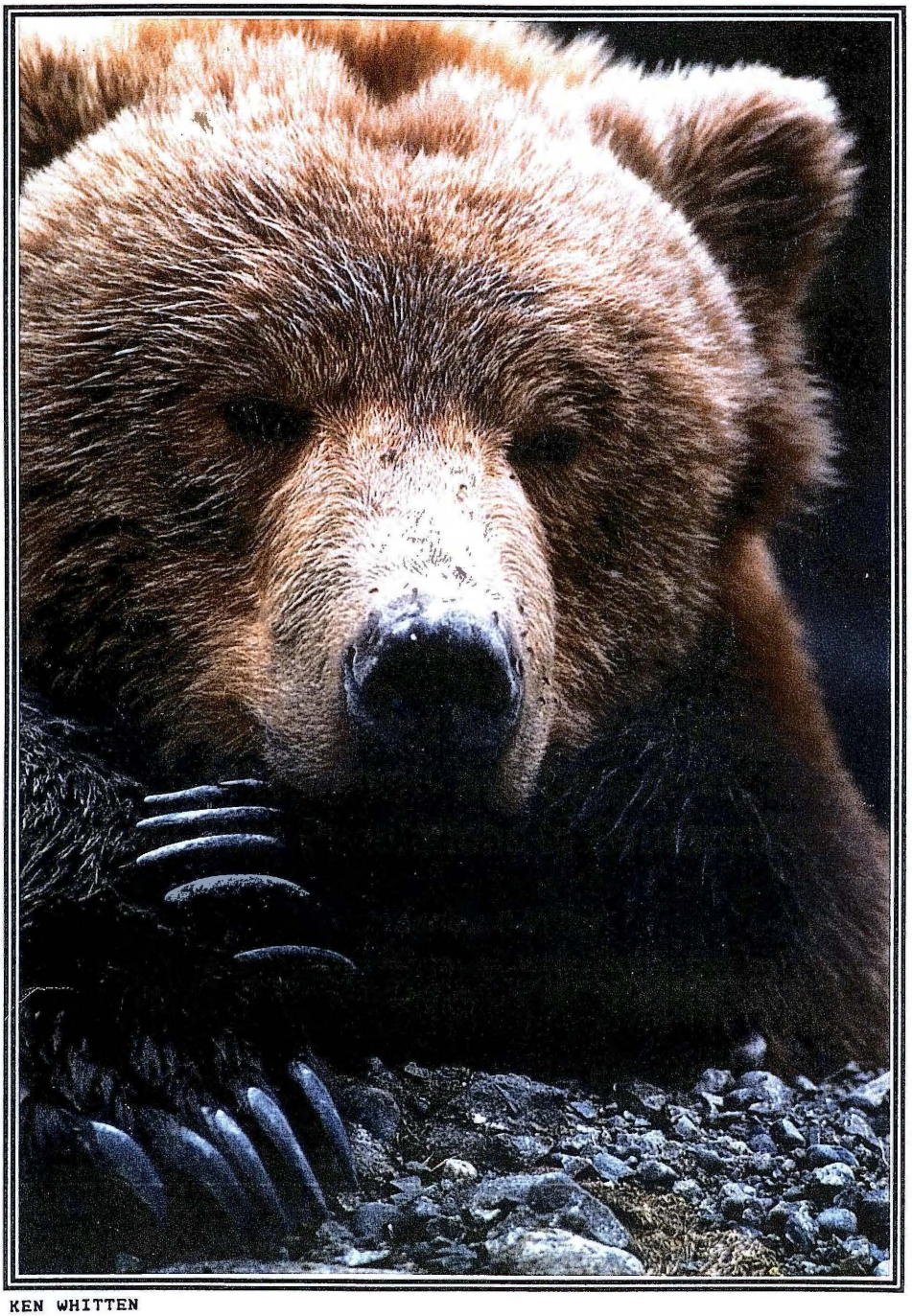
Alaska Department of Fish and Game
Division of Wildlife Conservation

Federal Aid in Wildlife Restoration
Research Final Report
1 July 1993-30 June 1996

Impacts of Heavy Hunting Pressure on the Density and Demographics of Brown Bear Populations in Southcentral Alaska

Sterling D Miller



KEN WHITTEN

Grants W-24-2,
W-24-3, W-24-4
Study 4.26
June 1997

STATE OF ALASKA
Tony Knowles, Governor

DEPARTMENT OF FISH AND GAME
Frank Rue, Commissioner

DIVISION OF WILDLIFE CONSERVATION
Wayne L. Regelin, Director

Free copies of this report and other Division of Wildlife Conservation publications are available to the public. Please direct requests to our publications specialist.

Mary Hicks
Publications Specialist
ADF&G, Wildlife Conservation
P.O. Box 25526
Juneau, AK 99802
(907) 465-4190

RESEARCH FINAL REPORT

STATE: ALASKA **STUDY NO:** 4.26

COOPERATORS: NONE

GRANT NO: W-24-2, W-24-3, W-24-4

STUDY TITLE: Impacts of Heavy Hunting Pressure on the Density and Demographics of Brown Bear Populations in Southcentral Alaska

PERIOD: 1 JULY 1993 TO 30 JUNE 1996

SUMMARY

Brown bear (*Ursus arctos*) populations have been exposed to intensive harvest pressure in Alaska's Game Management Unit (GMU) 13. Since 1980 varying kinds of liberal brown bear hunting regulations in Unit 13 have been adopted by Alaska's Board of Game. The objective for these regulations was to reduce bear abundance to increase moose (*Alces alces*) calf survivorship and moose availability for harvest by hunters. This predator reduction effort was accelerated starting fall 1995 with adoption of the most liberal brown bear hunting regulations in Alaska for Unit 13. These new regulations were adopted primarily in response to the state's new intensive management law (AS 16.05.255): " An act relating to the powers of the Board of Game and to intensive management of big game to achieve higher sustained yield for human harvest."

Progress in the long-term effort to reduce bear density was measured in a remote portion of Unit 13E where density was expected to be reduced as a consequence of high harvests in the subunit. Previous efforts had revealed significantly lower densities in nearby highly accessible portions of Unit 13E compared with more remote areas. There was no direct measure of trends in either remote or accessible portions of the subunit. Such a measure in a remote portion of Unit 13 was obtained during spring 1995 by repeating a density estimate done 10 years earlier in the same study area. This earlier estimate was part of the study associated with the proposed Susitna Hydroelectric Project. In this study area, density was 18.8 independent bears/1000 km^2 (95% CI = 15.9-23.8) in 1985 and 23.3 independent bears/1000 km^2 in 1995 (95%CI =19.3-30.1). An anticipated significant decline in bear density was not documented during this study.

These results should not be interpreted that hunting has not affected bear density in GMU 13. The Susitna Hydroelectric Project study area is in a remote portion of Unit 13 where access is difficult for bear hunters. In a 1987 study in a more accessible area along the Denali Highway, bear density was 30% of that documented in the recent 1995 study. The low density and changes in population composition in the Denali Highway area were attributed to heavy hunting pressure (Miller 1990*a*).

The heavy hunting pressure in Unit 13 resulted in increased proportion of females in the population during 1995 compared to 1985. Three methods were used to compare sex ratio in the study area. With the weighted snapshot approach, the number of males/100 females (all ages)

changed from 70 to 21 between 1985 and 1995 ($P = 0.03$). A similar change was observed for changes in sex ratio for bears ≥5 years old, but the difference was not significant ($P = 0.2$). The weighted snapshot approach includes repeated counts of the same individual based on the number of times that individual was in the search area during density estimation searches. Other methods of estimating changes in population composition, including the unweighted snapshot, and composition of capture approaches yielded nonsignificant changes in sex ratio.

Key Words: Alaska, brown bear, grizzly bear, hunting impacts, population composition, population density, reproductive rates, Unit 13, Ursus arctos.

CONTENTS

BACKGROUND

Little is known about trends in bear populations in Unit 13 before the 1980s. Between 1948 and 1953, the federal government conducted a poisoning campaign directed at wolves, reducing wolf numbers in Unit 13 to as few as 12 (Rausch 1969, Ballard et al. 1987). Because the poison was distributed around carcasses of dead animals (J. Didrickson, Palmer AK, pers. commun.), mortality to bears that scavenged these carcasses occurred "often" (Rausch 1969:126), and it is

believed bear populations were depleted. After statehood, bears were managed conservatively and bear populations probably increased gradually over the next 20 years.

Systematic brown bear studies in Unit 13 began in 1978. These studies yielded information on bear movements, predation rates on ungulates, and sex and age composition of the bear population (Spraker et al. 1981). Additional bear studies focused on the role of bear predation on moose calf survival (Ballard et al. 1980, 1990, 1991; Ballard and Larsen 1987; Ballard and Miller 1990). These studies resulted in a bear density estimate and bear population composition estimates for 1979 in a study area surrounding moose Count Area 3 near the Denali Highway in northern Unit 13 (Subunit 13E) (Miller and Ballard 1980). This bear density estimate was done during a bear transplant experiment (Ballard and Miller 1990) and was subsequently adjusted downward to correct for suspected overestimation bias based on lack of population closure (Miller 1990*a*). During 1980-1986 the Alaska Power Authority financed a major bear study in a nearby area with similar bear habitat but where bear hunting was more difficult because of the absence of road access. In this area south of the Denali Highway, a large 2-dam hydroelectric project was proposed but never built. In this Su-hydro area studies were designed to evaluate the proposed project's effects on wildlife and included intensive studies of black bear, brown bear, moose, caribou, wolves, and other species. The bear studies significantly increased the amount of available information about bear biology, density (in 1985), population composition, movements, and predation rates (Miller 1987).

In addition to these research projects, Alaska Department of Fish and Game (ADF&G) management staff produced annual federal aid reports designed to track the status of bear populations in Unit 13, based on research findings, harvest data, incidental observations, and other available information. Excerpts from these reports demonstrate uncertainty about the status of this population during the heavy harvests of the 1980s (Miller 1993*a*, Appendix A).

The predator-prey research conducted in Unit 13 during the late 1970s and early 1980s indicated brown bears were killing many moose calves and that an experimental reduction in bear densities increased calf survivorship (Ballard and Larsen 1987, Ballard and Miller 1990). This research was completed in the early stages of the moose population's recovery from the severe winters of the early 1970s (Ballard et al. 1991). These calf mortality study results led the Alaska Board of Game to expand opportunity to hunt brown bears in Unit 13. This liberalization was intended to increase the number of moose available to hunters in Unit 13 and led to increased bear harvests starting in 1980. Similar liberalizations and increases in harvest occurred elsewhere in southcentral Alaska (Miller 1990*b*). In 1986 this project began evaluating the response of the brown bear population to liberalized regulations and increasing harvests in Unit 13.

Strong support for further reductions in bear numbers in Unit 13 comes from residents in the unit and from owners of recreational cabins (especially in Subunit 13A). Transfers of small state land parcels to private ownership in the area during the early 1980s greatly increased human presence in bear habitat. These changes corresponded to an apparent increase in nuisance bear problems and property damage by bears, an increase interpreted by many locals to indicate bear population increases or, at least, that bear densities were higher than desired. Support for bear reductions also comes from some ungulate hunters living within and outside Unit 13.

In fall 1995 still more liberal bear hunting regulations were implemented in Unit 13. Regulations adopted by the Board of Game changed the bag limit from 1 every 4 years (the limit in most other portions of Alaska) to 1 every year and eliminated the need for resident brown bear hunters in Unit 13 to purchase a $25 tag. These regulations opened the fall hunting season on August 10 (instead of September 1) to encourage August caribou hunters to take bears. The intent of these regulations was to further augment brown bear harvests by encouraging incidental and nondiscriminatory harvests, thereby causing a reduction in bear abundance which would lead to increased moose survivorship and a corresponding increase in harvests of moose by hunters.

My studies in a heavily hunted portion of Unit 13 complement studies in Unit 20A where brown bear populations were intentionally reduced and are now being allowed to recover (Reynolds 1990, 1995) and in Unit 9 where bear populations have recovered to desired levels after heavy harvests in the late 1960s (Sellers and Miller 1990, Sellers 1994). The work in Unit 13 also complements work in Minnesota where a heavily hunted black bear (*Ursus americanus*) population was found to withstand heavier than expected harvests by hunters (Kontio et al. 1997).

OBJECTIVES

Objectives for this study were to: 1) document changes in density and in the sex and age composition in a brown bear population subjected to heavy rates of harvest by hunters; 2) monitor changes in individual bear reproductive performance and survivorship in a population subjected to heavy harvest rates; and 3) investigate the hypothesis that brown bear cub survivorship is inversely related to hunting pressure or the proportion of adult males in the population.

METHODS

DENSITY ESTIMATION

In 1995 density was estimated in the same search area previously used to estimate density in 1985 (Miller et al. 1987). The search area was subdivided into the same 9 quadrats used during the 1985 study (Miller 1987, Miller et al. 1997). The location of this search area and comparison study areas along the Denali Highway are illustrated in Fig. 1.

Four fixed-wing aircraft (PA 18), each with a biologist and pilot, searched assigned quadrats during each replication. All quadrats were searched during each replication. Teams in each aircraft rotated between quadrats on successive replications to lessen potential bias based on previous experience in a quadrat. Searches were conducted without using telemetry equipment. When bears were spotted, telemetry equipment was activated to determine whether bears were radiomarked. If radiomarked, locations were plotted and searches continued. If not radiomarked, in most cases a marking team in a helicopter (Hughes 500) captured and marked the bears. Unmarked bears were not captured and marked on the last day of the density estimate.

One of the fixed-wing aircraft was also used to establish closure during each replication. This aircraft flew around the periphery of the search area and used telemetry equipment to determine whether each radiomarked bear was within or outside the area being searched. In most cases, radiomarked bears were not precisely located during these periphery flights. Precise locations were obtained only when the telemetry signal from a bear was close to the search area periphery

to determine whether the bear was in or out. I was the biologist in the aircraft conducting the closure flights for all replications.

One bear (501) had been incorrectly recorded as having shed its collar the previous year, based on location of the shed collar transmitting on that frequency on the ground. The shed collar had been shed years previously by another bear on the same frequency and 501 was still radiomarked. Because not all aircraft were scanning for this frequency when they saw "unmarked bears," 501 was treated as unmarked even when correctly identified.

Five replications were completed on 5 successive days during May 15-19, 1995. More replications were originally scheduled, but the study was terminated early to conserve funds when it became clear that results would not be different from the 1985 results. Detailed results from the density estimation work were presented in Miller (1995).

POPULATION COMPOSITION

Standardized techniques for measuring population composition have not been described. All available techniques, short of knowing every individual in an island population that is alive at one time, have biases and flaws. Since male bears have larger home ranges than females, male abundance will be overestimated relative to female abundance in most methods of measuring composition that are based on knowledge of which individuals are present in a given area during a given period.

I used 4 ways to measure composition, 3 of which should be biased in favor of males since they include males using our designated study areas from a larger area than from which females are included. Since bears do not have exclusive territories from which they exclude other bears, any parcel of territory used to capture or count bears for inclusion in composition calculations will be overlapped by the home ranges of numerous individuals. The number of males who overlap such a parcel will be drawn from a larger area than for females, providing a male bias. Although this bias cannot be avoided, it can be standardized using systematic ways of measuring composition, such as consistent period length and timing. A fourth way of measuring composition is reported here. This method attempts to reduce bias based on larger home ranges of males by weighting the bears known to be in the search area during the density estimation period by the number of times they were present.

In my GMU 13 studies, most bears observed during premarking periods were captured and marked. Rarely did bears escape from observation planes prior to being captured or did the capture team pass on making an effort to capture individuals based on safety considerations such as avalanche danger. Data on such escapes was not collected, but I estimate this occurred less frequently than once per 50 bears observed (excluding offspring with their mothers) and was not a source of bias.

Bear composition was measured using the following approaches:

1 The **unweighted snapshot** approach includes the individuals captured and seen in a search area, or known through telemetry to be present in a search area during replicated searches to obtain density estimates (Miller et al. 1997). These density estimates are

typically conducted following 2 or more years of premarking effort that result in a number of radiomarked bears in and around the search area (only those known to be in the search are counted). Unmarked bears seen during the search are captured and are added to the composition data. This method has the advantage of being an objective and easily replicable way to obtain comparison measures in subsequent years. This approach will not work in circumstances where efforts are not made to capture all unmarked bears seen during the density estimation period.

2 The **modified unweighted snapshot** approach includes all the individuals in #1 plus individuals previously radiomarked in the study area that are known to be alive during the density estimate even if they were not documented to be in the density estimation area during the density estimation period. This method permits use of additional available information and results in a larger sample size than #1. Results using this method are less useful for making comparisons between areas and times unless standardized procedures are used during the premarking procedure for capturing and marking animals from a well-described and consistent area. If there is a bias against radiomarking male bears during the premarking period or if males are more likely to shed their collars, then using this approach will cause a relative bias against males. This is because there will be more previously marked females known, through telemetry, to be near but not in the search area than males.

3 The **weighted snapshot** approach utilizes the same individuals as #1 but weights each individual by the number of times it was known present in the search area. A bear present 6 times is, in essence, counted 6 different times while an individual present only once is counted only once. Equal weights were used for presence in the search area, determined by resightings of previously marked bears, presence based on telemetry locations, and by captures of new bears in the search area. The infrequent cases in which unmarked bears were seen but not captured were used in calculating sex ratio only insofar as it could be determined with certainty what sex they were (e.g., females with offspring). Data on mean and median ages were weighted in the same way as data on sex ratios.

4 The **capture record** approach includes data from all bears captured in the study area during a period of time. In my studies in Unit 13, I included all bears captured during the premarking and density estimation periods (2-5 years) that were at least 3 years old when captured. I excluded bears <3 because these bears are still with their mothers and including them would result in exacerbating the bias toward younger animals. Because of recruitment and high mortality of younger age classes, this bias is always present; the magnitude of this bias would be a function of the length of the period over which data were cumulated (longer periods result in more bias). The capture record approach is not a snapshot approach as it cumulates sightings over a period of years and includes individuals who may not still be alive (or near the study area) during the final years of the period. It would also be possible to advance age at capture to calculate age during a standard later year in calculations of population age parameters but I did not do this.

For the capture record approach, the longest period used for my Unit 13 studies was 6 years (1980-1985) in the MidSu (Su-hydro) study area where density was estimated in 1985 and again

in 1995. Some of the adult female bears radiomarked in the earlier study were still radiomarked during the 1993-94 premarking period for the 1995 estimate. These females were all >15 years old by this time. Inclusion of the old previously radiomarked females in the capture sample for 1993-1995 makes the implicit assumption these females would have been captured during this period even if they hadn't been previously radiomarked. In order to permit more standardized comparisons of population composition based on captures during 1993-1995 (3 years), composition based on captures during 1980-83 (4 years, but few [6] bears were captured in 1982) was calculated as well as composition based on captures during 1980-1985 (6 years). Data used for the capture record approach for studies since 1980 are presented in Table 1. Data for composition in the upper Susitna area based on captures in 1978 and 1979 are presented in Spraker et al. (1981) and Miller and Ballard (1980).

Statistical tests to test the null hypothesis that population composition was the same for unweighted data were based on Chi square analysis. For the weighted data, Earl Becker recommended the following procedure to test whether sex ratio in population (P_1) was the same as in population (P_2).

In population P_1 there were n_1 individuals known to be present in the search area at least once; the weighted number of total times present for these individuals was $\sum w_i$. The proportion of females in the weighted population (P_{F1}) was $\sum$ (w_i for females)/ $\sum w_i$. The variance for P_{F1} was calculated as:

$$V(P_{F1}) = P_{F1}(1- P_{F1})/n_1.$$

and the SE (P_{F1}) is the square root of this value.

Under the null hypothesis that the proportion of females was the same in both populations (following Snedecor and Cochran 1980:125), a z-test statistic was calculated as:

$$z = (P_{F1} - P_{F2})/ \sqrt{P_{fho}(1- P_{fho})(1/n_1 +1/n_2)}$$

where P_{fho} is the proportion of females in the combined populations of P_1 and P_2. Since the harvest data are heavily weighted toward males, z was evaluated as a 1-tailed test (H_a: $P_{F1} < P_{F2}$ where P_{F2} was the population subjected to heavier harvest).

Reproductive Rates

Data on reproductive rates of brown bears in northern Unit 13 have been collected since 1980 by tracking radiomarked bears from fixed-wing aircraft and counting offspring observed with their mothers. In some years bears were monitored intensively to collect these and other data. For the last decade, however, reproductive rates have been monitored with less intensive observations. During this period, I typically obtained only 1-2 sightings following den emergence and again prior to den entrance plus a sighting in midsummer designed to document whether losses to litters occurred prior to or following this observation. Transmitters on marked bears were switched at 3-year intervals with some skips or advances of remarking times designed to avoid handling bears during years when they had newborn cubs.

Age of first litter production was estimated by tracking radiomarked subadults until they were observed with a litter. For each age class <10 years-old, I calculated the proportion of bears in that age class that were known to have had litters; these data included females observed with litters and captures of females showing evidence of lactation. Bears without such evidence were classified as not yet having had a litter ("open"). There is high mortality of these subadults from hunting, and frequently subadult females were shot or their radios failed or shed before these bears produced their first litter. This yielded incomplete data for these subadults. Such incomplete records were included, based on the assumption the subadult bear would have had a litter the following year. Incomplete data were included only in the cases where inclusion would increase the mean age of first litter production as it would have been erroneous to make the assumption that very young bears would have produced litters the year following our loss of contact with them. Simulation studies demonstrated that more accurate estimates of age of first reproduction were obtained using this approach (Miller 1990*b*).

Interval between litter recruitments was calculated based on the interval between a female's production of her first litter and the first successful weaning of that litter (typically when the offspring are in their third year of life). Intervals between litter recruitments also included the periods between separation from 1 litter and separation from the next litter produced. Mean interval was calculated for all completed intervals. Values for incomplete intervals that would be greater than the mean for the completed intervals were also included in order to obtain more accurate estimates of litter recruitment interval (Miller 1990*b*). Because some old females stopped producing litters or stopped raising litters successfully to age of separation, these individuals were excluded from the sample of incomplete intervals.

RESULTS AND DISCUSSION

CAPTURE AND MARKING RESULTS

Using helicopter darting techniques, we captured 126 bears during 1993-1996. There was 1 capture mortality during this period (552 in 1996). Of these, 40 bears were captured in 1996 in the new study area in Unit 13A and the rest were captured in Unit 13E. Fifty-five bears, including some recaptures, were captured in 13E as part of studies designed specifically to estimate density in the old Su-hydo (MidSu) study area. We recaptured an additional 31 bears in Unit 13E to inspect or adjust collars. Records for bears captured and marked since 1980 are presented in Table 1.

HUNTER HARVESTS IN GMU 13

Hunting regulations and harvests in Unit 13 during the period 1961-1996 are presented in Table 2. Large increases in reported harvest are associated with the periods when bag limits were 1/year (1982-1986, 1995-present) instead of the statewide standard of 1/4years (Table 2). Under regulations allowing taking of brown bears every year in Unit 13, hunters have an incentive to incorrectly report bears as having been taken in Unit 13 when they were actually taken elsewhere ("bootlegging"). This incentive results because correct reporting would prevent a hunter from taking a bear elsewhere in the state the following year, including the popular brown bear permit hunt on Kodiak Island. It is unknown how much the relatively liberal bag limit in Unit 13 actually corrupts the accuracy of the harvest statistics, but some bootlegging was documented in the early

1980s and was the primary factor for eliminating the 1/year bag limit in 1986. I suspect that bootlegging will become increasingly prevalent the longer the incentive persists.

Number Bears Killed

Trends in brown bear harvest in Unit 13 (excluding Subunit 13E) and in Subunit 13E are illustrated in Fig. 2. Data for Subunit 13E are plotted separately as this is the subunit in which brown bear density estimates have been designed to indicate trends in populations (reported below). In Unit 13 (excluding 13E) an increasing trend in reported bear harvests was evident throughout the 1970s to 1986 when reported harvests fell in response to reversion to a bag limit of 1/4 years. No trend was evident subsequently although reported harvests may again be increasing in recent years in response to the increased bag limit in 1995 (Fig. 2). In Subunit 13E harvest trend has been consistently increasing during the period 1969-present, with marked increases during the 1982-86 period when bag limits were 1/year (Fig. 2).

Harvest Density

Harvest of females is the key component in the dynamics of bear populations. Annual kill density for female brown bears in Subunits 13A and 13E are presented in Fig. 3. Kill density was similar in both areas through 1986 but, subsequently, kill density has been markedly higher in 13E (Fig. 3). In both areas, increases in number of females killed were evident during 1982-83 through 1986-87 and again during 1995-96 when bag limits were 1/year (Fig 3).

For both sexes, kill density has been consistently higher in Subunit 13E than in Subunit 13A since 1975 (Fig. 4). Brown bear harvest density was higher in Subunit 13E than in any other interior Alaskan area, including other subunits in Unit 13, in an earlier comparison (Miller 1993*b*).

Harvest Sex Ratio

Although imperfect, the sex composition of harvests is an index to exploitation rate. Generally, an increasing proportion of females in harvests, under conditions where relative vulnerability of the sexes remains constant, is consistent with an interpretation of increasing exploitation rate (Fraser et al. 1982; Tait 1983; Harris 1984; Miller and Miller 1988).

Brown bear harvests have been predominantly male in Unit 13 from 1969 to 1996. Of 2149 brown bears harvested in the area and for which sex was identified by examination of the hide (hereafter "known sex"), 58% were males. In Subunit 13E during this same 27-year period, 753 known sex bears were reported harvested and 56% were males. During spring seasons which have been in effect in Unit 13 since 1980, harvests are markedly skewed toward males (69.8% in all of Unit 13 and 75% in Subunit 13E). Of 499 known sex bears harvested during the last 27 fall seasons in Subunit 13E, 49.5% were males. Spring seasons select for males primarily because males exit dens earlier and consequently are vulnerable to hunters for a longer period (Miller 1990*e*).

Trends in sex ratio in harvests were examined using cumulated totals for 3 years to dampen fluctuations. There were no clear trends in proportion of males in the harvest of brown bears in Unit 13 (excluding Subunit 13E) or in Subunit 13E (Fig. 5). In all of Unit 13 (excluding Subunit 13E), more males than females were harvested in all years and there seemed to be an increasing trend in proportion of males during 1987-1992, which subsequently reversed to a declining trend (Fig. 5). A similar, but more extreme, pattern was evident in Subunit 13E (Fig. 5). In Subunit

13E, more females than males were harvested during a few years in the late 1980s and, again, last year (Fig. 5).

Because of biases toward males in spring seasons, fall harvests probably more closely reflect population composition. Fall harvests still include biases toward males, however, because adult females accompanied by newborn or yearling offspring may not be shot. Males have consistently predominated during fall seasons in Unit 13 (excluding Subunit 13E) except recently when slightly more females than males have been harvested during fall (Fig. 6, based on cumulated data for 3 years). Overall, there has been a long-term increasing trend in proportion females in fall harvests except for a puzzling reversal during 1987-1990 (Fig. 6). The composition in fall harvests in Subunit 13E follows the same pattern as in the rest of Unit 13, but proportions are more extreme. The percentage of females in fall harvests have been higher in Subunit 13E than in the rest of Unit 13 during 12 of the last 13 years (Fig. 6). Also, more females than males were taken during 8 of the last 13 years of fall harvests (Fig 6, cumulating values for 3 years).

Marked Bear Harvest Rate

Annual harvest rates of bears marked in Unit 13 studies during 1980-1995 are presented in Table 3. Overall during this period, the harvest rate of marked animals was 10.8% (17% for males and 8.2% for females) (Table 3). The highest percentage of radiomarked bears shot during this period was 22% in 1984; the next highest year was 1995 (18.5%) (Table 3).

These rates include harvests of radiomarked bears and harvests of marked bears without radiocollars when they were shot (not collared or collars shed). Nonradiomarked bears were not counted in the denominator of the harvest rate (available for harvest) until they were taken. When harvested, they were counted as available for harvest during the year of harvest as well as during all preceding years back to the year of original capture (this procedure probably results in an overestimation bias).

DENSITY COMPARISONS IN SUBUNIT 13E

Density estimates in the 1985 and 1995 studies in the same Su-hydro study area, as well as estimates in 1987 in the Denali Highway study area, are given in Table 4 for the maximum likelihood estimator. Comparison estimates for the same data using the bear-days estimator were provided in Miller (1995). Density estimates are given in 3 measurement units:

1 **Independent bears** does not include any offspring accompanying their mothers regardless of the age of these offspring but includes observations of a breeding male and female as 2 independent observations,

2 **Bears > 2** includes all independent bears as well as 2-year-old bears still accompanying their mothers as independent observations, and

3 **Bears of all ages** includes, as independent observations, cubs-of-the-year, yearling, and older bears still accompanying their mothers.

These units have different applications. Because of yearly variations in cub production, density comparisons within an area over time are best expressed as independent bears. Comparisons between areas are best expressed in units of bears ≥ 2 years-old because of potential differences in

age of weaning. Density in units of bears of all ages is calculated to permit comparisons with studies elsewhere which report density in this way. The capture-mark-recapture studies conducted in Alaska make the assumption that observations are independent of each other; this assumption is clearly violated when offspring still with their mothers are counted as independent observations. Simulation studies indicate this assumption violation results in little bias in point estimates but does underestimate CI coverage (Miller 1990*b*: Appendix D).

Density Comparisons within the Su-hydro Study Area

Density was estimated at 18.75 independent bears/1000 km^2 in 1985 and at 23.31 bears/1000 km^2 in 1995. The 95% CI for the 1985 estimate overlapped the 1995 estimate but the 80% CI did not (Table 4). Only 5 replications were completed in 1995 compared with 7 in 1985. Had we completed 7 replications in 1995, the CI would have been smaller and the differences may have been significant.

