/85 5/25/87 6/25/88 6/20/89	6/21/90	16/1978 13/1979 4/1980 8/1981 9/1982 3/1985 4/1986 6/1987 3/1988 5/1989 3/1990	Unknown, presumed dead
1142 F	14	6/9/78	--	9/18/78	7/1978	Hunter kill 1987?

Table 2. Continued.

Bear no./sex	Initial capture Age	Date	Recaptures	Date of last location	Locations/ year	Status, fall 1991
1143 F	9	6/9/78	--	7/28/79	2/1978 1/1979	Unknown
1144 F	1	6/9/78	9/4/85	10/1/86	2/1978 1/1979 1/1985 2/1986	Dead, killed by other bear?
1145 F	2	6/10/78	--	5/4/80	15/1978 5/1979 1/1980	Unknown
1146 F	14	6/10/78	--	5/15/79	15/1978 1/1979	Unknown
1147 M	3	6/10/78	7/10/80 9/15/84 6/30/86 6/27/88 6/18/91	8/23/91	2/1978 1/1984 2/1985 1/1986 4/1987 3/1988 4/1989 0/1990 3/1991	Functional collar
1148 M	6	6/10/78	--	9/21/78	8/1978	Unknown
1149 F	4	6/11/78	6/24/87 5/27/90	8/24/91	3/1978 2/1987 1/1988 4/1989 4/1990 3/1991	Functional collar
1150 M	5	6/16/78	--	6/16/78	1/1978	Unknown
1151 F	3	6/16/78	6/22/83	5/18/84	1/1983 1/1984	Unknown, shed collar
1152 M	3	6/16/78	--	10/2/78	2/1978	Unknown
1153 F	2	6/16/78	6/8/85	8/8/85	2/1985 2/1986	Unknown; possible sighting with 2 cubs 1986

Table 2. Continued.

Bear no./sex	Initial capture Age	Initial capture Date	Recaptures	Date of last location	Locations/ year	Status, fall 1991
1154 F	12	6/21/78	--	6/9/80	2/1978 1/1979 1/1980	Unknown
1155 M	1	6/21/78	--	9/1/81	2/1978 1/1979	Dead, hunter kill
1156 F	6	6/21/78	6/23/87	6/28/88	1/1978 2/1987 1/1988	Dead, killed by other bear?
1157 M	5	6/24/78	6/30/79 6/23/87 6/18/89	6/25/90	1/1978 2/1979 1/1987 1/1989 1/1990	Functional collar?
1158 F	7	6/24/78	7/1/88	5/31/89	1/1978 2/1988 1/1989	Unknown, shed collar
1159 M	10	6/24/78	8/16/80 9/16/83	9/16/83	2/1978 1/1980 1/1983	Unknown
1160 M	Cub	7/1/78	--	7/1/78	1/1978	Unknown
1161 M	Cub	7/1/78	--	7/1/78	1/1978	Unknown
1162 M	2	7/1/78	7/2/78	7/26/78	2/1978	Dead
1163 M	2	7/3/78	--	7/3/78	1/1978	Unknown
1164 M	3	5/7/79	7/6/80 9/18/84 7/1/86	5/21/87	1/1979 1/1980 1/1984 4/1985 3/1986 1/1987	Dead, hunter kill

Table 2. Continued.

Bear no./sex	Initial capture Age	Date	Recaptures	Date of last location	Locations/ year	Status, fall 1991
1165 M	3	9/17/79	7/13/80 9/14/84 6/19/89	6/24/90	1/1979 1/1980 2/1984 2/1985 3/1986 1/1987 2/1988 2/1989 2/1990	Unknown
1166 F	10	9/18/79	7/7/80 6/22/83 6/24/90 6/20/91	8/24/91	2/1979 1/1980 1/1983 2/1984 2/1985 4/1986 0/1987-89 1/1990 5/1991	Functional collar
1167 F	7	9/18/79	6/18/87 6/24/90	6/24/90	1/1979 5/1987 2/1988 3/1989 4/1990	Unknown, shed collar
1168 F	Cub	9/18/79	--	9/18/79	1/1979	Unknown
1169 F	11	7/5/80	6/21/83 9/6/85	5/26/86	1/1980 1/1983 1/1984 3/1985 1/1986	Dead, killed by male bear
1170 F	Cub	7/5/80	--	7/5/80	1/1980	Dead
1171 M	Cub	7/5/80	--	7/5/80	1/1980	Dead
1172 M	11	7/6/80	9/16/84	8/9/85	1/1980 1/1984 2/1985	Unknown, shed collar
1173 M	Cub	7/10/80	5/25/84 6/7/85	6/27/86	1/1980 2/1985 1/1986	Dead

Table 2. Continued.

Bear no./sex	Initial capture Age	Initial capture Date	Recaptures	Date of last location	Locations/ year	Status, fall 1991
1174 F	Cub	7/10/80	5/25/84 6/7/85 6/27/86 6/19/87 6/23/90 6/22/91	6/22/91	1/1980 1/1984 3/1985 6/1986 4/1987 5/1988 0/1989 2/1990 4/1991	Functional collar
1175 M	7	7/12/80	--	7/12/80	1/1980	Unknown
1176 F	18	7/13/80	9/16/84 6/22/87	9/23/88	2/1980 1/1984 3/1985 3/1986 6/1987 4/1988	Dead, old age?
1177 F	1	7/10/80	9/18/83 6/10/85 6/30/86 6/23/90 6/18/91	8/24/91	2/1980 1/1983 4/1984 5/1985 3/1986 2/1987 1/1988 0/1989 2/1990 3/1991	Functional collar
1178 F	13	8/18/80	--	8/18/80	1/1980 8/1981 22/1982	Unknown
1179 F	2	8/18/80	6/22/83 6/10/85 6/22/87	6/1/89	1/1980 7/1981 1/1983 1/1984 5/1985 2/1986 4/1987 3/1988 1/1989	Alive, nonfunctional collar
1180 F	Cub	8/18/80	--	8/20/80	1/1980	Presumed dead

Table 2. Continued.

Bear no./sex	Initial capture Age	Initial capture Date	Recaptures	Date of last location	Locations/ year	Status, fall 1991
1181 F	Cub	8/18/80	9/15/83 5/26/84 6/6/85	9/30/86	1/1980 1/1983 4/1984 6/1985 6/1986 1/1987	Dead at 1986/87 den
1232 M	4	9/18/83	--	9/18/83	1/1983	Unknown
1233 M	11	9/18/83	6/8/85 6/10/85 6/30/88	6/16/89	1/1983 1/1985 1/1986 1/1988 1/1989	Unknown, shed collar
1234 F	5	9/18/83	6/6/85	4/15/88	1/1983 1/1985 1/1986 2/1987 1/1988	Unknown, nonfunctional collar
1261 M	10	6/22/83	--	6/22/83	1/1983	Unknown
1401 M	11	5/25/84	--	5/25/85	2/1984 2/1985	Unknown
1402 M	3	5/25/84	6/5/85 6/29/86		2/1985 1/1986	Dead, hunter kill
1403 F	3	5/25/84	6/5/85 7/1/86 5/25/87	5/21/88	2/1985 2/1986 5/1987 1/1988	Dead, killed by other bear
1404 M	3	5/25/84	6/5/85	11/8/86	1/1984 2/1985 2/1986	Unknown, shed collar
1405 M	7	5/26/84	6/20/87 6/21/90	6/24/91	1/1984 2/1987 3/1988 1/1989 1/1990 2/1991	Functional collar

Table 2. Continued.

Bear no./sex	Initial capture Age	Initial capture Date	Recaptures	Date of last location	Locations/ year	Status, fall 1991
1406 F	10	9/13/84	--	9/13/84	1/1984	Dead, eaten by other bear
1407 F	10	9/14/84	6/20/89 6/20/91	8/24/91	1/1984 3/1985 3/1986 6/1987 4/1989 5/1990 3/1991	Functional collar
1408 M	10	9/15/84	--	9/15/84	1/1984	Unknown, not collared
1409 M	Cub	9/16/84	--	9/16/84	1/1984	Presumed dead
1410 F	20	9/16/84	--	6/27/86	1/1984 3/1986	Unknown
1411 M	7	6/4/84	6/24/88 6/28/88	6/18/89	1/1985 2/1988 1/1989	Unknown
1412 M	15	6/4/85	--	5/5/86	1/1985 2/1986	Dead, hunter kill
1413 F	9	6/8/85	6/25/88	6/28/88	2/1985 3/1986 3/1987 2/1988	Unknown
1414 F	2	6/8/85	--	6/8/85	1/1985	Unknown, not collared
1415 F	15	9/5/85	--	9/5/85	1/1985	Unknown
1416 F	9	9/5/85	6/28/88	8/24/91	1/1985 3/1986 2/1987 3/1988 3/1989 3/1990 5/1991	Dead
1417 F	9	9/6/85	6/21/88	6/18/89	2/1986 1/1987 2/1988 1/1989	Unknown

Table 2. Continued.

Bear no./sex	Initial capture Age	Date	Recaptures	Date of last location	Locations/ year	Status, fall 1991
1418 M	17	9/6/85	--	9/6/85	1/1985	Unknown
1420 M	7	6/25/86	6/24/88	6/4/88	2/1986 1/1987 2/1988	Unknown, shed collar
1421 M	13	6/25/86	--	9/23/87	1/1986 4/1987 1/1988	Unknown, shed collar
1422 F	Cub	6/26/86	--	6/30/86	2/1986	Dead by 9/30/86
1423 M	Cub	6/26/86	--	6/30/86	2/1986	Dead by 9/30/86
1424 F	8	6/27/86	6/29/88 6/22/90	8/24/91	2/1986 1/1987 2/1988 3/1989 4/1990 2/1991	Functional collar
1425 F	7	6/29/86	6/24/88 6/26/90 6/22/91	8/24/91	3/1986 5/1987 3/1988 2/1989 3/1990 5/1991	Functional collar
1426 F	Cub	6/29/86	--	6/29/86	2/1986	Dead by 9/30/86
1427 M	Cub	6/29/86	--	6/29/86	2/1986	Dead by 9/30/86
1428 F	7	6/30/86	--	4/15/88	2/1986 1/1988	Unknown
1434 M	Cub	6/18/87	--	5/31/89	3/1987 2/1988 1/1989	Unknown
1435 F	Cub	6/18/87	--	5/31/89	3/1987 2/1988 1/1989	Unknown
1436 F	Cub	6/18/87	--	6/18/87	1/1987	Dead by 6/23/87

Table 2. Continued.

Bear no./sex	Initial capture Age	Date	Recaptures	Date of last location	Locations/ year	Status, fall 1991
1437 F	9	6/19/87	6/20/90	8/24/91	3/1987 1/1988 2/1989 1/1990 6/1991	Functional collar
1438 F	13	6/20/87	--	4/15/88	3/1987 1/1988	Unknown
1439 F	9	6/20/87	--	4/15/88	2/1987 1/1988	Unknown, shed collar
1440 F	13	6/20/87	6/27/88 6/25/90 6/19/91	8/24/91	3/1987 2/1988 2/1989 3/1990 5/1991	Functional collar
1441 F	15[a]	6/20/87	--	6/14/89	3/1987 3/1988 2/1989	Unknown
1442 M	Cub	6/20/87	6/24/88	10/10/88	3/1987 2/1988	Dead in den with 1443
1443 M	Cub	6/20/87	6/24/88	10/10/88	3/1987 2/1988	Dead in den with 1442
1444 M	Cub	6/20/87	6/24/88	6/18/89	3/1987 2/1988 3/1989	Dead, killed by other bear
1445 F	1	6/20/87	--	9/17/87	4/1987	Dead, killed by no. 1447
1446 M	9	6/22/87	--	6/22/87	1/1987	Unknown
1447 M	4	6/23/87	--	9/17/87	2/1987	Unknown, shed collar
1448 M	8	6/24/87	--	9/2/87	2/1987	Unknown, shed collar
1449 M	1	6/24/87	--	6/24/87	1/1987 1/1988	Dead in shallow den with 1450
1450 F	1	6/24/87	--	6/24/87	1/1987 1/1988	Dead in shallow den with 1449

Table 2. Continued.

Bear no./sex	Initial capture Age	Initial capture Date	Recaptures	Date of last location	Locations/ year	Status, fall 1991
1451 F	12	6/24/87	--	6/15/89	1/1987 2/1988 1/1989	Unknown
1453 M	14	6/25/88	--	6/20/89	2/1988 2/1989	Unknown
1454 F	12	6/25/88	6/24/90 6/24/91	8/24/91	1/1988 0/1989 2/1990 5/1991	Functional collar
1455 M	6	6/25/88	--	6/25/88	1/1988	Unknown, not collared
1456 M	9	6/26/88	--	10/10/88	2/1988	Dead, hunter kill
1457 F	10	6/26/88	--	6/17/89	2/1988 1/1989	Unknown
1458 F	9	6/27/88	6/22/90	8/24/91	1/1988 3/1989 1/1990 4/1991	Functional collar
1459 M	13	6/27/88	6/22/91	8/24/91	1/1988 4/1989 0/1990 4/1991	Functional collar
1460 F	10	6/27/88	6/22/90	8/24/91	1/1988 2/1989 3/1990 5/1991	Functional collar
1461 F	12	6/27/88	--	6/14/89	1/1988 1/1989	Unknown
1462 M	4	6/27/88	--	6/18/89	1/1988 2/1989	Unknown
1463 M	11	6/28/88	--	6/28/88	1/1988	Unknown, not collared

Table 2. Continued.