These results indicate that density in this area has increased marginally between 1985 and 1995 and do not support the prediction by Miller (1992, 1993*a*) that population density in this area should decline. The prediction of a decline was based on reported harvests in excess of calculated sustainable harvest levels in Unit 13E.

Comparisons Between Su-hydro and the Denali Highway Study Areas

The 1987 density estimate in the Denali Highway study area which is readily accessible to hunters was 8 independent bears/1000 km^2 (95% CI = 5.6-7.6) (Table 4). This density was significantly lower than in either the 1985 or 1995 studies in the Su-hydro area. Habitat in the Denali Highway study area appears equivalent to that in the nearby but relatively inaccessible Su-hydro study area. A higher density was reported in the Denali Highway study area in 1979 using different techniques that resulted in a large CI (Table 5). Consequently, it could not be proven that density in the Denali Highway actually declined between 1979 and 1987 but Miller (1990*a*,*c*; 1993*a*) concluded this was probably the case, based on high kill densities, differences in population composition, and the decline in point estimates, albeit nonsignificant because of the large 1979 CI.

Comparisons Between CMR Estimators

Population and density estimates presented in Table 4 were based on the maximum likelihood estimator described by White (1993), which is a modification designed to accommodate immigration and emigration of an estimator described by White and Garrott (1990). The original "bear-days" estimator for use with data of this kind was described by Miller et al. (1987). As noted for other CMR (capture-mark-resight) bear studies in Alaska (Miller et al. 1997), population estimates and CIs for 1995 based on the bear-days estimator were similar to estimates based on the maximum likelihood estimator (Miller 1995). The population of independent bears was 29.3 (95% CI = 23.1-41.6) based on the bear-days estimator, compared with 30.7 (95% CI = 25.4-39.7) based on the maximum likelihood estimator (Miller 1995).

Population Closure and Sightability

The importance of documenting the presence of bears during each replication with periphery flights was demonstrated by data on population closure for bears present at least once on the study area (Table 7 in Miller 1995). During the 5-day density estimation period, radiomarked bears were available on the study area 90 times but were actually on the study area only 75 times

(83%) (Miller 1995). Closure for males was 73% (11 of 15) and for females closure was 85% (64 of 75). Closure was highest for females with 2-year-old offspring (100%) and females with newborn offspring (93%) (Miller 1995).

Lowest sightability in 1995 studies was for males (9%) (1 of 11), followed by females with newborn cubs (14%) (2 of 14), solitary females (25%)(6 of 24), and females with yearling or 2-year-old offspring (38%) (10 of 26) (Miller 1995). Overall, sightability was 25% (19 of 75) compared with 24% during 1985 in the same study area and 47% during 1987 in the Denali Highway study area (Miller et al. 1997).

Number of Marks Available

The maximum likelihood estimator modified for immigration and emigration (White 1993) used in the above analysis requires a parameter not required for the traditional Chapman estimator. This is the number of marked animals available during the study, or m_i. For our study m_i was defined as the total number of marked bears present on the search area at least once during the capture period. Because bears move across the border of the search area, this value is larger than the number of marked bears available during any particular replication. Because unmarked bears observed were captured and marked during the search period, the value for m_i increased during the capture period (Miller 1995).

POPULATION COMPOSITION

The unweighted snapshot to estimated population composition is based on just the individuals known to have been present in the study area at least 1 time during the density estimation period (Table 5). In 1985 there were 82.4 males per 100 females in the unweighted subpopulation of bears ≥2 comparedwith 27.8 in 1995 (Table 5) but the difference was not significant (X^2, 1 df = 0.25, 1-tailed $P = 0.62$). In the unweighted subpopulation of bears ≥5, there were 71.4 males per 100 females in 1985 and 30.9 in 1995 (Table 5); these differences were also not significant (X^2, 1 df = 0.44, 1-tailed $P = 0.51$).

A weighted snapshot approach was used to estimate composition based on the number of times individuals were known to be in the study area during density estimation studies (Tables 6-8). Using this approach for bears ≥2, the number of males per 100 females changed from 69.7 to 20.6 between 1985 and 1995 in the Su-hydro area (Table 9). This difference was significant ($z = 1.84$, 1-tailed $P = 0.03$). For bears ≥5, the sex ratio changed from 53.0 to 26.0 during this same period, but this difference was not significant ($z = 0.86$, 1-tailed $P = 0.2$). I believe there is less of a bias toward males, and perhaps even a bias toward females, with the weighted snapshot compared to the unweighted snapshot.

A final approach for estimating composition is to base it on the sex and age of all bears captured over a period of time, regardless of whether they were alive or dead during the density estimation period. This way of examining composition is primarily useful to compare with historical data. Bears <3 years old were excluded from these calculations because cubs, yearlings, and 2-year-olds still with their mothers were frequently not captured. For the same reasons mentioned above, this approach will exaggerate the abundance of males. For the subpopulation of 46 bears ≥ 3, there were 71.4 males/100 females during 1980-85 compared with 53.3 in 1993-95 ($X^2 = 0.63$, 1 df, $P = 0.42$). In the subpopulation of bears ≥5, there were 70.0 males/100 females in 1985 compared

with 42.9 in 1995 (Table 8) ($X^2 = 0.52$, 1 df, $P = 0.47$). The proportion of males in 1993-1995 was lower than during the 1980s in the Su-hydro study area (Table 9).

Composition based on captures can also be used to compare composition in the upper Susitna (Denali Highway) area based on captures during 1978-79 and 1986-87 (Table 9). Although there were large differences in sex ratio of bears captured during these periods (Table 9), these differences were not significant for bears ≥3 ($X^2 = 0.16$, 1 df, $P = 0.7$)or for bears ≥5 ($X^2 = 0.48$, 1 df, $P = 0.49$).

The proportion of the population composed of dependent offspring (age 0-2) appeared larger during 1995 than during 1985 although the test was not robust and the differences were not significant (Table 5). The ratio of offspring age 0-2 to adults ≥5 was the same in 1985 and 1995 ($X^2 = 2.34$, 1 df, 2-sided asymptotic $P = 0.127$) as was the ratio of offspring to females ≥5 in these 2 periods ($X^2 = 0.59$, 1 d.f., 2-sided asymptotic $P = 0.44$).

Results from the 3 different methods of calculating population composition are contrasted in Table 10 for the 4 different density estimates conducted in Unit 13.

Population Estimation

Following the 1987 density estimate in the Denali Highway study area, a Unit 13 brown bear population estimate was made based on subjective extrapolations from 2 density estimates in Unit 13E, one along the Denali Highway (1987) and the other in the Su-hydro (MidSu) study area (1985) (Miller 1990*c*:87). This estimate was revised upward based on the higher density found in the Su-hydo area during 1995 (Table 11, Fig. 7). Only the areas where the earlier population estimate was based on the 1985 estimate were altered; other portions of Unit 13 where estimates were based on the 1987 estimate were unchanged. Based on these extrapolations, there were 1456 bears (all ages) and 1197 bears (≥ 2) in Unit 13 in 1995.

The fluctuations in total bear estimates in Unit 13 between 1987 and 1995 (Table 9) illustrate the problems with basing management decisions on unitwide population estimates. In all likelihood, total bear populations were lower in 1995 than they were in 1987.

Comparisons of Bears Seen per Hour of Search Effort

A total of 7640 (127.3 hours) minutes was spent in active search for bears during the 5 replications, an average of 25.5 hours per replication (Table 12). These times do not include time spent commuting to and from search areas or time spent circling unmarked bears before capture.

Search intensity averaged 70 seconds/km^2 during the 1995 density estimate. This search intensity was higher than during the 1985 estimate in the same area (45 seconds/km^2) or than during the 1987 estimate in the Denali Highway (1987) study area (60 seconds/km^2) (Table 12). Higher search intensity should result in observing a higher proportion of both marked and unmarked bears in the study area. In 1995, however, sightability of marked bears was 25% (Miller 1995), almost identical to the 24% obtained with less intensive searches in 1985. These limited data do not support the existence of a relationship between search intensity and sightability.

The limited data available on search hours per independent bear seen support a possible relationship between bear sighting frequency and bear density (Fig. 8). During 1985, 2.7 hours of search effort per independent bear observed were required, compared with 2.4 hours during 1995 (Miller 1995). This is essentially the same as 0.36 hours/independent bear in 1985, compared with 0.42 hours in 1995.

A regression was plotted to illustrate the relationship between independent bears seen per hour of search and density (Fig. 8). This relationship was based on 3 data points obtained during CMR density estimates in the MidSu (Su-hydo) area (1985 and 1995) and in the UpSu (Denali Highway) area in 1987. These points are based on complete searches of quadrats at a search intensity of approximately 1 minute/km^2.

This relationship was used to make a rough estimate of density in the Unit 13A study area based on independent bears seen per hour during the 7 days of effort to find bears for capture during spring 1996 (Fig. 8). During the capture efforts, the fixed-wing pilots found 0.5 independent bears/hour, including only the time spent actively searching for bears (Table 12). Based on bears/hour seen during the density estimates in Unit 13, this location frequency resulted in a density estimate of 32 independent bears/1,000 km^2 (Fig. 8). The data included in this analysis excluded offspring accompanying their mothers (dependent bears) and bears seen as a consequence of radiotracking.

The relationship based on sighting rates during density estimates overestimates bear density in the Unit 13A search area, based on sighting rates during capture efforts. As a result, the density estimate during the scheduled Unit 13A density estimate in 1998 should be <32 independent bears/1,000 km^2. The search pattern used during the capture effort in Unit 13A should have a relatively higher sighting rate because:

1 Searches to find bears for captures involve more of a high-grading approach than the complete searches of a study area used during CMR density estimates.

2 The habitat in the 13A study area is relatively more open than habitats in either the MidSu or UpSu habitats.

3 The pilots used during the capture efforts in the 13A study area (Harley and Chuck McMahon and Jerry Lee) were among those I consider to be most skilled at finding bears. These same fixed-wing pilots, along with some less skilled at finding bears, participated in the CMR density estimates. The consequence of this is a partial dilution of the observation efficiency during the CMR density estimates by inclusion, in the CMR statistics, of pilots less skilled at finding bears.

Costs of 1995 Density Estimate and 1996 Premarking Efforts

Capture-mark-resight estimates of bear density are expensive. The 1995 density estimate cost approximately $150,000 spread out over 3 years (Miller 1995). The actual density estimate in spring 1995 cost about $57,000 compared with $60,000 in the same area during 1985. In 1985 logistic support was available as part of the Su-hydro project, and 8 replications were obtained in contrast to the 5 replications during 1995. Initial premarking costs for the 1995 estimate would

have been higher had there not been a number of radiomarked bears present in the study area. Radiomarks on these individuals (all females) had been maintained since termination of the Susitna Dam marking studies in 1985.

Total expenditures during FY 95-96 for premarking and monitoring in the new Unit 13A study area were about $90,000. Of this, $26,700 was spent on fixed-wing spotters during capture efforts, $20,500 on helicopter charter during capture efforts, $7,000 on telemetry relocation efforts following capture, $22,000 on telemetry equipment (some of which will be used in future years), $8,000 on drugs, $3,400 on fuel, and $3,000 on lodging and board. Forty bears were captured in the Unit 13A study area at a cost of about $2,000/bear. Of this, it cost $700/bear captured for charter of fixed-wing spotter aircraft and $510/bear captured for helicopter charter.

BROWN BEAR REPRODUCTIVE RATES

Reproductive rates of brown bears in Subunit 13E reported by Miller (1993) are updated for this report. These data will be used to refine models of sustainable harvest rates and to document changes in reproductive or survival rates associated with heavy exploitation.

Litter Size

Litter size was calculated for litters with offspring of various ages. These data are not independent in the sense that a female's litter would be counted as newborns and again when these cubs were yearlings, 2-year-olds, and older as long as the litter remained with the adult female.

Mean litter size for 94 litters of newborn cubs was 2.12 (range 1-4) (Table 13). Fifty-eight of 159 cubs (36.5%) failed to survive their first year of life (Table 13). Reflecting loss of these cubs, mean litter size for 80 litters with yearling offspring was 1.83 (range 1-3) (Table 14). Twelve of 99 yearlings were lost during their second year of life (Table 14). Mean litter size for 53 litters of 2-year-old offspring was 1.79 (range 1-3) (Table 15). Most offspring are weaned in their third year of life, and I observed 7 instances when offspring were weaned as 3-year-olds (mean size = 20 and 2 instances when they were weaned as 4-year-olds (Table 16).

Cub Sex Ratio and Morphometrics

I obtained measurements and determined sex from 35 newborn cubs captured in Unit 13 (Table 17). Sex ratio was not significantly different from 50:50 (X^2 = 0.61, 1 df, P =0.43) (Table 17). Sex ratio for 31 offspring handled as yearlings was also not significantly different from 50:50 (X^2 = 0.37, 1 df, P = 0.54) (Table 18). Concerns over potential capture-induced separation of litters led to infrequent captures of females with newborn cubs, especially during recent years of this study.

Age at First Reproduction

Since cessation of Su-hydro studies in 1985, few data were collected on age of first reproduction as primary emphasis was placed on retaining collars on radiomarked adult females rather than on capture and tracking of subadult females. Data were based on tracking of radiomarked subadult females until they were observed with offspring. Based only on bears that were tracked until they were observed with offspring, mean age of first litter was 5.52 years (range 4-8) (Table 19). This way of estimating mean age of first litter has an underestimation bias because it excludes older

females who are shot or lose their transmitters before producing their first litter. Including barren females >5 by assuming they would have produced a litter the following year resulted in a mean age of first litter production of 5.58 (range 4-9) (Table 19). First litters had been produced for 47.2% of radiomarked subadults by age 5 and 90.2% by age 6 (Table 19).

Reproductive (Recruitment) Interval

Reproductive interval was defined as the period between raising a litter to the age of 2 and the next time a female raised a litter to the age of 2. This is a recruitment interval rather than a reproductive interval. Reproductive intervals are misleading as a female may produce a litter but lose it in the spring and produce another litter the following year; this would be a recruitment interval of 1 year but inclusion of such intervals would be meaningless from the standpoint of producing population recruits. I also included intervals based on the period between production of a female's first litter of newborn cubs and her next production of a litter of 2-year-olds (if the first litter survived, this was calculated as being a recruitment interval of 3 years). Recruitment intervals longer than 3 years resulted when an entire litter was lost as newborns or yearlings, when females skipped 1 or more years without having cubs after raising a litter to age 2 or older, or when females kept their litters with them an additional year and separated when the offspring were 3 years old.

I observed 47 complete recruitment intervals with a mean length of 3.2 years (range 2-8). In addition, I observed 9 incomplete intervals (for bears > 24 years old when they had their last litter) that were greater than 3 years, the mean length of these intervals (assuming offspring would have been produced and survived until age 2) was 5 years. Including these incomplete intervals with the complete intervals yielded an interval length of 3.5 years for 55 intervals (Table 20).

Reproductive senility

We observed reproductive senility for 2 radiomarked females and reduced productivity during old age for 2 additional females. Bear 337 weaned offspring at age 15 and age 19 but has not had a litter during ages 20-28 (Table 21). Bear 423 weaned offspring at age 22, produced cubs that she lost the following year at age 23, but has been barren during ages 24-30 (Table 21). This bear apparently died when she was 30 (presumably of old age but her radio collar, and probably her body, was in the Susitna River and could not be retrieved). Bear 283 last weaned 2-year-old offspring when she was 23 in 1991. She has subsequently produced 2 litters (at age 24 and 26, each with a single offspring); one litter was lost as COY and the second litter was lost as yearlings (Table 21). Like 283, bear 388 appeared to have reduced productivity when she was 22-24 years old before being shot at age 24 (Table 21). The oldest female to successfully wean offspring in Unit 13 was 22 (female 396 who weaned 3-year-old offspring in 1992) (Table 21). These data are slow to accumulate because old females unaccompanied by offspring are more vulnerable to hunters than females accompanied by offspring.

CALF MORTALITY

Three studies of causes of calf mortality have been conducted and previously reported in Unit 13. These studies were based on intensive monitoring of radiomarked moose calves and inspection of kill sites. Results of these studies have not been previously compiled in a single reference; these data are presented in Table 22. Combining results of these studies indicated 46% of radiomarked calves were killed by brown bears (88 of 193) (Table 22).

Evaluation of Population Model Predictions

Regardless of whether the planned reductions in brown bear abundance result in higher harvests of moose in GMU 13, the effort to reduce bears in this area provides an opportunity to develop and test models designed to predict changes in bear abundance based on available data. If such models can be developed and evaluated in Unit 13, it will provide a management paradigm by which to manage bears in Unit 13 and elsewhere. In Alaska, available data include information on number of bears harvested, the sex and age composition of the harvested segment of the population, estimates of reproductive and survival rates based on observations of radiomarked bears, and estimates of population size based on extrapolations from areas where density has been estimated.

Based on available data on reproductive rates and minimal estimates of natural mortality based on data obtained in Unit 13, Miller (1988) estimated the maximal sustainable harvest rate for Unit 13 bears at 5.7%. Because of unreported mortalities and uncertainties inherent in management of low-density species like brown bears that are difficult to monitor and have low reproductive rates, a sustainable harvest rate of 5% was used to develop a population tracking model based on reported harvests in Unit 13 (Miller 1990*c*, 1992, 1993*a*). The model is a simple spreadsheet approach which results in a population "growing" when reported harvests are less than calculated sustainable rates and "declining" when the reverse is the case. The model did not incorporate immigration effects because no data is available on rates of immigration; it also does not incorporate density dependent effects because of absence of data (Miller 1990*d*, McLellan 1994).

This model was used to reconstruct populations in GMU 13 and showed declining populations for most scenarios (Miller 1993*a*). The estimated population in 1987 in Unit 13 (excluding Unit 13D) was 857 bears, and scenarios were run where this number of bears was present in 1987 and in 1980 (before the period of heaviest harvest). The most optimistic scenario for this reconstruction showed a decline from 1130 bears in 1978 to 722 bears in 1991 in Unit 13 (excluding Unit 13D) (Miller 1993*a*:85). In Unit 13A this model predicted a 1991 density of 10 to 19 bears/1,000 km^2 (Miller 1993*a*:86); the measured density in a remote portion of this area in 1995 was 41 bears of all ages (Table 4).

Possibilities for the failure of the model to correctly predict changes in bear abundance include:

1 Inflated harvest statistics caused by incentives to falsely report bears as having been taken in Unit 13 that actually were taken elsewhere. These incentives resulted from a 1/year bag limit during 1982-1986, years of record reported harvests (Miller 1993*a*).

2 Immigration subsidy of Unit 13E bear populations from surrounding unhunted refugia, especially Denali National Park.

3 Population underestimation biases. Such bias could result from systematic biases in the technique to estimate density, from errors in extrapolation from intensively studied areas to surrounding bear habitats, or from disturbance of bears in the 1985 study that lead to underestimation (such disturbance may have resulted from intensive helicopter and other activities associated with Su-hydro impact assessment studies).

4 Augmented productivity or survivorship caused by compensatory responses of the bear population to heavy hunting pressure concentrated on males. Density dependent responses in bear populations have not been demonstrated in the literature (Miller 1990*d*; Reynolds 1990, 1994, 1995; McLellan 1994; Garshelis 1994; Taylor 1994; Derocher and Taylor 1994). Alternatively, input data for productivity and survivorship parameters could have been underestimated.

5 Augmented productivity caused by a shift in population composition toward females as a consequence of heavy hunting pressure. Between 1985 and 1995 there was a shift in population composition toward adult females and an increase in the proportion of subadults in the population (Table 5).

6 Differences in distribution patterns based on the early spring in 1995 compared with a late spring in 1985. As a consequence of these differences, the 1995 estimate was completed 2 weeks earlier than in 1985. From the standpoint of plant phenology, these estimates were conducted at roughly equivalent times.

Not all of these possibilities can be tested, but some sensitivity analyses can be used to evaluate probable effects of miscalculating initial population size, sustainable harvest rates, or bootlegging effects. This was done for GMU 13 (excluding Unit 13D) using the following initial population values (Table 11):

- 857 bears in 1980 (this is a pessimistic scenario based on the number of bears estimated to inhabit Unit 13 (excluding Unit 13D) following the 1987 population estimate);
- 1069 bears present in 1987 (this is an intermediate scenario based on the number of bears calculated to inhabit Unit 13 (excluding Unit13D) in 1995;
- 1069 bears present in 1995.

Based on the original model with 5% sustainable harvest, a population of 857 bears in 1980 would have declined to near zero by 1995 based on reported harvest numbers, and a population of 1069 bears in 1986 would have declined to 439 bears (Fig. 9).

If sustainable harvest rates are increased to 6%, the population in the first scenario still declined dramatically to 126 bears in 1995, but the population with the second scenario remained relatively stable, declining to 969 bears by 1995 (Fig. 10). This indicates that at a 6% sustainable harvest rate and 1069 bears in 1986, the model may be able to track the population changes observed in the area. It is worth noting that both immigration and higher productivity or survival would have the effect of increasing sustainable number of bears that could be harvested in the area.

With a sustainable harvest rate of 5%, reducing the reported harvest during 1982-1986 to 85% of observed values had little effect on scenario 1 (Fig. 11). This indicates this level of misreporting would be unlikely to affect model performance under the scenario where there were only 857 bears in 1980. Under the 5% sustainable harvest scenario where there were 1069 bears in 1986, a 15% level of bootlegging resulted in a decline to 439 bears in 1995, compared to 969 bears without the bootlegging "adjustment" (Figs 9, 11).

These simulations indicate the population tracking model is more sensitive to changes in sustainable harvest rate inputs than to moderate errors in harvest reporting. Future work should concentrate on improving estimates of sustainable harvest rates, including values which include immigration rates and changes in productivity or survival that are affected by population composition changes resulting from heavy harvest pressure.

ACKNOWLEDGMENTS

I gratefully acknowledge the assistance of staff who help tag bears without injury to either bears or people. Staff who assisted in density estimation work or capture of bears during 1993-1996 were Bruce Bartley, Suzan Bowen, Jeff Cain, John Crouse, Howard Golden, Jeff Keay (National Biological Survey), Bill Leacock, Dennis McAllister, Mike McDonald, Jeff Selinger, John Schoen, Bob Tobey, Bill Taylor, Ward Testa, and Jim Woolington. Special thanks to Bill Taylor who helped arrange the logistics for the 1996 tagging operation. Much of the success of our efforts to capture bears is due to the skills of our pilots: Jerry Lee (Basin Airmotive, Glennallen), Harley McMahan (McMahan Flying Service-Gulkana), Chuck McMahan (Gulkana), Sandy Hamilton (Fairbanks) and John Schoen in fixed-wing aircraft. Helicopters used in this project were ably piloted by Ken Barnes or Lynn Beckhorn (Saloy Helicopters, Wasilla) and Larry Larrivee (Pollux Aviation). The project would not exist without support from former Regional Supervisor Ken Pitcher, Regional Supervisor Jeff Hughes, former Research Coordinator Karl Schneider, and Research Coordinator Chuck Schwartz. I thank Chuck Schwartz for his helpful comments on an earlier draft of this manuscript.

LITERATURE CITED

BALLARD, WB, SD MILLER, AND TH SPRAKER. 1980. Moose calf mortality study. Alaska Dep. of Fish and Game, Fed. aid *in* Wildl. Restor. Projects W-17-9, W-17-10, W-17-11, and w-21-1, Job 1.23. 123pp.

——, TH SPRAKER, AND KP TAYLOR. 1981. Causes of neonatal moose calf mortality in southcentral Alaska. J. Wildl. Manage. 45:335-342.

——, AND SD MILLER. 1990. Effects of reducing brown bear density on moose calf survival in southcentral Alaska. Alces 26:9-13.

——, ——, AND JS WHITMAN. 1990. Brown and black bear predation on moose in southcentral Alaska. Alces 26:1-8.

——, AND D LARSEN. 1987. Implications of predator-prey relationships to moose management. Swedish Wildl. Res. Suppl. 1:581-602.

——, JS WHITMAN, AND CL GARDNER. 1987. Ecology of an exploited wolf population in south-central Alaska. Wildl. Monog. 98. 54pp.

——, ——, AND DJ REED. 1991. Population dynamics of moose in south-central Alaska. Wildl. Monogr. 114. 49pp.

DEROCHER, AE, AND MK TAYLOR. 1994. Density-dependent population regulation of polar bears. Pages 25-30 *in* M. Taylor, ed. Density-dependent population regulation in black, brown, and polar bears. Int. Conf. Bear Res. and Mange. Monogr. series No. 3. 43pp.

FRASER, D., J. GARNER, G. KOLENOSKY, AND S. STRATHERN. 1982. Estimation of harvest rate of black bears from age and sex data. Wildl. Soc. Bull. 10:53-57.

GARSHELIS, DL. 1994. Density-dependent population regulation of black bears. Pages 3-14 *in* M. Taylor, ed. Density-dependent population regulation in black, brown, and polar bears. Int. Conf. Bear Res. and Mange. Monogr. series No. 3. 43pp.

HARRIS, RB. 1984. Harvest age-structure as an indicator of grizzly bear population status. MS Thesis, Univ. of Montana, Missoula. 204pp.

KONTIO, BD, DL GARSHELIS, EC BIRNEY, AND DE ANDERSON. 1997. Resilience of a Minnesota black bear population to heavy hunting: Self-sustaining population or population sink? Intl. Conf. Bear Res. and Manage. 10:in press.

MCLELLAN, B. 1994. Density-dependent population regulation of brown bears. Pages 15-24 *in* M. Taylor, ed. Density-dependent population regulation in black, brown, and polar bears. Int. Conf. Bear Res. and Mange. Monogr. series No. 3. 43pp.

MILLER, SD. 1987. Susitna hydroelectric project, final report on big game studies, Vol. VI black bear and brown bear. Alaska Dep. of Fish and Game and Alaska Power Authority. 276pp.

——. 1988. Impacts of increased hunting pressure on the density, structure, and dynamics of brown bear in Alaska's management unit 13. Alaska Dept. of Fish and Game, Fed. Aid in Wildl. Restor. Research Final Report on Project W-22-6. 151pp.

——. 1990*a*. Detection of differences in brown bear density and population composition caused by hunting. Int. Conf. Bear Res. and Manage. 8:393-404.

——. 1990*b*. Impacts of increased hunting pressure on the density, structure, and dynamics of brown bear in Alaska's management unit 13. Alaska Dept. of Fish and Game, Fed. Aid in Wildl. Restor. Research Progress Report on Project W-23-2. 54pp.

——. 1990*c*. Denning ecology of brown bears in southcentral Alaska and comparisons with a sympatric black bear population. Int. Conf. Bear Res. and Manage. 8:279-287.

——. 1990*d*. Impact of increased bear hunting on survivorship of young bears. Wildl. Soc. Bull. 18:462-467.

——. 1990*e*. Impacts of increased hunting pressure on the density, structure, and dynamics of brown bear in Alaska's management unit 13. Alaska Dept. of Fish and Game, Fed. Aid in Wildl. Restor. Research Progress Report on Project W-23-3. 88pp.

——. 1992. Impacts of increased hunting pressure on the density, structure, and dynamics of brown bear in Alaska's management unit 13. Alaska Dept. of Fish and Game, Fed. Aid in Wildl. Restor. Research Final Report on Project W-23-4, Study 4.21. 56pp.

——. 1993*a*. Impacts of increased hunting pressure on the density, structure, and dynamics of brown bear in Alaska's management unit 13. Alaska Dept. of Fish and Game, Fed. Aid in Wildl. Restor. Research Final Report on Projects W-22-6, W-23-1, W-23-2, W-23-3, W-23-4, and W-23-5, Study 4.21. 182pp.

——. 1993*b*. Brown bears in Alaska: A statewide management overview. Wildlife Technical Bulletin #11, Alaska Department of Fish and Game. 40pp.

——. 1995. Impacts of heavy hunting pressure on the density and demographics of brown bear populations in southcentral Alaska. Alaska Dept. of Fish and Game, Fed. Aid in Wildl. Restor. Research Progress Report on Grant W-24-3. 28pp.

MILLER, SD, AND WB. BALLARD. 1980. Estimates of the density, structure, and biomass of an interior Alaskan brown bear population. Pages 82-123 (Appendix 5) *in* Ballard, WB, SD Miller and TH Spraker, Moose calf mortality study. Alaska Dep. of Fish and Game, Fed. Aid in Wildl. Restor. Research Final Report on Project W-17-9, W-17-10, W-17-11, and W-21-1, Job 1.23.

——, EF BECKER, AND WB BALLARD. 1987. Black and brown bear density estimates using modified capture-recapture techniques in Alaska. Int. Conf. Bear Res. and Manage. 7:23-35.

——, AND SM MILLER. 1988. Interpretation of bear harvest data. Alaska Dep. of Fish and Game, Fed. Aid in Wildl. Restor. Research Final Report on Project W-23-1. 65pp.

——, GC WHITE, RA SELLERS, HV REYNOLDS, JW SCHOEN, K TITUS, VG BARNES, RB SMITH, RR NELSON, WB BALLARD, AND CC SCHWARTZ. 1997. Brown and black bear density estimates in Alaska using radio-telemetry and replicated mark-resight techniques. Wildl. Monog. 133. 54pp.

RAUSCH, RA 1969. A summary of wolf studies in southcentral Alaska, 1957-1968. Trans. North Am. Wildl. and Nat. Resour. Conf. 34:117-131.

REYNOLDS, HV. 1990. Population dynamics of a hunted grizzly bear population in the northcentral Alaska Range. Alaska Dep. Fish and Game Fed. Aid in Wildl. Restor. Res. Progress Report on Project W-23-2. 63pp.

——. 1994. Effects of harvest on grizzly bear population dynamics in the northcentral Alaska Range. Alaska Dep. Fish and Game, Fed. Aid in Wildl. Restoration, Grant W-24-2, Study 4.25. 30pp.

——. 1995. Effects of harvest on grizzly bear population dynamics in the northcentral Alaska Range. Alaska Dep. Fish and Game, Fed. Aid in Wildl. Restoration, Grant W-24-3, Study 4.25. 27pp.

SNEDECOR, GW, AND WG COCHRAN. 1980. Statistical methods, 7th ed. Iowa State Univ. Press, Ames Iowa. 507 pp.

SPRAKER, TH, WB BALLARD, AND SD MILLER. 1981. Brown bear studies, Game Management Unit 13. Alaska Dep. Fish and Game, Fed. Aid in Wildl. Restoration Final Rep. Proj. W-17-10 and W-17-11. 57pp.

SELLERS, RA. 1994. Dynamics of a hunted brown bear population at Black Lake, Alaska. 1993 Annual Progress Report, Alaska Dep. Fish and Game. 61pp.

——, AND SD MILLER. 1990. Dynamics of a hunted brown bear population at Black Lake, Alaska. Third annual progress report:1990. Alaska Dep. Fish and Game. 23pp.

TAIT, DEN. 1983. An analysis of hunter kill data. PhD thesis, Univ. of British Columbia, Vancouver. 129pp.

TAYLOR, M., ed. 1994. Density-dependent population regulation in black, brown, and polar bears. Int. Conf. Bear Res. and Mange. Monogr. series No. 3. 43pp.

TESTA, W. 1996. Population dynamics of moose and predators in Game Management Unit 13. Alaska Dep. Fish and Game Fed. Aid in Wildl. Restor. Res. Progress Report on Project W-24-3.

WHITE, GC. 1993. Evaluation of radio tagging marking and sighting estimators of population size using Monte Carlo simulations. Pages 91-103 *in* J. D. Lebreton and P.M. North (eds.), Marked individuals in the study of bird populations. Birkhäuser Verlag Basel Switzerland.

——, AND RA GARROTT. 1990. Analysis of wildlife radiotracking data. Academic Press. 383pp.

PREPARED BY:

STERLING D MILLER
Wildlife Biologist III

APPROVED BY:

Wayne L. Regelin
Wayne L Regelin, Director
Division of Wildlife Conservation

SUBMITTED BY:

CHARLES C. SCHWARTZ
Research Coordinator, Region II

Mary Jo Ch for
Steven R Peterson, Senior Staff Biologist
Division of Wildlife Conservation

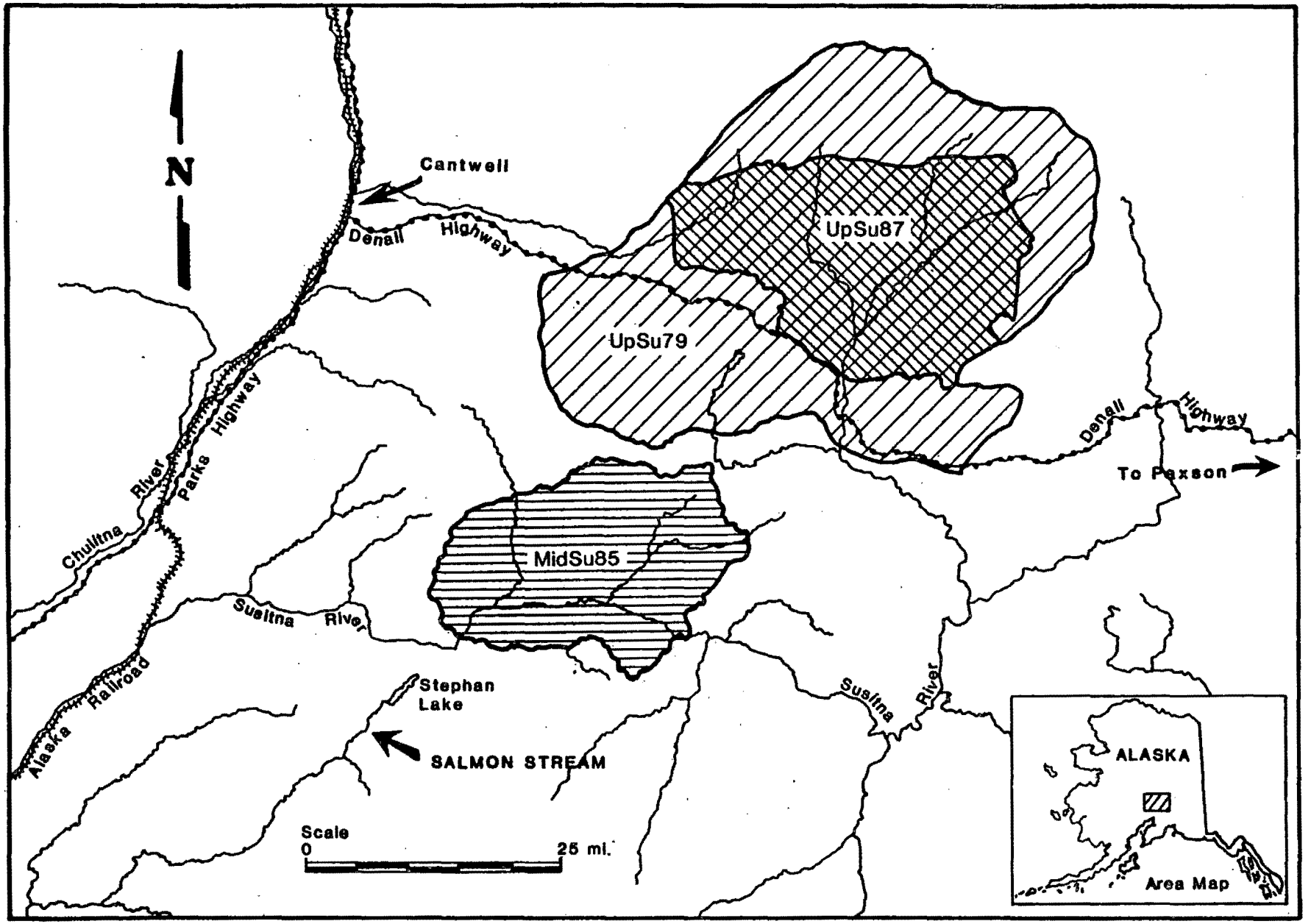


Figure 1. Study area in Unit 13E where density estimates were obtained in 1985 and 1995 ("MidSu85" also referred to as the Su-hydro area in this report). Also illustrated are comparison study areas along the Denali Highway where hunter access is relatively easy and where density estimates were obtained during 1979 (UpSu79) and 1987 (UpSu 87).

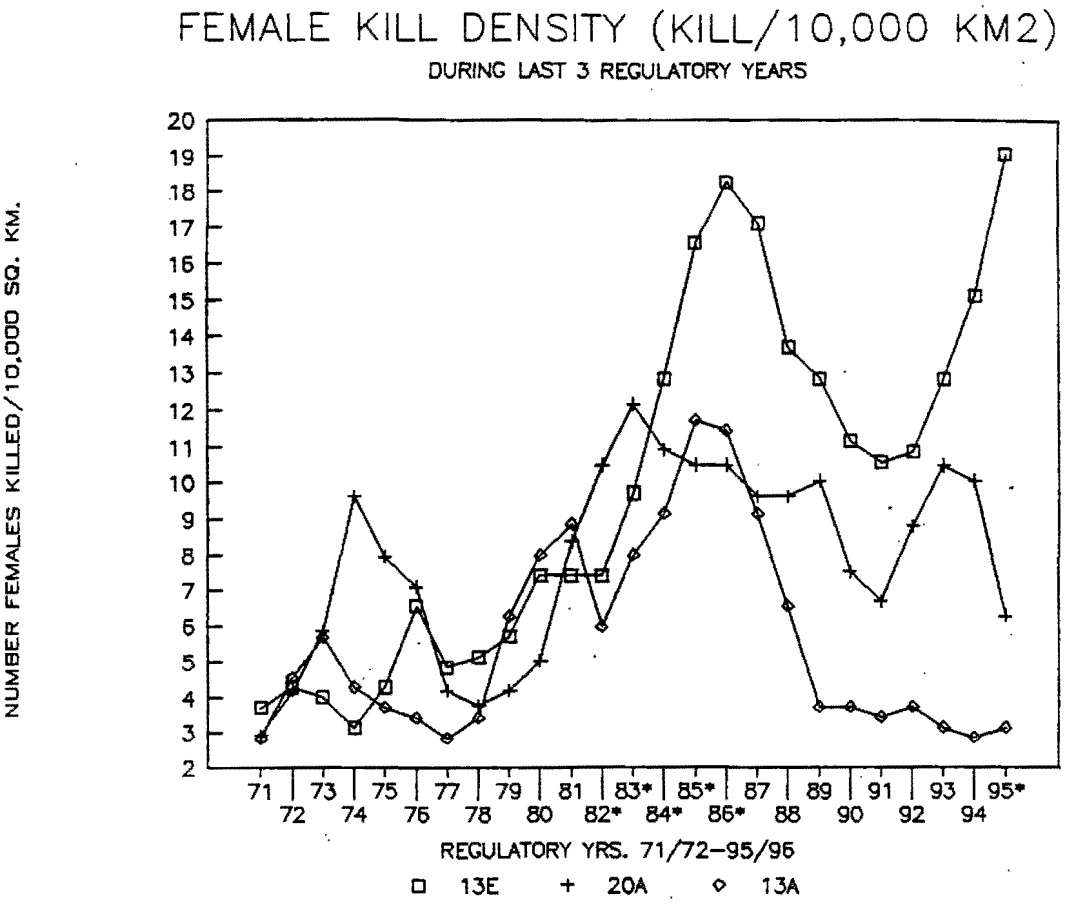


Figure 2. Trends in brown bear harvests in Unit 13 (excluding Subunit 13E) and in Subunit 13E during regulatory years 1969/70-1995/96.

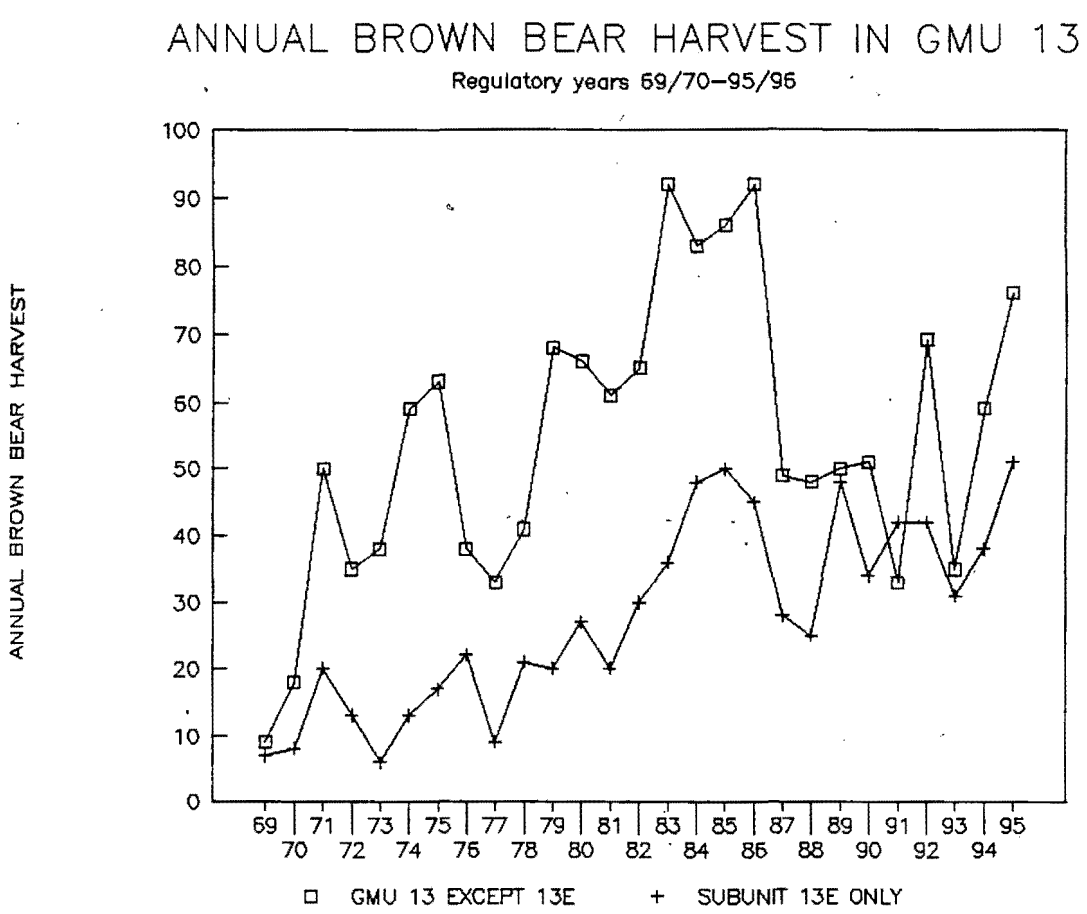


Figure 3. Trends in brown bear kill numbers in Subunits 13E, 13A, and 20A based on data cumulated for 3 regulatory years. Years with asterisk were years with a 1/year bag limit in Unit 13.

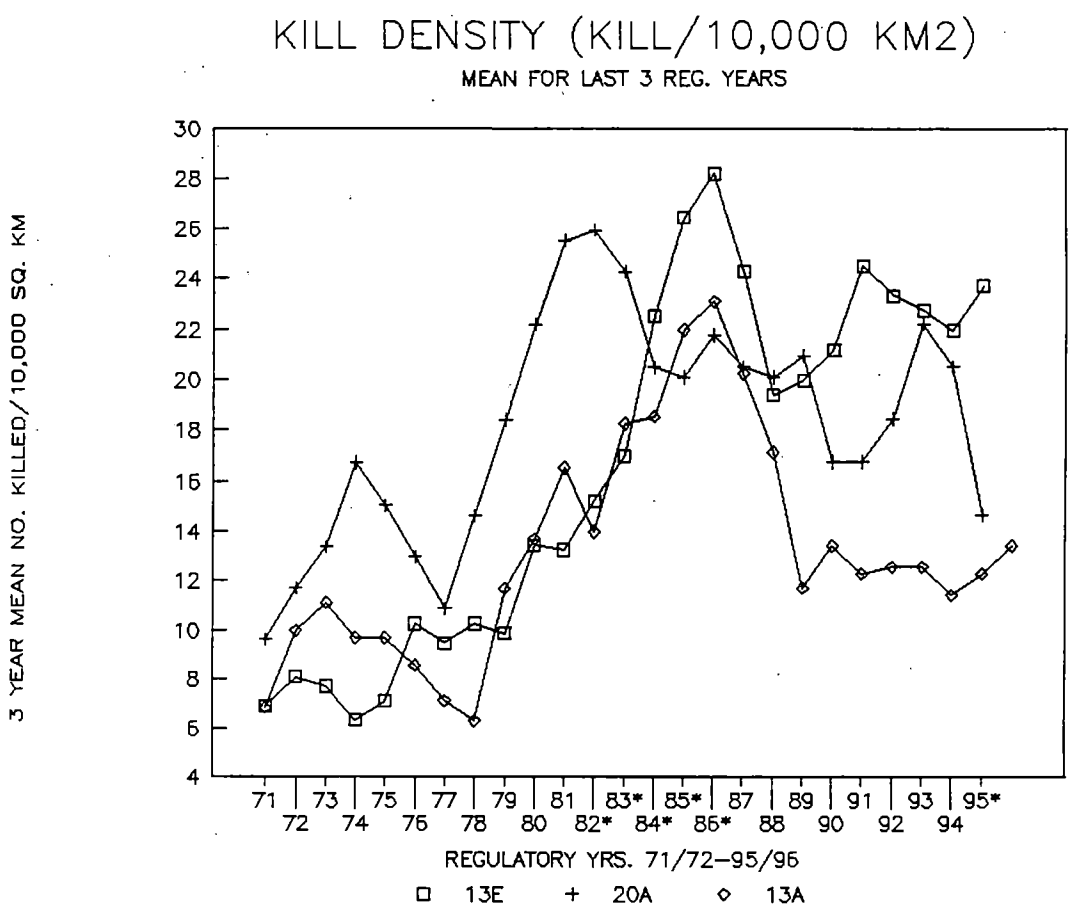


Figure 4. Trends in female brown bear kill density in Subunits 13E, 13A, and 20A based on data cumulated for indicated year and for 2 preceding regulatory years. Years with asterisk were years with a 1/year bag limit in GMU 13.

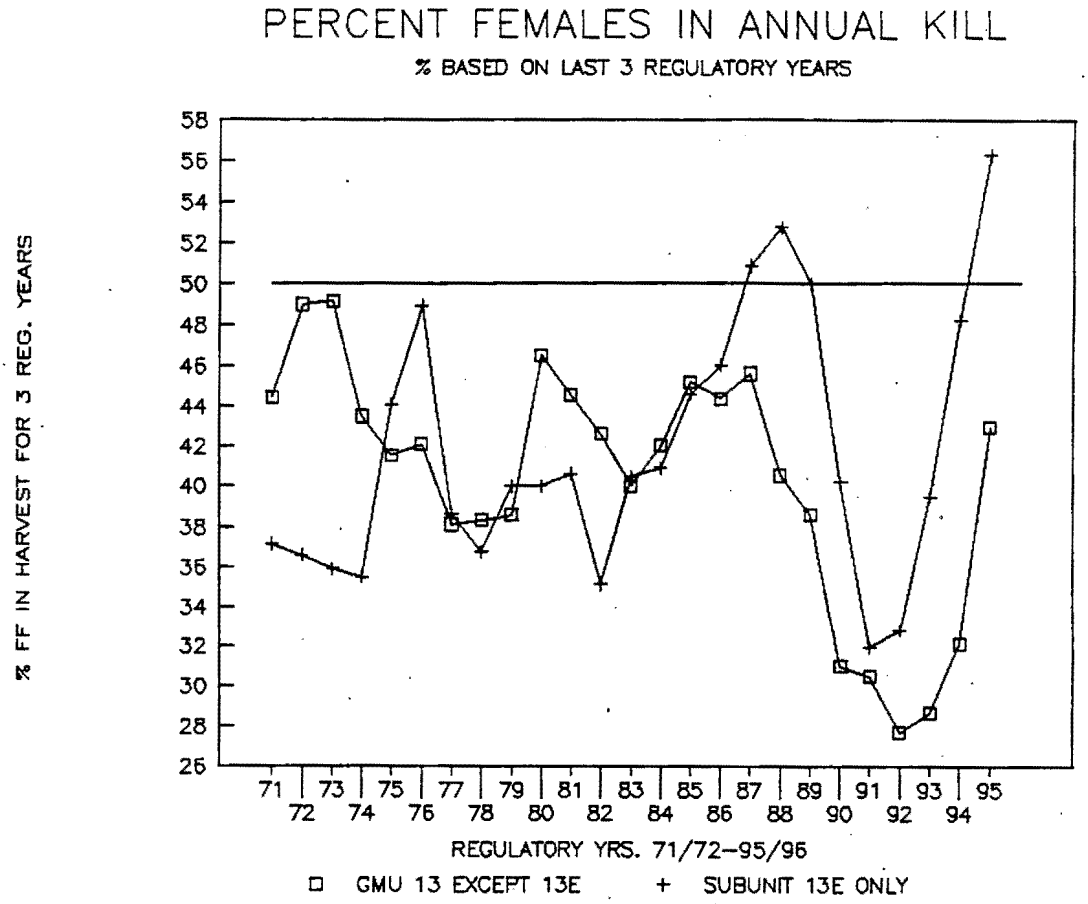


Figure 5. Trends in percent females in brown bear harvests in Alaska's Unit 13 (excluding Subunit 13E) and in Subunit 13E during 1971-1995 based on data cumulated for indicated year and 2 preceding years.

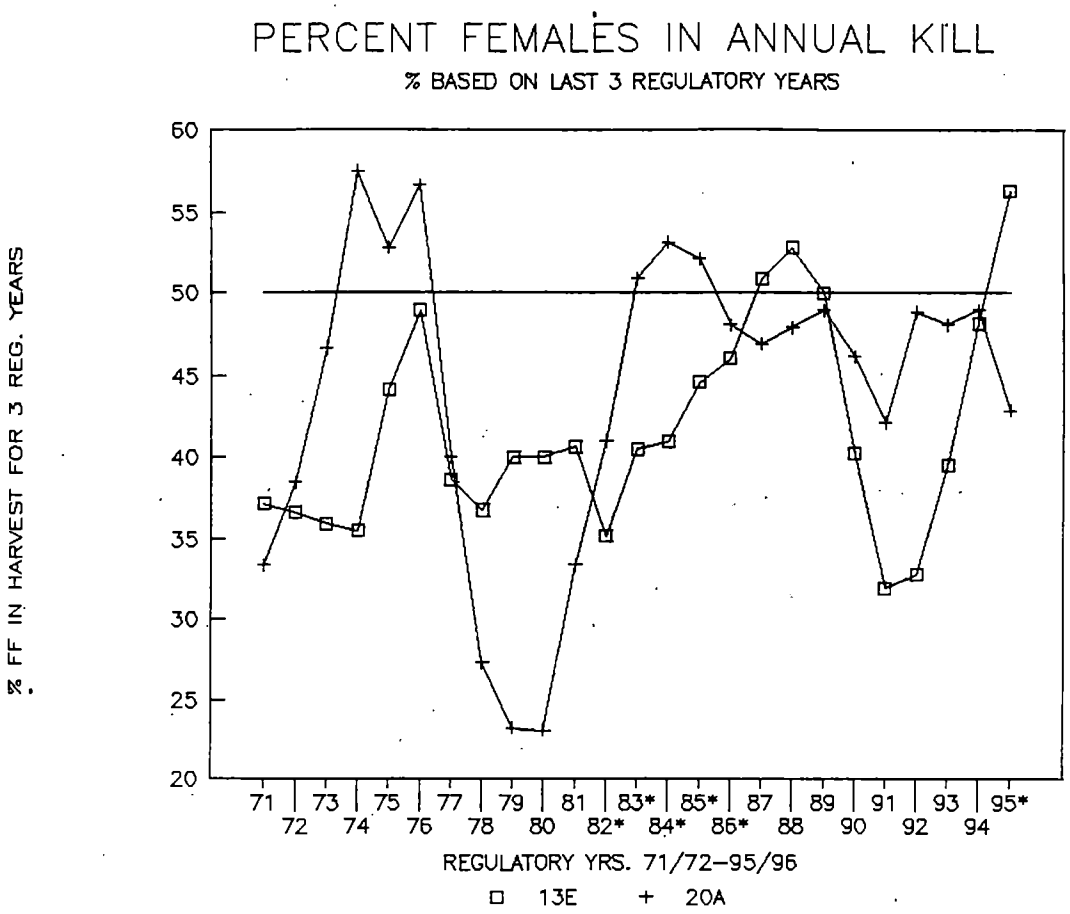


Figure 6. Trends in percent females in brown bear harvests during fall seasons in Alaska's Unit 13 (excluding Subunit 13E) and in Subunit 13E during 1971-1995 based on data cumulated for indicated year and 2 preceding years.

DENSITY ESTIMATION STRATA TO ESTIMATE NUMBER OF BEARS IN UNIT 13

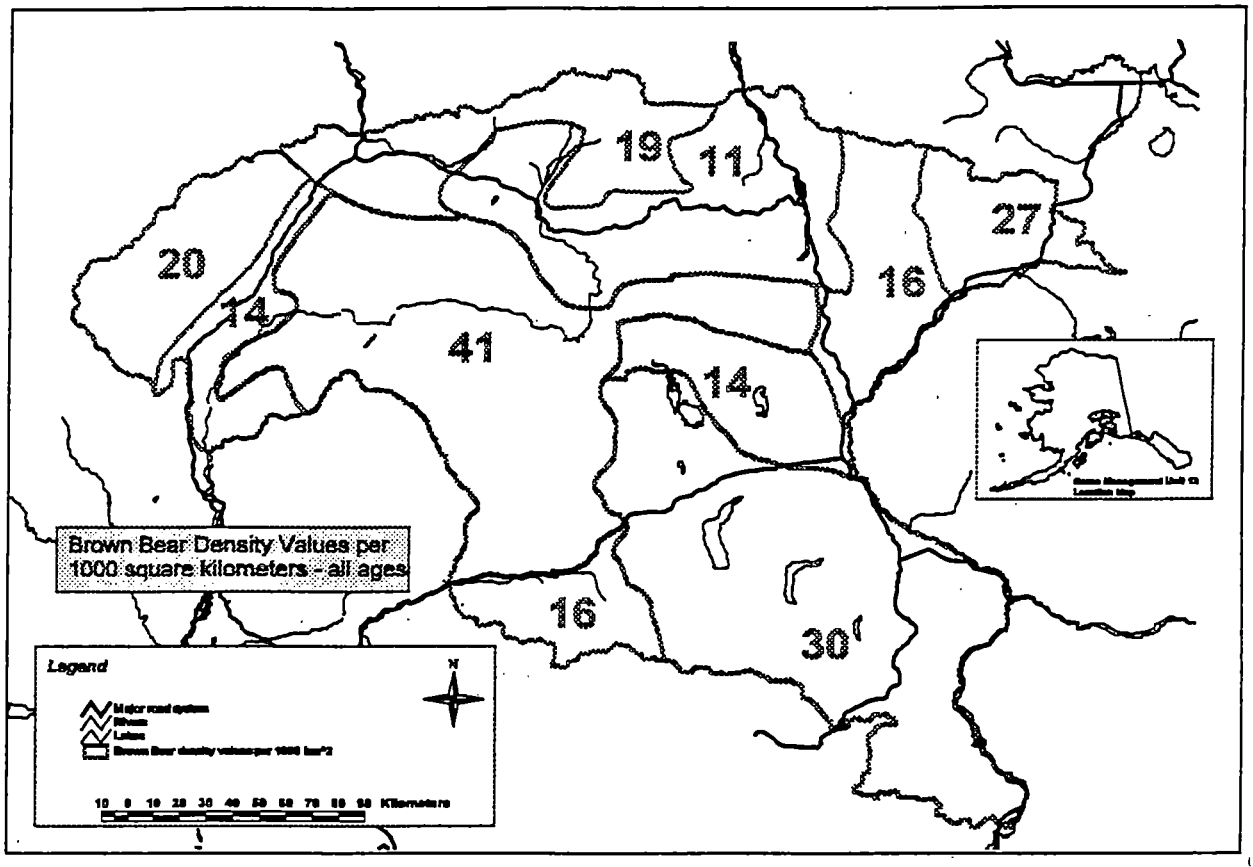


Figure 7. Density strata (bears of all ages)/1,000 km^2 used to estimate population size in Unit 13 based on extrapolations from density estimates obtained in 1987 (Upper Susitna) and 1995 (Su-hydro) study areas.

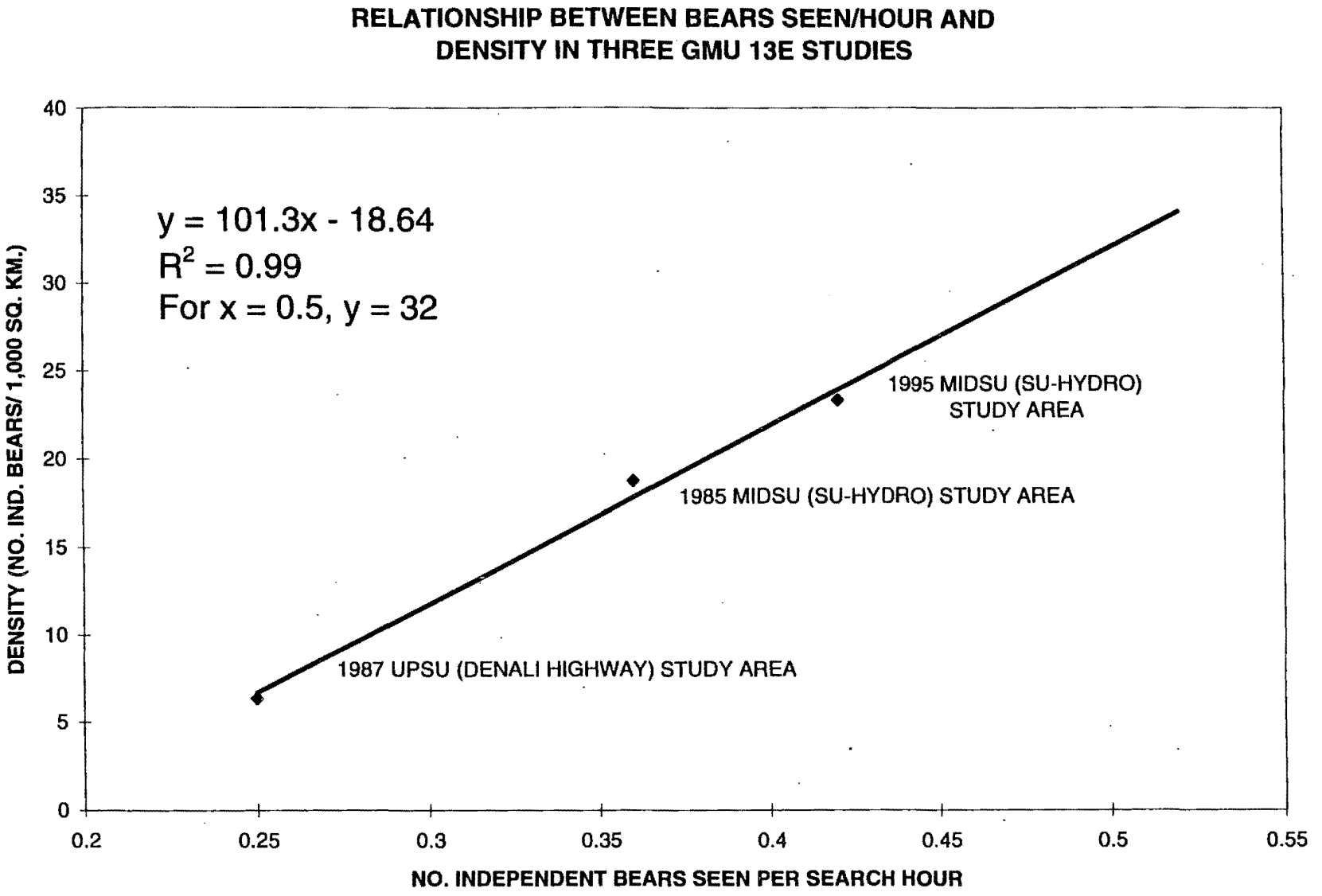


Figure 8. The relationship between independent bears seen per hour of search effort and measured density during 3 capture-mark-resight density estimates in Alaska's Unit 13.