Bear no./sex	Initial capture Age	Initial capture Date	Recaptures	Date of last location	Locations/ year	Status, fall 1991
1464 F	13	6/29/88	5/27/90	8/24/91	2/1988 0/1989 2/1990 5/1991	Alive, nonfunctional collar
1465 F	12	6/29/88	6/14/89 6/20/90	8/24/91	2/1988 4/1989 2/1990 4/1991	Functional collar
1466 M	1	6/29/88	6/19/89	6/19/89	2/1988 2/1989	Unknown
1467 F	9	6/29/88	--	10/10/88	2/1988	Unknown
1468 F	16	6/30/88	--	5/16/91	1/1988 3/1989 0/1990 1/1991	Functional collar
1469 M	1	7/1/88	--	7/1/88	1/1988	Unknown, not collared
1470 M	1	7/1/88	--	7/1/88	1/1988	Unknown, not collared
1471 M	1	7/1/88	--	7/1/88	1/1988	Unknown, not collared
1472 M	1	7/1/88	--	7/1/88	1/1988	Unknown, not collared
1473 F	6	6/14/89	--	6/14/89	1/1989	Unknown
1474 F	4	6/14/89	6/21/91	6/22/91	1/1989 1/1990 4/1991	Functional collar
1475 F	24	6/15/89	--	6/15/89	1/1989	Unknown, not collared
1476 M	10	6/15/89	--	6/15/89	1/1989	Unknown, not collared
1477 M	9	6/15/89	6/23/91	6/23/91	1/1989 1/1991	Functional collar
1478 M	12	6/18/89	6/24/91	8/24/91	1/1989 0/1990 2/1991	Functional collar

Table 2. Continued.

Bear no./sex	Initial capture Age	Initial capture Date	Recaptures	Date of last location	Locations/ year	Status, fall 1991
1479 F	9	6/18/89	6/21/90 6/18/91	8/24/91	1/1989 1/1990 3/1991	Functional collar
1480 M	Cub	6/19/89	--	8/24/91	3/1989 3/1990 2/1991	Alive, with mother
1481 F	Cub	6/19/89	--	8/24/91	3/1989 3/1990 2/1991	Alive, with mother
1482 M	Cub	6/19/89	--	6/19/89	3/1989	Dead
1483 F	Cub	6/19/89	6/20/91	8/24/91	4/1989 4/1990 4/1991	Alive, with mother
1484 F	Cub	6/19/89	6/20/91	8/24/91	4/1989 4/1990 4/1991	Alive, with mother
1485 M	Cub	6/20/89	--	6/20/89	5/1989	Unknown
1486 M	2	5/27/90	6/23/91	8/24/91	2/1990 3/1991	Functional collar
1487 F	2	5/27/90	6/20/91	8/24/91	2/1990 4/1991	Dead, eaten by other bear
1488 M	Cub	6/20/90	6/21/91	8/24/91	2/1990 4/1991	Alive, with mother
1489 M	Cub	6/20/90	6/21/91	8/24/91	2/1990 4/1991	Alive, with mother
1490 M	6	6/20/90	--	9/10/91	1/1990 2/1991	Killed by hunter
1491 M	17	6/21/90	--	6/20/90	1/1990	Unknown
1492 M	1	6/22/90	6/18/91	8/24/91	2/1990 5/1991	Alive, with mother
1493 F	1	6/22/90	6/18/91	8/24/91	2/1990 5/1991	Alive, with mother

Table 2. Continued.

Bear no./sex	Initial capture Age	Date	Recaptures	Date of last location	Locations/ year	Status, fall 1991
1494 M	1	6/22/90	6/21/91	8/24/91	1/1990 5/1991	Alive, with mother
1495 F	1	6/22/90	6/21/91	8/24/91	1/1990 5/1991	Alive, with mother
1496 M	1	6/23/90	6/23/91	8/24/91	1/1990 3/1991	Functional collar
1497 M	1	6/23/90	--	6/22/91	1/1990 3/1991	Functional collar
1498 F	1	6/24/90	6/24/91	8/24/91	2/1990 5/1991	Alive, with mother
1499 M	1	6/24/90	6/24/91	8/24/91	2/1990 5/1991	Alive, with mother
1500 F	1	6/24/91	6/24/91	8/24/91	2/1990 5/1991	Alive, with mother
1701 M	1	6/24/90	6/20/91	8/24/91	1/1990 5/1991	Alive, with mother
1702 F	1	6/24/90	6/20/91	8/24/91	1/1990 5/1991	Alive, with mother
1703 M	13	6/24/90	--	6/24/90	1/1990	Unknown, not collared
1704 F	1	6/25/90	6/21/91	8/24/91	2/1990 5/1991	Alive, with mother
1705 M	1	6/25/90	6/21/91	8/24/91	2/1990 5/1991	Alive, with mother
1706 F	1	6/25/90	6/21/91	8/24/91	2/1990 5/1991	Alive, with mother
1707 M	1	6/25/90	6/19/91	6/22/91	1/1990 4/1991	Functional collar
1708 M	1	6/26/90	6/22/91	8/24/91	3/1990 5/1991	Alive, with mother
1709 M	1	6/26/90	6/22/91	8/24/91	3/1990 5/1991	Alive, with mother

Table 2. Continued.

Bear no./sex	Initial capture Age	Initial capture Date	Recaptures	Date of last location	Locations/ year	Status, fall 1991
1710 M	1	6/26/90	6/22/91	8/24/91	3/1990 5/1991	Alive, with mother
1711 F	4	6/17/91	--	6/22/91	3/1991	Functional collar
1712 M	17	6/18/91	--	6/18/91	1/1991	Functional collar
1713 F	2	6/19/91	--	8/24/91	2/1990 5/1991	Alive, with mother
1714 M	2	6/19/91	--	8/24/91	2/1990 5/1991	Alive, with mother
1715 F	2	6/19/91	--	8/24/91	2/1990 5/1991	Alive, with mother
1716 F	8	6/19/91	--	8/24/91	4/1991	Functional collar
1717 F	Cub	6/19/91	--	8/24/91	4/1991	Alive, with mother
1718 F	Cub	6/19/91	--	8/24/91	4/1991	Alive, with mother
1719 M	3	6/20/91	--	8/24/91	3/1991	Functional collar
1720 M	16	6/22/91	--	6/22/91	1/1991	Functional collar
1721 F	2	6/22/91	--	6/22/91	1/1991	Functional collar
1722 M	2	6/22/91	--	8/24/91	2/1991	Functional collar
1723 M	3	6/23/91	--	6/23/91	1/1991	Unknown, not collared
1724 M	4	6/23/91	--	6/23/91	1/1991	Unknown, not collared
1725 M	4	6/23/91	--	6/23/91	1/1991	Unknown, not collared
1726 M	3	6/24/91	--	8/24/91	2/1991	Alive, with mother
1727 M	1	6/24/91	--	8/24/91	4/1991	Alive, with mother

[a] Estimated age, based on comparison of tooth-wear patterns with those of known-aged bears.

Table 3. Reproductive history and litter size for female grizzly bears in the western Brooks Range, Alaska, 1977-91.[a]

Bear No.	Age[b] in 1991	Reproductive history and litter size[c]															
		1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
1085	23	B	B	NB?	NB	PD											
1086	19	2yl	2 2y	2 3y/B	2c/PD												
1087	15				NB/NPO	B	B	UN	B	B	2c/B	1c	B	2c	2yl	2 2y	
1089	18	NB/NPO	B	2c	UN	UN	1c?	UN	UN	B	2c	1yl	B	3c	3yl	3 2y	
1090	23	3yl	3 2y	3 3y/B	UN	UN	PD										
1092	19	1c	1 yl	1 2y	B	B	B	B	B?	B?	B?	B/D					
1095	20	?B	?B	UN	UN	UN	UN	UN	UN	?/B	2+c	2 yl	2 2y	2 3y/B	2c	2yl	
1097	22	B	B	2c/B	2c/B	3c	3yl	3 2y	3 3y	3 4y/B	B	B	B	3c	3yl	2 2y/B	
1100	20	NB/NPO	B	2c/B	B	UN	UN	UN	UN	UN	UN	UN	UN	UN	UN	UN	
1102	16	NB/NPO	NB	B	2c	B	1c	UN	UN	UN	UN	UN	UN	UN	UN	UN	
1104	19	2 2y/B	1c/B	1c	1yl	1 2y/B	B	B	B	B	2c	B/D					
1105	18	B	B	1c/B	2c	2yl	2 2y	2 3y	2 4y	2 5y/B	B	1+c/B/D					
1106	13	3c	3yl	2 2y/D													
1110	28	B	2c	2yl	2 2y	2 3y/PD											
1111	26	2 4y/B	B	3c/B	UN	UN	UN	UN	UN	UN	UN	UN	UN	UN/PD			
1118	28	B	2c	2yl	UN	UN	UN	UN	UN/B?	B	B?	UN	UN/PD				
1119	20	B	B	UN	UN	UN	UN	UN	UN	UN	UN	UN	UN	UN	UN	UN	
1121	22	2c	2yl	2 2y/B	2c	UN	UN	UN	B?	B	1c/B/D						
1125	17	NPO	UN	UN	UN	UN	UN	UN	UN	UN	UN	UN/B	3+c	3+yl	3+2y	3 3y	
1127	28	B	UN	PD													
1128	21	1yl/B	3c	UN	UN	UN	UN	UN	UN	UN	UN	UN	UN	UN	UN	UN	
1130	26	2c	1yl	UN	UN	UN	PD										
1134	21	3yl	2 2y	2-3y/B?	c?/B?	B	3c	B?D									
1136	15				NPO	UN	UN	UN	UN	UN	UN/B	2+c	2yl	UN	UN	UN	
1138	27	2 2y, 1yl	2 3y, 1 2y	UN/2 4y, 1 3y/B	UN/PD												
1139	19	UN/B	2c	2yl	2 2y/B	3c	3yl	2 2y	B	D							
1141	12					NB	B	UN	UN	B	1c	c?/B	B	1c	1y	UN	
1142	27	UN/PO	B	UN	UN	UN	1 2y?	UN	UN	UN	UN	D					
1143	22	2c	2yl	2 2y	2 3y/B?	UN	UN	UN	UN	UN	UN	UN	UN	UN	UN	UN	

Table 3. Continued.

Bear No.	Age[b] in 1991	Reproductive history and litter size[c]															
		1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
1144	9		NPO	UN	UN	UN	UN	UN	UN	NPO	D						
1146	25	1-2yl	1 2y	1 3y/B	UN	UN	UN	UN	UN	UN	UN	UN	UN	UN/PD			
1149	17	NB/NPO?	NB	UN	UN	UN	UN	UN	UN	UN	UN	B	2c	2yl	2 2y	2 3y/B	
1151	16		NPO	UN	UN	UN	UN	NPO/NB	UN	UN	UN	UN	UN	UN	UN	UN	
1153	15		NPO	UN	UN	UN	UN	UN	UN	NPO/B?	2c?	UN	UN	UN	UN	UN	
1154	25	1c	1yl	1 2y	1 3y/B	2c	UN	UN	UN	UN	UN	UN	UN	UN	UN	UN	
1156	16		B/NPO?	UN	UN	UN	UN	UN	UN	UN	UN	B	D				
1158	20		B/NPO?	UN	UN	UN	UN	UN	UN	UN	UN	UN/B	2c	UN	UN	UN	
1166	22		NPO	B?	B	3c	1yl	1 2y/B	B?	B	1c	UN	UN/B	2+c	2yl	2 2y	
1167	19		UN/B	1c	B	B	B	UN	UN	UN	UN/B	3c	2yl	2 2y/B	3c	UN	
1169	17		UN	B	2c	B	2c	2yl	?/B	3c/B?	D						
1174	11				NPO/NB	NB	NB	NB	NB	NB	B	B	B	1+c	1 yl	1 2y/B	
1176	26				UN/B	2c	1yl	UN	2c	B	1c	1yl/B/D					
1177	12							NPO/NB	NB	NB	B	B	UN/B	UN/1+c	1yl	1 2y/B	
1178	24		UN/B	UN/1+c	1 2y	1 3y/B	2c/B	UN	UN	UN	UN	UN	UN	UN	UN	UN	
1179	13									NPO/B	B	B	B	1c	UN	UN	
1181	7									NPO/B	2c/B?	D					
1234	13							NPO	UN	B	2c	B	UN	UN	UN	UN	
1403	7									NB	NPO/B	B	D				
1406	11								D								
1407	17								NPO	B	2c/B	B	B	3c/B?	B	B	
1410	27								B	UN	UN	UN	UN	UN	UN	UN	
1413	12									NPO/B	3c/B	UN/B?	c?/B	UN	UN	UN	
1415	18									PO/B?	UN	UN	UN	UN	UN	UN	
1416	16								UN	B	1c/B	3c	2yl	2 2y/B	2 3y/B	3c/D	
1417	14								UN	NPO/B?	B	B	B?	B	B	UN	
1424	15									UN	PO/B	1c	1yl	1 2y/B	2c/B	1c	
1425	13								UN	UN/B	2c/B?	B	B	3c	3yl	3 2y	
1428	12									UN	NPO/B	UN	UN	UN	UN	UN	
1437	13										B	1c	UN	B	2c	2yl	
1438	15								UN/B	3+c	3+yl	3 2y	UN/B?	UN	UN/B	2+c	

Table 3. Continued.