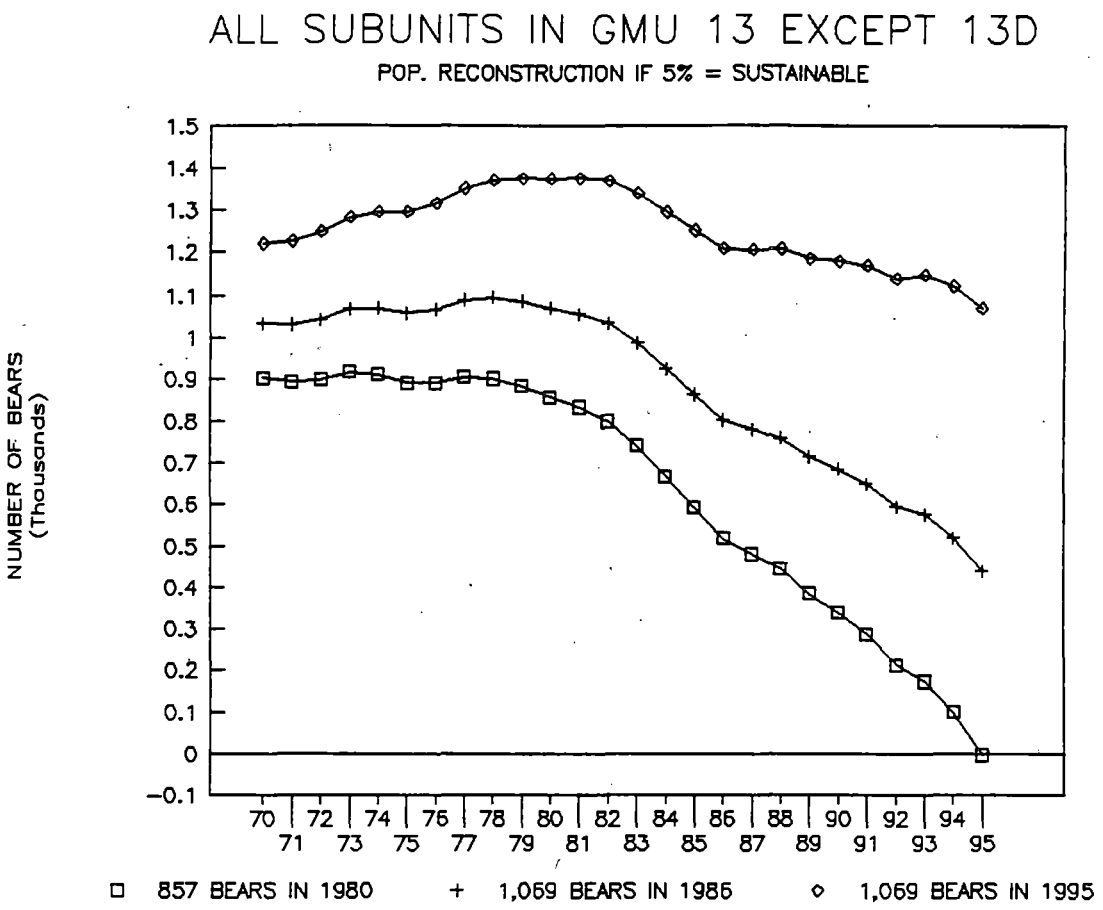


Figure 9. Brown bear population projections in Unit 13 (excluding Subunit 13D) based on assumption that sustainable harvest = 5% of the population. Population size scenarios are based on the assumption the 1987 population estimate existed in 1980 and the 1995 population estimate existed in 1986 and in 1995.

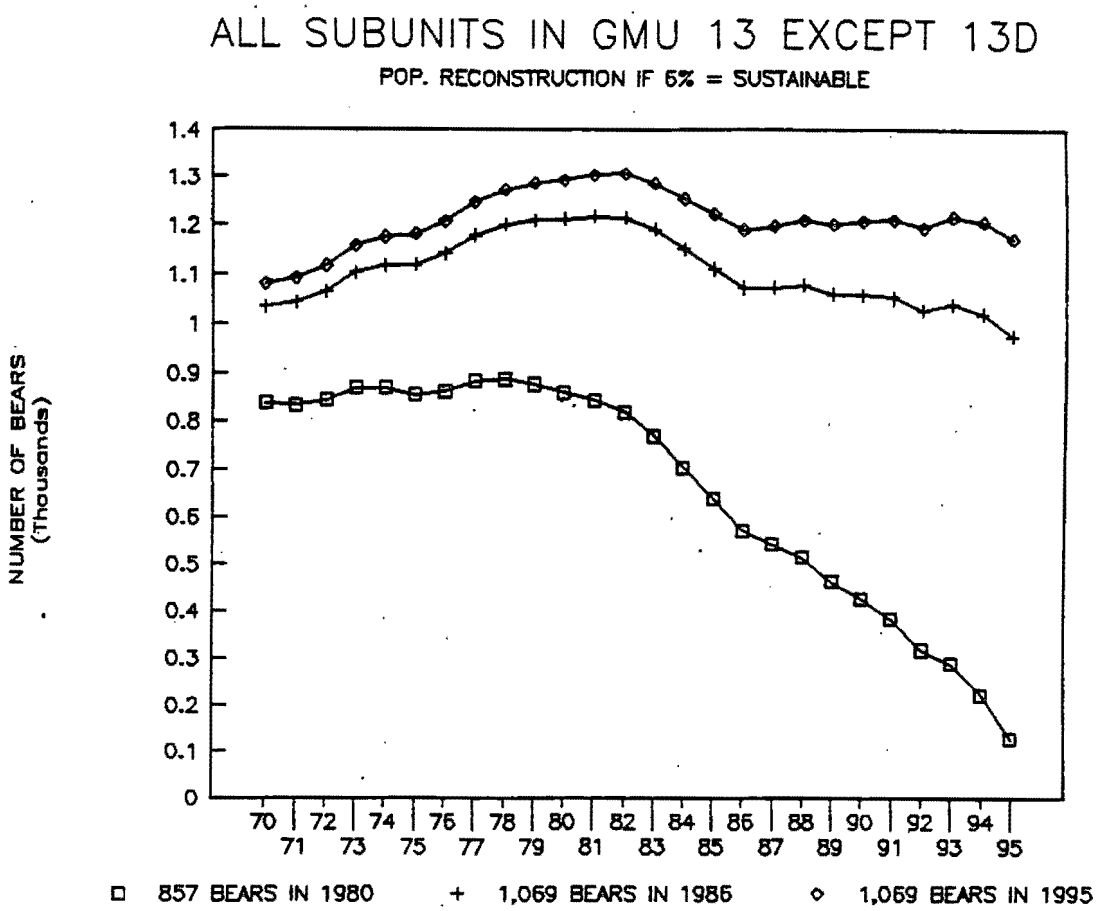


Figure 10. Brown bear population projections in Unit 13 (excluding Subunit 13D) based on assumption that sustainable harvest = 6% of the population. Population size scenarios are based on the assumption the 1987 population estimate existed in 1980 and the 1995 population estimate existed in 1986 and in 1995.

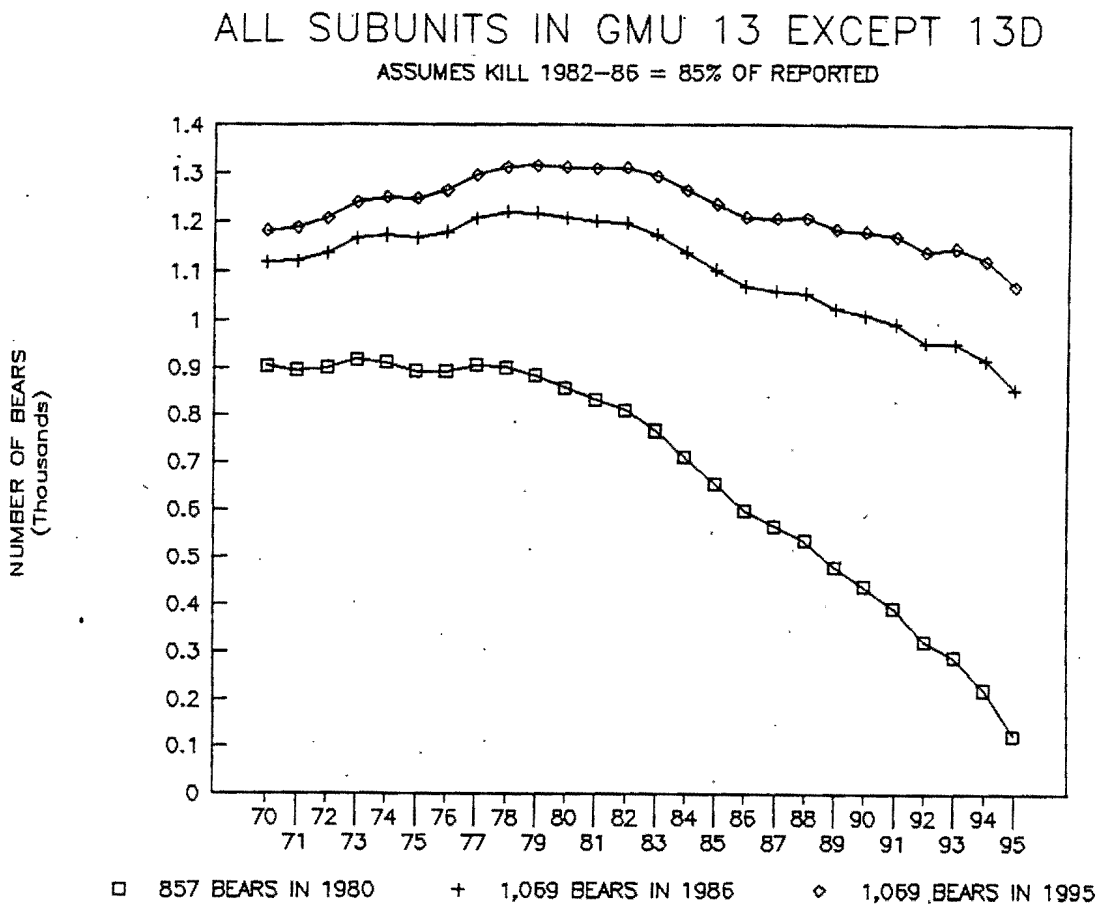


Figure 11. Brown bear population projections in Unit 13 (excluding Subunit 13D) based on assumption that sustainable harvest = 5% of the population and actual harvest was 85% of reported harvest during the period 1982-1986 when the bag limit was 1 bear/year. Population size scenarios are based on the assumption the 1987 population estimate existed in 1980 and that the 1995 population estimate existed in 1986 and in 1995.

Table 1. Brown bears captured in Unit 13 studies 1980-June 1996

Tattoo	Sex	Age**	Capture Wt.	Capture Date	Serial #	Ear Tags	Comments
(277)	F	10.5	225*	4/10/80		1065/1066	w/2ylgs, not marked, collar shed 80/81 den capture mortality
(278)	M	9.5	375*	4/19/80		--	capture mortality
(279)	M	9.5	400*	4/20/80		1100/1099	collar shed by 6/12/80. recaptured 5/18/83, shot 9/84
280	M	5.5	300*	4/20/80		1097/1098	recollar next spring, recaptured 5/94
(214)	M	4.5	300*	4/22/80		1072/1071	collar shed 9/9/80, recaptured 6/85, shot fall 91
281	F	3.5	250*	4/22/80		16175/15950	not turgid, see 5/81 & 5/94 recaptures
(282)	M	4.5	325*	4/22/80		1079/1080	see 6/82 recapture, shot spring 92
283	F	12.5	280*	4/22/80		690/689	w2@ 2.5: 284 and 285
(284)	M	2.5	180*	4/22/80		1074/1073	w/283 see 5/5/81 recapture
285	M	2.5	180*	4/22/80		687/688	w/283
286	M	3.5	264	5/1/80		1081/1082	
(292)	F	3.5	174	5/2/80		1322/1321	Turgid, shot 5/89
(293)	M	(3.5)	277	5/2/80		1116/1115	recaptured 8/81, 5/83, shot spring 85
(294)	M	10.5	607	5/2/80		--	died on 8/6/81 recapture
(295)	M	12.5	589	5/3/80		1303/1304	collar shed by 5/4/80
299	F	13.5	285	5/4/80		1109/1110	w/2 ylgs, turgid, recaptured 5/7/81
(297)	M	1.5	65	5/4/80		(1301/1302)	w/299, shot by hunter on 9/18/81
298	M	1.5	65	5/4/80		1318/1317	w/299
(306)	F	3.5	163	5/4/80		1319/1320	turgid, see 5/13/93 recapture, shot 9/95
(308A)	M	6.5	480	5/6/80		(1126/1125)	shot 9/83
(308B)	F	5.5	240	5/6/80		1096/1095	turgid (?) - died on 8/6/81 recapture
(309)	M	12.5	600	5/6/80		(1117/1118)	collar shed by 5/14/80, recaptured 6/85, shot spring 90
(312)	F	10.5	319	5/7/80		1312/1311	w/311
(311)	M	2.5	227	5/7/80		--	w/312, shot on 9/16/80
313	F	9.5	286	5/7/80		1119/1120	w/314 @ 2.5
314	F	2.5	154	5/7/80		(1049/1050)	w/313, recaptured 6/1/85. 6/87
315	F	2.5	90*	5/7/80		1127/1128	alone, recaptured 5/18/83
(284#2)	M	3.5	125	5/5/81		(1074/1073)	near 283 w/2c, shot by hunter on 5/18/81
(331)	F	6.5	172	5/5/81		(1296/1295)	w/332 and 333, died August 1982
(332)	M	2.5	79	5/5/81		(1215/1216)	w/331 and 333, shot by hunter on 9/5/82
(333)	M	2.5	67	5/5/81		(1240/1239)	w/331 and 332, shot by hunter on 9/3/81
334	F	10.5	325	5/5/81		1292/1291	estrus, missing in 1982, recaptured 5/96
335	F	3.5	194	5/5/81		(1220/1219)	w/334?, recaptured 5/14/83
281#2	F	4.5	-	5/5/81		1201/1202	estrus? recaptured 5/15/83
283#2	F	13.5	261	5/6/81		1089/1090	w/338 and 339 @ 0, recaptured 5/14/83
338	F	0.5	12	5/6/81		1224/1223	w/283, sex switched to female
(339)	M	(0.5)	13	5/6/81		1222/1221	w/283, recaptured 6/85, sec switched to male; shot 9/85
312#2	F	11.5	280	5/6/81		1300/1299	w/2c @ 0.5 (not captured), recaptured 5/14/83
313#2	F	10.5	284	5/6/81		1120/1119	w/336, recaptured 5/14/83

Table 1. Continued

Tattoo	Sex	Age**	Wt.	Date	Serial #	Ear Tags	Comments
336	F	0.5	–	5/6/81		1237/1238	w/313, not drugged (abandoned)
337	F	13.5	321	5/6/81		1294/1293	w/3c reunited on 5/9/81, recaptured 5/14/83, 5/94
(340)	F	3.5	190	5/6/81		1225/1218	not estrus, recaptured 5/15/83, Rt. eartag replaced 5/90
280#2	M	6.5	394	5/7/81		1097/1267	w/F341, recaptured 5/16/83
(341)	F	6.5	224	5/7/81		(1208/1207)	w/M280, collar failed, recaptured 6/82;died in 88/89 den
299#2	F	14.5	291	5/7/81		1109/1110	w/2@2.5 (297 & 298 - not recaptured), recaptured 8/81
(342A)	M	2.5	220	5/7/81		1228/1227	alone, see 5/25/82 recapture, died 7/84
344	F	5.5	–	5/8/81		1204/1203	w/2 cubs subsequently, recaptured 5/14/83
(345)	M	7.5	495	5/8/81		– –	capture mortality
(308B)#2	F	6.8	–	8/6/81		– –	recapture mortality
299#3	F	14.8	–	8/6/81		1109/1110	collar replaced, recaptured 5/18/81
(293#2)	M	(4.8)	–	8/6/81		1115/1116	collar replaced, recaptured 5/18/83, shot spring 85
(294#2)	M	11.8	–	8/6/81		– –	recapture mortality
347	M	14.8	500*	8/6/81		(1234/1233)	collar shed 9/81, recaptured 6/9/85
(342A#2)	M	3.5	250*	5/25/82		1228/1227	collar replaced, died 7/84
(373)	M	9.5	450*	6/11/82		– –	no tattoo, w/G283 (F), collar shed 6/83
(282#2)	M	6.5	350*	6/11/82		(529/1643)	recap. marked bear, shed collar, recap. 5/84 & 6/86, shot sp. 92
(379)	F	(5.5)	300*	6/11/82		(1595/1585)	w/2@c, Downstream study, shot 9/85
(380)	F	15.5	275*	6/12/82		(1588/532)	w/2@1, not captured, shot 9/83
(381)	F	(3.5)	200*	6/12/82		(533/1592)	alone, recaptured 5/18/84 & 6/86, shot 9/89
313#3	F	12.5	300*	5/15/83	6259	same	w/2@1
(382)	M	1.5	66	5/14/83	12546	2135/2134	w/313 and 383, recaptured 5/18/84, implant, shot 5/9
(383)	F	1.5	53	5/14/83	12542	(2490/2491)	w/313 and 382, died unknown causes, implant
283#3	F	15.5	–	5/14/83	(6340)	same	w/cub #3, recaptured 6/86
(003)	F	0.5	–	5/14/83	1024	(1360/1359)	w/283, special cub collar, no tattoo, cub eaten
337#2	F	15.5	–	5/14/83	6309	same	w/385@2
(312#2)	F	13.5	350*	5/14/83	(6342)	(1299/1300)	w?386@2, died 5/16/84
386	M	2.5	200*	5/14/83	15212-12545(Imp)	2146/2141	w/312, breakaway 5B collar, dispersed, implant
344#2	F	7.5	325*	5/14/83	10445	same	w/2@0, not captured
335#2	F	5.5	–	5/14/83	–	same	no radio in chopper
335#3	F	5.5	236	5/16/83	(15276)	same	alone, one year added to 81 age based on 83 tooth
(388)	F	14.5	450*	5/14/83	(6988)	((2478/2477)	w/389 and 390@2, recap. 5/84 & 6/86, eartags gone 5/90, shot 9/93
(389)	M	(2.5)	135	5/14/83	(15214-12544	2170/2171	w/388 and 390, breakaway 5B collar, died 10/83, implant
390	M	2.5	125*	5/14/83	15211-12543	2148/2147	w/388 and 389, breakaway 5B collar-shed, implant
340#2	F	5.5	250*	5/15/83	(15285)	same	recaptured 5/17/84, collar replaced 6/85, shot fall 95
384	F	12.5	300*	5/15/83	15279	2499/2500	w/391, 392, 393@2
(391)	M	2.5	140*	5/15/83	(15213)	(2078/2079)	w/384 et al., breakaway 5B collar, shot 9/84
(392)	M	2.5	140*	5/15/83	(15246)	(2111/2110)	w/384 et al., breakaway 4B collar, shot 5/84

Table 1. Continued

Tattoo	Sex	Age**	Wt.	Date	Serial #	Ear Tags	Comments
393	F	2.5	105	5/15/83	15247	1589/1598	w/383 et al., breakaway 4B collar, recaptured in 13A, 5/96
(293#3)	M	(6.5)	439	5/15/83	15291	same	--, shot spring 85
(394)	F	6.5	250*	5/15/83	(15277)	(1693/1692)	w/cub #4, shot 9/84
(004)	F	0.5	10	5/15/83	--	(1358/1357)	w/394, chewed on, no tattoo, died later
(395)	F	3.5	175*	5/15/83	(15289)	(2415/2416)	alone, regular 6B collar, shot 9/4/83
281#3	F	6.5	325*	5/15/83	(15284)	same	w/2@0 (#5 and #6), recollared 5/17/84, 9/94
(005)	M	0.5	8.5	5/15/83	(1023)	(1350/134)	w/281, expandable cub collar, no tattoo, eaten
(006)	F	0.5	8.3	5/15/83	(1026)	(1346/1345)	w/281, expandable cub collar, no tattoo, eaten
280#3	M	8.5	482	5/16/83	(15290)	same	recaptured 6/85
396	F	13.5	274	5/16/83	(14885)	1685/1684	w/2@2, (397,398), recaptured 6/86, 9/94
(397)	F	(2.5)	132	5/16/83	--	(2493/2492)	w/396, recaptured 6/4/85, shot 9/85
(398)	F	(2.5)	135*	5/16/83	--	2105/2104	w/396, shot 6/86
(399)	M	(9.5)	600*	5/17/83	(15278)	2087/2108	recaptured 5/15/84, shot 5/87
(400)	M	(20.5)	542	5/17/83	(15281)	2132/2133	recaptured 5/18/84, shot 5/93
299#4	F	16.5	275*	5/18/83	15283	same	w/3@0, darted in den, recaptured 5/15/84
418	M	0.5	13*	5/18/83	1024	1347/1348	w/G299, special cub collar, shed 10/83, old #7
(279#2)	M	12.5	700*	5/18/83	(10339)	1653/1100	recapture, previous shed collar, recaptured 5/16/84
315#2	F	5.5	203	5/18/83	15288	same	estrus, alone, just marked previously
(403)	F	6.5	275*	5/18/83	15275	(1564/1565)	w/2@0, not captured, Downstream. Shot DLP 8/95
407	F	4.5	220*	5/19/83	2905	2401/1543	alone, downstream, recaptured 6/85
299#5	F	17.5	308	5/15/84		same?	w/3@1, 417-419
(417#2)	M	1.5	94	5/15/84	12080	same	w/G299 & siblings, small implant, shot 5/86
418#2	M	1.5	86	5/15/84	12081	same	w/G299 & siblings, large implant
419#2	M	1.5	84	5/15/84	12076	same	w/G299 & siblings, small implant
(399)#2	M	(10.5)	662	5/15/84	(6405)	same	alone, shot 5/87
(388#2)	F	15.5	400*	5/16/84	same	same	w/2c, replaced 6/86, shot 9/93
(16)	M	0.5	--	5/16/84	(1389)	(1389/1390)	w/G388, capture-induced separation, died/shed 6/84
(17)	F	0.5	00	5/16/84	(1623)	(40/50)	w/G388, capture-induced separation, died 5/84
312#3	F	14.5	300*	5/16/84	(6332)	same	w/3c, old and new radio failures, capture mortality on 5/84
(279#3)	M	13.5	800*	5/16/84	(6339/18884)	same	large implant, shot 9/84
281#4	F	(7.5)	350*	5/17/84	(6407)	same	w/2c, recaptured 6/87, 5/94
(21)	M	0.5	14	5/17/84	(1703)	1386/1383	w/G281, drowned?
(22)	M	0.5	14	5/17/84	(1710)	(1385/1384)	w/G281, killed by BrB
337#3	F	16.5	325	5/17/84	same	same	w/2c, recaptured 6/85
(08)	F	0.5	12	5/17/84	1708	(1338/1337)	w/337, shot spring 90
09	F	0.5	12	5/17/84	1711	1340/1339	w/337
340#3	F	6.5	375*	5/17/84	same	same	w/2c, recaptured 6/85, 6/87, shot fall 95
(23)	F	0.5	17	5/17/84	1713	45/28	w/340, shot 4/89, sex determined @ sealing
(24)	M	0.5	14	5/17/84	1706	44/27	w/340, shot, Clearwater Mts. 9/91, sex determined at sealing
420	F	19.5	350*	5/17/84	6335	2447/2057	w/2@1, one is 421

Table 1. Continued

Tattoo	Sex	Age**	Wt.	Date	Serial #	Ear Tags	Comments
422	M	4.5	205	5/18/84	18716	2136/2137	alone near camp
381#2	F	(5.5)	263	(5/18/84)	(6341)	same	alone, collar replaced on 6/86, shot 9/89
(400#2)	M	(21.5)	600*	5/18/84	(6325)	same	alone, shot 5/93
(382#2)	M	2.5	148	5/18/84	(15289)	same	w/G313, old implant breakaway, picked up 6/86, shot 5/93
423	F	21.5	300*	5/18/84	(6306)	none	w/4c, drug problem, recaptured 6/86
25	M	0.5	7	5/18/84	1712	39/32	smallest cub w/G423
–	F	0.5	–	5/18/84	--	49/48	other sibling w/G423 not marked or sexed
425	F	14.5	–	6/01/84	(6344)	2486/2413	w/282 M, recaptured 6/86. 3 teeth misplaced
(282#3)	M	8.5	–	6/01/84	(--)	same	w/425, recap. of shed collar, recap. 6/86, shot spring 92
342#3	M	5.6	–	7/28/84	–	–	capture mortality
(427)	M	(3.5)	195	6/01/85	(6322)	(1697/2113)	rot-away canvas spacer used, shot spring 92
(398#2)	F	(4.5)	200*	6/01/85	(6315)	same	396's offspring @2 in 1983, shot 6/86
(214#2)	M	9.5	600*	6/03/85	(xx46)	(1071/1649)	previously shed collar, recaptured 5/86, shot fall 91
437	F	2.5	175*	6/03/85	1036	2082/2083	w/G421, probably sibling, rot-away collar, recaptured 5/95
(309/440#2)	M	17.5	700*	6/04/85	(6298)	(2193/1523)	old collar shed, tattoo 440, RA, shot spring 90
(442)	M	(13.5)	750*	6/04/85	--	(1627/2117)	"Harley" yellow flag in rt. ear, shot 9/86, ear tag gone
443	M	8.0*	400*	6/04/85	--	2172/--	red flat in right, blond
(397#2)	F	(4.5)	300*	6/04/85	6449	(1534/1597)	estrus w/443, was w/G396 in 1983@2, shot 9/85
(447)	F	7.5	400*	6/05/85	10337	2430/2429	breakaway, shot 9/94
347#2	M	18.5	650*	6/09/95	--	2184/2181	orange flags in ears, old eartags gone
(339/450#2)	M	(4.5)	150*	6/09/85	--	(1221/2130)	originally captured in 1981 @0 w/G283, sexed as F switched w/sex of sibling? tattoos = 450, shot 9/85
385#2	F	4.5	130*	6/09/85	--	1507/1592	green flag on visual drop-off, old ear tags replaced
407#2	F	6.5	200*	6/09/85	same	same	alone drop-off feature added to collar
337#4	F	17.5	200*	6/09/85	6440	same	w/2@1 - these have no collars
273#2	F	9.5	200*	6/09/85	(6342)	same	age = 3 in 1979, transported, returned, see 6/87
(340#4)	F	17.5	250*	6/10/85	(6333)	same	replaced collar, w/2@1, recaptured 6/87, shot fall 95
280#4	M	10.5	400*	6/10/85	--	same	collar removed
388#3	F	17.5	425*	6/05/86	(6348)	same	w/2@1, not captured, collar replaced, shot 9/93
335#4	F	8.5	300*	6/05/86	(6288)	same/2481	w/1@2 = G466, collar replaced
466	F	2.5	150*	6/05/86	--	2097/2056	w/mom - 335
396#2	F	16.5	300*	6/06/86	(6343)	same	estrus, collar replaced
(381#3)	F	(7.5)	225*	6/06/86	(15285)	--/same	w/2@1, not captured, collar replaced, shot 9/89
(214#3)	M	10.5	600*	6/06/86	--	none/2062	collar removed, shot fall 91
283#4	F	18.5	300*	6/06/86	(6340)	same	w/2@1, not captured, collar replaced
423#2	F	22.5	275*	6/06/86	(6306)	1540/1541	w/3@2, not captured, collar replaced
425#2	F	16.5	250*	6/06/86	6449	same	w/2@1, not captured, last tooth pulled, lost 9/89
(282#4)	M	10.5	550*	6/06/86	--	(2129/same	alone, collar removed, neck bad
453	F	4	250*	6/03/86	6345	2443/2363	UPSU w/2@0, lost 1c but successfully reintroduced next day
(468)	F	0.5	15	6/03/86	--	562/561	UPSU w/G453, shot spring 91
–	F	0.5	17	6/03/86	–	558/559	UPSU w/G453