Bear No.	Age[b] in 1991	Reproductive history and litter size[c] 1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
1439	13								UN/B	3+c	3+yl	3 2y	UN/B	3+c	3+yl	3+2yr	
1440	17											2 2yr?/B	B	1c	1yl	B	
1441	19[d]										B	3c	3yl/B	B	UN	UN	
1451	16											PO/B	2c	2yl	UN	UN	
1454	15												B	UN/3+c	3yl	3 2y	
1457	13												B?	UN/B	2+c	2+yl	
1458	12												B	2c	2yl	2 2y	
1460	13												B	3c	2yl	2 2y	
1461	15												B	B	2+c	2+yl	
1464	16												B	UN/3+c	3yl	3 2y	
1465	15												B	3c/B?	B	B	
1467	12											UN/B	c?/B	UN	UN	UN	
1468	19												B?	B	UN	UN	
1473	8[d]													NPO/B	UN/B	1+c	
1474	6													NPO/NB	UN	B	
1475	26													NB?	UN	UN	
1479	11													B	B	B	
1711	5															B	
1716	8														UN/B	2c	
1734	13[d]													UN/B	2+c	2+yl	
1737	27[d]															UN	
1739	8[d]														UN/B	2+c	
1745	5[d]															UN/B	
1749	7[d]														UN/B	3+c	

[a] Designations are as follows: PO, evidence of previous offspring; NPO, no evidence of previous offspring; UM, unmarked; UN, unobserved; B, bred during that season; NB, did not breed; D, documented death; PD, presumed dead after intensive search of home range or because of advanced age; c, yl, 2y, 3y, female accompanied by cub, yearling, 2-year-old, 3-year-old young; c/B, cubs lost prior to breeding season, subsequent breeding by female; yl/B, 2y/B, etc., offspring weaned, then subsequent breeding by female.

Table 3. Continued.

[b] These ages were determined from cementum annuli during the year of capture, but the ages reported here include years subsequent to the bear's capture. However, in cases of bears known or presumed dead, the data listed represent their ages in the year of their death.

[c] Litter sizes should be viewed as minimum since mortality to other offspring may have occurred prior to observation.

[d] Estimate after close examination.

Table 4. Annual number of adult females ($\geq$6 years of age) observed in the study area, their observed production of cubs of the year, and the observed survival of those cubs, western Brooks Range, Alaska, 1977-91.

	Adult females				No. cubs observed (no. litters)			No. cubs survived (no. litters)		
Year	Observed this year	Observed subsequently[a]	Total observed	No. with cubs	Observed this year	Observed subsequently	Σ	Observed this year	Observed subsequently	Σ
1977	19	5	24	6	8(4)	3(2)	11(6)	7(4)	3(2)	10(6)
1978	22	0	22	5	10(5)	0	10(5)	6(4)	0	6(4)
1979	19	1	20	7	12(7)	0	12(7)	3(2)	0	3(2)
1980	18	0	18	7	13+[b](7)	0	13+[b]	2(1)	0	2(1)
1981	12	0	12	5	13(5)	0	13(5)	8(4)	0	8(4)
1982	14	0	14	5	9(5)	0	9(5)	2(1)	0	2(1)
1983	8	0	8	0	0	0	0	0	0	0
1984	11	2	13	1	2(1)	0	2(1)	0	0	0
1985	16	2	18	3	3(1)	6(2)	9(3)	0	6(2)	6(2)
1986	28	4	32	15	24(14)	2(1)	26(15)	2(2)	2(1)	4(3)
1987	28	2	30	9	14+[b](9)	2(1)	16+[b]	8(4)	2(1)	10(5)
1988	31	1	32	6	8+[b](5)	3(1)	11+[b](6)	4(2)	3(1)	7(3)
1989	24[c]	4	29	14	25(11)[c]	13(6)	38(17)	16(8)	16(7)	32(15)
1990	23	10	33	7	9(4)	6(3)	15(7)	4(2)	6(3)	10(5)
1991	22	9	31	7	6(3)	8(4)	14(7)	3(2)	8(4)	11(6)

[a] Females which were captured in subsequent years were very probably present in the population for at least 1 or 2 previous years. This is especially true for females accompanied by offspring; no such radio-collared females were observed to migrate to other areas. For those reasons, these females were assumed to be residents of the study area.

[b] Some females were known to have produced cubs but lost them before the litter was observed. In these cases, a litter size of 1+ was assigned.

[c] Includes no. 1179, whose home range includes both the study area and an area 60 km south near the Noatak River, connected by a migratory corridor. She had 1 cub in the Noatak portion of her home range in 1989.

Table 5. Reproductive status of females observed or assumed present in the western Brooks Range study area, 1986-91[a].

	Observed with offspring				Observed breeding[b]		Not observed, assumed present			
Year	Cubs	Yrlg	2-yr olds	3-yr olds	Lone	Weaned or lost offspr.	Present with cubs next year[c]	Present next year, status unk[d]	Observed previous year	Total present, assumed and observed[b]
1986	16	2	0	0	13	7	3	5	1	40
1987	10	3	2	0	15	3	4	10	3	47
1988	7	5	1	0	20	2	4	3	2	42
1989	17	3	3	1	8	6	2	0	5	39
1990	7	14	2	1	4	2	5	0	5	38
1991	7	5	12	2	6	4	1	1	4	38

[a] Abbreviations include yrlg, yearlings; 2-yr olds, 2-year-olds; 3-yr olds, 3-year-olds; offspr., offspring (cub through 3-year-olds) under maternal care; and unk, unknown.

[b] Females that weaned or lost offspring and then bred were also included in categories of females with offspring; therefore, totals do not include numbers from the "weaned or lost offspring" category.

[c] This category includes those females that were not observed during a specific year but which were assumed present and successfully bred within the area because they produced cubs the next year.

[d] Females were assumed present in the population 1 year prior to observed or assumed breeding; therefore, reproductive status was not known during years prior to actual observation.

Table 6. Observed spring litter size and number of offspring in cub, yearling, 2-year-old, and 3-year-old age classes, 1977-91.

Age class	Litter size	No. of litters 1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	Total No. of litters	Total No. of offspring	$\bar{x}$ litter size
Cub	1	2	1	3	2	0	3	0	0	0	5	4	0	5	0	2		27	27	
	2	5	5	3	6	3	2	0	1	0	9	1	3	3	6	3		51	102	
	3	1	2	2	0	3	1	0	0	3	1	3	1	9	1	2		28	84	
No. offspring		15	17	15	14	15	10	0	2	9	26	15	9	38	15	14		106	214	2.02
Yearling	1	2	3	2	1	1	1	0	0	0	0	2	1	0	4	0		17	17	
	2	2	4	5	0	1	0	1	0	0	0	1	3	2	4	5		28	56	
	3	3	0	0	0	0	3	0	0	0	2	0	1	1	6	0		16	48	
No. offspring		15	11	12	1	3	10	2	0	0	6	4	10	7	30	10		61	121	1.98
2-year-old	1	0	1	2	2	1	1	0	0	0	0	0	0	1	0	2		10	10	
	2	2	3	3	3	0	1	1	0	0	0	0	1	2	1	5		22	44	
	3	0	1	0	0	0	0	1	0	0	0	2	0	0	1	5		10	30	
No. offspring		4	10	8	8	1	3	5	0	0	0	6	2	5	5	27		42	84	2.00
3-year-old	1	0	0	1	1	1	1	0	0	0	0	0	0	0	0	0		4	4	
	2	1	0	2	0	1	0	1	0	0	0	0	0	1	1	1		7	14	
	3	0	0	1	0	0	0	0	1	0	0	0	0	0	0	1		3	9	
No. offspring		2	0	8	1	3	1	2	3	0	0	0	0	2	2	5		14	27	1.93
Females >6 yrs w/offspring		19	20	24	15	11	13	4	2	3	17	13	9	26	25	26				
Females >6 yrs w/o offspring		5	4	2	5	3	2	4	9	15	11	15	20	9	4	5				

Table 7. Annual number of adult female grizzly bears ($\geq$6 years of age) observed in the study area, and their observed annual production of weaned offspring, western Brooks Range, Alaska, 1977-91.

	Adult females			Offspring weaned, by age (no. litters)					
Year	Observed this year	Observed subsequently[a]	Total	1-yr	2-yr	3-yr	4-yr	5-yr	Total
1977	19	5	24		4(2)[b]	2(1)	2(1)		8(4)
1978	22	0	22						0
1979	19	1	20		2(1)	6(3)	3(1)		11(6)
1980	18	0	18		2(1)	3(2)			5(3)
1981	12	0	12		1(1)	3(2)			4(3)
1982	14	0	14						0
1983	8	0	8		4(2)				4(2)
1984	11	2	13						0
1985	16	2	18				3(1)	2(1)	5(2)
1986	28	4	32						0
1987	28	2	30	3(2)[b]					3(2)[b]
1988	31	0	31	3(1)		6(2)			9(3)
1989	25	4	30		3(2)	2(1)			5(3)
1990	23	10	33			3(1)			3(1)
1991	22	9	31		4(3)	2(1)			6(4)

a Females that were captured in subsequent years were very probably present in the population for at least 1 or 2 previous years. This is especially true for females accompanied by offspring; no such radio-collared females were observed to migrate to other areas. For those reasons, these females were assumed to be residents of the study area and were included in the adult female population in previous years.

b Includes 2 yearling offspring that were not accompanied by their mother (probably no. 1440) when captured and were assumed weaned.

Appendix A. Capture procedures using helicopters for brown and grizzly bears in Alaska (Draft).

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INTRODUCTION

Immobilization and handling of any species of wild animal should only be considered if it is necessary to accomplish research, management, public safety, or animal welfare goals. Such goals should be well-designed, have undergone peer review, and have a good chance of being accomplished.

It is essential that the capture be accomplished with a minimum of risk to the health and welfare of individual animals and populations. Because of their low reproductive capacities and low population densities, it is especially important that capture mortality risk of brown or grizzly bears be minimized. An effective capture process will also allow for a more rapid recovery to normal behavior and habitat use.

Any capture or handling of wild animals includes a degree of mortality risk. I have found that capture-related mortalities can be kept to a minimum by adherence to the following procedures.

CAUSES OF MORTALITY

Being aware of potential causes of capture mortality can help the biologist to minimize such mortality risk. For studies in which I have been involved during 1973-92, 18 grizzly bears (1.6%) died during 1,105 captures (Table 1). Applying the knowledge gained from the causes of these mortalities has allowed 346 grizzly bear captures since 1988 without any confirmed capture-related mortalities.

Causes of capture-related mortality included side effects from drug use, 10 (6 from M-99, 4 from Sernylan); drowning, 4; injury from the dart, 1; suffocation during recovery, 1; and unknown causes, 2. At least 4 of the 6 mortalities due to M-99 use were associated with decreased respiration and hyperthermia; the other 2 may have been related to decreased respiratory rate but their temperatures were normal. Of the 4 mortalities related to Sernylan use, 3 were apparently due to hypothermia (capture myopathy may have contributed to 1 of these), and 1 was due to regurgitation during recovery.

Deaths by drowning are usually avoidable. Of the 4 drowning deaths, 1 died in a river when the spotter aircraft lost visual contact with the bear during a capture attempt of 3 bears. During recovery from immobilization, another moved 100 m from the capture site and collapsed in a small creek. Two others drowned in small puddles (30 x 50 cm), one in an area of open tundra and the other in a stand of willows. These deaths illustrate importance of observers in the spotter aircraft maintaining close visual contact of the bear.

Of the remaining 4 mortalities, 1 died when a dart with a 25-mm needle missed the rump and hit the bear on the side. The needle nicked the lung as it injected the drug; the lung collapsed and the bear died within 3 min. One partially recovered bear pushed himself against a tussock in such a way that the lower jaw forced the radiocollar against his trachea and he suffocated. The cause of death could not be determined for 2 bears; possible causes included drowning and injury inflicted by other bears.

In another case, 2 unusually small cubs were abandoned by their light-weight first-time mother 2 days after her capture during 1992. However, these mortalities were not confirmed as capture-related because the family was reunited after capture. Another possible cause of the abandonment include inadvertent disruption of the family bond by another helicopter used by geologists who reported seeing the cubs alone after landing in the area. In addition, because of the low body weights of both the cubs and the mother, the likelihood of the cubs' abandonment or mortality due to natural factors was high and could not be ruled out. The 5-year-old mother weighed only 145 lb, compared with a mean weight of 240 lb for 24 other females that were weighed when accompanied by cubs; similarly, both cubs weighed only 8 lb compared with mean weight of 23.6 lb for 23 other cubs. Only 1 adult female in the sample weighed less than 200 lb, and her cubs died; similarly, of 3 cubs in the sample that weighed less than 15 lb, only 1 survived.

USE OF HELICOPTERS

In areas where terrain and cover density allows, use of helicopters to capture bears is the most efficient and perhaps least stressful method available. In most circumstances, the approach of the bear by the helicopter may take no more than 3-4 min before the bear is darted. Once a bear is darted, it is usually immobilized within 3-6 min. For comparison, when traps or snares must be used because of the presence of heavy cover, bears may remain in traps for 1-24 hr.

The type of helicopter selected usually depends on availability and costs but 4-5 passenger Bell 206B and Hughes 500D helicopters are most commonly used. Capture operations are much more efficient and safe for both bears and biologists when using pilots with previous large mammal capture experience. The seating position of the biologist darting the bear varies with helicopter configuration: in the Hughes 500D, the pilot usually sits in the left front seat and the darter in the right front; in the Bell 206B, the pilot sits in the right front and the darter in the right rear. Some helicopters are equipped with a "darting door" that provides easy access for darting, but in others the door must be removed. When captures are made in precipitous terrain, extra personnel and equipment should be unloaded prior to capture to enhance helicopter maneuverability.

INITIAL LOCATION AND APPROACH

Selection of the capture period should depend upon the objectives to be addressed. For example, in most studies of population biology that require representative samples of adults, the most effective capture period occurs in June during the breeding season. Similarly, to radio-collar 2-year-old offspring accompanying specific females, capture must be accomplished during 5-15 May prior to weaning (in interior and northern Alaska). In areas where the presence of deciduous vegetation will make capture more difficult, capture may be most efficient prior to leaf-out.

Light fixed-wing, 2-person aircraft, preferably with tandem seating and powered by an engine of at least 150 hp, should be used to locate the bears to be captured. The types of habitat searched may vary from one region to another, depending upon availability of bear food sources and seasonal habitat use. Systematic drainage-by-drainage searches usually produce the best results. Monitoring previously radio-collared bears in the area can improve efficiency in locating bears by identifying patterns of habitat use. Similarly, unmarked bears that associate with radio-collared bears during the breeding season can easily be located.

Once a desired bear is sighted, the search aircraft should maintain visual contact with the bear, gain altitude to avoid harassing the bear, and direct the helicopter to the area using aircraft radios. If the bear has been disturbed prior to the arrival of the helicopter, the crew in the aircraft should attempt to maintain the bear in an area most conducive to the bear's safe immobilization--away from potential hazards such as rivers, cliffs, or steep canyons. This is best done by positioning the helicopter over the hazardous area because bears tend to move away from the aircraft. Close harassment of bears with aircraft is not effective and only serves to make the capture process more difficult.

Careful consideration of the direction of approach to the bear by the helicopter is important to maximize safety of the capture procedure and to minimize harassment. The fixed-wing aircraft should direct the helicopter to a route that is out of sight and hearing of the bear until immediately prior to capture. The helicopter should approach the bear in such a way that the bear moves away from hazardous terrain that could result in drowning or injury during capture. For example, if the bear is on a steep rocky hillside when the helicopter arrives, the approach should be made from above the hillside until the bear starts to descend. Then the helicopter should remain out of sight until the bear descends the hillside at its own pace before capture begins. If it is necessary for the darting team to drop off equipment and personnel or to remove a helicopter door prior to capture, this should be done at least 1 km from the capture site, out of sight and sound of the bears.

DRUG SELECTION AND USE

The recently developed drug Telazol (50% tiletamine HCL:50% zolazepam HCL; A. H. Robins Co.) appears the best choice for immobilization of bears by darting them from helicopters. Advantages of this drug include an induction time of 3-10 min, a wide margin of dosage safety, a normal recovery time of 45-70 min, low volume doses, maintenance of thermoregulatory ability, and few adverse effects. Although it can be prepared in concentrations of up to 500 mg/ml, for all the uses discussed here a concentration of 200 mg/ml was used. The greatest disadvantage of using the drug is that there is no antagonist available, although one is currently being tested in Europe. However, because of the relatively short recovery time, this is usually not a problem.

Three other drugs have been used on bears in the past: Sernylan (Phencyclidine HCL, Bio-Ceutic Laboratories), Ketaset-Rompun (Ketamine HCL, Bristol Veterinary Products and Xylazine HCL, Haver-Lockhart), and M-99 (Etorphine HCL, Lemmon Co.) with its antagonist, M50-50 (Diphrenorphine, Lemmon Co.).

Advantages of using Sernylan include its wide margins of safety of doses, maintenance of thermoregulatory ability, and low volume of doses necessary for immobilization. Disadvantages include an induction time of 12-20 min with optimal dosages, a recovery time of 1.5-3 hr with optimal dosages, and its limited availability.

Ketaset-Rompun has effects similar to those of Sernylan. It also has the advantage that the Rompun portion of the drug has an antagonist, yohimbine HCL. As a disadvantage, bears under sedation for an hour or more have reportedly revived rapidly with little warning, posing a hazard to human safety.

M-99 has the advantages of induction times of 3-6 min and availability of the antagonist M-50-50 to reverse its effects. However, because dosage is critical, its use can result in a much higher rate of capture-related mortality. Respiration rate and thermoregulatory ability are depressed, and accidental injection of small amounts are considered lethal to humans. There have also been several reported cases of apparently immobilized bears that recovered rapidly and unexpectedly, posing a hazard to both human and bear safety.

Extreme care should be exercised when handling immobilizing drugs. Biologists should wear rubber gloves and eye protection when handling drugs. All personnel should be aware of first aid procedures in case of accidental injection. If access to hospitals is practical, medical staff should be made aware of the drugs being used. If there is no access to medical facilities, researchers should consult with doctors to determine appropriate treatment.

Dosages and loading darts

Chases that take less time cause less stress to bears. Dosages of 9-10 mg/kg of Telazol are preferable for immobilization. Such dosages are slightly heavier than necessary for immobilization but usually result in a 3-5 min induction time with an increase of only 10-15 min in duration of immobilization.

When using a drug with a wide margin of safety like Telazol, most darts can be prepared in the laboratory with preloaded dosages. Dosages are directly related to weights that are broadly similar within some sex and age classes. For example, most adult females >5 years of age in a particular area weigh within 10% of the mean adult female weight. These can be safely immobilized with the same dose, except that females with cubs of the year usually require less drug. Similarly, the same amount of drug is usually effective for yearlings of both sexes. Preloaded darts are less useful for bears of other sex and age classes because of greater individual differences in weight. When darts must be loaded in the field, safety considerations dictate that the helicopter land before dosages are prepared.

According to the manufacturer, Telazol should be used within 24 hr after it is mixed; however, by keeping the mixed drug cool when possible and out of direct sunlight, I have used it effectively up to 4 days after mixing. Telazol will corrode aluminum dart bodies; unused preloaded darts should be emptied at the end of each day. After use, internal portions of darts should be rinsed with water. Used darts should always be opened at the tail end first because drug is occasionally only partially injected and the plunger may still be under pressure.

Selection of darting equipment

For most capture efforts, I used a modified 32-gauge shotgun with a rifled barrel and iron sights (Palmer Cap-Chur Equipment). Darts and propellant charges are made by the same company. Because of the low visibility of shorter darts in heavily furred bears, darts of at least 7 cc capacity should be used for capture. When the selected dose is less than 7 cc volume, the internal plunger in the dart must be manually advanced toward the nose piece so that no air is injected with the drug. For yearlings, 2-year-olds, and bears with little obvious fat reserves, 19-mm needles should be selected; for all others, 30-mm needles are usually adequate. Use of barbed needles reduces the incidence of incomplete injections and the need to further stress bears with additional darting. It also allows the darter to ascertain where the dart struck the bear. Medium-powered propellant charges (green wadding) should be used to fire the darts. To reduce the impact of the dart on small bears, the dart should be pushed half-way down the gun barrel with a cleaning rod. The barrel of the dart gun should be cleaned daily to ensure free travel of the fired dart. Rules of firearm safety should always be followed when handling dart guns; a dart gun should never be cocked until it is pointed at the bear and should never be pointed skyward or returned to the helicopter cabin until it is uncocked.

DARTING PROCEDURES

It must be emphasized again that the well-being and safety of the bear should take precedence over any other aspect of capture: if terrain, cover, or other environmental conditions do not allow for capture and recovery of the bear with minimal risk, the capture effort should be postponed until another time. Similarly, all aspects of the capture process should be oriented toward reducing the amount of stress to the bear; this can primarily be accomplished by minimizing the length of time between initial approach by the helicopter and immobilization.

Approach

The helicopter should approach rapidly until the bear is approximately 40 m ahead of the aircraft; then the approach should slow and the bear darted as the helicopter overtakes it at 3-10 m distance. The darting process is most consistently successful when the running bear is directly in front of the right front skid of the helicopter before the dart is fired. (This assumes that the darter is seated in a right-hand seat.) If the bear is at an oblique or perpendicular angle to the long axis of the helicopter, the chances of the dart missing the bear are greatly increased.

The dart should never be fired until the darter is certain of hitting the bear. It is always more important to be certain of hitting the bear with the dart in a good location than it is to take a chance of missing the bear. If the bear takes evasive action that increases the difficulty of the shot, it is better to make another pass at the bear than to take a poor shot that may miss the bear. If the first dart misses the bear, the additional time required to load or prepare a dart increases the time a bear is stressed.

Occasionally bears may stop running or attempt to hide under vegetation. When this occurs, the bear can be darted from directly above; otherwise, rotor wash may deflect the dart.

The preferred dart placement is in the heavy muscles of the rump, where any bruising caused by the injection is minimized. By the fall season, when fat reserves in the rump may interfere with induction of the drug, the best locations for dart placement are in the neck or lower hind legs.

To reduce stress on the bear when practical and safe, the helicopter should move out of sight of the bear as soon as it is darted and remain so until immobilization is complete. During this time, the fixed-wing aircraft should maintain visual contact with the bear and should maintain radio contact with the helicopter. If the bear approaches wet areas where it could drown or terrain that could cause injury to a partially immobilized bear, the helicopter must be alerted in time to haze the bear away from such hazards.

Additional dosages

If the bear shows no signs of immobilization within 10 min of being darted with Telazol, it should be darted again with a full dose. In cases of partial immobilization, the amount of additional drug necessary to complete the immobilization will vary, but will usually require at least 1 ml of Telazol. If the bear can walk, additional drug should be injected using a dart gun; if it cannot but is not completely immobilized, it can be approached cautiously on foot and injected by hand with a standard syringe.

Multiple captures

More than 1 unmarked bear may be present at a capture site, especially when family groups or breeding pairs are located. Whether an attempt is made to capture more than 1 member of the group should depend upon the terrain and potential hazards to the bears. Except under ideal conditions, a second bear should not be darted until the first bear darted is immobilized and its physical well-being has been ensured.

When breeding pairs are captured, the male should always be immobilized first, because after the capture effort begins circumstances often dictate that only one bear can be immobilized. Females usually leave the area, but males may return and endanger the safety of the immobilized female or the capture crew.

Other considerations

If only the mother in a family group is captured, no attempt should be made to herd the cubs or yearlings back to the capture site. Such attempts result in increased harassment to the offspring; if left alone, even cubs of the year will follow the scent trail to return to their mothers. Harassment decreases the probability that the family will be re-united.

Because of the increased potential for injury due to their thin skin and small size, cubs of the year should not be darted from helicopters. If they remain close to their immobilized mother, cubs can be captured on the ground by hand. This can be accomplished either by having a person hide until the helicopter herds the cub to the hiding place or by approaching the cub with the helicopter and jumping from the helicopter skid to capture it. Cubs should be held by one hand on the scruff of their neck and the other hand on their rump until they are injected with drug and immobilized. This is best done with bare hands because use of gloves interferes with a good grip on the fur.

If a family group is to be captured, the adult female should be immobilized first because the offspring tend to stay in the vicinity of their mother and they can more easily be hazed away from hazards during the capture effort. After handling is complete, the immobilized offspring should not be placed so close to the mother that she could roll on them during her recovery from the drug. Cubs of the year and yearlings appear to recover from immobilization more quickly than older bears and often require injection of additional drug so that the bears recover about the same time.

When the darted bear begins to show signs of the effects of drugging, observers in the fixed-wing aircraft should carefully scrutinize the area for any potential hazards to the bear, especially the presence of wet or marshy areas in which the bear could drown. If any are present, the helicopter should immediately fly to the area to herd the bear away from the hazard or be on hand to move the bear to safer ground.

Moving bears by helicopter

If their normal temperature of 101^{o} F is exceeded by more than 4^{o} F by the capture process and they cannot be readily cooled at the capture site, bears should be transported by helicopter to a nearby area where snow or water is available for cooling.

In other cases, bears should be moved by helicopter from the capture site for their safety while recovering. For instance, when only the female of a breeding pair is captured, she should be moved by helicopter 1-2 km away from the capture site before handling to break the scent trail. Otherwise, there is a potential for injury by the male if he locates her when she is still under the influence of the drug and unable to respond to his advances with normal behavior. If both are captured, additional drug should be administered to the male so that he recovers after the female.