Table 1. Continued

Tattoo	Sex	Age**	Wt.	Date	Serial #	Ear Tags	Comments
454	F	4	175*	6/03/86	6278	2358/2353	UPSU alone, no tattoo
(455)	M	8	525	6/03/86	6351	(2058/1700)	UPSU alone, drop-off collar, removed all tags 6/87, shot 9/89
(456)	M	6	250*	6/04/86	(15290)	(2441/2352)	UPSU w/2@0, one captured, shot 5/87
–		0.5	33	6/04/86	–	551/552	UPSU w/uncaptured sibling & 456
457	M	7	525	6/04/86	15291	(2129/2066)	UPSU w/458, drop-off collar, removed all tags 6/87
(458)	F	17	200*	6/04/86	6443	2421/2446	UPSU w/457, drop-off collar, shed, shot spring 90
459	F	3	100*	6/04/86	–	2435/2407	UPSU alone, recaptured 6/87
460	F	7	300*	6/04/86	6349	(560/564)	UPSU w/2@0, no ear flags, roto tags, recaptured 5/90, 5/96
–	M	0.5	30	6/04/86	–	–	UPSU capture mortality
(–)	F	0.5	30	6/04/86	–	553/554	UPSU w/460 & sibling, shot 9/88
(461)	F	5	275*	6/05/86	(15284)	(1529/2427)	UPSU w/1@0, shot 8/95
–	M	0.5	26	6/05/86	–	567/555	UPSU w/461
462	F	7	275*	6/05/86	6298	2412/2487	UPSU w/1@1, magnet left on? in 86, okay in 87
463	M	1.5	90*	6/05/86	–	2193/2198	UPSU w/G462
							UPSU alone, recaptured 5/93 when cementum aged at 10, shot 9/94
(464)	M	2	150*	6/05/86	–	2185/2177	
465	F	3	250*	6/05/86	(6309)	1525/2442	UPSU alone, collar removed 6/87
(466)	F	2	150*	6/05/86	–	2097/2056	UPSU offspring w/G335 (Su-Hydro), shot spring 91
467	M	3	190	6/05/86	–	2144/2138	UPSU alone
(340#5)	F	19.5	342	6/05/87	(6293)	same	alone, replaced collar, shot fall 95
337#5	F	19.5	288	6/05/87	(27816)	same	estrus, replaced collar, recaptured 5/90
281#5	F	10.5	300*	6/05/87	(27814)	same	estrus, replaced collar
314#3	F	9.5	320*	6/05/87	(6295)	2498/3071	w/3@0, L. ear tag replaced, recap. 5/93
273#3	F	11.5	300*	6/05/87	(27821)	676/3082	w/3@0, replaced left ear tag, replaced collar
(001)	F	0.5	16	6/05/87	–	581/584	w/273 & uncaptured sibling, shot 4/92
(002)	M	0.5	18	6/05/87	–	585/578	w/273 & uncapturd sibling, shot 4/92
341#3	F	12.5	313	6/05/87	(6324)	same	w/1@1, replaced collar, died in 88/89 den
468	F	1	70	5/30/87	27826	558/559	UPSU w/mom 453 & sibling, glue-on transmitter
459#2	F	4	198	5/30/87	6344	(same)	UPSU alone, rot-away collar, shed summer 88
					27827		UPSU glue-on radio (mod. 300)
469	F	6	275*	5/30/87	19053	2364/2424	UPSU w/2@1, 85 radio
					1023		UPSU glue-on transmitter (mod. 200), 19-50 ppm
(470)	M	2	185	5/30/87	(3.930**)	2176/2179	UPSU alone, glue-on transmitter
(470#2)	M	2	–	6/08/87	–	–	UPSU removed transmitters, shot 9/87
471	M	5	450*	5/30/87	–	2099/1699	UPSU w/girlfriend 472
471#2	M	5	–	6/08/87	–	–	UPSU removed radio
(472)	F	(12)	375*	5/30/87	–	(3076/3045)	UPSU estrus, w/boyfriend (471) and 1@1 (475), shot 8/96
(472#2)	F	(12)	–	6/08/87	–	–	UPSU removed radio, shot 8/96
(473)	F	6	295	5/30/87	–	3075/3045	UPSU alone
(473#2)	F	6	–	6/08/87	–	–	UPSU removed radio, shot 9/88
474	M	3	335	5/31/87	6302	2512/2658	UPSU alone, 85 radio
					27828	–	UPSU glued-on radio (mod. 300)

Table 1. Continued

Tattoo	Sex	Age**	Wt.	Date	Serial #	Ear Tags	Comments
475	M	1	70*	5/31/87	1022	2637/2504	UPSU w/472 and stepdad, glue-on radio
475#2	M	1	--	6/08/87	--	--	UPSU removed transmitter, checked teeth
476	M	2	150*	5/31/87	19048	2067/2065	UPSU w/477 (sibling?)
					27852	--	UPSU glue-on radio
476#2	M	2	--	6/08/87	--	--	
(477)	F	2	125*	5/31/87	--	2654/2699	UPSU w/476 (sibling?)
(477#2)	F	2	--	6/08/87	--	--	UPSU removed radio, shot 9/87
478	F	9	340*	6/01/87	X988	3026/3046	UPSU w/2@1
					1700	--	UPSU glue-on radio (mod. 300)
(479)	M	2	224*	6/04/87	--	2503/2681	UPSU alone
(479#2)	M	2	--	6/08/87	--	--	UPSU removed collar
480	M	2	205	6/04/87	--	2649/2635	UPSU alone
480#2	M	2	--	6/08/87	--	--	UPSU removed collar
481	F	14	282	6/05/87	6287	3016/3064	UPSU w/3@1, old 85 radio
482	F	7	300*	6/06/87	--	3093/3080	UPSU w/3@1
482#2	F	7	--	6/08/87	--	--	UPSU removed radio
457#2	M	8	600*	6/07/87	--	--	UPSU removed collar & eartags, both badly infected
455#2	M	9	550*	6/08/87	--	--	UPSU removed collar & eartags, both badly infected
465	F	4	310*	6/08/87	--	(same)	UPSU alone, removed collar
No bears captured in 1988 & 1989							
340#6	F	22.5	--	5/27/90	6350	215/214(R)	replaced collar and rt. ear tag, shot fall 95
(388#4)	F	21.5	--	5/27/90	6440	181/183(R)	replaced collar and 2 missing eartags, shot 9/93
335#5	F	12.5	--	5/27/90	15286	same	w/2@1, not captured, replaced radio, recaptured 5/94
281#6	F	13.5	--	5/27/90	19048	same	estrus, replaced collar, recaptured 5/94
273#4	F	14.5	--	5/27/90	19049	same/320(Y)	estrus, replaced collar & rt. eartag, recaptured 5/93
314#4	F	12.5	--	5/27/90	19045	same	w/1 coy capt.-induced separation, replaced collar
423#3	F	26.5	--	5/27/90	6353	same/212(W)	estrus, replaced collar & rt. eartag, see 5/93 recapture
337#6	F	22.5	--	5/27/90	6346	304/213(W/R)	alone, replaced collar & both eartags, recaptured 5/94
283#5	F	22.5	--	5/27/90	(19020)	same/193R	w/2@1, replaced collar & rt. eartag, recaptured 5/93
396#3	F	20.5	--	5/27/90	19046	same	w/3@1, replaced collar
460#2	F	15.5	--	5/27/90	6322	same	UPSU w/2@1, replaced collar, recaptured 5/93, 5/96
483	M	11A	525*	5/12/93	10636	155R/--	canvas spacer
484	F	4A	270	5/12/93	(10666)	168Y/168R	see 5/96
485	F	5A	250	5/12/93	(19040)	151Y/171Y	recaptured 5/96
486	F	6A	270	5/12/93	(10652)	180Y/180R	recaptured 5/96
487	M	5A	475	5/12/93	19054	160Y/160R	recaptured 6/94
(488)	(F)	(12A)	325*	5/13/93	18099	(088Y/089Y)	w/2@0, collar shed post capt., shot 9/96
(306#2)	F	16.5	390	5/13/93	(6349)	(163/170Y)	old tags gone, see 5/80 capture, shot 5/95
489	M	4A	380	5/13/93	10655	241R/242R	canvas spacer
(490)	M	2A	160	5/13/93	--	(178R/179R?)	w/491 sibling, shot 4/94
491	F	2A	100	5/13/93	--	93Y/94Y	w/490 sibling, recaptured 6/95
(423#4)	F	29.5	290	5/13/93	(19052)	165Y/212W	w/492, replaced collar, 1 tag gone, prob.nat.mort. 94

Table 1. Continued

Tattoo	Sex	Age**	Wt.	Date	Serial #	Ear Tags	Comments
492	M	3A	350*	5/13/93	–	135/186R	w/423, breeding
493	M	6A	390	5/13/93	(27816)	227/226	canvas spacer, shed 94, recapt. 5/93
(494)	M	5A	390	5/13/93	(6446)	372/356R	alone, shot 9/93
(495)	F	2A	210	5/13/93	(19054)	214/213G	canvas spacer, recpat. 5/94, shot fall 95
496	F	7B	265	5/14/93	(27814)	(221/098Y)	w/497@1, see 5/96 recapture
497	F	1.5K	80	5/14/93			w/mom 496, apparent capt.-induced separtion
498	F	20A	390*	5/14/93	(6348)	176/179Y	w/2coy, uncaptured--separated, recaptured 5/95
498	"	"	"	5/18/93	"	"	reunited family
511	F	0.5K	18	5/18/93		214/213G	reunited family
512	M	0.5K	21	5/18/93		216/215G	reunited family
499	F	6A	280	5/14/93	6443	(274/215Y)	no previous litter, recaptured 5/94, 5/96
(500)	M	(3A)	270	5/15/93	6293	159/177R	canvas spacer, shot 8/96
(340#7)	F	25.5	355	5/15/93	(6288)	213Y/214W	w/mm 487 & 3 @2, replaced collar, shot fall 95
501	F	2.5K	185	5/15/93	10654	154/164Y	canvas spacer, w/340, 2 sibs., & male 487, see 5/96
502	F	2.5K	175*	5/15/93	–	191/192Y	w/340 (mom), 2 sibs., recaptured 5/94
503	F	2.5K	180	5/15/93	–	166y/170R	w/340 (mom), 2 sibs., & male 487, recaptured 5/95
504	F	5A	310	5/16/93	6342	161/167Y	canvas spacer, dropped off 94
314#4	F	15.5	NA	5/16/93	27821	207/208Y	collar replaced, w/3@2, see 5/96 recapture
505	M	2.5K	200*	5/16/93	–	176/288R	w/314 (mon) and 2 sibs.
506	F	(2.5K)	180*	5/16/93	(6275)	(206/205Y)	w/314 (mom) and 2 sibs., spacer, recaptured 5/95, shot 4/96
507	F	2K	170*	5/16/93	–	199/200	w/314 (mom) & sibs., shed collar, recap. 95
273#5	F	17.5	285	5/16/93	6352	210Y/273	w/mm 464, replaced coller, L. eartag, see 6/96 recapture
(464#2)	M	9.5	550*	5/16/93	(6309)	(292/291R)	w/ff 273, no eartags left, shot 9/93
460#3	F	14.5	300	5/16/93	6351	(560/564R)	UPSU replaced collar, w/2@4, see 6/96
513	F	4K	240	5/19/93	6305	283/156Y	UPSU w/460 and 1 sib., shot DLP summer 93
508	F	6B	370	5/17/93	15290	202/201Y	alone
509	F	3A	205	5/17/93	(15291)	(295)/294Y	alone, recaptured 5/94, 5/96
283#6	F	25.5	290	5/17/93	(6343)	248Y/193R	replaced collar and L. eartag w/m 483, see 5/96
(510)	M	20A	(650)	(5/17/93)	(6341)	(249/250R)	w/ff 273, shot 9/95
280#4	M	19	680	5/20/94	5464	300/298R	w/281, removed collar on 6/95
281#7	F	17	375*	5/20/94	5460	2484/2474Y	replaced collar & eartags
514	M	4A	375*	5/20/94	–	235/244R	w/F502
502#2	F	3K	240	5/20/94	5455	same	w/Male 514
516	M	3A	260	5/20/94	–	285/285R	eartag error?, RA
518	F	4A	240	5/20/94	5465	243/244Y	loose collar, 23.5"
507#2	F	3K	210	5/20/04	5461	same	w/F518, recaptured in 95
487#2	M	6	550	5/20/94	same	same	New RA spacer
495#2	F	3	245	5/20/94	same	same	New RA spacer
509#2	F	4	240	5/21/94	same	same	w/lg. uncaptured M, new RA, expanded 1", recapt. 5/96
515	M	(4A)	375*	5/21/94	(5457)	(226/223R)	RA, w/F499, shot 4/96
499#2	F	7	300	5/21/94	same	288/289Y	w/M515, ears infected, collar expanded, see 5/96
335#6	F	16	290	5/21/94	5469	182/181Y	replaced collar, w1@1

Table 1. Continued

Tattoo	Sex	Age**	Wt.	Date	Serial #	Ear Tags	Comments
506#2	F	3K	210	5/21/94	same	same	alone, new RA, expanded 1", shot 4/96
501#2	F	3K	230*	5/21/94	(5459)	same	alone, RA applied
337#7	F	26	350*	5/22/94	5468	same	alone
517	F	18A	330	5/22/94	5463	243/252Y	w/2@1, not captured
519	M	3A	270	5/22/94	5466	232/236R	alone, RA spacer
(461#2)	F	12	294	5/22/94	(5467)	(same/251Y)	UPSU replaced 86 collar, w/3@1, uncaptured, shot 8/95
437#2	F	12	290	5/15/95	6354B	203/280Y	old tags (1985) gone w/2@2
(520)	F	9A	280	5/15/95	6333	249/250Y	w/2@2, shot 9/95
493	M	8	475	5/15/95	36361	same	breakaway collar
491	F	4	190	5/16/95	6346	same	canvas spacer
(521)	M	2*	170	5/16/95	(36350)	(200/199R)	w/sibling, shot 9/95
(522)	F	2A	140	5/16/95	36306	261/260Y	w/2 siblings
523	M	8A	660	5/16/95	36356	168/187R	shed, surg.tube
503#2	F	4K	245	5/17/95	19048	same	alone, canvas spacer
524	M	15*	600*	5/17/95	36355	210/209R	surgical tube
525	F	7A	290*	5/17/95	6451	219/220Y	w/2@1, canvas spacer, recaptured 5/96
280#5	M	20	620	5/18/95	–	same	removed collar
498#2	F	22	345	5/18/95	366910	same	w/2@2
506#3	F	(4K)	325*	5/18/95	(366911)	same	alone, loosened collar, shot 4/96
507#3	F	4K	240	5/18/95	366909	same	w/male, collar okay
526	F	4A	285	5/15/96	381889	326/325Y	13A, alone
527	M	19A	600*	5/15/96	381893	228/227R	13A
528	F	5A	290	5/15/96	381906	300/190Y	13A, alone
529	F	27A	350	5/15/96	381884	228/266Y	13A, alone
530	F	7B	255	5/15/96	381898	272/221Y	13A, w/2@3
531	M	3A	215	5/15/96	381913	277/278R	13A, w/530 & sib., spacer
532	F	22A	330*	5/16/96	381895	223/230Y	13A, w/2@1
533	F	1A	65*	5/16/96	–	183/184Y	13A, w/532 & 534
534	M	1A	75*	5/16/96	–	294/293R	13A, w/532 & 533
535	M	6B	575*	5/16/96	(381886)	195/196R	13A., alone?
393#2	F	15	295	5/16/96	381897	277/276Y	13A, w/3@0
536	F	16A	340	5/17/96	381890	329/330Y	13A, w/1@1, reunited on 5/19
537	F	1	97	5/17/96	–	268/269Y	13A, w/536, reunited on 5/19
538	M	3A	210	5/17/96	381916	220/212R	13A, spacer
(539)	F	3A	180	5/17/96	(381909)	(214/259Y)	13A, spacer, shot 5/27/96
540	F	14A	300*	5/17/96	19049	236/235Y	13A, alone
541/2	F	6A	250*	5/17/96	381905	246/245Y	13A, tattoo=542(mistake), w/542
542	M	6A	545	5/17/96	366904	158/157R	13A, w/541
543	M	3A	200*	5/17/96	381908	186/185R	13A, spacer
544	M	4A	410	5/17/96	381883	238/286R	13A, spacer
545	M	7A	515	5/18/96	381900	319/320R	13A, spacer
546	F	20A	320	5/18/96	–	-/275Y	13A, w1@1 eartag & 6B

Table 1. Continued

Tattoo	Sex	Age**	Wt.	Date	Serial #	Ear Tags	Comments
547	F	1	140	5/18/96	–	327/328Y	13A, w/546
537#2	F	1	–	5/19/96	381919	same	not w/mom, put on eartag radio
548	M	11A	640	5/20/96	–	254/253R	13A, white EF
549	F	7A	290	5/20/96	381887	324/323Y	13A, alone
550	F	13A	300	5/20/96	381907	305/306Y	13A, w/1@2(551)
551	F	2A	190	5/20/96	381911	196/195Y	13A, w/550 (mom)
536#2	F	16A	–	5/20/96	same	same	13A, slung back to 537 (@1)
(552)	F	2A	165	5/21/96	–	–	13A, capture mortality
553	M	3A	295	5/21/96	–	216/-	13A, 6B & eartag radio
554	M	8A	550	5/21/96	–	310/309	13A, orange flags, w/555
555	F	4A	245	5/21/96	381901	302/301Y	13A, alone
556	F	9A	320	5/21/96	381899	292/293Y	13A, w/2@2
(557)	M	2A	155	5/21/96	(36348)	230/229R	13A, 405 collar w/rubber spacer, w/556 & 558, shot 9/96
(558)	(M)	(2A)	170	5/21/96	–	(205/206R)	13A, w/556 & 557, shot 9/96
(559)	(M)	(7B)	420	5/21/96	(381885)	162/152R	13A, w/334, shot 9/96
334#2	F	24	400	5/21/96	381894	315/316Y	13A, near 2@2 (560, 561)
560	F	2A	210	5/21/96	381910	265/157Y	13A, near 334, w/561
(561)	F	2A	160	5/21/96	–	(240/239Y)	13A, near 334, w/560, shot F/96
509#3	F	6	275*	5/22/96	366906	178/same	13E w/2@0, new collar
525#2	F	8	285	5/22/96	same	same	13E, w/2@2, expanded collar
485#2	F	8	265	5/22/96	6440	same	13E, w/2@2, new collar
501#2	F	5	240	5/22/96	366912	same	13E, w/2@0, loosened collar
496#2	F	10	325	5/22/96	366905	222/same	13E, w/1@2, replaced collar
460#4	F	17	315	5/22/96	366912	same	13E, w/2@2, loosened collar
484#2	F	7	290*	5/22/96	366907	same	13E, w/1@2, loosened collar
283#7	F	28	340	5/22/96	366908	same	13E, alone, new collar
499#3	F	9	295	5/22/96	15284	same	13E, w1@1, new collar
314#5	F	18	300	5/22/96	6344	same	13E, w3@1, new collar
486#2	F	9	295*	5/22/96	15290	same	13E, w/1@2 new collar
273#6	F	20	280*	6/18/96	6293	same	13E, w/2@1, new collar

* estimated

** Mattson certainty, code, K = known age

Table 2. Brown bear regulations and harvests in Alaska's Unit 13, 1961-1996.

Calendar year	Bag limit	Spring season	Autumn season	Total no. days	Spring kill	Autumn kill	Total kill
1961	1/year	none	9/1-9/30	30	0	42	42
1962	1/year	none	9/1-9/30	30	0	32	32
1963	1/year	none	9/1-9/30	30	0	43	43
1964	1/year	none	9/1-9/30	30	0	38	38
1965	1/year	none	9/1-10/15	30	1	47	48
1966	1/year	none	9/1-9/30	30	0	63	63
1967	1/year	none	9/1-9/30	30	0	32	32
1968	1/4years[1]	none	9/15-10/15	21	0	39	39
1969	1/4years	none	9/20-10/20	31	0	17	17
1970	1/4years	none	9/15-10/5	21	0	26	26
1971	1/4years	none	9/1-10/5	35	0	70	70
1972	1/4years	none	9/10-10/10	31	0	48	48
1973	1/4years	none	9/10-10/10	31	0	45	45
1974	1/4years	none	9/1-10/10	40	0	72	72
1975	1/4years	none	9/1-10/10	40	0	80	80
1976	1/4years	none	9/1-10/10	40	0	59	59
1977	1/4years	none	9/1-10/10	40	1	40	41
1978	1/4years	none	9/1-10/10	40	2	62	64
1979	1/4years	none	9/1-10/10	40	0	73	73
1980	1/4years	5/10-5/25	9/1-10/10	56	15	69	84
1981	1/4years	5/10-5/25	9/1-10/31	77	24	58	82
1982	1/year[1]	4/25-5/25	9/1-12/31	153	23	59	82
1983	1/year	1/1-5/31	9/1-12/31	273	36	81	117
1984	1/year	1/1-5/31	9/1-12/31	273	47	77	124
1985	1/year	1/1-5/31	9/1-12/31	273	54	91	145
1986	1/year	1/1-5/31	9/1-12/31	273	45	91	136
1987	1/4years[1]	1/1-5/31	9/1-12/31	273	46	58	104
1988	1/4years	1/1-5/31	9/1-12/31	273	19	48	67
1989	1/4years	1/1-5/31	9/1-12/31	273	25	52	77
1990	1/4years	1/1-5/31	9/10-12/31[3]	263	46	37[2]	83
1991	1/4years	1/1-5/31	9/10-12/31[3]	263	48	33	81
1992	1/4years	1/1-5/31	9/10-12/31[3]	263	42	63	105
1993	1/4years	1/1-5/31	9/1-12/31[4]	273	48	42	90
1994	1/4years	1/1-5/31	9/1-12/31[4]	273	24	58	82
1995	1/year[1]	1/1-5/31	8/10-12/31[4]	295	39	98	137
1996	1/year	1/1-5/31	8/10-12/31[4]	295	28	94*	122*

* Preliminary data

[1] Starting July 1 of year.

[2] Temporary ungulate season changes caused no overlap with autumn bear seasons for first time.

[3] Except for 13D which remained 9/1-12/31.

[4] Except for portion of 13E west of railroad opens on 9/10.

Table 3. Status of brown bears first marked during Unit 13 studies, 1980-1992. (A=alive, ND=no data available, F=shot in fall, SP=shot in spring, @*n* = with cubs of age *n*). ND in year of capture indicates brown bear was not collared or soon shed its collar and no subsequent data were collected.

Bear ID	Sex/Age	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
1980 captures														
214	M/2 in '78	A(ND)	A(ND)	A(ND)	A(ND)	A(ND)	A(ND)	A(ND)	A(ND)	A(ND)	A(ND)	A(ND)	Shot-F	–
273	F/3 IN '79	A(ND)	A(ND)	A(ND)	A(ND)	A(ND)	A(-)	A(-)	A(COY)	A(YLG)	A(@2)	A(-)	A(COY)	A(YLG)
277	F/10 in '80	A(-)	ND	ND	ND	ND	ND	ND	ND	ND	ND	–	–	–
279	M/9 in '80	A(-)	A(ND)	A(ND)	A(-)	Shot-F	–	–	–	–	–	–	–	–
280	M/5 in '80	A(-)	A(-)	A(-)	A(-)	A(-)	A(-)	A(ND)	A(ND)	A(ND)	A(ND)	A(ND)	A(ND)	A(ND)
281	F/3 in '80	A(-)	A(-)	A(-)	A(COY)	A(COY)	A(COY)	A(YLG)	A(@2)	A(COY)	A(YLG)	A(@2)	A(-)	A(COY)
282	M/4 in '80	A(ND)	A(ND)	A(-)	A(-)	A(-)	A(-)	A(-)	A(ND)	A(ND)	A(ND)	A(ND)	A(ND)	Shot-SP
283	F/12 in '80	A(@2)	A(COY)	A(@1)	A(COY)	A(-)	A(COY)	A(YLG)	A(@2)	A(@3)	A(COY)	A(YLG)	A(@2)	A(COY)
284	M/2 in '80	A(ND)	Shot-SP	–	–	–	–	–	–	–	–	–	–	–
286	M/3 in '80	A(ND)	A(ND)	A(ND)	A(ND)	Shot-F	–	–		–	–	–	–	–
292	3 in '80	A(ND)	A(ND)	A(ND)	A(ND)	A(ND)	A(ND)	A(ND)	A(ND)	A(ND)	Shot-SP	–	–	–
293	M/3 in '80	A(-)	A(-)	A(-)	A(-)	ND	Shot-SP	–	–	–	–	–	–	–
294	M/10 in '80	A(ND)	Died-Aug	–	–	–	–	–	–	–	–	–	–	–
295	M/12 in '80	ND	ND	ND	ND	ND	ND	ND	ND	–	–	–	–	–
297	M/1 in '80	A(ND)	Shot-F	–	–	–	–	–	–	–	–	–	–	–
299	F/13 in '80	A(YLG)	A(-)	A(COY)	A(COY)	A(YLG)	ND	–	–	–	–	–	–	–
306	F/3 in '80	A(ND)	A(ND)	A(ND)	A(ND)	A(ND)	A(ND)	A(ND)	A(ND)	A(ND)	A(ND)	A(ND)	A(ND)	A(ND)
308a	M/6 in '80	A(-)	A(ND)	A(ND)	Shot-F	–	–	–	–	–	–	–	–	–
308b	F/5 in '80	A(-)	Died-Aug	–	–	–	–	–	–	–	–	–	–	–
309	M/12 in '80	A(ND)	A(ND)	A(ND)	A(ND)	A(ND)	A(ND)	A(ND)	A(ND)	A(ND)	A(ND)	Shot-SP	–	–
311	M/2 in '80	Shot-F	–	–	–	–	–	–	–	–	–	–	–	–
312	F/10 in '80	A(ND)	A(ND)	A(ND)	A(ND)	Died-NS	–	–	–	–	–	–	–	–
313	F/9 in '80	A(@2)	A(COY)	A(COY)	A(YLG)	A(-)	Shot-F	–	–	–	–	–	–	–
314	F/2 in '80	A(ND)	A(ND)	A(ND)	A(ND)	A(ND)	A(YLG)	A(@2)	A(COY)	A(YLG)	A(@2)	A(COY)	A(COY)	A(YLG)
315	F/2 in '80	A(ND)	A(ND)	A(ND)	A(-)	A(-)	A(ND)	Shot-SP	–	–	–	–	–	–
1981 captures														
331	F/6 in '81	–	A(@2)	Died-Aug	–	–	–	–	–	–	–	–	–	–
332	M/2 in '81	–	A(ND)	Shot-F	–	–	–	–	–	–	–	–	–	–
333	M/2 in '81	–	Shot-F	–	–	–	–	–	–	–	–	–	–	–
334	F/10 in '81	–	Lost	A(ND)	A(ND)	A(ND)	A(ND)	A(ND)	A(ND)	A(ND)	A(ND)	A(ND)	A(ND)	A(ND)
335	F/2 in '81	–	A(-)	A(-)	A(-)	A(COY)	A(YLG)	A(@2)	A(-)	A(COY)	A(YLG)	A(@2)	A(@3)	A(@4)
337	F/13 in '81	–	A(COY)	A(YLG)	A(@2)	A(COY)	A(@1)	A(@2)	A(@3)	A(-)	A(-)	A(-)	A(-)	A(-)
339	M/0 in '81	–	Cub	YLG	A(ND)	A(ND)	Shot-F	–	–	–	–	–	–	–
340	F/3 in '81	–	A(-)	A(-)	A(-)	A(COY)	A(@1)	A(-)	A(COY)	A(COY)	A(YLG)	A(@2)	A(COY)	A(YLG)
341	F/6 in '81	–	A(-)	A(COY)	A(ND)	A(ND)	A(-)	A(COY)	A(@1)	A(Den death)	–	–	–	–
342a	M/2 in '81	–	A(-)	A(-)	A(-)	Died-NS	–	–	–	–	–	–	–	–
344	F/5 in '81	–	A(COY)	A(YLG)	A(COY)	YLG, Shot-F	ND	–	–	–	–	–	–	–
347	M/14 in '81	–	A(-)	A(ND)	A(ND)	A(ND)	A(-)	–	–	–	–	–	–	–
1982 captures														
379D	F/5 in '82	–	–	A(COY)	A(YLG)	A(@2)	Shot-F	–	–	–	–	–	–	–
380	F/15 in '82	–	–	A(YLG)	Shot-F	–	–	–	–	–	–	–	–	–
381	F/3 in '82	–	–	A(-)	A(-)	A(-)	A(COY)	A(YLG)	A(@2)	A(COY)	YLG, Shot-F	–	–	–