When members of a family group disperse after darting but before immobilization, offspring should be moved by helicopter to the capture site of their mother. Similarly, if >1 offspring are captured, but the mother is not, the young should be moved to 1 location, so that drug response and recovery can be monitored on each bear at the same time. Depending on the bear's size, it can be transported on the floor of the helicopter, strapped to the cargo rack of a skid, or suspended in a cargo net beneath the aircraft (least preferred alternative).

ON-GROUND HANDLING

As soon as the immobilization is complete, the respiration and body temperature of the bear should always be checked immediately. If temperature is above 105° F, the bear should be cooled with water or snow applied to the thinly haired areas of its body until the normal temperature of 101° F is resumed. Body temperatures may fall below normal if ambient temperatures are below freezing or when bears are immersed in cold, glacially fed or snow-melt streams during capture.

Once the bear's temperature and respiration rate are stabilized within normal limits, the bear should be positioned to best maintain its physical well-being during handling. Bears should be moved from wet or snowy areas to maintain body temperatures of 101-102° F. If it appears likely that body temperature may drop below 101° F, insulative tarps ("space blankets") or blankets may be used to cover the bear to retain body heat. These coverings should remain around the bear until normal temperature is regained or the bear revives. Also, the bear should be laid on its side or sternum so that breathing is not constricted. The head should be positioned slightly downhill of the body to allow excess salivation to drain. Brush or grass that could come into contact with the bear's eyes should be cut away and removed. Because bears' eyes remain open while immobilized, the bear should be positioned so that it faces away from the sun; if the blinking reflex is retarded, ophthalmic ointment should be placed in the eye to prevent drying.

Under ideal circumstances, the recovery from the effects of the drug will begin about the same time as the necessary handling of the bear is completed. If recovery from immobilization begins before handling is complete, injection of additional drug may be necessary. For bears older than cubs of the year, injection of an additional 1 cc of Telazol should be adequate to maintain sedation. Under the influence of Telazol, once the bear gains enough physical control to lift and turn its head in response to loud noises or vigorous shaking of its rump, it can usually recover enough in approximately 10 min to make further handling difficult. Because it may take up to 5 min for the additional dosage to take effect, it is important to monitor the degree of sedation throughout the handling period.

Fitting radiocollars

The use of radiocollars on bears allows collection of information that could not be learned by any other means. For example, quantitative data on mortality and survival, habitat use throughout home ranges, and long-term reproductive biology, all of which are critical to effective management of impacts by humans on bear populations, can only be collected using radiotelemetry.

To be effective tools, radiocollars must be fitted so they do not affect the behavior or survival of bears. Collars must be fitted tightly enough so they are not easily shed but loosely enough to allow for weight gain and so they do not impede normal neck movement or cause abrasions. The best fit is usually achieved when the collar can be tightly slipped over the bear's head; the collar then fits as loosely as it can on the neck without easily slipping off. Of all sex and age groups, it is most difficult to fit collars on adult male bears because the circumference of their neck and head is often similar.

Because of this problem, biologists must expect a higher rate of collar loss for males; in no circumstances should collars be intentionally fitted too tightly.

Break-away collars specifically designed to fall off after being worn for a year or less allow collars to be safely placed on growing bears. Different designs are produced by different radiocollar manufacturers. This type of collar should be used on females <6 years of age and on males <10 years of age. The disadvantages of these collars are that they are more easily shed than standard collars and must be replaced annually if contact is to be maintained with the bear.

Although the materials used to fabricate standard collars may wear enough that the collar will fall off within 4-5 yrs, some nonfunctional collars have been recovered from bears after being carried for 12 years. Spacers made of canvas material that will rot within 2-3 yrs can be attached between the 2 ends of the collar to ensure that collars do not remain on the bears indefinitely.

RECOVERY

Efforts to reduce stress to bears should continue during the recovery phase of immobilization. Once handling is completed, bears should be positioned so that they are safe from water or other hazards if they are aroused in a partially sedated condition. In areas where low bear density makes intraspecific contact during recovery unlikely, the helicopter and the capture team should leave the capture site prior to the onset of recovery. This allows the bear to sleep until it is fully recovered. Bears that are prematurely aroused may recover enough to move to a creek or other potentially hazardous area but not be sufficiently capable of avoiding the hazard.

Table 1. Causes of capture-related mortality of grizzly bears during research conducted in interior and arctic Alaska, 1973-92.[a]

Area/ year	Bear no., sex, age[a]	Drug	Cause of death
Eastern Brooks Range, 109 captures, 1973-75			
1973	1002 M 14	Sernylan	Drowned
1973	1005 M 11	Sernylan	Hypothermia
1974	1000 M 24	Sernylan	Regurgitation
1974	1066 F 20	Sernylan	Drowned
Western Brooks Range, 443 captures, 1977-92			
1987	1429 M ad	Telazol	Drowned
Northcentral Alaska Range, 229 captures, 1981-92			
1981	1301 M 6	Sernylan	Poor condition, hypothermia
1982	UM Un 1	Sernylan	Darted, not found; drowned?
1983	1338 M 6	Sernylan	Hypothermia?
1983	1347 M 6	M-99	Drug-related
1984	1315 M 15	M-99	Hyperthermia
1984	1327 F 18	Sernylan	Unknown; killed by other bear?
1985	1360 F 10	M-99	Drug related
1987	1370 F 3	Telazol	Collapsed lung
Arctic National Wildlife Refuge, 324 captures, 1982-90			
1982	1201 F 5	Sernylan	Drowned
1982	1215 M 18	Sernylan	Suffocated
1984	1190 F 9	M-99	Hyperthermia
1984	1234 F 3	M-99	Hyperthermia
1985	1228 M 9	M-99	Hyperthermia

SUMMARY: 1,105 captures, 18 mortalities = 1.6%

Drug Related	
M-99	6 mortalities
Sernylan	4 mortalities
Drowning	4 mortalities
Capture-related	4 mortalities

[a] Designations: ad, adult; UM, unmarked; Un, unknown.

Appendix B. Progress on Genetic Studies of the Western Brooks Range Grizzly Bear Population, 1991

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Laboratory Work

<u>January-June 1991</u>: Laboratory work was conducted at Montana State University. Ninety-one samples collected up to this time were analyzed using the restriction endonucleases Hinfl and HaeIII to cleave genomic grizzly bear DNA. Electrophoretic gels run with the resulting fragments were probed with PV47 and M13 probes labeled with radioactive P32. Not all samples were successfully profiled in this manner due to difficulties encountered in developing proficiency with the technique, but sufficient success was achieved to indicate that one or more additional probes would be necessary to determine paternity. Results also indicated that larger amounts of DNA were needed than previously used, and that tissue samples from earplugs were a better source of DNA than was blood.

Field Work

<u>June 1991</u>: During 18-26 June, 55 grizzly bears were captured and released; of these, 26 were previously unsampled. Blood samples were collected from all animals, and ear tissue samples were collected from 27 animals.

Laboratory Work

<u>June 1991</u>: From 26 to 28 June, Dr. Vyse worked with Dr. Matt Cronin at the USFWS Forensic Lab in Anchorage, Alaska and extracted DNA from the 55 blood samples collected.

<u>August 1991</u>: Lance Craighead ran test gels of these samples at Montana State University and extracted additional DNA from some samples.

<u>October 1991</u>: Lance Craighead extracted DNA from the recently collected ear tissue samples and determined the precise concentration of each DNA sample using a spectrophotometer (absorption at 260 nm wavelength). Extractions from ear tissue samples were found to contain up to 15 times the concentration of DNA extracted from blood samples. Selected DNA samples derived from blood were concentrated into smaller volumes. Yield of DNA using different techniques was:

<u>micrograms DNA extracted per 1.0 ml of sample</u>		
Salt-chloroform technique (blood)	55.00	<u>n</u> = 87
Salt-chloroform technique (tissue)	787.70	<u>n</u> = 83
Sodium acetate technique (blood):		
with fractionation of wbc	47.73	<u>n</u> = 8
without fractionation	14.65	<u>n</u> = 52

<u>November 1991</u>: Lance Craighead worked at the USFWS National Forensic Lab in Ashland, Oregon, from 14 November to 25 November with Dr. Steven Fain, Dr. Jerry Ruth, and Dr. Matt Cronin. Four genomic blots with 18 samples each were prepared

using Hinfl restriction endonuclease. Experience was gained in using non-radioactive alkaline phosphatase probes and fluorescent detection techniques. Additional experience was gained in fine-tuning other techniques involved in producing DNA fingerprints. It was determined that 8 micrograms or more of DNA are necessary per sample for a successful blot; this is about 4 times the concentration used previously. Two of the blots were probed using a 32-mer oligonucleotide (a subunit of Jeffreys 33.15 probe) labeled with alkaline phosphatase.

December 1991-January 1992: Dr. Steve Fain at Ashland developed fingerprints of the four blots using three additional probes: a Jeffreys (22-mer) 33.6 subunit, MS1, and Qmm101. These results are currently being analyzed; grizzlies in general, and western Brooks Range bears in particular, exhibit much less variation using these enzyme-probe combinations than do black or polar bears. Successful DNA fingerprinting to determine paternity will involve the use of two or more probes for each individual. Using either the PV47 or 33.15 probes we are able to score about 10 diagnostic bands although many individuals exhibit only 4 to 6 of those bands. A combination of both probes will permit scoring of 20 bands. In comparison fingerprinting studies of other species found:

scorable bands per probe		probe used
humans	30	(33.15)
old world monkeys	30	(33.15)
dogs	19	(33.15)
cats	13	(33.15)
sparrows	60	(33.6)
swans	18-23	(33.6)
naked mole rats	10	(33.15)
	7	(33.6)

Steve Fain's black bear analysis found 4-20 scorable bands per individual using both 33.6 and 33.15 probes. The gels we have run so far containing both black and grizzly bear samples exhibited less variation in grizzlies. In addition, many of the family groups examined had very similar banding patterns; offspring often had no bands present that did not come from the mother. For these reasons it will be more difficult to assign paternity than we expected, and in some cases it may not be possible to assign a single individual as the sire. Use of other probes, or random primer POR methods, may clear up this problem.

Presently, Lance Craighead, at the Montana State University lab, is concentrating the DNA samples derived from blood in preparation for future analysis this winter using alkaline phosphatase probes. Additional funding sources have also been approached; a proposal was sent to the National Fish and Wildlife Foundation in October. Subsequently, proposals were submitted to the Anheuser Busch Foundation, the Eppley Foundation For Research, and The World Wildlife Fund (turned down).

Publication

A short paper was presented at the International Association for Bear Research and Management conference held in Missoula, Montana during February 1991 (attached), entitled "Paternity determination with DNA fingerprinting in a grizzly bear population."

Future Scope of Work

Further laboratory work will continue until June 1992: genomic blots of each bear sampled will be developed under consistent conditions with known standards. Genetic profiles of each animal, consisting of a record of all diagnostic DNA bands present, will be determined and entered into a computer database (Lotus). A program developed at the Ashland lab will be used to determine degree of similarity between individuals and population-level genetic parameters. A minimum of 8 blots (15 samples per blot) will be needed to score a genetic profile for each animal sampled in the population. Additional blots will be required to compare possible sires with offspring on the same blot to determine paternity.

Depending upon funding, the purchase of additional items of equipment is planned. Primary needs are a hybridization chamber ($2,000) and a vacuum transfer apparatus ($1,400). This equipment will increase the efficiency and the reliability of the procedure. DNA reaction conditions are highly sensitive to conditions of pH and temperature; maintaining constant, reproducible reaction conditions is necessary to obtain consistent results.

PATERNITY DETERMINATION WITH DNA FINGERPRINTING IN A GRIZZLY BEAR POPULATION

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Abstract: We extracted DNA from 120 grizzly bears (*Ursus arctos horribilis*) in an arctic population for paternity analysis using DNA fingerprinting. Preliminary results indicate that a combination of several probes and/or enzymes will be necessary to identify sires of offspring with known mothers. Development of genetic profiles will provide estimates of population genetics parameters such as inbreeding coefficients, heterozygosity, and degree of polymorphism to use as a baseline in managing this and other, more endangered, populations.

Craighead, F. L., E. R. Vyse, and H. V. Reynolds III. In press. Paternity determination with DNA fingerprinting in a grizzly bear population. Int. Conf. Bear Res. and Manage. 9:000-000.

To effectively conserve and manage small wildlife populations it is necessary to determine the degree of genetic variation that exists. For this knowledge to be meaningful, there must be a genetic baseline for comparison derived from larger, more viable populations. The techniques of DNA fingerprinting with genomic DNA are uniquely suited to the analysis of inter-population genetic variation (Lynch 1992) and paternity analysis (Jeffreys et al. 1985a) and can provide estimates of kinship and inbreeding among individuals, and heterozygosity and degree of polymorphism for the population as a whole.