Table 3. Continued

Bear ID	Sex/Age	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
1983 captures														
382	M/1 in '83	–	–	–	YLG	A(ND)	A(ND)	A(ND)	A(ND)	A(ND)	A(ND)	A(ND)	A(ND)	A(ND)
384	F/12 in '83	–	–	–	A(-)	Lost in Sept-shot?	ND	ND	ND	ND	ND	ND	ND	ND
385	F/2 in '83	–	–	–	A(-)	A(-)	A(-)	ND	ND	ND	ND	ND	ND	ND
386	M/2 in '83	–	–	–	A(-)	Shot-SP	–	–	–	–	–	–	–	–
388	F/14 in '83	–	–	–	A(@2)	A(COY)	A(COY)	A(@1)	A(@2)	A(COY)	A(@1)	A(@2)	A(ND)	A(-)
389	M/2 in '83	–	–	–	A,Died Oct	–	–	–	–	–	–	–	–	–
390	M/2 in '83	–	–	–	A(-)	A(-)	ND	–	–	–	–	–	–	–
391	M/2 in '83	–	–	–	A(-)	Shot-F	–	–	–	–	–	–	–	–
392	M/2 in '83	–	–	–	A(-)	Shot-SP	–	–	–	–	–	–	–	–
393	F/2 in '83	–	–	–	A(-)	A(ND)	A(ND)	A(ND)	A(ND)	A(ND)	A(ND)	A(ND)	A(ND)	A(ND)
394	F/6 in '83	–	–	–	A(COY)	Shot-F	–	–	–	–	–	–	–	–
395	F/3 in '83	–	–	–	Shot-F	–	–	–	–	–	–	–	–	–
396	F/13 in '83	–	–	–	A(@2)	A(COY)	A(COY)	A(-)	A(-)	A(-)	A(COY)	A(YLG)	A(@2)	A(@3)
397	F/2 in '83	–	–	–	A(ND)	A(ND)	Shot-F	–	–	–	–	–	–	–
398	F/2 in '83	–	–	–	A(ND)	A(ND)	A(-)	Shot-SP	–	–	–	–	–	–
399	M/9 in '83	–	–	–	A(-)	A(-)	A(-)	A(ND)	Shot-SP	–	–	–	–	–
400	M/20 in '83	–	–	–	A(-)	A(-)	A(-)	A(ND)	A(ND)	A(ND)	A(ND)	A(ND)	A(ND)	A(ND)
403D	F/6 in '83	–	–	–	A(COY)	A(YLG)	A(-)	A(ND)	A(ND)	A(ND)	A(ND)	A(ND)	A(ND)	A(ND)
407D	F/4 in '83	–	–	–	A(-)	A(-)	A(-)	A(-)	A(-)	A(ND)	A(ND)	A(ND)	Shot-F	–
1984 captures														
420	F/19 in '84	–	–	–	–	A(YLG)	A(@2)	A(COY)	A(ND)	A(ND)	A(ND)	A(ND)	Shot-F	–
421	M/1 in '84	–	–	–	–	–	A(-)	A(ND)	A(ND)	Shot-F	–	–	–	–
422	M/4 in '84	–	–	–	–	A(-)	Died-SP	–	–	–	–	–	–	–
423	F/21 in '84	–	–	–	–	A(COY)	A(YLG)	A(@2)	A(COY)	A(-)	A(-)	A(-)	A(-)	A(-)
425	F/14 in '84	–	–	–	–	A(-)	A(COY)	A(YLG)	A(-)	A(COY)	A shot?	–	–	–
417	M/1 in '84	–	–	–	–	–	A(ND)	Shot-SP	–	–	–	–	–	–
023	F/0 in '84	–	–	–	–	COY	YLG	A(ND)	A(ND)	A(ND)	Shot-SP	–	–	–
008	F/0 in '84	–	–	–	–	COY	YLG	A(ND)	A(ND)	A(ND)	A(ND)	Shot-SP	–	–
024	M/0 in '84	–	–	–	–	COY	YLG	A(ND)	A(ND)	A(ND)	A(ND)	A(ND)	Shot--F	–
1985 captures														
427	M/3 in '85	–	–	–	–	–	A(-)	Shot-SP	–	–	–	–	–	–
429	F/1 in '85	–	–	–	–	–	A(ND)	Shot-SP	–	–	–	–	–	–
437	F/2 in '85	–	–	–	–	–	A(-)	A(ND)	A(ND)	A(ND)	A(ND)	A(ND)	A(ND)	A(ND)
442	M/13 in '85	–	–	–	–	–	A(ND)	Shot-SP	–	–	–	–	–	–
443	M/A in '85	–	–	–	–	–	A(ND)	ND	ND	ND	ND	ND	ND	ND
447	F/7 in '85	–	–	–	–	–	A(-)	A(COY)	A(ND)	A(ND)	A(ND)	A(ND)	A(ND)	A(ND)
1986 captures														
453U	F/4 in '86	–	–	–	–	–	–	A(COY)	A(YLG)	A(@2)	Shot-SP	–	–	–
454U	F/4 in '86	–	–	–	–	–	–	A(-)	A(COY)	ND	ND	ND	ND	ND
455U	M/8 in '86	–	–	–	–	–	–	A(-)	A(-)	A(ND)	Shot-F	–	–	–
456U	F/6 in '86	–	–	–	–	–	–	A(COY)	Shot-SP	–	–	–	–	–
457U	M/7 in '86	–	–	–	–	–	–	A(-)	A(-)	A(ND)	Shot-F	–	–	–

Table 3. Continued

Bear ID	Sex/Age	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
1986 captures - continued														
458U	F/18 in '86	–	–	–	–	–	–	A(-)	A(COY)	A(COY)	A(ND)	Shot-SP	–	–
459U	F/3 in '86	–	–	–	–	–	–	A(-)	A(ND)	ND	ND	ND	ND	ND
460U	F/7 in '86	–	–	–	–	–	–	A(COY)	A(YLG)	A(-)	A(COY)	A(YLG)	A(@2)	A(@3)
460U	F/0 in '86	–	–	–	–	–	–	COY	YLG	Shot-F	–	–	–	–
461U	F/5 in '86	–	–	–	–	–	–	A(-)	A(COY)	A(YLG)	A(ND)	A(COY)	A(@1)	A(@2)
462U	F/10 in '86	–	–	–	–	–	–	A(YLG)	A(COY)	A(YLG)	A(-)	ND	ND	ND
464U	M/2 in '86	–	–	–	–	–	–	A(ND)	A(ND)	A(ND)	A(ND)	A(ND)	A(ND)	A(ND)
465U	F/3 in '86	–	–	–	–	–	–	A(-)	A(-)	ND	ND	ND	ND	ND
467U	M/3 in '86	–	–	–	–	–	–	ND	ND	ND	ND	ND	ND	ND
1987 captures														
466U	F/2 in '87	–	–	–	–	–	–	–	A(ND)	A(ND)	A(ND)	A(ND)	Shot-SP	–
468U	F/2 in '87	–	–	–	–	–	–	–	YLG	A(ND)	A(ND)	A(ND)	Shot-SP	–
469U	F6 in '87	–	–	–	–	–	–	–	A(YLG)	ND	ND	ND	ND	ND
470U	M/2 in '87	–	–	–	–	–	–	–	Shot-F	–	–	–	–	–
001U	F/0 in '87	–	–	–	–	–	–	–	COY	YLG	A(ND)	A(ND)	A(ND)	Shot-SP
002U	M/0 in '87	–	–	–	–	–	–	–	YLG	A(ND)	A(ND)	A(ND)	A(ND)	Shot-SP
471U	M/1 in '87	–	–	–	–	–	–	–	A(-)	ND	ND	ND	ND	ND
472U	F/12 in '87	–	–	–	–	–	–	–	A(-)	ND	ND	ND	ND	ND
473U	F/6 in '87	–	–	–	–	–	–	–	A(-)	Shot-F	–	–	–	–
474U	M/3 in '87	–	–	–	–	–	–	–	A(-)	ND	ND	ND	ND	ND
476U	M/2 in '87	–	–	–	–	–	–	–	A(-)	ND	ND	ND	ND	ND
477U	F/2 in '87	–	–	–	–	–	–	–	Shot-F	–	–	–	–	–
478U	F/9 in '87	–	–	–	–	–	–	–	A(YLG)	ND	ND	ND	ND	ND
479U	M/2 in '87	–	–	–	–	–	–	–	A(-)	A(ND)	A(ND)	A(ND)	A(ND)	A(ND)
480U	F/2 in '87	–	–	–	–	–	–	–	A(-)	ND	ND	ND	ND	ND
481U	F/14 in '87	–	–	–	–	–	–	–	A(YLG)	A(@2)	ND	ND	ND	ND
482U	F/7 in '87	–	–	–	–	–	–	–	A(YLG)	ND	ND	ND	ND	ND

1988 - 1992 no new bears captured

Not included:
Subadults @ 2 in 1980: 285;
1983: 397 & 398 both recaptured in 1985
1986: 466
1993: 505
Subadults @1 in 1980: 298;
1983: 383;
1984: 418,419
1986: 463
1987: 468,475
1993: 497, 513

Table 3. Continued

Bear ID	Sex/Age	1993	1994	1995	1996(SP)	1997	1998
1980 captures - continued							
273	F/17 in '93	A(-)	A(COY)	A(COY)	A(YLG)		
280	F/18 in '93	A(-)	A(-)	Removed	ND		
281	F/16 in '93	A(YLG)	A(-)	A(COY) N.Mort.	--		
283	F/25 in '93	A(-)	A(COY)	A(YLG)	A(-)		
306	F/16 in '93	A(COY)	A(COY)	A(YLG)Shot	--		
314	F/15 in '93	A(@2)	A(COY)	A(COY)	A(YLG)		
1981 captures - continued							
334	F/22 in '93	A(ND)	A(ND)	A(ND)	recapt. (@2)		
335	F/14 in '93	A(COY)	A(YLG)	A(@2)	A(COY)		
337	F/25 in '93	A(-)	A(-)	A(-)	A(-)		
340	F/15 in 93	A(@2)	A(COY) Shot-F	--	--		
1983 captures - continued							
382	M/11 in '93	Shot-SP	--	--	--		
388	F/24 in '93	A(COY) shot	--	--	--		
393	F/12 in '93	A(ND)	A(ND)	A(ND)	Recapt. (COY)		
396	F/23 in '93	A(COY)	ND (failure)	ND	ND		
400	M/30 in '93	Shot-SP	--	--	--		
1984 captures - continued							
423	F/30 in '93	A(-)	Died	--	--		
1985 captures - continued							
437	F/10 in '93	A(ND)	A(ND)	A(@2)-Died	--		
447	F/15 in '93	A(ND)	Shot-F	--	--		
1986 captures - continued							
460	F/14 in '93	A(@4)	A(COY)	A(@1)	A(@2)		
461	F/13 in '93	A(COY)	A(YLG)	A(@2)-shot-F	--		
464	M/9 in '93	Shot-F	--	--	--		
1987 captures - continued							
479	M/8 in '93	Shot-F	--	--	--		
1993 captures - continued							
483	M/11 in '93	(shed)	ND	ND	ND		
484	F/4 in '93	A(-)	A(COY)	A(YLG)	A(@2)		
485	F/5 in '93	A(-)	A(COY)	A(YLG)	A(@2)		
486	F/6 in '93	A(-)	A(COY)	A(YLG)	A(@2)		
487	M/5 in '93	A(-)	A(-)	ND	ND		
488	F/12 in '93	A(@0, shed)	ND	ND	ND		
489	M/4 in '93	A(ND)	ND	ND	ND		
490	M/2 in '93	A(ND)	Shot (SP.)	--	--		
491	F/2 in '93	A(ND)	A(ND)	A(-)	A(-)		
492	M/3 in '93	ND	ND	ND	ND		
493	M/6 in '93	A(shed)	A(ND)	A(shed)	ND		
494	M/5 in '93	(shot-F)	--	--	--		
495	F/2 in '93	A(-)	A(shot-F)	--	--		
496	F/7 in '93	A(YLG)	A(COY)	A(YLG)	A(@2)		

Table 3. Continued

Bear ID	Sex/Age	1993	1994	1995	1996(SP)	1997	1998
1993 captures - continued							
498	F/20 in '93	A(COY)	A(YLG)	A(@2)-Died	--		
499	F/6 in '93	A(-)	A(-)	A(COY)	A(@1)		
500	M/3 in '93	A(-)	Shed	ND	ND		
501	F/2 in '93	A(-)	A(-)	A(-)	A(COY)		
502	F/2 in '93	A(ND)	A(Shed)	ND	ND		
503	F/2 in '93	A(ND)	A(ND)	A(Recapt.)	A(COY)		
504	F/5 in '93	A(Shed)	ND	ND	ND		
506	F/2 in '93	A(-)	A(-)	A(-)	Shot-SP		
507	F/2 in '93	A(ND)	A(-)	A(-)	A(COY)		
508	F/6 in '93	A(-)	A(-)	Shed	ND		
509	F/3 in '93	A(-)	A(-)	A(-)	A(COY)		
510	M/20 in '93	Shed	A(ND)	Shot-F	--		
513	F/4 in '94	Shot-July DLP	--	--	--		
514	M/4 in '94	--	Shed	ND	ND		
515	M/4 in '94	--	A(-)	A(ND)	Shot-SP		
516	M/3 in '94	--	ND	ND	ND		
517	F/18 in '94	--	A(YLG)	A(@2)	A(COY)		
518	F/4 in '94	--	A(-)	A(-)	A(-)		
519	M/3 in '94	--	A(-)	Shed	ND		
520	F/9 in '95	--	--	A(@2) Shot-F	--		
521	M/2 in '95	--	--	A(-) Shot-F	--		
522	F/2 in '95	--	--	A(-) Shot-F	--		
523	M/8 in '95	--	--	A-Shed	ND		
524	M/15 in '95	--	--	Shed	ND		
525	F/7 in '95	--	--	A(YLG)	A(@2)		

Table 3. Continued.

Summary	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
A. Max no. marked bears potentially alive in year [1]	24(13:11)	33(15:18)	31(12:19)	48(18:30)	47(15:32)	43(15:28)	51(16:35)	57(17:40)	44(10:34)	40(12:28)	33(10:23)	31(9:22)	26(7:19)
B. No. A KNOWN shot in year (M:F)	1(1:0)	3(3:0)	1(1:0)	3(1:2)	6(5:1)	5(2:3)	6(3:3)	4(2:2)	3(1:2)	6(2:4)	3(1:2)	5(2:3)	3(2:1)
Min. % known shot (B/A)	4%	9%	3%	6%	13%	12%	12%	7%	7%	15%	9%	16%	12%
males	8%	20%	8%	6%	33%	13%	19%	12%	10%	17%	10%	22%	29%
females	0	0	0	7%	3%	11%	9%	5%	6%	14%	9%	14%	5%
C. No. of A known shot plus suspected (unreported) shot in year (M:F)	1(1:0)	4(3:1)	1(1:0)	3(1:2)	8(5:3)	5(2:3)	6(3:3)	4(2:2)	3(1:2)	7(2:5)	3(1:2)	5(2:3)	3(2:1)
Probable min. % shot (C/(A)	4%	12%	3%	7%	17%	12%	12%	7%	7%	18%	9%	16%	12%
D. No. radiomarked bears known alive[2] (M:F)	10 (4:6)	15 (5:10)	17 (5:12)	32 (12:20)	32 (10:22)	30 (8:22)	30 (5:25)	35 (6:29)	20 (0:20)	15 (0:15)	12 (0:12)	11 (0:11)	11 (0:11)
E. No. of (D) known shot	0	0	1	2	7	2	2	1	2	2	0	0	0
males	0	0	1	1	4	0	1	0	0	0	0	0	0
females	0	0	0	1	3	2	1	1	2	2	0	0	0
% of radiomarked bears shot (E/D)	0	0	6%	6%	22%	7%	7%	3%	10%	13%	0	0	0
Cumulative % shot (based on bear-years available, from rows A and C).													
males	2.3%	8.8%	6.8%	6.6%	9.3%	9.7%	10.1%	9.5%	9.3%	10.0%	10.0%	10.4%	10.4%
females	7.7%	14.3%	12.5%	10.3%	15.1%	14.8%	15.4%	14.9%	14.5%	14.7%	14.3%	14.8%	15.4%
	0	3.5%	2.1%	3.9%	5.5%	6.5%	6.9%	6.6%	6.5%	7.6%	7.7%	8.1%	8.0%

[1]Includes A(ND) Excludes tagging and natural mortalities and ND for coy or ylgs when originally marked except if shot later. (M:F)

[2]Excludes A(ND), died, lost, cubs or ylgs.

Table 3. Continued

Summary	1993	1994	1995	1996 (SP)	1997	1998
A. Max. no marked bears potentially alive in year [1]	47(11:36)	41 (7:34)	39(7:32)	23(1:22)		
B. No. of A KNOWN shot in year (M:F)	6(5:1)	4(0:4)	6(2:4)			
Min. % known shot (B/A)	12.8%	9.8%	15.4%			
males	45.5%	0	28.6%			
females	2.8%	11.8%	12.9%			
C. No. of known shot plus suspected (unreported) shot in year (M:F)	6	4	6			
Probable min. % shot (C/(A)	12.8%	9.8%	15.4%			
D. No. radio marked bears known alive[2] (M:F)	30 (3:27)	27 (3:24)	27 (1:26)	22 (0:22)		
E. No. of (D) known shot	0	2	5			
males	0	0	1			
females	0	2	4			
% of radio-marked bears shot (E/D)	0	7.4%	18.5%			
males	0	0	100%			
females	0	8.3%	15.4%			
Cumulative % shot (based on bear-years available, from rows A and C).	10.6%	10.6%	10.8%			
males	17.2%	16.6%	17.0%			
females	7.5%	7.8%	8.2%			

[1]Includes A(ND) Excludes tagging and natural mortalities and ND for coy or ylgs when originally marked except if shot later. (M:F)

[2]Excludes A(ND), died, lost, cubs or ylgs.

Table 4. Comparision of brown bear population and density estimates in two study areas in Alaska's GMU 13. Estimates are based on the maximum likelihood estimator (White 1993).

	Su-hydro(1317 km^2)		Denali Hwy. or Upper Susitna, (1257 km^2)
Independent Bears	1985	1995	1987
Population Estimate	24.7	30.7	8.0
95% CI	20.9-31.3	25.4-39.7	6.8-10.6
80% CI	21.9-28.6	26.9-36.0	7.1-9.5
Density Estimate			
Bears/1000 km^2	18.8	23.3	6.4
95% CI	15.2-24.3	19.3-30.1	5.4-8.4
80% CI	16.6-21.7	20.4-27.3	5.6-7.6
Bears/100 mi^2	4.9	6.0	1.7
95% CI	4.1-6.2	5.0-7.8	1.4-2.2
80% CI	4.3-5.6	5.3-7.1	1.5-2.0
Bears ≥ 2			
Population Estimate	24.7	40.6	8.0
95% CI	20.9-31.3	34.0-51.2	6.8-10.6
80% CI	21.9-28.6	35.9-46.9	7.1-9.5
Density Estimate			
Bears/1000 km^2	18.8	30.8	6.4
95% CI	15.2-24.3	25.82-38.9	5.4-8.4
80% CI	16.6-21.7	27.3-35.6	5.6-7.6
Bears/100 mi^2	4.9	8.0	1.7
95% CI	4.1-6.2	6.7-10.1	1.4-2.2
80% CI	4.3-5.6	7.1-9.3	1.5-2.0
Bears of All Ages			
Population Estimate	35.6	53.7	13.5
95% CI	33.0-40.1	47.4-63.1	11.3-17.7
80% CI	33.7-38.3	49.3-54.9	11.9-16.0

Table 4. Continued

Bears of All Ages, cont.	Su-hydro(1317 km^2) 1985	Su-hydro(1317 km^2) 1995	Denali Hwy. or Upper Susitna, (1257 km^2) 1987
Density Estimate			
Bears/1000 km^2	27.0	40.8	10.7
95% CI	25.1-30.5	36.0-47.9	9.0-14.1
80% CI	25.6-29.1	37.4-41.7	9.5-12.7
Bears/100 mi^2	7.0	10.6	2.8
95% CI	6.5-7.9	9.3-12.4	2.3-3.7
80% CI	6.6-7.5	9.7-10.8	2.5-3.3

Table 5. Comparisons of brown bear densities and population composition in 4 studies in 2 study areas in Alaska's Game Management Subunit 13E. Composition based on the unweighted number of individuals known to be in the study area at least once during the density estimation period. The 1987 study in the Denali Highway area occurred in a portion of the 1979 study area.

	Su-hydro Area		Denali Hwy. Area	
	1985	**1995**	**1979***	**1987**
Days of search	7	5	17*	7
Population estimate (independent bears)	24.7	30.7	--	8.0
Density estimate (independent. bears)				
No./1000 km^2	18.8	23.3	10.5*	6.4
95% CI	15.2-24.3	19.3-30.1	6.0-25.7*	5.4-8.4
Number ≥ 2				
Males	14	5	19	8
Females	17	18	15	8
MM:100FF	82.4	27.8	126.7	100.0
Number ≥ 5				
Males	10	4	9	3
Females	14	13	10	6
MM:100FF	71.4	30.8	90.0	50.0
Number ≥ 10				
Males	6	2	3	0
Females	7	6	4	4
MM:100FF	85.7	33.3	75.0	0
Mean age ≥ 2				
Males	9.9	11.0	6.4	4.1
Females	10.2	10.5	7.0	8.3
Median age ≥ 2				
Males	9	8	4	2.5
Females	7	8	5	7.5

Table 5. Continued

	Su-hydro Area		Denali Hwy. Area	
	1985	1995	1979*	1987
Mean age ≥ 5				
Males	12.4	13.2	9.7	7.3
Females	11.9	13.1	8.7	10.7
Median age ≥ 5				
Males	10	11.5	9	8
Females	9	9	8	8.5
Number age 0 cubs	12	9	2	1
Number age 1 cubs	10	12	12	9
Number age 2 cubs	2	11	1	5
Total age 0-2	24	32	15	15
Cubs aged 0-2 as % of total population age 5.0+	100.0	188.2	78.9	166.7
Cubs aged 0-2 as % of female population age 5.0+	171.4	246.1	150.0	250.0

* Technique used to obtain the 1979 estimate was different from the other studies. Raw CMR estimate was reduced by 28% to compensate for suspected bias based on failure of closure assumption (Miller 1990a). Reported results are for bears >/= 2.0 rather than for "independent" bears.

Table 6 Brown bear population composition during 1985 density estimation in the Su-hydro (Midsu) study area. Composition is based on bears present at least once in the study area weighted by number of times the individual was known to be present in the study area.

Bear ID	Sex & Assoc.	Age (a)	Number of times present (n)	(a) Bears ≥2	(n) ≥ 5 only
420	F w/ 2@2	20	1	20	20
340	F w/ 2@1	7	4	28	28
314	F w/ 1@1	7	7	49	49
337	F w/ 2@1	17	3	51	51
423	F w/ 3@1	21	4	84	84
381	F w/ 2@0	6	1	6	6
281	F w/ 2@0	8	7	56	56
396	F w/ 2@0	15	7	105	105
425	F w/ 2@0	15	7	105	105
388	F w/ 2@0	16	7	112	112
437	F alone	2	6	12	
398	F alone	4	7	28	
397	F alone	4	4	16	
385	F alone	4	1	4	
447	F alone	7	3	21	21
273	F alone	9	3	27	27
341	F alone	10	4	40	40
n =	17		76	764	
421	M	2	5	10	
382	M	3	5	15	
427	M	3	7	21	
339	M	4	1	4	
422	M	7	4	28	28
443	M	8	1	8	8
214	M	9	4	36	36
282	M	9	7	63	63
280	M	10	2	20	20
399	M	11	6	66	66
442	M	13	1	13	13
309	M	17	3	51	51
347	M	18	1	18	18
400	M	22	6	132	132
n =	14		53	485	

Table 6 Continued

for bears ≥ 2	
weighted proportion FF =	0.59
SE =	0.09
for bears ≥ 5	
weighted proportion FF =	0.45
SE =	0.07

	MM:100 FF	Mean age		Median age	
		Males	Females	Males	Females
All ages	69.7	9.2	10.1	9	8
≥ 5 only	53.0	12.4	10.7	10	15

Table 7. Brown bear population composition during 1995 density estimation in the Su-hydro (Midsu) study area. Composition is based on bears present at least once in the study area weighted by number of times the individual was known to be present in the study area.

Bear ID	Sex & Assoc.	Age (a)	Number of times present (n)	(a) Bears ≥2	(n) ≥ 5 only
520	F w/ 2@2	9	5	45	45
437	F w/ 2@2	12	5	60	60
484	F w/ 1@1	6	5	30	30
525	F w/ 2@1	7	2	14	14
486	F w/ 2@1	8	5	40	40
496	F w/ 1@1	9	2	18	18
306	F w/ 3@1	18	1	18	18
283	F w/ 1@1	27	5	135	135
uncapt.	F w/ 2@1	?	1	--	--
499	F w/ 1@0	8	5	40	40
314	F w/ 3@0	17	4	68	68
281	F w/ 2@0	18	5	90	90
522	F w/ sibs.	2	4	8	
501	F alone	4	1	4	
506	F alone	4	5	20	
507	F alone	4	5	20	
491	F alone	4	4	16	
503	F alone	4	3	12	
518	F alone	5	1	5	5
337	F alone	27	5	135	135
n =	20		73		
521	M	2	2	4	
523	M	8	2	16	8
493	M	8	5	40	32
524	M	15	3	45	30
280	M	20	3	60	60
n =	5		15		

Table 7 Continued

			for bears ≥ 2 weighted proportion FF =	0.83	
			SE =	0.08	
			for bears ≥ 5 weighted proportion FF =	0.58	
			SE =	0.07	
	MM:100 FF		Mean age	Median age	
		Males	Females	Males	Females
All ages	20.6	11.0	11.6	8	8
≥ 5 only	26.0	12.4	15.1	8	12

Table 8. Brown bear population composition during 1987 density estimation in the Denali Highway study area. Composition is based on bears present at least once in the study area weighted by number of times the individual was known to be present in the study area.

Bear ID	Sex & Assoc.	Age (a)	Number of times present (n)	(a)(n)	
				All bears	≥ 5 only
469	F w/ 2@1	6	2	12	12
482	F w/ 3@1	7	1	7	7
460	F w/ 1@1	8	1	8	8
478	F w/ 2@1	9	2	18	18
458	F w/ 1@0	18	4	72	72
477	F alone	2	4	8	
459	F alone	4	3	12	
472	F alone	12	6	72	72
470	M	2	3	6	
476	M	2	5	10	
480	M	2	3	6	
474	M	3	2	6	
471	M	5	6	30	30
457	M	8	1	8	8
455	M	9	3	27	27
			for bears ≥ 2 weighted proportion FF =	0.50	
			SE =	0.13	
			for bears ≥ 5 weighted proportion FF =	0.35	
			SE =	0.09	

	MM:100 FF	Mean age		Median age	
		Males	Females	Males	Females
All ages	100	4.0	9.1	3	9
≥ 5 only	62.5	7.3	11.8	5	12

Table 9. Changes in composition of brown bear population in 2 study area in GMU 13E based on captures of bears ≥ 3 years old when first captured (age = age of first capture at age ≥ 3).

	Mid-Susitna (Su-hydro) study area			Upper Susitna study area	
	1980-83	1980-85	1993-95*	1978-79	1986-87
Bears ≥ 3 years old					
No. of males	16	20	16	19	5
No. of females	24	28	30	18	15
Males/100 females	66.7	71.4	53.3	105.6	33.3
Mean age of males	8.5	8.2	7.1	6.2	5.2
Median age of males	9.0	8.5	5	4	5
Mean age of females	7.6	8.7	11.0	6.8	7.3
Median age of females	6	8	7	5	6
Bears ≥ 5 years old					
No. of males	12	14	9	7	3
No. of females	16	20	21	11	11
Males/100 females	75.0	70.0	42.9	63.6	27.3
Mean age of males	10.1	10.2	9.9	10.7	6.7
Median age of males	9	9	9	9	7
Mean age of females	9.9	11.0	14.3	8.7	8.7
Median age of females	10	11	15	9	7

* Includes 8 adult females radio-marked and tracked since earlier studies during 1980-1985 (314 @ 15, 335 @ 16, 273 and 281 @ 17, 283 and 340 @ 25, 337 @ 28, and 423 @ 29; indicated age is age when recaptured to replace collar). Without these bears, the mean and median ages for the 16 other females ≥ 3 would be 10.0 and 6.5 and for the 8 other females ≥ 5 mean and median ages would be 16.1 and 12.0.

Table 10. Comparison of results from different techniques for measuring composition of brown bear populations in Subunit 13E. "Snapshot" is based on bears present at least once in the density estimation area during the density estimation period (see Table 4). "Weighted snapshot" is based on same bears as the snapshot but each individual is weighted by the number of times it was know to be present in the density estimation area (see Tables 5-7). Composition based on "captures" includes all bears captured in the density estimation area and a surrounding periphery zone during 2-5 years of capture effort (see Table 8).

	Su-hydro Area		Denali Hwy. Area	
	1985	**1995**	**1979***	**1987**
Males:100 Females				
Bears ≥ 2				
Snapshot	82.4	27.8	126.7	100
weighted snapshot	69.7	20.6	--	100
captures ≥ 3	71.4	53.3	105.6	33.3
Males:100 Females				
Bears ≥ 5				
Snapshot	71.4	30.8	90.0	50.0
weighted snapshot	53.0	26.0	--	62.5
captures ≥ 3	70.0	42.9	63.6	27.3
Mean Age				
Males ≥ 2				
Snapshot	9.9	11.0	6.4	4.1
weighted snapshot	9.2	11.0	--	4.0
captures ≥ 3	8.2	7.1	6.2	5.2
Males ≥ 5				
Snapshot	12.4	13.2	9.7	7.3
weighted snapshot	12.4	12.4	--	7.3
captures	8.2	7.1	6.2	5.2
Females ≥ 2				
Snapshot	10.2	10.5	7.0	8.3
weighted snapshot	10.1	11.6	--	9.1
captures ≥ 3	8.7	11.0	6.8	7.3
Females ≥ 5				
Snapshot	11.9	13.1	8.7	10.7
weighted snapshot	10.7	15.1	--	11.8
captures	11.0	14.3	8.7	8.7

Table 10. Continued

	Su-hydro Area		Denali Hwy. Area	
	1985	1995	1979*	1987
Median Age				
Males ≥ 2				
Snapshot	9	8	4	2.5
weighted snapshot	9	8	--	3
captures ≥ 3	8.5	5	4	5
Males ≥ 5				
Snapshot	10	11.5	9	8
weighted snapshot	10	8	--	5
captures	9	9	9	7
Females ≥ 2				
Snapshot	7	8	5	7.5
weighted snapshot	8	8	--	9
captures ≥ 3	8	7	5	6
Females ≥ 5				
Snapshot	9	9	8	8.5
weighted snapshot	15	12	--	12
captures	11	15	9	7

Table 11. Brown bear population estimates (bears of all ages) in GMU 13 subunits. Changes between 1987 and 1995 result from changes in the strata where population estimates were based on the 1985 density estimate in the Su-hydro area to reflect the new estimate obtained in this area during 1995. Area of each unit reduced by 6.1% to reflect elevations >5,000 feet not considered bear habitat (follows Miller 1990:87).

	Bears of all ages		Bears ≥ 2 only		Independent bears	
Subunit	1987[1]	1995[2]	1987[1]	1995[3]	1987[1]	1995[4]
13A	233	337	157	256	157	209
13B	149	160	96	122	96	99
13C	112	108	75	82	75	67
13D	371	387	251	294	251	240
13E	364	465	244	353	244	288
Total	1229	1456	823	1197	823	903

[1] From Miller (1990*c*:87); in the 1985 and 1987 density estimates, number of independent bears = number of bears ≥2.

[2] Based on Miller (1990c except for modifications based on 1995 density estimate in Su-hydro area.

[3] Based on assumption from the 1995 density estimate that the density of bears ≥2 is 76% of the estimate of bears of all ages (31 bears ≥2/1,000 km^2 ÷ 41 bears all ages/1,000 km^2).

[4] Number of independent bears calculated as 62% of estimated number of bears of all ages (based on 1985 and 1995 population estimates in the Su-hydro area where the estimated number of independent bears was 69.4% and 57.2%, respectively, of the estimated number of bears of all ages).