DNA fingerprinting can be defined as the use of detectable DNA probes that hybridize to hypervariable tandem repeat segments (Wyman and White 1980) of DNA. The technique was first developed by Jeffreys lab (Jeffreys et al. 1985b) to describe unique genetic profiles of individuals using human DNA. This technique has been used to develop pedigrees of dogs, cats (Jeffreys and Morton 1987), and mice Jeffreys et al. 1987); to demonstrate multiple paternity in house sparrows (Burke and Bruford 1987, Wetton et al. 1987); to reveal paternity of snow goose nestlings (Quinn et al. 1987), and old world monkeys (Weiss et al. 1988); and for animal identification, paternity testing, and linkage analysis in horses, dogs, pigs, chicken, and fish (Georges et al. 1988).

Paternity, and the development of pedigrees for wild populations, has been used to measure realized reproductive success in red-winged blackbirds (Gibbs et al. 1990), and to analyze kinship in prides of Serengetti lions (Packer et al. 1991). We have been investigating the use of DNA fingerprints in a viable population of arctic grizzly bears to determine paternity and to use these data for population genetic analysis. The study population is located in the northern foothills of Alaska's western Brooks Range (Reynolds 1991).

We acknowledge the generous help of Steven Fain at the National Fish and Wildlife Forensic Lab, Matthew Cronin with the U.S. Fish and Wildlife Service, Layne Adams and Al Lovaas of the U.S. National Park Service, and the financial assistance of the Lost Arrow, Gamble, and Wiancko Foundations.

METHODS

Whole blood was collected in the field and stored in saline sodium citrate buffer (SSC). Ear tissue samples were removed with a leather punch while attaching ear tags. DNA was isolated from blood using the techniques of Mullenbach et al. (1989) and from tissue using the techniques of Cronin et al. (1991). DNA was resuspended in sterile distilled water at a concentration of 500 micrograms per milliliter.

Samples of DNA were digested with the restriction endonucleases Hinfl and HaeIII. The resulting fragments were separated by electrophoresis in 1.0% agarose gels at 20-25 milliamps for 18-24 hours, and transferred to nylon membranes using the Southern blot technique. Both charged and neutral nylon membranes were used. DNA filters prepared in this way were probed for tandem repeat sequences of genomic DNA with radiolabeled Pv47 and M13 probes, and with alkaline phosphatase-labeled oligonucleotide subunits of Jeffreys 33.15 and 33.6 probes. Labeled membranes were used to expose x-ray film that was then developed to reveal a characteristic banding pattern or DNA fingerprint.

RESULTS AND DISCUSSION

DNA has been extracted from 120 individuals in the study population. This represents over 90% of the bears currently alive. Ear tissue samples are the best source of DNA; approximately 15 times as much DNA can be extracted per milliliter of ear tissue sample as from blood. Eight to 10 micrograms of DNA appears to be an optimal amount for electrophoresis. HaeIII digestion reveals more diagnostic bands than does HinfI using Pv47 and M13 probes. The alkaline-phosphatase-labeled oligo probe Jeffreys 33.15 produces the best banding patterns for paternity determination, but does not alone reveal sufficient variation for identification of the sire.

To date, 30 individuals have been typed using Hinfl and Jeffreys 33.15 probe. Results from similar numbers of trials using HaeIII, Pv47, and Jeffreys 33.6 indicate that a combination of several enzyme-probe combinations is necessary for paternity identification. Additional trials are planned using oligo probes of M13, MS1, and CMM101.

Approximately 10 diagnostic bands are revealed in the genome using each probe and enzyme combination (Figure 1). This is less than the number revealed in humans (Jeffreys et al. 1985a), other primates (Weiss et al. 1988), and dogs and cats (Jeffreys and Morton 1987), but is equivalent to other mammal groups including black bear (Fain 1992, these proceedings). The use of two or more enzyme-probe combinations will provide sufficient data for population genetic analysis.

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Figure 1. A DNA fingerprint of 2 family groups and 11 assorted males. Bear 1456 was observed breeding with female 1141 the year before 1485 was born. Only one band (arrow) can be assumed to be inherited from the father, but this excludes many potential mates. Additional fingerprints using other enzyme-probe combinations are necessary to determine paternity. (Photo not included here.)

Appendix C. Total annual and cumulative captures of grizzly bears in the western Brooks Range, 1977-92.

Year	Bear number: Initial captures	Bear number: Recaptures	Annual total captures: Initial captures	Annual total captures: Recaptures	Cumulative total captures: Initial captures	Cumulative total captures: Initial captures and recapture
1977	1081-1138	1082(3),1983,1084,1086(2), 1089,1097,1104,1105	58	11	58	69
1978	1139-1163	1082,1083,1096,1099,1100, 1102,1103,1105,1110,1138	25	10	83	104
1979	1164-1168	1081,1082,1083,1086,1087, 1096,1099,1100,1110,1133, 1157	5	11	88	120
1980	1169-1181	1081(2),1082,1087,1092, 1096,1097(2),1102,1104, 1105,1134,1141,1147,1159, 1164,1166	13	17	101	150
1981-82	None	None				
1983	1232-34, 1261	1092,1097,1099,1104,1105, 1134,1139,1151,1159,1166, 1169,1177,1179,1181	4	14	105	168
1984	1401-1410	1081(2),1083,1987,1118, 1121,1124,1141,1147,1164, 1165,1172,1173,1174,1176, 1181	10	16	115	194
1985	1411-1418	1083,1089,1092,1097,1103, 1104,1105,1141,1144,1153, 1169,1173,1174,1177,1179, 1181,1233,1234,1402,1403, 1404	8	21	123	223

Appendix C. Continued.

Year	Bear number: Initial captures	Bear number: Recaptures	Annual total captures: Initial captures	Annual total captures: Recaptures	Cumulative total captures: Initial captures	Cumulative total captures: Initial captures and recapture
1986	1420-1428	1104,1147,1164,1174,1177, 1402,1403	9	7	132	239
1987	1434-1451	1081,1082,1095,1097,1141, 1149,1156,1157,1167,1174, 1176,1179,1403,1405,1407	18	15	150	272
1988	1453-1472	1089,1103,1136(2),1141, 1147,1158,1233,1411(2), 1413,1416,1417,1420,1440, 1442,1443,1444	20	18	170	310
1989	1473-1485	1081,1087,1095,1097,1141, 1157,1165,1407,1421,1465, 1466	13	11	183	335
1990	1486-1710	1081,1089,1149,1166,1167, 1174,1177,1405,1424,1437, 1440,1454,1458,1460,1464, 1465,1474,1479	25	19	208	378
1991	1711-1727	1087,1095,1097,1125,1147, 1174,1177,1407,1425,1440, 1459,1474(2),1477,1478,1479, 1483,1484,1486,1487,1488, 1489,1492,1493,1494,1495, 1496,1498,1499,1500,1701, 1702,1704,1705,1706,1707, 1708,1709,1710	17	39	225	434

Appendix C. Continued.

Year	Bear number: Initial captures	Bear number: Recaptures	Annual total captures: Initial captures	Annual total captures: Recaptures	Cumulative total captures: Initial captures	Cumulative total captures: Initial captures and recapture
1992	1728-1758	1087,1124,1179,1421,1438, 1439,1451,1457,1461,1473, 1477,1479,1480,1481,1706, 1708,1712,1716,1724	31	19	256	484

Appendix D. Intraspecific relationships of grizzly bears in the study area population, western Brooks Range, Alaska 1977-91.

Bear no.& sex	Age/ year at capture	Year of status and description of intraspecific relationship[b]
1081M	5/77	1977--NO; 1978--UNK; 1979--B/1097, UMF; 1980--B/1097, UMF; 1981--B/1167, 1087, UMF; 1982--B/UMF; 1983-88--NO; 1989--B/1416, 1157; 1990--NO; 1991--NO
1082M	13/77	1977--B/1105, 1128, UMF; 1978--B/UMF; 1979--B/1105, UMF; 1980--NO; 1981--B/UMF; 1987--B/1403; 1988--NO, died
1083M	7/77	1977--B/1085; 1978--NO; 1979--B/1100; 1980--B/1100, UMF; 1981--aggressively followed 1086 and 2 UM cubs, killed them?; 1982-83 UNK; 1984-86--NO; 1987--B/1177; 1988-present--UNK
1084M	7/77	1977--NO; 1978-83--UNK, probably emigrated; 1984--hunter kill outside the study area
1085F	19/77	1977--B/1099; 1978--NO; 1979--NO; 1980--NO; 1981-presumed dead
1086F	16/77	1977--2 ylg (1087, 1164); 1978--2 2yr; 1979--2 3yr, B/1096, 1099; 1980--2 UM cub, presumed dead (killed by 1083?)
1087F	1/77	1977--w/mother (1086) and sibl (1164); 1978--same; 1979--weaned; 1980--NO; 1981--B/1081; 1982--NO; 1983--UNK; 1984--B/UMM; 1985--NO; 1986--lost 2 UM cub, NO; 1987--lost 1 UM cub, NO; 1988--NO; 1989--2 cub (1483, 1484); 1990--2 ylg; 1991-- 2 2yr
1088M	4/77	1977--NO, outside study area; 1978--NO; 1979--B/UMF; 1980-88--UNK; 1989--hunter kill outside study area
1089F	4/77	1977--NO; 1978--NO; 1979--2 UM cub; 1980-81--UNK; 1982--1 UM cub; 1983-84--UNK; 1985--NO; 1986--2 UM cub; 1987--1 ylg; 1988--B/1411, UMM; 1989--3 cub; 1990--3 ylg (1704, 1705, 1706); 1991--3 2yr
1090F	18/77	1977--3 ylg; 1978--3 2yr; 1979--3 3yr, NO; 1980-81--UNK; 1982--presumed dead
1091M	19/77	1977--NO; 1978--B/UMF; 1979--presumed dead
1092F	8/77	1977--1 cub (1093); 1978--1 ylg; 1979--1 2yr, NO; 1980--B/1175, UMM; 1981--NO; 1982--B/UMM; 1983--NO; 1984--NO; 1985--NO; 1986--NO; 1987--NO, hunter kill

Appendix D. Continued.

Bear no.& sex	Age/ year at capture	Year of status and description of intraspecific relationship[b]
1093F	C/77	1977-78--w/mother (1092); 1979--weaned; 1980--presumed emigrated
1094M	4/77	1977--UNK; 1978-82--presumed emigrated; 1983--hunter kill outside study area
1095F	6/77	1977--NO; 1978--NO; 1979-84--UNK; 1985--NO; 1986--2 UM cub; 1987--2 ylg; 1988--2 2yr; 1989--2 3yr, B/1477, UMM; 1990--2 cub (1UM, 1727); 1991--2 ylg
1096M	7/77	1977--B/1097, 1104, UMF; 1978--B/1097, 1142; 1979--B/1102, 1086; 1980--B/1097; 1981--B/1167; 1982-present--UNK
1097F	8/77	1977--B/1096; 1978--B/1096; 1979--2 UM cub, B/1081, UMM; 1980--2 UM cub, B/1081, 1096, 1172; 1981--3 cub (1402, 1403, 1404); 1982--3 ylg; 1983--3 2yr; 1984--3 3yr; 1985--3 4yr/NO; 1986--NO; 1987--B/M?M; 1988--NO; 1989--3 cub (1480, 1481, 1482); 1990--2 ylg (1480, 1481); 1991--2 2yr/B unk male
1098M	3/77	1977--NO; 1978--UNK; 1979--possibly B/1100; 1980-88--UNK; 1989--B/UMF; 1990--UNK
1099M	10/77	1977--B/1085, UMF, killed 1101; 1978--killed cub of 1104?, B/1104; 1979--B/1086, 1102, probably killed 1106 and 2 2yr; 1980--NO; 1981--NO; 1982--B/1104; 1983--NO, hunter kill outside study area
1100F	6/77	1977--NO; 1978--NO; 1979--2 UM cub, B/1083, 1131, and 1159 or 1098?; 1980--B/1083; 1981-present--UNK
1101M	2/77	1977--mother probably 1104, weaned w/sibl (1102), killed by 1099
1102F	2/77	1977--mother probably 1104, weaned w/sibl (1101), 1978--NO; 1979--B/1096, 1099; 1980--2 cub (1180, 1181); 1981--NO; 1982--1 UM cub; 1983-present--UNK
1103M	8/77	1977--B/1104; 1978--B/UMF; 1979-84--UNK; 1985--B/1104; 1986-87--UNK; 1988--B/1468?, UMF; 1989--B/1424; 1990-present--UNK
1104F	9/77	1977--probably weaned 2 2yr (1101, 1102), B/1096, 1103; 1978--1 UM cub killed by 1099?, B/1099; 1979--1 cub (1177); 1980--1 ylg; 1981--1 2yr, B/UMM; 1982--B/1099, UMM; 1983--NO; 1984--B/1261, UMM; 1985--B/1103, 1233, UMM; 1986--2 cub (1422, 1423) lost both; 1987--NO, killed by MM in Sep

Appendix D. Continued.