Table 12. Comparison of number of hours spent searching for each independent bear seen in 1985 and 1995 density estimation efforts in the Su-hydro study area (MIDSU) (1,325 km^2 including 8 km^2 above 5,000 feet elevation), in the 1987 density estimate in the Denali Highway study area (UPSU) (1,309 km^2 including 51.7 km^2 above 5,000 feet elevation) and during 1996 capture efforts in the new 13A study area (area searched not estimated). During 1985, 1987, and 1995 density estimates, area above 5,000 feet elevation were searched but were not considered as bear habitat for purposes of density calculations.

	REP. 1	REP. 2	REP. 3	REP. 4	REP. 5	REP. 6	REP. 7	TOTALS
MINUTES OF SEARCH (1995)	1,355	1,548	1,491	1,459	1,787			7,640
NO. INDEPENDENT BEARS SEEN (1995)	6	12	15	9	11			53
HRS/IND. BEAR (1995)	3.76	2.15	1.66	2.70	2.71			2.40
MIN/KM^2	1.02	1.17	1.13	1.10	1.35			1.15
MINUTES OF SEARCH(1985)[1]	870	1067	935	1,083	933	1,232	797	6,917
NO. INDEPENDENT BEARS SEEN (1985)	5	1	7	9	9	6	5	42
HRS/IND. BEAR (1985)	2.9	17.8	2.23	2.01	1.73	3.42	2.66	2.74
MIN/KM^2	0.66	0.81	0.71	0.82	0.70	0.93	0.60	0.75
MINUTES OF SEARCH(1987)[2]	1,097	1,037	1,295	1,333	1,293	1,512	1,419	8,986
NO. INDEPENDENT BEARS SEEN (1987)	5	4	4	3	3	6	3	37
HRS/IND. BEAR (1987)	3.66	4.32	5.40	7.41	7.18	4.20	7.88	4.05
SECONDS/KM^2	50	47	59	61	59	70	65	59
MINUTES OF SEARCH(1996)[3]	765	628	628	813	750	657	737	4,978
NO. INDEPENDENT BEARS SEEN (1996)[3]	6	4	10	4	2	5	10	41
HRS/IND. BEAR (1996)[3]	2.13	2.62	1.1	3.4	6.25	2.19	1,23	2.02

[1] From Miller (1987:227)

[2] From Miller (1988:38)

[3] Data were collected during capture efforts which are more efficient at finding bears than effort during density estimation procedures. These data are not directly comparable to that collected during density estimates.

Table 13. Summary of Nelchina Basin brown bear litter size data for cub-of-the-year (based on spring observations of radio-collared bears), 1978-92 (spring).

Bear ID (year-age)	Litter Size(COY) (year)	Comments	Usable Summary
206 (1978, 13)	3 (1979)	Lactating female with male in 1978, during last observation prior to shedding collar the cubs were not seen but undergrowth was thick (6/17/79).	none
207 (1978, 11)	3 (1978)	When last seen on 10/7/78 had all three cubs on 5/31/79, had only 1 ylg. which stayed with her until last observation on 9/12/79.	2 of 3 lost
213 (1978, 10)	2 (1979)	Lost apparent ylg. due to 1978 capture, had newborns when transplanted in 1979, lost these 8-16 days after release, bear apparently died in study area after return.	none-transplant bias
231 (1979, 13)	3 (1979)	Turgid in 1978, bred, lost 2 of 3 cubs by 6/11/79, survivor lived at least until last observation on 8/3/79 (no exit data in 1980).	2 of 3 lost
273 (1987, 11)	3 (1987)	Survived to exit	0 of 3 lost
273 (1991, 15)	3 (1991)	Survived	0 of 3 lost
273 (1994, 18)	3 (1994)	Lost 3 in May	3 of 3 lost
273 (1995, 19)	3 (1995)	Lost 1 in May-June	1 of 3 lost
281 (1983, 6)	2 (1983)	Both killed by brown bear by 6/1/83, cubs collared	2 of 2 lost
281 (1984, 7)	2 (1984)	Lost both in May, 1 suspected killed by brown bear, other unknown (accidental drowning?), collared cubs.	2 of 2 lost
281 (1985, 8)	2 (1985)	Lost 1 in June, other survived	1 of 2 lost
281 (1988, 11)	2 (1988)	Both survived	0 of 2 lost
281 (1992, 15)	2 (1992)	Lost 1 in May	1 of 2 lost
281 (1995, 18)	2 (1995)	Mom and coy(?) died, August (2)	2 of 2 lost

Continued on next page

Table 13. Continued

Bear ID (year-age)	Litter Size(COY) (year)	Comments	Usable Summary
283 (1981, 13)	2 (1981)	Weaned 2 @2 in 1980, lost 1 cub by 9/1 other lost as ylg.	1 of 2 lost
283 (1983, 15)	1 (1983)	Killed by brown bear by 5/17/83, cub was collared	1 of 1 lost
283 (1985, 17)	2 (1985)	Both survived to den exit	0 of 2 lost
283 (1989, 21)	2 (1989)	Both survived to den exit	0 of 2 lost
283 (1992, 24)	1 (1992)	Lost after June	1 of 1 lost
283 (1994, 26)	1 (1994)	Survived	0 of 1 lost
299 (1982, 15)	1 (1982)	Bear weaned 2 @ 2 in 1981, cub lost by 6/9/82	1 of 1 lost
299 (1983, 16)	3 (1983)	All cubs collared, alive to den exit	0 of 3 lost
306 (1993, 16)	1 (1993)	Capture-related loss (?)	none
306 (1994, 17)	3 (1994)	Survived	0 of 3 lost
312 (1981, 11)	2 (1981)	Had a 2-year-old in 1980, lost 1 cub by 6/18, other weaned in 1983.	1 of 2 lost
312 (1984, 14)	3 (1984)	Capture-related losses (collared)	none
313 (1981, 10)	1 (1981)	Bear had a 2-year-old offspring in 1980, lost cub (possible capture-related)	1 of 1 lost (capture related?)
313 (1982, 11)	2 (1982)	Both survived	0 of 2 lost
314 (1987, 9)	3 (1987)	Lost 1 in late summer, other survived	1 of 3 lost
314 (1990, 12)	2 (1990)	Lost 1 in May naturally, other capture loss	1 of 1 lost
314 (1991, 13)	3 (1991)	Survived to den exit	0 of 3 lost

Continued on next page

Table 13. Continued

Bear ID (year-age)	Litter Size(COY) (year)	Comments	Usable Summary
314 (1994, 16)	3 (1994)	Lost in June, bred	3 of 3 lost
314 (1995, 17)	3 (1995)	Survived	0 of 3 lost
335 (1984, 6)	2 (1984)	Both survived to den exit	0 of 2 lost
335 (1988, 10)	2 (1988)	Survived	0 of 2 lost
335 (1993, 15)	2 (1993)	1 lost in July	1 of 2 lost
335 (1996, 18)	3 (1996)	--	--
337 (1981, 13)	3 (1981)	Cubs and female reunited, 1 cub lost in 81/82 den, other 2 survived to exit (1 weaned in 1983, other lost as ylg).	1 of 3 lost
337 (1984, 16)	2 (1984)	Both survived to den exit, collared cubs	0 of 2 lost
340 (1984, 6)	2 (1984)	Both survived to den exit, collared cubs	0 of 2 lost
340 (1987, 9)	3 (1987)	Lost all in early summer, bred	3 of 3 lost
340 (1988, 10)	2 (1988)	Lost 1 in summer	1 of 2 lost
340 (1991, 13)	3 (1991)	Survived to den exit	0 of 3 lost
340 (1994, 16)	2 (1994)	Mom shot in Sept.	2 of 2 lost
341 (1982, 7)	2 (1982)	Survived until 7/15/82 when bear was lost	none
341 (1986, 11)	1 (1986)	Survived	0 of 1 lost
344 (1981, 5)	2 (1981)	Both lost in '82 as yearlings	0 of 2 lost
344 (1983, 7)	2 (1983)	Lost 1 in early July - other survived to den exit.	1 of 2 lost
379 (1982, 5)	2 (1982)	Both survived	0 of 2 lost

Continued on next page

Table 13. Continued

Bear ID (year-age)	Litter Size(COY) (year)	Comments	Usable Summary
381 (1985, 6)	2 (1985)	Survived to exit	0 of 2 lost
381 (1988, 9)	3 (1988)	Survived to exit	0 of 3 lost
384 (1984, 13)	2 (1984)	Survived to September at least	0 of 2 lost
388 (1984, 15)	2 (1984)	Capture-related losses (collared)	none
388 (1985, 16)	2 (1985)	Survived to den exit	0 of 2 lost
388 (1988, 19)	2 (1988)	Survived to exit	0 of 2 lost
388 (1993, 24)	1 (1993)	Lost in July	1 of 1 lost
393 (1996, 15)	3 (1996)	--	--
394 (1983, 6)	1 (1983)	Lost (capture-related?) by 5/16, bred	1 of 1 lost (capture related?)
396 (1984, 14)	1 (1984)	Lost in May	1 of 1 lost
396 (1985, 15)	2 (1985)	Lost both in June, bred	2 of 2 lost
396 (1989, 19)	3 (1989)	All survived to exit, very large	0 of 3 lost
396 (1993, 23)	3 (1993)	Survived thru Sept.	--
403 (1983, 6)	2 (1983)	Lost 1 in Sept., other OK to den exit	1 of 2 lost
403 (1986, 9)	3 (1986)	2 survived to exit	1 of 3 lost
420 (1986, 21)	2 (1986)	Both lost in mid-summer	2 of 2 lost
423 (1984, 21)	4 (1984)	One died in July (collared), others OK to den exit	1 of 4 lost
423 (1987, 24)	1 (1987)	Lost in early summer	1 of 1 lost

Continued on next page

Table 13. Continued

Bear ID (year-age)	Litter Size(COY) (year)	Comments	Usable Summary
425 (1985, 14)	2 (1985)	Survived	0 of 2 lost
425 (1988, 17)	1(1988)	Lost in June	1 of 1 lost
425 (1989) 18	2 (1989)	Suspect shot in fall	none
447 (1986, 8)	2 (1986)	Lost contact (shed collar)	none
453 (1986, 4)	2 (1986)	Both survived to exit	0 of 2 lost
454 (1987, 5)	2 (1987)	Unknown survival (shed collar)	none
456 (1986, 6)	2 (1986)	Cubs lost in den?	2 of 2 lost
458 (1987, 18)	1 (1987)	Lost in mid-summer	1 of 1 lost
458 (1988, 19)	3 (1988)	Survived thru Sept., shed in spring	0 of 3 lost?
460 (1986, 7)	2 (1986)	1 lost due to capture	none
460 (1989, 10)	2 (1989)	Survived to exit	0 of 2 lost
460 (1994, 15)	2 (1994)	Survived	0 of 2 lost
461 (1986, 5)	1 (1986)	Lost due to capture	none
461 (1987, 6)	2 (1987)	1 lost in mid-summer, other survived	1 of 2 lost
461 (1990, 9)	2 (1990)	1 lost in June - October	1 of 2 lost
461 (1993, 12)	3 (1993)	Survived	0 of 3 lost
462 (1987, 8)	2 (1987)	Survived	0 of 2 lost
484 (1994, 5)	2 (1994)	1 lost in August	1 of 2 lost
485 (1994, 6)	2 (1994)	Survived	0 of 2 Lost
486 (1994, 7)	2 (1994)	Survived	0 of 2 lost

Continued on next page

Table 13. Continued

Bear ID (year-age)	Litter Size(COY) (year)	Comments	Usable Summary
488 (1993, 12)	2 (1993)	??	none
496 (1994, 8)	3 (1994)	2 lost in July	2 of 3 lost
498 (1993, 20)	2 (1993)	Survived	0 of 2 lost
499 (1995, 8)	1 (1995)	Survived	0 of 1 lost
501 (1996, 5)	2 (1996)	--	--
503 (1996, 5)	1 (1996)	--	--
507 (1996, 5)	1 (1996)	--	--
509 (1997, 7)	2 (1996)	--	--

Summary

No. of cubs	No of litters	Mean litter size (range)	58 of 159 cubs lost in first year of life = 36.5% (2 of these possibly capture-related).
199	94	2.12 (1-4)	

Table 14. Summary of Nelchina Basin brown bear litter size data for litters of yearlings (based on spring observation of radio-collared bears), 1978-1992 (spring).

Bear ID (year-age)	Litter Size (ylgs.) (year)	Comments	Summary
207 (1978, 11)	1 (1979)	Survived until 9/12/79	0 of 1 lost
213 (1978, 10)	1 (1978)	Apparent ylg. was not captured, had cubs following year	1 of 1 lost (capture related?)
220 (1978, 5)	1 (1978)	Ylg. entered den and was weaned in 1979, bred	0 of 1 lost
221 (1978, 8)	2 (1978)	Survived, weaned in 1979	0 of 2 lost
231 (1978, 12)	1 (1979)	Survived until 8/79	none
234 (1978, 5)	2 (1978)	Paxson dump bear, lost apparent ylgs. between 6/23/78 and 8/4/78, reportedly had cubs in August 1979, radio failed	none
240 (1979, 5)	2 (1979)	Bear transplanted with ylgs., not known if ylgs. survived to return to study area, bear was alone on 7/18/80	none
244 (1979, 6)	1 (1979)	Thin female transplanted with ylg, ylg. survived at least 21 days, female bred, but alone in July and August 1980	none-transplant bias
251 (1979, 10)	2 (1979)	Very large ylgs. lost 10-17 days after transplant, bear had no cubs in 1980 (August)	none-transplant bias
254 (1979, 9)	2 (1979)	Female died after transplant (ylgs.??)	none
261 (1979, 7)	2 (1979)	Lost 1 ylg. between 1 and 7 days after transplant, other survived at least until Sept., didn't return to study area	none-transplant bias
269 (1979, 16)	2 (1979)	Transplanted, returned to study area with female, no cubs on 9/29/80, shot in fall 1981 reportedly without cubs	none-transplant bias
273 (1988, 12)	3 (1988)	Survived	0 of 3 lost

continued on next page

Table 14. Continued.

Bear ID (year-age)	Litter Size (ylgs.) (year)	Comments	Summary
273 (1992, 16)	3 (1992)	--	--
273 (1996, 20)	2 (1996)	--	NA
274 (1979, 11)	1 (1979)	Transplanted, no radio	none
277 (1980, 10)	2 (1980)	Ylgs. visually aged, not captured, survived to enter den, no exit data as bear shed collar in den	0 of 2 lost
281 (1986, 9)	1 (1986)	Survived, weaned next year	0 of 1 lost
281 (1989, 12)	2 (1989)	Survived	0 of 2 lost
281 (1993, 16)	1 (1993)	Survived thru Sept.	0 of 1 lost
283 (1982, 140)	1 (1982)	Lost by 5/18/82	1 of 1 lost
283 (1986, 18)	2 (1986)	Survived, weaned next year	0 of 2 lost
283 (1990, 22)	2 (1990)	Survived, weaned next year	0 of 2 lost
283 (1995, 27)	1 (1995)	Lost in May	1 of 1 lost
299 (1980, 13)	2 (1980)	Both survived, weaned next year	0 of 2 lost
299 (1984, 17)	2 (1984)	Survived with internals to exit from den	0 of 3 lost
306 (1995, 18)	3 (1995)	Mom shot 9/95	3 of 3 lost *
312 (1982, 12)	1 (1982)	Survived, weaned next year	0 of 1 lost

continued on next page

Table 14. Continued.

Bear ID (year-age)	Litter Size (ylgs.) (year)	Comments	Summary
313 (1983, 120)	2 (1983)	Lost 1 (surgery related?) by 6/2/83, other survived through October	0 of 1 lost
314 (1988, 10)	2 (1988)	Survived to exit	0 of 2 lost
314 (1985, 7)	1 (1985)	Survived to den exit	0 of 1 lost
314 (1992, 14)	3 (1992)	Survived	0 of 3 lost
314 (1996, 18)	3 (1996)	--	--
335 (1985, 7)	2 (1985)	1 lost in June, other survived to exit	1 of 2 lost
335 (1989, 11)	2 (1989)	Survived	0 of 2 lost
335 (1994, 16)	1 (1994)	Survived	0 of 1 lost
337 (1982, 14)	2 (1982)	Lost 1 by 6/17/82, other survived	1 of 2 lost
337 (1985, 17)	2 (1985)	Survived to den exit	0 of 2 lost
340 (1985, 7)	2 (1985)	Survived to October at least	0 of 2 lost (?)
340 (1989, 11)	1 (1989)	Survived through October at least	0 of 1 lost (?)
340 (1992, 14)	3 (1992)	Survived	0 of 3 lost
341 (1987, 12)	1 (1987)	Survived	0 of 1 lost
344 (1982, 6)	2 (1982)	Lost 1 by 6/17, other by 7/26/82	2 of 2 lost
344 (1984, 8)	1 (1984)	Lost 1 in May, sibling lost year before	1 of 1 lost

continued on next page

Table 14. Continued.

Bear ID (year-age)	Litter Size (ylgs.) (year)	Comments	Summary
379 (1983, 6)	2 (1983)	Lost 1 in June-September period	1 of 2 lost
380 (1982, 15)	2 (1982)	Both survived to den entrance, at least 1 exited den and was weaned	0 of 2 lost
381 (1986, 7)	2 (1986)	Survived, weaned next year	0 of 2 lost
381 (1989, 10)	3 (1989)	Mother shot in fall	0 of 2 slot
388 (1986, 17)	2 (1986)	Survived, weaned next year	0 of 2 lost
388 (1989, 20)	2 (1989)	Survived to lost	0 of 2 lost
396 (1990, 22)	3 (1990)	Survived	0 of 3 lost
403 (1984, 7)	1 (1984)	Survived through November at least	0 of 1 lost
403 (1987, 10)	2 (1987)	--	--
420 (1984, 19)	2 (1984)	Survived to den exit	0 of 3 lost
423 (1985, 22)	3 (1985)	All survived to den exit	0 of 3 lost
425 (1986, 15)	2 (1986)	Both lost in mid-summer - possibly capture related. Not seen until 6 weeks following capture. Bred in 1987.	none
453 (1987, 5)	2 (1987)	Survived to exit	0 of 2 lost
460 (1987, 8)	1 (1987)	Survived until September, assume weaned at 2 and was shot the next fall	0 of 1 lost
460 (1990, 11)	2 (1990)	Survived to den exit	0 of 2 lost
460 (1991, 10)	1 (1991)	Survived to den exit	0 of 1 lost

continued on next page

Table 14. Continued.

Bear ID (year-age)	Litter Size (ylgs.) (year)	Comments	Summary
461 (1988, 8)	1 (1988)	?	?
461 (1994, 13)	3 (1994)	Survived	0 of 3 lost
462 (1988, 9)	2 (1988)	Survived	0 of 2 lost
469 (1987, 6)	2 (1987)	Survived until mid-summer	--
472 (1987, 12)	1 (1987)	Collar removed, lost control	none
478 (1987, 9)	2 (1987)	--	--
481 (1987, 14)	3 (1987)	At least 2 survived to exit	0 of 2 lost (?)
482 (1987, 7)	3 (1987)	Collar removed, lost contact	none
484 (1995, 6)	1 (1995)	Survived	0 of 1 lost
485 (1995, 7)	2 (1995)	--	--
486 (1995, 8)	2 (1995)	Survived	0 of 2 lost
496 (1993, 7)	1 (1993)	Capture loss?	none
496 (1995, 9)	1 (1995)	Survived	0 of 1 lost
498 (1994, 21)	2 (1994)	Survived	0 of 2 lost
499 (1996, 9)	1 (1996)	--	--
517 (1994, 18)	2 (1994)	Survived	0 of 2 lost
523 (1996, ~18)	2 (1996)	--	--
525 (1995, 7)	2 (1995)	Survived	0 of 2 lost

continued on next page

Table 14. Continued.

Bear ID (year-age)	Litter Size (ylgs.) (year)	Comments	Summary
536 (1996, ~ 9)	1 (1996)	--	--
546 (1996, ~ 15)	1 (1996)	Separated in June? (@2?)	--

* Mom shot

Summary

No. of yearlings	No. litters	Mean litter size (range)	
146	80	1.83 (1-3)	12 of 99 lost = 12.1% (1 loss possibly capture-related; 3 "losses" when mom shot)

Table 15. Summary of Nelchina Basin bear litter size data for litters of 2-year olds (based on observations of radio-collared bears).

Bear ID (year-age)	2-year old Litter Size (year)	Comments
204 (1978, 7)	2 (1978)	weaned by 6/19/78, bred
220 (1978, 5)	1 (1979)	weaned by 6/17, bred
221 (1978, 8)	2 (1979)	--
269 (1979, 16)	2? (1980)	--
273 (1989, 13)	2 (1989)	--
281 (1987, 10)	1 (1987)	weaned by 6/5
281 (1990, 13)	2 (1990)	weaned, bred
283 (1980, 12)	2 (1980)	weaned in mid-June, bred, new litter next year
283 (1987, 19)	2 (1987)	2(+?) still with mother in '88, weaned next year
283 (1991, 22)	2 (1991)	weaned in spring
299 ((1980, 13)	2 (1981)	weaned in 5/81. new litter in 1982
312 (1980, 10)	1 (1980)	weaned right after capture in May, new litter in 1981
312 (1983, 13)	1 (1983)	weaned by 6/13, bred
313 (1980, 9)	1 (1980)	weaned by May, bred, new litter in 1981
313 (1984, 13)	1 (1984)	weaned in May, bred

continued on next page

Table 15. Continued.

Bear ID (year-age)	2-year old Litter Size (year)	Comments
314 (1986, 8)	1 (1986)	weaned
314 (1989, 11)	2 (1989)	weaned
314 (1993, 15)	2 (1993)	weaned in June, bred
331 (1981, 6)	2 (1981)	weaned by 6/15, bred, no cubs in 1982, died in 1982 (reason?)
334 ((1996, 24)	2 (1996)	--
335 (1990, 12)	2 (1990)	not weaned
335 (1995, 17)	1 (1995)	weaned in June-July
337 (1983, 15)	1 (1983)	weaned by 5/15, bred
337 (1986, 18)	2 (1986)	still with mother in 86/87 den, weaned next year
340 (1993, 15)	3 (1993)	weaned in May, bred
341 (1988, 13)	1 (1989)	--
379 (1984, 7)	1 (1984)	apparently weaned cub (time?), bred
381 (1987, 8)	2 (1987)	weaned in spring
384 (1983, 12)	3 (1983)	weaned by 6/13, one of these 3 may not have been part of this litter, bred
388 (1983, 14)	2 (1983)	weaned by 6/13, bred

continued on next page

Table 15. Continued.

Bear ID (year-age)	2-year old Litter Size (year)	Comments
388 (1987, 18)	2 (1987)	weaned by 6/23
388 (1990, 21)	2 (1990)	weaned, bred
396 (1983, 13)	2 (1983)	weaned by 6/1, bred
396 (1991, 21)	2 (1991)	Survived, not weaned
420 (1985, 20)	2 (1985)	weaned in May
423 (1986, 23)	3 (1986)	weaned
437 (1985, 12)	2 (1995)	weaned in May, bred
453 (1988, 6)	2 (1988)	shot in fall
460 (1991, 12)	2 (1991)	survived, not weaned
460 (1996, 17)	2 (1996)	--
461 (1989, 10)	2 (1989)	weaned, no more data
461 (1992, 13)	1 (1992)	still w/mom on 8/18/92
461 (1995, 16)	3 (1995)	weaned in June
481 (1988, 15)	2 (1988)	??
484 (1996, 7)	1 (1996)	--
486 (1996, 9)	2 (1996)	weaned in May, bred
496 (1996, 10)	1 (1996)	--

Table 15. Continued.

Bear ID (year-age)	2-year old Litter Size (year)	Comments
498 (1995, 22)	2 (1995)	weaned in May, bred
517 (1995, 19)	2 (1995)	weaned in May
520 (1995, 9)	2 (1995)	weaned in May, bred
525 (1996, 8)	2 (1996)	--
550 (1996, ~ 12)	1 (1996)	--
556 (1996, ~ 12)	2 (1996)	--

Summary

No. of 2-year olds	No. of litters	Mean litter size (range)
95	53	1.79 (1-3)

Table 16. Summary of Nelchina Basin bear litter sizes for litters of 3- and 4-year-old offspring.

Bear ID (year-age)	3-year old Litter size (year)	Comments
337 (1987, 19)	2 (1987)	weaned
283 (1988, 21)	2 (1988)	weaned
273 (1990, 14)	2 (1990)	weaned > 10/91, <5/12/92, bred
335 (1991, 13)	2 (1991)	not weaned until next year
396 (1992, 22)	3 (1992)	weaned in June
460 (1992, 13)	2 (1992)	not weaned until next year
530 (1996, ~ 8)	2 (1996)	age of offspring pending

Bear ID (year-age)	4-year old Litter Size (year)	Comments
335 (1992, 14)	2 (1992)	weaned in June
460 (1993, 14)	2 (1993)	weaned in June, bred

Table 17. Morphometrics of brown bear cubs-of-the-year handled in GMU13, 1978-96.

Cub ID	Mother's ID	Date Handled	Sex	Wt (lbs)	Comments
001	G213	22 May 1979	M	10.0	transplanted see Spraker
002	G213	22 May 1979	M	10.0	et al. (1981)
--	G207	27 May 1978	M	12.0	see Spraker, et al. (1981)
--	G207	27 May 1978	F	12.0	
G338	G283	6 May 1981	M	12.0	ear tagged
G339	G283	6 May 1981	F	13.0	ear tagged
G336	G313	6 May 1981	F	--	cub abandoned?, ear tagged
003	G283	14 May 1983	F	--	collared
004	394	15 May 1983	F	10.0	neck = 230mm, ear tagged
005	G281	15 May 1983	M	8.5	collared
006	G281	15 May 1983	F	8.3	collared
418	G299	18 May 1983 (den)	M	>10	neck = 225mm, collared
419	G299	18 May 1983 (den)	M	>10	neck = 245mm. collared
417	G299	18 May 1983 (den)	M	>10	neck = 225mm, collared
016	G388	16 May 1984	M	13.5	collared, 13.5 lbs (5/29/84)
017	G388	16 May 1984	F	--	collared
021	G281	17 May 1984	M	14.0	collared, neck = 250mm
022	G281	17 May 1984	M	13.5	collared
008	G337	17 May 1984	F	12.3	collared, neck = 220mm
009	G337	17 May 1984	F	11.5	collared, neck = 230mm
023	G340	17 May 1984	?	16.5	collared
024	G340	17 May 1984	?	14.0	collared
025	G423	18 May 1984	M	7.0	collared, smallest of 4 in litter
--	G423	18 May 1984	F	--	not collared
018	G312	16 May 1984	F	17.0	collared
019	G312	16 May 1984	M	16.0	collared
020	G312	16 May 1984	M	17.0	collared
--	G453	3 June 1986	F	15.0	ear tagged
--	G453	3 June 1986	F	17.0	ear tagged
--	G456	4 June 1986	M	33.0	ear tagged
--	G460	4 June 1986	M	30.0	capture mortality
--	G460	4 June 1986	F	30.0	ear tagged
--	G461	5 June 1986	M	26.0	ear tagged
--	G273	5 June 1987	F	16.0	ear tagged
--	G273	5 June 1987	M	18.0	ear tagged
511	G498	18 May 1993	F	18.0	ear tagged
512	G498	18 May 1993	M	21.0	ear tagged

Totals: 19 males and 16 females (x^2 = 0.61, 1d.f., $\underline{P}$ = 0.43)

Table 18. Morphometrics of brown bears first handled as yearlings in GMU13, 1978-1996.