Bear no.& sex	Age/ year at capture	Year of status and description of intraspecific relationship[b]
1105F	7/77	1977--B/1082, 1124; 1978--B/1131?; 1979--1 UM cub, B/1082, UMM; 1980--2 cub (1173, 1174); 1981--2 ylg; 1982--2 2yr; 1983--2 3yr; 1984--2 4yr; 1985--2 5yr, B/UMM; 1986--NO; 1987--1+ UM cub, lost cub, B/1147, killed by hunter
1106F	11/77	1977--3 cub (1107, 1108, 1109); 1978--3 ylg, 1107 died at den emergence; 1979--killed by adult male (probably 1099), 2 2yr also probably killed
1107F	C/77	1977--w/mother (1106) and sibl (1108, 1109); 1978--died at den emergence
1108F	C/77	1977--w/mother (1106) and sibl (1107, 1109); 1978--w/1106, 1109; 1979--probably killed by 1099
1109F	C/77	1977--w/mother (1106) and sibl (1107, 1108); 1978--w/1106, 1108; 1979--probably killed by 1099
1110F	24/77	1977--NO; 1978--2 cub (1160, 1161); 1979--2 ylg; 1980--2 2yr; 1981--2 3yr; 1982--presumed dead
1111F	14/77	1977--2 4yr (1112, 1113), B/1131, returned to 2 4yr; 1978--2 5yr; 1979--3 UM cub; 1980-present--UNK
1112M	4/77	1977--w/mother (1111) and sibl (1113), weaned, then accepted again by mother; 1978--presumed emigrated
1113F	4/77	1977--w/mother (1111) and sibl (1112), weaned, then accepted again by mother; 1978-present--UNK
1114M	16/77	1977-79--NO; 1980-present--UNK
1115M	5/77	1977--NO; 1978-present--UNK
1116M	5/77	1977--NO; 1978-present--UNK
1117M	19/77	1977--NO; 1978-present--UNK
1118F	17/77	1977--NO; 1978--2 UM cub; 1979--2 ylg; 1980-83--UNK; 1984--NO; 1985--B/UMM; 1986--NO; 1987--presumed dead.
1119F	6/77	1977--NO; 1978--NO; 1979-present--UNK
1120M	20/77	1977--NO; 1978--NO; 1979-present--UNK

Appendix D. Continued.

Bear no.& sex	Age/ year at capture	Year of status and description of intraspecific relationship[b]
1121F	11/77	1977--2 cub (1122, 1123); 1978--2 ylg; 1979--2 2yr, NO; 1980--2 UM cub; 1981-83--UNK; 1984--NO; 1985--NO; 1986--1 UM cub, lost cub, B/UMM; 1987--killed by other bear, Sep-Oct
1122M	C/77	1977--w/mother (1121) sibl (1123); 1978--same; 1979--weaned; 1980-present--UNK
1123F	C/77	1977--w/mother (1121) sibl (1122); 1978--same; 1979--weaned; 1980-present--UNK
1124	17/77	1977--B/1105; 1978-83--UNK; 1984--NO; 1985-present--UNK, alive
1125F	3/77	1977--NO; 1978-87--UNK; 1988--3+ cub; 1989--3+ylg; 1990--3+ 2yr; 1991--1726, 2 UM 3yr
1126M	13/77	1977--B/1127; 1978-present--UNK
1127F	26/77	1977--B/1126; 1978--UNK; 1979--presumed dead
1128F	7/77	1977--1 ylg (1129), weaned, B/1082; 1978--3 UM cub; 1979-present--UNK
1129F	1/77	1977--w/mother (1128), not seen w/mother after capture
1130F	21/77	1977--2 UM cub; 1978--1 ylg; 1979-81--UNK; 1982--presumed dead
1131M	8/77	1977--B/1111; 1978--B/1105?; 1979--B?/1100; 1980-present--UNK
1132F	2/77	1977--w/sibl (1133); 1978-present--UNK
1133M	2/77	1977--w/sibl (1132); 1978--NO; 1979--NO; 1980-82--UNK, emigrated?; 1983--hunter kill outside study area
1134F	14/77	1977--3 ylg (1135, 1136, 1137); 1978--2 2yr(1136, 1137); 1979--2 3yr, NO; 1980--1 UM cub, B/UNK male; 1981--B/UMM; 1982--3 UM cub; 1983--no ylg, dead
1135M	1/77	1977--w/mother (1134) and sibl (1136, 1137), presumed dead
1136F	1/77	1977--w/mother (1134) and sibl (1135, 1137); 1978--w/mother (1134) and sibl (1137); 1979--weaned; 1980--NO; 1981-86--UNK; 1987--UNK, 2+ cub; 1988--2 ylg (1469, 1470); 1989-present--UNK

Appendix D. Continued.

Bear no.& sex	Age/ year at capture	Year of status and description of intraspecific relationship[b]
1137F	1/77	1977--w/mother (1134) and sibl (1135, 1136); 1978--w/mother (1134) and sibl (1136); 1979--weaned; 1980-present--UNK
1138F	23/77	1977--2 2yr (1151, 1153) and 1 ylg (1152); 1978--2 3yr, 1 2yr; 1979--UNK, presumed dead
1139F	11/78	1978--2 cub (1140, 1141); 1979--2 ylg; 1980--2 2yr, NO; 1981--3 UM cub; 1982--3 ylg; 1983--2 2yr; 1984--2 3yr, NO; 1985--dead
1140M	C/78	1978--w/mother (1139) and sibl (1141); 1979--same; 1980--weaned; 1981-present--UNK
1141F	C/78	1978--w/mother (1139) sibl (1140); 1979--same; 1980--weaned; 1981--NO; 1982--NO; 1983-84--UNK; 1985--NO; 1986--1 UM cub, lost cub; 1987--cub?, NO; 1988--B/1456, UMM; 1989--1 cub (1485); 1990--1 ylg; 1991--UNK, assumed dead
1142F	14/78	1978--B/1096, UMM; 1979-86--UNK; 1987--killed by hunter
1143F	9/78	1977--2 cub (1144, UM); 1978--2 ylg; 1979--2 2yr; 1980-present--UNK
1144F	1/78	1978--w/mother (1143) and UM sibl; 1979-84--UNK; 1985--NO; 1986--dead, eaten by other bear
1145F	2/78	1978--w/mother (1146); 1979--weaned; 1980--NO; 1981-present--UNK
1146F	14/78	1978--1 2yr (1145); 1979--1 3yr, NO; 1980-present--UNK
1147M	3/78	1978- NO; 1979-83--UNK; 1984-86--NO; 1987--B/1174, 1425, 1105; 1988--UNK; 1989--B/1441, 1424; 1990--UNK; 1991--B/1177
1148M	6/78	1978--NO; 1979-present--UNK
1149F	4/78	1978--NO; 1979-86--UNK; 1987--NO; 1988--2 cub (1486, 1487); 1989--2 ylg; 1990--2 2yr; 1991--wean 2 3yr, NO
1150M	5/78	1978--NO; 1979-present--UNK
1151F	3/78	1977--w/mother (1138) and sibl (1152, 1153); 1978--same; 1979--weaned, UNK; 1980-82--UNK; 1983-84--NO; 1985-present--UNK
1152M	3/78	1977--w/mother (1138) and sibl (1151, 1153); 1978--same; 1979--weaned, UNK; 1980-present--UNK

Appendix D. Continued.

Bear no.& sex	Age/ year at capture	Year of status and description of intraspecific relationship[b]
1153F	2/78	1977--w/mother (1138) and sibl (1151, 1152); 1978--same; 1979--weaned, UNK; 1980-82--UNK; 1983--NO; 1984--NO; 1985--NO; 1986--2 UM cub; 1987-present--UNK
1154F	12/78	1978--1 ylg (1155); 1979--1 2yr; 1980--1 3yr, NO; 1981--2 UM cub; 1982-present--UNK
1155M	1/78	1977--w/mother (1154); 1978-79--same; 1980--weaned, NO; 1981--hunter kill outside study area
1156F	6/78	1978--NO; 1979-86--UNK; 1987--B/1157; 1988--w/cubs?, killed by other bear
1157M	5/78	1978--B/UMF; 1979-86--UNK; 1987--B/1156; 1988--UNK; 1989--NO; 1990--UNK; 1991--NO
1158F	7/78	1978--NO; 1979-86--UNK; 1987--NO; 1988--2 cub (1471, 1472); 1989-present--UNK
1159M	10/78	1978--NO; 1979--B?/1100; 1980--NO; 1981-82--UNK; 1983--NO; 1984-present--UNK
1160M	C/78	1978--w/mother (1110) and sibl (1161); 1979-80--same; 1981--weaned; 1982-present--UNK
1161M	C/78	1978--w/mother (1110) and sibl (1160); 1979-80--same; 1981--weaned; 1982-present--UNK
1162M	2/78	1978--dead, probably sibl of 1163
1163M	2/78	1978--NO, probably sibl of 1162; 1979-present--UNK
1164M	3/79	1977--w/mother (1086) and sibl (1087); 1978--same; 1979-weaned; 1980--NO; 1981-83--UNK; 1984-85--NO; 1986--B/1413; 1987--hunter kill within study area
1165M	3/79	1979-80--NO; 1981-83--UNK; 1984-85--NO; 1986--B/1403, UMF; 1987--NO; 1988--NO; 1989--B/1167; 1990-91--UNK
1166F	10/79	1979-80--NO; 1981--3 UM cub, lost 2 cubs; 1982--1 ylg; 1983--1 2yr, NO; 1984-85--NO; 1986--1 UM cub; 1987-88--UNK; 1989--2+ cub, UNK; 1990--2 ylg (1701, 1702); 1991--2 2yr

Appendix D. Continued.

Bear no.& sex	Age/ year at capture	Year of status and description of intraspecific relationship[b]
1167F	7/79	1978--UNK; 1979--1 cub (1168) lost; 1980--B/UMM; 1981--B/1081, 1096; 1982--B/UMM; 1983-86--UNK; 1987--3 cub (1434, 1435, 1436), (lost 1434 prior to 6/23/87); 1988--2 ylg; 1989--2 2yr, B/1165; 1990--3 UM cub, lost cubs, NO; 1991--UNK
1168F	C/79	1979--w/mother (1167); 1980--dead
1169F	11/80	1980--2 cub (1170, 1171); 1981--B/M?M; 1982--2 UM cub; 1983--2 ylg (only 1 ylg 6/18/83); 1984--NO; 1985--3 UM cub; 1986--killed by other bear
1170F	C/80	1980--w/mother (1169), dead
1171M	C/80	1980--w/mother (1169), dead
1172M	11/80	1980--B/1097; 1981-83--UNK; 1984-85--NO; 1986-present--UNK
1173M	C/80	1980--w/mother (1105) and sibl (1174); 1981-84--same; 1985--weaned; 1986--dead
1174F	C/80	1980--w/mother (1105) and sibl (1173); 1981-84--same; 1985--weaned; 1986--NO; 1987--B/1147; 1988--B/UMM; 1989--UNK, 1+ cub; 1990--1 ylg (1497); 1991--1 2yr, B/UNK male
1175M	7/80	1980--B/1092; 1981-present--UNK
1176F	18/80	1980--NO; 1981--2 cub; 1982--1 ylg; 1983--UNK; 1984--2 cub (1409, 1 UM); 1985--NO; 1986--1 cub (1445); 1987--weaned ylg, B/1446, 1405, 1421, dead
1177F	1/80	1979--w/mother (1104); 1980--same; 1981--weaned, UNK; 1982--UNK; 1983--NO; 1984--UNK; 1985--B/UMM; 1986--NO; 1987--B/1083; 1988--NO; 1989--UNK, 1+ cub; 1990--1 ylg (1496); 1991--1 2yr, B/1147
1178F	13/80	1979--UNK 1+ ylg; 1980--1 2yr (1179); 1981--1 3yr, B/UMM; 1982--2 UM cub, B/UMM, M?M; 1983-present--UNK
1179F	2/80	1980--w/mother (1178); 1981--NO; 1982--UNK; 1983--B/1261; 1984--UNK; 1985-87--NO; 1988--emigrated south to Noatak R.; 1989--1 UM cub; 1990-91--UNK, alive
1180F	C/80	1980--w/mother (1102) and sibl (1181), dead
1181F	C/80	1980--w/mother (1102) and sibl (1180); 1981-82--UNK; 1983-85--NO; 1986--2 UM cub, B?; 1987--dead at den emergence

Appendix D. Continued.