Yearling ID	Mother's ID	Date Handled	Sex	Wt (lbs)	Comments
G232	G234	23 June 1978	F	100 (est.)	Spraker, et al. (1981)
G235	G234	23 June 1978	F	100 (est.)	
G238	G240	23 May 1979	M	95	transplanted, see Ballard
G239	G240	23 May 1989	F	65	et al. 1980
G245	G244	24 May 1979	F	46	transplanted, op cit.
G252	G251	27 May 1979	M	134	transplanted, op cit.
G253	G251	27 May 1979	M	139	
G256	G254	27 May 1979	M	47	transplanted, op cit.
G257	G254	27 May 1979	M	47	
G262	G261	2 June 1979	M	90	transplanted, op cit.
G263	G261	2 June 1979	M	87	
G270	G269	6 June 1979	F	100	transplanted, op cit.
G271	G269	6 June 1979	F	95	
G275	G274	7 June 1979	M	68	transplanted, op cit.
G297	G399	4 May 1980	M	65	tagged
G298	G399	4 May 1980	M	65	tagged
G382	G313	14 May 1983	M	66	implant transmitter
G383	G313	14 May 1983	F	53	implant transmitter, died
G417	G299	15 May 1984	M	94	implant transmitter, (small)
G418	G299	15 May 1984	M	86	implant transmitter, (large)
G419	G299	15 May 1984	M	84	implant transmitter, (small)
G421	G420	17 May 1984	M	78	sibling not captured, large implant and breakaway
G429	G314	1 June 1985	F	104	breakaway collar, shot 9/86
G463	G462	5 June 1986	M	90 (est.)	ear tagged
G468	G453	30 May 1987	F	70 (est.)	glue on radio
G475	G472	31 May 1987	M	75 (est.)	glue on radio
G497	G496	14 May 1993	F	80	13E --
G533	G532	16 May 1996	F	65 (est.)	13A --
G534	G532	16 May 1996	M	75 (est.)	13A --
G537	G536	17 May 1996	F	97	13A ear tag, radio
G547	G546	18 May 1996	F	140	13A --

Totals: 18 males and 13 females (x^2 = 0.37, 1d.f., P = 0.54)

Table 19. Age at first reproduction for GMU 13 brown bears

	Age						
ID No.	3	4	5	6	7	8	9
202	?	?	?	?	?	adult	adult
204	?	?	cubs	adult	adult	adult	adult
209	?	open	open[c]	open	?	?	?
215	open	open	?	?	?	?	?
219	?	open	?	?	?	?	?
220	?	cubs	adult	adult	adult	adult	adult
221	?	?	?	?	adult	adult	adult
234	?	cubs	adult	adult	adult	adult	adult
240	?	cubs	adult	adult	adult	adult	adult
244	?	?	cubs	adult	adult	adult	adult
248	?	open	?	?	?	?	?
261	?	?	?	adult	adult	adult	adult
264	?	open	?	?	?	?	?
267	?	open	?	?	?	?	?
273	open	?	?	?	?	?	?
277	?	?	?	?	?	?	adult
281	open	open	open	adult	adult	adult	adult
306	open	?	?	?	?	?	?
312	?	?	?	?	?	adult	adult
313	?	?	?	?	adult	adult	adult
314	?	?	?	adult	adult	adult	adult
315	open	?	open	open	?	?	?
331	?	cubs	adult	adult	adult	adult	adult
334	?	?	?	?	?	adult	adult
335	open	open	open	cubs	adult	adult	adult
340	open	open	open	cubs	adult	adult	adult
341	?	?	?	open[c]	adult	adult	adult
344	?	?	cubs	adult	adult	adult	adult
379	?	?	cubs	adult	adult	adult	adult
381	open	open	open	adult	adult	adult	adult
385	open	open	?	?	?	?	?
394	?	?	?	adult	adult	adult	adult
395	open	?	?	?	?	?	?
397	?	open	?	?	?	?	?
398	?	open	open	?	?	?	?
403	?	?	?	adult	adult	adult	adult
407	?	open	open	open	open	open	cubs?
447	?	?	?	?	open[c]	adult	adult
453	?	cubs	adult	adult	adult	adult	adult
454	?	?	cubs	adult	adult	adult	adult
456	?	?	?	cubs	adult	adult	adult
459	open	open	open	?	?	?	?
460	?	?	?	?	cubs	adult	adult
461	?	?	cubs	adult	adult	adult	adult
462	?	?	?	cubs	adult	adult	adult
465	open	open	open	?	?	?	?
469	?	?	cubs	adult	adult	adult	adult
478	?	?	?	?	?	adult	adult
482	?	?	?	cubs	adult	adult	adult

continued on next page

Table 19. Continued

	Age						
ID No.	3	4	5	6	7	8	9
484	?	open	cubs(94)	adult	adult	adult	adult
485	?	?	open	cubs(94)	adult	adult	adult
486	?	?	?	open[c]	cubs(94)	adult	adult
491	open	open	open	ND	--	--	--
495	open, shot	--	--	--	--	--	--
496	?	?	?	cubs	adult	adult	adult
499	?	?	open	open	open	cubs(95)	adult
501	open	open	cubs(96)	adult	adult	adult	adult
502	open	ND	ND	--	--	--	--
503	?	open	cubs(96)	adult	adult	adult	adult
504	?	?	open	ND	--	--	--
506	open	open	open, shot	--	--	--	--
507	open	open	cubs(96)	adult	adult	adult	adult
509	open	open	open	cubs(96)	adult	adult	adult
513	open	open, shot	--	--	--	--	--
518	?	open	open	--	--	--	--
520	?	?	?	?	cubs[c]	adult	adult
525	?	?	?	cubs	adult	adult	adult
526	?	open					?
528	?	?	open	?	?	?	?
530	?	cubs	adult	adult	adult	adult	adult
539	open,shot	--	--	--	--	--	--
541	?	?	?	open[c]			
549	?	?	?	?	open[c]		
555	?	open					
556	?	?	?	?	cubs[c]	adult	adult

[a] The following calculations exclude all question marks.

Age	3	4	5	6	7	8	9
# sub-adults	20	26	19	4	2	1	0
# 1st litters	0	6	11	10	2	1	1
# >1st litters	0	0	6	22	35	44	46
%≥1st litters	0.0	18.8	47.2	88.9	94.9	97.8	100.0

Mean age of first litter = 5.52 years.

continued on next page

Table 19. Continued

The following calculations correct for missing data by assuming litters were produced the following year for bears that died prematurely (when >5.5).

Age	3	4	5	6	7	8	9
# sub-adults	20	26	19	4	2	1	0
# 1st litters	0	6	11	15	3	1	1
# >1st litters	0	0	6	22	35	44	46
%≥ 1st litters	0.0	18.8	47.2	90.2	95.0	97.8	100.0

Mean age of first litter = 5.58 years.

[b] adult means first litter was at indicated age or younger.

[c] open means had no litter but not considered a subadult as could have had a previous, unobserved litter. Also means observed cubs not counted as could have had previous litter (e.g. 5.20).

Table 20. Summary of reproductive intervals for brown bears by bear ID. Based on data in Table 11, this report. Year litter was born and reason for intervals >3 years are indicated in parentheses; "lost" means lost complete litter at age coy unless otherwise indicated. Interval is defined as weaning of 1 litter to weaning of next litter or as from production of first litter to first weaning.

ID of Bears with Complete Intervals of:						
2 Years	3 Years		4 Years	5 Years	6 Years	8 Years
472*(85)	220(77)*	335(84)	313(82, 1 lost)	281(85, 2 lost)	335(87, skipped 1, weaned @ 4)	283(85, 1 lost @0, 1 lost @1; 1 weaned @ age 3, 1 skip)
221(77)*	340(84)	335(93)	340(88, lost 1)	460(89, weaned @ age =4)		337(84, weaned @ age = 3)
		299(83)				
	340(91)	337(81)	273(91, skipped 1)			
	314(84)*	337b(84)	281 (92, skipped 1)			
	314(87)	388(85)				
	314(91)	484(94)				
	380(81)*	388(88)				
	420(83)*	381(85)				
	379(82)	281(88)				
	423(84)	403(83)				
	299(79)*	453(86)				
	388(88)	461(87)				
	460(86)	461(90)				
	462(87)	461(93)				
	312(81)	481**(86)				
	283(89)	485(94)				
	273(87)	486(94)				
		496(94)				
		498(93)				
		517(93)*				

Table 20. Continued

Incomplete intervals that will be at least the indicated length:

3 Years	4 Years	5 Years	6 Years	7 Years	10+Years
273(94)	420(87, 1 lost)	403(1 lost @ age 1)		344(85, lost 2 @ age 1)	423**(27 in '90) (93, lost 1, skipped 6, died)
460(94)	331(83, skipped 1)	458(88, lost 1, skipped 1)		425(89, lost 1 @ age 1 and 1 @ 0, skipped 1)	396**(24 in '88)(94, lost 2, skipped 2, didn't wean until age 3
499(95)	341(86, skipped 1)	388(93, skipped 2, shot)		283**(age 24 in '92) (97, @ 0 lost, @ 1 lost, 1 skip)	337**(age 20 in '92) (97, skipped 9)
525(94)*	314(95, lost 1)				

* Litter was first observed when composed of 1-year olds.
** Interval not counted, bear reproductively senile.

Summary:

Reproductive Interval	Average
Complete Intervals Only (n = 47)	3.2 years
Incomplete Intervals Only>(3 years, but < 10 years, also excludes bear ≥ 23 years old) (n = 9)	5.0
Complete and Incomplete (n = 55)	3.5 years

Table 21. Reproductive histories (number of offspring by age of offspring) for radiomarked female brown bears in Alaska's Unit 13, 1978-1996.

Bear					Cubs		Yearlings		2-yr.-olds		3.5-yr.+		
ID	Area	Year	Age	Barren	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Comments
207	U	1978	11		3	3							Two lost in 798/79 den?
207	U	1979	12				1						
220	U	1978	5				1	1					
220	U	1979	5						1				Weaned
221	U	1978	8				2						Weaned
213	U	1978	12	X									
213	U	1979	13		3	1							2 lost in June, post transplant
273	M	1985	9	X									Age = 3 in 1979, translocated
273	M	1986	10	X									
273	M	1987	11		3	3							
273	M	1988	12				3	3					
273	M	1989	13						3	2			With mom in October
273	M	1990	14								2?	0	Not seen in spring
273	M	1991	15		3	3							
273	M	1992	16				3	?					
273	M	1993	17	X									
273	M	1994	18		3	0							
273	M	1995	19		3	2							
273	M	1996	20				2	2					
281	M	1980	3	X									
281	M	1981	4	X									
281	M	1982	5	X									
281	M	1983	6		2	0							Predation loss of cubs
281	M	1984	7		2	0							
281	M	1985	8		2	1							
281	M	1986	9				1	1					
281	M	1987	10						1	0			Weaned
281	M	1988	11		2	2							
281	M	1989	12				2	2					
281	M	1990	13						2	0			Weaned
281	M	1991	14	X									
281	M	1992	15		2	1							
281	M	1993	16				1	1					Ylg. seen in Sept.
281	M	1994	17						1	0			Assumed weaned
281	M	1995	18		2	0							Died, cub defense?
281	M	1996	19										
283	M	1980	12						2	0			Weaned
283	M	1981	13		2	1							
283	M	1982	14				1	0					
283	M	1983	15		1	0							
283	M	1984	16	X									
283	M	1985	17		2	2							
283	M	1986	18				2	2					
283	M	1987	19						2	2			
283	M	1988	20								2	0	Weaned at age 3

Table 21. Continued

Bear ID	Area	Year	Age	Barren	Cubs Spring	Cubs Fall	Yearlings Spring	Yearlings Fall	2-yr.-olds Spring	2-yr.-olds Fall	3.5-yr.+ Spring	3.5-yr.+ Fall	Comments
283	M	1989	21		2	2							
283	M	1990	22				2	2					
283	M	1991	23						2	0			Weaned
283	M	1992	24		1	0							
283	M	1993	25	X									
283	M	1994	26		1	1							
283	M	1995	27				1	0					Lost in May
283	M	1996	28	X									
299	M	1980	13				2	2					
299	M	1981	14						2	0			Weaned
299	M	1982	15		1	0							Lost in June
299	M	1983	16		3	3							
299	M	1984	17				3	3					
299	M	1985	18						3	?			Missing in May
306	M	1993	16		1	0							Prob. capture-related
306	M	1993	17		3	3							
306	M	1994	18				3	?					Shot in fall, ylgs?
308	M	1980	5	X									
308	M	1981	6	X									Recapture mortality
312	M	1980	10						1	0			Weaned
312	M	1981	11		2	1							
312	M	1982	12				1	1					
312	M	1983	13						1	0			Weaned
312	M	1984	14		2	x							Capture mortality
313	M	1980	9						1	0			Weaned
313	M	1981	10		1	0							Capture-related loss?
313	M	1982	11		2	2							
313	M	1983	12				2	1					
313	M	1984	13						1	0			Weaned, shot
314	M	1985	7				1	1					Mom = 313
314	M	1986	8						1	0			Weaned
314	M	1987	9		3	2							
314	M	1988	10				2	2					In Sept.
314	M	1989	11						2	0			Weaned
314	M	1990	12		2	0							Capture-related loss
314	M	1991	13		3	3							
314	M	1992	14				3	3					
314	M	1993	15						3	0			Weaned
314	M	1994	16		3	3							Lost in May
314	M	1995	17		3	0							
314	M	1996	18				3	3					
315	M	1983	5	X									
315	M	1984	6	X									Collar failed, shot in '86
331	M	1981	6						2	0			Weaned
331	M	1982	7	X									Bear died in July, reason?

Table 21. Continued

Bear					Cubs		Yearlings		2-yr.-olds		3.5-yr.+		
ID	Area	Year	Age	Barren	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Comments
335	M	1981	3	X									Weaned from 334
335	M	1982	4	X									
335	M	1983	5	X									
335	M	1984	6		2	2							
335	M	1985	7				2	1					1 lost in June
335	M	1986	8						1	0			Weaned
335	M	1987	9	X									
335	M	1988	10		2	2							
335	M	1989	11				2	2					
335	M	1990	12						2	2			
335	M	1991	13								2	2	Not weaned at 3
335	M	1992	14								2	0	Weaned at 4
335	M	1993	15		2	1							Lost Aug.-Sept.
335	M	1994	16				1	1					
335	M	1995	17						1	0			Weaned
335	M	1996	18		3	2							
337	M	1981	13		3	3							1 lost in den?
337	M	1982	14				2	1					1 lost in June
337	M	1983	15						1	0			Weaned
337	M	1984	16		2	2							
337	M	1985	17				2	2					
337	M	1986	18						2	2			
337	M	1987	19								2	0	Weaned at age = 3
337	M	1988	20	X									
337	M	1989	21	X									
337	M	1990	22	X									
337	M	1991	23	X									
337	M	1992	24	X									
337	M	1993	25	X									
337	M	1994	26	X									
337	M	1995	27	X									
337	M	1996	28	X									
340	M	1981	3	X									
340	M	1982	4	X									
340	M	1983	5	X									
340	M	1984	6		2	2							
340	M	1985	7				2	2					Survived to den entrance
340	M	1986	8						?				Assume weaned at age = 2
340	M	1987	9		3	0							
340	M	1988	10		2	1							
340	M	1989	11				1	1					Seen in October
340	M	1990	12						?				Assume weaned at age = 2
340	M	1991	13		3	3							
340	M	1992	14				3	3					
340	M	1993	15						3	0			Weaned
340	M	1994	16		2	0							Lost coy in May, shot Sept.
341	M	1981	6	X									
341	M	1982	7		2	?							Collar failed
341	M	1983	8	nd									
341	M	1984	9	nd									
341	M	1985	10	X									
341	M	1986	11		1	1							
341	M	1987	12				1	1					
341	M	1988	13						1	0			Weaned, died in den

Table 21. Continued

Bear ID	Area	Year	Age	Barren	Cubs		Yearlings		2-yr.-olds		3.5-yr.+		Comments
					Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	
344	M	1981	5		2	2							
344	M	1982	6				2	0					Lost June-July
344	M	1983	7		2	1							Lost in July
344	M	1984	8				1	0					Ylg. lost in May, failed in den?
379	D	1982	5		2	2							
379	D	1983	6				2	1					
379	D	1984	7						1	0			Prob. weaned in June
379	D	1985	8	X									Shot
380	M	1982	15				2	2					1 may have died in den
380	M	1983	16						1	0			Weaned at least 1, shot in Sept.
381	M	1982	3	X									
381	M	1983	4	X									
381	M	1984	5	X									
381	M	1985	6		2	2							
381	M	1986	7				2	2					
381	M	1987	8						2	0			Weaned
381	M	1988	9		3	3							
381	M	1989	10				3	?					Shot in fall
384	M	1983	12						2	0			Weaned 2-3 in June
384	M	1984	12		2	?							Missing in September
385	M	1983	2	X									
385	M	1984	3	X									
385	M	1985	4	X									Removed radio
388	M	1983	14						2	0			Weaned
388	M	1984	15		2	0							Capture-related loss
388	M	1985	16		2	2							
388	M	1986	17				2	2					
388	M	1987	18						2	0			Weaned
388	M	1988	19		2	2							
388	M	1989	20				2	2					
388	M	1990	21						2	0			Weaned
388	M	1991	22	nd									
388	M	1992	23	X									
388	M	1993	24		1	0							Lost in May, shot Sept.
394	M	1983	6		1	0							Pos. capture-related loss
394	M	1984	7	X									Shot in fall
396	M	1983	13						2	0			Weaned
396	M	1984	14		1	0							Lost in May
396	M	1985	15		2	0							Lost in May, June
396	M	1986	16	X									
396	M	1987	17	X									
396	M	1988	18	X									
396	M	1989	19		3	3							
396	M	1990	20				3	3					
396	M	1991	21						3	3			Not weaned @2
396	M	1992	22								3	0	Weaned @ 3
396	M	1993	23		3	3							Collar failed in den?

Table 21. Continued

Bear					Cubs		Yearlings		2-yr.-olds		3.5-yr.+		
ID	Area	Year	Age	Barren	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Comments
403	D	1983	6		2	1							
403	D	1984	7				1	1					Ylg. alive in Nov.
403	D	1985	8						1?				Not seen in May, weaned?
403	D	1986	9		3	2							
403	D	1987	10				2	?					Failed, shot '95
407	D	1883	4	X									
407	D	1884	5	X									
407	D	1885	6	X									
407	D	1886	7	X									
407	D	1887	8	X									Collar failed, shot '91
420	M	1984	19				2	2					
420	M	1985	20						2	0			Weaned
420	M	1986	21		2	0							Lost in May, shot '91
423	M	1984	20		4	3							1 lost in June
423	M	1985	21				3	3					
423	M	1986	22						3	0			Weaned
423	M	1987	23		1	0							Lost May-June
423	M	1988	24	X									
423	M	1989	25	X									
423	M	1990	26	X									
423	M	1991	27	X									
423	M	1992	28	X									
423	M	1993	29	X									With male
423	M	1994	30	X									Natural mortality
425	M	1984	14	X									
425	M	1985	15		2	2							
425	M	1986	16				2	0					Pos. capt.-related
425	M	1987	17	X									
425	M	1988	18		1	0							
425	M	1989	19		2	?							Missed in fall
437	M	1985	2	X									With sibling
437	M	1986	3	X									Shed collar
437	M	1995	12						2	0			Weaned, suspect shot
447	U	1985	7	X									
447	U	1986	8		2	?							Shed collar
453	U	1986	4		2	2							
453	U	1987	5				2	2					
453	U	1988	6						2	0			Weaned
453	U	1989	7	?									Shot in spring
454	U	1986	4	X									
454	U	1987	5		2	?							Shed collar
456	U	1986	6		2	2							Lost in den?
456	U	1987	7				0						Shot in May

Table 21. Continued

Bear					Cubs		Yearlings		2-yr.-olds		3.5-yr.+		
ID	Area	Year	Age	Barren	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Comments
458	U	1986	17	X									
458	U	1987	18		1	0							
458	U	1988	19		3	?							collar shed, shot in '90
460	U	1986	7		2	1							Capt.-related loss
460	U	1987	8				1	1					Okay in September
460	U	1988	9						1	0			Assume weaned, the @2 shot in Sept.
460	U	1989	10		2	2							
460	U	1990	11				2	2					
460	U	1991	12						2	2			
460	U	1992	13								2	2	Not weaned at age 3
460	U	1993	14								2	0	Weaned at age 4
460	U	1994	15		2	2							
460	U	1995	16				2	2					
460	U	1996	17						2	2			not weaned by Sept.
461	U	1986	5		1	0							Pos. capt.-related?
461	U	1987	6		2	1							
461	U	1988	7				1	1					Thru Sept.
461	U	1989	8						1	0			Assume weaned
461	U	1990	9		2	1							
461	U	1991	10				1	1					
461	U	1992	11						1	0			Weaned
461	U	1993	12		3	3							
461	U	1994	13				3	3					
461	U	1995	14						3	0			Weaned in Aug., shot
462	U	1986	7				1	?					Lost or weaned in June
462	U	1987	8		2	2							
462	U	1988	9				2	2					
462	U	1989	10						2	0			Weaned,
481	U	1987	14				3	2					
481	U	1988	15						2	0			Weaned, collar failed?
484	M	1993	4	X									
484	M	1994	5		2	1							Lost in Sept.
484	M	1995	6				1	1					
484	M	1996	7						1	0			Weaned

Table 21. Continued

Bear					Cubs		Yearlings		2-yr.-olds		3.5-yr.+		
ID	Area	Year	Age	Barren	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Comments
485	M	1993	5	X									
485	M	1994			2	2							
485	M	1995					2	2					
485	M	1996							2	0			Weaned
486	M	1993	6	X									
486	M	1994	7		2	2							
486	M	1995	8				2	2					
486	M	1996	9						2	0			Weaned
491	M	1996	4	X									
491	M	1996	5	X									
496	M	1993	7				1	0					Pos. capture-related loss
496	M	1994	8		3	1							Lost June-July
496	M	1995	9				1	1					
496	M	1996	10						1	0			Weaned
498	M	1993	20		2	2							
498	M	1994	21				2	2					
498	M	1995	22						2	0			Weaned, died in den, shot?
499	M	1993	6	X									
499	M	1994	7	X									
499	M	1995	8		1	1							
499	M	1996	9				1	0					Assume mortality?
501	M	1993	2	X									
501	M	1994	3	X									
501	M	1995	4	X									
501	M	1996	5		2	0							Lost coy
503	M	1995	4	X									
503	M	1996	5		1	0							
507	M	1994	3	X									
507	M	1995	4	X									
507	M	1996	5		1	1							
509	M	1993	3	X									
509	M	1994	4	X									
509	M	1995	5	X									
509	M	1996	6		2	?							

Table 21. Continued

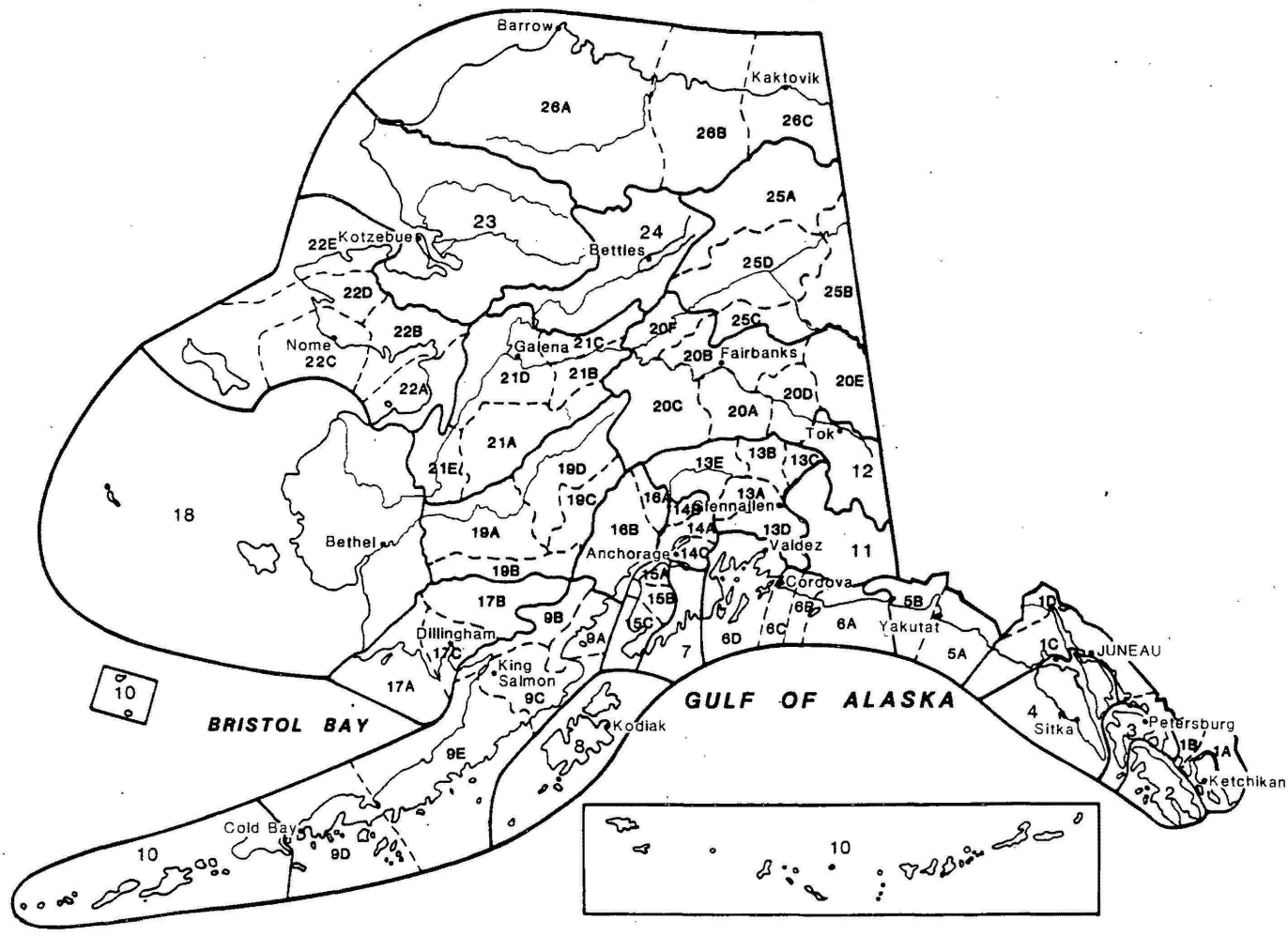
Bear ID	Area	Year	Age	Barren	Cubs		Yearlings		2-yr.-olds		3.5-yr.+		Comments
					Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	
517	M	1994	18				2	2					
517	M	1995	19						2	0			Weaned
517	M	1996	20		3	?							Shed?
518	M	1994	4	X									
518	M	1995	5	X									
518	M	1996	6	X									
525	M	1995	7				2	2					
525	M	1996	8						2				

Table 22. Causes of mortality of radio-marked moose calves in 3 studies conducted in Alaska's GMU 13 during 1977-1984.

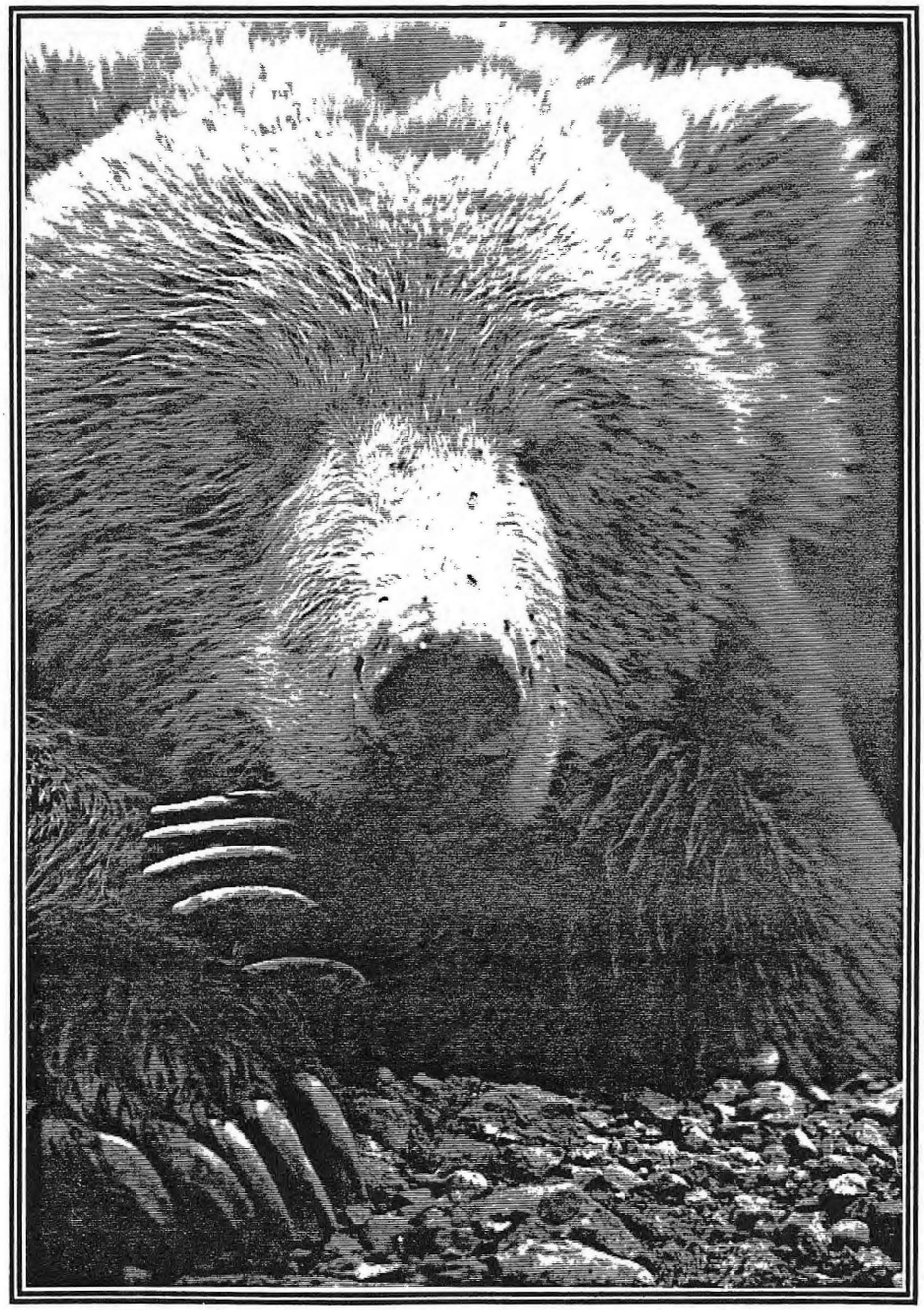
	1977-78[1]	1979[2]	1984[3]	TOTALS
No. calves collared[4]	120	27	46	193
No. (%) killed by				
Brown bears	52 (43%)	12 (44%)	24 (52%)	88 (46%)
Black bears	0	0	4 (9%)	4 (2%)
Wolves	2 (2%)	NA-see "other"	3 (7%)	5 (3%)
Other	12 (10%)	4 (15%)	7 (18%)	23 (12%)
All causes	66(55%)	15(56%)	38 (83%)	120 (62%)

[1] Data from Ballard et al. (1981)
[2] Results obtained during bear transplant operation (Ballard et al.1980)
[3] Data from Ballard et al. (1990).
[4] Excludes capture-related abandonments and deaths.

Alaska's Game Management Units



The Federal Aid in Wildlife Restoration Program consists of funds from a 10% to 11% manufacturer's excise tax collected from the sales of handguns, sporting rifles, shotguns, ammunition, and archery equipment. The Federal Aid program allots funds back to states through a formula based on each state's geographic area and number of paid hunting license holders. Alaska receives a maximum 5% of revenues collected each year. The Alaska Department of Fish and Game uses federal aid funds to help restore, conserve, and manage wild birds and mammals to benefit the public. These funds are also used to educate hunters to develop the skills, knowledge, and attitudes for responsible hunting. Seventy-five percent of the funds for this report are from Federal Aid.



KEN WHITTEN