Bear no.& sex	Age/ year at capture	Year of status and description of intraspecific relationship[b]
1232M	4/83	1983--NO; 1984-present--UNK
1233M	11/83	1983--B/1104; 1984--UNK; 1985--B/1104; 1986--NO; 1987--UNK; 1988-89--NO; 1990--UNK
1234F	5/83	1983--NO; 1984--UNK; 1985--NO; 1986--2 UM cub, lost?; 1987--NO; 1988-present--UNK
1261M	10/83	1983--B/1104, 1179; 1984-present--UNK
1401M	11/84	1984-85--NO; 1986-present--UNK
1402M	3/84	1981--w/mother (1097) and sibl (1403, 1404); 1982-84--same; 1985--weaned; 1986--moved SE, outside study area, B/UMF, hunter kill
1403F	3/84	1981--w/mother (1097) and sibl (1402, 1404); 1982-84--same; 1985--weaned; 1986--B/1165; 1987--B/1446, UMM; 1988--killed by other bear
1404M	3/84	1981--w/mother (1097) and sibl (1402, 1403); 1982-84--same; 1985--weaned; 1986-moved outside study area; 1987-present--UNK
1405M	7/84	1984--NO; 1985-86--UNK; 1987--B/1176; 1988-89--NO; 1990--UNK; 1991--NO
1406F	10/84	1984--killed by other bear
1407F	10/84	1984-85--NO; 1986--2 UM cubs/B?; 1987--NO; 1988--NO; 1989--3 UM cub, lost; 1990--B/UNK male; 1991--NO
1408M	10/84	History unknown, not collared
1409M	C/84	1984--w/mother (1176) and UM sibl; 1985--presumed dead
1410F	20/84	1984--NO; 1985-present--UNK, presumed dead
1411M	7/85	1984--NO; 1985-87--UNK; 1988--B/1089; 1989--B/1417; 1990--UNK
1412M	15/85	1985--NO; 1986--NO, hunter kill
1413F	9/85	1985--NO; 1986--3 UM cub, B/1164; 1987--NO; 1988--cub?, NO; 1989-present--UNK
1414F	2/85	History unknown, not collared

Appendix D. Continued.

Bear no.& sex	Age/ year at capture	Year of status and description of intraspecific relationship[b]
1415F	14/85	1985--NO; 1986-present--UNK
1416F	8/85	1985--NO; 1986--1 UM cub, lost cub, NO; 1987--3 UM cub; 1988--2 ylg; 1989--weaned 2 2yr, B/1081, re-unite w/2 2yr; 1990--wean 2 3yr, B/UNK male; 1991--3 UM cubs, dead
1417F	8/85	1985-88--NO; 1989--B/1411, 1459; 1990--NO; 1991--UNK
1418M	15/86	History unknown, not collared
1420M	7/86	1986--B/1105; 1987--NO; 1988--B/1425; 1989-present--UNK
1421M	13/86	1986-88--NO; 1989-91--UNK, alive
1422F	C/86	1986--w/mother (1104) and sibl (1423), dead
1423M	C/86	1986--w/mother (1104) and sibl (1422), dead
1424F	8/86	1986--NO; 1987--1 cub (1466); 1988--1 ylg; 1989--1 2yr, B/1147; 1990--2 UM cub, lost cubs, NO; 1991--1 cub
1425F	7/86	1985--NO; 1986--2 cub (1426, 1427), lost cubs, NO; 1987--B/1147, UMM; 1988--NO; 1989--3 cub (1708, 1709, 1710); 1990--3 ylg; 1991--3 2yr
1426F	C/86	1986--w/mother (1425) and sibl (1427), dead
1427M	C/86	1986--w/mother (1425) and sibl (1426), dead
1428F	7/86	1986--NO; 1987--UNK; 1988--NO; 1989-present--UNK
1434M	C/87	1987--w/mother (1167) and sibl (1435, 1436), dead
1435F	C/87	1987--w/mother (1167) and sibl (1434, 1436); 1988--w/mother and sibl (1436); 1989--weaned, UNK; 1990-present--UNK
1436F	C/87	1987--w/mother (1167) and sibl (1434, 1435); 1988--w/mother and sibl (1435); 1989--weaned, UNK; 1990-present--UNK
1437F	9/87	1986--NO; 1987--1 UM cub, lost cub; 1988--UNK; 1989--B/UMM; 1990--2 cub (1488, 1489); 1991--2 ylg
1438F	13/87	1987--3 UM 2yr; 1988--NO; 1989-90--UNK; 1991--2+ UM cubs (1756, 1757)
1439F	14/87	1987--3 UM 2yr; 1988--NO; 1989--3+ UM cubs; 1990--3+ ylg; 1991--3+ 2yr (1753, 1754, 1755)

Appendix D. Continued.

Bear no.& sex	Age/ year at capture	Year of status and description of intraspecific relationship[b]
1440F	14/87	1987--may be mother of 1449, 1450, B/UNK MM; 1988--B/1459; 1989--1 cub (1707); 1990--1 ylg; 1991--1 2yr, B/1459
1441F	15/87	1987--3 cub (1442, 1443, 1444); 1988--3 ylg, weaned, B/UMM; 1989--B/1124, 1147; 1990-present--UNK
1442M	C/87	1987--w/mother (1441) and sibl (1443, 1444); 1988--weaned; 1989--killed by other bear
1443M	C/87	1987--w/mother (1441) and sibl (1443, 1444); 1988--weaned; 1989--died in den
1444M	C/87	1987--w/mother (1441) and sibl (1443, 1444); 1988--weaned; 1989--died in den
1445F	1/87	1986--w/mother (1176); 1987--weaned, killed by 1447
1446M	15/87	1987--B/1176, 1403; 1988-present--UNK
1447M	4/87	1987--killed 1445; 1988-present--UNK
1448M	8/87	1987--NO; 1988-present--UNK
1449M	1/87	1986--w/mother (probably 1440) and sibl (1450); 1987--weaned; 1988--died in den w/1450
1450F	1/87	1986--w/mother (probably 1440) and sibl (1449); 1987--weaned; 1988--died in den w/1449
1451F	14/87	1987--NO; 1988--2 UM cub; 1989--2 ylg; 1990-91--UNK, alive
1453M	18/88	1988--B/1454; 1989--B/1468; 1990-present--UNK
1454F	10/88	1988--B/1453; 1989--3 UM cub; 1990--3 ylg; 1991--3 2yr (1498, 1499, 1500)
1455M	7/88	1988--B/1141; 1989-present--UNK, not collared
1456M	10/88	1988--B/1441, 1141; 1989--hunter kill
1457F	10/88	1988-89--NO; 1990--2+ UM cub; 1991--2+ ylg (1731, 1732)
1458F	7/88	1988--B/1459; 1989--2 cub (1494, 1495); 1990--2 ylg; 1991--weaned 2 2yr, B/1459, back w/2 2yr
1459M	17/88	1988--B/1440, 1458, 1460; 1989--B/1473, 1417, UMF; 1990--UNK; 1991--B/1440, 1458

Appendix D. Continued.

Bear no.& sex	Age/ year at capture	Year of status and description of intraspecific relationship[b]
1460F	8/88	1988--B/1459; 1989--3 cub; 1990--2 ylg (1492, 1493); 1991--2 2yr
1461F	Ad/88	1988--B/1459, UMM; 1989--NO; 1990--2+ cub; 1991--2+ ylg (1743, 1744), UNK
1462M	4/88	1988-89--NO; 1990-91--UNK
1463M	9/88	History unknown, not collared
1464F	7/88	1988--NO; 1989--3 UM cub; 1990--3 ylg; 1991--3 2yr (1713, 1714, 1715)
1465F	8/88	1988--NO; 1989--3 UM cub, lost cubs; 1990--NO; 1991--NO
1466M	1/88	1987--w/mother (1424); 1988--same; 1989--weaned, moved out of study area; 1990-present--UNK
1467F	6/88	1988--produced cub?, B/1103?; 1989-present--UNK
1468F	8/88	1988--NO; 1989--B/1453, UMM; 1990-91--UNK
1469M	1/88	1987--UNK, w/mother (1136) and sibl (1470); 1988--with mother and sibl; 1989-present--UNK
1470M	1/88	1987--UNK, w/mother (1136) and sibl (1469); 1988--with mother and sibl; 1989-present--UNK
1471M	C/88	1988--w/mother (1158) and sibl (1472); 1989-present--UNK
1472M	C/88	1988--w/mother (1158) and sibl (1471); 1989-present--UNK
1473F	6/89	1989--B/1459; 1990--NO; 1991--1+ UM cub
1474F	4/89	1989--NO; 1990--observed with UM small bear; 1991--B/UNK male
1475F	24/89	1989--NO; 1990--UNK, not collared
1476M	8/89	1989--NO; 1990--UNK, not collared
1477M	10/89	1989--B/1095; 1990--UNK, not collared; 1991--NO
1478M	10/89	1989--B/1479; 1990--UNK, not collared; 1991--NO
1479F	6/89	1989--B/1478; 1990--B/1405, 1491; 1991--B/1712

Appendix D. Continued.

Bear no.& sex	Age/ year at capture	Year of status and description of intraspecific relationship[b]
1480M	C/89	1989--w/mother (1097) and sibl (1481, 1482); 1990--w/mother and 1481 (1482 dead); 1991--weaned, remained w/sibling
1481F	C/89	1989--w/mother (1097) and sibl (1480, 1482); 1990--w/mother and 1480 (1482 dead); 1991--weaned, remained w/sibling
1482M	C/89	1989--w/mother (1097) and sibl (1480, 1481); 1990--dead
1483F	C/89	1989--w/mother (1087) and sibl (1484); 1990--same; 1991--same
1484F	C/89	1989--w/mother (1087) and sibl (1483); 1990--same; 1991--same
1485M	C/89	1989--w/mother (1141); 1990--same; 1991--UNK, assumed dead
1486M	2/90	1988--w/mother (1149) and sibl (1487); 1989--same; 1990--same; 1991--weaned, NO
1487F	2/90	1988--w/mother (1149), sibl (1486); 1989--same; 1990--same; 1991--weaned, observed w/1719, dead
1488M	C/90	1990--w/mother (1437), sibl (1489); 1991--same
1489M	C/90	1990--w/mother (1437), sibl (1488); 1991--same
1490M	6/90	1990--NO, killed by hunter on Kelly River
1491M	17/90	1990--B/1479, 1405M nearby; 1991--UNK
1492F	1/90	1989--w/mother (1460), sibl (1493); 1990--same; 1991--same
1493F	1/90	1989--w/mother (1460), sibl (1492); 1990--same; 1991--same
1494M	1/90	1989--w/mother (1458), sibl (1495); 1990--same; 1991--weaned, then back w/mother
1495F	1/90	1989--w/mother (1458), sibl (1494); 1990--same; 1991--weaned, then back w/mother
1496M	1/90	1989--w/mother (1177); 1990--same; 1991--weaned
1497M	1/90	1989--w/mother (1174); 1990--same; 1991--weaned
1498F	1/90	1989--w/mother (1454), sibl (1499, 1500); 1990--same; 1991--same

Appendix D. Continued.

Bear no.& sex	Age/ year at capture	Year of status and description of intraspecific relationship[b]
1499M	1/90	1989--w/mother (1454), sibl (1498, 1500); 1990--same; 1991--same
1500F	1/90	1989--w/mother (1454), sibl (1498, 1499); 1990--same; 1991--same
1701F	1/90	1989--w/mother (1166), sibl (1702); 1990--same; 1991--same
1702F	1/90	1989--w/mother (1166), sibl (1701); 1990--same; 1991--same
1703M	14/90	1990--NO; 1991--UNK
1704F	1/90	1989--w/mother (1089), sibl (1705, 1706); 1990--same; 1991--same
1705M	1/90	1989--w/mother (1089), sibl (1704, 1706); 1990--same; 1991--same
1706F	1/90	1989--w/mother (1089), sibl (1704, 1705); 1990--same; 1991--same
1707M	1/90	1989--w/mother (1440); 1990--same; 1991--weaned
1708M	1/90	1989--w/mother (1425), sibl (1709, 1710); 1990--same; 1991--same
1709M	1/90	1989--w/mother (1425), sibl (1708, 1710); 1990--same; 1991--same
1710M	1/90	1989--w/mother (1425), sibl (1708, 1709); 1990--same; 1991--same
1711F	4/91	1991--NO
1712M	17/91	1991--B/1479
1713F	2/91	1989--w/mother (1464), sibl (1714, 1715); 1990--same; 1991--same
1714M	2/91	1989--w/mother (1464), sibl (1713, 1715); 1990--same; 1991--same
1715F	2/91	1989--w/mother (1464), sibl (1713, 1714); 1990--same; 1991--same
1716F	8/91	1991--2 cub (1717, 1718)

Appendix D. Continued.

Bear no.& sex	Age/ year at capture	Year of status and description of intraspecific relationship[b]
1717F	C/91	1991--w/mother (1716), sibl (1718)
1718F	C/91	1991--w/mother (1716), sibl (1717)
1719M	3/91	1991--observed w/1487 (3yr F)
1720M	16/91	1991--NO
1721F	2/91	1991--w/sibl (1722)
1722M	2/91	1991--w/sibl (1721)
1723M	3/91	1991--NO
1724M	4/91	1991--NO
1725M	4/91	1991--NO
1726M	3/91	1988--UNK, w/mother (1125), sibl (2+ UM); 1989--same; 1990--same; 1991--same
1727M	1/91	1990--w/mother (1095), sibl (1 UM); 1991--same

a Ages determined from examination of cementum layering; C denotes a cub of the year.

b Designations are as follows:
NO, no interspecific interactions observed;
UNK, unknown status, no observations made during that year;
B/, bred with (number of other bear);
UM or M, unmarked or marked, often in conjunction with M or F, male or female. M?M denotes observation of male that appeared to be marked
2 cub, B/ denotes a female that produced 2 cubs, lost them, and subsequently bred with a male
sibl, sibling
yrl, 2 yr, or 3 yr denotes a yearling, 2-year-old, or 3-year-old